

中華民國核醫學學會

2025 年會暨國際研討會

綠色核醫

全球永續經營下
核子醫學的衝突與角色

• ESG EVERYWHERE •

時間：2025年11月1日（星期六）

地點：臺北榮民總醫院致德樓

地址：臺北市北投區石牌路二段322號

主辦單位 |  中華民國核醫學學會  臺北榮民總醫院  國家原子能科技研究院

協辦單位 |  亞洲核子醫學技術學會  臺灣醫用迴旋加速器學會  台灣電力公司  衛生福利部暨臺北榮民總醫院
毒藥物防治諮詢中心

2025年會暨國際學術研討會

中華民國核醫學學會2025年會暨國際學術研討會

主會場：第一會議室				
時間	演講題目		講者	座長
08:20-09:00	會員報到			
09:00-09:15	開幕致詞 臺北榮民總醫院 李偉強副院長、國家原子能科技研究院 高梓木院長 中華民國核醫學學會 王昱豐理事長			
09:15-09:20	大合照			
09:20-09:40	開場演講	健保藥品支付改革	林靜儀 政務次長 衛生福利部	王昱豐 理事長 中華民國核醫學學會
09:40-10:00		醫療永續-國際趨勢與台灣發展策略	林名男 副執行長 衛生福利部附屬醫療及社會福利機構管理會	
10:00-10:20	BREAK			
10:20-11:00	Isotope Production: How Far We Have Come, Current Status of Supply		Dr. Cathy S. Cutler Brookhaven National Laboratory & Chairmen of SNMMI, 2025	王昱豐 理事長 中華民國核醫學學會 路景竹 主任 臺大癌醫中心分院
11:00-11:40	Radiomolecular Precision Oncology: Using Beta, Alpha, and Electron Emitters for the Treatment of Metastatic Prostate Cancer – Will Cure Become Possible?		Prof. Richard P. Baum International Centers for Precision Oncology (ICPO) Academy	王昱豐 理事長 中華民國核醫學學會 黃玉儀 主任 和信治癌中心醫院
11:40-12:00	會員大會			
12:00-13:30	LUNCH			
13:30-14:10	Digital Twin for Personalized Radiopharmaceutical Therapy		Prof. Kuangyu Shi University of Bern, Switzerland	陳志成 教授 國立陽明交通大學 陳世欣 主任 林口長庚紀念醫院
14:10-14:50	From Ra-223 to Lu-177 PSMA-directed Radioligand Therapy: A Urologist’s Journey in Treating mCRPC with Radiopharmaceutical		魏子鈞 醫師 臺北榮民總醫院	
14:50-15:10	BREAK			
15:10-15:50	Radiation Protection in Nuclear Medicine		Prof. Wei-Hsung Wang Louisiana State University	林立凡 主任 三軍總醫院 曾能泉 主任 童綜合醫院
15:50-16:30	Next-Generation Radiohybrid PSMA PET: Clinical Insights and Multidisciplinary Perspectives on POSLUMA in Prostate Cancer		李建儀 主任 臺中榮民總醫院 林宜瀾 醫師 臺中榮民總醫院	

中華民國核醫學學會2025年會暨國際學術研討會

主會場：第二會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00	What If a Radiation Accident or Disaster Happened Tomorrow? Learning from Hiroshima and Fukushima	Prof. Nobuyuki Hirohashi Hiroshima University	彭南靖 主任 臺北榮民總醫院 鄭銘泰 執行長 衛生福利部臺北區區域緊急醫療應變中心
11:00-11:40	Radiation emergency medicine-Japanese system, experiences in Hirosaki university hospital, and RICE training course.	Prof. Hiroyuki Hanada Hirosaki University	彭南靖 主任 臺北榮民總醫院 林志泉 醫師 林口長庚紀念醫院
11:40-12:00	第一會議室：會員大會		
12:00-13:30	LUNCH		
13:30-14:00	Immunological Perspectives on Acute Radiation Syndrome and Sepsis	Prof. Michihito Kyo Hiroshima University	陳燕嘉 主任 臺北榮民總醫院
14:00-14:30	臺灣核電廠除役階段的輻射緊急醫療應變挑戰與策略	鄭銘泰 執行長 衛生福利部臺北區區域緊急醫療應變中心	程紹智 主任 台北慈濟醫院
14:30-14:50	台灣CBRN體系下核災應變的策略與角色	王則堯 醫師 臺北榮民總醫院	張晉銓 主任 高雄醫學大學附設中和紀念醫院
14:50-15:10	BREAK		
15:10-16:00	Radiological Emergency management program from Harvard.	姚珊汎 醫師 臺北榮民總醫院	陳義丰 主任 三軍總醫院
16:00-16:30	討論		

2025年會暨國際學術研討會

中華民國核醫學學會2025年會暨國際學術研討會

第三會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00	用於癌症治療的钆硼中子捕獲療法(GdBNCT) Gadolinium Boron Neutron Capture Therapy (GdBNCT) for Cancer Treatment	黃國柱 教授 國立清華大學	高梓木 院長 國家原子能科技研究院
11:00-11:40	Dolacga有效評估肝功能 Dolacga Empowers Every Liver Function Decision	王美惠 研究員 國家原子能科技研究院	蔡惠予 所長 國立清華大學
11:40-12:00	台灣醫用迴旋加速器學會會員大會		
12:00-13:30	LUNCH		
13:30-14:00	台灣核醫學發展：回顧、現況與未來展望	劉仁賢 主任 振興醫療財團法人振興醫院	王正忠 理事長 臺灣醫用迴旋加速器學會
14:00-14:30	國原院70 MeV迴旋加速器簡介與應用規劃	杜定賢 副所長 國家原子能科技研究院	王昱豐 理事長 中華民國核醫學學會
14:30-15:05	失智症與老年憂鬱症的關聯： ^{123}I -MIBG造影的角色 Intersection between Dementia and Geriatric Depression: Insights from ^{123}I -MIBG Imaging	楊凱鈞 主任 臺北榮民總醫院	李振弘 所長 國家原子能科技研究院
15:05-15:35	阿茲海默症早期腦血流改變：機制、生物標記與治療意涵 Early Cerebral Blood Flow Alterations in Alzheimer's Disease: Mechanisms, Biomarkers, and Therapeutic Implications	倪于晴 副研究員 國家原子能科技研究院	李哲皓 秘書長 中華民國核醫學學會

中華民國核醫學學會2025年會暨國際學術研討會

第四會議室-ASNMT			
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:20	Visit the Heavy Particle Center (Taipei Veterans General Hospital)	Taiwan / Korea / Japan	
11:20-11:50	The 13th ASNMT Anniversary Ceremony	Taiwan / Korea / Japan	司儀： 臺中榮總 黃莆蓉 三軍總醫院 陳恩賜
11:50-12:30	ASNMT Steer Committee Meeting	Taiwan / Korea / Japan	
11:40-12:00	第一會議室：核醫學會會員大會		
12:00-13:30	LUNCH		
	口頭報告題目(Topic)	姓名(Speaker)	座長(Moderator)
13:30~14:10	Oral presentation session 1 (01-04)	1. Jui-Yin Kung 2. Hui-Ping Chen 3. Wen-Wen Cheng 4. Takuya SAITO	Hoon Hee PARK Takayuki SHIBUTANI
14:10-14:50	Oral presentation session 2 (05-08)	1. Tomohiro SATO 2. Ryu Emura 3. Kosuke Sasaki 4. Mitsuha Fukami	Jun Young PARK Yih-Hwen HUANG
14:50-15:10	BREAK		
15:10~15:50	Oral presentation session 3 (09-12)	1. Taisei Komoda 2. Dae-Hong Kim 3. Kyuho YEON 4. Tae Heon Kim	KAO-YIN TU Tomoaki YAMAMOTO
15:50-16:30	Closing Ceremony & Flag Passing	Taiwan / Korea / Japan	

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第五會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00			
11:00-11:40			
11:40-12:00	第一會議室：會員大會		
12:00-13:20	Lunch Symposium：諾華		
13:30-14:10	早期阿茲海默氏症治療的曙光~類澱粉蛋白標靶治療	劉議謙 主任 天主教耕莘醫院	洪光威 副院長 彰濱秀傳紀念醫院
14:10-14:50	Leading a new era of Precision Medicine with digital PET/CT and AI solution	施宜伶 應用專家 GE Healthcare	陳惠萍 副理事長 中華民國核醫學學會
14:50-15:10	BREAK		
15:10-15:50	Positioning PRRT in GEP-NETs : Upfront Use, Sequencing, and What' s Next	黃文冠 醫師 林口長庚醫院	陳明晃 理事長 台灣神經內分泌腫瘤學會
15:50-16:30	Theranostics in Neuroendocrine Tumors—Case Sharing from NTUH	鄭媚方 主任 臺大醫院	

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第八、九會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00			
11:00-11:40			
11:40-12:00	第一會議室：會員大會		
12:00-13:20	Lunch Symposium：輝瑞		
13:30-14:15	口頭報告基礎組OS1	OB-001、OB-002、OB-006 OB-009、OB-008	張文議 博士 高志浩 教授
14:20-15:00	口頭報告基礎組OS2	OB-004、OB-005、OB-007 OB-010	林宜瀾 醫師 李昕迪 主任
15:00-15:10	BREAK		
15:10-15:50			
15:50-16:30			

中華民國核醫學學會2025年會暨國際學術研討會

第十會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00	RIA分析：內部品管(IQC)如何執行與管理	張錦標 副教授 國防醫學大學	王安美 技術主任 馬偕紀念醫院
11:00-11:40			
11:40-12:00	第一會議室：會員大會		
12:00-13:20	Lunch Symposium：輝瑞		
13:30-14:10	AIDD在藥物開發中的應用：工業與監管FDA視角 Regulatory and Pharmaceutical Industrial Perspective on Application of Artificial Intelligence for Drug Development	顧曼芹 主任委員 中華民國製藥發展協會	樊修秀 副理事長 中華民國核醫學學會 吳駿一 副教授 國立陽明交通大學
14:10-14:50	AI賦能藥物篩選與標靶解析 AI-empowered drug discovery and target deconvolution	林榮信 副主任 中央研究院	
14:50-15:10	BREAK		
15:10-15:50	從微觀到臨床：PET/MR神經影像技術的全貌進展 PET/MR Neuroimaging Across Scales: Bridging Molecular Precision and Clinical Impact	葉信顯 副教授 國防醫學大學	林明賢 主任 羅東聖母醫院 蘇家豪 教授 長庚大學
15:50-16:30	清醒與麻醉狀態下TBI動物模型之PET腦影像評估 PET Evaluation of Brain Imaging in TBI Animal Models under Awake and Anesthetized Conditions	張剛璋 博士 台北醫學大學	

中華民國核醫學學會2025年會暨國際學術研討會

第十一會議室			
時間	演講題目	講者	座長
08:20-09:00	會員報到		
09:00-09:20	第一會議室：開幕致詞及合照		
09:20-09:40	第一會議室：開場演講		
09:40-10:00			
10:00-10:20	BREAK		
10:20-11:00			
11:00-11:40			
11:40-12:00	第一會議室：會員大會		
12:00-13:20	Lunch Symposium：常捷		
13:30-14:30	住院醫師考試		
14:40-15:25	口頭報告臨床組OS3	OC-001、OC-002、OC-006 OC-004、OC-009	詹勝傑 主任 蔡雅琴 醫師
15:30-16:30	口頭報告臨床組OS4	OC-003、OC-005、OC-007 OC-008、OC-010、OC-011	汪姍瑩 主任 曾敬仁 主任

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2025年會暨國際學術研討會



王昱豐 理事長
中華民國核醫學學會

各位貴賓、各位先進、各位女士與先生：
歡迎蒞臨中華民國核醫學學會2025年年會！

這是台灣核醫界的年度盛會，非常感謝大家一同在台北榮民總醫院這座結合臨床實力與學術研究、引領醫療未來的醫學中心，深入探討「綠色核醫 — 全球永續經營下核子醫學的角色與衝突」。

面對全球氣候變遷、資源耗竭與人口高齡化的挑戰，醫療體系也正進入全面轉型的時代。在我們積極推動核醫精準診療的時刻，也必須思考角色如何延伸與永續；我們如何在提供高效能診斷與治療的同時，減少放射性廢棄物與輻射劑量？我們如何透過創新技術與智慧管理，達成綠色醫療的願景？

因此，今年的年會不僅涵蓋最新的核子醫學研究成果與臨床進展，更特別關心ESG（環境、社會、治理）議題在核子醫學領域中的實踐與挑戰。同時，我們也將ESG精神落實於年會的每個細節中 — 包括與弱勢團體合作、選用台灣在地小農的優質農產作為紀念品、簡化紙本流程、以及會場資源的永續管理，連一條識別證帶我們都別有用心，展現推動綠色醫療的堅持與誠意。希望每位與會者都能身體力行，成為改變的一部分。

更誠摯邀請來自全國與國際的嘉賓，在參與會議之餘，走訪我們美麗的城市 — 台北。這是一座兼容科技創新與文化底蘊的城市，不僅擁有先進的醫療能量，也致力於打造綠色、宜居、永續發展的都市環境。從便利的交通、豐富的美食、到深具人情味的街巷，我們相信，台北會帶給您難忘的體驗與回憶。

衷心感謝您的蒞臨與支持，祝福年會圓滿成功、各位身體健康、收穫豐盛！
歡迎大家！

2025年會暨國際學術研討會

講師介紹



Name : 林靜儀
Title : 政務次長
Institute : 衛生福利部
第一會議室 09:20~09:40

健保藥品支付改革

健保署推動藥品政策改革，聚焦新藥加速審查、依實證給付之價值支付制度及接軌國際，並強化本土供藥韌性，完善藥價調整機制、必要藥品保障合理藥價，鼓勵國內製造供應及生物相似藥/學名藥使用，兼顧病人用藥可近性及健保永續發展。

2025年會暨國際學術研討會

講師介紹



Name : 林名男
Title : 副執行長
Institute : 衛生福利部附屬醫療及社會福利機構管理會
第一會議室 09:40~10:00

醫療永續-國際趨勢與台灣發展策略

醫療永續國際趨勢除了節能減碳之外，很重要的一環是淨零路徑、供應鏈減碳、臨床減排與建構韌性醫療體系。核子醫學在永續可以精進發展的部分，例如提升儀器能效與待機管理、優化掃描與排程以減少重複與空檔、落實劑量管理與品質保證、精進放射性廢棄物減量與合規處理、推動數位化與遠距會診以減少移動。建置院所碳資料平台、制定核醫永續基準等，有賴核子醫學的專家共同努力。

2025年會暨國際學術研討會

講師介紹



Name : Cathy S. Cutler
Title : PhD.
Institute : Brookhaven National Laboratory &
Chairmen of SNMMI, 2025
第一會議室 10:20~11:00

Isotope Production: How Far We Have Come, Current Status of Supply

Countries through academia, national laboratories and industry have developed unique infrastructure that has supported research and development in isotope production leading to major advancements such as the development of the Technetium-99m generator at the US department of energy. Many isotopes based on national need were first developed at national laboratories and supported until they could be handed off successfully to the commercial sector. The economic models are changing in which a business model can now be made for companies to provide isotopes. Still a challenge faced is that isotope production is based on a global economy and many countries are heavily reliant on foreign supply. Additionally, the growing need for alpha and auger emitters requires advanced production techniques. New methods of production are being pursued, and advances are being made to aid in addressing some of the current shortfalls in isotope supply. This talk will present a bit of history, and the current status of supply as well as a forward look at what is needed to ensure supply.

2025年會暨國際學術研討會

講師介紹



Name : Richard P. Baum
Title : Professor
Institute : International Centers for Precision
Oncology (ICPO) Academy
第一會議室 11:00~11:40

Radiomolecular Precision Oncology: Using Beta, Alpha, and Electron Emitters for the Treatment of Metastatic Prostate Cancer – Will Cure Become Possible?

The integration of molecular imaging and targeted radionuclide therapy—collectively known as theranostics—has redefined the management of advanced prostate cancer. Prostate-Specific Membrane Antigen (PSMA) Radioligand Therapy (RLT) exemplifies this evolution, allowing precise tumor targeting and individualized treatment.

Recent phase III trials mark a milestone in clinical implementation. The PSMAfore trial demonstrated a significant delay in radiographic progression and improved overall survival in taxane-naïve metastatic castration-resistant prostate cancer (mCRPC) using ¹⁷⁷Lu-PSMA-617. The PSMAAddition trial extended the benefit to metastatic hormone-sensitive prostate cancer (mHSPC), establishing PSMA RLT as an effective option even in earlier disease stages. Meanwhile, the ECLIPSE trial provided convincing evidence for the robust activity and tolerable safety of targeted alpha therapies, with actinium-225-labeled compounds achieving deep molecular remissions in treatment-refractory patients.

New paradigms such as TANDEM radiotherapy (combining ¹⁷⁷Lu and ²²⁵Ac-PSMA ligands) and RadioVax—the combination of radioligand therapy with immune checkpoint inhibition—are reshaping the theranostic landscape and may overcome current resistance mechanisms.

Radiomolecular precision oncology now stands at the intersection of nuclear medicine and urology, bridging diagnosis and therapy through molecular targeting. As Taiwan's oncology community increasingly embraces PSMA-directed radiotherapy, these advances herald a new era of curative potential for metastatic prostate cancer.



Name : Kuangyu Shi
Title : Professor
Institute : University of Bern, Switzerland
第一會議室 13:30~14:10

Digital Twin for Personalized Radiopharmaceutical Therapy

Despite the success of radiopharmaceutical therapy (RPT), there is a belief that personalized treatment can further enhance treatment outcomes while maintaining low side effects. Developing personalized RPT poses greater challenges compared to external beam radiotherapy (EBRT) due to the complex dynamics of radiation dose delivery after intravenous injection of radiopharmaceuticals. Furthermore, conventional radiobiological modeling used in EBRT is not applicable to RPT due to increased dose complexity and tumor heterogeneity.

In this talk, we will explore how Digital Twin technology can support the personalization of radiopharmaceutical therapy (RPT). Digital twins integrate multi-level computational models, including anatomical models, physiologically based pharmacokinetic models, convection-reaction diffusion models, and DNA damage and repair models, to simulate radiopharmaceutical delivery, dose deposition, and dose effects in virtual patients. This enables the exploration and optimization of treatment strategies. Moreover, advanced technologies such as spatial transcriptomics, total-body PET, organ-on-chips, and artificial intelligence—including large language models—are introduced to bridge the gap between digital twins and real patients. By combining clinical, experimental, and computational approaches, we aim to advance theranostic digital twins, bringing us closer to truly personalized treatments.

2025年會暨國際學術研討會

講師介紹



Name : 魏子鈞
Title : 醫師
Institute : 臺北榮民總醫院
第一會議室 14:10~14:50

From Ra-223 to Lu-177 PSMA-directed Radioligand Therapy: A Urologist's Journey in Treating mCRPC with Radiopharmaceutical

Metastatic castration-resistant prostate cancer (mCRPC) has entered a radiopharmaceutical era: first with bone-targeting alpha emitter radium-223 (Ra-223) improving overall survival and skeletal morbidity in symptomatic bone-predominant disease, then with prostate-specific membranous antigen (PSMA)-targeted radioligand therapy (RLT), Lutetium-177 (Lu-177) vipivotide tetraxetan (Pluvicto) delivering tumor-specific beta radiation across metastatic sites. However, the clinical selection, timing, sequencing, etc., are all important practical issues but so far of some uncertainties, especially regarding a good prognosis for patients with mCRPC. Besides, recent regulatory expansions that move PSMA RLT earlier in the mCRPC translate a new therapeutic strategy pathway. I would like to share my experience from an urologist prospective on this journey of mCRPC treatments through radial pharmaceuticals during the past decade. Since many life-prolonging agents such as androgen-receptor pathway inhibitors (ARPi), cytotoxic chemotherapy, and even poly ADP-ribose polymerase inhibitors (PARPi), have been moved upfront, a stepwise clinic workflow is crucial to coordinate imaging, bone health, marrow stewardship, and multidisciplinary delivery, to achieve a better clinical outcome.



Name : Wei-Hsung Wang
Title : Professor
Institute : Louisiana State University
第一會議室 15:10~15:50

Radiation Protection in Nuclear Medicine

Nuclear medicine is the science in which radioactive tracers, also known as radiopharmaceuticals, are administered into the body through injection, ingestion, or inhalation for the diagnosis and treatment of diseases. For diagnosis, detector systems (cameras) visualize the location of the radioactive tracers to produce images that show how organs and tissues are working. For therapy, large doses of radiopharmaceuticals are intravenously delivered to target organs to deposit lethal amounts of radiation. As a source of ionizing radiation, the safe and effective use of radiopharmaceuticals is vital to the everyday practice of nuclear medicine; patients, medical workers, the public, and the environment must be protected against unnecessary radiation exposure. The National Council on Radiation Protection and Measurements released Report 160 entitled "Ionizing Radiation Exposure of the Population of the United States" in March 2009, as an update of Report 93 (1987). It noted that the biggest increase in exposure from ionizing radiation was from medical procedures, with nuclear medicine procedures accounting for 26% of all medical exposures. Nuclear cardiology procedures were the largest contributor to collective effective dose. NCRP 160 also reported that the annual number of nuclear medicine procedures increased from 3.3 million to 18.1 million between 1972 and 2006. This presentation discusses the rationale, principles, and applications of appropriate radiological control measures in nuclear medicine practice as well as case studies on medical events involving the use of radioactive materials.

2025年會暨國際學術研討會

講師介紹



Name : 林宜瀟
Title : 醫師
Institute : 臺中榮民總醫院
第一會議室 15:50~16:30

Next-Generation Radiohybrid PSMA PET: Clinical Insights and Multidisciplinary Perspectives on POSLUMA in Prostate Cancer

提供POSLUMA ([18 F]-flotufolastat) 正子影像關於臨床使用時機，使用經驗，儀器配置，影線判讀與報告輸出等細節，比對科內使用 F-18 PSMA 1007 與POSLUMA之間的差異，並提供 PSMA影像與Plucivto治療案例進行討論。

探討新一代 radiohybrid PSMA PET 影像工具 POSLUMA 在攝護腺癌的臨床應用與前景；在疾病早期診斷、病灶定位及治療監測上的優勢外，亦強調其於治療決策及精準醫療中的重要角色；並整合泌尿科、腫瘤科及影像醫學等多專科專家觀點，提供跨領域臨床實務的深度洞見，做為攝護腺癌診療策略之重要參考。

2025年會暨國際學術研討會

講師介紹



Name : 李建儀
Title : 主任
Institute : 臺中榮民總醫院
第一會議室 15:50~16:30

Next-Generation Radiohybrid PSMA PET: Clinical Insights and Multidisciplinary Perspectives on POSLUMA in Prostate Cancer

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2025年會暨國際學術研討會

講師介紹



Name : Nobuyuki Hirohashi
Title : Professor
Institute : Hiroshima University
第二會議室 10:20-11:00

What If a Radiation Accident or Disaster Happened Tomorrow? Learning from Hiroshima and Fukushima

Learning from the 1999 JCO Tokai-mura criticality accident and the 2011 Fukushima Daiichi nuclear power plant disaster, Japan launched a new radiation disaster medical system in 2015. Nuclear emergency core hospitals are designated in prefectures with nuclear power plants to provide comprehensive medical care for affected residents, supported by the Nuclear Emergency Medical Support Center and the Advanced Radiation Emergency Support Center. Despite these efforts, training opportunities remain limited because nuclear disasters are rare, resulting in a shortage of qualified personnel. Fragmentation of responsibilities among ministries further hampers the establishment of an integrated medical care system, and preparedness for nuclear attacks remains largely undeveloped. As we commemorate the 80th anniversary of the atomic bombing of Hiroshima, we emphasize the urgent need to reexamine the significance of radiation disaster medicine and to foster the next generation of medical professionals across regions and beyond national borders.

2025年會暨國際學術研討會



Name : Hiroyuki Hanada
Title : Professor
Institute : Hirosaki University
第二會議室 11:00-11:40

Radiation emergency medicine-Japanese system, experiences in Hirosaki university hospital, and RICE training course.

After the Fukushima Daiichi Nuclear Power Plant Accident (FDNPPA) in 2011, radiational emergency medical (REM) system has been established according to nuclear response guideline (NRG) by Japan Nuclear Regulation Authority. NRG provided us emergency action level (EAL) of nuclear power plant, operational interventional level of radiation (OIL), and zoning of radiation protection for actions by residents. Precautionary action zone (PAZ; within 5 km from nuclear power plant) and urgent protective action planning zone (UPZ; from 5 km to 30 km from nuclear power plant) had been also determined. Prefectures where nuclear facilities are located have designated nuclear emergency core hospitals for nuclear emergency, which have nuclear emergency medical assistance teams (NEMAT). We now have around 100 of NEMATs. These NEMATs working in nuclear emergency core hospitals primarily.

2025年會暨國際學術研討會

講師介紹



Name : Michihito Kyo
Title : Professor
Institute : Hiroshima University
第二會議室 13:30-14:00

Immunological Perspectives on Acute Radiation Syndrome and Sepsis

Department of Radiation Disaster Medicine, Research Institute for Radiation Biology and Medicine, Hiroshima University, Hiroshima, Japan

2025年會暨國際學術研討會

講師介紹



Name : 鄭銘泰
Title : 執行長
Institute : 衛生福利部臺北區區域緊急醫療應變中心
第二會議室 14:00-14:30

臺灣核電廠除役階段的輻射緊急醫療應變挑戰與策略

台灣在核能電廠除役進程中，輻射緊急醫療體系面臨從「反應爐事故應變」轉向「除役與廢爐作業風險管理」的新挑戰。此階段的輻射事件型態與風險特性與運轉期不同，可能發生於拆除、廢棄物處理或運輸過程，涉及局部高劑量曝露與放射性污染事件。

本報告從國家層級出發，探討台灣輻射緊急醫療體系在除役階段的應變規畫與挑戰，包括醫療責任醫院與地方衛生單位的協作機制、教育訓練的持續性、以及實際核安演習經驗的回顧與啟示。講者曾參與核一、核二、核三廠核安演習之緊急醫療應變評核工作，將分享演習中觀察到的應變整備實況與改進方向，並討論醫療單位如何在核電廠除役時期持續維持 readiness 與人員專業能力，以確保輻射事故發生時仍能迅速且有效地應對。

2025年會暨國際學術研討會

講師介紹



Name : 王則堯
Title : 醫師
Institute : 臺北榮民總醫院
第二會議室 14:30-14:50

台灣CBRN體系下核災應變的策略與角色

本課探討在化學、生物、放射、核複合式災難 (CBRN) 威脅下，如何將傳統的輻射防護整合進現代應變體系。內容涵蓋國際趨勢、台灣核災挑戰、風險溝通與IDPA對話方法的應用，強調跨域協作與社會信任，定位核醫專家為應變體系中關鍵的整合節點。

2025年會暨國際學術研討會

講師介紹



Name : 姚珊汎
Title : 醫師
Institute : 臺北榮民總醫院
第二會議室 15:10-16:00

Radiological Emergency management program from Harvard

在這次的演講中我們簡單的介紹來自於哈佛的訓練課程；一個為期5天全日的課程，對象是軍警官方或醫療人員對於輻射緊急傷害有需求的人員所以一開始的課程會有介紹輻射相關議題、輻射相關生物效應以及當代的輻射災害以多種面向來說明。

課程有已能源觀點為出發的請能源公司負責核能發電廠域的副總裁介紹公司內部的營運作業方式已知說明與附近的鄰近地方政府針對核子事故相關的合作演習以及標準作業流程。之後是針對於新時代的小型核子發電裝置，在美國各地已有初步的安裝測試在這些新裝置時候也介紹了發展以及需要對應的輻射防護政策。

下一個是針對美國最特別的是可能會有核子相關的武器的使用從髒彈，密封射源的刻意引爆，高劑量物質於人口密集處的故意放置、甚至是核子彈、核能電廠的爆炸等等需要如何去計算影響範圍以及目前的應變政策等等另有課程請媒體業者來跟現場人員說明如何在發生事故的當下擬訂說詞以及如何準備記者會如何重點的支持發言人給予正確的資料以免在發言時有所疏失。

最後安排簡易的桌模試著以現場的方式來讓大家可以去想像在面臨到真實事件中消防人員、地方政府單位以及主管機關如何協調合力去面對事故的發生以及進展。

2025年會暨國際學術研討會

講師介紹



Name : 黃國柱
Title : 教授
Institute : 國立清華大學
第三會議室 10:20-11:00

用於癌症治療的钆硼中子捕獲療法(GdBNCT)

Gadolinium Boron Neutron Capture Therapy (GdBNCT) for Cancer Treatment

In the lecture, I will talk about the development of combined Gadolinium Neutron Capture Therapy and Boron Neutron Capture Therapy (GdBNCT) for the treatment of cancers. I will also talk about the course responsible for ineffective immunotherapies as well as how to convert an otherwise ineffective immunotherapy to become effective for cancer treatments.

2025年會暨國際學術研討會

講師介紹



Name : 王美惠
Title : 研究員
Institute : 國家原子能科技研究院
第三會議室 11:00-11:40

Dolacga有效評估肝功能 Dolacga Empowers Every Liver Function Decision

銻-68 Dolacga 注射液 是第一種針對肝細胞上的 ASGPR (去唾液酸糖蛋白受體) 的糖肽類 PET 放射性追蹤劑。

它具有快速、穩定的 銻-68 放射性標記和一致的製程。其凍乾試劑盒可實現室溫儲存、全球分銷和按需、現場製備，能提供臨床上可執行、高對比度、定量的肝功能 PET 影像，其表現優於目前的評估工具。

2025年會暨國際學術研討會

講師介紹



Name : 劉仁賢
Title : 主任
Institute : 振興醫療財團法人振興醫院
第三會議室 13:30-14:00

台灣核醫學發展：回顧、現況與未來展望

回顧

草創期
國外設備技術引進
核醫專科人才培育
成立中華民國核子醫學學會
核子醫學專科醫師
全民健康保險
SPECT、PET、Cyclotron
核醫藥物研發與生產
迴旋加速器學會
台灣分子影像學會
邁向國際

現況

Popularity of SPECT、PET、PET radiopharmaceuticals
Reimbursement: PET is limited covered by national health insurance and private health insurance
International relationship
Precision targeted theranostic radiopharmaceuticals and self-pay radiotheranostics
Development and application of NM imaging analysis software

未來展望

Basic molecular imaging research, translational research, clinical research and practice
Nanomedicine, precision personalized medicine, radiotheranostics, radiotargeting imaging biomarker
AI-based nuclear medicine molecular imaging platform and relevant instrument and technology development
Nuclear medicine physician with solid radiology basic training, physician-scientist, medical physics, medical engineering scientists, radiochemistry and radiopharmaceutical scientists
Collaboration with and strong support from biomedical industry, national health institutes, research institutes, universities and government
International talent of nuclear medicine and molecular imaging, and international relations

2025年會暨國際學術研討會

講師介紹



Name : 杜定賢
Title : 副所長
Institute : 國家原子能科技研究院
第三會議室 14:00-14:30

國原院70 MeV迴旋加速器簡介與應用規劃

國原院70 MeV迴旋加速器建置計畫於110年10月獲行政院核准執行，計畫於民國112年至115年間完成70 MeV迴旋加速器建置，116年完成試運轉。此加速器為質子加速器，加速能量範圍為28 – 70 MeV，最大輸出電流1 mA。此行加速器可執行雙射束照射，同時在加速器相對面二邊引出射束向兩個靶站照射。預定用途主要是診斷用醫用放射性同位素(Tl-201, I-123, Mo-99)的生產、治療用醫用放射性同位素(Cu-67)的研製以及質子應用照射服務和建立加速器中子源執行中子應用研究。70 MeV迴旋加速器設施預計建立6條射束線，其中3條射束線用於核醫方面，一條用於質子應用照射服務，二條用於中子源分別產生快中子和熱中子。

2025年會暨國際學術研討會

講師介紹



Name : 楊凱鈞
Title : 主任
Institute : 臺北榮民總醫院
第三會議室 14:30-15:00

失智症與老年憂鬱症的關聯： ^{123}I -MIBG造影的角色 Intersection between Dementia and Geriatric Depression: Insights from ^{123}I -MIBG Imaging

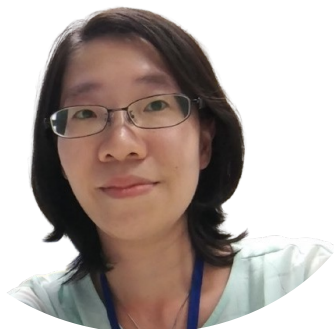
失智症與憂鬱症的照護與治療均是重要的公共衛生議題，且憂鬱症個案後來發生失智症之風險明顯增加。老年憂鬱症與青壯年憂鬱症有不同之臨床表現與較差之治療反應。研究顯示在部份未有失智臨床表現的老年憂鬱症個案，已能偵測到失智相關之病理變化；代表這些個案已經處在失智症的前驅期。提早辨識失智前驅期的憂鬱個案，探索其疾病生理機轉很重要：除了可改善老年憂鬱症的治療成效，也能夠更早期介入失智之病程；預防失智症產生。

過去對失智前驅期與老年憂鬱症之研究，著重在阿茲海默症。路易氏體失智症是除了阿茲海默症外最常見的退化性失智症，而且路易氏體失智症與老年憂鬱症之關係較阿茲海默症更為密切；因此評估老年憂鬱症個案是否有路易氏體失智症相關之病生理變化甚為重要。在路易氏體失智症的主要生物標記中：多巴胺轉運器與情緒及認知功能有關， ^{123}I -MIBG心臟造影被報告可用來偵測路易氏體失智症之早期變化。因多巴胺轉運器造影所偵測之路易氏體失智症病灶以皮質下為主，可以使用靜息磁振造影來評估其所造成大腦迴路之變化。

本團隊採用多模態影像學方法，評估未罹患失智症之老年憂鬱症患者：包括多巴胺轉運體造影、I- ^{123}I -MIBG心肌閃爍圖，以及靜息態功能性磁振造影；以評估 α -突觸核蛋白病理及其對關鍵腦迴路的影響。本演講會報告初步的研究成果，並探討未來的展望。

2025年會暨國際學術研討會

講師介紹



Name : 倪于晴
Title : 副研究員
Institute : 國家原子能科技研究院
第三會議室 15:00-15:30

阿茲海默症早期腦血流改變：機制、生物標記與治療意涵 Early Cerebral Blood Flow Alterations in Alzheimer's Disease: Mechanisms, Biomarkers, and Therapeutic Implications

本講題透過近年文獻整理，介紹腦血流下降被觀察為阿茲海默症早期的病理現象之一，可能與周細胞收縮、嗜中性球滯留及血栓形成等機制相關，並被認為與 $A\beta$ 及tau病理惡化有交互關係。研究亦顯示，相對腦血流下降與tau病理可各自影響認知功能，而與類澱粉蛋白病理呈現平行且交互作用的途徑。這些發現逐漸引發對潛在治療策略的關注，未來核醫灌注影像有機會在早期偵測與臨床介入上提供新的契機。

2025年會暨國際學術研討會

講師介紹



Name : 劉議謙
Title : 主任
Institute : 天主教耕莘醫院
第五會議室 13:30~14:10

早期阿茲海默氏症治療的曙光~類澱粉蛋白標靶治療

阿茲海默氏症的核心病理之一為類澱粉蛋白 (A β) 沉積與斑塊形成。隨著 A β PET 影像技術的發展，我們得以在活體中直接偵測斑塊，促進早期診斷與臨床研究。近年抗 A β 單株抗體藥物成功降低腦內 A β 負荷，並在早期病程展現延緩認知惡化的效果，首度證實疾病修飾治療的可行性。本演講將從 A β 斑塊與影像工具談起，介紹抗 A β 治療的最新進展與臨床意涵，展現阿茲海默氏症治療的嶄新曙光。

2025年會暨國際學術研討會

講師介紹



Name : 施宜伶
Title : 應用專家
Institute : GE Healthcare
第五會議室 14:10~14:50

Leading a new era of Precision Medicine with digital PET/CT and AI solution

Digital PET/CT 與 AI 的結合，正引領精準醫學進入新時代。

Omni Legend 採用先進的digital探測技術，提供更高靈敏度、更快速的掃描速度與更清晰的影像品質，不僅實現疾病的早期偵測，更能透過與 MIM 工作站整合，發揮 AI 在影像分析、療效評估與流程自動化上的優勢，加速個人化治療計畫的制定、療效追蹤與跨團隊合作。結合 Digital PET/CT 與 AI 驅動的解決方案，正逐步推動精準醫學邁向更智慧化、更高效率的未來。

2025年會暨國際學術研討會

講師介紹



Name : 黃文冠
Title : 醫師
Institute : 林口長庚醫院
第五會議室 15:10~15:50

Positioning PRRT in GEP-NETs: Upfront Use, Sequencing, and What's Next

Peptide receptor radionuclide therapy (PRRT) has achieved significant breakthroughs in neuroendocrine tumor (NET) treatment. The landmark NETTER-1 phase III trial demonstrated that ^{177}Lu -DOTATATE PRRT significantly prolonged progression-free survival (PFS) compared to high-dose octreotide in midgut NET patients (20-month PFS rate: 65.2% vs 10.8%, HR 0.21, $p < 0.001$) and improved overall survival (median OS 48.0 vs 36.3 months). NETTER-2 further established PRRT as first-line treatment for high-grade (G2 with high Ki-67 or low-grade G3) gastroenteropancreatic NETs, achieving a median PFS of 22.8 months versus 8.5 months with octreotide alone (72% risk reduction) and significantly higher objective response rate (43.0% vs 9.3%). In pancreatic NETs, the OCLURANDOM trial showed PRRT superiority over sunitinib (median PFS 20.7 vs 11.0 months) with lower toxicity. Imaging studies revealed that tumor-to-blood SUV ratio (TBR) predicts PRRT outcomes, with high baseline TBR and decreasing TBR during treatment correlating with better prognosis, while interim PET after cycle 2 identifies approximately 20-25% of early progressors. CAPTEM chemotherapy combined with PRRT demonstrated up to 72% response rates in pancreatic NETs, though benefits in midgut NETs were limited with increased bone marrow toxicity risk (10% MDS incidence). Emerging alpha-particle PRRT (such as ^{225}Ac -DOTATATE) shows remarkable efficacy in advanced and ^{177}Lu -refractory NET patients, achieving approximately 50% objective response rate, 80-87% disease control rate, with 24-month PFS and OS of 67.5% and 70.8% respectively, while serious hematologic or renal toxicity remains only 2-3%, significantly lower than beta-emitter PRRT, providing a novel therapeutic option for refractory NETs. Overall, PRRT has become standard-of-care for NETs, while alpha-PRRT represents a breakthrough advancement continually improving patient outcomes.



Name : 鄭媚方
Title : 主任
Institute : 臺大醫院
第五會議室 15:50~16:30

Theranostics in Neuroendocrine Tumors —Case Sharing from NTUH

Low- to intermediate-grade, well-differentiated neuroendocrine tumors (NETs), particularly those originating from the gastrointestinal tract or pancreas, frequently express somatostatin receptors (SSTRs), primarily subtypes 2 and 5. The mainstay of initial treatment involves somatostatin analogs (SSAs) like octreotide LAR and lanreotide, which bind these receptors, helping to alleviate hormone-related symptoms and slow tumor growth. Radiolabeled

SSAs have expanded the management toolbox by serving both diagnostic (e.g., ^{68}Ga -DOTATOC and ^{68}Ga -DOTATATE PET imaging) and therapeutic purposes (e.g., ^{177}Lu -DOTATATE). Treatment choices should be tailored to the patient's specific tumor characteristics and overall clinical profile.

2025年會暨國際學術研討會

講師介紹



Name : 張錦標
Title : 副教授
Institute : 國防醫學院
第十會議室 10:20-11:40

RIA分析：內部品管(IQC)如何執行與管理

課程主題：RIA 分析-內部品管(IQC)執行與管理授課重點：包括

醫院評鑑與ISO 15189 (2022) 對 IQC之要求

IQC之執行

選定各檢驗項目的 target value

選定各檢驗項目的 Tea

區分各檢驗項目分析儀器穩定之等級

計算各檢驗項目的 mean

計算各檢驗項目的 SD (或使用已確認的 SD)

依據分析品管檢體數目及儀器故障率，選擇適當的品管策略

選擇適當的品管規則與品管次數

IQC之檢討與管理

每日審閱

- 操作人員必須執行品管
- 結果必須符合品管規則
- 留執行紀錄

每週審閱

- 組長審查 QC Chart
- 是否有 Trend 或 Shift 之傾向
- 留審查紀錄

每月審閱

- 組長審查檢討表?
- 審查要求?
- 審查準則?
- 留審查紀錄

2025年會暨國際學術研討會

講師介紹



Name : 顧曼芹
Title : 博士
Institute : 中華民國製藥發展協會
第十會議室 13:30-14:10

AIDD在藥物開發中的應用：工業與監管FDA視角 Regulatory and Pharmaceutical Industrial Perspective on Application of Artificial Intelligence for Drug Development

- AI Drug Target Discovery is difficult but most valuable: A long shot with high rewards.
- AI Lead Optimization Cuts Timelines From 5+ Years to Months: A must tool for pharmaceutical RD.
- AI-assisted Clinical Study
- Large Pharma is focusing on Model-Informed Drug Development (MIDD) for Clinical Studies
- FDA Perspective (Discussion Paper and Guidance)
- Published article, discussion paper and guidance
- Industry Perspective (EU centric Consortium)
- Why and How Pharma Companies Adopt AIDD ?
- EU Machine Learning Ledger Orchestration for Drug Discovery MELLODDY, an Industry Consortium.
- African Ersilia Model, Democratizing Drug Development w/AI



Name : 林榮信
Title : 副主任
Institute : 中央研究院
第十會議室 14:10-14:50

AI賦能藥物篩選與標靶解析

AI-empowered drug discovery and target deconvolution

在這個課程中我將會介紹近年來AI在新藥開發領域相關的重要技術進展，包括如何找到有藥效作用的天然物的作用標靶，以及如何運用標靶蛋白質的結構及動態資訊，有效地藉由生成式AI探索巨大的化學空間，並產生有參考標靶結構且可合成的分子，並結合準確的結合自由能計算方法，以及藥物動力學所需要的物理化學性質及其他性質，來決定優先合成的藥物小分子。我也將介紹最近在運用AI robotics及其他設備來進行自動化藥物有機化學分子合成的近期發展，及我們實驗室在BSL-3全無人實驗室生物實驗操作的新穎系統開發。

2025年會暨國際學術研討會

講師介紹



Name : 葉信顯
Title : 副教授
Institute : 國防醫學大學
第十會議室 15:10-15:50

從微觀到臨床：PET/MR神經影像技術的全貌進展 PET/MR Neuroimaging Across Scales: Bridging Molecular Precision and Clinical Impact

本演講將從分子層級到臨床應用，全面剖析PET/MR 神經影像技術的最新進展。內容涵蓋跨物種轉譯、疾病機制探討與臨床診斷實例，強調分子精準與臨床影響的連結。

2025年會暨國際學術研討會

講師介紹



Name : 張剛璋
Title : 主任
Institute : 台北醫學大學
第十會議室 15:50-16:30

清醒與麻醉狀態下TBI動物模型之PET腦影像評估 (PET Evaluation of Brain Imaging in TBI Animal Models under Awake and Anesthetized Conditions)

(1) Purpose: Positron emission tomography (PET) with a high spatial resolution plays a pivotal role in the study of human behavior. In physiological brain functions, including blood flow, metabolism, and neurotransmission, anesthetized animals show reduced neural activity and brain metabolism. Physical stress reduced neural activity and metabolism, as shown through PET imaging.

(2) Methods: In our animal study, we used the adaptation method to track head motion in freely moving rats (traumatic brain injury (TBI) animal model) during PET acquisition. The highly specific radiotracers [18F]FEPE2I (dopamine transporter) and [18F]FADAM (serotonin transporter, SERT) helped us understand the relationship system between the anesthetized and awake groups in the brain neurotransmitter transporter.

(3) Results: Awake (motion-corrected) PET images showed [18F]FEPE2I and [18F]FADAM thus signifying that the regional standardized uptake value quantification in awake animals was significantly lower than that in anesthetized animals across different regions. The specific binding ratio of these neurotransmitter receptor-awake systems was marginally higher than that in the anesthetized animals.

(4) Conclusions: The present method enabled brain PET imaging in awake rats, thereby avoiding the confounding effects of anesthesia on PET readings. Thus, the interaction between cerebral physiology and cognitive performance is closely correlated to neural activation.

2025年會暨國際學術研討會

年會徵稿總編的話——精益求精、不斷向前

自2022年底接任學術委員會主委後，開始承辦核醫年會徵稿業務，至今邁入第三個年頭，第一年由於還在學習經驗，較為保守，比較大的變化只有將Google表單導入年會徵稿流程，獲得了成功的經驗；第二年開始大幅地擴充完備整個流程，利用新平台、在稿件編輯、整理、評審、呈現上引進各種新元素、新辦法，所有的努力，目的都在於使投稿作者、讀者、工作人員三贏——希望可以最大化年會投稿學術交流的效益及效率，然而又不要太大幅增加工作人員的負擔。今年是第三年，原本預期去年整個流程跟平台已經建置得差不多，徵稿作業應該可以非常順利，不用花費太多時間。不過真正進入工作，會發現還是有各種狀況題是去年沒有遇過，需要一一處理；且，在現有的架構上要再做一些微幅的改良，但是又與原來架構相容、不要出現錯誤，其實也是相當費神。

今年在開放Google投稿表單前，我們在文章關鍵字選項上，下了一番工夫，針對去年沒有被納入預設關鍵字而是以“其他”被作者填入的所有補充字眼，做了盤點，篩選出缺漏但是確有實際存在需要的關鍵字，將它們也列為今年的預設關鍵字；同時，也對器官系統導向的分類架構再做了一次細切，目的就是讓所有文章在投稿時都能有歸屬感，不讓投稿者覺得卡卡、找不到形容自己作品的關鍵字或分類，然後在心中心中疑惑我這一篇到底該算是哪一類？據盤點結果，今年新增了解剖學/CT/MR、定量分析、有趣影像、危險因子等關鍵字。看起來應該是達到使用者滿意度了——今年極少使用者以其他輸入關鍵字。表示幾乎所有的稿件都在某個分類路徑底下找到滿意的身份標籤。同樣的精神，也應用在預設機構院所上，唯有使用預設的字樣選填所屬機構，我們的團體貢獻分數才能正確的計算歸屬到各個機構院所；藉此，也可以看見每一個院所隨著年度其學術產能的動態變化。

然而在大家開心選用關鍵字的同時，卻伴隨一個新的現象：為數不少的稿件選用了過多的關鍵字(最大值：16個)，甚至是不適合、錯誤的關鍵字。其實關鍵字並不是越多越好，因為，在手冊中每一篇文章右上角會有關鍵字色標，但可能最多只能呈現七個左右，過多的關鍵字會互相排擠，如果真正重要的關鍵字被排在後面，可能會被捨棄，反而無法呈現正確的文章色標。索引的部分也是根據使用者投稿者所選用的關鍵字，進行文章索引對應，錯誤的關鍵字，會造成文章出現在錯誤的索引群下，因此若在使用今年手冊裡的索引，發現有一些關鍵字會納入不相符的稿件，乃是源自於當初投稿時選用不適合的關鍵字。這一點要請之後投稿者在投稿時，務必選取最正確、合適的關鍵字，才能夠讓我們設計的索引分類架構以及關鍵字色標，發揮最好的效果。在此，我舉兩例選取關鍵字得宜的作品(PC-025、PC-040)，請各位作者可以參考。

此外，有些關鍵字成為投稿者的大熱門，有非常多的稿件紛紛選用，這些大熱門包括影像組學、解剖學/CT/MR、影像處理這幾個關鍵字；若能夠正確選用是沒有關係，因為這反映了該領域在近年的關注熱度，但是審稿的時候卻發現這些熱門用字裡，很高比例的選用是錯誤的，多篇勾選影像組學的文章，閱讀後發現跟影像組學沒有任何關係，我一開始覺得疑惑為什麼會這樣，後來我想到一個可能的原因，可能部份會員對於“影像組學”這個名詞還不熟悉，把它誤會為影像重組的意思。關於影像組學，網路上可以找到非常多的說明及應用實例，我就不在此佔篇幅。倒是，想釐清一下“解剖學/CT/MR”、“影像處理”這兩個關鍵字的適用範疇：

解剖學/CT/MR：核醫功能性影像若沒有正確的解剖構造定位，必定沒有正確判讀或分析結果，有感於核醫專科醫師訓練過程中相對欠缺對解剖學/CT/MR的學習，故特別增加此一分類，專門收錄一些以CT或是MRI影像切入、能夠幫助核醫人學習解剖構造、或學習CT、MR判讀的一些題材。在此，不建議所有有涉及SPECT/CT或只是涉及CT、MR研究的作品皆一股腦地選用此標籤，因為此標籤側重的點是在提升核醫人對解剖構造的認識，造影modality本身並不是標籤重點。

影像處理：影像處理的素養應該是核醫從業人員養成中非常重要的一環，在每日例行業務中，核醫醫師及放射師應該要有對影像處理QC的能力、要能辨認常見的影像處理相關假影、如何因應處理；在特殊造影狀況中，也能夠靈活運用影像處理專業知能，達成良好影像；對於定量影像也應該要清楚定量原理、看得出何時定量數值有錯；有感於目前國內核醫養成生態並不是非常重視這塊，此標籤側重的精神是收錄作品旨在探討如何改善這些影像處理假影、定量錯誤，或是探討特殊狀況影像處理參數、以及比較同軟體不同參數、或不同軟體影像處理的結果時，才是本標籤適用範圍。在此，也不建議所有涉及影像的作品一律選用此標籤，所有影像都或多或少涉及影像處理，雖不能說選錯，但如此選法實在沒有分類上的價值，也並非開設此分類的用意。

關於統合分析，今年原始投入資料，有數篇勾選為統合分析的，但閱讀後發現並非統合分析，而是一些病房、病人數據的整理。我想，這也代表部份作者對統合分析不了解，可能誤以為只要有數據分析就屬於此項。也有情況是案例報告卻勾選為病例系列的，這些作品已將體裁改為經驗分享或其他適合的分類屬性，並據此計算團圓分數。無法一一通知原作者，亦在此一併說明。

2025年會暨國際學術研討會

今年另一個新狀況是有稿件在接受之後撤稿，原因是沒有收到接受函，故不及準備ePoster，我們感到非常可惜，事後追查，秘書處這邊確實有寄出接受函，沒收到的原因可能是掉信、spam...不可考，但年會失去了一份精采的作品。在此呼籲作者們，投稿時留的email信箱非常重要，是該稿件所有後續聯絡使用，務必正確、務必收信、務必注意官網公告徵稿作業時程、務必在沒收到通知時即時聯絡秘書處。去年有稿件在接受前撤稿，今年則是接受後撤稿，需要考慮更廣——手冊是否納入？ePoster是否納入？原接受函是否仍然有效？該作品明年是否仍能投稿？今年處理原則是該稿件視為未投入，明年仍可重投，不納入手冊及ePoster。但流程上如何作廢原接受函，因時間倉促，可能需留待之後設計規畫。

投入的摘要、ePoster，我們持續收到作者透過收件確認信上的連結要求修改原檔，但因為這些已上傳的檔案，同時有多方在使用並進行後續作業，包括總編、評審委員、廠商，若開放直接對原檔更動，投稿者可能在允許修改的時間外仍不斷改版，卻沒有一個有效機制可以同時通知多方人馬檔案已經修改，極可能造成各方人馬各自使用不同版本檔案作業的情形，且也必定造成投稿者跟學會對“正確版本”認知上的出入，故我們無法開放以原連結修改。任何修改都視為新版本，且必須在開放的時間內，依照既定的流程重投修改，每一筆重投必須對應原流水號，才能始終維持唯一“有效稿件”為正確版本，所以這類透過收件確認信要求修改原檔一律是不處理的，在此統一說明。今年，有少數幾筆稿件，在對應流水號上未能正確輸入，導致稿件計算重覆、筆數不正確，也花費相當多時間清理錯誤。希望投稿者投稿時能仔細閱讀相關說明、正確填寫相關資料。

今年兩位執行秘書，芸瑄跟杰穎，芸瑄負責格式審查及作者聯繫、對外窗口，把關非常認真仔細，在投稿流程初期有些作者遭受不只一次的格式退件，會有些焦躁，還請理解我們面對的是一百多篇的稿件、多個版本、多頭事項、多次聯繫，為了讓大家的心血作品能正確呈現，必定會有一些流程、時間、格式上的要求；杰穎負責投稿平台自動化流程的程式撰寫、及分類架構整理，也給我很大的幫助。在此謝謝兩位執行秘書。

編輯流程中，我還想感謝動因公司，他們團隊有良好的企畫執行能力，在手冊及ePoster上給予很好的技術支援，讓我能夠把點子實現出來。其中，我要特別感謝Benson蔡聿超先生，溝通非常仔細、邏輯清楚、負責、且做事的習慣也很好，都會在溝通後把確認過、尚待確認的種種事項留下文字記錄，讓雙方在下次討論時，可以一下就進入狀況，節省不少時間。經過去年的合作，今年我發現他完全了解、也記得去年我訴求的效果跟理念是什麼，今年的溝通因此省事不少，有些分類架構上的錯誤甚至是他幫我注意到的，合作起來相當愉快。手冊中色塊的用色，我本來預想每年是各自獨立的、也是他建議除了新增關鍵字用新色，其他延續去年用色，使得色塊用色，在不同年度的手冊上有了連貫。

最後我要感謝評審委員及座長。四位初審委員：林立凡主任、張雁翔醫師、陳世欣主任、黃潔宜醫師，他們負責了所有稿件的初審、回饋、修改複審、最後決定、團員評分、獎項推薦，還有精華回顧的撰寫...這串工作，光寫都覺冗長，而他們卻要一步驟一步驟實作出來，非常感謝他們的辛勞。我個人最高興的一件事是，這四位委員，全部都是自願報名幫忙的！真的非常感動。即使中間有些周折不順，主要源於我說明溝通不夠清楚，讓部份委員在審稿平台上不能順利找到正確檔案版本，花費了許多時間，我也因此更了解現行作業架構上的可能問題在哪，立凡主任也提出了許多很好的建議，幫助我把作業流程理得更順。然後，也非常感謝所有評審座長都自發地在時限內完成了稿件評分，讓我們後續獎項作業得以更順暢。其中，劉淑馨主任對於評審主觀有些許顧慮，怕自己不能給予稿件公正客觀的評分，為此還特別跟我通了電話。劉主任想的，其實也是我之前當評委、還有第一年徵稿時觀察到的，我很高興，有人跟我想的、在意的事情一樣。這也是為什麼我們要做初審委員制度、年度影像獎、還有團員評分辦法。我們希望藉由這些制度的設計，把每份作品各自放在合適的賽道、有所區隔，也讓每份作品得到當值的評價。

原以為今年應該沒什麼好寫的、想說可以一頁結束總編的話，沒想到還是寫到了去年的份量，我想說的差不多都暢所欲言了。謝謝理事長的指導與大力支持、謝謝作者們的共同努力，希望大家一起努力，讓核醫在國內開出花來！在此預祝大會圓滿成功！

中華民國核醫學學會 學術委員會主委

胡蓮欣
2025/10/27

2025年會暨國際學術研討會

2025核醫年會論文綜覽－編輯評析

張雁翔、林立凡、黃潔宜、陳世欣、胡蓮欣

在個人化醫療以及核醫發展欣欣向榮的氣象中，國內一年一度的核醫界年度盛事——中華民國核醫年會——在11月1號即將來到。今年核醫年會的投稿在機構來源與研究內容上皆展現高度多樣性，涵蓋學界與產業界成果。主題橫跨臨床應用、放射藥物研發、AI影像分析與輻射安全管理等領域，充分展現台灣核醫界在臨床決策支持、技術創新與精準醫療整合上的全面進展。從腫瘤影像、放射治療安全、神經退化疾病預測到新型放射藥物開發，皆可見核醫團隊在臨床實證與基礎創新之間緊密的轉譯連結。此外，稿件總數也比去年略有成長，有效投稿數總共150件，經過初審及修正後複審，有2件拒稿，148件接受(含4件稿件判定為接受，但仍建議自主修正)，但1篇作品在接受後撤稿，故最後接受並展出的作品共147件。其中，口頭基礎有9件，口頭臨床11件，壁報基礎29件，壁報臨床98件，以上147件稿件都列入團體貢獻獎項的計分；口頭共20件、壁報共44件列入個人獎評選；符合年度影像獎評選的稿件共54件。2件拒稿——都是稿件內容不完整且經初審建議修改後未有任何修正或說明，故該稿件目前狀態無法接受。

個人獎項分為口頭個人獎、壁報個人獎、及去年新增的年度影像獎 (Image of the Year)，壁報及口頭個人獎已行之有年，相信會員們都很熟悉。這裡特別說明一下年度影像獎的候選資格。由於前述個人獎項都限定只有原著論文、病例系列或統合分析才有資格參加評選，個案報告一直以來都沒有任何獎項，故自2024年起增設年度影像獎，鼓勵會員發表臨床或前臨床的精采影像。今年，在理事長支持下，獎金更是大幅提高，追平其他個人獎項獎金。此獎聚焦精采案例，故以病例系列、個案報告稿件中之臨床影像列入當然評比對象；基礎或臨床原著論文中的影像(含動物)若經初審委員推薦，亦可列入此項評比，此獎項之作者不限定醫師或醫事人員，但限為壁報發表作品。

在基礎論文部份，核醫界維持對新藥開發的關注，放射藥物製備技術也持續精進。和信楊詩涵放射師於[68Ga]Ga-FAPI-2286的合成研究中，系統性分析反應溫度、螯合條件與純化管柱的影響，最終建立最佳製程條件，成為臨床FAPI藥物GMP製備的重要參考 (OB-001)；同院李銘忻顧問以GMP自動化標誌系統，進行Ac-225核種標誌FAPI-46、FAPI-2286及3BP-FAPI-3940三種前驅物，測試其標誌條件與初探其放射化學純度分析方法，成功在特定條件下，達到放射性標誌效率30%，為國內Ac-225核種標誌的珍貴經驗 (OB-008)；和信團隊關於FAPI-2286的系列作品展現出高度主題導向專注力，兩位作者也都將在口頭報告發表，令人期待。台大邱晉宏技術員則以銅催化放射標誌法成功提升18F-MFBG的合成效率，克服傳統製程限制，為交感神經影像探針開啟臨床應用新契機 (OB-002)。此外，Primo普瑞默生技孟凡傑主任完成台灣首次[161Tb]Tb-PSMA-I&T自動化合成，放化純度達95%以上，顯示國內製藥平台已邁入高精度與高自動化的新里程碑 (PB-025)。高醫的陳宜伶放射師，運用碘125標誌的GPC-3抗體在肝癌細胞株上證實了專一性，也進一步在小鼠身上證實其分布 (OB-009)。臺北榮總王昱豐主任首度於斑馬魚模型中進行肝硬化誘發膽管癌之PET/MR整合影像研究，展示小型脊椎動物在非侵入性腫瘤追蹤上的可行性。該平台兼具低成本、高重複性與代謝影像可視化優勢，為藥物篩選與腫瘤生理研究開創新契機 (PB-014)。

人工智慧的導入為臨床與研究帶來革新。國原院曾聖彬研究員與高雄長庚醫院合作的Tc-99m ECD SPECT研究，以腦灌注動態特徵結合機器學習模型，成功預測輕度認知障礙患者轉化為阿茲海默症的風險，展現AI輔助影像分析在神經疾病預後評估上的巨大潛力 (PB-010)。屏東榮民總醫院李昕迪醫師報告了使用兩種機器學習的模型，以減低骨骼掃描的造影時間，展現了機器學習去雜訊技術的潛力，建議未來訓練策略必須納入變異性，方能建立具臨床實用性的穩健去雜訊模型 (PB-017)。

在輻射安全議題上，亦有多篇作品投入關注——奇美永康總院曾宜玲醫檢師探討使用甲狀腺攝取儀的井型計數器測量I-125廢水活度的可行性，結果顯示該方法具操作簡便、即時檢測的潛力 (PB-008)；奇美醫院張朝鈞醫檢師研究廢棄試管的殘餘活度是否可在法規限度內直接丟棄 (PB-022)；柳營奇美醫院陸建華藥師，報告了核醫藥師運送I-131至治療病房接受到的輻射劑量，顯示藥師年累積暴露量為33μSv，輻射暴露極低 (PB-024)。

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在臨床論文部份，彰濱秀傳郭之凡醫師利用 I-123 MIBG 掃描探討糖尿病合併心房顫動患者的心臟交感神經功能，結果顯示 H/M ratio 顯著下降，且總膽固醇為心臟神經損害的獨立預測因子。研究提出膽固醇不足可能影響神經修復的新假說，對臨床風險分層及後續跨領域研究具有啟發性 (OC-003)。門諾游冬齡醫師研究局部進展期口腔癌患者，於化放療前後接受 FDG PET/CT 評估，並追蹤超過四年。結果顯示部分反應的患者復發率顯著高於完全反應者。此研究證實 PET/CT 於治療後早期即可提供預後資訊，對臨床追蹤與治療策略調整具有直接實用價值 (PC-044)。台大陳怡潔放射師則以 PET/CT 為基準進行 Y-90 放射治療的個人化肺劑量分析，挑戰傳統固定肺重假設，證實「個人化肺質量」能更精準預測放射性肺炎風險，為治療安全性評估建立新典範 (OC-006)。高雄榮總俞長青放射師，系統性評估並比較 FDG PET/CT 與骨骼掃描在鼻咽癌患者骨轉移偵測中的診斷效能，研究設計嚴謹且完整，結果具高度臨床參考價值，與現行準則相符合 (PC-096)。RIA 相關研究也沒有缺席，大林慈濟黃筱崑醫師探討流程優化 (PC-038)；大林慈濟張素雲醫師研究操作步驟的差異與 iPTH 檢驗數值的關係 (PC-090)。

值得一提的是，自去年廣開投稿體裁以來，去年有收到統合分析稿件，今年首度出現文獻綜述的作品了！而且一口氣就是四篇，這四篇是由普瑞默生技分別與童綜合醫院和耕莘醫院合作所發表，專注在新藥臨床前研究、ADT 療法時間對於 PSMA 造影影響、PSMA 診療合一等相關主題 (PB-011、PC-059、PC-060、PC-073)，亦呈現高度主題式聚焦，且文章品質相當不錯，是很好的教育性材料。鼓勵會員們都能去閱讀。

病例報告方面，有非常多的有趣案例：高雄長庚楊因因醫師發表了病例報告，呈現兩位神經內分泌腫瘤合併肝轉移病例，接受 ^{177}Lu -DOTATATE PRRT 治療後，兩位患者的影像學均呈現良好反應 (PC-056)。和信李佩瑛醫師發表一非常富有啟發性的病例，一位食道癌患者在治療前後的正子影像發現了新的肝臟病灶無法排除肝臟轉移，但該病灶在後來追蹤的正子影像中自發消失，且對應在 CCRT 的高放射治療劑量範圍內，從臨床歷程來看，最後認為是放療引發的局部肝損傷 (PC-049)。大林慈濟莊紫翎主任發表的一例股骨頸骨折的病例，病理報告意外的呈現了類澱粉的沉積，有趣的是，術前的骨掃描在骨折處附近有明顯溶骨性病變而沒有 MDP 的攝取 (PC-001)。阮綜合醫院陳朝榮醫師描述一位以大量胸腔積液為首發症狀的病人，初期無法找到原發腫瘤，最終透過 FDG PET/CT 發現卵巢病灶並確診為卵巢癌合併腹膜轉移 (PC-029)。花蓮慈濟曾昶深醫師報告一例三陰性乳癌患者在免疫治療過程中出現罕見肌炎，FDG PET 顯示肌肉瀰漫性代謝增加，凸顯 PET 在免疫治療時代對 irAE 的鑑別與療效監測具臨床價值 (PC-003)。除了醫師，多位放射師——台中慈濟張添信放射師 (PC-092)、大林慈濟的張秀瑛放射師 (PC-020)、許幼青放射師 (PC-066)、高雄榮總侯曉琪放射師 (PC-031)——也都提出了有趣的案例分享，反映了他們在核醫團隊的關鍵角色，把關影像品質，並進一步探究臨床狀況，回饋給核醫及臨床醫師。

團體貢獻獎以去年通過的評分辦法評選，依據初審委員給分並依文章性質的不同權重計算積分。今年總積分最高為大林慈濟醫院。大林慈濟始終保持豐沛的產量，投稿篇數相當多，多篇原著論文是由醫事人員投出，相當值得嘉許，期許國內各醫療院所看齊他們的學術產能。今年，我們也很高興看到一些新朋友的加入，來自高雄醫學大學田育彰教授、長庚大學蕭穎聰教授、翁啟昌教授等人指導的作品也都出現在這次的稿件中，非常歡迎您們幫忙豐富核醫年會，也希望各位老師們能繼續在核醫學界持續耕耘。

關於今年的年度影像獎得主，在前述的 54 篇作品角逐之下，由陽明交通大學劉守軒研究員 PB-016 作品中的小鼠模型影像獲獎，該研究旨在合成乙基連接鏈的 ^{18}F NODA-E-FAPI-1，在攜帶 U87-MG 腫瘤的小鼠進行體內生物分布及腫瘤攝取成像效果與 ^{18}F FAPI-74 比較，不但成功合成 ^{18}F NODA-E-FAPI-1，並在 U87-MG 腫瘤小鼠模型展現良好的影像對比，顯示其作為腫瘤正子影像探針的潛在應用價值。

最後和去年一樣要特別說明，這篇綜覽篇幅有限，無法涵蓋所有稿件，要對無法列入的精采稿件說聲抱歉。到停筆的此刻，除了團體獎及年度影像已評分完成，個人獎項論文的評分還正在進行，這裡有無提及或先後順序和獎項並沒有直接關係。無論在此文中有提到的、沒提到的...我們非常建議會員們多多進到口頭報告會場，聆聽精采可期的口報發表，也多多利用 ePoster 現場展示電腦，瀏覽來自全國各地、多元、充滿活力的作品！

敬祝醫安研安。我們年會見！

2025 年會得獎名單

- 尚未開放 -

2025年會暨國際學術研討會

2024、2023 年會得獎名單

2024 年

獎項	口頭論文			
	口頭基礎	口頭臨床	核醫新秀獎	醫事人員獎
優等	國家原子能科技研究院 羅盛男 OB - 002	臺大醫院 曾文正 OC - 004	林口長庚醫院 張馨允 OC - 003	臺大醫院 簡御庭 OC - 008
佳作	和信醫院 李銘忻 OB - 001	高雄長庚醫院 陳宏杰 OC - 006	臺中榮民總醫院 蔡昭璋 OC - 005	和信醫院 楊詩涵 OB - 004

獎項	壁報論文	
	壁報基礎	壁報臨床
優等	普瑞默生物科技 張智偉 PB - 022	臺北榮民總醫院 彭南靖 PC - 083
佳作	臺大醫院 邱晉宏 PB - 002	臺北榮民總醫院 王昱豐 PC - 031

年會論文 團體貢獻獎	年度影像獎
和信醫院	和信醫院 黃玉儀 PC - 011

核醫學雜誌論文 團體貢獻獎	核醫學雜誌論文 審稿貢獻獎
新光醫院	汪嫻瑩

2023 年

獎項	口頭論文			
	口頭基礎	口頭臨床	核醫新秀獎	醫事人員獎
優等	和信醫院 李銘忻 OB - 05	臺大醫院 陳君奕 OC - 11	三軍總醫院 鄭皓文 OC - 08	和信醫院 楊詩涵 OB - 01
佳作	國家原子能科技研究院 王世民 OB - 04	新光醫院 黃博嵩 OC - 04	亞東醫院 施鈺呈 OC - 09	臺大醫院 徐丞 OC - 12

獎項	壁報論文	
	壁報基礎	壁報臨床
優等	長庚大學 黃少怡 PB - 25	臺北榮民總醫院 彭南靖 PC - 52
佳作	中山附醫 許琮翔 PB - 10	高雄長庚醫院 林至群 PC - 98

年會論文 團體貢獻獎
大林慈濟醫院

核醫學雜誌優秀論文	核醫學雜誌論文 團體貢獻獎	核醫學雜誌論文 審稿貢獻獎
邱藍儀 鄭如伶 徐健欽 張雁翔 陳宏杰	大林慈濟醫院	黃文盛

[⁶⁸Ga]Ga- FAPI-2286放射性標記條件及純化管柱選擇之研究

¹楊詩涵、¹李銘忻、¹羅盛男、¹林欣蕓、¹黃玉儀
¹和信治癌中心醫院 核子醫學科

背景介紹:

[⁶⁸Ga]Ga- FAPI-2286 (Gallium-68 fibroblast activation protein inhibitor 2286) 是一種在多種腫瘤微環境中表現出高度攝取之標靶放射性造影劑，用於特异性結合纖維母細胞活化蛋白 (FAP) 正子斷層掃描 (PET imaging)。這類 FAPI與Ga-68的標記 (radiolabeling) 和純化過程雖已有基礎技術，但仍存在一些技術與實務上的挑戰：1. 標記階段受 pH 控制、反應體積、螯合劑濃度影響，標記率 (radiochemical yield, RCY) 與放射化學純度 (radiochemical purity, RCP) 可能低於期望值。2. 分離純化階段受放射性副產物與未螯合 Ga-68 純化限制。前述臨床困境皆有放射性樣品處理，有時間壓力與高放射性下的操作安全與自動化挑戰。

材料方法:

本研究使用 Ga-68 與 FAPI-2286 於高溫 (95°C) 下進行標記，標記條件：95°C，反應 10 分鐘與 15 分鐘；純化方式：C18 管柱與 Oasis HLB 管柱。以 50% 乙醇洗脫，利用放射性高效能液相層析儀 (Radio-HPLC) 及放射薄層分析儀 (TLC) 進行測定確定純化品質，用以評估不同反應時間與 2 種分離管柱純化效果。並分別於 Citric Acid 及 Ammonium acetate 1.0 M / methanol = 1/1 (vol/vol) 展開條件下，測定未純化前放射化學純度 (RCP_{TLC})。為使實驗設計周延，以同等莫爾濃度前驅物 FAPI-2286 (0.1 mg/mL)，進行不同乙醇濃度 (50%、100%) 分段洗脫。並使用高效能液相層析儀 (HPLC) UV 吸收值，測定滯留時間與波峰積分面積，評估不同濃度乙醇對此 2 種管柱的洗脫效果。選擇最佳標記和純化條件，再以自動合成盒進行 [⁶⁸Ga]Ga- FAPI-2286 合成，並針對成品外觀、放射性核種純度、放射化學不純物、細菌內毒素、放射化學純度 (RCP_{TLC}) 2 小時安定性，進行 GMP 正子藥物調劑與規格品質驗證。

結果:

標記條件方面，於 95°C 加熱 10 分鐘，展開條件 Ammonium acetate 1.0 M / methanol = 1/1 (vol/vol)，RCY 值為 91.13%，純化產物放化純度 (RCP_{TLC}) 達 95.14%；而加熱 15 分鐘則分別提升至 RCY 值為 93.63%，放化純度 (RCP_{TLC}) 98.4%，結果顯示延長反應時間可顯著提升標記率。純化效率方面，Oasis HLB 管柱以 1 mL 100% 乙醇進行第一次洗脫，效率達 94.8%；再以 1 mL 100% 乙醇進行第二次洗脫，效率為 5.2%。C-18 管柱則分別為 92.6% 及 7.4%。在 50% 乙醇時，Oasis HLB 第一次洗脫率達 85.9%，第二次為 14.1%；C-18 管柱則為 76% 與 24%。顯示兩種管柱在 100% 乙醇下純化效果較佳。

結論:

[⁶⁸Ga]Ga- FAPI-2286 分別進行 Oasis HLB 放化純度 (RCP_{TLC}=100%；RCP_{HPLC}=83.3%) 與 C-18 管柱之放化純度 (RCP_{TLC}=100%；RCP_{HPLC}=84.62%) 分析，效益差異不顯著，因此選用 C-18 管柱。以 95°C 加熱 10 分鐘與 15 分鐘比較，Ga-68 半衰期短 (~68 分鐘)，多拖延 5 分鐘可能導致實際活性減損，收率提升有限。整體優化策略參數為採用 50% 乙醇、C-18 管柱與 95°C 反應 10 分鐘。結果顯示：Ga-68 FAPI-2286 成品外觀澄清，放射性核種純度 > 99.9%，酒精殘留 < 10%，放射化學純度 (RCP_{TLC}) 95.43%，內毒素 < 10 EU/mL，並在 2 小時內保持 > 95% 的放射化學純度，符合藥物規格及安全性要求。上述研究結果可做為腫瘤分子影像診斷藥物臨床應用及 GMP 品質管控參考。

Copper-mediated radiosynthesis of ^{18}F -meta-fluorobenzylguanidine (^{18}F -MFBG) as a positron emission tomography (PET) imaging agent for norepinephrine transporter

^{1,2}Ching-Hung Chiu, ¹Ting-Yen Lee, ³Ming-Hsin Li, ^{1,4}Kuan-Yin Ko, ¹Chia-Ju Liu, ¹Mei-Fang Cheng and ¹Steven Shinn-fong Peng

¹Department of Nuclear Medicine, National Taiwan University Hospital

²Department of Medical Imaging and Radiological Sciences, Chang Gung University

³Alliance Innovation Theranostics Pharma company, AITP.

⁴Department of Nuclear Medicine, National Taiwan University Hospital Cancer Center; Taipei, Taiwan.

Introduction:

^{18}F MFBG PET offers superior imaging performance, although clinical translation has been slowed by suboptimal radiochemical yields and formulation challenges. Copper-mediated radiofluorination (CMRF) enables efficient incorporation of ^{18}F into complex aromatic scaffolds under mild conditions and could address these bottlenecks. Although CMRF syntheses of ^{18}F MFBG have been reported, solvent selection and ^{18}F fluoride-elution conditions remain suboptimal, warranting further optimization. We therefore aimed to (1) optimize key CMRF parameters for ^{18}F MFBG and (2) characterize its in vivo performance with dynamic PET in healthy mice to establish baseline biodistribution supporting future clinical translation.

Materials and Methods:

^{18}F Fluoride was transferred to a GE Tracerlab FX_{FN}, trapped on a QMA cartridge, and eluted into the reactor with either $\text{K}_2\text{CO}_3/\text{K}222$ or $\text{KOTf}/\text{K}_2\text{CO}_3$. The reaction mixture was further azeotropically dried with acetonitrile. Then a reaction mixture consisting of tetrakis pyridine copper triflate and commercial pinacol boronate precursor in anhydrous DMF or DMA solvent was added for radiofluorination. Hydriodic acid was added for further hydrolysis. The crude product was dissolved in water and purified by semi-preparative HPLC column, with isocratic elution. We compared the ^{18}F fluoride-elution solutions ($\text{K}_2\text{CO}_3/\text{K}222$ vs $\text{KOTf}/\text{K}_2\text{CO}_3$) and solvents (DMF vs DMA) with respect to high-temperature stability and isolated radiochemical yield (RCY).

Results:

On the Tracerlab FX_{FN}, non-decay-corrected isolated RCY for ^{18}F MFBG was $9.3 \pm 3.0\%$ ($n = 3$). Although $\text{K}_2\text{CO}_3/\text{K}222$ has been reported previously, the lower basicity of $\text{KOTf}/\text{K}_2\text{CO}_3$ system (as indicated by conjugate-acid pK_a values HOTf ($\text{pK}_a \approx -14$; OTf^- essentially non-basic), and $\text{HCO}_3^-/\text{CO}_3^{2-}$ ($\text{pK}_{a2} \approx 10.3$)) afforded higher RCYs around 4%. Relative to DMF, DMA provided greater high-temperature stable whereas DMF may release dimethylamine upon heating and higher RCYs around 9%.

Conclusions:

Optimized radiosynthesis of ^{18}F -mFBG have been successfully synthesized by TRACERlab FXFN module with precursor in DMA and KOTf as an eluent. The radiochemical yield is $9.3 \pm 3.0\%$, molar activity = $208 \pm 148 \text{ GBq}/\mu\text{mol}$ ($n = 3$). In vivo performance with dynamic PET in healthy mice to establish baseline have been set-up.

Study of Quantitation Uncertainty using Amyloid PET Imaging for Assessment of Amyloid Status

Shao-Yi Huang¹, Kun-Ju Lin^{1,2}, Ing-Tsung Hsiao^{1,2}

¹Department of Medical Imaging and Radiological Sciences, College of Medicine, Chang Gung University, Taoyuan, Taiwan

²Department of Nuclear Medicine, Chang Gung Memorial Hospital, Linkou, Taoyuan, Taiwan

Introduction:

Amyloid PET quantification using the Centiloid (CL) scale standardizes A β burden assessment, but uncertainty exists near the cutoff, forming a “gray zone.” A clear definition of the CL gray zone may improve early detection and subject selection in clinical trials.

Materials and Methods:

We retrospectively analyzed 200 participants who underwent 18F-florbetapir amyloid PET, T1-weighted MRI, and clinical assessments. The optimal CL cutoff was derived by receiver operating characteristic (ROC) analysis in an age-matched cohort of 38 CU visually amyloid-negative and 39 dementia visually amyloid-positive subjects. To define the gray zone, a dual-cutoff strategy was applied using thresholds corresponding to >90% sensitivity and >90% specificity. In the remaining 122 subjects, concordance between visual reads (VR) and quantitative CL classification was assessed. Cognitive performance and other biomarkers were further compared across groups defined by lower cutoff, gray zone, and upper cutoff values.

Results:

An optimal CL cutoff of 19 (AUC=0.98; YI=0.90) was identified. Quantitative CL classification showed strong concordance with visual reads (VR; accuracy 92.8%, $\kappa = 0.85$), with excellent agreement at CL < 10 or > 32 (accuracy 98.1%, $\kappa = 0.96$). In contrast, the intermediate range (CL 10–32) constituted a gray zone with poor concordance (accuracy 54.5%, $\kappa = 0.068$). Subjects with CL > 32 exhibited later onset, and worse cognition compared with CL < 10 (all $p < 0.05$).

Conclusions:

A CL gray zone of 10–32 reflects diagnostic uncertainty where VR and quantitation diverge. Recognizing this zone is crucial for detecting emerging pathology, refining diagnostic precision, and optimizing recruitment for prevention and therapeutic trials in preclinical AD.

輻射作業危害操作應用資訊系統強化防災應變需求

¹呂惠敏、²張家鴻、¹陳建榮、¹陳怡潔、¹盧建萍、²曾雪玲、
³余誠泰、³郭婕、³黃淑慈、⁴魏玉雲、¹黃奕琿

¹國立臺灣大學醫學院附設醫院 核子醫學部

²國立臺灣大學醫學院附設醫院 影像醫學部

³國立臺灣大學醫學院附設醫院 資訊室

⁴國立臺灣大學醫學院附設醫院 安全衛生室

背景介紹:

各類輻射作業場所經常被視為具有潛在危害風險的威脅之一，輻射安全管理在本院專業分工的前提下，分屬多個單位負責，例如全院輻射工作人員由影像醫學部負責、許可類之可發生游離輻射設備由腫瘤醫學部負責、放射性物質由核子醫學部負責等，導致輻射作業場所的各項資訊分散，同時各個作業場所具有的危害特性及現場狀況缺少整合機制，甚至對於場所在緊急應變的整備能力亦無明確資料，連帶影響院內危害風險的全面評估及控管措施，也造成針對全院輻射作業場所的安全管理成效難以綜觀掌握。

材料方法:

本院核子醫學部、影像醫學部、安全衛生室以及資訊室共同組成「輻射作業場所安全管理團隊」，以全面整合有關輻射作業場所安全管理事項，並重新檢討現行管理問題，訂定本院輻射作業場所安全管理策略目標：增強輻射工作人員管理、強化危害風險管制、及加強場所災害預防整備能力，並自2023年起開始自主開發本院輻射作業場所E化管理系統 - iRay系統。

結果:

2025年第三季測試啟用，藉由iRay系統加強各輻射作業場所的危害性物質運作安全控管、輻射工作人員管理、輻射工作人員劑量及身體健康管理，與其安全教育訓練資格查核以及環境設施安全稽查等管理措施，同時縮短院內輻射作業流程，輻射工作人員在院內系統可以查詢歷年來工作劑量，協助全院輻射作業場所提升安全維護成效，並提供有效率的研究支援服務，達成零災害、零缺失之目標。

結論:

本院輻射作業場所安全管理團隊透過iRay系統的開發，應用資訊平台建立起管理的基礎架構，改善申請的審查時效，解決長期以來輻射作業場所危害資訊不明及人員安全維護的困擾，並嘗試強化輻射作業場所地理圖資功能，讓在各輻射作業場所的安全管理獲得提升，配合本院地理資訊系統的開發期程，本院iRay系統的各項放射性物質資料，可望利用web版編輯功能，增設GIS圖層以顯示危害相對位置，可作為院區空間利用及再造之參考，對於醫療作業環境及病人安全維護更能獲得保障。

Topic: Synthesis and Preclinical Biological Evaluation of Quinolone-based FAP Inhibitors as PET Probes for Imaging Fibroblast Activation Protein Expressing

Pei-Wen Wu¹, Shou-Hsuan Liu¹, Wei-Min Zhang¹, Yu-Hsuan Li¹, Shun-Fu Chang², Jia-Je Li¹, Mei-Hui Wang³,
Chuan-Lin Chen^{*,1}

From: ¹Department of Biomedical Imaging and Radiological Sciences of National Yang Ming Chiao Tung University, Taipei, Taiwan

² Department of Medical Research and Development, Chiayi Chang Gung Memorial Hospital, Chiayi, Taiwan

³National Atomic Research Institute, Taoyuan Taiwan

Introduction:

Fibroblast activation protein (FAP), overexpressed in cancer-associated fibroblasts, is an important target for tumor imaging and therapy. Most current FAP inhibitors (FAPIs), such as FAPI-02 and FAPI-04, are quinolone-based and radiolabeled for theranostic use, but fluorine-18 probes remain limited. Since diagnostic and therapeutic tracers require different pharmacokinetics, linker length plays a key role. Inspired by the rapid clearance of short-linker FAPI ligands, we developed ethyl-linker derivatives directly labeled with ¹⁸F or via Al-¹⁸F chelation, yielding three new PET probes ([¹⁸F] NODA-E-FAPI-1, [¹⁸F] NODA-E-FAPI-2, and [¹⁸F] FE-FAPI-2) compared with [¹⁸F]-FAPI-74.

Materials and Methods:

FAPI tracers were synthesized, radiolabeled with ¹⁸F, validated by TLC/HPLC, and evaluated for cellular uptake and in vivo biodistribution in U87-MG tumor-bearing mice using PET imaging.

Results:

All tracers showed excellent radiochemical purity (>95%), high FAP specificity, and strong cellular uptake, with [¹⁸F] NODA-E-FAPI-1 exhibiting the highest uptake. Biodistribution and positron emission tomography (PET) imaging confirmed that [¹⁸F] FE-FAPI-2 exhibited slower background clearance due to its higher lipophilicity, while the other three drugs had better urinary metabolic pathways, resulting in better contrast. At one hour, the tumor-to-muscle ratios of the three drugs were similar. At two hours, [¹⁸F] NODA-E-FAPI-2 and [¹⁸F]-FAPI-74 were similar, while [¹⁸F] NODA-FAPI-1 exhibited higher tumor accumulation and a higher tumor-to-muscle ratio. These results were confirmed by biodistribution and PET imaging.

Conclusions:

Biodistribution and PET imaging revealed distinct metabolic profiles, as [¹⁸F] FE-FAPI-2 cleared more slowly due to higher lipophilicity, while the others showed faster urinary clearance and better imaging contrast.

評估¹²⁵I-KX-1作為乳癌細胞治療藥物之潛力

^{1,2}吳懿芳、²翁啓昌

¹長庚大學 生物醫學系

²長庚大學 醫學影像暨放射科學系

背景介紹:

多聚 (ADP-核糖) 聚合酶-1 (PARP-1) 是一種參與 DNA 單股斷裂修復的酶，對維持基因組完整性與細胞存活至關重要。在部分腫瘤細胞，特別是帶有 BRCA1/2 基因突變者，同源重組修復缺陷導致對 PARP 依賴性增加，使其對傳統化療與放療反應不佳。本研究以 ¹²⁵I-KX-1 為模型 (Rucaparib 之衍生物)，探討其結合 PARP-1 並產生 Auger 電子效應的潛力，以期提升腫瘤細胞毒性，提供乳癌靶向放射治療的新方向。

材料方法:

本研究採所使用之 ¹²⁵I-KX-1 為實驗室自行製備，主要採用親電子方式將碘-125 透過一步反應結合至含錫之前驅物上，並於製程結束後以 HPLC 進行放化純度確認，相關之步驟可參考本研究室先前所發表之論文 [1]。此外，所選用之 MCF-7 細胞株屬於 ER+/PR+、HER2 低表現之乳癌亞型，為臨床上最常見且廣泛應用於乳癌研究的模型。由於其特性穩定且培養容易，適合作為評估 PARP 抑制劑及其放射性衍生物的實驗平台。為驗證該放射性藥物細胞毒殺能力以及比較其與現行常用之藥物 Olaparib 之效益，我們將 MCF-7 細胞以約 3000 顆/100 μL 培養基的濃度接種於 96 孔白色培養板中，於 37°C、5% CO₂ 培養 24 小時後移除生長培養基並加入不同治療藥物，其中 Olaparib 濃度為 0.01 μM~1 mM，¹²⁵I-KX-1 濃度則為 0.78125 μCi/mL~25 μCi/mL。處理完畢後使用 CellTiter-Glo 2.0 試劑測量冷光訊號並以 Prism 軟體進行劑量反應曲線之 EC₅₀ 分析。

結果:

根據初步結果，在 MCF-7 細胞中，Olaparib 的 EC₅₀ 為 297 μM，而 ¹²⁵I-KX-1 的 EC₅₀ 為 5.63 nM，從該結果可以顯示出該放射性藥物對所選用之乳癌細胞相較現行所使用之常規治療藥物之效率約 > 50 倍左右。

結論:

本研究成果雖顯示 ¹²⁵I-KX-1 在細胞層面展現出較強的細胞毒性效應，但因只選用一株乳癌細胞，代表性可能略為不足，後續本研究將持續於不同之細胞株以及活體動物上進一步確認其治療效益並期待其未來可用於臨床之可行性。

Ac-225自動化標誌纖維母細胞活化蛋白標靶系列胜肽 (FAPI-46、FAPI-2286與3BP-FAPI-3940) 之條件研究

Automated Radiolabeling Conditions of Actinium-225 with Fibroblast Activation Protein-Targeting Peptides FAPI-46, FAPI-2286, and 3BP-FAPI-3940

^{1,2}李銘忻、^{1,2}羅盛男、¹楊詩涵、¹林欣茹、¹洪綾蔓、¹黃玉儀
¹和信治癌中心醫院 核子醫學科
²群創生物科技公司

背景介紹:

標靶 α 療法為治療轉移性癌症的新興策略，目前核醫治療新藥臨床研究偏向靶向 (TAT, target alpha therapy) α 粒子Ac-225 (Actinium-225) 等放射性同位素臨床應用，因其高線性能量轉移 (LET) 和強大的細胞殺傷能力，在TAT癌症治療中應用日益廣泛。但優良藥品製造(GMP)級核種與足夠臨床劑量獲得困難，致使臨床進展緩慢。FAPI是一種纖維母細胞活化蛋白 (FAP) 抑制劑，可以用診斷性和治療性放射性同位素標誌，使其成為一種治療診斷藥物(theranostic agent)。針對腫瘤微環境癌症相關纖維細胞 (cancer-associated fibroblasts, CAFs) 高度表達FAP情況下，Ac-225-FAPI可以用來靶向並破壞表達FAP的癌細胞。FAPI-46、FAPI-2286及3BP-FAPI-3940在表達 FAP 的腫瘤中表現出較高的滯留率，文獻認為是三種極具潛力的 FAP 靶向放射性配體。目前仍然欠缺Ac-225核種標誌技術，我們以GMP自動化標誌系統，進行Ac-225核種標誌FAPI-46、FAPI-2286及3BP-FAPI-3940三種前驅物，測試其標誌條件與初探其放射化學純度分析方法，做為臨床試驗CMC文件之依據。

材料方法:

此Ac-225標誌實驗設計包含：前驅物使用美國MCE公司生產之FAPI-46(純度>99%)與NAMICROBIO公司生產之FAPI-2286與3BP-FAPI-3940 (純度>99%)；Ac-225核種由德國Eckert & Ziegler提供；標誌反應使用自動合成盒為德國Eckert & Ziegler之Modular-Lab PharmTracer；活度量測使用Atomlab™ 500Plus Dose Calibrator活度量測儀；使用德國Eckert & Ziegler之MiniScanPRO TLC Scanner進行iTLC放化純度分析；使用德國Eckert & Ziegler之SCX管柱將Ac-225濃縮(1 Mq/ 1 mL)；前驅物反應濃度量為30 μ g~100 μ g；Ac-225反應活度為10 Mq/ 1 mL；標誌反應溫度為85°C；pH值分別以酸性與鹼性溶液環境標誌；以不同反應時間進行標誌最佳反應時間測試。

結果:

以SCX管柱可以有效濃縮Ac-225活度濃度；在85°C溫度下，Ac-225可以在10分鐘內完成對FAPI-46、FAPI-2286及3BP-FAPI-3940的定量標誌；C-18管柱可有效將放射化學純度達>95%；在鹼性溶液環境，放射性標誌效率>30%；在酸性溶液環境，標誌效率=0；反應時間10分鐘與20分鐘沒有差異。

結論:

利用自動合成系統進行Ac-225核種標誌FAPI-46、FAPI-2286及3BP-FAPI-3940三種前驅物，初探與測試其標誌條件及其放射化學純度分析方法。由於Ac-225核種取得困難，相關測試參數與經驗非常珍貴，相關標誌純化參數可做為日後臨床試驗CMC文件之重要依據。未來將持續進行標誌效率提升研究與GMP製程測試與分析方法確效。

放射性碘¹²⁵I標誌GPC-3抗體奈米微胞作為肝癌標靶治療之藥物制放研究

¹陳宜伶、²何慈娟、³楊明慧、^{1,2}黃英峰、^{1,4}張晉銓、^{1,2,4}田育彰

¹高雄醫學大學附設中和紀念醫院 核子醫學科

²高雄醫學大學 醫學影像暨放射科學系

³高雄醫學大學附設中和紀念醫院 一般及消化系外科

⁴高雄醫學大學 醫學系

背景介紹:

肝癌的死亡率在國人癌症中排名第二。由於肝癌組織血管遍佈，目前雖可透過化學栓塞與手術進行治療，但仍存在許多限制。因此，發展具專一性且有效的標靶治療策略，對於提升肝癌治療效果具有重要意義。

材料方法:

以透明質酸-聚己內酯(HA-PCL)微胞包覆放射性碘標誌GPC3抗體(劑量0.4-10 μCi)與腫瘤細胞(HepG2、Hep3B、Huh7)培養，評估¹²⁵I-anti-GPC3 Ab微胞與腫瘤細胞株的專一性結合能力及細胞毒殺效果。小鼠藥物分佈是用GNMT (-/-)小鼠注射20 μCi 的藥物，犧牲小鼠後，取血及各部位器官稱重後以 γ 計數器測量放射活度並計算%ID/g，觀察其在肝腫瘤組織中的靶向性。為了解釋放射對細胞傷害程度與作用機制分析，細胞傷害與細胞生長週期的指標蛋白質， γ -H2AX、Mre11、NBS1、MRN complex及Cyclin B2將以免疫螢光染色做驗證。

結果:

體外實驗顯示，¹²⁵I-anti-GPC3 Ab能專一性結合人類肝癌細胞株(HepG2、Hep3B、Huh7)，並在24至48小時內抑制10~50%的細胞增生，同時促進最高可達60%的細胞死亡。體內實驗結果顯示，¹²⁵I-anti-GPC3 Ab微胞能特異性累積於肝腫瘤組織。小鼠於注射後24小時，肝腫瘤組織中DNA雙股斷裂感知蛋白MRN complex表現上升，DNA修復相關分子 γ -H2AX及細胞週期調控分子CCNB2表現下降，顯示其透過干擾DNA修復與細胞週期進程發揮抗癌作用。

結論:

本研究開發之¹²⁵I-anti-GPC3 Ab微胞，能有效靶向肝癌細胞與腫瘤組織，並透過抑制DNA修復與阻斷細胞週期達到毒殺效果，展現出作為肝癌標靶治療策略的潛力。

同位素碘-125標誌半乳聚醣應用於肝癌診斷之研究

¹陳巧寧、²陳宜伶、¹何慈娟、³楊明慧、^{1,2}黃英峰、^{2,4}張晉銓、^{1,2,4}田育彰

¹高雄醫學大學 醫學影像暨放射科學系

²高雄醫學大學附設中和紀念醫院 核子醫學科

³高雄醫學大學附設中和紀念醫院 一般及消化系外科

⁴高雄醫學大學 醫學系

背景介紹:

肝癌在台灣的癌症排名中位居第二，其發病原因之一是慢性B型肝炎病毒(HBV)感染。慢性HBV感染可能引發慢性肝炎、肝硬化，並進一步導致肝細胞癌(HCC)的形成。由於肝癌在早期階段難以被發現，本研究旨在開發同位素碘-125標誌半乳聚醣，以協助診斷肝病的病程進展。

材料方法:

本研究使用放射性同位素碘-125 標誌在植物II型阿拉伯半乳聚醣(Arabinogalactan; AG)以及鎘-植酸鹽(^{99m}Tc-Phytate)。以HBx 轉殖小鼠(HBx transgenic mice)和野生型小鼠(Wild type; WT)做為實驗動物模型，建立自發性肝病模型，以腹腔注射0.5 mCi放射性藥物犧牲後觀察兩種藥物在肝臟中的劑量。另外探討藥物在肝癌細胞和正常細胞中的吞噬率和存活率，進而評估¹²⁵I-AG對肝病病程發展之診斷可行性。

結果:

根據細胞實驗結果表示¹²⁵I-AG具備被肝癌細胞吞噬以及殺死肝癌細胞的效果，並透過動物實驗結果發現，¹²⁵I-AG會與肝臟中的去唾液酸糖蛋白受體(asialoglycoprotein receptor; ASGPR)結合聚集於肝臟，在具有肝臟損傷的小鼠分佈會升高，甚至在患有肝腫瘤的小鼠中，劑量分佈會達到最高。而^{99m}Tc-Phytate在正常小鼠肝臟中的劑量分佈會達到最高，其在具有肝臟損傷的小鼠分佈和健康小鼠相比則出現下降，更在患有肝腫瘤的小鼠中分佈達到最低。

結論:

透過¹²⁵I- AG和^{99m}Tc-Phytate在不同小鼠中肝臟之放射劑量差異，可以取得其比值，進而推算出肝臟腫瘤的大小與受損程度。

F-18-Fluorocholine PET/CT於原發性副甲狀腺功能亢進病人術前定位之臨床應用價值分析

¹蘇祐瑄、¹姚珊汎

¹臺北榮民總醫院 核子醫學部

背景介紹:

原發性副甲狀腺功能亢進 (PHPT) 多由副甲狀腺腺瘤或多腺體增生引起，造成副甲狀腺素過度分泌，導致高血鈣、骨質流失與腎結石。手術為唯一根治方式，而術前準確的影像定位對手術成功率與降低併發症至關重要。現行常用之Tc-99m-MIBI掃描與頸部超音波在多腺體病變、異位腺體或微小病灶中靈敏度有限。F-18-Fluorocholine (FCH) PET/CT具高空間解析度與代謝影像優勢，近年歐美研究已證實其可提升病灶檢出率，特別適用於MIBI陰性或影像表現複雜之病例。

材料方法:

本研究為回顧性研究，自2023年至2025年共納入20位經臨床診斷為PHPT且傳統影像檢查 (MIBI與/或頸部超音波) 未能明確定位病灶之病人。所有受試者接受FCH PET/CT檢查，採用院內合成F-18-Choline，注射劑量0.1 mCi/kg靜脈注射，於注射後60分鐘以Discovery MI Gen 2 PET/CT進行掃描，並進行衰減、散射及衰變修正。比較FCH PET/CT、MIBI與超音波在病灶定位之靈敏度、特異性及準確度，並進行次群分析以評估其在多腺體病變、異位腺體及微小病灶等臨床情境中的檢出效能。

結果:

初步結果顯示，FCH PET/CT在檢出多病灶、異位腺體及微小病灶方面均優於MIBI掃描，對於MIBI陰性個案亦可提供額外定位資訊。與超音波相比，FCH PET/CT在深部或非典型位置病灶的檢出率明顯提升。統計分析顯示，FCH PET/CT之整體靈敏度顯著高於傳統工具。

結論:

F-18-Fluorocholine PET/CT可作為PHPT病人術前定位的高效輔助工具，尤其在傳統影像陰性或疑難病灶中展現顯著優勢。其臨床應用有助於提高手術成功率、縮短手術時間並降低併發症風險，建議納入術前評估流程。

前置輔助性化療前後之FDG-PET於頭頸癌病人之變化：與血液學、病理學指標之關聯初探

¹ 陳穆遠、¹姚珊汎

¹臺北榮民總醫院 核醫部

背景介紹:

FDG-PET 在惡性腫瘤分期與前置輔助化療成效評估上已廣泛應用，其中針對食道癌的影像參數更具預後評估潛力。由於食道癌與頭頸癌共享場癌化 (field cancerization) 危險因子，且常為同時性癌症 (synchronous cancer)，FDG-PET 或可於頭頸癌發揮相同價值。本研究旨在探討治療前後定性與半定量影像指標的變化，並與臨床血液學及病理學常見預後因子比較其關聯。

材料方法:

回溯納入台北榮總 2024 年 7 月至 2025 年 6 月符合條件病人，針對病灶圈選兩次 FDG-PET 的原發部位、轉移性淋巴結及全身腫瘤量，量測腫瘤體積 (TV)、SUVpeak 與全腫瘤糖解量 (TLG)，並計算 TV 與 TLG 總和及差值。ROI 範圍以解剖影像輔助手動調整，排除分期 PET 中過小病灶；同時收集 LDH、NLR 等血液學及 LVI、ENE 等病理參數。統計方法採 Wilcoxon 符號檢定、Spearman 相關與 Mann-Whitney U 檢定，並進行個案定性分析。

結果:

共納入 12 位病人，其中 2 位因遠端轉移無術後病理資料，另 2 位依影像、病理與臨床表現判定為完全緩解。治療前後各影像參數均顯著下降；原發腫瘤 TLG 變化量與治療前白蛋白呈中度負相關，多項參數與術後轉移性淋巴結數量具統計相關。完全緩解個案在治療後原發與轉移病灶均呈低攝取，ROI 難以圈選，與病理結果一致。

結論:

FDG-PET 在頭頸癌前置輔助化療反應評估具潛力，部分參數與血液學及病理預後因子呈顯著相關，並與完全緩解病理結果一致。然而，本研究為回溯性小樣本，且缺乏長期預後資料，能否作為非侵入式化療反應評估工具仍需進一步驗證。

The Association of Cholesterol Level with Cardiac Sympathetic Nerve Damage Assessed by I-123 MIBG Scintigraphy in Diabetic Patients with Atrial Fibrillation

Chih-Fan Kuo¹, Guang-Uei Hung¹, Ching-Ni Lin², Pai-Yi Chiu³, Kenichi Nakajima⁴

¹Department of Nuclear Medicine, Chang Bing Show Chwan Memorial Hospital, Changhua, Taiwan

²Department of Nuclear Medicine, Show Chwan Memorial Hospital, Changhua, Taiwan

³Department of Neurology, Show Chwan Memorial Hospital, Changhua, Taiwan

⁴Department of Functional Imaging and Artificial Intelligence, Kanazawa University, Kanazawa, Japan

Introduction:

Atrial fibrillation (Af) is significantly more prevalent in patients with diabetes mellitus (DM) than in those without, yet the underlying mechanisms remain unclear. I-123 metaiodobenzylguanidine (MIBG) scintigraphy evaluates cardiac sympathetic nerve function. This study aimed to investigate the relationship between I-123 MIBG uptake, cholesterol levels, and Af in patients with DM.

Materials and Methods:

A total of 52 patients were prospectively enrolled and divided into three groups: 15 with both DM and Af, 21 with DM but without Af, and 16 controls (without DM or Af). All patients underwent cardiac scintigraphy using an intravenous injection of 2 mCi of I-123 MIBG. The heart-to-mediastinum (H/M) ratio was measured to assess cardiac sympathetic nerve function. H/M ratio, lipid profiles, HbA1c, and demographic data were compared among the groups.

Results:

The Af group showed significantly lower H/M ratio, total cholesterol (TC), and high-density lipoprotein (HDL) levels (2.54 ± 0.66 , 179.00 ± 32.01 mg/dL, and 52.33 ± 9.14 mg/dL, respectively) compared to the non-Af group (3.01 ± 0.66 , 200.00 ± 28.36 mg/dL, and 55.97 ± 14.54 mg/dL; all $p < 0.05$). No significant differences were observed in age, triglycerides, low-density lipoprotein (LDL), fasting glucose, or HbA1c. Logistic regression analysis identified TC as the only independent predictor of an abnormal H/M ratio (< 2.2).

Conclusions:

These preliminary findings suggest that the development of Af in diabetic patients is associated with cardiac sympathetic nerve dysfunction. This dysfunction may be linked to insufficient serum cholesterol levels necessary for nerve repair, rather than DM itself. Further studies are warranted to confirm this hypothesis.

Prediction of external radiation dose in thyroid cancer patients using a simplified biokinetics model with detector measurements and I-131 whole-body scan parameters

¹Hui-Ling Lo, ¹I-Feng Chen

¹Department of Nuclear Medicine, Tri-Service General Hospital, National Defense Medical University, Taiwan

Introduction:

Radioactive iodine (RAI) therapy is a standard treatment for differentiated thyroid carcinoma (DTC). Accurate estimation of post-discharge radiation exposure is essential for determining appropriate isolation measures and protecting caregivers. This study is based on a previously established radioactive iodine biokinetics model and incorporates imaging parameters to estimate relevant biokinetic parameters, thereby simplifying the evaluation of patients' external radiation dose.

Materials and Methods:

We retrospectively reviewed data from patients with DTC who received RAI therapy between September 2023 and March 2025.

Radiation dose rates measured by a ceiling-mounted detector in a shielded room, and parameters from I-131 whole-body scans were applied to a biexponential model.

This approach allowed for the estimation of key biokinetic parameters, including the thyroidal uptake fraction (Ft) and the effective half-life of extra-thyroidal tissues (Tet). Correlations between radiation dose rate and characteristics such as renal function, thyroid function, body mass index (BMI), and follow-up interval were analyzed.

Results:

A total of 80 patients were included. The estimated thyroidal uptake fraction (Ft) was 0.017 ± 0.03 , and the effective half-life of extra-thyroidal tissue (Tet) was 13.80 ± 4.62 hours. Pearson's correlation analysis revealed that the retention ratio of radioiodine in patient measured at follow-up (RR_F) was significantly associated with the Ft, Tet, discharge retention ratio (RR_D), and the ratio of thyroid counts to non-thyroid counts (T/N ratio) ($p < 0.05$). The external radiation dose at follow-up was strongly correlated with model-predicted values ($r = 0.7964$), and the prediction accuracy was significantly higher at intervals within 144 hours compared with those beyond 144 hours ($p < 0.05$).

Conclusions:

The simplified biokinetics model incorporating imaging parameters provides an effective approach for estimating external radiation dose. The accuracy of our predictive method, especially within 144 hours, supports its clinical utility for discharge planning and radiation safety aligned with the ALARA principle.

Prognostic value of lymph node-to-primary tumor standardized uptake value ratio in esophageal cancer patients who underwent neo-adjuvant concurrent chemoradiotherapy and esophagectomy

Chang-Shen Tseng¹, Bee-Song Chang², Shu-Hsin Liu¹, Sheng-Chieh Chan^{1,3}

¹Department of Nuclear Medicine, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan.

²Department of Cardiothoracic Surgery, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien.

³School of Medicine, Tzu Chi University, Hualien, Taiwan

Introduction:

The lymph node-to-primary tumor standardized uptake value ratio (NT ratio) is an emerging metabolic parameter that reflects the metastatic potential of malignancies more comprehensively than individual SUV measures. However, its prognostic significance in esophageal cancer patients following neo-adjuvant concurrent chemoradiotherapy and esophagectomy remains underexplored.

Materials and Methods:

We retrospectively analyzed esophageal cancer patients who underwent neoadjuvant chemoradiotherapy followed by esophagectomy. [¹⁸F]FDG PET/CT parameters, including the SUVmax of both primary tumors and metastatic lymph nodes, were evaluated. Prognostic significance was assessed with overall survival (OS) and event free survival (EFS) as the endpoint. Survival analysis was conducted using Kaplan-Meier plots, accompanied by the Mantel-Cox log-rank test and Cox regression.

Results:

A total of 95 patients were included, with a median follow-up of 45 months. During this period, 65 patients (68.4%) died, while 62 patients (65.2%) experienced disease recurrence or second primary tumor. Patients with a higher NT ratio had significantly worse OS and EFS. Kaplan-Meier analysis revealed a median OS of 32.4 months for the high-ratio group, compared to 98.7 months in the low-ratio group ($p < 0.01$). Multivariate Cox regression identified NT ratio as an independent predictor of poorer OS ($p < 0.01$, HR=2.966) and EFS ($p = 0.047$, HR=1.954).

Conclusions:

The NT ratio offers high prognostic value in predicting overall survival and event free survival among esophageal cancer patients who underwent neo-adjuvant concurrent chemoradiotherapy followed by esophagectomy. This parameter may enhance risk stratification and guide postoperative management strategies.

Personalized Lung Dosimetry with Y-90 PET/CT Validation for Risk Assessment of Radiation Pneumonitis after Radioembolization

Yi-Chieh Chen¹, Hui-Min Lu¹, Shinn-Fong Peng², Mei-Fang Cheng¹

Department of Nuclear Medicine¹, Medical Imaging², National Taiwan University Hospital and College of Medicine, Taipei

Introduction:

Accurate estimation of lung absorbed dose is critical for preventing radiation pneumonitis (RP) in patients undergoing Yttrium-90 (Y-90) microsphere radioembolization. Conventional dosimetry assumes a uniform lung mass of 1000 g, which may underestimate true absorbed lung dose. We used post-treatment Y-90 PET/CT-based lung dosimetry as the reference standard to evaluate the accuracy of pre-treatment dose estimates and to identify risk factors for RP.

Materials and Methods:

We retrospectively analyzed 100 patients treated with Y-90 microspheres from April 2018 to March 2025. Pre-treatment lung dose was first estimated using administered Y-90 activity and lung shunt fraction (LSF) derived from ^{99m}Tc- MAA planar imaging with a default 1000 g lung mass per manufacturer guidance. A personalized lung mass was then calculated from CT on ^{99m}Tc- MAA SPECT/CT for individualized dose estimates. Post-treatment image-based lung dose was quantified using Y-90 PET/CT. Clinical and imaging records were reviewed for RP. PET/CT-based dose and related parameters were compared between RP and non-RP groups.

Results:

Of 100 patients, 4 (4%) developed RP. No significant differences were found in sex, tumor type, or microsphere type between patients with and without RP. Patients who developed RP received higher administered activity (3.16 ± 1.88 GBq vs 1.47 ± 0.73 , $P < 0.001$) and had greater LSF ($7.6 \pm 2.82\%$ vs $4.5 \pm 2.23\%$, $P < 0.05$). Fixed-mass estimate yielded lower lung doses than personalized approach (3.66 ± 3.47 vs 4.99 ± 4.81 Gy, $P < 0.0001$). Both pre-treatment estimates correlated moderately with PET/CT-based lung dose (fixed: $r=0.612$; personalized: $r=0.678$; both $P < 0.0001$), whereas LSF alone did not ($r=0.150$, $P = 0.136$). PET/CT-based mass-normalized lung dose (Gy/g) was higher in RP patients (10.70 ± 9.06 vs 3.05 ± 2.21 ; $P < 0.0001$).

Conclusions:

Personalized lung-mass estimates yield higher pre-treatment lung doses than the conventional 1000 g assumption. Y-90 PET/CT-based dosimetry demonstrated significantly higher mass-normalized lung dose in patients who developed RP, supporting its association with pulmonary toxicity. Incorporating individualized lung mass into pre-treatment planning may improve risk stratification and enhance patient safety in Y-90 radioembolization.

[¹⁷⁷Lu]DOTATATE Therapy for Metastatic Pheochromocytoma and Paragangliomas: NTUH Experience

Li-Hua Tang¹, Wan-Chen Wu², Shyang-Rong Shih², Chia-Ju Liu¹, Chih-Yuan Wang², Shinn-Fong Peng^{1,3}, Kuan-Yin Ko⁴, Mei-Feng Cheng¹

Department of Nuclear Medicine¹, Internal Medicine², Medical Imaging³, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan.

Department of Nuclear Medicine⁴, National Taiwan University Cancer Center, Taipei, Taiwan.

Introduction:

Metastatic pheochromocytoma/paraganglioma (PPGL) are rare tumors with limited options for recurrent or progressive disease. Because these tumors frequently express somatostatin receptors, peptide receptor radionuclide therapy (PRRT) with [¹⁷⁷Lu]DOTATATE is promising. However, catecholamine release during administration can precipitate hypertensive crisis. Standard infusion protocols used for gastrointestinal neuroendocrine tumors may be insufficient; therefore, individualized extended-infusion regimens merit consideration.

Materials and Methods:

We retrospectively reviewed patients with metastatic PPGL treated with [¹⁷⁷Lu]DOTATATE at our institution between 2022 and 2025. To reduce hemodynamic instability, we implemented a modified protocol prior to PRRT: α/β -adrenergic blockade for ≥ 10 –14 days, adequate hydration, an ICU bed on standby, and three intravenous lines with emergency medications prepared. Clinical symptoms, antihypertensive requirements, laboratory values, treatment-related adverse events, and tumor markers were collected. Each patient received 200 mCi of [¹⁷⁷Lu]-DOTATATE per cycle.

Results:

Three patients (two females and one male; aged 56–60 years) had multisite metastases (liver, lung, bone, peritoneum). Except for one patient, all had completed 4 cycles. Treatment was generally well tolerated; 2 patients developed transient grade 2 leukopenia and lymphopenia. The first two patients received a 2-hour [¹⁷⁷Lu]DOTATATE infusion. The third patient also received a 2-hour infusion for cycle 1 but developed immediate post-infusion tachycardia and hypertension (192/93 mmHg). After multidisciplinary discussion, subsequent cycles used a 4-hour [¹⁷⁷Lu]DOTATATE infusion and a 6-hour L-arginine/L-lysine infusion.

Conclusions:

Despite elevated risks, patients with metastatic PPGL can be treated safely with [¹⁷⁷Lu]DOTATATE when teams are well trained, monitoring is rigorous, intravenous medications are prepared, and an extended-infusion protocol is used.

AI-Assisted Interpretation of Bone Scans: Performance Comparison Between ChatGPT-4o and a TFDA-Approved Bone Scintigraphy Platform in AI-Driven Nuclear Imaging Interpretation

¹Wei-Jen Chen, ¹Yuan-Yu Lee, ¹Chiung-Wei Liao, ²Yi-Jin Chen, ²Pei-Chun Yeh, ²Yu-Chieh Kuo, ¹Pei-Hsuan Lin, ²Pak-Ki Chan, ^{1,2}Chia-Hung Kao

¹Department of Nuclear Medicine and PET Center, China Medical University Hospital, Taichung, Taiwan
²Artificial Intelligence Center, China Medical University Hospital, Taichung, Taiwan

Introduction:

Large language models such as ChatGPT-4o have drawn attention for their potential in diagnostic support within the medical field. However, their capabilities in nuclear medicine applications remain underexplored. In this study, we aimed to evaluate and compare the performance of ChatGPT-4o and a TFDA-approved bone scintigraphy platform, the BS Platform, in interpreting bone scintigraphic images for the detection and localization of bone metastases.

Materials and Methods:

We retrospectively analyzed 52 whole-body bone scintigraphic images using three interpretation methods: ChatGPT-4o's multimodal image analysis, the BS Platform, and board-certified nuclear medicine physicians. For ChatGPT-4o, image analysis was guided by the standardized prompt: interpret this bone scan, identify the affected skeletal regions, generate a structured report including only the findings and impression sections, apply standard nuclear medicine terminology, and follow the output tone rules defined in the project instructions. The performance of interpretations was evaluated based on both binary classification and lesion localization across nine predefined anatomical regions. The results were then compared to the reports from board-certified physicians, which served as the gold standard in this study.

Results:

For binary classification, ChatGPT-4o achieved 84.6% accuracy, comparable to the BS Platform's accuracy of 82.7%. However, ChatGPT-4o showed considerably lower performance in lesion localization, with regional precision and sensitivity of 32.5% and 13.3%, respectively. In contrast, the BS Platform demonstrated superior localization performance, attaining 80.3% precision and 64.9% sensitivity.

Conclusions:

ChatGPT-4o showed potential for detecting bone metastases but lacked sufficient capability in lesion localization, making it unsuitable for clinical use. In contrast, the BS Platform's superior performance enables it to be more reliable for clinical applications.

From Heart Failure to Ventricular Arrhythmias: A Case Series of Functional Imaging Using Myocardial Perfusion and Innervation

¹Cheng-Han Tsai, ¹Yu-Cheng Shih, ²Shan-Hui Huang, ³Chen-Hsi Hsieh, ¹Shan-Ying Wang, ¹Yen-Wen Wu

¹Department of Nuclear Medicine, Far Eastern Memorial Hospital, New Taipei City, Taiwan

²Division of Cardiology, Cardiovascular Medical Center, Far Eastern Memorial Hospital, New Taipei City, Taiwan

³School of Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan

Introduction:

I-123 MIBG scintigraphy allows functional assessment of cardiac sympathetic innervation and provides prognostic information in patients with heart failure (HF) and arrhythmias. The combination of MIBG SPECT and myocardial perfusion imaging (MPI) offers insights into regional mismatch, denervation, and potential arrhythmic substrates.

Materials and Methods:

Three patients with ischemic or non-ischemic cardiomyopathy and refractory ventricular arrhythmias were evaluated using dual MIBG and MPI imaging pre- and post-intervention. Interventions included coronary revascularization, stereotactic body radiation therapy (SBRT), and heart transplantation. HMR, washout rate (WR), and regional innervation patterns were assessed.

Results:

MIBG imaging detected more extensive sympathetic dysfunction than perfusion imaging. Post-treatment follow-up showed partial reinnervation, reduction in arrhythmic burden, and improved WR and HMR in two cases. One patient showed sympathetic recovery post-transplant despite persistent perfusion abnormalities. Another demonstrated improved regional innervation with reduced VPC burden after SBRT, even with worsened perfusion. The third case, a revascularization case, showed recovery of sympathetic innervation, with perfusion and ventricular function remaining stable after viability-guided PCI. MIBG changes preceded or exceeded perfusion changes, highlighting the sensitivity of sympathetic imaging.

Conclusions:

MIBG imaging complements MPI in evaluating ventricular arrhythmia substrates. Sympathetic reinnervation may occur after effective therapy and precede perfusion recovery. MIBG SPECT appears to correlate better with clinical improvement and arrhythmia reduction than MPI alone.

Quantitative Analysis of ^{99m}Tc -MAA Lung Perfusion SPECT/CT in Chronic Thromboembolic Pulmonary Hypertension: A Preliminary Study

¹Yu-Sheng Liu, ²Shih-Chuan Tsai, ³Jing-Uei Hou, ⁴Shin-Yi Wang, ⁵Yi-Jing Lin

¹⁻⁵Department of Nuclear Medicine, Taichung Veteran's General Hospital, Taichung, Taiwan

Introduction:

^{99m}Tc -MAA lung perfusion SPECT/CT is a valuable imaging modality for excluding chronic thromboembolic pulmonary hypertension (CTEPH). However, visual interpretation may be subject to observer variability. This preliminary study aimed to evaluate the feasibility of quantitative analysis to enhance the diagnostic accuracy of lung perfusion SPECT/CT in patients with CTEPH.

Materials and Methods:

This single-center retrospective observational study enrolled patients who underwent lung perfusion SPECT/CT at our hospital between March 2022 and March 2025. All patients were evaluated with multimodality assessments, including echocardiography, computed tomography, and right heart catheterization (RHC). Among all the 30 patients, 17 with diagnosis of CTEPH with perfusion defects on lung perfusion SPECT/CT and mean pulmonary arterial pressure (mPAP) ≥ 20 mm Hg on RHC were assigned to the CTEPH group. The remaining 13 patients were included in the control group. Quantitative image analysis of lung perfusion SPECT/CT was performed using multiple thresholds, ranging from 0.0 to 1.0 of the maximal counts in increments of 0.1. For each threshold, the perfusion defect ratio was calculated, and the corresponding diagnostic performance was evaluated.

Results:

Using thresholds between 0.1 and 0.5 of the maximal counts, the perfusion defect ratios in the CTEPH group were significantly higher than those in the control group. At a threshold of 0.1 of the maximal counts, a lung perfusion defect ratio cutoff of 20.6% yielded a sensitivity of 70.6% and a specificity of 100% for identifying CTEPH.

Conclusions:

This preliminary study suggests that quantitative analysis of ^{99m}Tc -MAA lung perfusion SPECT/CT may serve as an objective tool for the diagnose CTEPH. However, further comprehensive studies are warranted to validate these findings.

Impact of SUVmax in ^{18}F FDG-PET on Patients with Esophageal Squamous Cell Carcinoma Receiving Neoadjuvant Chemoradiotherapy

¹Jiun-Chang Wu ²Ku-Hung Lin, ³Nai-Wen Su, ⁴Mei-Lin Chan

¹Department of Critical Care Medicine, MacKay Memorial Hospital, Taipei, Taiwan

²Department of Nuclear Medicine, MacKay Memorial Hospital, Taipei, Taiwan

³Division of Hematology and Oncology, Department of Medicine, MacKay Memorial Hospital, Taipei, Taiwan

⁴Division of Thoracic Surgery, Department of Surgery, MacKay Memorial Hospital, Taipei, Taiwan

Introduction:

Neoadjuvant chemoradiotherapy (neoCRT) followed by esophagectomy with reconstruction is the standard treatment strategy for locally advanced esophageal squamous cell carcinoma (ESCC). Even though the robust intensity and complicated therapy was given to patients, most of them still experience disease recurrences and metastases.

Materials and Methods:

In this retrospective cohort study, we focused on identifying poor prognostic factors and enrolled 140 patients who completed neoCRT followed by surgery. The maximum standardized uptake value (SUVmax) measured by ^{18}F -fluorodeoxyglucose positron emission tomography (^{18}F FDG-PET) after neoCRT may serve as an indicator of worse overall survival (OS), disease-free survival (DFS), and metastasis-free survival (MFS).

Results:

Univariate Cox regression analysis demonstrated that higher post-neoCRT SUVmax values were significantly associated with worse outcomes. Specifically, patients with SUVmax ≥ 6.3 had poorer OS (hazard ratio: 2.921, 95% CI 2.023 – 4.218, $p < 0.001$), patients with SUVmax ≥ 4.5 predicted shorter DFS (hazard ratio: 1.932, 95% CI 1.370 – 2.724, $p < 0.001$), and patients with SUVmax ≥ 3.6 predicted inferior MFS (hazard ratio: 2.458, 95% CI 1.664 – 3.632, $p < 0.001$).

Conclusions:

SUVmax on ^{18}F FDG-PET/CT may predict prognosis in patients with ESCC receiving neoadjuvant chemoradiotherapy.

學齡前六歲以下兒童之核子醫學檢查利用情形分析

Utilization of Nuclear Medicine Examinations Among Children Under Six Years of Age

1,2李怡旻、2,3莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 研究部

²佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

³慈濟學校財團法人慈濟大學 醫學系

背景介紹:

根據研究顯示，核子醫學科(以下簡稱核醫)以全身骨頭掃描檢查、心肌灌注檢查、正子造影檢查為主要的三種檢查，因此病人也以中老年人口為主，鮮少有學齡前嬰幼兒前來檢查，且過往也鮮少有針對這年齡層病人進行核醫檢查之研究。因此，本研究目的有二，分別為針對學齡前嬰幼兒利用核醫檢查情形進行探討、比較學齡前嬰幼兒與全部病人其利用核醫檢查情形是否不同。

材料方法:

本研究為回溯性研究，資料來源為南部某準醫學中心核子醫學科檢查資料庫，資料期間為2004至2023年。根據檢查日期及病人出生日期計算病人年齡。並依年齡篩選出未滿6歲之學齡前嬰幼兒，並區分為0-2歲、2歲以上兩組，採用SAS® OnDemand for Academics進行資料處理與統計分析，以描述性統計顯示受試者核醫利用情形，以卡方檢定檢測兩組病人核醫利用情形是否有差異。

結果:

共有138筆資料，扣除重複檢查後共有108位病人，男性共68位(62.96%)，平均年齡為 1.49 ± 1.53 歲。0-2歲共74人(68.52%)、2歲(含)以上則有34人(31.48%)。檢查項目以腎臟掃描共54例(50%)居多，其次為腎功能檢查共35例(32.41%)，而全身骨頭掃描則有10例(9.26%)。卡方檢定檢查結果顯示，不同年齡層其檢查項目間未達統計顯著差異($P = 0.601$)，顯示未滿六歲之學齡前嬰幼兒其核醫檢查利用情形相似。根據研究機構核醫資料顯示，研究期間共有172,542筆檢查紀錄，前三大檢查項目分別骨質密度檢查、全身骨頭掃描、心肌灌注檢查。整體而言，學齡前嬰幼兒核醫檢查量僅佔總檢查量的0.08% (138/172,542)，且其常見檢查項目亦有明顯差異。

結論:

本研究顯示，學齡前嬰幼兒接受核醫檢查的比例極低，且檢查項目亦異於整體核醫檢查常見項目。其比例偏低可能與核醫檢查需注射放射性藥物有關，考量放射性藥物對仍在發育階段嬰幼兒的潛在風險，臨床上傾向審慎評估是否執行此類檢查。因此，當有必要對嬰幼兒進行核醫檢查時，應更加強輻射防護措施與相關衛教說明，以確保病人安全。

女性患者父母髌部骨折病史與其骨質疏鬆症風險之關聯性 Association Between Parental Hip Fracture History and Osteoporosis Risk in Female Patients

^{1,2}李怡旻、^{2,3}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 研究部

²佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

³慈濟學校財團法人慈濟大學 醫學系

背景介紹:

文獻指出女性骨質疏鬆症盛行率約為23.1% (95%CI: 19.8–26.9)，且年齡越高者發生骨質疏鬆的風險越高，而這也顯示女性年齡越大者其骨鬆風險越高。而研究也顯示父母有髌部骨折病史者，其自身有骨鬆的風險顯著增加，然而過往這類研究均以歐美人士為主要的研究對象鮮少以亞洲人甚至是台灣人作為主要的研究族群，因此本研究旨在針對女性民眾其父母有無髌部骨折病史對骨質疏鬆風險差異情形。

材料方法:

本研究為回溯性研究，資料來源為南部某準醫學中心機構進行之門診及住院骨質密度檢查數據，資料蒐集期間為2019年1月1日至2023年12月31日。選取性別為女性之受試者，若同位受試者有多筆檢查紀錄，則僅將最早一筆資料納入分析。骨質密度檢查設備乃採用雙能量X線吸收測量法 (DXA)。骨質疏鬆定義乃是依據世界衛生組織 (WHO) 的骨密度測量標準 (T值 $\leq$ -2.5) 作為判定標準，而父母有無髌部骨折則採受試者自行填答方式。統計軟體使用SAS® OnDemand for Academics，統計方法使用個數、百分比、卡方檢定、羅吉斯迴歸，並在控制年齡條件下檢定父母有無髌部骨折病史對骨質疏鬆之差異性。

結果:

本研究共計8,820人符合收案條件，全為女性患者，平均年齡為 68.2 ± 12.2 歲，父母有髌部骨折病史者共計276位 (3.13%)，有骨質疏鬆症則有4,913位 (55.70%)，卡方檢定顯示未達統計顯著差異 ($P = .517$)。進一步以邏輯斯迴歸結果顯示調整年齡變項後，父母有髌部骨折病史者其發生骨質疏鬆的勝算比是父母沒有髌部骨折病史者的1.42倍 (95% CI: 1.13–1.77) ($P < .001$)。

結論:

本研究結果顯示父母有髌部骨折病史者，其骨質疏鬆的風險較高。因此建議若父母有髌部骨折者，應更加注意其自身是否有骨質疏鬆情況。本研究採用回溯性研究設計，且父母是否有髌部骨折由病人自填，並無實際探究受試者父母是否真的有無髌部骨折的情形，因此可能會有回憶偏差的情形。

優惠措施與COVID-19疫情對自費PET檢查量之影響

Effects of Promotional Programs and COVID-19 on Self-Paid PET Scan Volume

^{1,2}李怡旻、^{2,3}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 研究部

²佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

³慈濟學校財團法人慈濟大學 醫學系

背景介紹:

全身正子斷層掃描 (Positron Emission Tomography, PET) 係利用氟-18標記去氧葡萄糖 (^{18}F -FDG) 作為放射性示蹤劑進行全身代謝性影像評估，對於腫瘤早期偵測及全身轉移病灶之判定具高敏感性，優於傳統骨骼掃描，並可應用於部分非腫瘤性疾病 (如神經退化性病變) 之評估。惟檢查費用高昂，單次檢查費用可達數萬元，雖研究醫院於每年5、8月提供自費項目85折優惠，但從未探究其成效，故本研究旨在探討優惠措施對民眾自費接受PET檢查意願之影響。

材料方法:

本研究為回溯性研究，資料來源為南部某準醫學中心核子醫學科2020年至2024年間之檢查紀錄。研究對象為自費接受PET檢查個案，依檢查日期判斷是否屬於優惠期間，並統計研究期間每月自費PET檢查件數。考量COVID-19疫情會對醫療行為產生影響，故將2021至2022年定義為「疫情期間」，其餘年份則歸為「非疫情期間」。資料處理與統計分析使用SAS® OnDemand for Academics進行，描述性統計包括平均數與標準差；採用獨立樣本T檢定，探討是否優惠期間、是否疫情期間之每月自費PET檢查量差異。最後以負二項式迴歸檢視是否優惠期間與是否疫情期間之交互作用項對自費PET檢查量的影響。

結果:

研究期間共196件自費PET檢查，平均每月檢查量為 3.27 ± 5.35 件。是否為優惠期間之平均檢查量分別為 5.40 ± 9.43 、 2.84 ± 4.13 件，是否為疫情期間之平均檢查量分別為 4.33 ± 6.56 、 1.67 ± 1.88 件。獨立樣本T檢定結果顯示，優惠期間與否在自費檢查量上無統計顯著差異 ($P = 0.412$)，但疫情期間與否則有顯著差異 ($P = 0.026$)。負二項式迴歸分析探討優惠措施與疫情期間的交互作用，顯示未達統計顯著水準 ($\beta = 0.92$, $\exp(\beta) = 8.0$, $P = 0.240$)。雖交互作用項之事件比 (Incidence Rate Ratio, IRR) 為8.00，表示在「非疫情期間」且「有優惠措施」的情境下，自費檢查量是「疫情期間且無優惠措施」的8倍，然未達顯著顯示可能潛在因素，值得後續研究探討。

結論:

研究結果顯示，自費PET優惠價格並未顯著提升其接受率。其可能原因是否與折扣後費用仍高，或民眾不清楚此項檢查抑或對放射線暴露存有疑慮等因素，尚待後續研究釐清。

Digital Inspection Strategies Improve Efficiency and Reliability in Radioactive Wastewater Tank Monitoring

¹Chun-Che Lo, ¹Yu-Tzu Chang, ^{1,2}Chi-Wen Huang

¹Department of Nuclear Medicine, Chung-Shang Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan.

Introduction:

Leakage from radioactive wastewater tanks poses substantial occupational and environmental risks, while manual paper-based logging is prone to human error.

Materials and Methods:

Guided by human-factors principles of automation, memory load reduction, and real-time alerting, we developed a digital inspection workflow using the implementation leverages Google's native server-side scripting platform. Tank levels are entered via smartphone or laptop; Deviations $> \pm 3$ cm from the previous day trigger simultaneous e-mail and Telegram alerts. A time-driven trigger issues reminders if no entry is received by 14:00, and a confirmation e-mail is sent upon submission.

Results:

Over a 3-month pilot (about 90 entries), missed inspections fell from 10 % to 0 %. Mean alert latency dropped from 10 min to < 1 min, daily labor decreased from 12 min to 4 min, and 24 sheets of paper were saved—equivalent to ≈ 108 g CO₂e.

Conclusions:

The proposed low-cost digital strategy markedly reduces human error and response delay while yielding measurable carbon and labor savings, offering a scalable solution for radioactive wastewater tank monitoring.

輻射防護評估：現行鉛衣汰換標準與文獻比較

¹解仲為

¹嘉義基督教醫院核子醫學科

背景介紹:

對於從事輻射相關作業之工作人員而言，鉛衣是常見且具實效之個人防護裝備，具備物理屏蔽功能。然而，在長期使用下，隨著使用頻率與個人穿戴習慣，常常會產生裂痕、破洞或其他形式之結構性損壞。因此，本研究旨在統整近5年本院鉛衣檢測之相關紀錄，針對其中顯示有破損之檢測結果進行分析，並與既有文獻資料加以比較。

材料方法:

統整出近5年鉛衣檢測的結果，依照本院的鉛衣汰換標準為：一、單一裂縫不得超過3公分，且裂縫大小總和不得超過21公分，位置不能在重要器官；二、破洞半徑大小不得超過0.3公分；三、參考ICRP 103號報告提出之組織加權因子。經由上述標準可將檢測完成的鉛頸、鉛衣區分為合格、堪用、報廢3種狀態，本研究將被列為堪用的鉛衣與2001年Kent Lambert提出的汰換標準及2023年Joan M Brewer提出的汰換標準再次進行測定。

結果:

本研究取前5年被列為堪用的鉛衣或鉛頸，以文獻標準重新進行測量，發現其可堪用鉛衣件數的誤差都在三件以內，且本研究分別與兩篇參考文獻進行獨立樣本t檢定計算p值，p值皆大於0.05，不具統計意義。

結論:

本研究目前的數據顯示與另外兩篇研究差異不大，代表作者所在之機構，其汰換標準與兩篇研究的汰換標準雷同。同時本研究也推算出裂縫及破洞大小所相對應的面積，未來會根據裂縫及破洞大小，及其所產生之破損面積作實際測量洩漏之輻射劑量，計算出實際可堪用之鉛衣能承受最大破損。

GMP manufacturing of a novel PSMA PET tracer [^{18}F]AIF-P16-093 as a first step leading to its commercialization

¹Chih-Hao K. Kao*, ^{1,2}Wan Leung, ²Chang-Yu Wang

¹Lemen Bioscientific Co Ltd, Kaohsiung, Taiwan

²Department of Radiation Oncology, Yuan' s General Hospital, Kaohsiung, Taiwan

Introduction:

[^{18}F]AIF-P16-093 is a novel PET tracer targeting PSMA for early detection of prostate cancer. The tracer' s early-phase human trial elsewhere suggested further development is warranted. This study aimed to implement its radiosynthesis into our GMP manufacturing and gave [^{18}F]AIF-P16-093 a status of "IND-ready" in Taiwan.

Materials and Methods:

The precursor for labeling, P16-093, was purchased from Five Eleven Pharma, Inc. (Philadelphia, PA USA). Fluorine-18 was produced by a Sumitomo HM12 cyclotron in Yuan' s General Hospital. The radiosynthesis and product radiochemical purity test were based on methods previously published. Lemen' s GMP facility was certified to the PIC/S standard. After testing manual and semi-manual labeling and establishing the products quality test items, three consecutive batches of [^{18}F]AIF-P16-093 were produced and tested under GMP condition.

Results:

Manual radiosynthesis and product radiochemical purity (RCP) test for [^{18}F]AIF-P16-093 were first conducted in the radiochemistry lab in Yuan' s General and yielded good results (d.c.RCY: $55.6 \pm 3.0\%$; RCP: $93.0 \pm 0.7\%$, n=5). The production then migrated to Lemen' s GMP facility. Three consecutive batches by semi-manual operation were performed and so-produced [^{18}F]AIF-P16-093 was tested for its RCP and other general items of radiopharmaceuticals in quality control (RCP: $97.7 \pm 0.12\%$, n=3). All quality specifications of the products were satisfied and manufacturing procedure was compliant to our GMP standard. A satisfactory product stability was tested up to 4h.

Conclusions:

By successfully completing this project, we have established procedures to manufacture and test [^{18}F]AIF-P16-093 under appropriate GMP condition. The product manufactured is suitable for early-phase human trial and the procedure would be further optimized leading to its eventual commercialization. Acknowledgement: This research was supported by the Southern Taiwan Science Park Bureau, National Science and Technology Council, Taiwan, R.O.C. under contract: 113CH-1-02.

農曆七月對核子醫學科檢查利用的影響：長期趨勢分析 The Impact of the Lunar Seventh Month on Nuclear Medicine Examination Utilization: A Longitudinal Trend Analysis

^{1,2}李怡旻、^{2,3}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 研究部

²佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

³慈濟學校財團法人慈濟大學 醫學系

背景介紹:

社會變遷是影響人們日常行為的重要因素之一，因此農曆七月對核子醫學檢查的影響是否也會因社會變遷而有所變化值得關注，故，本研究旨在探討過去20年農曆七月對核子醫學檢查的影響與趨勢變化。

材料方法:

採用回溯分析蒐集台灣南部某準醫學中心2004年至2023年之核子醫學科檢查紀錄。SAS® OnDemand for Academics進行資料處理與分析，並以線性迴歸及Jonckheere–Terpstra分別檢視非農曆七月與農曆七月之「2004至2023年年平均每日檢查人數」之長期趨勢。

結果:

2004–2023年期間共5,048天檢查日，非農曆七月、農曆七月之年平均每日檢查人數分別為 19.08 ± 2.26 人、 19.10 ± 2.09 人。趨勢分析結果顯示，整體而言，僅農曆七月期間的年平均每日檢查人數呈現隨時間增加的趨勢。

結論:

農曆七月的年平均每日檢查人數會隨時間有上升的趨勢，顯示台灣民眾在社會變遷影響下，對該月份的傳統禁忌遵從度正逐漸下降。

以甲狀腺攝取儀之井型計數器測量碘125廢水活度之研究

1曾宜玲、1卓世傑、1張淑芬、1顏吉龍、1段淑薰、1顏玉安、1李將瑄

1奇美醫院永康總院 核子醫學科

背景介紹:

碘125廢水，是放射免疫分析實驗室(RIA)作業後會產生之放射性廢液。依照現行之法規，該類放射性廢液之活度必須予以儲放至可排放標準以下，方能排放外釋。通常實驗室大多將碘125廢水樣本，送往輻射偵測中心或核研所等實驗室測量，以求得廢水活度。如此雖然較為準確，但在時效與方便性方面則稍嫌不足。所以如能以其他方法快速與簡單的測量碘125廢水的活度，應是頗值得研究的方向。本研究即是以甲狀腺攝取儀之井型計數器(Well counter)，測量碘125廢水活度之研究。

材料方法:

將碘125廢水取樣300CC，送往輻射偵測中心檢驗，結果做為標準值。於送驗之300CC樣品中另取4CC與2CC之樣品各1支，以甲狀腺攝取儀之井型計數器，在不連續之4日中，每日各測量1組資料，共8組。前3組資料每次測量3次，第4組則測量10次。

結果:

以甲狀腺攝取儀之井型計數器測量之碘125廢水活度值與輻射偵測中心測量值比較，在2CC部分，其4組資料分別為輻射偵測中心測量標準值的123.2%、123.2%、123.6%與122.3%。在4CC方面，其4組資料則分別為輻射偵測中心測量標準值的82.7%、82.4%、82.3%以及81.8%。

結論:

以甲狀腺攝取儀之井型計數器測量之碘125廢水活度值，不論是2CC或4CC之樣品與輻射偵測中心測量的標準值比例均相當穩定。但2CC樣品換算之活度值偏高，4次平均為123.1%；相反的4CC樣品的比例卻偏低，僅為82.3%。因此，以甲狀腺攝取儀之井型計數器測量之碘125廢水活度值，應為可行。惟仍應先收集送驗實驗室與測量儀器之數據比例作為校正之用。

核醫品質指標之成效分析與持續改進

¹楊士頤、¹莊穎昌、¹曾旭吟、¹李世昌

¹國立成功大學醫學院附設醫院影像醫學部核子醫學科

背景介紹:

本科依財團法人全國認證基金會(TAF) ISO15189醫學實驗室-品質與能力要求規範，監控並分析多項品質指標，以確保醫療服務之準確性、時效性與安全性。本研究回顧並分析113年度品質指標執行之情況，以作為114年持續改善的依據。

材料方法:

1. 資料收集：113年1月至113年12月，取自每月品管會議報告紀錄。
2. 品質指標(共10項)：
 - (1)異常輻射環境汙染率(=0%)、(2)預防管路滑脫措施正確執行率(=100%)、(3)病患準備不適合率($\leq 0.3\%$)、(4)影像品質不良數量(≤ 5 件)、(5)報告時效逾時數量(≤ 5 件)、(6)客戶諮詢與抱怨處理完成率($> 90\%$)、(7)受檢者候檢時間 > 14 天之比率($< 9\%$)、(8)核醫同位素藥物藥損率(N/A)、(9)MAG3藥品標誌合格率(=100%)、(10)肺灌注檢查危險值通報比率(N/A)
3. 分析方式：
 - (1)依設定閾值進行合格率判定、
 - (2)異常數據列入品管會議檢討與矯正行動、
 - (3)年度彙整後與前期比較成效

結果:

1. 達標之指標：
指標1、2、4、5、6、7、8、9、10全年均維持在目標範圍內，顯示輻射安全管理、影像品質、報告時效與病人安全服務品質穩定。
2. 未達標之指標：
指標3-病患準備不適合率於3月及6月出現超標，主因為部分病患未依規定空腹準備，影響檢查品質。
3. 改善措施：
檢前加強電話衛教與書面提醒、(2)檢查單上新增「須空腹」字樣
4. 持續監控：
指標8-核醫同位素藥物藥損率與指標10-肺灌注檢查危險值通報比率雖無設立固定閾值，仍每月檢討原因以減少浪費與確保通報流程即時性。

結論:

113年度品質監控成果顯示大多數指標皆達標，反映出團隊在輻射安全、檢查品質與時效管理上的穩定表現。病患準備不適合率為唯一異常指標，透過強化檢前衛教與檢查單提示，預期可於114年達到全面改善。持續監控與品管會議檢討將有助於早期發現問題並即時修正，確保醫療服務持續符合高品質與安全標準。

Comparison of Two Dynamic Cerebral Perfusion Features for Predicting MCI Progression Using Tc-99m ECD SPECT

¹Sheng-Pin Tseng, ¹Hui-Chieh Yang, ¹Chia-Yu Lin, ¹Zhi-Kun Lin, ²Chiung-Chih Chang, ¹Yu-Ching Ni

¹Department of Radiation Protection, National Atomic Research Institute, Taoyuan, Taiwan

²Department of Neurology, Kaohsiung Chang-Gung Memorial Hospital, Kaohsiung, Taiwan

Introduction:

Mild cognitive impairment (MCI) is an early stage of Alzheimer's disease (AD), but not all MCI cases progress to AD. Identifying high-risk MCI early is important for timely intervention. This study utilized Tc-99m ECD SPECT cerebral perfusion imaging to extract two dynamic features—Absolute Difference (D) and Relative Change (R)—and compared their effectiveness in predicting MCI progression.

Materials and Methods:

In collaboration with Kaohsiung Chang Gung Memorial Hospital, this study utilized retrospective data in which each participant underwent baseline and follow-up ECD SPECT scans, along with a third time-point cognitive assessment. Patients converting to AD within eight years were labeled progressive MCI (pMCI), while those remaining at the MCI stage for at least eight years were labeled stable MCI (sMCI). Forty-two cases (28 pMCI, 14 sMCI) were included. D was defined as intensity change per time interval ($D = (I_1 - I_2)/\Delta t$), and R as normalized change relative to baseline ($R = D/I_1$), where I_1 and I_2 are Z-score standardized mean intensities within brain regions, and Δt is the interval between scans. Four feature selection methods (none, RFE, F-score, LASSO) and six classifiers (SVM, RF, GBM, XGBoost, LightGBM, CatBoost) were tested via five-fold cross-validation. Metrics included AUC, F1-score, and accuracy.

Results:

R features with CatBoost and RFE achieved AUC 0.81, F1 0.881, accuracy 0.833; D features' best combination reached AUC 0.87, F1 0.862, accuracy 0.785. Violin plots showed R features had higher median and upper-bound performance across models, especially in F1-score, with density skewed toward high values, indicating better robustness. D features showed lower medians, density biased to lower-performance regions, and more AUC outliers, suggesting possible instability or overfitting.

Conclusions:

Normalized longitudinal changes (R) provided more stable and accurate predictions than absolute differences (D). These results support the clinical potential of cerebral perfusion dynamics for early AD risk assessment.

Radiopharmaceuticals: New Drug Development Process and the Importance of Preclinical Research

¹Li Yu Chen, ¹Ya Ting Huang, ¹Hsin Jou Kuo, ¹Fan-Chieh Meng, ¹Arsyangela Verena, ¹Chi-Wei Chang

¹ Primo Biotechnology Co., Ltd , Taipei, Taiwan.

Introduction:

Radiopharmaceuticals combine radioactive isotopes with targeting molecules and are widely used in the diagnosis and treatment of cancer, heart disease, and neurological disorders. These drugs utilize targeted carriers (such as small molecules, peptides, or antibodies) linked with radioactive nuclides, enabling not only "visualized diagnosis" but also "localized/systemic therapy," making them a core tool in nuclear medicine precision diagnostics and radiotheranostics. With innovations in molecular targeting technology, imaging equipment, and radioactive isotopes, the development of nuclear medicine radiopharmaceuticals is rapidly growing. It is projected that by 2025, the global market size for nuclear medicine radiopharmaceuticals will reach \$11.77 billion and is expected to surpass \$42.03 billion by 2032, with a compound annual growth rate (CAGR) of 19.9%.

Literature Review:

The development process of radiopharmaceuticals can generally be divided into four main stages: drug discovery, preclinical evaluation, clinical trials, and regulatory approval. Among these, preclinical studies are a critical step, aimed at establishing target specificity, biodistribution, pharmacokinetics, dosimetry, and assessing potential toxicity and safety. These evaluations typically involve in vitro cell assays, in vivo animal imaging, and stability analyses. Radiopharmaceuticals must undergo preclinical evaluation that addresses both pharmacological effects and radiological safety, as guided by the IAEA and Taiwan's Ministry of Health and Welfare. In Taiwan, developers are required to assess the pharmacological activity, pharmacokinetics, and toxicity of the non-radioactive component. Depending on the intended use, simplified toxicology strategies may be applied, especially for diagnostic agents that qualify as microdosing. For therapeutic radiopharmaceuticals, additional dosimetry studies and target organ risk assessments are required. In summary, preclinical studies are essential for confirming drug feasibility, ensuring safety, and supporting regulatory approval.

透過比較兩組放射免疫分析試劑和 CLIA 方法以消除對 FT4 檢測的干擾

¹蕭如玟、¹王怡文

¹佛教慈濟醫療財團法人台北慈濟醫院核子醫學科放射免疫分析組

背景介紹:

甲狀腺素 (T4) 是主要的甲狀腺激素，在血液循環中通常與蛋白質 (主要是TBG) 結合，而游離狀態的T4 (FT4) 只佔了不到0.03%，但這極少數的FT4卻是影響生物活性的重要激素。

甲狀腺檢查透過測量血液中游離狀態的T4 (FT4) 來評估甲狀腺功能和診斷甲狀腺疾病。一般來說，當患者出現甲狀腺功能異常的症狀時，便會進行全面性甲狀腺檢驗 (包含促甲狀腺素 (TSH) 、或三碘甲狀腺素 (T3) 、或四碘甲狀腺素 (T4)) 。

FT4的正常範圍通常在0.7到1.8 ng/dL之間，也會因實驗室選用的測量方法而略有不同。

偶有出現TSH正常、FT4偏高，不符合臨床之現象 (表示FT4受到干擾)，以致臨床醫師在給藥 (調藥)、治療上，無法正確判斷。為改善此類情況，實驗室以不同方法學及不同試劑，來檢測FT4，排除會干擾FT4之因素，給予符合臨床診斷的報告。

材料方法:

收集自113年12月至114年05月之TSH正常、FT4偏高的檢體20支。以FT4(radioimmunoassay)、FT4 Plus(radioimmunoassay)、CLIA方法同時檢測。

結果:

- 1.FT4(radioimmunoassay): 20支檢體FT4偏高(高於參考值)
- 2.FT4 Plus(radioimmunoassay): 20支檢體FT4落在參考值範圍內
- 3.CLIA方法: 20支檢體FT4偏高(高於參考值)

顯示FT4 Plus(radioimmunoassay)試劑能排除干擾FT4之因素，能給予符合臨床診斷的報告。

結論:

FT4 Plus(radioimmunoassay)試劑說明書內提到，FT4易受到生物素(Biotin)干擾，而生物素(Biotin)存在於許多保健食品，如維生素B群、生物素美容錠...等，FT4 Plus(radioimmunoassay)試劑可阻隔Biotin干擾。

病人攝入生物素(Biotin)相關保健食品後的1-3小時血清濃度達到高峰，此時採血檢測FT4濃度一般會偏高，待8小時代謝後採血檢測FT4才降至食用前濃度。由於無法預測病人攝取保健食品的種類與食用的時間點，因此，實驗室發現有不符臨床數值的報告，會以FT4 Plus(radioimmunoassay)試劑再次操作，排除干擾的可能性，以提供醫師更正確的臨床診斷。

記憶對對碰-核醫藥物與檢查

¹丁若洵、¹李世昌

¹國立成功大學附設醫院 影像醫學部核子醫學科

背景介紹:

核醫藥物與檢查種類繁多，學生時常反應複雜、不好記憶，只能靠死背覺得困難。因此我們希望透過遊戲式教學讓學生輕鬆記憶，並在臨床實際操作前，以系統化的方式加深學生對藥物與檢查的印象，得以輕鬆銜接臨床。

材料方法:

設計遊戲記憶卡牌，並於課程後進行記憶對對碰遊戲。

課程進行前先讓學生填寫筆試前測&課前問卷；課程中分三個主題介紹：1.檢查vs藥物2.核種vs半衰期3.核種vs能量；課程結束後進行記憶對對碰遊戲，依序翻開相對應之紙牌，如果翻出成對的卡牌則繼續遊戲，如果未翻出成對卡牌，則順序輪至下一位，最後收集最多成對卡牌之學生可以獲得小禮物；最後於遊戲結束後填寫筆試後測&課後滿意度。

結果:

以113年度執行遊戲式教學之20位學生為例，前測平均分數為48分，後測平均分數為84分，在前後測成績上有顯著差異。比較112年度未進行遊戲式教學之24位學生及113年度進行遊戲式教學之20位學生，112年度學生期初筆試平均分數74分、期中筆試平均分數80分、期末筆試平均分數89分；113年度學生期初筆試平均分數83分、期中筆試平均分數87分、期末筆試平均分數94分，筆試平均成績皆有所提升。比較112年度未進行遊戲式教學之24位學生及113年度進行遊戲式教學之20位學生，112年度學生DOPs(Direct Observation of Procedural Skills,直接觀察臨床技術評估)平均成績85.67分、mini-CEX(mini-clinical evaluation exercise,迷你臨床演練評量)平均成績85.88分；113年度學生DOPs平均成績85.9分、mini-CEX平均成績86.2分，DOPs、mini-CEX平均成績皆略為提升。

結論:

透過遊戲式教學，可以提升學生實習成效，更加理解核醫藥物及檢查並提升實習信心、減輕實習壓力。

Integrated PET/MR Imaging in a Zebrafish Model of Liver Cirrhosis–Induced Intraductal Carcinoma: A Feasibility Study for In Vivo Oncological Imaging

Yuh-Feng Wang¹, Avery Landon Wang², Chi-Yu Lai^{3,4}, Chi-Han Wu⁵, Hsin-Hung Lai³, Guor-Mour Her³, Skye Hsin-Hsien Yeh⁶

¹Department of Nuclear Medicine, Taipei Veterans General Hospital, Taipei, Taiwan.

²Taipei American School, Taipei, Taiwan.

³Institute of Biopharmaceutical Sciences, National Yang Ming Chiao Tung University, Taipei, Taiwan.

⁴Health Innovation Center, National Yang Ming Chiao Tung University, Taipei, Taiwan.

⁵Brain Research Center, National Yang Ming Chiao Tung University, Taipei, Taiwan.

⁶School of Medicine, National Defense Medical Center, Taipei, Taiwan.

Introduction:

This study aimed to develop a novel zebrafish model of liver cirrhosis–induced intraductal carcinoma and to explore the feasibility of applying integrated PET/MR imaging for in vivo longitudinal assessment of tumor development in small vertebrate models.

Materials and Methods:

Adult zebrafish with histologically confirmed liver cirrhosis and intraductal carcinoma were anesthetized using a tricaine–isoflurane combination and administered F-18 FDG via direct intracardiac injection (20–35 μ Ci in 3 μ L) using a microinjection system. Following recovery and tracer uptake (40 minutes), each fish was re-anesthetized and positioned in a custom-made agar-based mold for stabilization. PET imaging (10 minutes) was performed using a high-sensitivity scanner, followed by a 40-minute high-resolution T1-weighted MRI. After imaging, the fish were returned to their tanks for recovery and subsequently sacrificed for liver histology.

Results:

MRI revealed clear intraparenchymal hepatic lesions that corresponded closely with histopathological findings. However, the PET imaging exhibited pronounced tracer accumulation in the gastrointestinal tract, partially obscuring hepatic tumor visualization. Despite this, the cardiac injection technique ensured reliable radiotracer delivery and allowed for consistent image acquisition in live zebrafish. All subjects tolerated the imaging workflow without mortality.

Conclusions:

This study is the first to demonstrate the feasibility of integrated PET/MR imaging in a zebrafish model of hepatobiliary malignancy. The protocol enables non-invasive, longitudinal tumor monitoring and may serve as a cost-effective platform for screening anticancer therapies or studying cancer metabolism. Future improvements, including fasting protocols, alternative tracers, and advanced image quantification, are expected to enhance tumor specificity and accuracy in this model.

核醫標靶診療藥物中心作業環境改善與風險管理

¹林欣純、^{1,2}李銘忻、¹楊詩涵、¹林亭君、¹洪綾蔓、¹黃玉儀

¹ 和信治癌中心醫院 核子醫學科

² 群創生物科技公司

背景介紹:

核醫標靶診療藥物 (Theranostic Radiopharmaceuticals) 製備須同時滿足GMP與輻射防護要求，確保產品品質與操作安全。本中心原有空間配置為準備室 (C級區) 與製藥室 (B級區) 分離，前者配置laminar flow hood供cold kit調劑及合成原物料處理，後者包含合成Hot cell與分裝isolator (內部A級區)。原場域的合成區與分裝區位於同一環境，具有交叉污染的品質風險，並存在層流完整度、與輻射防護不足等問題。為改善上述情況，本中心進行空間重整計畫與設施設備升級，並研究驗證改善結果。

材料方法:

空間與潔淨度分級調整：(1) 取消準備室與製藥室隔間，合併為單一製藥室；(2) 原製藥室內新增一隔間，以區隔出分裝室，使產品合成作業配製皆於同一潔淨區層級內完成；(3) 將合成Hot cell調整至C級區，避免污染A級區分裝環境；(4) 新增具有鉛屏蔽之Biosafety Cabinet (BSC)，專供cold kit調劑，保留原laminar flow hood用於合成cassette檢查與緩衝液前驅物等溶液之製備；(5) A級區與C級區間為每一種藥物增設專屬管線。

結果:

環境設備重整增設後，環境潔淨度檢測結果顯示，製藥室與分裝室之空氣懸浮粒子、浮游菌與落下菌等均符合GMP限值，無新增污染風險；靜態懸浮粒子 ($\geq 0.5 \mu\text{m}$) A級區：12 ($\leq 3520 \text{ particles/m}^3$)，背景B級區：19 ($\leq 3520 \text{ particles/m}^3$)。C級區：33 ($\leq 3,520,000 \text{ particles/m}^3$)，背景C級區：84。作業動線簡化並減少跨區頻率與作業時間；改善前，每週平均3-4次跨級區進行cold kit調劑或合成；改善後，cold kit調劑不再跨區，僅合成作業需跨級區，頻率依合成次數而定。跨級區作業需額外進行清潔與二更著裝，改善後每批次約減少作業時間8分鐘與相關耗材物品使用。BSC導入提升層流穩定度與輻射防護，提高藥物風險管理，降低人員輻射暴露，藥物增設專屬管線，降低藥物交叉污染之風險。

結論:

透過空間重整與設備升級，核醫藥物製備環境可同時達成污染防控與作業安全目標，確保藥品生產潔淨度符合PIC/S/GMP與Annex 1 CCS要求，並顯著改善作業效率與動線流暢度，可作為其他單位進行GMP升級與正子藥物調劑之參考模式。未來將進一步利用BSC內建鉛屏蔽設計，安置Ge-68/Ga-68 generator，將cold kit調劑納入BSC操作環境，更進一步簡化流程並強化輻射防護。後續可統計操作人員劑量徽章數據，評估人員暴露劑量之降低，作為持續優化的重要依據。

Topic: Biological evaluation of novel ^{18}F -labeled Fluorinated NODA ethylene linker FAPI as PET Probe for Imaging Fibroblast Activation Protein Expressing

Pei-Wen Wu¹, Shou-Hsuan Liu¹, Yu-Hsuan Li¹, Shun-Fu Chang², Jia-Je Li¹, Chuan-Lin Chen^{*,1}

From: ¹Department of Biomedical Imaging and Radiological Sciences of National Yang Ming Chiao Tung University, Taipei, Taiwan

² Department of Medical Research and Development, Chiayi Chang Gung Memorial Hospital, Chiayi, Taiwan

Introduction:

Fibroblast activation protein (FAP), abundant in cancer-associated fibroblasts, is a key biomarker for targeted imaging and therapy. Current FAP inhibitors like FAPI-02 and FAPI-04 require different pharmacokinetics for diagnostic versus therapeutic use. Inspired by short-linker FAPI-06/07 with rapid clearance, we synthesized [^{18}F] NODA-E-FAPI-1 with an ethyl linker and compared it with [^{18}F]-FAPI-74.

Materials and Methods:

Both [^{18}F] NODA-E-FAPI-1 and the reference [^{18}F]-FAPI-74 were synthesized, radiolabeled, and validated by radioactive TLC and HPLC. Cellular binding and uptake were assessed in HT-1080-FAP-GFP++ versus HT-1080 cells. In vivo biodistribution and tumor uptake were compared in U87-MG tumor-bearing mice using small animal PET/CT imaging.

Results:

[^{18}F] NODA-E-FAPI-1 showed higher radiolabeling efficiency, yield, and cellular uptake than [^{18}F]-FAPI-74, with both tracers exhibiting high FAP specificity and >95% radiochemical purity. In vivo, tumor-to-muscle ratios were similar at 1 hour, but at 2 hours [^{18}F] NODA-E-FAPI-1 demonstrated higher tumor accumulation and contrast (18.81 ± 1.65 and 21.44 ± 1.34 , respectively).

Conclusions:

[^{18}F] NODA-E-FAPI-1 was successfully synthesized. This drug exhibited excellent radiochemical labeling yield and good contrast in U87-MG-bearing mice, demonstrating its potential as a tumor positron emission tomography (PET) imaging probe.

Comparison of Two Machine Learning Training Strategies for Reducing Acquisition Time in Tc-99m Bone Scintigraphy

^{1,2}Sin-Di Lee, ²Tzer-Jen Wei, ^{1,3} Chien-Wei Kuo

¹Department of Nuclear Medicine, Pingtung Veterans General Hospital, Pingtung, Taiwan

² College of Artificial Intelligence, National Yang Ming Chiao Tung University, Tainan, Taiwan

³Department of Medical Imaging and Radiological Sciences, Kaohsiung Medical University, Kaohsiung, Taiwan

Introduction:

To achieve optimal image quality of bone scintigraphy, guidelines recommend high acquisition counts, but this prolongs imaging time and radiation exposure. Machine learning (ML)-based denoising offers the potential to improve image quality in low-count scans, yet its clinical applicability remains uncertain.

Materials and Methods:

We retrospectively collected dynamic bone scans (3 s/frame, 100 frames, 256×256 matrix) from 198 patients (466 images, April–November 2023) on a Siemens Intevo Excel. Summed images with variable frame numbers simulated different acquisition times (3–300 s). Datasets were split into training (70%), validation (15%), and testing (15%). Preprocessing included normalization and augmentation. Two training strategies were compared: Model 1: Diffusion-like U-Net with attention blocks, trained to predict noise relative to a 5-min reference. Model 2: Modified training to predict an image acquired with twice the duration of the input, using an SSIM-weighted loss to preserve structure. Performance was evaluated against the Google MAXIM baseline using PSNR, SSIM, MS-SSIM.

Results:

Model 1 initially achieves a PSNR comparable to that of the MAXIM model in the first iteration. However, with repeated iterations, its SSIM and MS-SSIM gradually deteriorate. Model 2 consistently underperforms MAXIM in terms of PSNR, but its SSIM and MS-SSIM progressively improve and approach performance of MAXIM as iterations increase.

Conclusions:

Both strategies enhanced low-count bone scintigraphy but revealed a trade-off: Model 1 favored smoother texture and higher PSNR, while Model 2 better preserved textural similarity. Importantly, the relationship between acquisition time and noise strength was not stable, suggesting that training strategies must account for variability when designing robust denoising models for clinical use.

Dynamic Taguchi Optimization of TLD Reader for Environmental Radiation Assessment at an Isotope Therapy Center

^{1,2}Chi-Wen Huang, ³Bo-Wen Chen, ¹Jui-Hung Weng, ⁴Chien-Yi Chen

¹Department of Nuclear Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan

³Master Program in Medical Imaging and Radiological Sciences, Chung Shan Medical University, Taichung, Taiwan

⁴Department of Medical Imaging and Radiological Sciences, Chung Shan Medical University, Taichung, Taiwan

Introduction:

Radioiodine therapy utilizing Iodine-131 (¹³¹I) is the standard treatment for thyroid cancer. Patients undergoing this treatment temporarily become radiation sources, creating exposure risks for healthcare personnel. This study evaluates environmental radiation exposure at the ITC of Chung Shan Medical University Hospital while optimizing TLD readout parameters through Taguchi methodology.

Materials and Methods:

Thermoluminescent dosimeters (TLD-100H) were calibrated with standardized ¹³¹I gamma radiation sources. Eighteen TLD chips were randomly divided into three experimental batches. Taguchi optimization identified optimal readout parameter combinations using four control factors: initial temperature, heating rate, maximum temperature, and preheat time.

Results:

Radiation exposure measurements ranged from 57.2 ± 10.3 mSv to 0.17 ± 0.03 mSv per treatment cycle, correlating with proximity to patients and exposure duration. The minimum detectable dose for background radiation was established, confirming methodology sensitivity. Taguchi analysis identified the optimal readout parameters as: initial temperature 135 °C, heating rate 10 °C/s, maximum temperature 240 °C, and preheat time 10 s. This optimized set substantially improved TLD readout consistency across trials, reducing signal variability.

Conclusions:

This study validates the effectiveness of dynamically optimized TLD systems for environmental radiation assessment in isotope therapy facilities. Taguchi methodology established robust calibration protocols that enhance measurement precision. Findings provide essential data for radiation safety evaluations and evidence-based protective strategies for healthcare personnel and patients.

使用Grok進行台灣醫事放射師執照考試表現之模擬研究

張珺慈¹, 黃琪雯^{1,2}, 羅浚哲¹
¹中山醫學大學附設醫院 核子醫學科
²中山醫學大學 醫學系

背景介紹:

隨著人工智慧 (AI) 技術的進展, 大型語言模型 (LLMs) 如Grok在醫學教育與專業評量中的應用日益受到關注。台灣醫事放射師執照考試涵蓋基礎醫學、醫學物理學與輻射安全、放射線器材學、放射線診斷原理與技術學、放射線治療原理與技術學、核子醫學診療原理與技術學等科目, 包含文字與影像判讀題型, 對AI的多模態處理能力構成挑戰。Grok作為對AI開發的多模態模型, 具備處理文字與影像的潛力, 適合用於模擬此類專業考試的表現。本研究旨在模擬評估Grok 3於台灣醫事放射師執照考試 (繁體中文試題) 中的表現, 聚焦其文字與影像題型的處理能力, 並檢視其在各科目中的得分是否滿足平均60分的及格要求。

材料方法:

本研究採用模擬實驗設計, 選用Grok 3作為測試模型。模擬題庫涵蓋台灣醫事放射師執照考試的六大科目, 試題選自: 2023年歷屆考題, 所有試題均為繁體中文, 包含文字題與影像題 (X光、CT、MRI判讀)。試題逐一輸入Grok 3, 利用其多模態功能進行處理, 依標準答案評分。假設考試滿分100分, 各科目平均分數需達60分方為及格。

結果:

模擬結果顯示, Grok 3於繁體中文試題中獲得總分70分 (滿分100分), 各科目平均分數均達60分, 符合及格標準。各科目得分如下:

基礎醫學 (解剖學、生理學與病理學): 72分 (正確率72%)。

醫學物理學與輻射安全: 75分 (正確率75%)。

放射線器材學 (磁振學與超音波學): 70分 (正確率70%)。

放射線診斷原理與技術學: 68分 (正確率68%)。

放射線治療原理與技術學: 67分 (正確率67%)。

核子醫學診療原理與技術學: 65分 (正確率65%)。

文字題的正確率約為78% (得分約47/60), 高於影像題的正確率約58% (得分約23/40)。Grok 3在X光與CT影像判讀中能識別部分關鍵特徵, 但在涉及臨床判斷的題目表現較弱。繁體中文環境可能因訓練語料限制影響表現, 但整體仍達到及格要求。

結論:

本模擬研究顯示, Grok 3於台灣醫事放射師執照考試中具備及格潛力, 總分70分且各科目均達60分以上。其多模態能力於影像題型展現一定成效, 特別在基礎醫學與醫學物理學科目表現較佳。惟影像題正確率偏低, 顯示臨床判斷與繁體中文專業知識的處理能力待提升。本研究為AI於放射醫學教育與認證的應用提供初步洞見, 未來需真實數據驗證與模型優化以提升表現。

應用 Power BI 於碘131 治療作業分析之經驗分享

¹陳薇璇、¹許幼青、¹廖建國、^{1,2}莊紫翎
¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

碘131同位素治療 (Iodine-131 therapy) 是針對甲狀腺功能亢進與甲狀腺癌術後的標準療法，其大劑量消融治療過程需住院隔離以防止輻射外洩。2022年9月起，大林慈濟醫院正式啟用碘131病房，然因全台尚無一致性的規範與資料格式，導致各項治療與病患資料紀錄零散、統計困難。為解決此問題，本研究嘗試導入 Power BI 分析平台，整合並視覺化病人資料、治療副作用與轉診資訊，期望藉此提升跨部門的溝通效率與資料應用的價值。

材料方法:

1. 匯入既有 Excel 檔，包括「碘131病房治療資料」與「病人資料檔」，將資料進行整理與建立關聯性。
2. 整理治療副作用資料，並細分為如：噁心、聲音沙啞、喉嚨痛、頸部腫脹等症狀，以利統計與圖像化分析。
3. 利用 Power BI 儀表板功能建立清單、卡片與環圈圖呈現各項數據。

結果:

本研究透過 Power BI 作為分析工具，整合碘131 治療作業中多項關鍵因素，結果顯示以下幾點應用效益：1.副作用視覺化呈現，將副作用資料依類別細分後，可快速檢視各類症狀發生狀況，提升副作用追蹤效率，並強化病人衛教準確性。2.轉診資料整併分析，整合轉診醫院與醫師資料後，可清楚觀察其來源分布、平均住院天數與外釋劑量，有助未來病房資源配置與管理策略。3.視覺化圖表直觀清晰，Power BI 的儀表板設計直觀，易於跨部門使用與即時查詢，增進臨床人員溝通效率。4.資料整合應用拓展，進一步納入分期資訊，協助分析不同癌症階段的治療反應；外釋劑量數據亦提供未來制定全國統一標準的參考依據，並可用於評估開單醫師與藥物劑量之間的適切性。

結論:

Power BI 在碘131病房病人資料管理與治療成效分析中展現優異的資料整合與視覺化能力，能有效減少人工彙整與跨部門溝通所需時間，提升整體臨床作業效率與決策品質。雖目前仍需仰賴人工輸入資料，未來若能與醫院資訊系統串接並實現自動化更新，將更進一步提升應用成效。透過這些資料的綜合分析，能更全面地掌握碘131 治療的全貌，為後續臨床決策與品質改善提供強而有力的數據支持。

接受鐳223治療病人注射活度與當時身體輻射劑量率關係之研究 -以台灣南部某醫院為例

¹鄭揚霖、¹卓世傑、¹張南雄、¹林凡珍、¹陳懿貞、¹魯育伶、¹李將瑄

¹奇美醫院永康總院 核子醫學科

背景介紹:

鐳223是現在用於治療去勢抗性攝護腺癌(castration-resistant prostate cancer, CRPC)病人的重要藥劑之一。鐳223主要是 α 射源，半衰期11.4天，但亦會產生少量的3.6%的 β 粒子及1.1%的 γ 射線。因此接受鐳223治療注射的病人仍會產生一定程度之輻射劑量。以輻射防護之觀點而言，為提供工作同仁及病人家屬有效之輻射防護作為建議，病人注射當時身體產生之輻射劑量率究竟為多少？應頗值得研究。本文即為以南部某醫院為例，研究接受鐳223治療病人注射活度與當時身體輻射劑量率關係之研究。

材料方法:

收集2022年7月4日至2025年7月8日於南部某醫院，接受鐳223治療時病人之各次給予活度與注射開始至結束之間，測量其背部5公分處(兩側肩胛骨下緣中間，約第7-8胸椎處)的最高輻射劑量率之資料，共49位病人，183人次的資料。由於即使同一位病人，每一次治療的體重與身體狀況都可能不同，其所產生之輻射劑量率當然也可能有差異，所以本研究將以183人次的資料來加以統計分析，以得出結果和結論。

結果:

- 1.注射的活度平均、最大、最小與中位數分別為3.28、4.75、1.90與3.28 MBq。
- 2.病人注射當時的輻射劑量率平均為4.28uSv/h，最高為6.70uSv/h，最低為1.32 uSv/h，中位數則為4.21 uSv/h。
- 3.注射活度與輻射劑量率的相關係數為0.41，R2值則僅為0.17。

結論:

本研究的結果發現，接受鐳223治療之病人，注射之活度與當時身體輻射劑量率，統計結果平均各為3.28 MBq與4.28 uSv/h。但注射活度與當時身體輻射劑量率之相關係數與線性迴歸之R2結果，各僅有約0.41和17%，顯示鐳223病人，注射之活度大小與輻射劑量率似乎並無明顯之關係。值得討論的是，雖然病人之後的輻射劑量率可能會受腫瘤骨轉移程度的不同而有相當的變化，但由於此效果並非注射當時即時發生的情形，再者也非本研究的主要目的，因此本研究並未納入考量，僅此說明。

放射免疫分析室廢棄試管剩餘活度與輻射劑量率之研究 -以台灣南部某醫院放射免疫分析室為例

¹張朝鈞、¹卓世傑、¹顏吉龍、¹張淑芬、¹段淑薰、¹顏玉安、¹李將瑄

¹奇美醫院永康總院 核子醫學科

背景介紹:

放射免疫分析室之檢驗作業結束後，剩餘之試管(康氏管)即為含輻射劑量之放射性廢棄物。依照台灣現行法令與ISO15189之規範，此類放射性廢棄物必須予以收集、儲放至法令允許之輻射劑量率限值以下，方能予以外釋。所以了解廢棄試管之剩餘活度與劑量率，是頗為重要的。本文即為，放射免疫分析室廢棄試管剩餘活度與輻射劑量率之研究。

材料方法:

- 1.收集南部某醫院放射免疫分析室，TSH、CEA、AFP、T4、T3等五種檢驗項目，各20支作業完畢之廢棄試管(康氏管)。
- 2.再以 Gamma Counter予以計數，共收集到5組共100筆之活度資料。
- 3.測量50支未使用試管(康氏管)之總重，平均即得單支試管重量約2.88g。
- 4.依據以上資料，及I-125之Gamma Constant($7.432\text{E-}5 \text{ mSv/hr per Mbq at 1.0 meter}$)，統計分析以得出結果。
- 5.再依據〈輻射源豁免管制標準〉第2 條第1項及附表一之規定，以I-125之豁免管制活度濃度($1\text{E}+3\text{Bq/q}$)為依據，以提出結論。

結果:

- 1.TSH、CEA、AFP、T4、T3等五組，其廢棄試管CPM平均值各為6157、2230、4306、10434、19880。
- 2.以廢棄試管CPM平均值換算每公斤(約348支試管)剩餘活度，TSH、CEA、AFP、T4、T3等五組分別為35.71、12.93、24.97、60.52、115.30 KBq。
- 3.廢棄試管1公尺處之輻射劑量率則TSH、CEA、AFP、T4、T3各為0.003、0.001、0.002、0.004、0.009uSv/h。

結論:

依據本研究樣本顯示，南部某醫院放射免疫分析室之TSH、CEA、AFP、T4、T3等五種檢驗項目，廢棄試管之剩餘活度以T3最高，CEA最低，每公斤分別為115.30與12.93KBq，距離1公尺之輻射劑量率則各為0.009 及0.001 uSv/h。如以I-125之豁免管制活度濃度為依據，則本研究樣本之TSH、CEA、AFP、T4、T3等五組試管可逕行外釋丟棄之最大重量分別為28、77、40、16、及8.5Kg以下。但各實驗室實施廢棄試管外釋時，仍應再行計算、量測，並以核安會之規定與說明為執行依歸。

甲狀腺功能在醫療輻射與非輻射工作人員間之比較

盧永承

戴德森醫療財團法人嘉義基督教醫院 核子醫學科

背景介紹:

甲狀腺是人體最容易受游離輻射影響的器官之一。醫療輻射工作人員因長期接觸游離輻射，可能增加甲狀腺功能異常的風險。既往僅有少量研究探討低劑量輻射與甲狀腺功能之關聯，但結果零散且缺乏一致性，難以得出明確結論。因此本研究旨在評估醫療輻射工作人員與非輻射工作人員間的甲狀腺功能差異，並進一步探討在5年累積劑量中有劑量累積的人員對甲狀腺功能的影響。

材料方法:

研究對象為收集某醫療機構在113年有接受輻射體檢之輻射工作人員共163人，另收集非甲狀腺門診病患血清檢體35份作為對照組，並根據113年劑量佩章(TLD)中5年累積劑量結果分為有劑量暴露與無劑量暴露二組。所有研究對象均檢測血清中之促甲狀腺激素(TSH)與游離甲狀腺素(FT4)濃度，採用放射免疫分析法(ISOTOP試劑)來檢測，TSH和FT4生物參考區間分別為0.30~4.00 uIU/mL以及0.80-1.77 ng/dL，最後以統計學方法Mann-Whitney U-test來作檢定 ($p < 0.05$ 為顯著差異)。

結果:

本研究發現，醫療輻射工作人員($N=163$)與非輻射工作人員($N=35$)的甲狀腺功能並無顯著差異 (TSH平均值為 2.16 ± 1.14 vs 2.08 ± 1.19 uIU/mL，中位數為1.88 (IQR 1.50 -2.54) vs 1.87 (IQR 1.20-2.69)， $p=0.477$ 和FT4平均值為 1.04 ± 0.13 vs 0.99 ± 0.08 ng/dL，中位數為1.01 (IQR 0.95-1.11) vs 1.00 (IQR 0.92-1.03)， $p=0.061$)。即使在輻射工作人員內部，有劑量暴露組($N=11$ ，平均累積劑量1.81 mSv)與無劑量暴露組($N=152$)之間也未見顯著差異 (TSH平均值為 1.88 ± 0.84 vs 2.18 ± 1.16 ，中位數為1.98 (IQR 1.32 -2.19) vs 1.86 (IQR 1.50-2.56)， $p=0.527$ 和FT4平均值為 1.06 ± 0.13 vs 1.04 ± 0.13 ，中位數為1.11 (IQR 0.91-1.15) vs 1.01 (IQR 0.95-1.11)， $p=0.389$)。

結論:

雖然先前研究對於低劑量游離輻射是否會影響甲狀腺功能尚無定論，本研究結果顯示，在小規模樣本下，醫療輻射工作人員與非輻射工作人員的甲狀腺功能並無顯著差異。雖有研究提到輻射工作醫護人員罹患甲狀腺功能低下症的風險可能增加，但本篇研究的結果並未支持，因此後續研究建議擴大樣本數，並納入年齡、性別、甲狀腺疾病史、工作壓力及夜班等潛在干擾因子，進行嚴謹的長期追蹤研究，以更清楚評估游離輻射對甲狀腺功能的可能影響。

Radiation Safety of Radiopharmacists Transporting I-131 Therapeutic —A Study from a Nuclear Medicine Division in Southern Taiwan

Chien-Hua Lu¹, Yu-Sheng Hung¹

¹Division of Nuclear Medicine, Chi Mei Medical Center, Liouying, Tainan

Introduction:

In our hospital, I-131 therapeutic drugs for inpatients are transported by pharmacists using a stainless steel trolley (40 × 35 × 85 cm) containing a lead box (18 × 18 × 18 cm, thickness 1.5 cm). The drug is placed inside the lead box and delivered to the ward for administration. Medication is delivered four times per week. The department is located in the basement level, while the ward is on the second floor of the medical building. Each one-way delivery covers a distance of approximately 61.5 meters and takes about 10 minutes, including waiting for the elevator. This study evaluates the radiation safety for pharmacists based on the equivalent dose received.

Materials and Methods:

Using a patient treatment dose of 150 mCi I-131 as the reference, we measured the radiation dose rate at 100 cm from the drug (approximate chest height of the pharmacist) and estimated the radiation exposure to the pharmacist. An ATOMTEX AT1121 scintillation detector was used for measurement. The average exposure dose was compared with the annual dose limit set by regulations to assess the pharmacist's actual dose and whether additional radiation protection measures are necessary.

Results:

The average radiation exposure rate to the pharmacist was 1.05 μ Sv/hr. Each delivery took about 10 minutes, corresponding to a single-trip exposure of 0.175 μ Sv. With approximately 190 administrations per year, the annual cumulative exposure was 33.25 μ Sv.

Conclusions:

According to the Nuclear Safety Commission's radiation protection standards, the annual effective dose limit for radiation workers is 20 mSv. Based on this study, the estimated annual dose received by a pharmacist is far below the regulatory limit. Therefore, the radiation exposure risk is extremely low, and no additional protective measures are required.

First Automated Radiosynthesis of [^{161}Tb]Tb-PSMA-I&T in Taiwan Using the iPHASE MultiSyn Synthesizer

¹Fan-Chieh Meng, ¹Chi-Wei Chang, ¹Arsyangel Verena, ¹Ya-Ting Huang,
¹Ya-Yao Huang*

¹R&D department, Primo Biotechnology Co., Ltd., Taipei, Taiwan

Introduction:

^{177}Lu -PSMA-I&T, which targets the prostate-specific membrane antigen (PSMA), has demonstrated effectiveness in treating patients with metastatic castration-resistant prostate cancer (mCRPC). Compared to Lutetium-177, Terbium-161 has a similar half-life and decay characteristics, but also releases a significant number of internal conversion (IC) and Auger electrons (AE), which can deliver higher radiation doses and are suitable for eradicating small tumor lesions and micro-metastatic disease while minimizing collateral damage to surrounding healthy tissues. Here, we report the fully automated radiosynthesis of ^{161}Tb -PSMA-I&T on the iPHASE MultiSyn synthesizer and compare its results with those from ^{177}Lu -PSMA-I&T.

Methods:

PSMA-I&T precursor was purchased from ABX (Radeberg, Germany); $^{161}\text{TbCl}_3$ in 0.05 M HCl was obtained from TERTHERA (Breda, The Netherlands). MultiSyn cassette and reagent kits were purchased from iPHASE Technologies (Melbourne, Australia). The precursor (0.74 $\mu\text{g}/\text{mCi}$) was reacted with $^{161}\text{TbCl}_3$ in 0.3 M sodium acetate buffer (pH 5.0) and heated at 95 °C for 28 min. The reaction mixture was then formulated by adding sterile water for injection containing sodium L-ascorbate (500 mg) and DTPA (1 mg), followed by sterile filtration into a product vial. The radiochemical purity (RCP) of the final product was determined using iTLC and HPLC.

Results:

^{161}Tb -PSMA-I&T was successfully synthesized on the iPHASE MultiSyn synthesizer. The radiochemical yield (RCY) exceeded 90%, with a total synthesis time of approximately 54 minutes, a final product volume of 12 mL, and a pH of 5.0. The RCP by HPLC was $\geq 95\%$, and the fraction of unreacted ^{161}Tb determined by iTLC ($R_f = 0.9-1.0$) was $\leq 5\%$. In comparison to ^{177}Lu -PSMA-I&T, similar radiochemical purity was achieved without the addition of gentisic acid. Furthermore, the radiochemical yield increased by about 10%, which we think is due to the additional 12 minutes of reaction time, despite differences in the products. It may give us insights into improving the radiochemical yield of ^{177}Lu -PSMA-I&T in the future.

Conclusions:

The first fully automated synthesis of ^{161}Tb -PSMA-I&T on the iPHASE MultiSyn has been successfully established in Taiwan. Stability studies at high activity concentrations are currently underway to ensure compliance with clinical criteria.

Procedures for GMP-Compliant Production of [^{177}Lu]Lu-PSMA-I&T, Quality Control, and Evaluation of Stability Over Five Days

¹Arsyangela Verena, ¹Fan-Chieh Meng, ¹Chi-Wei Chang, ¹Ya-Ting Huang, ¹Ya-Yao Huang*
¹R&D department, Primo Biotechnology Co., Ltd., Taipei, Taiwan

Introduction:

[^{177}Lu]Lu-PSMA-I&T is an FDA-approved, clinically validated ligand for radioligand therapy (RLT) in patients with metastatic castration-resistant prostate cancer (mCRPC), with encouraging clinical results reported in multiple studies. To support reliable clinical translation and potential large-scale production in Taiwan, robust GMP-compliant automated synthesis and quality control (QC) process are required. We report procedures for the GMP-compliant production of [^{177}Lu]Lu-PSMA-I&T using the iPHASE MultiSyn synthesizer. Quality control was performed according to the European Pharmacopoeia monograph (EP 11.7) and an extended stability study was conducted over five days in a GMP-compliant facility.

Materials and Methods:

The automated radiosynthesis of [^{177}Lu]Lu-PSMA-I&T was performed on an iPHASE MultiSyn synthesizer. The PSMA-I&T precursor (ABX, Radeberg, Germany) was dissolved in 0.3 M sodium acetate buffer (pH 5.0) and mixed with 2,5-dihydroxybenzoic acid, followed by radiolabeling with [^{177}Lu]LuCl₃ (SHINE Technologies, Janesville, US) at 95 °C for 18 min. The crude reaction mixture was subsequently diluted with 10 mL of sodium ascorbate/DTPA solution and filtered through a sterile 0.22-μm Millex-Catheters GV filter into the final product vial. Quality control was performed in accordance with the EP. Radiochemical purity was assessed by HPLC (Waters e2695) and ITLC (LabLogic Scan-RAM), while chemical impurities and radionuclidic purity were determined by HPLC and γ-spectrometry (LabLogic Spec-RAM), respectively. A stability study was conducted at room temperature for 5 days, during which radiochemical purity was assessed daily by HPLC.

Results:

[^{177}Lu]Lu-PSMA-I&T was obtained in 44 min with a final pH of 5.5, a radiochemical yield >80%, radiochemical purity >95%, and radionuclidic purity >99.9%. All content of impurities met the acceptance criteria specified in the EP. The final product was sterile, pyrogen-free, and stable at room temperature, with an RCP greater than 95% maintained for up to five days.

Conclusions:

We successfully established a GMP-compliant, fully automated radiosynthesis of [^{177}Lu]Lu-PSMA-I&T using the iPHASE MultiSyn synthesizer, producing a final product that met all EP quality specifications and remained stable for at least 5 days at room temperature. These results support the feasibility of routine GMP production and large-scale clinical application of [^{177}Lu]Lu-PSMA-I&T in Taiwan.

SPECT/CT 檢查量十年趨勢分析：單一中心回顧性研究 A 10-Year Trend Analysis of SPECT/CT Utilization: A Single-Center Retrospective Study

1,2李怡旻、2,3莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 研究部

²佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

³慈濟學校財團法人慈濟大學 醫學系

背景介紹:

單光子發射電腦斷層掃描 (Single Photon Emission Computed Tomography, SPECT) 結合電腦斷層掃描 (Computed Tomography, CT) 技術，可同時提供生理功能與解剖結構的影像資訊，進而提升病灶定位的準確性，並有助於區分生理性與病理性的放射性攝取。由於 SPECT/CT 能強化影像判讀的精確性，故在臨床上，當遇到影像解釋困難或需進一步鑑別之情境時，常作為重要的輔助診斷工具。而過往研究也指出 SPECT/CT 能提高影像判讀的正確性，因此本研究旨在探討過去十年間 SPECT/CT 在核醫臨床應用上的使用趨勢與變化，並進一步探究各項檢查 SPECT/CT 的利用情形。

材料方法:

本研究為回溯性研究，資料來源為南部某準醫學中心核子醫學科檢查資料，資料期間為2014-2023年。依據檢查代碼篩選檢查項目，且依每人一日一筆檢查代碼為原則刪減多餘的檢查筆數，最終統計各項核醫檢查SPECT/CT的利用情形並分析每月SPECT/CT檢查量。採用SAS® OnDemand for Academics進行資料處理與統計分析，以平均值、標準差呈現年平均、月平均之SPECT/CT檢查量及各項檢查，並分析月平均SPECT/CT檢查量是否會隨時間有增減趨勢。

結果:

本研究期間共完成 5,605筆 SPECT/CT檢查，其中利用率多高的檢查項目以全身骨骼掃描共4,532筆 (80.9%)最多、淋巴閃爍攝影檢查490筆 (8.7%)居次、鎂-67炎症掃描248筆 (4.4%)。SPECT/CT檢查年平均、月平均與日平均檢查量分別為 560.50 ± 136.00 、 46.71 ± 15.88 及 2.60 ± 1.52 筆。以線性迴歸進行趨勢分析後發現，月平均之 SPECT/CT檢查量整體呈現上升趨勢，惟統計上未達顯著水準 ($p = 0.069$)。而在各項檢查的SPECT/CT利用僅有淋巴閃爍攝影檢查呈現逐年增加趨勢且達統計顯著意義 ($p = 0.002$)。

結論:

本研究觀察到 SPECT/CT 檢查量整體呈逐月上升趨勢，惟未達統計顯著。在各項檢查中，僅有淋巴閃爍攝影呈顯著遞增，可能與近年乳癌及婦癌手術病例數增加有關；全身骨骼掃描雖為最常見檢查，需求則相對穩定；炎症相關掃描則因其他影像技術應用而未見明顯變化。本研究未能取得診斷資料，無法進一步釐清造成利用變化的原因，未來可針對疾病別進行分析。

控制年齡後接受骨密度檢查患者中性別與髖部手術接受率之差異：一項醫院基礎研究 Sex Differences in Hip Surgery Utilization After Age Adjustment Among Patients Receiving DXA Scans: A Hospital-Based Study

1,2李怡旻、2,3莊紫翎

1佛教慈濟醫療財團法人大林慈濟醫院 研究部；2佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科；

3慈濟學校財團法人慈濟大學 醫學系

背景介紹:

股骨髖關節置換術(hip arthroplasty)與髖部骨折內固定術(internal fixation for hip fracture) (以下簡稱髖部手術)乃髖部骨折常見之術式，而造成髖部骨折的原因與骨質疏鬆症息息相關。性別、年齡為骨質疏鬆症之常見之危險因子，因此本研究乃探究性別對是否曾接受髖部手術的影響，並進一步分析是否曾接受髖部手術與骨質疏鬆的差異情形。

材料方法:

本研究為橫斷式回溯性研究，蒐集2019 - 2023年於期間內在隸屬某宗教財團法人之醫療機構進行門診、住院骨質密度檢查之相關數據。排除非因進髖部手術而無配合量測髖部骨質密度檢查者，若同位受試者有多筆檢查紀錄，則僅將最後一筆資料納入分析。研究工具：骨質密度檢查之設備採用雙能量X線吸收測量法 (DXA)。骨質疏鬆定義則依據根據世界衛生組織 (WHO) 的骨密度測量標準，將骨質密度以T值分為骨質正常 ($T \geq -1.0$)、骨質流失 ($-1.0 > T \geq -2.5$)、骨質疏鬆 ($T \leq -2.5$)。雙腳任一邊有進行股骨髖關節置換術或髖部骨折內固定術者，則視為曾接受髖部手術。統計軟體使用 SAS® OnDemand for Academics，統計方法使用個數、百分比、卡方檢定，分別檢視性別、骨質疏鬆情形與是否曾接受髖部手術之差異性，最後以多元羅吉斯迴歸探究在控制年齡及骨質疏鬆情形後，性別對是否曾接受髖部手術的影響。

結果:

共納入10,635位受試者，其中女性8,779位 (82.55%)，平均年齡為 68.73 ± 12.29 歲。整體而言，共1,392位 (13.09%) 受試者曾接受髖部手術；其中男性為346位 (18.64%)，女性為1,046位 (11.91%)，骨質疏鬆情形則以骨質疏鬆共6535位 (52.99%) 占多數。卡方檢定顯示性別、骨質疏鬆情形均與是否接受髖部手術間具有統計上顯著差異 ($P < .001$)。為進一步探討在控制年齡及骨質疏鬆情後性別對是否曾接受髖部手術之影響，本研究採多元羅吉斯迴歸分析。結果顯示，女性相較於男性接受髖部手術的勝算比為0.607 ($P < .001$)，亦即在調整控制變項後，女性接受髖部手術的勝算比男性低約39.3% ($1 - 0.607 = 0.393$)。

結論:

過往研究指出，停經後女性因雌激素減少而加速骨質流失，增加髖部骨折的風險。然而本研究在控制年齡及骨質疏鬆情形後發現，男性接受髖部手術的勝算顯著高於女性。此結果可能受到本研究中女性比例明顯偏高影響。推測女性可能較常接受骨質密度檢查，並在診斷骨質疏鬆後較易接受藥物治療或相關衛教介入，因此降低其發生髖部骨折進而接受手術的機率，導致女性接受髖部手術的勝算比男性低。

三向接頭內殘存示蹤劑對腎絲球過濾率檢查影響

¹呂麗如、²陳世緯

¹恩主公醫院核子醫學科

²恩主公醫院核子醫學科

背景介紹:

腎臟球過濾率檢查 (GFR) 是臨床常用以評估腎臟功能的重要檢查，能提供受檢者雙側腎功能參數，包括 GFR (ml/min) 及腎功能 (Split Function)。此檢查通常藉由放射性示蹤劑靜脈注射後，進行腎臟動態功能影像獲取與分析。

在臨床檢查流程中，靜脈注射時使用三向接頭延長管路，常因示蹤劑殘留於接頭內，隨著後續的利尿劑一同被推入體內，可能造成時間-活度曲線出現額外波動，進而影響檢查數據的準確性。

材料方法:

動態腎/泌尿功能測定需於受檢者血管放留置針，其後接T型延長管再接三向接頭。三向接頭除一端接T型延長管外另兩端分別接放射性示蹤劑及生理食鹽水。使用閃爍攝影機進行照影。於注射放射性示蹤劑^{99m}Tc-DTPA後開始收集影像，並在第11分鐘注射利尿劑(與放射性示蹤劑同一接頭)後繼續收集影像11分鐘。

使用西門子 Renal Process進行分析，將收集之影像的第1~32張堆疊後圈選雙側腎臟範圍及背景ROI，依ROI範圍於每個時間點繪製成圖表，可獲得兩側腎圖。

臨床個案為一51歲女性受檢者，其腎圖除注射放射性示蹤劑後2-4分鐘有一高峰外，並於12-13分鐘產生另一高峰。檢查過程中，第11分鐘中注入利尿劑，而其腎圖產生之第二高峰出現在利尿劑注射後，不排除為三向接頭內殘存之放射性示蹤劑。本研究以染劑模擬放射性示蹤劑，設計靜脈注射過程之模擬實驗。比照檢查時注射藥物方式與順序，先將染劑注入後再由三向接頭另一端推食鹽水，此時三向轉接頭已有染劑殘留。將三向接頭染劑針筒端換成利尿劑後繼續注射，最後再由三向接頭另一端推食鹽水。

結果:

使用染劑模擬注射藥物方式，染劑於三相接頭內有明顯殘留，當其他液體進入三向接頭時，殘留染劑再次被推送出來。不排除為造成受檢者腎圖於12-13分鐘另一高峰的原因。此現象可能對實際腎臟動態影像檢查造成干擾，導致 GFR 與 Split Function 分析數據失真。

結論:

腎圖中第二高峰會造成最後分析準確性。建議在示蹤劑注射後繼續注入10毫升生理食鹽水，並將最後2-3毫升食鹽水推至示蹤劑針筒內，目的是排除三向接頭內殘餘之示蹤劑，以防止殘餘藥物造成分析準確度。除三向接頭內殘餘之示蹤劑影響外。病人手肘彎曲造成藥物累積在彎曲處也是可能原因之一，因此建議除了使用生理食鹽水沖洗三向接頭外亦須注意受檢者手肘盡量伸直，避免人為因素造成分析結果準確性。

Amyloidosis Presenting as Non-MDP-Avid Osteolytic Lesions on Bone SPECT/CT: A Rare Cause of Femoral Neck Pathologic Fracture

^{1,2}Tzyy-Ling Chuang

¹Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan;

²School of Medicine, Tzu Chi University, Hualien, Taiwan;

Introduction:

We report a rare case of amyloidosis presenting as osteolytic lesions with background activity on bone SPECT/CT, leading to a right femoral neck pathologic fracture.

Case report:

A 70-year-old woman with hypertension, diabetes, and end-stage renal disease (on peritoneal dialysis from 2008 to 2019, then hemodialysis) presented with right hip and thigh pain after stretching. She had a history of bilateral carpal tunnel decompression (2022). Initial radiographs suggested bilateral femoral head osteolytic lesions. Despite analgesics, her symptoms worsened, leading to an inability to ambulate. Subsequent imaging confirmed a displaced right femoral neck fracture (Garden type IV) with adjacent osteolytic changes, raising suspicion for metastasis, multiple myeloma, or brown tumor. Bone SPECT/CT revealed radiotracer uptake at the fracture site, but only background activity over the osteolytic lesions. Laboratory work-up excluded multiple myeloma; intact PTH was elevated at 385.32 pg/mL. Parathyroid scintigraphy revealed likely hyperfunctioning of the left superior and possibly inferior glands. After right total hip replacement, histopathology of the osteolytic lesion demonstrated sheets of amorphous material, exhibiting apple-green birefringence under polarized light with Congo red staining, confirming an unexpected diagnosis of amyloidosis. The review of a prior abdominal CT (2019) revealed no pre-existing bone lesions before the initiation of hemodialysis.

Conclusions:

In patients with chronic renal failure on long-term dialysis, both dialysis-related amyloidosis and brown tumors can mimic osteolytic metastatic bone disease, particularly in the setting of secondary hyperparathyroidism. Although brown tumors and amyloidosis have been reported to show increased uptake on bone scintigraphy, our patient demonstrated only background activity at the osteolytic sites. Musculoskeletal amyloid deposition may cause compressive neuropathies (such as carpal tunnel syndrome in our case), tendon damage, joint stiffness, and, rarely, pathologic fractures, predominantly involving the femoral neck. Chronic exposure to dialysis-related antigens may trigger beta-2-microglobulin amyloid deposition in bone. Recognizing these rare skeletal manifestations of chronic dialysis-associated conditions is essential for accurate diagnosis and optimal management.

一種應用於鼻胃管病患之食道逆流閃爍攝影簡便流程：個案報告

¹周煒倫, ¹曾昶深, ¹林雅萍, ^{1,2,3}陳昱宏, ⁴楊筱惠, ⁵秦家翊, ¹劉淑馨

¹佛教慈濟醫療財團法人花蓮慈濟醫院核子醫學科

²慈濟大學醫學系

³慈濟大學醫學影像暨放射科學系

⁴佛教慈濟醫療財團法人花蓮慈濟醫院兒童外科

⁵佛教慈濟醫療財團法人花蓮慈濟醫院小兒科

背景介紹:

食道逆流閃爍攝影雖是歷史悠久的檢查，但其靈敏度及游離輻射暴露皆優於食道攝影。然而，鼻胃管病患施作時不易判別影像中活度是否源自管內殘留，且部分病患在拔除鼻胃管後可能難以重新插回。本文報告一項針對鼻胃管病患之簡便且實用的造影流程，並探討SPECT/CT在其中可能扮演的角色。

病例報告:

一位7歲患有芳香族L-胺基酸類脫羧基酶(AADC)缺乏症而長期臥床並以鼻胃管灌食的女童，此次因反覆嗆咳及吸入性肺炎住院。由於病患無法自主配合吞嚥，上消化道攝影或胃鏡可能增加吸入性肺炎或相關的麻醉風險，因此安排了食道逆流閃爍攝影以評估是否有胃食道逆流並由鼻胃管灌注放射性藥品。病患仰臥在GE NM/CT 860檢查床上由鼻胃管灌入含0.75 mCi ^{99m}Tc-phytate 150mL的配方奶，再灌入40 mL的水來清除管內殘餘活度，我們收集動態影像(每張10秒持續60分鐘)，造影中發現放射活度逆流至食道中段，我們再次灌水後，逆流現象未見改變，排除單純管內活度誤判，確認為胃食道逆流陽性。隨後的SPECT/CT影像可確認逆流高度至食道上半段，為嚴重的胃食道逆流。此病患由於長期管灌需求及反覆吸入性肺炎，經檢查證實合併有嚴重胃食道逆流，因此轉介兒童外科安排胃造口以及胃底摺疊術(Fundoplication)來減少病患吸入性肺炎的風險。

結論:

正常的胃食道逆流攝影是口服放射藥品來造影，惟本案患有特殊疾病須由鼻胃管灌入造影藥品。透過簡單的灌水步驟可有效排除鼻胃管內殘餘活度，降低誤判風險。儘管SPECT/CT無法區分活度是否位於管內，但對於逆流高度的定位具有重要輔助價值。這類嚴重疾病患者雖然檢查不易，但本報告所提出之流程具備可行性與實用性，能協助特殊病患完成檢查，進而達成協助臨床決策的終極目的。

Clinical value of ^{18}F -FDG PET in paraneoplastic and pembrolizumab associated myositis: Report of a rare case

¹Chang-Shen Tseng, ^{1,2,3}Yu-Hung Chen, ⁴Ching-Chun Ho, ^{2,5}Kuei-Ying Su, ⁶Sung-Chao Chu, ¹Shu-Hsin Liu

¹Department of Nuclear Medicine, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan.

²School of Medicine, Tzu Chi University, Hualien, Taiwan

³Department of Medical Imaging and Radiological Sciences, Tzu Chi University, Hualien, Taiwan

⁴Department of Surgery, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical

⁵Division of Allergy, Immunology and Rheumatology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical

⁶Department of Hematology and Oncology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan

Introduction:

Autoimmune myositis is a rare condition that typically presents with myalgia and weakness. It may occur as a paraneoplastic syndrome or as an immune-related adverse event (irAE) induced by immune checkpoint inhibitors (ICIs). While ^{18}F -FDG PET is widely used for detecting cancer metastasis, its role in identifying inflammation is increasingly recognized. Here, we report a rare case of paraneoplastic and pembrolizumab-associated myositis and highlight the clinical utility of ^{18}F -FDG PET in diagnosis and disease monitoring.

Case Report:

A 53-year-old woman diagnosed with triple-negative breast cancer (TNBC), classified as cT2N1M0, underwent neoadjuvant immunochemotherapy with docetaxel, carboplatin, and pembrolizumab. Following first cycle, she developed progressive weakness, myalgia, skin rash, dysphagia, dyspnea, and limb edema, eventually becoming bedridden. ^{18}F -FDG PET was performed to rule out disease progression and skeletal metastasis. The image showed diffusely increased ^{18}F -FDG uptake in muscles without metastasis. Laboratory testing revealed an elevated creatine kinase (CK) at 1945 U/L and the presence of anti-transcription intermediary factor 1 (TIF1)- γ autoantibodies, supporting the diagnosis of pembrolizumab-triggered paraneoplastic myositis. The patient was treated with corticosteroids and intravenous immunoglobulin. Follow-up ^{18}F -FDG PET demonstrated a reduced muscular ^{18}F -FDG avidity, with a muscle-to-liver uptake ratio decline from 1.53 to 0.81. Her symptoms gradually improved, and the CK level normalized 3d. The patient subsequently underwent modified radical mastectomy, with a final pathological stage of ypT2N1a. She is currently undergoing rehabilitation and has regained ambulation with the assistance of a walker.

Conclusions:

Myositis is a rare comorbidity among patients with TNBC, whether as an irAE of pembrolizumab or paraneoplastic manifestation. While CK levels serve as a biomarker for muscle injury, ^{18}F -FDG PET provides a visual assessment of myositis severity and helps differential diagnosis between cancer metastasis and myositis. Thus, ^{18}F -FDG PET is a valuable molecular imaging tool in cancer patients suspected paraneoplastic or ICI-associated myositis.

Nuclear Bone Scanning in Leprosy: a Case Report

Ya-Wen Chuang, Ying-Fong Huang, Chia-Yang Lin, Chin-Chuan Chang, and Hsiu-Lan Chu

Department of Nuclear Medicine, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan

Introduction:

Leprosy, or Hansen's disease, is an uncommon disease. There are few cases in which nuclear medicine imaging obtained in the diagnostic workup.

Case Report:

The authors report a case in which leprosy was diagnosed and under treatment at other hospital, was referred to our department for detecting leprosy bone lesions. Tc-99m methylene diphosphonate (MDP) scan demonstrated leprosy periostitis, a classic pattern and distribution of uptake related to leprosy, and the findings were similar to prior studies of few cases with leprosy and bone scintigraphy published before. Our findings were more prominent than results of the previous plain films of this case.

Conclusions:

Although the diagnosis of leprosy had been established by skin biopsy, the use of bone scan can help determine if there is periostitis and the extent of involvement. Furthermore, other diseases may produce bone lesions similar to those of leprosy, as, for example, osteomyelitis and diabetic gangrene. Clinical correlation and careful interpretation is needed of the unusual uptake of radiotracer.

Recurrent HPV-Positive Oropharyngeal Squamous Cell Carcinoma with Suspected Metachronous Tracheal Tumor: A Case Report

^{1,2}Chi-Wen Huang, ¹Chun-Che Lo, ¹Jui-Hung Weng

¹Department of Nuclear Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan

Introduction:

HPV-positive oropharyngeal squamous cell carcinoma (OPSCC) typically demonstrates excellent prognosis and therapeutic response following concurrent chemoradiotherapy. However, disease recurrence or development of second primary malignancies remains a significant clinical challenge, particularly when involving uncommon anatomical sites such as the trachea.

Case Report:

We report a 59-year-old male patient diagnosed with cT3N1M0 HPV-positive OPSCC in February 2024. Following concurrent chemoradiotherapy, the patient achieved near-complete response and continued maintenance therapy with oral UFUR.

Routine surveillance MRI in April 2025 revealed a suspicious recurrent mass in the right oropharynx with central necrotic changes. Subsequent FDG-PET/CT demonstrated a hypermetabolic oropharyngeal lesion (4.2 cm, SUVmax 13.2) alongside a 7 mm hypermetabolic nodular lesion within the trachea (SUVmax 7.8). Bronchoscopy examination identified a friable tracheal mass located 8 cm proximal to the carina. Histopathological analysis revealed moderately differentiated squamous cell carcinoma with positive staining for cytokeratin and P40, diffuse P16 positivity, and negative TTF-1 expression, consistent with HPV-associated malignancy.

Conclusions:

This case demonstrates the rare occurrence of suspected metachronous tracheal squamous cell carcinoma in a patient with previously treated HPV-positive OPSCC. Comprehensive imaging surveillance, prompt endoscopic evaluation, and definitive histopathological confirmation are essential for distinguishing recurrent disease from second primary tumors, thereby informing optimal clinical management strategies.

Evaluation of the Effect of Modified L-T4 Withdrawal Protocol Prior to I-131 Treatment

Chien-Hua Lu¹, Yu-Sheng Hung²

^{1,2} Division of Nuclear Medicine, Chi Mei Medical Center, Liouying, Tainan, Taiwan

Introduction:

To facilitate the absorption of radioactive iodine (I-131) for ablation of residual thyroid tissue or differentiated thyroid cancer following thyroidectomy, patients typically discontinue L-T4 for four weeks or receive recombinant human TSH (rhTSH) injections for two consecutive days prior to treatment to elevate TSH levels to $>30\text{--}50\text{ }\mu\text{U/mL}$. However, many patients experience intolerable side effects from L-T4 withdrawal, such as cold intolerance and fatigue. While rhTSH provides an alternative, it incurs a high out-of-pocket cost. This study explores a modified withdrawal protocol aimed at reducing patient discomfort and financial burden without compromising therapeutic efficacy.

Materials and Methods:

Patients discontinued L-T4 for five days, received a single rhTSH injection on day six, and were hospitalized on day seven for I-131 therapy. Prior to administration, serum TSH levels were measured to confirm suitability for treatment.

Results:

From January 1 to November 31, 2024 (Taiwan Year 113), 25 patients underwent this protocol. All patients achieved TSH levels $>30\text{ }\mu\text{U/mL}$ before I-131 administration, with a mean value of $86.91\text{ }\mu\text{U/mL}$, satisfying the pre-treatment criteria.

Conclusions:

A conventional four-week L-T4 withdrawal can lead to adverse effects including impaired cardiac function, elevated cholesterol, worsening depression, fatigue, altered taste, constipation, and reduced physical activity. In contrast, the modified protocol involving only a five-day withdrawal followed by a single rhTSH injection maintains therapeutic efficacy while minimizing patient discomfort and reducing the need for a second rhTSH dose, thereby alleviating the financial burden.

Unexpected FDG-Avid Lung Lesions on PET/CT During Colon Cancer Staging: A Case of Mycobacterial Infection Mimicking Metastasis

^{1,2}Chi-Wen Huang, ¹Chun-Che Lo, ¹Jui-Hung Weng

¹Department of Nuclear Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan

Introduction:

FDG PET/CT is a standard tool for colorectal cancer staging, offering high sensitivity for detecting primary tumors and distant metastases. However, increased FDG uptake is not specific to malignancy and may also result from infectious or inflammatory conditions. Accurate differentiation between metastasis and benign causes is critical for staging and treatment planning. We report a case of FDG-avid lung lesions incidentally found during colon cancer staging, later identified as non-tuberculous mycobacterial (NTM) infection rather than metastasis.

Case Report:

A 67-year-old man presented with progressive abdominal pain and bowel obstruction symptoms. Colonoscopy revealed a circumferential ulcerated mass at the splenic flexure. Biopsy confirmed moderately differentiated adenocarcinoma. A self-expandable metallic stent was placed due to luminal obstruction. For staging, FDG PET/CT was performed and showed intense uptake (SUVmax 9.7) at the primary colon tumor, with mild activity in regional lymph nodes. Unexpectedly, multiple FDG-avid thick-walled cavitory nodules were seen in both upper lungs, the largest with SUVmax 15.16 in the right upper lobe. Hypermetabolic mediastinal and hilar nodes further raised concern for pulmonary metastases.

Given the atypical pattern and high uptake, infection was suspected. Sputum studies were strongly AFB positive, while PCR for *Mycobacterium tuberculosis* was negative. Molecular testing later confirmed *Mycobacterium kansasii*, an NTM species. No evidence of metastasis was found elsewhere. The patient began appropriate antimicrobial treatment under infectious disease care.

Conclusions:

This case highlights the importance of cautious FDG PET/CT interpretation in cancer patients. FDG-avid lung lesions are not always metastatic and may represent infections like NTM. In this case, PET/CT not only aided in cancer staging but also revealed an unsuspected infection. Recognizing such mimics is essential to avoid misdiagnosis and guide proper management.

Radionuclide Imaging in Intermittent Gastrointestinal Bleeding: A Case-Based Perspective

^{1,2}Chi-Wen Huang, ¹Chun-Che Lo

¹Department of Nuclear Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan

Introduction:

Radionuclide imaging is essential for evaluating gastrointestinal (GI) bleeding, particularly intermittent hemorrhage or small bowel bleeding that is challenging for conventional endoscopy. Technetium-99m labeled red blood cell (RBC) scintigraphy provides extended surveillance with exceptional sensitivity for detecting minimal bleeding episodes. SPECT/CT integration enhances diagnostic accuracy through precise anatomical localization.

Case Report:

A 74-year-old female on maintenance hemodialysis presented with progressive melena and deteriorating anemia. Despite comprehensive endoscopic evaluation, the bleeding source remained incompletely characterized, requiring nuclear medicine imaging.

Tc-99m-labeled RBC scintigraphy was performed using standard protocols. Dynamic imaging followed radiotracer administration, with serial static acquisitions over multiple hours. Delayed 7-hour imaging demonstrated abnormal focal radiotracer accumulation in the right lower quadrant and pelvis, corresponding to the terminal ileum and ascending colon—consistent with intermittent active GI bleeding in the ileocecal area.

Integration with concurrent endoscopic findings of gastric antral vascular ectasia (GAVE) provided comprehensive understanding of the bleeding pattern. SPECT/CT hybrid imaging enabled precise three-dimensional anatomical localization, enhancing diagnostic confidence and supporting clinical decision-making.

Conclusions:

This case demonstrates the clinical value of Tc-99m RBC scintigraphy with delayed imaging and SPECT/CT fusion in detecting intermittent GI bleeding challenging to identify by endoscopy alone. The complementary nature of nuclear medicine and endoscopy highlights the importance of multimodal diagnostic approaches in complex bleeding scenarios, ultimately improving clinical outcomes and patient management.

以Tc-99m動態影像技術建立Ra-223治療前靜脈導管滲漏偵測流程之臨床驗證

李佳鴻、黃美瑩、莊凱文、吳雅嵐

佛教慈濟醫療財團法人台北慈濟醫院

背景介紹:

Radium-223 dichloride (Ra-223) 是一種常用於治療轉移性去勢抗性攝護腺癌的放射性藥物。治療效果主要仰賴 Ra-223於骨組織中類似鈣離子的行為，其能選擇性地沉積於骨轉移病灶。然而Ra-223除具治療效益外，亦潛藏操作風險，特別是在靜脈注射過程中若發生滲漏，可能導致患者局部皮膚與軟組織暴露於高劑量 α 輻射，造成嚴重放射性損傷。Ra-223的放射性衰變路徑包含一連串 α 與 β 衰變，然而由於 α 與 β 粒子不易被伽瑪攝影機偵測，臨床上難以直接觀察其分布狀況。因此需採取可靠的示蹤技術以提前評估導管功能，避免藥物外滲風險。本研究提出一種結合Tc-99m示蹤劑與動態核醫影像技術的檢測方法，預先確認靜脈導管通暢性，確保Ra-223注射之安全以達成治療順利進行之目的。

材料方法:

護理師先於病人手臂或其他位置放置靜脈導管後，放射師備妥含Tc-99m示蹤劑的生理食鹽水。具體流程為：取5 mL生理食鹽水，加入一滴放射活性約0.15 mCi之Tc-99m標定藥物，充分混合後抽入針筒。將病人帶至伽瑪攝影機旁，確認導管位於探測視野範圍內。於注射混合液同時，以能量140.5 keV、能窗為20%，進行每3秒收取一幀、共90秒的動態影像紀錄。若影像中未見Tc-99m滯留，代表導管功能正常且無藥物滲漏，即可終止影像擷取並注射Ra-223。反之若90秒內或結束時仍觀察到Tc-99m訊號殘留，則研判為導管可能外滲，須由護理師重新置換導管並重複上述步驟，再進行測試，確認無滲漏疑慮後才能注射Ra-223。

結果:

某醫學中心自2021年11月至2025年6月，共進行Ra-223注射85次。其中有2例 (2.35%) 經動態影像觀察發現Tc-99m滯留，疑似導管滲漏。經重新放置靜脈導管後再評估，皆確認無滲漏現象，並成功完成Ra-223注射。累計85次注射Ra-223藥物皆未造成患者不良反應，由此判斷技術能有效辨識潛在外滲風險。

結論:

以Tc-99m示蹤劑進行靜脈導管功能與藥物滲漏的預檢，是一種成本低廉、操作簡便且具高準確性的臨床方法。該技術不僅能提升Ra-223治療時的注射安全性、減少患者放射性損傷之風險，亦具應用潛力於其他靜脈導管之評估場域，如住院病房的留置針通暢性確認，臨床實用性高，值得推廣。

從Gamma Camera均勻度品質管制探討 HVPS 與 PMT 之潛在連續性劣化現象

¹王嘉鴻¹張佳琪¹曾能泉

童綜合醫療社團法人童綜合醫院 核子醫學科

背景介紹:

在核醫學影像技術中，閃爍攝影機（Gamma Camera）係平面核醫影像與SPECT系統之基礎構件。而均勻度為檢視同一放射性分布反應一致性之指標，是保障影像品質與診斷準確性之關鍵。若儀器均勻度不良，易產生偽影，影響病灶識別與定量分析。高壓電源供應器（High Voltage Power Supply, HVPS）在Gamma Camera的主要功能是為光電倍增管（Photomultiplier Tube, PMT）提供穩定且可調的高壓電壓以及確保PMT在適當的放大條件下將微弱的閃爍光轉換為可被處理的電訊號。本研究為探討HVPS與PMT之間可能存在的潛在連續性劣化現象相關性。

材料方法:

本研究使用GE Discovery NM/CT 670系統，依《核醫用閃爍掃描儀品質控管執行程序書》執行每日均勻度測試。2025年6月，儀器於使用LEHRS準直儀校正通過後，更換MEGP準直儀進行I-131掃描，檢查結束再換回LEHRS時，發現detector 1號頭影像出現固定污染點，影響影像重建，2號頭無異常。排除外部因素後，原廠確認為HVPS偶發性故障導致能峰漂移（energy peak shifting）與污染假象，更換HVPS後影像恢復正常。2025年7月中旬QC，再度發現detector 1號頭之CFOV均勻度異常，且異常區域與6月相同。回顧7月QC數據，發現CFOV數值已呈緩步上升趨勢。最終經原廠確認為PMT損壞所致，更換PMT後QC通過，恢復正常。

結果:

綜合兩次事件分析，detector 1號頭於6月發生HVPS偶發性異常，已造成能峰漂移與污染影像，當時雖未出現PMT故障，但可能已造成潛在損害。隨即7月出現同一探頭PMT損壞，時間相近、區域重疊、均勻度變化有趨勢可循，顯示該區元件可能已有潛在硬體老化或連續性劣化問題，符合HVPS故障可能導致PMT受損的技術邏輯。

結論:

本研究發現HVPS故障可能導致PMT增益不穩並增加其損壞風險，並顯示元件老化具區域性與連續性。建議透過均勻度數據趨勢分析，及早辨識潛在劣化，確保影像品質與診斷準確性。

右側乳腺癌應用核醫前哨淋巴結閃爍攝影發現左側腋窩前哨淋巴結-個案報告

¹王雅萍、¹曾能泉

¹童綜合醫療社團法人童綜合醫院 核子醫學科

背景介紹:

衛生福利部113年統計資料，乳腺癌在女性癌症死亡率中排名居前，已是女性最常見的癌症之一。手術切除是乳腺癌主要的治療方式，而術中會針對前哨淋巴結（Sentinel Lymph Node, SLN）進行病理切片，以確認癌細胞是否已經擴散至淋巴結，並進而影響手術範圍。因此，以核醫前哨淋巴結閃爍攝影（Sentinel Lymph Node Scintigraphy）作為精準定位工具已成為標準程序之一。造影檢查通常針對手術同側之淋巴結進行定位，意外發現對側淋巴結顯影的個案較為少見，故本次針對此類情況做單一個案報告。

病例報告:

本病例是79歲女性右側乳腺癌的患者，2015年3月已切除右側部分乳房，2025年1月因確認復發預執行手術切除前，至核醫科接受前哨淋巴結閃爍攝影併單光子電腦斷層掃描。檢查流程先於右側乳暈周圍注射2mCi Tc-99m phytate以觀察腫瘤區域的淋巴引流途徑，並即時進行序列性1、2、3、4、5分鐘進行平面掃描，完成平面攝影後，進一步進行單光子發射電腦斷層掃描（SPECT/CT），以提供精確的三維定位資訊。影像檢查結果發現左（對側）腋下顯示一顆淋巴結，並後續於手術接受病理穿刺檢查，確認無惡性細胞。因患者曾接受右側乳房部分切除，可能造成原有淋巴引流中斷，導致放射性示蹤劑引流至左側腋下，形成對側淋巴引流，此現象在術後乳癌患者中為少見個案。

結論:

文獻報告統計在極少數（約0.2-0.3%）的患者中，可見對側腋下前哨淋巴結引流，可能與淋巴引流路徑改變而出現對側淋巴引流（contralateral lymphatic drainage）之現象相關。此種情況雖罕見，但具有重要臨床意義，應避免將對側腋下淋巴結誤判為轉移或新病灶。以前哨淋巴結攝影結合SPECT/CT作為術前評估淋巴引流方向及引流節點定位，確實為有效之影像工具，對於手術規劃與治療決策具有高度參考價值。此類異常引流路徑應進一步以病理檢查確認，並進行多學科團隊討論以擬定後續處置方針。

從日本核醫教育與研究經驗，反思台灣核子醫學發展方向 -參加ISORD-12國際放射防護會議之經驗分享

¹王榛婷、²張淑敏、²張晉銓

高雄醫學大學附設中和紀念醫院 核子醫學部

背景介紹:

隨著核子醫學技術持續進步，臨床放射藥物的診斷與治療應用日益多元。然而，台灣在醫療用核種的自主供應、新型放射藥物的研發推動與災害應變教育等方面，仍存在一定的侷限。2025年我有幸參與於日本東京大學舉行的第12屆國際放射防護會議（ISORD-12），透過實地觀摩與課程參與，深入了解日本在核醫放射應用與教育上的前沿研究與實踐策略。本次經驗分享旨在回顧三項重點課程，並反思其對台灣核醫領域的啟發。

材料方法:

本次經驗分享聚焦於三場印象深刻的研究簡報與課程，分別來自東京大學與福島研究團隊，主題涵蓋：1. 226Ra回收與225Ac生產（高橋教授，東京大學）：以煤灰作為原料回收226Ra，進行225Ac生產，支援 α 放射線治療藥物的穩定供應。2. 64Cu-ATSM 放射藥物應用於低氧腫瘤（松本教授，東京大學）：開發“Visible”癌症藥物，具診斷與治療雙重功能，並已進入Phase III臨床試驗。3. 放射性污染行為與災後教育推動（檜垣教授）：針對福島核災後的放射性碘與銫進行環境傳播研究與去除技術開發，並延伸至教育訓練教材設計。

結果:

1. 日本藉由煤灰等副產物回收226Ra，自製225Ac來支援 α 粒子治療需求，結合研究機構與產業端，實現資源循環與醫療創新。► 台灣目前225Ac等核種仰賴進口，尚未建立自主供應體系。
2. 64Cu-ATSM可於PET顯影中顯示腫瘤低氧區，兼具治療效果，是極具潛力的theranostic藥物，日本正推進臨床驗證。► 台灣放射藥物研發與臨床應用仍以診斷性為主，治療型藥物尚未廣泛使用。
3. 從福島核災經驗中，日本不僅建立核種去除技術，也著重科普教材與災害教育模擬，使輻射安全成為全民議題。► 台灣輻射教育偏重基礎防護，缺乏災難模擬與民眾風險認知訓練。

結論:

透過參與ISORD-12國際會議，不僅看見日本在放射應用教育與產業鏈的整合，更深感核醫教育應追求臨床、研究與社會應對的三向融合。未來希望能將這些經驗帶入台灣核醫體系，促進放射應用的永續發展與創新轉型。

30歲口腔癌患者經FDG PET/CT發現三處第二原發頭頸癌：病例報告

王靖誼、翁瑞鴻

中山醫學大學附設醫院 核子醫學科

背景介紹:

口腔鱗狀細胞癌 (oral squamous cell carcinoma, OSCC) 是頭頸癌中最常見者。頭頸癌具有發生第二原發癌症 (second primary tumor, SPT) 的高度風險。這些SPT常發生於食道、咽喉與肺部，尤其在初診晚期患者。追蹤病情時需高度警覺，除局部復發或遠端轉移外，亦可能出現多重原發病灶。FDG PET/CT為全身性的影像，適用於頭頸癌患者能早期偵測這類潛在病變。

病例報告:

本案為一名30歲男性，2022年診斷為右側頰部中度分化鱗狀細胞癌 (moderately differentiated SCC of right buccal mucosa)，接受右側廣泛切除手術及選擇性頸部淋巴結清除術，病理分期為pT3N3。2022-2024年間，臨床治療方式包含cisplatin的同步化學放射治療 (CCRT)、口服Ufur進行維持治療。爾後因病情進展繼續接受nivolumab合併放療，後續分階段進行nivolumab單獨或合併lenvatinib治療，並再次使用口服Ufur藥物。2025年左側頸部腫大，切片結果為鱗狀細胞癌，隨後接受FDG PET/CT檢查以再分期。影像發現除右下牙齦與下頷骨外，舌根與下咽部亦有局部高代謝攝取病灶，與起初右頰癌位置不同，臨床診斷均為原發癌症。新發現的頭頸癌彼此是同時(synchronous)關係，但與起初右頰癌是非同時(metachronous)關係。臨床上 PET常發現頭頸癌患者發生第二原發癌症，但在如此年輕患者同時發生三處第二原發癌症實屬罕見。合理推測與患者早自少年時期即有大量吸菸與嚼檳榔劣習，導致顯著的區域癌化(field cancerization)效應有關。

結論:

即使是年輕的OSCC患者，如果初診時相對晚期，於接受完整手術與多線免疫/標靶治療後，仍可能發展SPT。FDG PET/CT不僅可用於追蹤復發，也能有效發現異位新發腫瘤，提供臨床團隊進行治療決策的重要依據。

Early PSA Flare Following ^{177}Lu -PSMA-617 Therapy in mCRPC: Lower Biochemical Response with Maintained Overall Survival

Yu-Yi Huang^{1,2}, Pei-Ing Lee¹, Bor-Tou Huang¹, Kuo-Cheng Huang³

¹ Department of Nuclear Medicine, Koo Foundation Sun Yat-Sen Cancer Center

² School of Medicine, National Yung Ming Chiao Tung University

³ Department of Medical Oncology, Koo Foundation Sun Yat-Sen Cancer Center

Introduction:

A transient rise in prostate-specific antigen (PSA) shortly after ^{177}Lu -PSMA-617 radioligand therapy (RLT) may confound early response assessment in metastatic castration-resistant prostate cancer (mCRPC). We examined whether an early PSA flare is associated with biochemical response and survival.

Materials and Methods:

We retrospectively reviewed mCRPC patients treated with ^{177}Lu -PSMA-617 at Koo Foundation Sun Yat-Sen Cancer Center (September 2022–October 2024). PSA was measured at baseline and 2-week intervals. Early PSA flare was defined as a $\geq 25\%$ rise within 4 weeks that subsequently declined. Biochemical response (PSA50) was a $\geq 50\%$ PSA reduction from baseline.

Results:

Eighteen men (median age 75 years, range 55–91) received 45 cycles (median 2, range 1–6); mean activity was 7.0 GBq per cycle (range 3.0–7.4). Early PSA flare occurred in 8/18 (44.4%). PSA response (PSA50) is significantly lower in flare vs. non-flare group (12.5% vs. 70.0%, $P = 0.0248$). Overall survival showed no significant difference between flare and non-flare groups (HR 1.49, 95% CI 0.45–4.92; $P = 0.5128$).

Conclusions:

An early PSA flare within 4 weeks of ^{177}Lu -PSMA-617 is associated with a substantially lower likelihood of achieving PSA50, yet OS appears comparable to patients without flare. Early PSA kinetics should be interpreted cautiously; prospective validation in larger cohorts is warranted.

Comparison of CNN-Based Automatic Segmentation Without SUV Threshold Versus $SUV \geq 3$ Cutoff in Ga-68-PSMA PET Quantitative Analysis

Yu-Yi Huang^{1,2}, Pei-Ing Lee¹, Bor-Tou Huang¹, Kuo-Cheng Huang³

¹ Department of Nuclear Medicine, Koo Foundation Sun Yat-Sen Cancer Center

² School of Medicine, National Yung Ming Chiao Tung University

³ Department of Medical Oncology, Koo Foundation Sun Yat-Sen Cancer Center

Introduction:

Most published studies on Ga-68-PSMA PET use quantitative parameters derived from commercial software with an $SUV \geq 3$ voxel threshold. Our center developed a convolutional neural network (CNN)-based AI automatic segmentation model that delineates lesions without imposing an SUV lower limit. This study aimed to evaluate potential differences between the two approaches.

Materials and Methods:

Data from 21 patients were analyzed. SUVmean and total tumor volume were calculated using AI-segmented lesions with and without an $SUV \geq 3$ threshold (yielding SUVmean_3, Volume_3). The Wilcoxon signed-rank test was used for paired comparisons. Logistic regression, ROC curves, and Youden's index assessed associations with $\geq$ Grade 3 adverse events; subgroup analysis included patients 1–18 who had no image-based dose adjustments.

Results:

Raising SUV to ≥ 3 significantly increased SUVmean (median: 6.31→8.54, $p < 0.001$) and reduced Volume (median: $1.25 \times 10^6 \rightarrow 0.98 \times 10^6$ mm³, $p < 0.001$). Among the first 18 patients without image-based dose adjustments, Volume_3 correlated with AE risk ($p = 0.029$, AUC = 0.911, cutoff $\approx 9.33 \times 10^5$ mm³), while original Volume showed borderline significance but greater specificity (AUC = 0.982, cutoff $\approx 1.23 \times 10^6$ mm³).

Conclusions:

Omitting the $SUV \geq 3$ threshold lowers SUVmean and raises tumor volume. Volume thresholds help identify AE risk in certain patients, while AI-derived volumes without the $SUV \geq 3$ cut-off maintain higher specificity.

接受鐳-177-PSMA-617治療之血液透析病患的輻射防護經驗報告

¹林亭君, ¹楊詩涵, ²賴蘭室, ^{1,3}黃玉儀

¹和信治癌中心醫院核子醫學科

²和信治癌中心醫院血液透析室

³國立陽明交通大學醫學院醫學系

背景介紹:

鐳-177-PSMA-617 (Pluvicto) 是治療轉移性去勢抵抗性前列腺癌 (mCRPC) 的有效方式，但對於需定期洗腎 (hemodialysis, HD) 病患的輻射安全處理尚缺乏臨床指引。本個案為台灣首例因接受鐳-177治療的HD病患，並經驗分享相關輻射防護作業與執行成效。

材料方法:

一名78歲mCRPC男性患者，接受兩次經調整劑量 (89 mCi與86.1 mCi) 的Lu-177-PSMA-617治療。並安排兩次分別於注射後20–24小時及68–71小時進行HD。由於院內透析室與一般門診病患共用空間，於輻射安全評估考量此兩次洗腎作業我們另安排加護病房其中病室內設有洗腎相關設備，洗腎當日安排病室相鄰兩間病室無病人入住。洗腎期間安排兩名核醫科放射師及兩名血液透析室護理人員共同參與洗腎作業，對於參加工作人員皆給予電子劑量計 (Thermo EPD MK2) 監測人員劑量，兩次洗腎作業時間分別為4小時及3小時，期間的環境監測使用輻射監測儀器 (ATOMTEX- AT1121)，區域包含與病人距離1公尺與4公尺(護理站)處之劑量率測量。輻防人員於洗腎前一日執行輻射防護措施，包含病床上鋪設除汙紙、病床與洗腎儀器周邊地面鋪設除汙紙、提供裝置透析液容器、人員防護衣、手套、鞋套相關耗材。

結果:

兩次血液透析作業，護理師輻射暴露範圍1~23μSv，放射師輻射暴露範圍為1~12μSv，周邊環境輻射劑量率距病患1公尺處輻射劑量率為1~2μSv/hr，4公尺處(護理站)輻射劑量率已低於0.3μSv/hr (已達背景水準)。作業後量測所有地面除汙紙、防護衣、手套、鞋套皆無污染。量測兩次收集透析液容器其表面劑量率最高10μSv/hr，皆排入院內放射性廢水槽收集儲放。

結論:

總結而言，我們的研究顯示，對接受規律血液透析的病人進行 Lu-177-PSMA-617 治療是可行的，且對醫療人員與環境的輻射暴露疑慮極低。依監測結果推估透析護理師參與治療後洗腎作業一年可執行43次，放射師一年可協助監控輻射作業1666次。環境輻射暴露率也完全在安全範圍內，距離病患4公尺處輻射暴露率降至背景水準。

Rare sarcoma mimicking metastatic breast cancer on ^{18}F -FDG PET/CT: A Case Report

^{1,4*}Chi-Jung Tsai, ²Ya-Ju Tsai, ³Meng-Ting Chiang, ^{5#}Shih-Hsin Tu

^{1*,2,3}Departments of Nuclear Medicine, Taipei Medical University Hospital, Taipei

⁴Department of Radiology, School of Medicine, College of Medicine, Taipei Medical University

^{5#} Division of Breast Surgery, Department of Surgery, Taipei Medical University Hospital, Taipei

Introduction:

The role of ^{18}F -FDG PET/CT in breast cancer is in staging, prognosis, treatment response evaluation, radiotherapy planning, and detection of recurrence. We report a rare case of follicular dendritic cell sarcoma(FDCS) in an elder female of breast cancer history on FDG PET/CT.

Case report:

A female patient had history of infiltrating lobular carcinoma in right breast and underwent mastectomy 20+ years ago. The final stage was pT2N1M0. During regular follow up, abdominal sono revealed multiple anechoic lesions in liver and then CT & MR showed several T2 hyperintense nodules in right lobe of liver and a 7.4 cm splenic lobulated hypovascular mass, favor tumor metastases. The following FDG-PET depicted an intense-FDG-avid mass in the spleen and multiple mild-FDG-avid nodules in liver, lymphoma or metastases should be further investigation. The final pathology of splenectomy and liver tumor biopsy revealed follicular dendritic cell sarcoma. Literally, FDCS is a rare mesenchymal neoplasm arising from follicular dendritic cells of lymphoid follicles. FDCS also immunoreactive for GATA3, has been described arising in the axillary nodes and was confused initially for carcinoma of unknown primary. FDCS uniformly was positive for CD21, CD23, and CD35. A study has shown that GATA3 expression can have prognostic relevance. They found that GATA3 positivity was associated with a shorter disease free survival and overall survival. In our case, GATA3 stain was equivocal, CD21, CD23 and CD35 were focally positive, respectively. Whole-body ^{18}F -FDG PET/CT of this patient displayed a single mass in spleen, and multiple unapparent lesions in liver, it might be correspondent to less aggressive biology associated with equivocal GATA3 expression.

Conclusions:

We describe a rare case of follicular dendritic cell sarcoma in spleen with hepatic metastasis on FDG PET/CT, which is easily mistaken for metastatic tumors in a breast cancer patient.

Unexpected Striping Artifact on FDG PET/CT Due to Arm Positioning: A Case Report

Yi-Hsun Chen, Yu-Ling Hsu

Department of Nuclear Medicine, Ditmanson Medical Foundation Chia-Yi Christian Hospital, Taiwan

Introduction:

PET/CT imaging is a powerful diagnostic tool for oncologic and metabolic assessment. Standard protocol typically requires patients to raise their arms above the head to minimize attenuation artifacts and avoid truncation. However, improper positioning or patient contact with the scanner gantry may introduce image artifacts, including cold artifacts and streaks, that may mimic or obscure pathology. As described by Sarikaya et al. (2021), artifacts caused by arm motion, truncation, or beam hardening can significantly impair image quality and diagnostic accuracy

Case report:

A 50-year-old male underwent an ^{18}F -FDG PET/CT scan as part of a health check-up. The scan protocol included arms-up positioning during image acquisition. Review of the maximum intensity projection (MIP) image revealed a striping artifact over the left elbow. The patient recalled that his left elbow was resting against the PET/CT gantry during acquisition due to body size and the confined scanner bore.

No significant motion was observed, and injection quality was optimal with no signs of extravasation. Comparison of attenuation-corrected (AC) and non-attenuation-corrected (non-AC) PET images confirmed that the artifact was present on both image sets, indicating a cause unrelated to attenuation correction alone. This observation is consistent with striping artifacts described in Sarikaya et al.'s case of an ^{18}F -NaF PET/CT, where similar artifacts were caused by asymmetric arm positioning and physical contact with the gantry.

Conclusions:

This case highlights the importance of proper arm positioning and adequate patient clearance from the scanner gantry during PET/CT acquisitions. Even minor contact or asymmetry in arm placement may result in striping artifact, potentially leading to diagnostic confusion. Technologists should ensure symmetrical and relaxed positioning with sufficient spacing to avoid contact with the gantry. When artifacts are suspected, reviewing non-attenuation-corrected images and considering the use of extended FOV reconstruction or modified scatter correction protocols may improve diagnostic confidence.

核醫病人準備錯誤的可預防性分析與分級衛教實踐：永續導向品質改善經驗分享

黃慧娥、洪佑昇

奇美醫療財團法人柳營奇美醫院 核子醫學科

背景介紹:

病人準備錯誤在核醫檢查中常導致重複掃描與耗材浪費，增加醫療成本與環境負擔。尤其在教育程度偏低地區，衛教內容過於複雜可能降低病人理解力與配合度。隨著病人安全與永續醫療議題受到重視，將準備錯誤視為可預防事件並納入安全指標，成為品質改善的重要方向。本研究目的旨在透過分級衛教設計與錯誤事件監測，提升病人準備正確率，降低重照率與耗材使用，建立具永續導向的核醫品質改善模式。

材料方法:

本研究於台灣某區域醫院核醫科執行，為期六個月，分為基線觀察期（前三個月）與介入改善期（後三個月），依三大方向進行：（一）分級衛教設計：除提供標準版的書面衛教單外，口頭衛教依病人教育程度分為標準版與簡易版衛教內容，以病人可以清楚了解檢查目的與流程，與配合檢查的方式去執行。（二）可預防事件納入安全指標：將病人準備錯誤登錄並分析，納入科內病人安全監測。飲食與禁食錯誤：正子檢查未禁食、心肌灌注掃描食用含咖啡因食物、碘-131掃描未遵守低碘飲食、未依指示停用特定藥物。時間與流程錯誤：未完成前置檢查，影響流程安排，或未依表訂時間報到，導致藥物失效。（三）重照率與耗材使用監測：記錄病人準備錯誤造成的重複掃描事件，記錄耗材使用量與消耗原因，提升護理人員操作的一致性以減少個別差異造成的重複操作，評估流程改善成效。

結果:

（一）病人準備錯誤率由 4.8% 降至2.2%，顯示病人對檢查前指示的理解與配合度提升。（二）重複掃描率由5.2%降至2.8%，反映檢查前病人準備品質改善，影像品質不佳情況減少。（三）耗材使用量方面，每位病人平均針頭使用量由1.4支降至1.2支，手套使用量由1.2雙降至1.1雙，顯示流程更為精簡且減少不必要操作。

結論:

本研究證實，透過分級衛教設計與錯誤事件監測，不僅可提升病人準備品質與檢查效率，也能強化病人安全與資源管理，可將此模式納入常規作業，並持續追蹤其長期成效。

全身骨骼掃描中意外發現血管鈣化活性攝取之病例分享

¹張秀瑛¹廖建國^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

全身骨骼掃描主要可用於評估懷疑患有惡性腫瘤、感染、炎症、外傷或代謝性骨病的患者，以判斷骨骼是否存在異常。然而，檢查過程中有時也可偵測到非骨性結構的異常活性攝取，例如因腫瘤、激素變化、炎症、局部缺血、外傷或其他因素所導致的現象。在此篇病例報告中我們介紹一位在全身骨骼掃描結果中意外發現血管鈣化有活性攝取的病例。

病例報告:

一名87歲患有糖尿病、慢性腎病及攝護腺癌男性患者於2025年4月由臨床科醫師轉介至本科進行全身骨骼掃描。常規的平面全身骨骼掃描檢查發現其左側第12根肋骨有異常的活性攝取增加，除此之外在骨盆左側疑似股骨頸處也有異常的活性攝取增加，為了進一步釐清疑似股骨頸病灶的性質，針對該處加照SPECT/CT。影像檢查結果發現原疑似股骨頸處的異常活性聚積實際上並非骨性病灶，而是左股動脈或靜脈的鈣化斑塊造成的異常活性攝取現象。

結論:

非骨性的異常活性攝取並不少見於全身骨骼掃描，其形成原因可能與多種病理相關，包括血管性、感染和發炎等病因。常用於全身骨骼掃描的放射性示蹤劑Tc-99m MDP (二磷酸鹽) 具有與骨頭中的結晶羥基磷灰石結合的特性，因此如果血管內有異常的鈣化聚積則有可能會導致活性攝取的異常增加，此現象有時可見發生於鈣化性尿毒症皮膚病變或慢性腎病患者。本篇病例報告中所介紹的患者同時具有慢性腎病與攝護腺癌，增加了血管鈣化風險。若未進一步影像確認，易將該攝取誤認為骨轉移，導致臨床判斷錯誤，加照SPECT/CT也可以更提高診斷的準確性，以此病例藉此與大家分享。

全身骨骼掃描之顱內活性異常攝取：經SPECT/CT與MRI確診之腦膜瘤

¹張秀瑛¹廖建國^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

全身骨骼掃描 是用於癌症分期和追蹤的最常見的檢查之一，具有高度敏感性，但其特異性相對較低。在全身骨骼掃描中有時可發現非典型的骨外攝取，這可能與患者的原發疾病相關，腦膜瘤雖通常以MRI或CT作為主要診斷工具，但在少數情況下，全身骨骼掃描亦可意外的發現腦膜瘤。此外，其他病變如腫瘤鈣化、梗塞和鈣化動脈瘤等，也可能在全身骨骼掃描中會呈現異常的顱內活性攝取。在此我們介紹一位在全身骨骼掃描結果中意外發現腦膜瘤活性攝取的病例。

病例報告:

患者為95歲女性，病史包括糖尿病、冠狀動脈心臟病、大腸癌、肺癌及既往診斷之良性腦瘤。患者由臨床醫師轉介至本科進行全身骨骼掃描以評估骨格狀況。全身骨骼掃描檢查發現胸腰椎及雙膝呈現疑似退化性關節炎、左側肺部疑似有肋膜積水所形成的活性攝取，頭部則發現局部的異常活性攝取。針對頭部的局部活性攝取增加利用加照SPECT/CT來加以鑑別診斷。檢查結果發現其頭部的局部異常活性攝取增加是由其右側基底腦的腫瘤所造成，因此建議臨床醫師利用其他影像學檢查進一步區分是否為轉移性病變。在後續的腦部MRI檢查中證實了其頭部局部活性攝取增加是由腦膜瘤所造成。

結論:

腦膜瘤是常見的良性顱內腫瘤，於老年族群中較為常見，其危險因子包括外傷、荷爾蒙替代療法和乳癌等。多數腦膜瘤臨床無明顯症狀，常於影像學檢查中偶然發現而被診斷出來尤其是腦部 MRI 檢查。全身骨骼掃描可用於檢測局部或全身性骨病變中的成骨細胞活性，雖常用於癌症患者的分期和追蹤，但偶而可發現非骨性病灶的異常活性攝取。以腦膜瘤為例，其異常活性攝取可能是由腫瘤鈣化、骨質增生或反應性骨變化等原因所導致，結合其他影像檢查如MRI或CT能提高診斷準確性，並避免將此類病灶誤判為轉移性病變。

利用放射性藥物在副甲狀腺自體移植於大腿病人再定位復發副甲狀腺瘤

¹張秀瑛¹廖建國^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

副甲狀腺瘤為常見的良性內分泌腫瘤，常導致副甲狀腺功能亢進及高鈣血症，標準治療為手術切除。為維持術後鈣磷平衡，部分患者需將正常腺體自體移植至異位部位，如前臂或大腿。然而，異位移植腺體仍可能發生腫瘤性變化，導致復發，且因位置異常與體積小，影像定位困難。在此我們介紹一位在手術當天執行副甲狀腺掃描並利用放射性藥物（Tc-99m MIBI）進行體外標記以協助手術準確定位的病例報告。

病例報告:

一位63歲女性患者，2020年因次發性副甲狀腺機能亢進於外院接受全副甲狀腺切除，並將部分正常腺體自體移植於左大腿前側。術後一年，患者再度出現高血鈣，轉介至本院進一步檢查。首次副甲狀腺掃描顯示頸胸部無異常攝取，但左大腿移植處有明顯局部放射活性聚積。SPECT/CT進一步確認異常活性聚積位於肌肉內，疑似復發副甲狀腺腫瘤。手術當天再次執行副甲狀腺掃描，並在靜脈注射Tc-99m MIBI後利用放射性藥物進行體外標記定位，以協助手術精確切除。

結論:

副甲狀腺瘤的復發是副甲狀腺手術後常見的問題，尤其是在進行副甲狀腺自體移植的患者中。術後的解剖變化使得傳統影像學檢查難以準確識別復發的瘤體。放射性藥物在副甲狀腺自體移植後復發副甲狀腺瘤的定位中，提供了一種有效的輔助診斷手段，此技術可協助提高副甲狀腺瘤定位的精確度，使手術更為安全和精確。

F-18 rhPSMA正子掃描與F-18 NaF正子掃描及傳統Tc-99m MDP骨掃描相比在攝護腺癌的應用-個案報告

¹張佳琪、¹莊志堅、¹曾能泉、²黃振義、³歐宴泉

童綜合醫療社團法人童綜合醫院 ¹核子醫學科²影像醫學部³泌尿腫瘤中心

背景介紹:

台灣的攝護腺癌發生率近幾年快速上升，目前是男性國人的第五大癌症，為早期偵測到轉移病竈，以利後續治療，各項正子示蹤劑檢查已被開發出來應用於臨床診斷上，如Ga68-PSMA-11、F-18 Fluciclovine、F-18 NaF、F-18 rhPSMA-7.3、F-18 PSMA-1007等，可用於攝護腺癌之分期、復發、轉移、及療效評估等臨床時機，而近年來為克服Ga68-PSMA-11半衰期過短藥品運送不易，F-18 PSMA類藥物於臨床的應用也越來越多，這些正子影像檢查各有其優勢，擬藉由此案例影像來探討F-18 rhPSMA-7.3 與F-18 NaF與傳統骨掃描相比在攝護腺癌的應用。

病例報告:

個案為80歲男性，於2022年發現PSA數值上升，安排F-18 Fluciclovine正子掃描、F-18 NaF正子掃描，並於2022年9月進行荷爾蒙療法，PSA數值下降，持續追蹤，2025年1月執行Tc-99m MDP 骨掃描發現可疑病竈，且PSA數值升高，故安排F-18 NaF正子掃描 & F-18 rhPSMA-7.3 正子掃描檢查，其中，F-18 NaF 正子掃描發現更多處骨性轉移病竈，F-18 rhPSMA-7.3正子掃描則發現近膀胱頸復發及多處骨轉移病竈。

結論:

F-18 rhPSMA-7.3正子掃描可應用於攝護腺癌分期、復發、淋巴結與遠端轉移、及療效評估等臨床場景，F-18 NaF正子掃描可發現較多骨骼病竈，2022年9月JNM的研究指出F-18 rhPSMA-7.3跟其它PSMA類藥物相比，有較低膀胱尿液活性，容易偵測原發部位病竈，對新診斷、復發、轉移攝護腺癌有較好的形態學成像的診斷能力，且顯示較低的讀者間(inter-observer bias)差異，而傳統銻99m骨掃描在影像上的敏感度較低。因此，F-18 rhPSMA-7.3正子掃描影像在復發、淋巴結及遠端轉移的偵測上是有助益的，搭配F-18 NaF正子掃描影像檢查能完整評估骨性及軟組織病竈的腫瘤負荷(tumor burden)，有利臨床決策及治療計畫擬定。

不同儀器骨骼掃描影像模糊率之比較

Comparison of Image Blurring Rates in Bone Scintigraphy Across Different Gamma Camera Systems

¹廖建國、¹許幼青、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

本科多年來針對骨骼掃描的項目一直有在監控影像模糊率，由於影像品質與攝影儀器的老舊及維護現況息息相關，因此近2年我們也開始監控不同儀器的影像模糊率。本研究目的即為比較不同儀器之骨骼掃描影像模糊率，以作為儀器監控政策之參考。

材料方法:

回溯性收集2024年1月至2025年6月，例行骨骼掃描之影像品質檢討資料，分析比較每月各儀器之影像模糊率，其中排除非儀器因素所造成的模糊(例如放射性藥物劑量、病人造影中移動、BMI及腎功能等)。例行骨骼掃描使用的儀器，包括Hawkeye 4(機齡17年)、Infinia 2(機齡14年)、NM/CT 860(機齡4年)等3項。影像是否模糊由醫師目視影像判定，若影像品質可以接受，不至於影響判讀，但整體清晰度略差，則判定為影像模糊。

結果:

總計收集4222件個案，其中影像品質判定為「模糊」之個案計39件。整理結果發現，2024年1月至2025年6月之平均影像模糊率為0.92%，Hawkeye 4、Infinia 2、NM/CT 860各儀器之影像模糊率分別為1.33%、2.11%及0.50%。近2年中以2024年2月及7月之影像模糊率最高(16.67%)，皆發生在使用Infinia 2儀器時，而2024年11月及12月以及2025年6月之影像模糊率最低(0%)。由於Infinia 2使用的次數較少(平均每月少於20次)，導致Infinia 2每月的模糊率可能並不可靠，因此我們進一步以各儀器這兩年的總件數及總模糊件數來分析影像模糊率，結果發現Hawkeye 4、Infinia 2、NM/CT 860各儀器之影像模糊率分別為1.62%、1.53%、0.63%，顯示影像模糊率與儀器的機齡有關，Hawkeye 4的機齡最高，其模糊率也最高，而NM/CT 860機齡最低，其模糊率也最低。

結論:

比較不同儀器骨骼掃描之影像模糊率，發現機齡17年的Hawkeye 4 (1.62%)與機齡14年的Infinia 2 (1.53%)皆明顯高於機齡4年的NM/CT 860 (0.63%)，結果顯示機齡愈高其影像模糊率也愈高。造影室持續監控不同儀器骨骼掃描之影像模糊率，再搭配儀器故障率之監控，可更明確的了解儀器老舊對影像品質及檢查作業的影響，有助於儀器汰換之評估。

The diagnostic accuracy of Ga68-PSMA-11 PET/CT in prostate cancer patients presented with exclusive rib lesions

Bor-Tau Hung, MD. Pei-Ing Lee, MD. Yu-Yi Huang, MD.

Department of nuclear medicine, Koo foundation Sun Yat-Sen Cancer Center.

Introduction:

Prostate-specific membrane antigen (PSMA) PET combined with computed tomography (CT) has significantly advanced the field of prostate cancer imaging, offering higher sensitivity and specificity than many other conventional imaging. However, interpreting exclusive rib lesions remains challenging. The aim of the study was to determine the sensitivity, specificity, PPN, NPV, and accuracy of Ga68-PSMA-11 PET/CT in prostate cancer patients presented with exclusive rib lesions.

Materials and Methods:

Prostate cancer patients who underwent Ga68-PSMA-11 PET/CT were retrospectively enrolled between September 2023 and June 2025 at Koo foundation Sun Yat-Sen cancer center. Patients with metastatic disease of other locations than ribs (64/165) and patients without rib lesions (84/165) were excluded according to image reports. Among the remaining 17 cases who received Ga68-PSMA-11 PET/CT for initial staging or biochemical recurrence of prostate cancer, one case without follow up was also excluded. Finally, 16 reports of the PET/CT studies were collected and images were reviewed. The standard of reference for rib metastasis was the presence of tumor at histopathologic examination (1/16, 6%) or post-therapy prostate-specific antigen (PSA) levels (15/16, 94%).

Results:

The medium (range) number of exclusive costal lesions per patient was 1.5 (1-5) with a single rib lesion described in 12(75%) patients and multiple rib lesions in 4(25%) patients. Of the 16 patients enrolled in the study, 11(69%) had benign costal lesions, and 5(31%) had malignant costal lesions. PET/CT indicated rib lesions as benign or equivocal in 9/16(56%) patients and malignant in 7/16(44%) patients. The overall sensitivity, specificity, PPN, NPV, and accuracy was 100%, 82%, 71%, 100%, and 88% respectively, for PET/CT identification of exclusive ribs metastasis. The SUVmax (mean±SD) of malignant and benign costal lesions showed wide variation and no statistically significant difference (6.28 ± 7.44 vs 3.10 ± 1.85 , $p=0.18$).

Conclusions:

Isolated PSMA-avid rib lesions without other bones, lymph nodes, and visceral organs involvement are uncommon and more likely benign. Nevertheless, Ga68-PSMA-11 PET/CT is still a very powerful diagnostic tool in this scenario. Future studies focusing on the additional utility of semiquantitative values from PSMA PET/CT are warranted.

Rare Phosphaturic Mesenchymal Tumor Detected in Maxilla Using Tc-99m MIBI SPECT/CT

¹Chao-Wei Tsai, ¹Shih-Chuan Tsai, ¹Hsin-Yi Wang, ¹Yi-Jing Lin, ¹Jing-Uei Hou

¹Department of Nuclear Medicine, Taichung Veteran's General Hospital, Taichung, Taiwan

Introduction:

Phosphaturic mesenchymal tumor (PMT) is a rare cause of tumor-induced osteomalacia (TIO) mediated by excess fibroblast growth factor-23 (FGF-23), resulting in renal phosphate wasting and impaired vitamin D activation. Nonspecific symptoms and the small, anatomically variable nature of PMTs frequently delay diagnosis, and anatomical imaging may be non-diagnostic. Functional imaging is therefore pivotal; while ⁶⁸Ga-DOTA-SSTR PET/CT is most sensitive, ^{99m}Tc-MIBI SPECT/CT can localize lesions by exploiting mitochondrial sequestration of sestamibi and remains widely accessible.

Case Report:

A 54-year-old man had five years of progressive bilateral lower-limb weakness culminating in wheelchair dependence. Examination showed bilateral patellar hyperreflexia, hip-flexor weakness with wasting, and diffuse bony tenderness. Biochemistry demonstrated severe hypophosphatemia, elevated alkaline phosphatase, and secondary hyperparathyroidism; serum FGF-23 was markedly elevated (320.37 pg/mL), raising suspicion for TIO. ^{99m}Tc-MIBI SPECT/CT revealed focal uptake in the alveolar process of the left maxilla. Oral-cavity MRI showed a corresponding avidly enhancing lesion with cortical erosion and periosteal reaction. Left partial maxillectomy was performed; histopathology with immunohistochemistry confirmed PMT. Postoperatively, hypophosphatemia resolved, serum calcium normalized, and mobility improved substantially.

Conclusions:

This case highlights the diagnostic utility of ^{99m}Tc-MIBI SPECT/CT for localizing elusive PMTs that underlie TIO, enabling curative resection and rapid biochemical remission. In centers lacking somatostatin-receptor imaging, ^{99m}Tc-MIBI SPECT/CT offers a practical, readily available alternative that can be integrated into diagnostic algorithms to expedite tumor detection and improve clinical outcomes.

以30分鐘胃內活性殘留率評估簡化液體胃排空閃爍攝影檢查之可行性與準確性

^{1,2}蘇詩琪, ²邱駿逸, ^{1,3}詹宏彬

¹高雄榮民總醫院 核子醫學科

²高雄榮民總醫院 放射線部

³國立中山大學醫學院 生物醫學研究所

背景介紹:

胃排空閃爍攝影 (GES) 可評估胃將食物排出至十二指腸的速度與效率，臨床適應症包括診斷胃蠕動功能異常、胃輕癱、延遲或快速排空等。液體 GES 適合無法吞嚥固體餐的患者，檢查時間短，可快速篩檢胃排空異常。然而，部分患者因無法久躺或檢查中斷，影像完整性不足，影響判讀。本研究旨在建立簡化評估方法，提升檢查可行性與臨床應用性。

材料方法:

回溯分析 90 例液體 GES 資料，檢查流程為飲用含 1 mCi Tc-99m-DTPA 的 200 mL 水後，立即進行仰躺動態攝影 (1 分鐘/張，共 30 分鐘)。依 Ziessman 等文獻計算胃排空半衰期 (T1/2)，T1/2 < 22 分鐘定義為正常。依 Farrell 文獻計算胃內活性殘留率 (30 分鐘 ROI / 1 分鐘 ROI × 100%)，並進行 ROC 分析以判定延遲排空 (T1/2 ≥ 22 分鐘) 的最佳截斷值。

結果:

47 例為正常，43 例延遲排空。30 分鐘殘留率預測延遲排空的 AUC 為 0.970 (95% CI : 0.938–1.000, p < 0.05)，最佳截斷值為 37%，敏感度 93.0%、特異度 95.0%。殘留率 > 37% 判定為延遲排空，≤ 37% 判定為正常，與 T1/2 分類結果完全一致。

結論:

本研究提出的「雙時點法」(1 分鐘與 30 分鐘影像) 可在不進行完整 30 分鐘動態攝影的情況下，準確判斷液體胃排空狀態。以 37% 為截斷值具有高敏感度與特異度，對無法完成標準檢查的患者提供可行且有效的替代方案。

正子造影發現罕見之子宮內膜癌轉移腋下淋巴結：個案報告

陳琬淇、翁瑞鴻

中山醫大附設醫院 核子醫學科

背景介紹:

FDG正子造影雖未獲健保給付於子宮內膜癌，卻有很高的偵測敏感度。本案例為一治療後CA-125異常升高的患者，藉全身正子造影檢查發現罕見之單一右腋下淋巴結轉移，並因此獲得正確後續處置。

病例報告:

一位56歲子宮內膜癌患者，完成手術及化學治療。追蹤時因為CA-125異常升高，於是接受FDG正子造影檢查，發現全身影像唯一異常在單一右腋下淋巴結腫大且代謝增高。同時骨盆腔未發現有腫瘤復發，全身亦未發現其他轉移病灶或乳房腫瘤。右腋下淋巴結經病理切片，證實為子宮內膜癌之轉移。

結論:

子宮內膜癌常見發生骨盆腔及腹部淋巴結轉移，遠端轉移則最常見於肺部、肝臟及骨骼。單一右腋下淋巴結病變，依學理應優先考慮乳癌轉移或淋巴瘤等，但本案例正子造影並未發現骨盆腔腫瘤復發或原發乳癌。是故須行切片供病理診斷。子宮內膜癌轉移腋下淋巴結非常罕見，文獻僅有零星個案報告。全身FDG正子造影除了偵測到轉移病灶外，亦對後續處置決策發揮了關鍵作用。

Unknown primary malignancy with the initial manifestation of pleural effusion proven as ovarian cancer on F-18 FDG PET/CT

Chao-Jung Chen

Departments of Nuclear Medicine, Yuan' s General Hospital, Kaohsiung, Taiwan

Introduction:

Pleural effusion is a common clinical condition with a wide differential diagnosis, including both benign and malignant causes. Among the malignant etiologies, the most commonly implicated cancers are lung, breast, and hematologic malignancies, such as lymphoma. However, pleural involvement as the initial presentation of gynecologic malignancies, particularly ovarian cancer, is rare and often poses significant diagnostic challenges. Here, we present a case of ovarian cancer that initially manifested as a massive pleural effusion, which was ultimately diagnosed using F-18 FDG PET/CT.

Case report:

A 75-year-old female patient presented with a productive cough for 2 weeks and dyspnea for several days. Chest X-ray and subsequent chest CT revealed a massive left pleural effusion without any obvious signs of malignancy. Cytology of the left pleural effusion was positive for malignant cells, consistent with metastatic adenocarcinoma. Video-assisted thoracoscopic surgery revealed a metastatic mediastinal lymph node, but no malignancy was found in the lung or pleura. Given the unknown primary malignancy, the patient was referred for F-18 FDG PET/CT for further evaluation. It revealed two suspicious hypermetabolic lesions in the bilateral adnexa, likely in the ovaries, as well as suspected peritoneal carcinomatosis in the pelvic cavity. Primary ovarian cancer should be considered as a primary diagnosis. Debulking surgery was performed, and pathology confirmed left ovarian cancer with right ovary involvement and peritoneal carcinomatosis.

Conclusions:

In conclusion, this case highlights an unusual presentation of ovarian cancer, initially manifested as a massive pleural effusion. F-18 FDG PET/CT was instrumental in confirming the malignant origin from the ovary. Although rare, gynecologic malignancies should always be considered in patients primarily presenting with pleural effusion.

A Case of Non-Small Cell Lung Cancer (NSCLC) with Esophageal Inflammatory Pseudotumor Mimicking Malignancy and Liver Metastasis on 18F-FDG PET/CT

Shu-mei Lu, Yu-Ling Hsu

Department of Nuclear Medicine, Ditmanson Medical Foundation Chia-Yi Christian Hospital, Chia-Yi, Taiwan

Introduction:

18F-FDG PET/CT has a well-established role in the diagnosis and staging of a wide variety of cancers. Preliminary data and quantitative analysis show it can also provide early information on tumor response to therapy, potentially enabling personalized patient management.

Case Report:

We demonstrate a 68 year-old female who has non-small cell lung cancer (NSCLC) with spinal invasion s/p T4-T5 decompressive laminectomy s/p Paclitaxel + Carboplatin + added Pembrolizumab s/p R/T; solitary brain mets s/p SRS s/p Afatinib (T4N3M0) for re-staging survey. 18F-FDG PET/CT scan is indicated. Procedure: 6.5 mCi (18F)-fluorodeoxyglucose was administered intravenously, and the patient was allowed to rest quietly for 50-60 minutes. Imaging was performed with scanning from head to mid thigh. Serum blood glucose at the time of the injection was measured as 104 mg/dL. Imaging finding: wall thickening with increased FDG uptake over esophagus; malignancy should be carefully ruled out. Further survey was suggested. Also suspect liver metastasis. Later pathological esophagus biopsy shows squamous hyperplasia with intraepithelial neutrophilic infiltration, spongiosis and presence of sloughed keratin with PAS-positive Candida yeasts and pseudohyphae. Acute and chronic inflammation with squamous hyperplasia and candidiasis were impressed. Liver RFA was also performed. After 3 months, the follow-up 18F-FDG PET/CT scan revealed regressive lesion at esophagus and liver.

Conclusions:

PET/CT is supported by clinical advantage to detect not only local relapse but also distant metastatic spreading, with a significant impact on patient's management and selection. However, sometimes inflammatory responses or atypical infections can mimic malignancies, so clinicians should exercise caution in their diagnosis. Also, 18F-FDG PET/CT parameters on both pre-ablation and post-ablation scans may predict local recurrence in patients treated with RFA for lung metastases and primary lung cancers. This case also demonstrates that (18F)-FDG PET/CT can be a useful diagnostic tool for post-RFA evaluation.

Direct Intra-Patient Comparison of ^{18}F -PSMA-POSLUMA and ^{18}F -PSMA-1007 PET/CT in a Castration-Resistant Prostate Cancer Patient with Rising PSA

¹Hsiao-Chi Hou, MS; ^{2,3}Yow-Ling (Shirley) Shiue, PhD; ⁴Yin-Shen Chen MD; ¹ Daniel Hueng-Yuan Shen MD, PhD; ^{1,2}Hung-Pin Chan, MD, MS

¹Department of Nuclear Medicine, Kaohsiung Veterans General Hospital, Kaohsiung City, Taiwan

²Institute of Biomedical Sciences, College of Medicine, National Sun Yat-sen University, Kaohsiung city, Taiwan

³Institute of Precision Medicine, College of Medicine, National Sun Yat-sen University, Kaohsiung city, Taiwan

⁴Division of Urology, Department of Surgery, Kaohsiung Veterans General Hospital, Kaohsiung City, Taiwan.

Introduction:

PSMA PET/CT is pivotal for detecting recurrent or metastatic prostate cancer. ^{18}F -PSMA-POSLUMA has rapid clearance with low hepatobiliary excretion, whereas ^{18}F -PSMA-1007 shows minimal urinary but higher hepatobiliary uptake. Intra-patient comparisons are rare yet informative for tracer selection.

Case Report:

A 71-year-old male with pT3bN1 prostate cancer (Gleason 4+3, initial PSA 78 ng/mL) underwent radical prostatectomy, radiotherapy, and ADT, later developing nmCRPC. On APRI, PSA rose to 56.1 ng/mL despite negative conventional imaging. PET/CT with both tracers showed no locoregional recurrence. ^{18}F -PSMA-POSLUMA demonstrated higher urinary bladder activity and minimal hepatobiliary uptake; ^{18}F -PSMA-1007 showed intense gallbladder/liver uptake. Both detected PSMA-avid pulmonary carcinomatosis, cervical/mediastinal lymphadenopathy, and bilateral thyroid nodules, with higher uptake on ^{18}F -PSMA-1007.

Conclusions:

Both tracers identified metastatic and benign hypervascular lesions, but differed in physiologic distribution, potentially impacting lesion conspicuity. Tailoring PSMA ligand choice to suspected disease sites may optimize detection. This case highlights how head-to-head PET/CT can inform tracer selection in challenging clinical scenarios.

信息化教學在核醫學學習課程中的現況分析

1,2 張春梅 3 陳佳惠

1高雄榮民總醫院 核子醫學科 醫事放射師

2台南應用科技大學 助理教授

3義守大學 醫學影像暨放射科學系 副教授

背景介紹:

信息化教學已經成為醫學教育領域的重要組成部分，核醫專業課程的實踐性和複雜性，以及其未來的發展方向，面臨極大的挑戰。如何強化學習思維，提升邏輯與表達能力，採用創新教學策略，結合具體的教學案例，比較傳統教學與信息化教學方法，分析信息化教學在核醫實習中的優勢和限制。

材料方法:

以 Google Classroom 評量實習學生對於核醫造影知識與技能的表現，搭配「[EverCam](#)、Canva、Gamma、google 簡報」，把課堂講授基礎理論錄製成數位教材，google 表單設計測驗題，依據學生學習後之測驗結果，採用“錯誤選項剖析”，以提升學生批判性思維。思維可視化：借助[Xmind](#)，讓學生把放射性藥物攝取、代謝、造影技術、影像判讀、注意事項繪成概念圖，臨床教師重點評論邏輯的正確性。學習心得：學生實習結束後，依“情境、推理、得失、改進”等面向，撰寫反思紀錄，培養認知能力。

結果:

統計2022年03月至2025年06月，實施學生數共32例。Google Classroom 評量中，實習學生核醫造影知識測驗之平均正確率達82%，較課前提升12%，其中『放射性藥物代謝』題型為正確率最低。經「錯誤選項剖析」後，學生於重答此題型時正確率提升至93%。以 Xmind 製作概念圖，呈現放射性藥物攝取、造影技術與判讀步驟，其邏輯正確性經臨床教師逐一評註，超過85%學生概念圖邏輯符合臨床診斷思維。實習結束後，學生在「情境、推理、得失、改進」等面向撰寫反思，普遍自覺在批判性推理能力明顯進步，例如：「學會從錯誤中分析原因，修正核醫影像診斷思維」。

結論:

信息化教學通過內容重構、流程再造，把核醫學學習的困難點，轉化為提升學習者邏輯思維、臨床能力與表達素養的增長點。翻轉課堂結合為核醫教育提供了可複製、可持續的模式，並減輕臨床教師的教學負荷量。

建立簡易打卡系統降低醫事放射實習生遲到率

¹李佩璇、¹楊朝瑋、²張文釗*

¹澄清綜合醫院中港院區 核子醫學科

²澄清綜合醫院中港院區 放射診斷科

背景介紹:

近年來醫事放射實習生的管理越趨困難。常常有遲到的現象發生，但因沒有適當的打卡系統而未留下紀錄，造成實習生僥倖心理或需補時數時統計不易完成。實習生來來去去，使用院方打卡系統費時費力且不易管理。因此希望藉由建立Excel製作的簡易打卡系統降低實習生遲到率。

材料方法:

統計112學年度8位醫事放射實習生，在使用簡易打卡系統前後的遲到率。收集期間分為:使用前2023年8月至9月、使用後2023年11月至12月，各43個工作天。分別統計實習生遲到之比率。未使用打卡系統前，由實習生的臨床導師觀察記錄實習生的遲到狀況。開始啟用由Excel製作的簡易打卡系統後，實習生需到固定電腦進行簽到，輪到不同單位實習時，亦須執行簽到。利用卡方檢定進行統計分析。

結果:

8位醫事放射實習生，在使用打卡系統前的遲到率為31.3%，使用後降低至12.5%。利用卡方檢定，Pearson卡方值為0.041(p值小於0.05)，有統計上顯著差異。

結論:

藉由建立簡易打卡系統留下紀錄，可適度減少實習生僥倖心理，並提高實習生間互相督促的作用，降低其遲到率。且在需補實習時數時亦有紀錄可查，降低實習生抱怨與臨床教師統計時間。

Intrauterine Device-related Pelvic Uptake on Post-therapeutic ^{131}I Scintigraphy and SPECT/CT in Papillary Thyroid Carcinoma

¹Chia-Ning Liu, ¹Shih-Chuan Tsai, ¹Shin-Yi Wang, ¹Jing-Uei Hou, ¹Yi-Jing Lin

¹Department of Nuclear Medicine, Taichung Veteran's General Hospital, Taichung, Taiwan

Introduction:

Pelvic uptake in post-therapeutic ^{131}I scintigraphy may mimic metastasis. Recognition of benign causes, such as intrauterine device (IUD)-related activity, may aid in avoiding misdiagnosis.

Case Report:

A 50-year-old woman with papillary thyroid carcinoma underwent thyroidectomy and neck dissection, followed by 150 mCi ^{131}I ablation. A post-therapeutic whole-body scan obtained 14 days after the treatment demonstrated a distinct focal uptake in the lower pelvis with star artifacts. Subsequent SPECT/CT images on day 16 localized the activity to the uterine cavity, corresponding to an indwelling IUD, without clinical evidence of pelvic disease.

Conclusions:

IUD-related ^{131}I uptake likely results from chronic endometrial inflammation and ionic interactions between metallic components and iodide. Without recognition, such uptake could be mistaken for metastasis, leading to unnecessary interventions. SPECT/CT in this situation is valuable for anatomical correlation, ensuring accurate interpretation. Moreover, from a radiation safety perspective, it would be prudent to minimize avoidable uterine dose by elective removal of the IUD prior to ^{131}I therapy in future treatments. Recognition of this phenomenon is essential to avert misclassification of benign uptake as metastatic disease and to minimize collateral radiation to reproductive organs.

使用床中單固定病人身體完成骨骼掃描檢查-個案報告

¹邱禹臻、¹許幼青、¹廖建國、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

核子醫學科骨骼掃描檢查是一種非侵入性檢查，先將微量的放射性同位素藥物經靜脈注射進入人體內，由目標器官或組織攝取藥物，再以儀器進行掃描，這項檢查對於偵測乳癌、肺癌、攝護腺癌等癌症的骨骼轉移有相當高的敏感性，不同於電腦斷層或是核磁共振，骨骼掃描檢查能進行全身掃描，偵測癌細胞轉移的部位。本文個案因情緒緊張加上體型較為肥胖，檢查過程中一直移動身體，執行骨骼掃描檢查時有可能因為沒有固定好身體部位而造成身體移動，影響掃描影像品質導致醫師影像判讀困難。本報告目的為護理師利用床中單固定病人身體部位，協助順利完成骨骼掃描檢查，提出分享。

病例報告:

病人為一名61歲的女性病人，身高160公分，體重116公斤。在2025年2月份開始摸到左側乳房有硬塊至本院就診，切片報告為左側乳房外上象限惡性腫瘤，於2025年3月17日行左胸乳腺腫瘤切除手術，診斷名稱：Left breast cancer, 電腦斷層報告為cT3N3cM1(bone meta), stage IV。核子醫學科大部分病人執行骨骼掃描檢查時固定方式為病人需要躺在檢查床上，使用棉被和束帶將雙手固定於身體兩側，身體需不能移動以確保影像清晰。病人術前至核子醫學科做骨骼掃描檢查，檢查時間約半小時，病人躺上檢查台後主訴自己很緊張，很害怕自己肥胖的體型會跌落至檢查台下，在檢查過程中，檢查台會慢慢往外移動，檢查剛開始時，病人一直移動身體，並因緊張害怕而哭泣，護理師先讓病人雙手固定在身體兩側，再將床中單從病人背後鋪平，最後將床中單兩側拉直後至胸前綁活結，如此可固定住病人身體，檢查過程中護理師在旁陪伴安慰，檢查過程中病人表示，床中單固定住身體後比較有安全感，也不會一直想移動身體，最後順利完成骨骼掃描檢查。

結論:

骨骼掃描檢查是目前核子醫學科可以進行全身骨骼癌症轉移的主要篩檢工具，檢查過程中病人需要平躺、身體不能移動才能順利完成此項檢查。核子醫學科每日下午都會補充枕頭套、棉被、床中單等被服用物，而床中單主要用處為保護床墊，防止病人的體液、分泌物滲入床墊，保持床墊清潔衛生，當有特殊需求時，它也可作為創意固定病人的工具，協助病人順利完成骨骼掃描檢查。

核醫兒童腎臟造影檢查之前置作業及護理照護-個案報告

¹邱禹臻、¹許幼青、¹廖建國、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

核醫腎臟造影檢查在兒童與成人間的應用，儘管基本原理相同，但在臨床目的、檢查方式、劑量、準備等方面都有所不同。兒童常見臨床目的為評估先天性腎臟或泌尿道異常，判斷是否需手術介入，而成人常見臨床目的為評估腎功能不全原因，判斷腎臟手術或腫瘤手術前後的功能；兒童檢查方式因可能無法合作，需安排麻醉鎮靜，而成人檢查方式通常能配合指示，不需要麻醉鎮靜；兒童檢查劑量需依體重計算劑量，而成人使用標準劑量。此個案報告對象為兩歲五個月的男童，檢查過程需由麻醉科團隊執行麻醉和配合儀器掃描，對兒童及家屬而言可能造成焦慮與不適。本個案報告為整理麻醉前置作業以及病人衛教與護理照護之內容，護理師在病人檢查前、中、後給予的衛教與護理照護，提出分享。

病例報告:

兩歲五個月的男童，身高86公分，體重11公斤。媽媽產前檢查時發現個案右側腎積水，診斷為右腎中度腎盂擴張，2023年3月1日腹部超音波報告為右腎輕度至中度腎盂擴張，建議六個月後追蹤，2023年8月31日腹部超音波檢查報告建議安排進一步檢查，2023年9月21日做第一次腎臟造影檢查，報告為雙腎未發現明確的功能性阻塞性泌尿道疾病，建議後續定期追蹤，期間都有定期做腹部超音波檢查，2025年5月14日做第二次腎臟造影檢查。兒童接受腎臟造影檢查時，因年齡太小無法配合檢查程序，需要麻醉協助，麻醉科在腎臟造影檢查前的前置作業重點包括：1.收集患者基本資料(年齡、體重、服藥狀況、過去醫療史、麻醉過敏史)。2.身體評估(如扁桃腺肥大、氣喘、心肺功能、神經發展狀況)。3.家長溝通與說明麻醉方式、可能風險、副作用(如術後嗜睡、噁心、過敏等)，填寫麻醉同意書。核醫科護理師執行兒童腎臟造影檢查前、中、後衛教及照護內容，分述如下：檢查前：1.禁食時間、報到日期及時間。2.檢查日不要穿帶有金屬物的衣服或配件。3.檢查日攜帶尿布、濕紙巾、安撫用物。4.輻射藥物注意事項。5.照會麻醉科安排麻醉事宜。檢查中：1.安排獨立病房，協助麻醉科同仁進行麻醉流程。2.佈置檢查環境，如降低音量、燈光調暗。3.病人躺上檢查台後協助擺位，使用布膠固定病人身體，預防跌倒。4.觀察IV管線是否順暢。5.檢查過程中裝上心電圖及血氧機監測並紀錄生命徵象。6.護理師觀察病人是否出現噁心、嘔吐等症狀。檢查後：1.檢查結束後輕聲叫醒病人，讓家屬在旁安撫病人情緒。2.確認病人意識清醒及所有生命徵象都正常後填寫核子醫學科病人鎮靜紀錄表。3.如果病人沒有清醒需與麻醉科交班，麻醉科人員會帶病人至恢復室繼續觀察後續情況。4.返家後多喝水，加速體內輻射線藥物排出。

結論:

核醫兒童腎臟造影檢查常用於評估兒童泌尿系統的功能與結構，檢查過程經由麻醉科團隊及核醫科護理師完整的前置作業與護理照護，使其能順利完成檢查，可提升整體檢查的安全與成功率。

放射免疫分析實驗室改善檢體處理流程之成效分析

¹黃筱嵐、¹張素雲、¹沈宜瑾、¹廖建國、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

放射免疫分析實驗室中，檢體處理的時間過長，會影響後續的實驗操作、報告發出時間、工作流程的效率及外送檢體送出時間。本實驗室於2024年1月進行檢體處理流程之改善，本研究目的即為分析實驗室改善檢體處理流程之成效，以了解改善成果是否持續有效。

材料方法:

收集2023年1月至2025年6月所記錄之檢體處理時間，進行分析與比較。檢體處理時間是從開始收檢時間計算(14:00)，結束時間為醫療數據系統提取最後一支檢體簽收時間，兩者相減得出處理檢體所花費時間(分鐘)。2023年原有流程是將檢驗項目量多者，檢體編號排在前面，外送項目排在最後，檢體的離心、分裝處理亦是如此，2024年為改善檢體處理流程，實施新的檢驗單張項目排序流程，優先處理外送檢體，包含檢驗單張排序、檢體簽收、檢體離心及分裝。

結果:

總計收集126299件檢體處理個案，各年度件數分別為2023年49697件、2024年52403件、2025年上半年24199件。分析結果發現，2023年之平均檢體處理時間為50分鐘，其中以1月份最高(69分鐘)，11月最低(41分鐘)，而2024年及2025年上半年之每月檢體處理時間介於30-43分鐘之間，平均檢體處理時間則分別為35分鐘及32分鐘皆明顯低於2023年。顯示2024年實施改善措施後，平均檢體處理時間已大幅降低，直至2025年仍能維持在32分鐘，顯示實施的改善措施持續有效。

結論:

分析結果顯示，所實施的改善措施持續有效，可顯著減少實驗室中的檢體處理時間。這一改善有助於加快運作時間，使流程更順暢，且因提前結束外送檢體處理的時間，線上也可以更有餘裕的時間仔細審核報告，提升實驗室的運行效率與檢驗品質。

放射導引副甲狀腺切除手術中主刀醫師之輻射暴露：單一術者五例初步觀察

¹林亭君, ¹江孟昕, ¹李佩瑛, ¹黃柏濤, ²程宗彥^{1,3}黃玉儀

¹和信治癌中心醫院核子醫學科

²和信治癌中心醫院一般外科主治醫師

³國立陽明交通大學醫學院醫學系

背景介紹:

放射導引副甲狀腺切除術(Radio-guided parathyroidectomy)以 ^{99m}Tc-sestamibi (MIBI) 協助術中定位，可縮短探索時間並提高成功率；然而，手術團隊的職業輻射暴露量仍需以實測資料佐證。本研究以單一術者連續個案之個人劑量監測，提供國內初步數據作為輻射防護與流程優化之參考。此次目的主要是量測與描述主刀醫師在放射導引副甲狀腺切除手術期間的有效劑量 (μSv) 與平均劑量率 ($\mu\text{Sv/hr}$)，並探索注射活度不同對暴露之影響。

材料方法:

2025年五月至七月間之5台放射導引副甲狀腺切除術，於手術前注射 ^{99m}Tc-sestamibi 10 mCi ($n=3$) 或 5 mCi ($n=2$)。主刀醫師於胸前佩帶電子個人劑量計，分別記錄配戴前與手術結束後讀值；以「術後－術前－背景」計算實際劑量。手術時間以進出刀時間計算；平均劑量率 = 實際劑量/手術時間。

結果:

共 5 台手術，平均手術時間 3.7 小時 (中位數 3.0，範圍 2.0–8.0)。單例實際劑量介於 25–140 μSv (中位數 90 μSv ；平均 80.4 μSv)。平均劑量率介於 10.0–45.0 $\mu\text{Sv/hr}$ (中位數 17.7 $\mu\text{Sv/hr}$ ；平均 24.3 $\mu\text{Sv/hr}$)。以注射活度分層：10 mCi：平均劑量率 31.3 $\mu\text{Sv/hr}$ ；5 mCi：平均劑量率 13.8 $\mu\text{Sv/hr}$ (較10 mCi 低約 56%)。以保守線性外推，若單一術者每年執行 12台且維持相似流程，年有效劑量約0.96mSv (0.080 mSv/台 $\times$ 12台)，遠低於通行之醫療工作者年限值 (1mSv/年)。

結論:

在本院流程下，放射導引副甲狀腺切除術對主刀醫師之單例有效劑量平均 0.08 mSv、平均劑量率24 $\mu\text{Sv/hr}$ ，屬低度暴露。適度下調注射活度 (例如 5 mCi) 可顯著降低暴露而不影響完成手術之可行性。建議各中心以標準化流程及連續個人劑量監測落實ALARA原則，並建立本土參考資料以支援臨床與教育。

CEA品管液泡製後不同時間檢驗結果之初步比較

¹沈宜瑾、¹張素雲、¹黃筱嵐、¹廖建國、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

CEA (癌胚抗原) 是在癌細胞中過度表現的醣蛋白，如大腸癌、胃癌、胰臟癌和肺癌。CEA數值升高通常與腫瘤的生長和轉移有關，而CEA值下降則可能表示治療效果良好。CEA品管液為例行內部品管作業所需，品管失敗常與泡製之品管液變質有關。本研究目的為比較CEA品管液泡製後不同時間的檢驗結果，以探討品管液泡製後可使用時間。

材料方法:

CEA使用的實驗試劑套組廠牌為Beckman Coulter，實驗方法為IRMA(immunoradiometric assay)，品管液廠牌為BIO-RAD，品管套組有低、中、高三種不同濃度，泡製前為粉末狀，泡製時每罐加入2.0 ml的去離子水，加入去離子水後靜置15分鐘，靜置後均勻搖晃15分鐘，之後再靜置15分鐘即可分裝品管液。收集2025年7月至8月CEA品管液泡製後不同時間的檢驗結果，計算泡製後各天數檢測結果與第1天結果之差異(%)，並依此項目內部品管之 ± 2 倍CV值判定差異是否可接受。

結果:

收集品管液泡製後之數據總計42筆，其中濃度1、濃度2、濃度3各14筆。比較結果發現，品管液泡製後21天之內之檢測結果與第1天剛泡製之差異(%)，皆可被接受，但泡製後21天之後之檢測結果則有數筆不可接受，也就是出現明顯的差異(圖1)。由於原廠建議的保存期限是泡製後在 2-8°C 下可保持 14 天的穩定性，因此我們再依不同周數進行比較，結果發現濃度1在泡製後1周內到泡製後4~5周皆無明顯差異，濃度2為在泡製後3~4周有1件差異、泡製後4~5周有2件差異，濃度3在泡製後4~5周有1件差異(表1)，由此可看出原廠設定的14天有效期限是較好的實驗方法，使用品管液時如已經泡製超過2周建議不要再使用，如果因特殊原因不得不使用時，也應在3周內使用較佳。不過，由於各濃度之樣本數只有14支，此結果仍需要收集更多的樣本進一步研究才能確定。

結論:

初步比較結果顯示，品管液泡製後21天之內之檢測結果與第1天剛泡製之差異(%)，皆可被接受，但泡製後21天之後之檢測結果則有可能不可接受。不過，此結果仍需進一步研究證實，實驗室品管作業仍應依原廠建議使用泡製後14天之內的品管液，以避免使用可能變質的品管液而影響檢驗品質。

Does dual-time point post-therapy Lutetium-PSMA scan provide diagnostic value in patients with metastatic castration-resistant prostate cancer?

Pei Ing Lee, Yu-Yi Huang, Bor-Tau Hung

Department of Nuclear Medicine, Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan

Introduction:

Lu-177-PSMA therapy has demonstrated significant efficacy in patients with metastatic castration-resistant prostate cancer (mCRPC) exhibiting progressive disease. Current clinical practice recommends at least one post-therapy whole body scan, typically 1-2 days after treatment, to evaluate tumor uptake and guide treatment response. The potential benefits of delayed post-therapy scans remain unclear. This study aims to assess whether dual-time point post-therapy Lu-177-PSMA scans provides additional diagnostic information in mCRPC patients undergoing Lu-177-PSMA treatment.

Materials and Methods:

This retrospective study included 26 mCRPC patients treated with Lu-177-PSMA-617 at our institution between November 2022 and May 2025. Post-therapy whole body scans were conducted at two-time points: 24-hour and days 7-9 (delayed) after dose administration. Lesion detection capabilities and image quality were compared between 24-hour and delayed scans using visual analysis.

Results:

Of the 26 patients, 25 with 61 post-therapy scans were analyzed. One patient was excluded due to incomplete imaging data. The median age was 75.7 years (range 57-90 years), and Lu-177-PSMA-617 doses ranged from 80-200mCi. Visual analysis showed higher background and bowel activity on 24-hour images. Disease sites (17 prostate, 54 bone, 6 liver, 24 lymph node, 5 lung, and 7 others) were consistent between 24-hour and delayed-scans in 24 patients. Five of these 24 patients exhibited additional bone metastases on delayed scan. But these findings did not impact M-status or treatment response evaluation. One of 25 patients had inconsistent 24-hour and delayed scan finding. Delayed scan revealed a bone metastasis missed on 24-hour scan, resulting in a change in M-status and clinical management in this patient.

Conclusion:

Delayed post-therapy Lu-177-PSMA whole body scans demonstrated improved lesion detection due to reduced background activity, potentially influencing treatment evaluation and management in select cases. These findings suggest that delayed scans may offer incremental diagnostic value, particularly in cases with ambiguous results on early imaging. Further studies are warranted to evaluate the routine clinical utility of delayed scans.

A Comparative Analysis of Siemens Semi-Automated Software and Manually Developed Programs for MUGA Ejection Fraction Assessment

Chih-Hao Chen¹, Austin Wang², Yuh-Feng Wang^{1,3}

¹ Department of Nuclear Medicine, Taipei Veterans General Hospital

² Taipei American School

³ Department of Biomedical Imaging and Radiological Sciences, National Yang Ming Chiao Tung University

Introduction:

Over the past decades, MUGA (multi-gated acquisition) ejection fraction (EF) analysis at Taipei Veterans General Hospital has been performed using a self-developed software program. However, with advances in clinical practice, the adoption of vendor-provided, standardized tools for semi-quantitative MUGA-EF reporting is becoming an important future trend. This study aimed to evaluate the feasibility of replacing the in-house software with the built-in EF tool provided by the Siemens system.

Materials and Methods:

Dynamic gating data from 100 MUGA studies acquired on a Siemens Symbia scanner (January to April 2025) were analyzed. Manually delineated EF values (EF-O) were compared with semi-automated values derived using the Siemens eSoft EF tool, including standard semi-automatic (EF-SA) and curve-fitted semi-automatic (EF-SAC), to evaluate the feasibility of software replacement.

Results:

We assessed the intra-class correlation coefficient (ICC[3,1]) and regression models. The ICC between EF-O and EF-SA was 0.89, and between EF-O and EF-SAC was 0.93. Using EF-O as the reference, regression analysis showed R^2 values of 0.752 (linear) and 0.814 (polynomial) for EF-SA, and 0.743 (linear) and 0.816 (polynomial) for EF-SAC.

Conclusion:

The results demonstrate that both EF-SA and EF-SAC show high consistency and good agreement with EF-O, with EF-SAC achieving the highest concordance and fit. Expanding the regression model with additional samples may further improve accuracy and yield more robust transformation equations, supporting the potential of this method to replace the existing MUGA-EF approach.

碘-131住院治療以電子衛教取代口頭衛教之初步成效 Preliminary Evaluation of the Effectiveness of Electronic Health Education for Hospitalized Patients Undergoing Iodine-131 Therapy

¹王苡安、¹廖建國、¹林昱璵、¹許幼青、^{1,2}莊紫翎
¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

碘-131病人治療前需具備明確的自我照護知識，為確保病患充分了解相關注意事項，住院前衛教相當重要。以往由護理師進行口頭衛教，不僅耗時，也因衛教資訊量多、病人教育程度等因素，導致衛教當下理解不佳及事後來電詢問等問題，本研究目的即為分析以電子衛教取代口頭衛教之初步成效。

材料方法:

衛教時間、病人理解錯誤率、當日衛教後詢問率以及返家來電諮詢率等資料，進行比較與分析。電子衛教內容以將之前入住碘-131病房前注意事項及低碘飲食須知之衛教單張為基礎，進行內容彙整與整合後，使用AI-Felo智慧簡報製作軟體進行簡報設計。簡報內容除原有項目外，另新增臨床照護經驗分享、病人常見疑問解答以及病友推薦之低碘食材等資訊，簡報完成後，由護理師錄製語音說明，並搭配剪輯軟體進行影像後製，製作成一部長度約6分半鐘之衛教影片。目前放置於診間電腦桌面，衛教當日由護理人員播放給病患及家屬觀看，影片另以QR code形式產出連結，提供病患及家屬返家後可掃描收看。

結果:

在2024年10月至2025年5月進行的口頭衛教組中，合計收集19位病人的衛教資料，分析結果平均衛教時間為1.5小時，病人與家屬反映衛教內容多、無法馬上記起來，理解錯誤率高達30%。衛教當下有40%的病人或家屬會主動提出問題，但多為衛教內容，顯示理解吸收不佳；返家後亦有25%的個案來電詢問，主要對衛教內容記憶模糊或理解不清，反映出傳統口頭衛教在訊息傳遞明顯落差。另自2025年6月起實施的電子衛教，合計收集11位病人的衛教資料，平均衛教時間則縮短為1小時，病人在衛教後的理解錯誤率明顯下降至18%，衛教過程中僅有9%的病人提出問題，且內容與影片重點緊密相關，返家後來電詢問比例同樣僅為9%，顯示衛教理解度大幅提升。更值得注意的是，多數病人與家屬反映影片內容清晰，圖片字體適中、語音適中，且回家後可透過QR Code重複觀看，幫助記憶與理解，進一步提升了衛教品質與整體照護滿意度。

結論:

研究結果顯示，以電子衛教取代口頭衛教是實用可行的，不僅提升了病患對碘-131住院治療前的理解與接受度，亦有效減少護理人員衛教所需時間與重複性溝通的困擾，我們將持續以此方式進行，以提升整體醫療服務品質與病人照護滿意度。

FDG PET/CT in Prediction of Recurrence in Patients with Locally Advanced Oral Cancer.

¹Dung-Ling Yu, ²Jun-Hong Juo, ³Cheng-Hui Chiu.

¹Department of Nuclear Medicine, ²Department of Medical Oncology, ³Department of Radiology. Mennonite Christian Hospital, Hualien, Taiwan

Introduction:

The purpose of this study is to evaluate the role of FDG PET/CT performed after chemotherapy in predicting recurrence among patients with locally advanced oral cancer.

Materials and Methods:

A total of 156 patients with locally advanced oral cancer were enrolled in the study. All patients underwent FDG PET/CT both before and after 3 cycles of concurrent chemoradiotherapy (CCRT). The follow-up period ranged from 27 to 83 months, with a median of 51.3 months. Complete response (CR) was defined as the absence of FDG uptake in the primary tumor and neck region, whereas partial response (PR) was defined as residual FDG uptake in either the primary tumor or the neck region. Recurrence was defined as the appearance of new lesions detected by clinical assessment or imaging during follow-up.

Results:

Among the 156 patients who underwent CCRT, 111 achieved complete response (CR) and 45 achieved partial response (PR). During follow-up, 21 patients in the CR group and 20 patients in the PR group developed recurrence. There was a significant relationship between response status and recurrence, with patients in the PR group being more likely to developed recurrence than those in the CR group, $\chi^2 (1, N = 156) = 10.7, p < .05$.

Conclusions:

In patients with locally advanced oral cancer, response status assessed by FDG PET/CT after CCRT may be a predictor of recurrence during follow-up.

利用 T c-99m標記紅血球經皮下注射靜脈攝影搭配SPECT/CT意外發現腹主動脈瘤

¹許文齡、¹張淑敏、¹王榛婷、¹紀雅閔、¹張晉銓、¹許玉春

¹高雄醫學大學附設中和紀念醫院 核子醫學部

背景介紹:

利用 T c-99m標記紅血球(^{99m}Tc-RBCs)經皮下注射靜脈攝影是核子醫學常見用以診斷是否有深層靜脈栓塞的檢查，搭配單光子電腦斷層(SPECT/CT)能提供臨床更多訊息以鑑別診斷。腹主動脈瘤是指腹主動脈異常擴張，平時無症狀，當動脈瘤大到一定程度或者動脈瘤破裂時才會產生症狀。臨床三典型症狀為腹痛或背痛、低血壓或休克以及腹部搏動性腫塊，如果沒有及時發現，當動脈瘤破裂時就會因大出血休克快速死亡。吸菸、男性和陽性家族史是最重要的危險因素。

病例報告:

一位80歲男性因腿部水腫及D-dimer升高至核醫科進行了下肢靜脈檢查。行 T c-99m標記紅血球(^{99m}Tc-RBCs)皮下放射性核種靜脈造影顯示：雙側小腿靜脈瓣膜閉鎖不全，右上小腿靜脈栓塞，左小腿疑似血栓性靜脈炎。而在單光子電腦斷層影像中發現兩個大型囊狀腹部動脈瘤：一個位於分叉處上方，另一個位於左髂動脈內（梭形）。

結論:

T c-99m標記紅血球靜脈攝影是核子醫學常見一項用於診斷偵測下肢靜脈栓塞導致下肢水腫，及評估深部靜脈栓塞可能的檢查。搭配SPECT/CT掃描，能針對異常活性累積(hot spot)或低下(cold area)的地方，提供相對應的解剖位置及組織密度，幫助提供臨床更多有利的資訊。然而額外的電腦斷層，會增加病人輻射劑量的暴露，在使用上一定要遵守利大於弊的原則謹慎評估。

鎳-177標靶核種治療藥物臨床注射流程實務整理

¹洪綾蔓、¹林亭君、¹陳思靜、¹張筱琪、¹陳韻絮、¹黃玉儀

¹和信治癌中心醫院 核子醫學科

背景介紹:

隨著¹⁷⁷Lu-DOTATATE(治療無法手術切除或轉移性、具SSTR陽性的胃腸道胰腺神經內分泌腫瘤)和¹⁷⁷Lu-PSMA-617(治療PSMA陽性之轉移性去勢抗性攝護腺癌)相繼於臺灣取得藥物許可，各醫院陸續準備引進鎳-177標靶核種治療藥物，提供病人更多治療選擇。由於此類治療涉及放射特性，整體流程亦需兼顧病人安全、無菌調劑及專責人員操作，因此建立一套標準化的臨床注射流程，對於確保治療品質與安全性具有關鍵性。

材料方法:

本院依據藥品仿單建議及累積之臨床實務經驗，針對鎳-177標靶核種治療藥物的臨床注射流程進行整理，涵蓋所需器材與給藥步驟，內容包括：1.注射方式選擇：直接靜脈輸注、重力法搭配點滴幫浦輸注、或自動針筒注射幫浦輸注。2.前置作業：點滴裝置、給藥管路及相關醫療器材之準備。3.注射過程防護措施：鉛屏蔽操作與即時放射劑量監測。4.注射後處理：靜脈管路沖洗，以及放射性廢液與醫療廢棄物管理。

結果：

依據不同注射方式選擇，將列出各方式所需之點滴裝置、給藥管路、相關醫療器材和輻射防護設備提供參考。目前僅¹⁷⁷Lu-PSMA-617可適用直接靜脈輸注，以無菌調劑抽出所需劑量後，經由病人靜脈導管緩慢推注藥品1至10分鐘；重力法搭配點滴幫浦輸注在初期準備上門檻較低較為簡便，不過注射時須注意不少細節，如點滴和給藥導管長短針配置細節、管路滲漏可能、藥瓶內真空壓力平衡等等，此方式的操作高度仰賴經驗累積和突發狀況處理能力；自動針筒注射幫浦輸注和直接靜脈輸注一樣，須以無菌調劑抽出所需劑量，且須準備注射時工作人員輻射防護給藥推車平台，但和直接靜脈輸注不同是，透過自動針筒注射幫浦可調整藥物輸注速率和時間，提高操作控制性，然而為了病人及工作人員安全，須特別注意給藥管路連接方式，應避免中途拆卸管路裝置，而破壞無菌給藥條件和造成藥物流出或滲漏導致輻射汙染風險。不論採用何種注射方式，均須持續監測相關人員之輻射暴露風險，以確保操作安全。

結論:

鎳-177標靶核種治療藥物的注射過程需要醫師、放射師、藥師、護理師跨團隊合作及臨床實務經驗累積。期望此實務整理可作為臨床操作參考，協助建立標準化、可複製的治療模式，以確保病人療效與安全，提供未來欲執行鎳-177標靶核種治療之單位注射方式選擇及流程建立之參考。

Comparable Efficacy of Water and Effervescent Tablet Approaches for Gastric Distention in FDG PET Imaging

Wan-Jo Chang, Kuan-Yin Ko

Department of Nuclear medicine, National Taiwan University Cancer center, Taipei, Taiwan.

Introduction:

Gastric distension techniques are commonly employed in FDG PET imaging to enhance visualization of gastric and perigastric lesions. Two routinely used methods in clinical practice are oral water ingestion and effervescent tablets, both of which are safe and feasible. Despite their frequent use, comparative evidence under real-world conditions remains scarce. This study aims to evaluate and compare the efficacy of these two methods.

Materials and Methods:

This single-center retrospective study included patients scheduled for FDG PET imaging with gastric distension protocols determined by the nuclear physician. Patients with known gastric lesions or prior gastrointestinal surgery were excluded. Gastric distension efficacy was assessed by measuring duodenal bulb diameter on low-dose CT, while physiologic gastric activity was evaluated by SUVmax in the fundus, body, and pylorus to determine the impact of collapsed mucosa on tracer uptake.

Results:

We retrospectively enrolled 23 patients who underwent gastric distention prior to FDG PET imaging, including 12 patients in the water group and 11 patients in the effervescent tablet group. There were no statistically significant differences in baseline demographics between the two groups (mean age: 67.5 ± 10.6 years vs. 65.1 ± 14.4 years, $P = 0.78$; proportion of males: 41.6% vs. 63.6%, $P = 0.41$). Following gastric distention, both groups demonstrated a significant increase in duodenal bulb dimension on low-dose CT (all $P < 0.05$). In addition, SUVmax of the gastric fundus, body, and pylorus significantly decreased after gastric distention in both groups (all $P < 0.05$). When comparing the magnitude of changes between groups, no statistically significant differences were observed in duodenal bulb dimension (water: $50.3\% \pm 0.28$ vs. tablet: $59.1\% \pm 0.29$, $P = 0.47$), reduction in SUVmax of the gastric fundus (-35.3% vs. -49.4% , $P = 0.23$), gastric body ($-43.3\% \pm 0.21$ vs. $-34.2\% \pm 0.23$, $P = 0.33$), or gastric pylorus ($-42.5\% \pm 0.10$ vs. $-28.0\% \pm 0.23$, $P = 0.09$).

Conclusions:

Both water and effervescent tablet methods achieved comparable gastric distention with significant reduction of physiological gastric activity. As no significant differences were observed between groups, either approach may be adopted based on patient preference or workflow considerations. Larger-scale studies are warranted for validation.

使用不同針具更換方式的實際操作經驗分享

曾旭吟、謝沁玟、周珉湊、盧淑婷、李世昌、邱南津

國立成功大學醫學院附設醫院 醫學影像部核子醫學科

背景介紹:

在醫護人員執行放射性藥物注射的過程中，除了要注意輻射的時間、距離、屏蔽保護之外，還需要注意是否會有針扎的問題產生。傳統針具在使用過程中可需要拔蓋把針頭插入點滴輸液套才能將放射性藥物注入受檢者體內，但這會導致意外針扎與交叉感染，為了提升安全性與效率，臨床上逐漸採用旋式接頭針具，並發展出不同的操作版本。然而，不同版本在操作流程、成本、藥物殘留及人員花費時間上皆有差異，因此有必要進行系統性比較。

材料方法:

受檢者在報到後護理師執行生理監測，並放置留置針。受檢者於注射室內平躺休息，由醫護人員執行注射放射性藥物。注射流程:先注射放射性藥物後再注入20cc食鹽水。病人的身上會有T型延長管（病人打針處）和點滴輸液套（食鹽水接入病人的T型延長管）。使用不同的T型延長管和點滴輸液套會有以下3種版本，材料分別有a.T型延長管（免針式安全型）、b.T型延長管、c.輸液套、d.點滴輸液套（免針式安全型）。
版本一：使用a.T型延長管（免針式安全型）和c.輸液套。放射性藥物從a.T型延長管的接頭以壓旋的方式打入。
版本二：使用b.T型延長管和c.輸液套。放射性藥物針筒從b.T型延長管旋式的方式打入。
版本三：使用b.T型延長管和d.點滴輸液套（免針式安全型）放射性藥物從d.點滴輸液套（免針式安全型）的分支以壓旋式的方式打入。

結果:

使用版本一壓旋式的方式連接注入放射性藥物，可以避免針扎，但因注入的接頭靠近手部，藥物有可能會積聚在接頭，導致影像或圈選SUV數值會有影響。版本二用旋式的接放射性藥物，可以避免針扎，但在旋入放射性藥物或是20cc食鹽水時，都必須先把擋片關起來才能旋入或更換注射物，會造成人員在執行打藥過程時間延長以致人員劑量增加，而且放射性藥物打完後換旋入20cc食鹽水時，過程可能會因為來回旋開延長管的接口和擋片，導致藥物回流滴到病人衣服或床單以致有汙染的可能。版本三壓旋式的連接注入放射性藥物，可以避免針扎，並減少與病人接觸的時間。

結論:

這三種版本皆是不用拔針頭蓋，以壓旋式或旋開的方式連接打入放射性藥物和20cc食鹽水，對於醫護人員都有避免到針扎的可能。綜合三種版本的結果，以版本三的方式對於本科醫護人員在操作上比較安全且方便。

Radiation-induced liver disease mimicking metastasis on FDG PET/CT after chemoradiation treatment for esophageal cancer

Pei Ing Lee, Yu-Yi Huang, Bor-Tau Hung

Department of Nuclear Medicine, Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan

Introduction:

FDG PET/CT is a valuable imaging modality for assessing treatment response in esophageal cancer patients following radiation therapy. However, post-irradiation inflammation may result in false-positive PET findings, complicating interpretation. This case highlights radiation-induced liver disease (RILD) mimicking metastatic disease on PET/CT after concurrent chemoradiation (CCRT) for esophageal cancer.

Case Report:

A 67-year old man presented with dysphagia and chest pain. Endoscopy revealed a circumferential tumor in the lower esophagus, and biopsy confirmed squamous cell carcinoma. Staging FDG PET/CT demonstrated increased FDG uptake in the lower esophagus and subcarinal lymph nodes. The patient underwent pre-operative CCRT targeting esophagus, mediastinum, supraclavicular and peri-gastric regions. Re-staging PET/CT performed 5 weeks post-treatment showed resolution of primary tumor and metastatic lymph nodes. But a new FDG-avid lesion was detected in the left hepatic lobe, suggestive of metastasis. Contrast-enhanced CT scans and liver function tests were unremarkable. Retrospective analysis of the patient's pre-treatment radiation plan revealed that the hepatic lesion corresponded to areas of liver irradiated with doses up to 45 Gray. A follow-up FDG PET/CT performed 6 weeks later demonstrated complete resolution of the left hepatic lesion, confirming RILD rather than metastasis.

RILD typically develops 2-8 weeks post-radiation therapy and is associated with liver doses of 30-35 Gray. In distal esophageal cancer, the left and caudate lobes of liver are especially vulnerable due to their proximity to the radiation field. FDG uptake in RILD may be attributed to sinusoidal endothelial damage, leading to FDG trapping in dilated sinusoids.

Conclusions:

RILD can present as FDG-avid lesions on PET/CT, potentially mimicking malignancy. Our case underscore the importance of correlating PET findings with radiation dose distribution to avoid misdiagnosing RILD as malignancy, particularly in patients undergoing radiation therapy for distal esophageal cancer.

Rare Occurrence of Chondroid Neoplasm in ^{99m}Tc MDP Bone Scan and SPECT: a Case Report

Yu-Chien Shiau, Ya-Huang Chen, Chia-Wen Lai, Che-Wei Chang, Po-Wei Li, Chao-Chun Huang, Yen-Wen Wu, Shan-Ying Wang.

Division of Nuclear Medicine, Far Eastern Memorial Hospital, New Taipei, Taiwan

Introduction:

Chondroid neoplasms are a diverse group of benign and malignant tumors characterized by the production of a cartilaginous matrix, including bone and soft tissue tumors like enchondromas, osteochondromas, and chondrosarcomas. Diagnosis relies on X-ray, MRI, and pathological examination, and often aided by recent advancements in molecular genetics and radiomics. We present a case of chondroid neoplasm elucidated by ^{99m}Tc MDP bone scan and SPECT.

Case Report:

The 58 year-old man had history of thyroidectomy 9 years ago and BPH under control. He came to our clinic for left inguinal mass for 30~40 years and increasing size gradually. The huge mass size about 5cm x8cm is not movable, hard, no local pain, no local heat, and no skin lesion. He denied fever, no BW loss. X-ray showed huge calcified mass with amorphous and multilobulated appearance in the left inguinal and around the left hip joint. No evidence of bone destruction. Suspects tumoral calcinosis. DDX: Calcinosis of chronic renal failure, Synovial chondromatosis, osteosarcoma (less likely). MRI showed Suspects tumoral carcinosis, idiopathic or hyperparathyroidism. DDX: Extra-skeletal chondrosarcoma (very rare). Then bone scan and SPECT were arranged and showed no obvious osteoblastic bone metastasis detected and suspect tumor calcification, tumor ossification, or bone tumor in left inguinal region. Operation was arranged with wide excision-bone tumor of left inguinal area. And pathology showed chondroid neoplasm with differential diagnoses including 1. Soft tissue chondroma (if the tumor arises from soft tissue), 2. Periosteal chondroma, and 3. (Periosteal) low-grade chondrosarcoma.

Conclusions:

Diagnosis of the chondroid neoplasms relies on X-ray, MRI, and pathological examination, which is relatively challenging. One author utilized molecular genetics and radiomics for the differential diagnosis between enchondroma and chondrosarcoma. We suggest the utilization of molecular genetics and radiomics and AI for more accurate diagnosis in the future.

[¹⁷⁷Lu]Lu-177-PSMA 治療後全身平面影像於不同能峰設定下之比較分析

楊橙凌¹ 楊詩涵¹ 李佩瑛¹ 黃玉儀¹
¹和信治癌中心醫院

背景介紹:

[¹⁷⁷Lu]Lu-177-PSMA為治療轉移性攝護腺癌的重要放射性藥物。治療後的核醫影像評估可提供療效與安全性之依據。然而，Lu-177 同時釋放 113 keV 與 208 keV 兩種 γ 能峰，臨床影像收集時最佳能峰設定尚未獲得一致共識。本研究旨在比較不同能峰設定對治療後全身影像之總計數、病灶對背景比值(target-to-background ratio, TBR) 與影像品質的影響。

材料方法:

本研究納入38位接受[¹⁷⁷Lu]Lu-177-PSMA治療之攝護腺癌病人，於注射後隔日，使用 Siemens Symbia T SPECT/CT 系統搭配中能量準直儀進行全身平面掃描(whole-body planar scan)。掃描參數設定為：速率13 cm/min，能峰分別取 113 keV $\pm$ 20%、208 keV $\pm$ 20%，以及兩者合併(113+208 keV)，矩陣大小 256 $\times$ 1024。共擷取480個病灶之計數值(counts)，以縱膈腔血池(mediastinal blood pool)為背景區域，每個病灶分別測量113 keV、208 keV及113+208 keV三種能峰之計數值，計算病灶對背景比值(target-to-background ratio, TBR)，並記錄三種能峰之總計數值(total count)，利用成對t檢定(paired t-tests)分析總計數值與TBR差異。同時由2位具豐富核醫影像判讀經驗之核醫科專科醫師給予影像品質排名，並以Friedman檢定評估不同能峰影像視覺品質名次的差異。

結果:

整體分析顯示，不同能峰的總計數量呈現明顯差異，合併能峰(208+113 keV)平均計數值最高(約3890675 count)，顯著高於單一能峰 (113 keV約 2,317,150 count；208 keV約1,581,200 count； $p<0.001$)。TBR分析顯示，各目標組織在208keV的TBR為最高，208+113 keV次之，最後為113 keV。而不同目標間的TBR分佈均呈顯著差異，且成對t檢定證實三種能峰間的TBR差異呈高度顯著($p<0.001$)。影像品質視覺評分則以合併能峰組最佳 (平均排名1.36)，優於 208 keV (平均排名2.21) 與 113 keV (平均排名2.43)，差異具統計意義 ($p=0.011$)。

結論:

本研究證實，在[¹⁷⁷Lu]Lu-177-PSMA治療後進行全身核醫影像評估時，能峰設定對總計數值與影像品質均具有顯著影響。其中合併能峰 (113 keV + 208 keV) 可獲得最高總計數值，並呈現最佳影像品質，提升病灶檢出率及診斷準確性，建議臨床條件優先採用合併能峰設定。又因為研究結果顯示雖然 113 keV 具較高總計數，但TBR 與視覺判讀表現相對不足；而208 keV總計數最低，但在對比度及 TBR 上具較佳成效，因此在設備僅能收集單一能峰的情況下，建議優先採用 208 keV，以確保影像品質與臨床診斷價值。

Radiomic Profiling of Metastatic Prostate Cancer: Identifying Key Lesion Characteristics Using Ga-68-PSMA-11 PET Imaging

Yu-Yi Huang^{1,2,3}, Chih-Hao Chen⁴, Austin Wang⁵, Jyh-Cheng Chen²

¹Department of Nuclear Medicine, Koo Foundation Sun Yat-Sen Cancer Center

²Department of Biomedical Imaging and Radiological Sciences, National Yang Ming Chiao Tung University

³School of Medicine, National Yung Ming Chiao Tung University

⁴Department of Nuclear Medicine, Taipei Veterans General Hospital

⁵Taipei American School

Introduction:

Prostate cancer incidence is rising worldwide, and with metastasis becoming an increasing prevalent issue, a detection system for metastasis is now of a paramount concern. PSMA PET offers high sensitivity and specificity, while radiomics enhances Ga-68-PSMA-11 PET by extracting quantitative features. This study assessed radiomic heterogeneity in recurrent and metastatic prostate cancer lesions to identify diagnostic markers.

Materials and Methods:

We analyzed 117 metastatic cases, categorizing lesions into prostate bed (n=75), lymph nodes (n=384), bone (n=1861), and other soft tissues (n=68). Fifty lesions per category were randomly selected for feature extraction using Pyradiomics v3.1.0. After removing irrelevant variables, 112 features remained. One-way ANOVA reduced these to 18, followed by ReliefF algorithm to retain features with power >0.01. The dataset was split 80/20 for training/testing, with 5-fold cross-validation in MATLAB for model validation.

Results:

Using the ReliefF algorithm, four features, i.e., maximum, minimum, 10th percentile, and mean, with a power greater than 0.01 were identified. The Medium Gaussian SVM achieved a test overall accuracy of 65% in differentiating between recurrent and metastatic prostate cancer lesion sites, and the precision, recall, F1-score and AUC ranged from 0.43~0.88, 0.30~0.90, 0.35~0.86, and 0.79~0.83, respectively.

Conclusions:

This study identifies distinct radiomic features across different metastatic prostate cancer sites, underscoring their potential for improved lesion characterization. Although the 65% accuracy indicates the need for further refinement, these findings lay the groundwork for future research on radiomics-based tools, which could enhance the sensitivity and specificity of metastatic prostate cancer diagnosis and treatment monitoring.

Evaluation of Easy Z-Score Imaging System Processing Parameters for Differentiating Parkinson's Disease and Dementia with Lewy Bodies

Yuh-Feng Wang, MD, PhD, Tse-Hao Lee, MD, Nan-Jing Peng, MD

Department of Nuclear Medicine, Taipei Veterans General Hospital, Taipei, Taiwan,

Introduction:

Parkinson's disease (PD) and dementia with Lewy bodies (DLB) are neurodegenerative disorders with overlapping motor and cognitive symptoms, complicating clinical differentiation. This study aims to assess the utility of Easy Z-score Imaging System (e-ZIS) parameters, including the Cingulate Island Sign (CIS) ratio, in distinguishing between PD and DLB.

Materials and Methods:

A retrospective analysis was conducted on patients who underwent Tc-99m ethyl cysteinate dimer (ECD) cerebral perfusion single photon emission computed tomography (SPECT) and Tc-99m [2-[[2-[[[3-(4-chlorophenyl)-8-methyl-8-azabicyclo[3.2.1]oct-2-yl]methyl](2-mercaptoethyl)amino]ethy]-amino]ethane-thiolato(3-)-N2,N2',S2,S2']oxo-[1R-(exo-exo)] (TRODAT-1) dopamine transporter (DAT) SPECT between January 2022 and December 2023. Patients with confirmed dopaminergic degeneration were classified into PD (n=18) or DLB (n=5) groups. Mann-Whitney U tests compared e-ZIS parameters, and Pearson's correlation analysis assessed relationships between severity, extent, and the CIS ratio.

Results:

DLB patients showed higher mean values for severity, extent, and the ratio of regional cerebral blood flow (rCBF) reduction, suggesting more severe perfusion deficits, though these differences were not statistically significant. Unexpectedly, PD patients demonstrated a slightly higher mean CIS ratio than DLB patients (0.31 vs. 0.24), contrary to the conventional interpretation that lower CIS ratios are associated with DLB. Correlation analysis revealed a strong relationship between severity and extent.

Conclusions:

Although no significant differences were observed, DLB patients tended to have more severe perfusion deficits. The finding that PD patients exhibited higher CIS ratios than DLB patients challenges the conventional understanding of the CIS ratio as a DLB-specific marker. These results suggest that the CIS ratio should not be used in isolation to distinguish PD from DLB, and highlight the need for larger, multimodal studies to refine diagnostic strategies.

Demonstration of Eyelid Metastasis from Adenocarcinoma of Lung on F-18 FDG PET/CT Scan : A Rare Case Report

^{1,2}Shiou-Chi Cherng, ¹Yu-Hsiang Chou, ¹Tsung-Han Yang

¹Department of Nuclear Medicine, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan.

²School of Medicine, Buddhist Tzu Chi University, Hualien, Taiwan.

Introduction:

Eyelid metastasis, occupying less than 1% of all malignant eyelid lesions, is very rare. In previously reported cases, the primary tumors of eyelid metastasis included breast, skin, gastrointestinal tract, genitourinary tract, and uvea. Originating from lung cancer, however, is rare. We demonstrate a patient of eyelid metastasis from lung adenocarcinoma on fluorine-18-fluoro-deoxyglucose (F-18-FDG) positron emission tomography with computed tomography (PET/CT) scan.

Case Report:

A 68-year-old female patient was admitted to our ophthalmology ward because there was a nodular lesion in her left lower eyelid and orbit computed tomography (CT) showed an infiltrated tumor in the left orbital fossa, suspicion of lymphoma. The F-18-FDG PET/CT scan was performed, which showed several nodular or focal lesions of increased FDG uptake in the left lower eyelid, right middle lung, and right mediastinal space, highly suspected the primary right lung cancer with left eyelid metastasis. Excision of the eyelid tumor, pathology showed a metastatic adenocarcinoma (mucinous subtype) with lung primary. Histopathologic examination revealed immunoreactivity to CK7 and TTF1, but was negative for CK20. She was treated under the diagnosis of right middle lung cancer with regional lymph nodes and left eyelid metastases, cT1cN0-2M1b, stage IVB.

Conclusions:

Our patient had no history of systemic cancer. A nodule in the left lower eyelid was the first sign of lung cancer, and lymphoma was suspicious. F-18-FDG PET/CT has excellent sensitivity and specificity in demonstrating lung adenocarcinoma due to the tumor's intensely FDG-avid nature, stressing the importance of histopathological examination.

Challenge of Subcutaneous Radionuclide Venography in Diagnosis of Upper Extremity Deep Vein Thrombosis

¹Chien-Wei Kuo, ^{1,2}Sin-Di Lee

¹Department of Nuclear Medicine, Pingtung Veterans General Hospital, Pingtung, Taiwan

²College of Artificial Intelligence, National Yang Ming Chiao Tung University, Tainan, Taiwan

Introduction:

Upper extremity deep vein thrombosis (UEDVT) is characterized by thrombus formation in the deep venous system of the arm, most commonly affecting the subclavian, axillary, or brachial veins. Dynamic radionuclide venography (RNV) has been reported to localize venous occlusions in UEDVT by injecting radiopharmaceuticals into distal superficial veins followed by dynamic imaging. Subcutaneous RNV with Tc-99m-labeled red blood cells has previously been applied in lower extremity deep vein thrombosis (LEDVT); however, to our knowledge, its use in UEDVT has not been described. Here, we report two cases of suspected UEDVT evaluated with subcutaneous RNV.

Case Report:

Case 1:

A 70-year-old male has history of distal common bile duct adenocarcinoma with obstructive jaundice. Port-A catheter was placed in the left subclavian vein for chemotherapy. After 6 months, the patient complained about left upper limb pitting edema. Subcutaneous RNV showed decreased radioactivity in the left ulnar/radial veins and suspicious increasing collaterals. Contrast venography revealed left subclavian vein occlusion. The patient received percutaneous transluminal angioplasty and symptoms was resolved.

Case 2:

A 83-year-old female has history of left breast cancer post concurrent chemoradiotherapy 20 years ago. At first, she complained about left upper limb swelling, and initial subcutaneous RNV showed negative findings. Then she was lost to follow-up for 8 months. Second subcutaneous RNV showed decreased radioactivity of deep venous system over left upper arm and forearm, with presence of multiple collaterals. However, contrast venography revealed negative results.

Conclusions:

These observations suggest that while the technique may visualize venous pathways, its diagnostic accuracy for UEDVT remains limited and requires further investigation before clinical application.

Distinctive Imaging Response Pattern in Liver Metastases from Neuroendocrine Tumors Treated with ¹⁷⁷Lu-DOTATATE PRRT: A Two-Case Report

Yin-Yin Yang, Yen-Hsiang Chang

Department of Nuclear Medicine, Kaohsiung Chang-Gung Memorial Hospital, Kaohsiung, Taiwan

Introduction:

Neuroendocrine tumors (NETs) represent a heterogeneous group of neoplasms derived from neuroendocrine cells distributed throughout the body. Although relatively uncommon, NETs pose a diagnostic and therapeutic challenge due to their diverse clinical presentations, often resulting in delayed diagnosis. The presence of liver metastases is considered the most critical prognostic factor, significantly influencing survival and treatment strategies. While surgical resection of hepatic metastases offers the best chance for long-term survival, most patients present with unresectable disease. Peptide receptor radionuclide therapy (PRRT) with ¹⁷⁷Lu-DOTATATE has emerged as an effective, well-tolerated treatment that improves progression-free survival and enhances quality of life. This report presents two cases of advanced NET with liver metastases treated at our institute, demonstrating distinctive imaging responses following PRRT.

Case Report:

Case 1: A 64-year-old woman was diagnosed with pancreatic NET and liver metastases at age 60 and initially treated with Lanreotide. Disease progression was noted three years later, and PRRT with ¹⁷⁷Lu-DOTATATE was initiated. After four treatment cycles, CT images revealed a 30.1% reduction in the sum of the longest diameters of target hepatic lesions, with a distinctive pattern of intratumoral necrosis with peripherally enhancing residual tumors.

Case 2: A 44-year-old man underwent low anterior resection for rectal NET at age 36, followed by somatostatin therapy with Sandostatin LAR. At age 43, hepatectomy, splenectomy, and distal pancreatectomy were performed for liver and pancreatic metastases, followed by Y-90 therapy. However, residual liver lesions showed no regression. PRRT with ¹⁷⁷Lu-DOTATATE was then initiated. After three treatment cycles, tumor volume decreased by 39%, again with imaging demonstrating central necrosis with peripherally enhancing residual lesions.

Conclusions:

Both patients exhibited a distinctive response pattern on imaging—size reduction with central necrosis and peripheral enhancement—after ¹⁷⁷Lu-DOTATATE PRRT. These findings underscore PRRT as an effective, targeted therapy for advanced, well-differentiated NETs with hepatic metastases, offering disease control when other options are limited.

Left Humeral Enchondroma Mimicking Bone Metastasis on Tc-99m MDP Whole-Body Bone Scan: A Case Report

Wen-Hsin Cheng, Yen-Hsiang Change

Department of Nuclear Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Introduction:

Bone scintigraphy is widely used in the staging of breast cancer to detect skeletal metastases. However, increased tracer uptake may also occur in benign bone lesions, which can lead to diagnostic uncertainty and potentially alter the treatment strategy.

Case Report:

A 63-year-old woman with newly diagnosed ductal carcinoma in situ (DCIS) of the left breast underwent preoperative bone scintigraphy, which revealed a focal area of increased uptake in the left proximal humerus. As the lesion was indeterminate for metastasis or a primary bone tumor, additional imaging was performed. She underwent partial mastectomy with sentinel lymph node sampling, followed by MRI of the left humerus postoperatively. MRI demonstrated a 2.5 × 2.2 cm lobulated chondroid lesion consistent with enchondroma, without features suggestive of malignancy. Given the benign nature of the lesion, no additional systemic adjuvant therapy was required, and the patient was discharged with routine follow-up.

Conclusions:

This case highlights the importance of correlating bone scintigraphy findings with cross-sectional imaging to distinguish between metastatic disease and benign bone lesions. Early use of multimodality imaging facilitates accurate diagnosis and prevents unnecessary alterations in the treatment course for patients with early-stage breast cancer.

門診同位素治療室建置之考量-以臺中榮總為例

¹²龔瑞英、¹謝政道、¹黃莆蓉、¹陳耀文、¹林宜瀟、²張振榮、^{12*}蔡世傳

¹臺中榮民總醫院 核子醫學科
²中臺科技大學 醫學影像暨放射科學系
*指導作者

背景介紹:

同位素治療是一種利用放射性同位素釋放的輻射來治療疾病的方法，進行大劑量治療時為了符合病人安全及輻防法規要求，多數醫院規劃有同位素治療病房供病人住院治療。近年由於鎳-68/鎳-177在神經內分泌腫瘤及攝護腺癌的治療數量日益增加，為避免排擠同位素治療病房病人，擬建置門診同位素治療室供該類病人於門診治療期間使用，本研究分享門診同位素治療室建置之考量。

材料方法:

配合院部可用空間規劃門診同位素治療室空間及廢液儲存空間，該治療室預計收治需住院隔離亦需集中收集廢棄物管理之鎳-177治療病人，透過單次最高使用劑量評估人員暴露及空間屏蔽。

結果:

考量初期病人數量及空間使用率，每月最多收治8名鎳-177病患。配合核醫科空間，門診同位素治療室設置於核醫科正子中心角落，並規劃治療病人專用廁所。屏蔽設計使用鉛牆或混凝土複合結構，注射藥物針劑採鎢套筒屏蔽，作業人員搭配鉛屏風使用，透過流程模擬增進流程順暢，降低人員暴露。治療室收治鎳-177病患，單次最高劑量不超過 300 mCi，為存放治療過程產生的液態廢棄物，規劃四槽 1.00 m³儲存桶與排放桶，依病患使用廁所頻次計算，一桶約可使用1.5個月，等待衰減監測後排放，固態廢棄物收集存放於廢料室等待衰變，偵測後排放。

結論:

本研究提供門診同位素治療室建置之考量經驗，供後續醫院規劃參考。

Feasibility and Advantages of [^{18}F]PSMA-1007 PET as Baseline Imaging Prior to [^{177}Lu]PSMA Radioligand Therapy

¹Ai-Ping Chang, ²Chih-Yi Wu, ^{3,5}Yu-Min Fan, ^{4,5}Chun-Hou Liao, ³Wen-Hua Lo, ³Jia-Hsin Fang, ²You-Shen Kuo

1. Education and Research department of Cardinal Tien Hospital

2. Primo Biotechnology Co., Ltd, Taipei, Taiwan.

3. Department of Nuclear medicine of Cardinal Tien Hospital

4. Department of Urology of Cardinal Tien Hospital

5. School of Medicine, College of Medicine, Fu Jen Catholic University

Introduction:

[^{177}Lu] PSMA-617 and [^{177}Lu] PSMA-I&T improved survival outcomes in metastatic castration-resistant prostate cancer (mCRPC). To optimize patient selection and predict therapeutic response, accurate baseline imaging is essential. [^{18}F] PSMA-1007 PET offers physical advantages over [^{68}Ga] PSMA-11, including higher production yield, longer half-life, and superior spatial resolution. Structurally, [^{18}F] PSMA-1007 is based on the PSMA-617 backbone, sharing the glutamic acid–urea–lysine binding motif and hydrophobic linker, making it the most chemically homologous PET tracer to the therapeutic ligand [^{177}Lu] PSMA-617. These provide strong rationale for its role as a diagnostic and therapeutic partner.

Literature review:

Multiple studies confirm the feasibility of [^{18}F] PSMA-1007 PET as baseline imaging before RLT. Prognostic analyses show SUV mean, PSMA tumor volume (PSMA-TV), and total lesion PSMA (TL-PSMA) correlate with PSA response and survival in [^{177}Lu] PSMA-I&T-treated patients. Frameworks such as RECIP 1.0 and PROMISE V2 enhance consistency of quantification and improve prediction of progression. Comparative studies indicate [^{18}F] PSMA-1007, especially when assessed with the miPSMA score, offers high diagnostic accuracy and reproducibility for clinically significant prostate cancer. Translational studies demonstrate its biodistribution closely mirrors [^{177}Lu] PSMA-617, supporting their “theragnostic tandem.” Despite slightly different hepatobiliary clearance patterns from the Lu-177 PSMA ligand, [^{18}F] PSMA-1007 remains a robust and advantageous baseline imaging basis for PSMA-targeted RLT therapy and can powerfully complement other clinical tools for diagnostic and therapeutic assessment and early recurrence detection.

Timing Matters: Impact of ADT Duration on PSMA PET Interpretation in Prostate Cancer

¹Chih-Yi Wu, ^{2,4}Hung-Pin Chan MD(co-first author), ² Daniel Hueng-Yuan Shen MD PhD, ³Ying-Shen Chen MD, ¹Ya-Ting Huang PhD, RN, NP, ²Hsiao-Chi Hou, ¹You-Sheng Kuo
¹1. Primo Biotechnology Co., Ltd, Taipei, Taiwan.

²Department of Nuclear Medicine, Kaohsiung Veterans General Hospital, Kaohsiung 813, Taiwan

³ Division of Urology, Department of Surgery, Kaohsiung Veterans General Hospital, Kaohsiung 813, Taiwan

⁴ Institute of Biomedical Sciences, College of Medicine, National Sun Yat-Sen University, Kaohsiung 804, Taiwan

Introduction:

Prostate cancer (PCa) is the most common malignancy in men. Despite advances in treatment, the prognosis for metastatic castration-resistant PCa (mCRPC) remains dismal. Androgen deprivation therapy (ADT) remains the standard treatment for hormone-sensitive PCa. Prostate-specific membrane antigen (PSMA) PET imaging has revolutionized staging and recurrence detection, surpassing traditional CT and bone scans. It targets PSMA, which is expressed on approximately 90% of mCRPC cells, and assists in the diagnosis and staging of PCa at all stages. However, concurrent hormonal therapy and ADT can modulate PSMA expression over a certain period of time, potentially impacting the interpretation of final PSMA PET images. Therefore, optimization and development of pre-examination educational workflows are necessary.

Literature review:

Short-term androgen deprivation therapy (ADT, 2–4 weeks) can trigger a PSMA “burst” by reversing androgen receptor-mediated FOLH1 suppression, increasing uptake (up to 7-fold) and revealing occult lesions, especially in csPCa and mHSPCa. This heterogeneous, time-dependent effect can raise SUVmax in bone metastases by up to 77%. In contrast, long-term ADT (>12 weeks) markedly reduces PSMA expression and lesion visibility (~45% detectable), likely due to apoptosis of androgen-sensitive cells. After 3 months, SUVmax, PSMA-TV, and PSMA-TL decline significantly, though lesion size may remain unchanged due to sclerosis. Clinically, PSMA PET is optimal before or within 3–4 weeks of ADT initiation in hormone-sensitive disease. Short-term androgen receptor pathway inhibitors (ARPIs) produce similar effects, and discontinuation before imaging is generally unnecessary unless suppression complicates interpretation.

Renal Mobility Observed During Dynamic Renal Scintigraphy and Its Impact on GFR Analysis

Shih-Fu Wang, Yu-Ling Hsu.

Department of Nuclear Medicine, Ditmanson Medical Foundation Chia-Yi Christian Hospital

Introduction:

A 67-year-old male presented with persistent gross hematuria for one week. Abdominal computed tomography (CT) revealed a tumor in the left ureter with associated hydronephrosis, turned out to be **transitional cell carcinoma (TCC)** of the left ureter. The patient was sent to our department to evaluate his individual renal function, underwent dynamic nuclear medicine renal scintigraphy for glomerular filtration rate (GFR) evaluation using a standard 20-minute acquisition protocol. Despite the patient's physical stability, dynamic imaging demonstrated inferior renal mobility. This unexpected movement raised concerns regarding the accuracy of GFR quantification based on fixed region-of-interest (ROI) placement.

Materials and Methods:

Two different ROI selection methods were employed to assess the impact of renal mobility on GFR results:

A Method – Static ROI (Fixed kidney position): The ROI does not include the area of kidney movement.

B Method – Dynamic ROI (Including renal migration range)

Results

A Method: Total GFR: 38.28 ml/min. Left kidney GFR: 11.8 ml/min. Right kidney GFR: 26.48 ml/min. Split renal function: Left 31%, Right 70%.

B Method: Total GFR: 45 ml/min. Left kidney GFR: 15 ml/min. Right kidney GFR: 30 ml/min. Split renal function: Left 33%, Right 67%.

Conclusion:

The findings clearly indicate that failing to account for renal mobility during ROI selection (A Method) may lead to an underestimation of renal function, particularly for the affected kidney. In contrast, incorporating the full range of renal movement during ROI placement (B Method) yielded higher and likely more accurate GFR values. Therefore, it's a reminder that clinicians should review each dynamic imaging carefully and adjust ROI accordingly.

病例報告：84歲男性骨質疏鬆合併雙磷酸鹽相關顎骨壞死 (BRONJ)

¹林俊凱、¹陳惠萍、¹張賴昇平

¹東基醫療財團法人台東基督教醫院

背景介紹:

患者於112年至本院耳鼻喉科就診，診斷右側慢性鼻竇炎。因牙齒不適右上傷口持續未癒轉會牙科，發現右上小白齒區有骨壞死現象。右下顎臼齒區可見骨暴露，伴隨膿液分泌與輕度腫脹。經與核醫科醫師討論，安排各項檢查。

病例報告:

患者為84歲男性，因右上慢性鼻竇炎及牙齒疼痛與顎骨暴露病灶就診，經病史與影像檢查，診斷為骨質疏鬆合併雙磷酸鹽相關顎骨壞死 (BRONJ)。本文呈現其臨床表現、治療經過與文獻回顧。

病患於耳鼻喉科診斷出右側慢性鼻竇炎，良性攝護腺增大未伴有下泌尿道症狀，長期吸菸每天超過一包，尼古丁依賴伴有尼古丁導致之疾患，無高血壓、糖尿病、心臟病等病史。牙科就診發現右上小白齒區有骨壞死現象。右下顎臼齒區可見骨暴露約1.5 × 2.0 cm，伴隨膿液分泌與輕度腫脹。觸診疼痛，牙齦無明顯癒合，右下唇麻木。與核醫科醫師討論，後續安排全口曲面斷層檢查、骨質疏鬆檢查、核醫骨壞死檢查(SPECT/CT)、核醫全身發炎檢查、牙組織病理切片，全口曲面斷層檢查確認病患右上顎後牙區骨質硬化與不規則骨吸收。核醫骨壞死檢查(SPECT/CT)、全身發炎檢查，顯示局部骨壞死區，骨髓腔消失、皮質骨不規則破壞。骨質疏鬆檢查為骨質疏鬆須進入治療，病理切片結果為壞死性發炎及細菌團塊，符合口腔顎骨壞死診斷。

結論:

本病例顯示高齡男性就診時並未使用靜脈雙磷酸鹽，非因骨鬆治療藥物引起之疾病。根據AAOMS BRONJ診斷標準未使用過雙磷酸鹽類藥物、顎骨有持續暴露超過8週、無顎骨放射治療病史，符合口腔顎骨壞死診斷。後續牙科治療及處置為停止拔牙及侵入性手術操作、局部沖洗、系統性抗生素及疼痛控制。積極與核醫科醫師討論於處置完成後可接受Prolia Inj.60mg/mL靜脈注射半年一次的治療。

口腔顎骨壞死診斷常見於接受靜脈注射雙磷酸鹽的癌症患者，尤其為控制骨轉移。好發年齡多為高齡患者，常見於拔牙後或牙周病相關區域。治療以保守方式為主，控制感染與症狀；外科介入需謹慎，僅限於保守治療無效或病灶進程。文獻顯示高齡、糖尿病、癌症骨轉移及長期靜脈雙磷酸鹽使用均為高危險因子。

本病例顯示高齡男性就診時並未使用靜脈雙磷酸鹽，懷疑因吸菸誘發顎骨壞死。臨床上應注意患者牙科處置前的藥物史，並需跨科別合作與以期早期診斷及給于病患後續治療。

Value of whole-body ^{18}F -FDG PET radiomics for predicting bone marrow involvement in patients with diffuse large B-cell lymphoma

^{1,2,3}Yu-Hung Chen, ³Kun-Han Lue, ⁴Sheng-Chuan Huang, ⁴Yi-Feng Wu, ⁴Sung-Chao Chu, ¹Shu-Hsin Liu

¹Department of Nuclear Medicine, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan.

²School of Medicine, Tzu Chi University, Hualien, Taiwan

³Department of Medical Imaging and Radiological Sciences, Tzu Chi University, Hualien, Taiwan

⁴Department of Hematology and Oncology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan

Introduction:

^{18}F -FDG PET is effective for detecting bone marrow involvement (BMI) in patients with diffuse large B-cell lymphoma (DLBCL). However, approximately 10-20% of BMI is reportedly been missed on PET. Radiomics, which extracts quantitative imaging features beyond human visual perception, may improve BMI detection in this context.

Materials and Methods:

We retrospectively analyzed pre-treatment ^{18}F -FDG PET from 139 patients with DLBCL (80 analog and 59 digital PET images). BMI was determined by bone marrow biopsy or positive PET findings (i.e., focal ^{18}F -FDG avid lesions in the bone marrow). Using the segmented contours of whole body total metabolic tumor volume (TMTV), 108 features were extracted with the Pyradiomics. Feature harmonization across analog and digital PET scanners was performed using Combat. A subset of 10 features was selected via chi-square testing for BMI classification. A logistic regression model incorporating these features was constructed and evaluated using 10-fold cross-validation. Model performance was assessed using the area under the receiver operating characteristic curve (AUC) and odds ratios (ORs).

Results:

There were 36 patients with BMI (21 positive PET BMI, 8 positive biopsies, 7 positive both on imaging and biopsy). The 10 most important predictors of BMI were metabolic diameters (Maximum 2D diameter row, column, slice, Maximum 3D diameter, Least axis length, Minor and Major axis lengths), heterogeneity (GLRLM gray level nonuniformity), TMTV, and shape feature (sphericity). The 10-fold cross-validated logistic regression model of the 10 features significantly predicted BMI (AUC = 0.803, OR = 1.044, $p < 0.001$). Among patients with negative PET findings, 8 had biopsy confirmed BMI; of these, 4 (50%) were correctly reclassified by the radiomic model. The radiomic model reduced the false negative rate of ^{18}F -FDG PET from 7.21% to 4.76%. This model remained predictive in subgroups according to PET scanners (analog PET AUC = 0.728, OR = 1.030, $p = 0.002$; digital PET AUC = 0.905, OR = 1.077, $p < 0.001$).

Conclusions:

Whole body radiomics is able to predict BMI in patients with DLBCL. The whole body radiomic model may supplement ^{18}F -FDG PET interpretation and reduce false negative rate. Incorporating radiomics into PET interpretation may reduce reliance on invasive bone marrow biopsies. Further validation in larger prospective cohorts is needed to confirm these findings and support clinical integration.

Assessing respiratory motion stability of novel ^{18}F -FDG PET-derived morphological features

^{1,2}Tan Sze Ian, ^{1,3,4}Yu-Hung Chen, ⁴Kun-Han Lue, ¹Shu-Hsin Liu

¹Department of Nuclear Medicine, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan.

² Hualien Hsien Association of Radiological Technologists (HHART)

³School of Medicine, Tzu Chi University, Hualien, Taiwan

⁴Department of Medical Imaging and Radiological Sciences, Tzu Chi University, Hualien, Taiwan

Introduction:

Respiratory motion has variable impact on the stability of PET-derived radiomic features, potentially compromising their clinical utility. Recently, four novel morphological features, NHOCmax, NHOCpeak, NHOPmax and NHOPpeak, have shown promising prognostic values for lung cancer. However, their respiratory motion stability has not been assessed.

Materials and Methods:

^{18}F -FDG PET imaging data from 100 patients (164 lesions from 36 lung cancer patients and 64 patients with other types of cancers) were retrospectively analyzed. We analyzed both data-driven respiratory gating (DDG) and non-DDG images. Four novel morphological features, normalized distances from the SUVmax of radiotracer uptake to tumor centroid (NHOCmax) and tumor perimeter (NHOPmax), and normalized distances from the SUVpeak of radiotracer uptake to tumor centroid (NHOCpeak) and tumor perimeter (NHOPpeak), were extracted for analysis. We also extract 7 known respiratory stable features for comparison. The coefficient of variation (CoV) and intraclass correlation coefficient (ICC) were used to assess feature reproducibility and reliability, respectively. The two feature stability measures were also analyzed in subgroups according to lesion size (MTV < 3 mL, 59 lesions; MTV $\geq$ 3 mL, 105 lesions).

Results:

Sphericity, first-order entropy, GLRLM run entropy, GLCM joint and sum entropy demonstrated low CoV (< 5%) and high ICC (> 0.90) values, indicating excellent reproducibility and reliability under respiratory motion. In contrast, NHOCmax, NHOCpeak, NHOPmax and NHOPpeak, showed high variability (CoV > 30%) and low ICC values (< 0.77), particularly in the group with MTV < 3 mL. GLCM IDMN and IDN demonstrated excellent CoV and good ICC values but also exhibited reduced ICCs in cases with small MTVs.

Conclusions:

The four novel morphological features are sensitive to respiratory motion. Notably, the respiratory motion shows negligible effect on these features in lesions with small MTVs. Therefore, to ensure consistency and reliability in biomarker research, it is prudent to apply a standardized respiratory gating protocol for these four features across all cases.

優化TRM流程提升全程躺床病人核醫檢查效率與安全：經驗分享

1、許幼青¹、廖建國¹、林昱璵、¹陳薇璇、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

核醫科檢查流程涉及多部門、多專業協作，病人的安全與舒適度直接影響影像品質與檢查成效。團隊資源管理 (Team Resource Management, TRM) 是一套透過明確分工、標準化溝通與即時回饋來降低醫療錯誤的管理模式。本院在臨床檢查前中後發現，有些部分病人是屬於躺床的病人，其在檢查過程前中後會因體位移動引起不適或者呼吸狀況不佳，導致檢查延誤甚至中斷，故為改善此問題，團隊針對原有TRM流程進行優化，以期提高效率與病人滿意度。

材料方法:

病房推床至核醫科接受核醫檢查且全程躺床的病人，原本床移動流程常造成時間延誤與病人不適。為改善此問題，團隊在原有TRM流程中進行多項優化：在領導(Leader)進行事前說明(Briefing)即增加「床移動前病情確認」環節，提前評估病人的呼吸狀況、平躺耐受度與管路固定情形；在搬運與推床過程前中後落實交班(ISBAR)標準化溝通，發現異常時以簡短明確語句傳達並要求重複確認；在床移動至檢查室後，導入強制回覆確認(Check back)機制，要求接收者口頭回應「OK」或重述訊息；同時在確保體位、管路及生命徵象均在安全範圍內；以及在檢查過程加入重申關切(Two-Challenge Rule)來確認病人「可否平躺」、「是否需加墊支撐」及「呼吸狀況穩定性」等項目，必要時立即喊「暫停」並重新評估，確保病人安全與舒適度。

結果:

流程優化後，團隊在全程躺床病人之推床與檢查銜接流程中，突發狀況的平均反應時間由原本3.8分鐘（範圍3-5分鐘）縮短至52秒內，能即時處理如呼吸不適、管路鬆脫、體位不耐受等緊急情況，有效提升臨床應變效率與病人安全。

病人在推床後可直接銜接檢查，無需額外重新定位或體位調整，平均節省約 2.3 分鐘，大幅提升核醫檢查的整體作業效率。在照護品質方面，病人於推床前即完成體位評估與必要支撐調整，檢查過程中呼吸負擔降低、身體支撐度提升，整體舒適度與安全感顯著改善。病人普遍回饋，檢查過程中感受到更穩定的支撐與照護，亦肯定醫療團隊的應變效率與協作能力。特別值得一提的是，自新流程實施以來，每月移動床異常次數通報維持為0件，顯示流程設計在病人移動安全上具高度穩定性與執行力。團隊對新流程的熟悉度與應變能力亦明顯提升。TRM機制啟用後，異常訊息可於30秒內完成接收與處置啟動，遠優於過往平均2分鐘的反應時間，展現流程優化在跨部門協作與即時處理上的顯著成效。整體而言，TRM機制在全程躺床病人運送與檢查銜接流程中的導入，不僅提升了病人安全與流程效率，也強化團隊執行力與照護品質，為臨床帶來實質改善。

結論:

經過流程優化的TRM應用在核醫檢查中，能顯著縮短處理突發狀況的時間、減少檢查延誤，並提升病人舒適度與滿意度。此結果顯示，將「床移動前病情確認」、「標準化溝通」與「即時回饋機制」納入流程，可提高團隊反應效率與檢查品質。此模式不僅適用於核醫檢查，也可推廣至其他需床移動與跨部門協作的高風險檢查與治療情境，具臨床應用價值。

放射師於全身骨骼掃描中發現腎臟攝取之有趣影像——個案報告

1、許幼青¹、廖建國、¹林昱璵、¹陳薇璇、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

食道癌為食道上皮細胞惡性腫瘤，依組織型可分為鱗狀細胞癌與腺癌，少數為小細胞癌。臨床症狀包括吞嚥困難、體重減輕與貧血。核醫分子影像檢查在腫瘤診斷、分期與治療反應評估中具有關鍵角色，在檢查過程中偶爾會發現與主訴無關、但具臨床意義的偶發影像。本案例為一名食道小細胞癌病人，在進行核醫檢查時意外發現泌尿系統變異與水腎，屬於一個值得討論的有趣影像。

病例報告:

患者為58歲已婚女性，有1子2女。既往病史包括糖尿病、白內障手術，父親曾罹患口腔癌。約2-3個月前出現吞嚥困難與貧血，並有消化性潰瘍及胃食道逆流病史。2025年7月14日，病人與兒子一同至診所就醫。內視鏡檢查發現食道胃結合部上方3公分處有潰瘍腫塊，初次切片顯示鱗狀細胞癌；另在胃體部與食道下1/3段重複切片結果皆為小細胞癌。內視鏡檢查顯示賁門腫瘤，伴隨遠端食道及胃旁組織侵犯，屬局部進展期。醫師為了評估骨轉移情況，進行全身骨骼掃描。掃描過程中，放射師注意到右側腎臟上極有異常放射性攝取現象，與典型骨轉移分布不符。出於臨床敏感度與警覺性，放射師主動查閱同一時期的電腦斷層影像以比對該處結構，發現雙側輸尿管收集系統不完全或完全重複，以及右上腎分支輸尿管擴張合併腎盂腎積水。確認此為非預期但具臨床意義的異常後，放射師主動通報核醫科醫師，進一步促成跨科團隊對此影像進行討論與紀錄。此發現與病人主訴無直接關聯，但為一項具有解剖學與臨床意義的偶發影像，可能與先天性泌尿系統變異或慢性泌尿道阻塞有關，對後續臨床評估及處置具有參考價值。

結論:

本案例為罕見的食道小細胞癌合併胃侵犯，病人接受核醫骨骼掃描以評估轉移情形時，並未發現明顯骨轉移病灶，但在影像中意外揭露右上腎異常放射性攝取。值得強調的是，此發現源自於放射師在掃描執行過程中即主動辨識異常攝取型態，並進一步查閱病人電腦斷層影像，確認疑似泌尿系統結構異常後，再通報核醫科醫師。這樣的流程展現放射師不僅具備影像技術執行能力，更具臨床敏感度與判讀素養，是核醫團隊中不可或缺的專業角色。整體而言，此案例不僅強化核醫影像的多面向應用價值，也突顯放射師於臨床影像流程中的主動觀察、判讀與通報責任，對提升病人整體照護品質具有關鍵貢獻。

Assessment of Primary Mediastinal Yolk Sac Tumor and Coexistent Left Ventricular Non-Compaction Cardiomyopathy using ^{18}F -FDG PET/CT: A Case Report

Chun-Che Lo¹, Chi-Wen Huang^{1,2}, Yu-Tzu Chang¹

¹Department of Nuclear Medicine, Chung-Shang Medical University Hospital, Taichung, Taiwan

²Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan

Introduction:

The coexistence of aggressive Primary Mediastinal Yolk Sac Tumor (PMYST) and rare Left Ventricular Non-Compaction (LVNC) is exceptional. We report a case where ^{18}F -fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F -FDG PET/CT) played a key dual diagnostic role.

Case report:

A 28-year-old male with an alpha-fetoprotein (AFP) of 1,482 ng/mL was diagnosed with a 10 cm PMYST. After one bleomycin, etoposide, and cisplatin (BEP) chemotherapy cycle complicated by severe aplastic anemia, a PET/CT, performed after a standard fasting of approximately 6 hours, showed moderate tumor uptake (SUVmax 7.2) and unexpected left ventricular (LV) uptake (SUVmax 11.8), with a concurrent left ventricular ejection fraction (LVEF) of 45%. Following successful tumor resection (90% necrosis), a follow-up PET/CT showed no malignancy but revealed a dramatic surge in cardiac metabolism (LV SUVmax 31.2). This prompted a cardiac magnetic resonance imaging (MRI) which confirmed LVNC as his LVEF critically dropped to 28.5%. With targeted heart failure therapy, his LVEF recovered to 35% and AFP normalized.

Conclusions:

This case demonstrates how ^{18}F -FDG PET/CT can provide precise oncologic surveillance while simultaneously offering a non-invasive window into cardiac pathophysiology. The direct correlation between intense myocardial FDG uptake and acute heart failure provides clinical support for the metabolic remodeling hypothesis, underscoring the importance of interpreting metabolic activity in non-target organs.

透析患者腸造口滲血之核醫出血掃描診斷

¹陳薇璇、¹許幼青、¹廖建國、^{1,2}莊紫翎
¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

腸道出血檢查是一種臨床上常見但診斷不易的情況，特別是對接受腹膜透析病人而言，其出血風險更高且表現常不典型。當傳統內視鏡或影像學檢查未能明確找出血源時，核子醫學中的 Tc-99m 標記紅血球出血掃描提供了一項非侵入性且高敏感度的診斷工具。此掃描方法可追蹤體內的出血動態路徑，有助於精確定位出血點，特別適用於疑似小腸或大腸出血病例。

病例報告:

本案為一位 42歲女性病人，已接受腹膜透析治療長達五年，因末期腎病導致多項併發症。近期因自行抽吸腸造口後發現造口有滲血現象，且有血塊，疑似腸造口出血。實驗室檢查顯示 Hb 為 8.8 g/dl，WBC 為 7000/ μ l，符合慢性失血所致的貧血表現。病人有空腸穿孔病史，已裝設人工腸造口。由於傳統內視鏡無法準確評估小腸及部分大腸區域，因此安排進行 Tc-99m 標記紅血球腸道出血檢查。檢查過程中，病人經靜脈注射放射性紅血球後，進行靜態攝影，4.5小時與5小時均未見異常放射性活性區，於24小時掃描時可於右下腹觀察到一持續性放射性活性區，符合升結腸區段，且將腸造口之糞便排出後，於24.5小時掃描未偵測到活性，可確定並非腸造口出血，而診斷為大腸出血。且核醫科敏感度較高，因此臨床醫師無安排後續大腸鏡檢查，亦不需要更換腸造口，只需繼續門診追蹤即可。

結論:

此病例說明核醫出血掃描在腹膜透析患者腸道出血鑑別上的重要角色。對於有腸造口、慢性腎病或腸道手術病史者，傳統內視鏡可能受限，尤其適用於間歇性出血或內視鏡無法觀察的中段小腸出血病灶。而 Tc-99m 標記紅血球掃描可有效定位出血點並提供臨床診斷依據，進一步協助臨床醫師決定後續治療方向，此技術對於疑難性出血個案具有高度臨床價值。

Femoral Osteochondritis Dissecans and Tibial Osteochondral Defect in an Adult: A Rare Presentation Revealed by Bone SPECT/CT

^{1,2}Tzyy-Ling Chuang

¹Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan;

²School of Medicine, Tzu Chi University, Hualien, Taiwan;

Introduction:

We reported a 46-year-old woman with femoral osteochondritis dissecans and tibial osteochondral defect, diagnosed through arthroscopy and comprehensive imaging, including bone SPECT/CT.

Case report:

A 46-year-old woman presented with persistent right knee swelling and pain six months after a fall in January 2024. MRI initially revealed a lateral meniscus tear, for which she underwent meniscus repair in June 2024 and subsequent meniscectomy in October 2024 due to unresolved symptoms. Physical examination showed swelling extending from the lateral knee to the anterior thigh, limited extension, and no tenderness. Retrospective MRI review identified edema of the right tibial plateau and distal femoral condyle. Despite Evenity injection and multiple arthrocentesis procedures, symptoms persisted, and joint cultures remained unremarkable. Arthroscopic debridement and chondroplasty performed in January 2025 revealed severe synovitis, >50% cartilage erosion of the lateral femoral condyle with a loose body, and tibial plateau cartilage damage. Bone SPECT/CT demonstrated bony destruction, cleft formation, and increased radiotracer uptake at the distal femur and proximal tibia. Based on imaging and arthroscopic findings, femoral osteochondritis dissecans and tibial osteochondral defect were diagnosed.

Conclusions:

Osteochondritis dissecans is a specific form of osteochondral lesion typically seen in younger individuals, resulting from impaired blood supply to the subchondral bone, leading to bone necrosis and cartilage detachment (loose body). Although more common in the knee (especially the medial femoral condyle), adult cases, such as the one presented here involving the lateral femoral condyle, are rare but important to recognize. Osteochondral defects are broader in nature, referring to any structural damage to both the cartilage and underlying bone, often resulting from trauma, degeneration, or chronic stress. Bone SPECT/CT is invaluable for diagnosing osteochondritis dissecans and osteochondral defects, as it reveals focal tracer uptake with cleft formation and subchondral bone destruction while simultaneously providing anatomical detail and metabolic information. Advanced imaging enables timely diagnosis and management, underscoring the need to consider osteochondritis dissecans in adults with persistent knee pain unresponsive to conventional therapy.

Bone SPECT/CT Unveils T12/L1 Spondylodiscitis with Sequestrum: A Cold Lesion with Peripheral Uptake in a Drug Abuser with Back Pain

^{1,2}Tzyy-Ling Chuang

¹Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan;

²School of Medicine, Tzu Chi University, Hualien, Taiwan;

Introduction:

We report a T12/L1 spondylodiscitis case with sequestrum, appearing as a cold lesion with peripheral uptake on bone SPECT/CT.

Case report:

A 56-year-old male developed severe lower back pain without trauma two months prior, managed conservatively with analgesics and rest. Symptoms progressed to bilateral anterior thigh and lower limb numbness. Bone scan with SPECT/CT showed radiotracer accumulation in T12 and L1, with central cold areas in the disc and an osteolytic lesion. The bone scan protocol included whole-body planar imaging at 14 cm/min, followed by SPECT/CT acquisition (14 s/frame, 6°/step) and low-dose CT (120 kVp, 100 mA) for anatomical correlation. MRI revealed a T12 compression fracture, T12/L1 disc increased signal intensity, endplate erosion, and paraspinal abscesses, suggesting infectious spondylodiscitis. Antibiotics were initially prescribed as the patient refused surgical admission. Urinalysis revealed the presence of illicit substances, testing positive for buprenorphine, amphetamine, and methamphetamine. One month later, he underwent T10-L3 pedicle screw fixation, T12/L1 transforaminal lumbar interbody fusion, and autograft placement. Surgery revealed a large T12/L1 cavity with a necrotic T12 bone fragment, filled with a massive autograft and 5 c.c. of sinbone. Retrospective MRI review revealed a low-intensity area below the T12 fracture line, aligning with the cold osteolytic lesion on bone SPECT/CT, suggestive of sequestrum.

Conclusions:

Spondylodiscitis remains diagnostically challenging, particularly in intravenous drug users. Imaging is crucial for any such patient with back pain, even with normal inflammatory markers. MRI and bone/gallium-67 SPECT/CT serve as complementary standards. SPECT/CT criteria include a bone scan suggestive of osteomyelitis (three-phase positivity with focal hyperperfusion, hyperemia, and delayed uptake in adjacent endplates). FDG PET/CT is increasingly recognized for its superior sensitivity in detecting active infection and guiding management. Sequestrum, a necrotic bone fragment within avascular sclerotic tissue, is a complication of osteomyelitis and hinders treatment by limiting antibiotic penetration. HIV testing was not performed in this patient, which may represent a diagnostic limitation.

碘-131大劑量治療病患出院後環境輻射偵測經驗分享

¹吳忠順, ¹蘇詩琪, ¹譚鴻遠
¹高雄榮民總醫院核醫科

背景介紹:

本院同位素治療中心於2024年10月底正式開幕，中心共有2床治療病房，可同時收治2位病患。截至今年7月底，中心共收治135人次I-131治療病患及3人次Lu-177-PSMA治療病患。中心配置固定式偵檢器可24小時監控病房內外之輻射劑量，病患出院後先由輻防人員使用移動式偵檢器偵測病房環境輻射，並將輻射污染物處理完畢後再由清潔人員進行環境整理，本研究分享病患出院後環境輻射偵測之經驗，提供大家參考。

材料方法:

病房於病患入住前先以包膜黏貼於飲水機按鍵、感應門開關、電燈、電話、電視遙控器、呼叫鈴、冰箱手把及病床兩邊手把等處，以除汙紙黏貼於書桌書椅、病床枕頭、床邊桌、浴室外地板、浴室內馬桶、洗手台區域及垃圾桶地面等處，垃圾袋則分為一般垃圾桶、衣服被服更換桶及鉛垃圾桶3處。病患於入住時由護理師衛教將垃圾依照是否接觸體液分別放置，衛教病患刷牙(吐痰)時使用嘔吐槽、洗手時使用洗手台、小便時採坐姿及淋浴時切勿小便等輻防注意事項。病患出院後由輻防人員使用輻射偵檢器就以上管制點進行偵測，偵測時先處理高輻射區域，嘔吐槽及洗手台則先擦拭後再於低背景區偵測擦拭物，偵檢器背景值約為0.1微西弗/小時，偵測物表面大於0.2微西弗/小時視為輻射污染。

結果:

依偵測結果進行分析後發現，輻射污染比例依序為輻射廢棄物垃圾桶(99.1%)、冰箱廚餘(88.6%)、嘔吐槽(85.1%)、浴室內馬桶和洗手台區域除汙紙(56.8%)、枕頭上除汙紙(23.0%)、書桌除汙紙(12.2%)，另病患誤用一般垃圾桶及洗手台導致輻射偵測值超過0.2微西弗/小時的比例為4.4%及5.4%。輻射廢棄物偵測值介於0.4-2000微西弗/小時，平均值為47.3微西弗/小時，如扣除7次偵測值大於100微西弗/小時(6.1%；分析原因應為病患之口水或輕微之嘔吐物)，平均值為14.8微西弗/小時，冰箱廚餘偵測值介於0.32-72微西弗/小時，平均值為7.6微西弗/小時。另有2次單獨收集病患使用過之棉片，偵測值分別為5和28微西弗/小時。

結論:

病患入住前給予詳細之說明，可降低病患殘留之輻射污染物。I-131能量較高，偵測時容易受到干擾而使偵測失準，建議偵測時宜先處理高污染區域(如輻射垃圾桶及嘔吐槽等)或於低背景區(如前室)偵測移除後之包膜及除汙紙。分析I-131病患出院時病房內之輻射偵測狀況，可幫助輻防人員掌握輻射偵測重點，並能於最短的時間內完成除汙及偵檢工作，除能提高工作效益外，對降低輻防人員本身和周遭工作人員或入住病患之輻射劑量亦有助益。

核醫造影室影像分析品質之改善成效分析 Enhancing Image Quality in Nuclear Medicine Imaging Suites: An Outcome Analysis of Image Processing Improvements

¹廖建國、¹許幼青、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

影像分析為核醫造影作業中重要的步驟，影像分析品質的優劣攸關醫師影像判讀的正確性。本科多年前為監控影像分析之正確性，即訂定影像分析異常件數之指標，並由醫師審查影像分析之品質。本研究目的即為回溯性分析近9年影像分析異常率及其發生原因，以了解年度改善情形，並作為持續改進之參考。

材料方法:

回溯性收集2017年1月至2025年6月，例行影像分析品質審查之紀錄資料，分析各年度影像分析異常件數及異常率，再進一步分析其發生原因以及其檢查項目，以比較各年度影像分析品質表現情形，以及發生原因之變化，並探討達成零異常目標的可行性。

結果:

總計收集42378件檢查個案，其中影像分析異常之個案計9件，大部份皆為作業量最大的骨骼掃描(8件)，僅1件為骨質密度檢查。整理結果發現，2017年至2025年6月之間，影像分析異常件數之年度平均值為1件，而影像分析異常率則為0.02%。其中以2017年之影像分析異常率最高(0.05%)，而2022年及2024年之影像分析異常率最低(0%)，結果顯示近4年之影像分析異常率相較於前5年已有下降之趨勢，近9年已有2年之異常率可控制在0%。進一步分析影像分析異常之原因，發現排序居前兩位者為比對(compare)影像前後二次放置相反($n = 2$; 22.22%)以及影像左右方向標示錯誤($n = 2$; 22.22%)，而影像分析錯誤、SPECT影像未分析、影像對比過亮、比對(compare)影像未分析、影像日期標示錯誤等則分別各有1件($n = 1$; 11.11%)。2022年以後，大部份的原因皆已有效控制，僅剩影像日期標示錯誤及影像左右方向標示錯誤尚須持續努力改善，以達零異常的目標。

結論:

研究結果顯示，本科近9年之影像分析異常率平均為0.02%，其中近4年的表現較好，2022年及2024年皆已達零異常之目標，顯示我們多年的努力已有不錯的成果。根據本科的經驗，影像分析要達成100%的正確率雖有一定難度，但並非不可能，只要我們秉持追求卓越品質的精神，持續針對尚須努力的部份力求改善，未來一定可達成理想的目標。

Timing Matters: Impact of ADT Duration on PSMA PET Interpretation in Prostate Cancer

¹Chih-Yi Wu, ^{2,4}Hung-Pin Chan(co-first author), ² Daniel Hueng-Yuan Shen, ³Ying-Shen Chen,

¹Ya-Ting Huang, ²Hsiao-Chi Hou, ¹ You-Sheng Kuo

¹1. Primo Biotechnology Co., Ltd, Taipei, Taiwan.

²Department of Nuclear Medicine, Kaohsiung Veterans General Hospital, Kaohsiung 813, Taiwan

³ Division of Urology, Department of Surgery, Kaohsiung Veterans General Hospital, Kaohsiung 813, Taiwan

⁴ Institute of Biomedical Sciences, College of Medicine, National Sun Yat-Sen University, Kaohsiung 804, Taiwan

Introduction:

Prostate cancer (PCa) is the most common malignancy in men. Despite advances in treatment, the prognosis for metastatic castration-resistant PCa (mCRPC) remains dismal. Androgen deprivation therapy (ADT) is the cornerstone of hormone-sensitive PCa treatment. Prostate-specific membrane antigen (PSMA) PET imaging has transformed staging and recurrence detection, surpassing conventional CT and bone scans. However, concurrent ADT and androgen receptor pathway inhibitors (ARPIs) can modulate PSMA expression, potentially impacting PET interpretation.

Literature review:

Evidence indicates a time-dependent effect of ADT on PSMA uptake. Short-term ADT (2~4 weeks) can trigger a transient "PSMA flare" by reversing androgen receptor-mediated FOLH1 suppression, increasing tracer uptake and revealing occult lesions. Hope et al. reported almost 7-fold increase in PSMA uptake within 4 weeks of bicalutamide treatment, while Ettala et al. observed SUVmax increases of up to 77% in bone metastases 3~4 weeks post-ADT. Similar early effects were confirmed in a Taiwanese prospective study, where 80% of patients showed partial metabolic response after 3 months of ADT (Tseng et al.). In contrast, long-term ADT (>12 weeks) markedly reduces PSMA expression and lesion visibility. Afshar-Oromieh et al. demonstrated that only 33% of lesions remained detectable after a median of 230 days of continuous ADT, and Hoberück et al. reported significant declines in SUVmax, PSMA-TV, and TL-PSMA after 5 months of therapy. These findings indicate that PSMA PET is most informative when performed before or within the first few weeks of ADT initiation, while prolonged therapy substantially diminishes lesion detectability, underscoring the clinical importance of optimal imaging timing.

放射免疫分析作業量自費佔率之分析及探討 Analysis and Evaluation of the Proportion of Self-Paid Cases in Radioimmunoassay Workload

¹廖建國、¹張素雲、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

放射免疫分析為核醫科提供服務的重要項目，例行作業中除了主要的健保病人外，自費檢查亦佔有不少的比率。自費檢查的主要來源包括自費病人以及癌症篩檢，其中癌症篩檢佔有一定的比率。本研究目的即為分析近兩年RIA實驗室之作業量自費佔率以及癌症篩檢所佔的比率，以作為工作規劃之參考。

材料方法:

回溯性收集2024年1月至2025年6月，實驗室每月檢驗件數之資料，依不同月份分析近2年RIA實驗室之自費檢驗件數及其佔率(即檢驗件數所佔的比率)，再比較近2年自費作業量及其佔率的變化，以了解目前的自費佔率，並探討自費作業量變化的原因以及未來如何持續提升自費佔率。本科實驗室操作項目合計15項，包括T3、T4、TSH、Free T4、Thyroglobulin、PTH-i、Cortisol、Prolactin、Ferritin、AFP、CEA、PSA、CA 125、CA 15-3、CA 19-9等，其中後6項為例行癌症篩檢的項目。

結果:

整理結果發現，2024年1月至2025年6月本科放射免疫分析之平均每月自費檢驗件數為2084件，自費佔率為24%。其中2025年(1-6月)的自費件數(2037件)與自費佔率(24%)皆與2024年相近(2108件; 24%)($p > 0.05$)。進一步分析癌症篩檢所佔的比率，發現近2年癌症篩檢的件數佔全部自費量的22.4%，其中2025年(1-6月)的癌症篩檢自費佔率(30.2%)較2024年(18.6%)明顯的增加 ($p < 0.05$)，顯示2025年我們承接癌症篩檢的作業量已有明顯的成長。不過，2025年癌篩的自費作業量雖然比率增加，但整體的自費作業量並未較2024年明顯成長。究其原因，主要與今年本科自費病人的作業量明顯減少有關。

結論:

本科近2年之平均每月作業量自費佔率為24%，2025年(1-6月)的自費佔率與2024年相近。其中癌症篩檢佔全部自費量的22.4%，顯示癌症篩檢在放射免疫分析作業中佔有不少的比率。近年本科配合醫院提升自費佔率的政策，放射免疫分析扮演非常重要的角色，自費病人的多寡由臨床醫師開單決定，我們無法掌控，但在癌症篩檢方面未來可再規劃承接更多體檢任務，以持續提升作業量之自費佔率。

友善職場環境推動：預防肌肉骨骼危害之實務展示

¹呂惠敏、¹陳建榮、¹陳怡潔、¹盧建萍、¹徐丞、
¹李婷嫻、¹董佳慧、¹王淑貞、¹羅美芳、¹黃奕琿、^{1、2}彭信逢

¹國立臺灣大學醫學院附設醫院 核子醫學部
²國立臺灣大學醫學院

背景介紹:

隨著高齡化時代的來臨，和核子醫學機器的特殊性，檢查結束後病患往往無法行起床，需要醫事放射師或護理師的協助，導致同仁的手或腰因為輔助病患而被拉傷或腰部受傷。

經危害風險評估工具關鍵指標檢核系統KIMBF(全身施力)評估本部協助病患躺下及起身之風險程度為中高程度(總風險值為56)，代表對於一般耐受力的人也有可能超過身體負荷，而疾病或疼痛。

材料方法:

經與本院職業暨環境醫學部、安全衛生室討論以考慮於檢查床邊安裝適合之扶手、讓病患有抓握的施力點，較有機會靠自身的力量起身，以減少同仁協助病患起身所需的力。把手設計考慮檢查環境安全性，和不影響日常業務作業空間，選擇可以移動式直立床邊扶手，協助同仁減少因為工作導致工傷的可能性。

結果:

在本院東址2樓第5、7、8掃描室及B1第1、2、3掃描室共6處檢查床增設移動式直立床邊扶手。工作同仁使用滿意度高達100%，雖無法收集病患使用前後滿意度，但有不少病患詢問相關商品名稱，要自行購買給長輩使用。縮短上下檢查床作業時間，優化工作流程，讓同仁能將更多時間投入醫療工作上，提升整體工作效率。

結論:

在行政管理具體成效中可減少職災與病假，降低營運成本與風險，而且也可改善工作環境，降低同仁因身體不適或職業傷害而請病假的頻率，並減少人力調度成本，並確保醫療服務的連續性。降低醫療糾紛風險，能安全地轉移病患，減少因操作不當導致的病患跌倒或受傷事件，間接降低潛在的醫療糾紛風險。

同時塑造友善職場文化，以關懷同仁為出發點，醫院主動採購輔具，是對同仁身體健康與工作安全的實際承諾，能有效提升同仁的歸屬感與滿意度，進而降低離職率，留住優秀人才。營造安全友善的職場氛圍。提升醫院專業形象。醫院現代化、人性化的管理理念，不僅關注病患照護，也同樣重視員工的福祉，有助於塑造正面的社會形象。

Apical Sparing Pattern of ATTRCM in Gated Myocardial Perfusion Imaging: A Case Report

¹Ya-Min Chi; ^{1,2}Chin-Chuan Chang

¹Department of Nuclear Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan.

²School of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan.

Introduction:

Transthyretin cardiac amyloidosis (ATTRCM) is a rare but increasingly recognized cause of restrictive cardiomyopathy, which often presents with heart failure and arrhythmias. Traditionally diagnosed through echocardiography and cardiac MRI, a distinctive pattern of myocardial strain known as “apical sparing” has been noted in ATTRCM, characterized by preserved strain in the apical region compared to the basal segments. Recent advances in gated myocardial perfusion imaging (GMPI) may also be useful in detecting this apical sparing pattern, although its role in diagnosing ATTRCM remains underexplored.

Case Report:

An 84-year-old male with biopsy-confirmed transthyretin cardiac amyloidosis presented with progressive dyspnea and fatigue. He underwent GMPI with dipyridamole-induced stress testing under continuous electrocardiogram (ECG) monitoring. Following injection of Tl-201, gated single-photon emission computed tomography (SPECT) imaging was performed from the right anterior oblique to the left posterior oblique position, with resting images obtained 3–4 hours later under the same acquisition parameters. Image reconstruction revealed mild perfusion defects in the inferior wall and a subtle defect in the apical region. However, gated imaging demonstrated reduced thickening of the global left ventricular wall, sparing only the apex—consistent with echocardiographic findings. This mismatch pattern was atypical compared with the perfusion abnormalities typically seen in ischemic heart disease. The decreased global wall thickening with relative apical sparing suggested ATTRCM.

Conclusions:

Apical sparing is a well-documented echocardiographic feature of ATTRCM, where longitudinal strain is preserved in the apex but reduced in the basal and mid-segments. Recent studies have shown that myocardial work indices can further distinguish ATTRCM from other forms of hypertrophy, such as hypertrophic cardiomyopathy or hypertension. While apical sparing has been predominantly associated with echocardiography, this case suggests that gated myocardial perfusion imaging may also reveal this characteristic pattern, potentially offering alternative diagnostic tool for ATTRCM. Although GMPI is not typically used for strain imaging, the combination of perfusion and thickening assessment could highlight regional differences, such as apical sparing, in cardiac amyloidosis.

完成6劑鐳223治療病人治療前後體重變化之研究 -以台灣南部某醫院為例

¹卓世傑、¹江佳諭、¹張虹麗、¹梁育雅、¹陳懿貞、¹魯育伶、¹李將瑄

¹奇美醫院永康總院 核子醫學科

背景介紹:

鐳223是現在用於治療去勢抗性攝護腺癌(castration-resistant prostate cancer, CRPC)病人的重要藥劑之一。由於鐳223藥劑治療的可能副作用，包括腹瀉、噁心與嘔吐...等可能造成體重減輕的情形。因此觀察完成6劑鐳223治療病人，治療前後體重變化的情形，或許是值得研究的方向。本文即為，完成6劑鐳223治療病人治療前後體重變化之研究。

材料方法:

收集2022年3月8日至2025年6月9日於南部某醫院，完成6劑鐳223治療病人之第一劑治療體重(初始體重)與第六劑治療時體重(完成體重)資料。再剔除躺床或坐輪椅等測量體重有困難之病人，共收集到25位病人之資料，加以統計分析以得出結果和結論。

結果:

- 1.樣本病人初始體重平均值為66.72kg，最大值為90kg，最小值47.2kg，中位數為65kg，標準差為10.47kg。
- 2.初始體重減完成體重之變化比例(即， Δ 體重/初始體重 $\times 100\%$)，其平均值為0.86%，最大值7.4%，最小值-4.6%，中位數與標準差，分別為1.25%及3.13%。
- 3.有60%或15位病人體重變輕，有40%或10位體重變重。體重變輕病人平均減少2.08kg，最多減少3.5kg，最少0.1kg，減少的中位數與標準差，分別為1.7kg及1.09kg。變重病人平均增加1.45kg，增加最大的是3kg，增加最少的是0.3kg，增加的中位數與標準差，各為1.45kg及0.85kg。

結論:

依據本研究發現，完成6劑鐳223治療之25病人，體重平均僅減輕0.86%，顯示病人治療前後之體重變化似乎並不明顯。其次，樣本中有60%或15位變輕，變輕病人平均減少2.08kg，標準差為1.09kg，另有40%或10位體重變重，變重病人平均增加1.45kg，標準差則為0.85kg，也顯示鐳223的治療結果，對體重增減的影響，在方向與程度上，均不甚顯著。

Clinical Outcomes of PSMA and FDG PET in the Detection of Osseous Metastases in Prostate Cancer

^{1,2}Nan-Jing Peng, ¹Meng-Ying Chen, ¹Ko-Han Lin, ¹Yun-Hsuan Chao, ^{1,2}Lien-Hsin Hu, ¹Tse-Hao Lee, ¹Yuh-Feng Wang

¹Department of Nuclear Medicine, Taipei Veterans General Hospital, Taipei, Taiwan.

²School of Medicine, National Yang-Ming Chiao Tung University, Taipei, Taiwan.

Introduction:

Prostate-specific membrane antigen (PSMA) PET has generally demonstrated superior sensitivity and specificity compared with fluorodeoxyglucose (FDG) PET in the detection of prostate cancer, including skeletal metastases. This study aims to evaluate the diagnostic performance of PSMA-1007 PET in identifying osseous metastases among patients with prostate cancer, as well as to elucidate the complementary role of FDG PET.

Materials and Methods:

This retrospective study included patients with prostate cancer who underwent both PSMA-1007 PET and FDG PET imaging at Taipei Veterans General Hospital. A total of 65 patients who received both scans within a one-month interval were analyzed. Osseous metastases were detected in 30 patients (46%) using PSMA-1007 PET, of whom 18 (60%) also exhibited corresponding skeletal uptake on FDG PET. Among the 35 patients without evidence of bone metastases, 17 (49%) demonstrated nonspecific PSMA uptake in the skeleton. Additional malignancies and intratumoral heterogeneity were identified in 9 patients through FDG PET. Survival outcomes were evaluated using Kaplan–Meier analysis, with statistical significance defined as $p < 0.05$.

Results:

The mean overall survival (OS) was 16.7 months for patients with osseous metastases and 23.3 months for those without ($p = 0.008$). The presence of nonspecific PSMA skeletal uptake was not associated with significant differences in OS ($p = 0.728$). Conversely, the detection of additional malignancies and tumor heterogeneity on FDG PET was correlated with poorer prognosis ($p = 0.043$).

Conclusions:

PSMA-1007 PET demonstrates high sensitivity and prognostic value in the detection of bone metastases in prostate cancer. Nonspecific PSMA skeletal uptake does not carry prognostic implications for clinical outcomes. FDG PET may provide added value in selected cases characterized by heightened glycolytic activity, which is associated with adverse prognosis.

使用 ^{18}F -FDG PET/CT診斷免疫球蛋白G4相關性疾病:個案報告

¹李冠賢、¹王士豪、¹林君宜
¹彰化基督教醫院核子醫學科

背景介紹:

免疫球蛋白G4相關性疾病(IgG4-related disease, IgG4-RD)是一個全身性發炎纖維化的疾病，約 60% 的患者會影響多個器官。此疾病的特徵由病理切片可見腫瘤樣的病灶、IgG4 陽性淋巴漿細胞浸潤 (lymphoplasmacytic infiltration) 及席紋樣纖維化 (storiform fibrosis)，血清中IgG4濃度常有升高現象。此疾病的診斷主要經由病理組織切片及免疫化學染色來確認。IgG4-RD 在肺部的臨床表現，可能以假性腫瘤、間質性肺炎或肋膜增厚來表現，臨床上出現咳嗽、咳血、喘、肋膜炎、胸痛等症狀，但也可能沒有任何症狀，IgG4-RD典型的電腦斷層影像為氣管血管束 (bronchovascular bundle) 變厚、肺泡間質病變(alveolar interstitial patterns)、實質結節 (solid nodule)、圓形毛玻璃樣病灶(round-shaped ground-glass opacities)。^[1]

病例報告:

我們報告一名患者2024年7月因上呼吸道感染及反覆發燒由急診入院，經X光檢查，診斷為支氣管肺炎，患者2024年6月於友院抽血檢驗，發現IgG4過高，懷疑免疫球蛋白G4相關性疾病(IgG4-related disease)，經肺部電腦斷層檢查後，雙側肺部輕度瀰漫性支氣管壁增厚，抽血檢驗IgG數值為3787.3mg/dL、IgG4數值為1650mg/dL，與IgG4肺部臨床表現相似，經抗生素、抗組織胺及症狀治療藥物治療之後，於8月底電腦斷層檢查發現仍有瀰漫性氣管內壁增厚及發炎情形，於2024年9月與10月，安排Ga-67全身掃描，9月影像顯示右側胸壁有發炎，給予類固醇治療後，10月影像顯示無明顯發炎，在2024年11月，再次安排肺部斷層掃描，顯示無明顯腫瘤，同月底因疑似IgG4相關免疫性疾病，入院接受進一步檢查。安排 ^{18}F -FDG PET/CT 檢查，影像顯示雙側頸部、鎖骨上、縱膈腔、肺門和腹股溝區淋巴結呈現熱點(圖一)，經切除左側腹股溝淋巴結(圖二)化驗，顯微鏡下可見淋巴漿細胞浸潤、席紋樣纖維化，高倍視野下陽性漿細胞>60個，綜合上述病理特徵與臨床表現診斷為IgG4相關淋巴結病變，後續經由類固醇藥物治療，2025年2月IgG4數值降低為1210mg/ dL，病情持續改善中。

結論:

^{18}F -FDG PET/CT對於評估器官發炎上有很大的作用，在病灶定位、採集檢體和確定疾病上給予一定程度的幫助。隨著 ^{18}F -FDG PET/CT在IgG4-RD評估中的應用越來越廣泛，不同器官系統的特徵性影像越來越受到認可^[2]。對於診斷IgG4-RD有很好的應用價值。

腎功能不全患者接受碘-131治療之評估與照護探討 Exploration of Evaluation and Care in Patients with Chronic Kidney Disease Undergoing Iodine-131 Therapy

¹王苡安、¹許幼青、¹廖建國、^{1,2}莊紫翎
¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科
²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

口服碘-131放射性同位素藥物，主要經由腎臟代謝，所以腎功能不佳病人可能會引起藥物在體內停留時間過長，而增加住院天數及副作用風險。本篇討論一位在接受大劑量碘-131治療前已出現腎功能不佳，並因停用甲狀腺素一個月及接受Thyrogen後腎功能惡化成AKI(急性腎損傷，acute kidney injury)的患者，藉此探討治療劑量調整與臨床照護重點。

病例報告:

有一位42歲女性病人，主要在雲林台大醫院就診，病史有甲狀腺癌、高血壓、糖尿病、高血脂及缺鐵性貧血，患者因左側甲狀腺癌伴隨頸部淋巴結轉移，於2025/01/06執行甲狀腺切除術和左側頸部淋巴結清除術。患者於2025/01/05住院時抽的血中尿素氮(BUN) 22 mg/dl、肌酸酐(Cr)1.3 mg/dl腎功能指數(eGFR)為47.7、血紅素(Hb)為7.2g/dl，住院期間血壓約183/83 mmHg，患者於2025/01/09出院。經雲林台大醫師建議於2025/03/12入住本院碘131病房口服120 mCi作為治療。入院後常規血液檢查顯示BUN 32.2 mg/dl、Cr 2.67 mg/dl、eGFR 19.48(表一)，研判為慢性腎臟病(chronic kidney disease, CKD)合併腎功能惡化的狀態，怕有AKI的危險性，加上病人2025/02/11起低碘飲食、停甲狀腺素(eltroxin)一個月及2025/03/11施打一支Thyrogen，經主治醫師與核醫科主任討論後，由於存在腎功能受損的高風險，判斷病人出現急性腎損傷，主治醫師與核醫科主任決定將治療劑量由120 mCi 調降至78 mCi。住院期間病人有3次嘔吐及頸部腫脹，但經對症處理後最終患者於2025/03/14穩定出院。

結論:

AKI較常發生的高危險群有原本腎功能較差的病人(eGFR < 60)、高齡患者(eGFR正常值90，30歲過後每年以0.8下降，故此個案42歲，eGFR正常值應為約80.4)、有心血管疾病患者(高血壓、糖尿病、心衰竭)及有在使用利尿劑或水份攝取不足者，依個案病史與檢驗數值，可見其在治療前即存在 CKD，且因長期停用甲狀腺素可能導致腎臟血流下降，加重腎功能惡化，吻合AKI症狀。文獻亦指出長期低甲狀腺素可能導致腎臟血流下降，eGFR < 60 者不建議長期停用 eltroxin，住院期間因須要多補充水分，建議分次喝，不能一次喝太多水。本案例顯示：對於腎功能不佳的患者，在進行碘-131治療前應謹慎評估腎功能與相關病史，並調整劑量或採取替代方案，以降低風險並提供適切照護。

骨骼掃描追蹤未分化肉瘤預後意外發現軟組織積液水腫

¹林昱璵、^{1,2}莊紫翎、¹許幼青、¹廖建國

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

未分化肉瘤 (Undifferentiated Sarcoma) 是一種罕見且具侵襲性的惡性腫瘤，屬於軟組織肉瘤的一種，整體而言可以分成軟組織惡性肉瘤(soft tissue sarcoma)及骨肉瘤(bone sarcoma)。因為在成人的惡性肉瘤主要是以軟組織惡性肉瘤為主，無法明確歸類為特定的分化類型。它起源於結締組織，如肌肉、脂肪和纖維組織，並且腫瘤細胞在顯微鏡下表現出異質性和不規則性。常見於四肢的深層軟組織（特別是大腿），其次為腹膜後、軀幹、頭頸部，常見於中老年人（40-70歲），臨床症狀：無痛性腫塊為首發表現，後續有疼痛、功能障礙、壓迫神經或血管，若肺部轉移則有咳嗽、胸痛、呼吸困難。

病例報告:

一位罹患右大腿未分化肉瘤的54歲男性病人，2022年起接受手術及共35次放射線治療，劑量為7000cGy、化療（doxorubicin）、復健及長期追蹤，在某次的骨骼掃描追蹤時，影像上意外發現遠端右大腿的部位疑似有軟組織攝取增加的情況，不確定是否為放射線治療後導致局部微血管損傷破裂，使血流進入軟組織，進而增加放射性同位素在該區的沉積量，造成影像呈現攝取異常的狀況（圖一），為了更完整了解右大腿的狀況，加照SPECT/CT掃描，結果影像在異常攝取的區域，疑似為感染或者發炎的狀況（圖二），後續針對軟組織進行MRI掃描，發現遠端右大腿肌肉（股四頭肌內的股內斜肌）出現輕度囊性液體積聚，大小約 9.8×15.5×71.9 mm，且鄰近肌肉與皮下組織有水腫及顯影劑增強的現象（圖三），可能為手術後纖維化或局部炎症造成，之後持續追蹤該部位情況，病況穩定。

結論:

未分化肉瘤的治療最佳方式為手術切除，需廣泛切除腫瘤及周圍正常組織，若無法切除或邊緣陽性時需搭配放射治療，但通常用於晚期轉移病例也可使用化療，必須注意局部復發率較高，需長期追蹤，主要怕復發後轉移至肺部、肝臟或骨骼等部位。定期追蹤檢查中，核醫骨骼掃描在提供了重要的診斷資訊，原以為是放射治療造成微血管組織損傷，卻意外地發現大腿軟組織因為積液水腫及發炎而呈現藥物異常攝取的現象，雖然骨骼掃描對骨細胞的變化有著高敏感的特性，但軟組織細胞的微小改變，骨掃描亦能提供一定程度的輔助診斷。結合SPECT/CT的精準定位功能，更進一步提升其臨床價值，無論在癌症治療前的評估，或是治療後的追蹤監控，皆為相當關鍵的診斷工具。

核醫I-131 MIBG在診斷嗜鉻細胞腫瘤中所扮演的角色

¹林昱璵、^{1,2}莊紫翎、¹許幼青、¹廖建國

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

嗜鉻細胞瘤與副神經節瘤是一種分泌兒茶酚胺的神經內分泌腫瘤，為一種罕見疾病，發生率大約每百萬人口有2-8例，源自於腎上腺髓質的嗜鉻細胞及自律神經系統，占次發性高血壓病人的0.1-0.6%。可在任何年齡發生，最常發生在30到50歲，男女的發生頻率相同。主要症狀為腫瘤過度分泌一種或多種兒茶酚胺（正腎上腺素、腎上腺素和多巴胺），約50%嗜鉻細胞瘤患者會出現陣發性頭痛、出汗和心跳加速，持續或陣發性高血壓等症狀。可能合併胰島素抗性、空腹血糖上升、糖尿病碳水化合物代謝異常。當出現高腎上腺素分泌、頑固或難治型高血壓、有家族性症候群、嗜鉻細胞瘤的家族史、偶然發現腎上腺腫瘤且影像學特徵與嗜鉻細胞瘤一致、年輕型（<20歲）高血壓、特發性擴張型心肌病變、發紺型先天性心臟病就要懷疑罹患嗜鉻細胞瘤，通常診斷嗜鉻細胞瘤可使用抽血及核醫I-131 MIBG檢查來確認。

病例報告:

一位45歲男性病人，本身已抽菸20年，胸悶持續一段時間且有出汗、嘔吐、胸痛等症狀，因心源性休克住院，接受氣管插管（ETT）、體外膜氧合（ECMO）及主動脈內氣球幫浦（IABP）治療，電腦斷層掃描後，發現後腹腔有不明腫塊，為進一步確認腫塊的病理狀況，安排核醫I-131-MIBG檢查，經靜脈注射後24小時進行全身顯像與SPECT/CT，影像發現在腹膜後腫塊對MIBG藥物呈現高度攝取，懷疑為MIBG親和性高的兒茶酚胺分泌腫瘤（嗜鉻細胞瘤），之後進行抽血及尿液篩檢，結果發現去甲腎上腺素(Norepinephrine)為220.8 µg/24h（正常值：> 97 µg/24h），腎上腺素(Epinephrine)為121.7 µg/24h（正常值：> 27µg/24h）及香莢杏仁酸定量(Vanillylmandelic Acid)為17.6 mg/24h（正常值為：1-7.5mg/24h），確診為後腹腔副神經節瘤合併嗜鉻細胞瘤，實屬罕見，後續進行手術切除病理確診，持續追蹤治療。

結論:

嗜鉻細胞瘤治療首選為手術完全切除，手術存活率為98-100%，腫瘤切除後高血壓症狀也隨之解除，但1-2周後應追蹤24小時尿液中兒茶酚胺與後腎上腺髓素的含量，避免腫瘤殘存或其他隱匿性轉移病灶。對於嗜鉻細胞瘤的診斷，雖然抽血檢驗可以快速懷疑是否有嗜鉻細胞腫瘤，但在核醫I-131 -MIBG檢查因為嗜鉻細胞瘤與標誌藥物的結合，影像上可以更明顯看到病灶部位對藥物高度攝取，再結合SPECT/CT立體影像定位，能夠更精準的找出腫瘤的位置，對於嗜鉻細胞瘤的診斷，成為不可或缺的檢查工具。

肥厚性骨頭關節病變在全身骨骼掃描的表現

¹李佩璇、¹楊朝瑋

¹澄清綜合醫院中港院區 核子醫學科

背景介紹:

全身骨骼掃描是核醫科應用非常廣泛的檢查項目之一。透過靜脈注射Tc-99m MDP來進行造影。Tc-99m MDP為磷酸鹽類似物，與骨骼中的結晶氫基磷灰石結合。臨床上造成攝取增加的原因，包含骨折、感染、骨轉移和不太常見的骨病等。肥厚性骨頭關節病變 (Hypertrophic Osteoarthropathy, HOA)，是一種以四肢長骨骨膜新生、指趾端杵狀變形、關節腫痛為主要表現的臨床症候群。可分為原發性：罕見，具家族遺傳性、繼發性：常見，與多種疾病相關，尤其是胸腔內疾病。

病例報告:

一名46歲女性患者因右下肺腺癌，於2023年9月接受全身骨骼掃描檢查。在注射Tc-99m MDP (20 mCi) 約3小時後進行影像攝取。掃描結果顯示四肢呈現瀰漫性且縱向的放射性攝取增強，此種骨膜攝取模式呈現典型的「railroad-track」徵象，為HOA的特徵表現。根據文獻，繼發性HOA常與肺癌、肺部感染、慢性阻塞性肺疾病、囊性纖維化及心臟右向左分流等病因相關，其中在肺癌患者中，與肺腺癌的關聯性最為密切。本案例的全身骨骼掃描影像，顯示結果高度符合HOA的診斷。

結論:

理學檢查、放射線學影像以及全身骨骼掃描，皆為HOA之重要診斷工具。於繼發性HOA中，多數病例在原發病灶移除後，其臨床症狀可顯著緩解。值得注意的是，當全身骨骼掃描顯示四肢長骨呈現瀰漫性放射性攝取時，應優先考慮HOA之可能，而非單純解釋為骨轉移。

探討真正全身PET/CT掃描的重要性-3個案例報告

¹李將瑄、¹顏玉安、¹吳麗君

¹奇美醫療財團法人奇美醫院

背景介紹:

標準FDG PET/CT多以軀幹掃描為主，涵蓋顱底至大腿，為半身掃描且雙手上舉會影響頭部影像。雖能涵蓋多數腫瘤常見轉移部位，但可能忽略上肢、下肢與頭部等區域的重要病灶，進而影響癌症分期與治療策略。我們實行"真正"得全身PET/CT掃描從頭到腳包括上肢可涵蓋全身。

病例報告:

2023/5/29-2025/2/21期間，共926位病人，345位女性，581位男性，平均59歲，淋巴瘤佔18.68% (173/926)，頭頸癌31.21% (289/926)，食道癌10.48% (97/926)，肺癌8.32% (77/926)，乳癌11.45%(106/926)，大腸癌7.13% (66/926)，直腸癌3.89% (36/926)，子宮頸癌4.86%(45/926)，黑色素癌1.84% (17/926)，甲狀腺癌2.16%(20/926)。已排除骨關節炎等良性病灶，及中軸骨已有發現(含頭及四肢)後不影響分級及治療以外，有3例為淋巴瘤(2位Diffuse large B-cell lymphoma和1位B-cell chronic lymphocytic leukemia/small lymphocytic lymphoma)，發現在全身正子有上下肢及頭頸部的病灶，佔全數0.3% (3/926)，佔淋巴瘤1.73% (3/173)。

結論:

此三例淋巴瘤病人，均因發現非軀幹病灶，分別在小腿脛骨、頭骨及大腿小腿肌肉有FDG攝取，而由第III期修正為第IV期。真正全身掃描提升了診斷準確性並避免誤治，本院對於第三期及第四期的治療方式不同(用藥種類及次數不同)。真正全身PET/CT掃描能補足軀幹掃描盲點，在分期判讀與治療規劃中具臨床價值，尤其在淋巴瘤中應考慮常規應用。

大腸直腸癌化療引起PSA數值變化的案例

盧永承 許友齡

戴德森醫療財團法人嘉義基督教醫院 核子醫學科

背景介紹:

前列腺特異抗原 (Prostate-specific antigen, PSA) 為目前臨床上最常用於篩檢與追蹤攝護腺癌的重要腫瘤標記物。一般而言，PSA 會受到攝護腺疾病 (如攝護腺癌、良性攝護腺肥大、攝護腺炎) 影響，而隨著疾病進展或治療而變化。雖然 PSA 與攝護腺相關疾病高度相關，但在臨床實務中，仍可能出現與疾病狀態不一致的 PSA 波動，導致醫師對檢驗結果的疑慮。因此，釐清 PSA 變化與臨床治療史之間的關聯，對於臨床判讀及病人管理極為重要。

病例報告:

患者為69歲男性，109年1月因直腸乙狀結腸連接部惡性腫瘤住院治療，住院期間檢測PSA報告為128.0 ng/ml (參考區間0~4.0)，為高度異常值。隨後患者自109年2月起至9月，接受了直腸癌的化學治療，化療結束後PSA值出現了顯著的變化，在同年9/22泌尿外科門診時PSA值為1.01，已恢復至正常參考區間，10/26追蹤報告顯示PSA進一步降至0.72，然而一年後，在110年10月7日開始，PSA值上升至37.10 ng/ml，12/30 PSA值達到76.70，而在111年3月時病人PSA已飆升到614.0。泌尿外科醫師對於PSA先前的劇烈波動向實驗室諮詢，實驗室確認當日品管正常且針對報告做第二次驗證，之後協同科內醫師查詢病史後發現，患者於109年2月至9月間因直腸惡性腫瘤曾接受化學治療，在化療結束後，PSA值顯著下降，並一度恢復至正常範圍，然而，隨著攝護腺惡性腫瘤病情的發展，PSA 再度逐漸上升至高度異常值，檢視其化療前後影像結果，在攝護腺位置其腫瘤的大小也與PSA數值的變化趨勢相符，並將此訊息回饋給臨床，讓臨床醫師對病人能提供更準確的疾病監測與治療。化學療法為全身性治療，使用藥物來破壞癌細胞，以阻止或減緩癌細胞的生長。本案患者在直腸癌化療前PSA值呈現高度異常，化療後PSA值降至正常隨後再飆升，這說明了PSA數值的下降，是化療藥物產生全身性反應的臨床證據。

結論:

現今實驗室大多採用自動化與資訊系統連線傳輸，錯誤報告機率極低，因此當臨床有諮詢檢驗報告時，醫檢師可先確認檢驗前、中、後流程是否有誤，再請科內醫師幫忙查詢病患病史，在檢驗前是否做過治療？服用的藥物是否會干擾檢驗？再配合影像結果做比對，將查詢結果回饋給臨床。本案患者PSA值在直腸癌化療結束後顯著下降，但後續追蹤又持續快速上升，證明PSA值的波動是因化療的全身性治療而改變，也證明了PSA上升與攝護腺腫瘤進展高度相關。因此本案例再次強調跨部門的溝通與整合醫療資訊的重要性，以提供更準確的疾病監測與診斷。

PSMA PET/CT vs NaF PET/CT 在骨轉移偵測之互補性分析：六例病例回顧

¹蔡沛君、¹莊志堅、¹曾能泉、²黃振義、³歐宴泉

¹童綜合醫療社團法人童綜合醫院 核子醫學科

²童綜合醫療社團法人童綜合醫院 影像醫學部

³童綜合醫療社團法人童綜合醫院 泌尿腫瘤中心

背景介紹:

攝護腺癌為男性常見的惡性腫瘤之一，治療後部分患者會出現生化復發 (biochemical recurrence, BCR)，需進一步評估是否存在局部復發或遠端轉移。在評估生化復發時，NCCN指南建議優先考慮PSMA PET。此技術具有極高的靈敏度與特異性，能偵測傳統影像如CT、MRI及骨掃描難以發現的微小轉移病竈。¹⁸F- rhPSMA-7.3為新一代高親和力前列腺特異膜抗原 (PSMA) 配體，具高度特異性與敏感性於偵測攝護腺癌細胞；相較之下，¹⁸F-Sodium Fluoride (NaF)為骨代謝專一性示蹤劑，對骨骼代謝活躍病竈敏感度高。兩者在骨轉移病竈偵測上特性迥異，其互補性與診斷價值值得探討。

材料方法:

本研究回顧六位攝護腺癌患者，接受¹⁸F-NaF PET/CT與¹⁸F- rhPSMA-7.3 PET/CT檢查。分析兩種檢查對骨轉移病竈的偵測情形，以對比劑電腦斷層作為診斷參考(reference test)，偵測並比較其敏感度、特異性及假陽性情況。結合臨床資料及其他影像檢查結果，評估兩種檢查的優劣及互補效果。所有PET/CT檢查皆於同一台GE Discovery MI PET/CT進行，且造影條件以歐洲核醫學學會操作指引建議執行，以確保影像品質及一致性。

結果:

六位患者中，對比劑電腦斷層未偵測出轉移性骨病竈，¹⁸F-NaF PET/CT檢查共偵測出約59處骨骼異常放射性增加病竈，其中疑似轉移病竈32處，良性或需進一步檢查的病竈有27處。¹⁸F- rhPSMA-7.3 PET/CT檢查則偵測出約9處骨轉移病竈，其中多數與¹⁸F-NaF PET/CT檢查所見重疊，但部分非骨骼病竈僅由¹⁸F- rhPSMA-7.3 PET/CT檢查呈現。兩者結果顯示¹⁸F-NaF PET/CT檢查骨轉移病竈敏感度高，¹⁸F- rhPSMA-7.3 PET/CT檢查則具較佳特異性，有助區分骨轉移真實病竈與良性病變。這兩種檢查互補使用，能提升骨轉移偵測的準確度及臨床判斷力。

結論:

本研究顯示¹⁸F- rhPSMA-7.3 PET/CT與¹⁸F-NaF PET/CT檢查在偵測攝護腺癌骨轉移方面各有優勢且具互補性。¹⁸F-NaF PET/CT檢查對骨骼代謝活躍病竈敏感度高，但因其標記的是骨骼新陳代謝，可能因退化性病變或創傷等非惡性病竈造成假陽性。相較之下，¹⁸F- rhPSMA-7.3 PET/CT檢查是針對攝護腺癌細胞表面的攝護腺特異性膜抗原進行標記，因而具有較高的**特異性**，能更準確辨識真實癌症轉移病竈，減少假陽性結果。建議臨床上可依照病人情況，選擇合適的 PET/CT 檢查，或兩者結合應用，以提高骨轉移偵測的準確度及臨床治療決策調整。

探討電腦斷層攝影檢查使用之含碘對比劑對核子醫學腎絲球過濾率測定的影響

¹童惠珊、¹莊志堅、¹曾能泉

¹童綜合醫療社團法人童綜合醫院 核子醫學科

背景介紹:

含碘對比劑常用於放射診斷部門之電腦斷層 (CT) 檢查以提升影像品質。然而，對比劑可能因每個人的腎臟代謝速率不同而暫時滯留於腎盂，需一段時間方能完全排泄。本研究旨在探討患者於接受含碘對比劑CT檢查後，若在短時間內即進行核子醫學腎絲球過濾率 (GFR) 測定，是否會影響檢查結果之準確性。

病例報告:

一名46歲女性個案於2018、2022與2025年共三次皆於同日接受電腦斷層檢查(施打OMNIPAQUE對比劑 90ml)與核子醫學科GFR測定(Tc-99m DTPA 6mCi)。兩檢查間時間分別為2018年與2025年的相距5-6小時，惟2022年的檢查相距少於1小時。核醫GFR測值分別為85.93 ml/min/1.73m² (2018年)、74.00 ml/min/1.73m² (2022年)及82.58 ml/min/1.73m² (2025年)。核醫檢查前一個月之血液檢測eGFR值分別為106.0 ml/min/1.73m²(2018年)、116.0 ml/min/1.73m² (2022年)與104.8 (2025年) ml/min/1.73m²。三次核醫GFR測值與抽血eGFR 數值相比各減少20.07(2018年)、42(2022年)與22.22 (2025年)，2018與2025年的GFR數值差異相對較小，2022年則差異較大。

結論:

依本研究結果說明，2018年及2025年於含碘對比劑之電腦斷層檢查後5-6小時進行的核醫GFR測定結果，與血液檢測數值相近；惟2022年在間隔時間不足1小時的情況下，GFR差距較大。此結果顯示，不排除在含碘對比劑未完全經腎臟排泄前進行核醫GFR測定的話，可能導致腎功能被低估。因此，建議此兩種檢查間隔須至少達5小時，以降低含碘對比劑殘留對檢測準確度的影響，並在臨床解讀結果時納入檢查時間間隔之考量，但因此篇報告為單一個案，於臨床表現上是否存在統計學意義仍須審慎考量。

非預期性正子重大當機案件之改善措施

¹²龔瑞英、¹陳耀文、¹林宜瀟、²張振榮、^{12*}蔡世傳

¹臺中榮民總醫院 核子醫學科
²中臺科技大學 醫學影像暨放射科學系
*指導作者

背景介紹:

正子造影設備價格高昂，多數單位僅配置一台，病人需依預約時間接受檢查並給予輻射藥物。由於藥物具時間衰減特性，若設備因故無法運作，院內備援機制常只能轉送至他院或另行安排檢查時間，造成診療延誤與病人不便。本研究回顧過往除了儀器零件故障以外之非預期性重大當機事件，分析原因並提出改善措施。

材料方法:

回溯2020年正子造影設備 (Philips Vereos) 安裝至今所有不符合事件及維修工單，統計故障案例，排除了儀器零件故障以外，若事件導致停機並影響檢查排程則納入分析，並進一步探討重大故障原因。

結果:

2020年至2025年間共發生三件重大停機當機事件，包含(1)單項檢查英文名稱長度超過儀器上限、(2)受檢者姓名人工輸入錯誤、(3)受檢者生理資訊錯置後更正錯誤，造成儀器資料庫異常，停機時間4小時，共20位病人重新執行檢查。針對上述問題導入改善措施：(1)盤點與統整所有開單項目，修正超過儀器上限之欄位；(2)檢查排程線上化，設備自動撈取受檢者資料，並分時段建立獨立清單；(3)病人檢查完成後進行影像確認，若出現影像異常，立即重新造影，如儀器故障且工程師判定資料庫出現異常現象時，立即啟動設備備援機制，透過備援設備執行造影檢查。三案均已進行後續追蹤，未再發生相同問題。

結論:

透過系統化改善措施與流程修正，可有效降低正子造影設備重大當機事件的再發率，提升異常處置效率與病人就醫安全。

心肌灌注掃描檢查意外發現肺腫瘤活性吸收

¹朱秀蘭、²游慧貞

¹高雄醫學大學附設中和紀念醫院 核子醫學部

²高雄醫學大學附設中和紀念醫院 影像醫學部

背景介紹:

心肌灌注掃描是一種核子醫學檢查，用於評估心臟肌肉的血液供應狀況及冠狀動脈疾病之診斷。檢查過程包括壓力相及休息相兩個階段，患者需先注射放射性同位素（如TL-201或TC-99MIBI），然後進行單光子電腦斷層掃描（SPECT）。因TL-201類似鉀離子，會經由 $\text{Na}^+/\text{K}^+\text{ATPase}$ system主動運輸之機轉進入心肌細胞內，TL-201被心肌細胞攝取比例和血流量成正比，便可反應冠狀動脈血流供應量。TL-201不僅可以用於心肌灌注掃描檢查，也可以做為癌症追蹤檢查放射藥劑，因TL-201也可經由 $\text{Na}^+/\text{K}^+\text{ATPase}$ system聚集在代謝旺盛的腫瘤細胞，可以做腫瘤造影，臨床上常使用在腫瘤分期、決定 biopsy 的位置、治療後評估療效等。其適應症為甲狀腺癌、腦瘤、骨骼軟組織腫瘤、肺癌、頭頸部癌等癌症。

病例報告:

本次案例為84歲男性心臟病患者，於2023年11月進行心肌灌注掃描檢查時，發現在右上肺葉部有TL-201活性異常吸收，經檢視患者病史發現其過往曾患直腸癌且已治療，此後有呼吸窘迫之症狀。查核患者於2023年2月透過CT檢查亦曾發現右上肺葉部有2公分的腫塊，同年5月再做CT檢查追蹤時，發現腫塊成長為2.4公分。因患者腎臟功能差，兩次CT檢查皆未打顯影劑，無病理檢查報告，故無法確定其為良性或惡性腫瘤。截至2025年1月並未有進一步檢查或處理腫瘤紀錄。

結論:

TL-201憑藉其 $\text{Na}^+/\text{K}^+\text{ATPase}$ system親和性，不僅適用於心肌灌注評估，更可透過聚積於代謝活躍腫瘤細胞進行癌症造影，在甲狀腺癌、腦瘤等多種惡性腫瘤的分期、定位及療效評估中具有重要臨床價值。

iPTH有清洗與無清洗兩種方法檢驗結果之初步比較

¹張素雲、¹黃筱嵐、¹沈宜瑾、¹廖建國、^{1,2}莊紫翎

¹佛教慈濟醫療財團法人大林慈濟醫院 核子醫學科

²慈濟學校財團法人慈濟大學 醫學系

背景介紹:

完整副甲狀腺素 (intact parathyroid hormone; iPTH) 在體內的主要功能是調節血鈣濃度。當血鈣濃度降低時，iPTH 會被分泌，促使骨骼釋放鈣質，並減少腎臟對磷的重吸收，以維持血鈣平衡。因此，iPTH 對洗腎患者是一項非常重要的監測檢驗。iPTH 檢驗的標準操作方法為：第一次培育後吸乾，無須清洗即可直接加入碘-125 標化抗體。然而，在日常實驗室作業中，曾發生同仁誤多做了一次清洗步驟的情況。為了解此額外步驟是否會對檢驗結果造成影響，本研究設計比較「有清洗」與「無清洗」兩種方法的檢測結果差異，並評估其是否落於允收範圍內。本研究選取 11 支病人檢體，作為初步比較樣本，涵蓋正常值與高低值檢體，以便觀察不同濃度範圍下的結果差異。雖然樣本數有限，但可先提供趨勢性資料，協助判斷清洗步驟對結果的影響，並作為後續是否需進一步擴大樣本數驗證的依據。

材料方法:

相同病人檢體，使用試劑(Beckman Coulter/Immunotech IRMA iPTH)進行檢測，第一組依原廠試劑說明書進行操作。第二組於步驟2將吸乾步驟更改為2ml iPTH緩衝液洗兩次(表1)，其他步驟不變，均使用同一伽瑪計數器進行計數。獲得兩組檢驗結果後，再使用Excel軟體計算第一與第二組檢測值結果之差異(%), 並依此項目內部品管之 ± 2 倍CV值判定差異是否可接受。

結果:

本研究共測試 11 支病人檢體，以評估有清洗與無清洗兩種方法之檢測結果是否一致。雖然樣本數不大，但先作為初步比較分析，可觀察清洗步驟對結果的潛在影響。11支檢體中，有7支檢體檢驗值高於正常參考上限 (>64.87 pg/mL)，另4支檢體位於正常參考範圍內 ($6.87-64.87$ pg/mL)，涵蓋部分低值與高值樣本。分析結果顯示，兩種方法在 10 支檢體中差異皆落於 ± 2 倍 CV 允收範圍內 (90.9%)，僅檢體編號 11 之差異超過允收標準。

進一步檢視差異方向，發現多清洗步驟後的檢測值大多呈現輕微降低趨勢，偏差幅度似與原始濃度有一定關聯：高濃度樣本的百分比差異相對較小，而低濃度樣本的變化較明顯。超出允收範圍的檢體屬於低濃度區間，且偏差為「偏低」，顯示在低值檢體中清洗步驟可能造成檢測值被低估，導致潛在的臨床判讀誤差。整體而言，雖然多清洗步驟對大部分樣本影響不大，但由於仍有部分檢體結果不可接受，加上額外清洗會增加操作時間且不符合標準流程，因此不建議將其納入常規操作。

結論:

初步比較結果顯示，有清洗與無清洗兩種方法的 iPTH 檢驗結果，並非所有檢體的差異都在允收範圍內，尤其低濃度檢體更容易出現偏差且呈現偏低的傾向。本研究雖僅納入 11 支檢體 (含正常值與高值檢體)，仍能觀察到多清洗步驟對檢驗結果可能造成系統性影響。由於多數檢體差異可接受，但仍有一例超出允收範圍，加上額外清洗會增加操作時間並偏離原廠標準流程，故不建議在常規操作中加入此步驟。若未來欲探討高中低值差異，建議應擴大樣本數並涵蓋不同濃度區間，評估偏差方向及幅度是否一致，並以統計方法確認其結果仍在可接受的變異範圍內，方能確保檢驗品質與臨床解讀的可靠性。

使用FDG PET/CT在惡性胸膜間皮瘤上的診斷-案例分析

¹曾柏銘,³姚維仁²沈淑禎,²呂建璋,¹門朝陽,²林雅婷,
¹天主教中華聖母修女會醫療財團法人天主教聖馬爾定醫院正子造影中心
²天主教中華聖母修女會醫療財團法人天主教聖馬爾定醫院核子醫學科
³戴德森醫療財團法人嘉義基督教醫院核子醫學科

背景介紹:

FDG PET/CT 正逐漸成為評估胸膜腫瘤的重要工具，並已在惡性胸膜間皮瘤的診斷與分期中確立其臨床角色。同時，它在治療計劃的制定、治療反應的監測以及患者預後的評估方面展現出顯著潛力。此檢查模式在鑑別其他原發性胸膜腫瘤及胸膜轉移病灶時亦具有明顯優勢。整體而言，FDG PET/CT 在多數人類實體腫瘤的臨床管理中皆扮演關鍵角色，不僅能協助區分胸膜病灶的良惡性、原發或轉移、局部或播散，亦能為臨床提供預後資訊與治療成效的評估依據。

病例報告:

一名具有糖尿病及高血壓病史並接受長期藥物治療的患者，因出現呼吸困難至胸腔內科門診就診。臨床檢查時，於右側胸腔聽診發現呼吸音減弱，懷疑為肋膜積水，因而進行針吸術。細胞學檢查（2025/03/13）顯示間皮細胞增生並伴隨異型性。後續胸部電腦斷層檢查（2025/03/20）確認右側肋膜積液，但未見明顯腫瘤。由於患者持續呼吸困難，遂收住院並安排右側胸腔鏡檢查。胸腔鏡下取得之肋膜切片(biopsy)經病理學檢查確診為惡性胸膜間皮瘤。FDG PET/CT影像根據AJCC第8版TNM分期，這名患者的腫瘤總厚度為4公分，屬於T3N0M0期。然而，由於僅進行了切片檢查，因此無法提供病理的TNM分期。而在進一步的正子造影（PET/CT）檢查影像顯示，患者的右側胸腔內側及外側都有明顯的FDG聚集，SUVmax在早期與延遲期分別達到7.35與10.36

結論:

惡性胸膜間皮瘤是一種高度侵襲性且預後不良的腫瘤。影像學上，FDG PET/CT 已被證實在區分良性與惡性肋膜增厚方面具有重要價值。其所提供的功能性資訊可補充傳統影像對於肋膜腫瘤的侷限，協助診斷惡性胸膜間皮瘤，以及區分良惡性的孤立性纖維瘤、脂肪瘤與脂肪肉瘤。在臨床管理上，FDG PET/CT 已逐漸成為不可或缺的工具。雖然 SUVmax 在預後評估上的結果仍有爭議，但代謝腫瘤體積（Metabolic Tumor Volume, MTV）與全腫瘤糖解量（Total Lesion Glycolysis, TLG）已被證實在惡性胸膜間皮瘤的分期、治療反應監測與預後評估中具有實質的臨床應用價值。

個案報告：核醫腸胃道出血檢查發現大腸癌病例

¹張添信、¹陳慶元

¹佛教慈濟醫療財團法人台中慈濟醫院 核子醫學科

背景介紹:

腸胃道出血是臨床常見且潛在危險的症狀，尤其在老年患者中，準確找出出血源對選擇治療方案與改善預後至關重要。核醫腸胃道出血掃描 (Gastrointestinal Bleeding Scintigraphy, GIBS) 利用放射性標記紅血球，可動態追蹤出血位置，對持續性或原因不明的出血具有高度敏感性，當放射性藥物攝取區域固定且不隨腸蠕動移動時，除考慮持續性出血，也應警覺可能存在腫瘤等病理變化。

病例報告:

本案患者為81歲女性，主訴糞便顏色呈暗紅色並伴隨慢性貧血，因症狀持續而就醫並入院接受進一步評估，首次進行核醫腸胃道出血掃描，結果顯示升結腸遠端一處放射性藥物攝取區域明顯且固定，未發現明顯移動跡象，提示該處可能有持續局部的血流增加，若固定不動的聚積可能如腫瘤或者尿液活性汙染等等...

隨後進行腹部電腦斷層掃描，發現同一位置存在一個腫瘤性病灶，與核醫攝取位置吻合，進一步安排大腸內視鏡檢查，發現該部位有明顯腫瘤樣病變，進一步切片組織病理報告顯示為分化不良大腸腺癌，免疫組織化學染色結果支持該診斷，患者隨後接受相關治療與追蹤。

結論:

本病例強調核醫腸胃道出血掃描在定位出血源的關鍵角色，判定出血源通常是血管外出現訊號，並且會隨時間移動(「流」血)，但當尤其藥物攝取區域固定不移時，應高度懷疑腫瘤性病變，結合電腦斷層影像及內視鏡檢能有效協助早期診斷大腸癌，有助於臨床醫師制定更適切的治療方案，面對年長患者反覆腸道出血時，積極多角度診斷有助於早期發現惡性病變，提升治療成效與患者生活品質。

核醫心肌血流灌注中的射出分率與冠狀動脈疾病的關聯性探討

¹張添信、¹陳慶元

¹佛教慈濟醫療財團法人台中慈濟醫院 核子醫學科

背景介紹:

心肌灌注顯像 (Myocardial Perfusion Imaging, (MPI)) 除了用於偵測心肌缺血與梗塞外，左心室射出分率 (Ejection Fraction, (EF)) 也是臨床常用的心臟功能參數，依過去文獻指出，低EF與冠狀動脈疾病 (Coronary Artery Disease, (CAD)) 有較高的相關性，但EF偏高時是否能排除CAD風險，仍缺乏系統性研究，本研究旨在探討TI-201 MPI檢查所得之 EF與CAD (以心導管的心臟血管攝影為黃金標準答案) 之相關性，並嘗試評估EF作為CAD預測因子的診斷效能。

材料方法:

本研究回溯性收案1272名接受 MPI 檢查之病人，納入條件為：於MPI後180天內接受心導管檢查 (coronary angiography (CAG))，且無急性心肌梗塞或冠狀動脈支架病史，最終共收入167人符合條件 (男性 127 人)，平均年齡 66.3 ± 10.3 歲，MPI使用 TI-201，並紀錄 EF值，CAD定義為CAG顯示主要血管狹窄 $\geq 70\%$ ，統計方法包括獨立樣本 t 檢定、ROC曲線及多變項邏輯斯回歸，調整年齡、性別、糖尿病、高血壓、高血脂與吸菸。

結果:

CAD組之EF顯著低於非CAD組 ($p=0.048$)，ROC分析顯示EF對CAD 的AUC 為0.6，診斷效能有限。最佳截點約在EF 67–68%，敏感度 61%、特異度約51%，邏輯斯回歸顯示EF與CAD呈負相關 ($OR=0.971$ ， $p=0.024$)，男性 ($OR=3.24$ ， $p=0.006$) 與糖尿病 ($OR=2.79$ ， $p=0.006$) 為獨立危險因子。

結論:

MPI測得之EF與CAD之間呈現負相關，但單獨作為診斷工具的效能有限，將EF與臨床危險因子 (如性別與糖尿病) 結合，或可提升CAD的鑑別診斷風險能力，建議EF應作為輔助性而非單獨的預測指標。

Radioiodine Uptake in the Post-therapy Images Mimicking Pelvis Metastasis of Thyroid Cancer: A Case Report

Tsu-Kang Chen, Yen-Hsiang Chang

Department of Nuclear Medicine, Kaohsiung Chang-Gung Memorial Hospital, Kaohsiung, Taiwan

Introduction:

For patients with ATA low-risk differentiated thyroid cancer, radioiodine is commonly administered after total thyroidectomy to ablate residual thyroid tissue and to provide post-therapy whole-body imaging. Although pelvic radioiodine uptake on post-therapy scans often raises concern for metastatic disease, benign etiologies may also account for such findings, potentially leading to false-positive interpretations.

Case Report:

A 26-year-old female patient, with a past history of right lobectomy performed at another hospital for minimally invasive follicular thyroid carcinoma (pT2Nx, stage I), was referred to our institution for further management due to elevation of thyroglobulin (Tg) levels. Completion thyroidectomy was performed at our hospital, followed by administration of 30 mCi of radioiodine for remnant ablation and post-therapy whole-body imaging. The scan demonstrated focal uptake in the thyroid remnant and an additional focus in the pelvis. Pelvic SPECT/CT localized the uptake to a mass lesion adjacent to the uterus. The stimulated Tg was 33.5 ng/mL. Gynecologic evaluation with trans-abdominal ultrasonography revealed a right adnexal heterogeneous mass with an absence of vascular flow on color Doppler imaging, favoring the diagnosis of a teratoma.

Conclusions:

Pelvic radioiodine uptake should not be assumed to represent metastatic disease, as benign causes, such as ovarian teratoma, may produce false-positive findings. Hybrid imaging with SPECT/CT plays an important role in precisely localizing radioiodine uptake, differentiating physiological or benign lesions from true metastasis. Careful integration of clinical history, imaging modalities, and biochemical data is essential for accurate interpretation and to avoid misdiagnosis.

The value of Tc99mMAA pulmonary perfusion/Tc99m DTPA aerosol ventilation scintigraphy in diagnosis of pediatric lung/heart disease: retrospect review in uni center hospital.

Yu Wen Chen^{1,3}, Zen Kong Dai^{2,3}.

Department of Nuclear Medicine¹, Division of cardiopulmonary section, Department of Pediatric², Kaohsiung medical university hospital; School of medicine³, Kaohsiung medical university, Kaohsiung, Taiwan.

Introduction:

Tc99mMAA pulmonary perfusion scintigraphy is a unique imaging to disclose the pre capillary lung flow reserve reality. In most of pediatric lung/heart, eg asthma or congenital heart disease, etc, Tc99mMAA pulmonary perfusion scintigraphy is an essential imaging modality, except CXR and XCT. In this article, we will review Tc99mMAA pulmonary perfusion and/or Tc99m DTPA aerosol ventilation scintigraphy application in pediatric lung/heart disease in the past five years in uni center hospital (KMUH, Taiwan).

Materials and Methods:

During 2000 to 2024, we collected 22 pediatric patients (M/F 16/6; 0-20year-old), most of them had history of variation of asthma, OB (obliterative bronchiolitis), pulmonary hypertension and congenital heart disease(ASD, VSD and great vessel transition etc.). All of them received pulmonary perfusion scintigraphy, which flow dynamic, eight-view planar imaging and SPECT were acquired after 2-4 mCi Tc99mMAA intravenous injection. Optionally, Tc99m DTPA aerosol ventilation scintigraphy is suggested for elder school-age children. Before what perfusion scan, eight-view planar imaging were acquired while 20-25mCi Tc99m DTPA aerosol inhalation.

Results:

We divide patients with two groups indication: lung (16 cases) and heart (6 cases) disease. In lung disease group: VQ match reduction/ defects (hypoxia induced vascular constriction) and incidentally airway stenosis, eg. Congenital cystic adenomatoid malformation (CCAM) in various asthma are detected. In heart disease group: VQ mismatch reduction/ defects and highly sensitive shunt detection are interpreted. Indeed, certain medical treatment strategy is became different, eg. in case of CCAM and OB.

Conclusions:

Tc99m MAA pulmonary perfusion and/or Tc99m DTPA aerosol ventilation scintigraphy imaging modalities provide micro environments of VQ mismatch/match reduction while pediatric lung/heart disease pathological progression. However, pediatric radiation safety is promised.

Comparison of Whole-Body ^{18}F -FDG PET/CT and Tc-99m MDP Bone Scintigraphy in Detecting Bone Metastases and Evaluating Treatment Response in Nasopharyngeal Carcinoma Patients

¹Chang-Ching Yu, ²Chien-Yi Ding, ³Hueisch-Jy Ding

¹Department of Nuclear Medicine, Kaohsiung Veterans General Hospital, Taiwan

²Department of Medical Imaging and Radiological Science, Chung Shan Medical University, Taiwan

³Department of Medicine Imaging and Radiological Science, I-Shou University, Taiwan

Introduction:

This study systematically evaluates and compares the diagnostic performance of ^{18}F -fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F -FDG PET/CT) and technetium-99m methylenediphosphonate bone scintigraphy (Tc-99m MDP BS) in detecting bone metastases among nasopharyngeal carcinoma (NPC) patients, with additional analysis of their clinical utility in therapeutic response assessment.

Materials and Methods:

This retrospective study comprehensively evaluated 45 pathologically confirmed nasopharyngeal carcinoma (NPC) patients with clinically suspected bone metastases, recruited between January 2020 and December 2024 at our medical center. All participants underwent dual-modality imaging within a standardized 30-day window: whole-body ^{18}F -FDG PET/CT and Tc-99m MDP BS. The diagnostic reference standard was established through a multi-tiered approach, incorporating either histopathological confirmation (when available) or a combination of cross-sectional imaging (MRI/CT) with longitudinal clinical/imaging follow-up exceeding 12 months to ensure diagnostic certainty. Both lesion-based and patient-level analyses were systematically performed to evaluate diagnostic concordance. Quantitative assessment included calculation of core diagnostic performance metrics - sensitivity, specificity, diagnostic accuracy, and area under the receiver operating characteristic curve (AUC) - with comprehensive statistical comparison between modalities using McNemar's test for paired categorical data and Chi-square analysis for independent comparisons, all performed with 95% confidence intervals.

Results:

The analysis of 208 bone lesions (136 metastatic, 72 benign) demonstrated that ^{18}F -FDG PET/CT significantly outperformed Tc-99m MDP BS in diagnostic accuracy (95.2% vs 76.0%), sensitivity (96.3% vs. 94.1%), specificity (93.1% vs 43.1%); and AUC for PET/CT was 0.97 (95% CI: 0.94–0.99; $p < 0.001$) versus 0.81 for BS (95% CI: 0.75–0.87; $p < 0.001$). At the patient level, PET/CT correctly classified 93.3% of cases (42/45) versus 77.8% for BS, with markedly improved specificity (88.9% vs 33.3%, $p < 0.01$), positive predictive value (94.7% vs 75.0%, $p < 0.01$) and sensitivity (97.1% vs. 94.3%, $p = 0.56$). Notably, PET/CT enabled earlier detection of metabolic changes in osteolytic lesions during treatment response monitoring, establishing its clinical superiority for both initial diagnosis and therapeutic assessment in NPC patients. The consistent performance across lesion- and patient-level analyses strongly supports PET/CT as the preferred modality for comprehensive bone metastasis evaluation.

Conclusions:

^{18}F -FDG PET/CT demonstrates superior diagnostic performance over Tc-99m MDP BS for bone metastasis detection in NPC, with significantly higher accuracy, specificity and accuracy in lesion-based analyses. Its metabolic imaging capability enables earlier treatment response assessment. Aligning with NCCN guidelines, we recommend ^{18}F -FDG PET/CT as the preferred modality for initial staging and therapy evaluation in NPC patients requiring high diagnostic certainty.

Sacral Metastasis Mimicking Facet Osteoarthritis on Tc-99m MDP Bone Scintigraphy

Dallas Yew

Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan

Introduction:

A case of right breast cancer with upper sacrum bone metastasis, where bilateral lumbar uptake on Tc-99m methylene diphosphonate (MDP) bone scintigraphy closely resembled facet joint osteoarthritis, posing a risk for misdiagnosis during image interpretation.

Case Report:

A 43-year-old woman with right breast invasive carcinoma presented to our hospital for further evaluation and oncologic work-up. Planar Tc-99m MDP bone scintigraphy demonstrated mildly increased tracer uptake in the bilateral L5/S1 facet joints region, initially suggestive of degenerative osteoarthritis. However, SPECT/CT (single photon emission computed tomography/computed tomography) revealed it to be bilateral peripheral increased uptake surrounding a photopenic osteolytic lesion in the upper sacrum, findings consistent with bone metastasis.

Conclusions:

Tc-99m MDP bone scintigraphy is a widely utilized imaging modality, particularly valuable for detecting and monitoring malignancies with a high propensity for osseous metastases, such as breast cancer. Metastatic bone involvement typically manifests as focal areas of increased radiotracer uptake. In the spine, metastatic lesions often localize to the vertebral bodies and pedicles, while increased uptake in the facet joints is more commonly associated with degenerative osteoarthritis. However, as illustrated in this case, metastatic disease can closely mimic benign degenerative changes on planar scintigraphy, potentially leading to diagnostic confusion. This underscores the importance of incorporating hybrid imaging techniques, such as SPECT/CT, which offer both functional and anatomical information, and of correlating imaging findings with the patient's clinical history and symptoms to ensure accurate interpretation.

Conclusions:

This case highlights the potential for metastatic lesions to mimic benign degenerative changes on planar bone scintigraphy. Accurate diagnosis requires careful correlation with clinical context and the use of hybrid imaging such as SPECT/CT to distinguish malignant from benign findings.

Tc-99m-Labeled Red Blood Cell Scintigraphy for Assessing Transarterial Embolization of Renal Hemorrhage

Dallas Shun-Yu Yew

Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan

Introduction:

A case of left renal hemorrhage treated with transarterial embolization (TAE). A Tc-99m-labeled red blood cell scan (Tc-99m RBC scan) was performed to evaluate the effectiveness of the embolization and to detect any residual active bleeding.

Case Report:

A 32-year-old man presented with acute left renal injury, severe back pain, and anemia. Ultrasonography revealed an enlarged left kidney, and a biopsy confirmed a perirenal hematoma. Contrast-enhanced CT demonstrated active contrast extravasation within the left kidney, indicating ongoing hemorrhage, for which TAE was performed. However, due to persistent perirenal hematoma and continued anemia, residual active bleeding could not be ruled out. A Tc-99m RBC scan was subsequently performed, revealing blood accumulation in the left perirenal space but with no tracer activity. These findings suggested an old hematoma without active bleeding, confirming the embolization was successful. Follow-up hemoglobin levels stabilized, and the patient was safely discharged.

TAE is a safe and effective technique for controlling active organ bleeding, including renal hemorrhage. However, even after successful embolization, residual hematomas can persist and may obscure ongoing bleeding. Tc-99m RBC scintigraphy—commonly used for non-invasive evaluation of gastrointestinal (GI) bleeding—may also play a valuable role in this context by assessing the effectiveness of TAE and detecting any residual active or recurrent bleeding.

Conclusions:

Tc-99m RBC scintigraphy may offer a convenient, non-invasive method for assessing hemorrhage resolution within the abdominal cavity, including renal bleeding.

A False-Negative Tc-99m Bone Scintigraphy in the Presence of Diffuse Skeletal Metastases

Dallas Yew

Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan

Introduction:

A case of right breast cancer with extensive bone metastases. However, the Tc-99m methylene diphosphonate (MDP) bone scintigraphy yielded a false-negative result due to the diffuse and symmetric distribution of metastases throughout the skeleton.

Case Report:

A 49-year-old woman was diagnosed with invasive lobular carcinoma of the right breast. Tc-99m MDP bone scintigraphy demonstrated diffusely homogeneous tracer uptake throughout the skeleton, and also fair tracer activity in the bilateral kidney. However, CT scan revealed multiple mixed osteoblastic and osteolytic metastatic lesions involving the spine, as well as the thoracic and pelvic skeleton. Therefore, the diffuse and symmetric uptake pattern on bone scintigraphy was not physiological, and in fact disseminated bone metastases.

Tc-99m MDP bone scintigraphy is a widely utilized imaging modality, particularly for the detection and follow-up of malignancies with a high propensity for bone metastasis, including breast, prostate, and lung cancers. Neoplastic bone involvement typically appears as focal areas of increased radiotracer uptake. In cases of extensive and symmetrically distributed disease, a so-called “superscan” pattern may be observed, which can mimic physiological uptake and lead to diagnostic uncertainty. Superscans are usually characterized by faint or absent renal activity; however, in rare instances such as the present case, renal uptake may still be preserved. In such scenarios, careful correlation with cross-sectional imaging, clinical history, and presenting symptoms is essential for accurate interpretation.

Conclusions:

Diffuse and symmetric bone metastases can result in false-negative findings on Tc-99m MDP bone scintigraphy. This underscores the importance of correlating bone scan results with other imaging modalities and clinical presentation, rather than relying solely on scintigraphy for diagnosis.

Establishing a Cross-Regional CCC Evaluation System for Nuclear Medicine in Taiwan

¹² Hui-Ping Chen, ¹³⁴ Jui-Yin Kung, ¹⁵ Bang-Hong Yang, ¹⁶ Kao Yin Tu

¹ Taiwan Association of Medical Radiation Technologists (TAMRT)

² Department of Nuclear Medicine, Taitung Christian Hospital, Taitung, Taiwan

³ Department of Nuclear Medicine, Taichung Veterans General Hospital, Taichung, Taiwan

⁴ Department of Medical Imaging and Radiological Science, Central Taiwan University of Science and Technology, Taichung, Taiwan

⁵ Department of Nuclear Medicine, Taipei Veterans General Hospital, Taipei, Taiwan

⁶ Department of Nuclear Medicine, Mackay Memorial Hospital, Taipei, Taiwan

Introduction:

In Taiwan, radiological technologists collaboratively developed competency-based medical education (CBME) assessment tools through national consensus. A pilot program was launched in 2022, applying these tools to both Post-Graduate Year (PGY) and Under-Graduate Year (UGY) training. Concurrently, an advanced practice framework was introduced, requiring each institution to establish a Clinical Competency Committee (CCC) to evaluate learner progress and provide guidance. However, many small nuclear medicine departments lack sufficient personnel to form their own CCC. This study aimed to establish a cross-regional CCC model to support competency assessments in the nuclear medicine field.

Materials and Methods:

TAMRT organizes annual training programs for clinical educators. A CCC-specific training session was held on December 21, 2024, leading to the establishment of a regional CCC system divided into four areas: North, Central, South, and East. This system supports consensus-based evaluations of CBME trainee progression and technologist advancement applications.

Results:

A total of 64 educators completed CBME training, with 17 certified in CCC evaluation (accounting for 26.6% of seed educators). The CCC system consists of 16 evaluators-6 from the North, 4 from the Central, 5 from the South, and 1 from the East-including 3 chief conveners and 13 regional reviewers. Quarterly meetings are planned. From December 2024 to June 2025, two meetings were held to review 8 advancement cases. Seven cases were approved after revision (87.5% approval rate), and one withdrawn due to incomplete documentation.

Conclusions:

Through structured faculty development and national collaboration, a cross-regional CCC evaluation system for nuclear medicine in Taiwan was successfully implemented and has effectively completed its initial assessments of technologist advancement cases.

Integrating AI-Assisted Poster Creation into Radiological Technology Internships

¹²Jui-Yin Kung, ¹Chi-Wei Chang, ²Chen-Jung Chang, ¹²Shih-Chuan Tsai

¹Department of Nuclear Medicine, Taichung Veterans General Hospital, Taichung, Taiwan

² Department of Medical Imaging and Radiological Science, Central Taiwan University of Science and Technology, Taichung, Taiwan

Introduction:

Radiological technology students rarely receive formal training in academic poster design during their education. To bridge the gap between clinical training and future professional needs, this study introduced AI-assisted health education poster creation during internships.

Materials and Methods:

From July to December 2024, a total of 20 interns participated. After preliminary instruction on poster design principles and AI tool usage, students independently created health education posters using a combination of five text-based and six image-based AI tools, along with PowerPoint and Canva. A poster exhibition was held at the end of the internship, accompanied by peer sharing and a satisfaction survey.

Results:

Results showed that over 70% of students had no prior experience in poster making, and 20% had never used AI tools. Despite this, all students successfully completed their posters through guided collaboration. The average satisfaction score for the AI-assisted course was 8.2 out of 10. Qualitative feedback revealed that students found the experience novel and valuable. Several students appreciated the opportunity to explore AI applications for the first time, while others recommended incorporating more templates or sample designs in the introductory phase.

Conclusions:

This study demonstrates that integrating AI tools into internship training can enhance students' digital literacy, creativity, and academic communication skills. The experience helped students better prepare for future roles in both clinical practice and professional academic engagement.

Colon Transit Study

¹Wen-Wen Cheng, ²Kao-Yin Tu
Department of Nuclear Medicine, MacKay Memorial Hospital
¹Tamsui branch
²Taipei headquarters

Introduction:

Constipation is one of the common modern diseases today. Distinguishing between primary and secondary (organic) constipation is essential for appropriate treatment. In 1999, Dylan Bartholomeuse et al. conducted a comparative study of Ga-67 and In-111, finding that the results of both were very similar. This is good news for Nuclear Medicine in Taiwan, as Ga-67 is more accessible and cheaper than In-111. Therefore, the evaluation metrics of our department also refer to the conclusions of this study.

Materials and Methods:

Our clinical procedure involves patients ingesting 300 c.c. of water or orange juice mixed with 1 mCi Ga-67, followed by imaging at 6, 24, 48, and 72 hours. Reviewing patients from 2020 to 2025, there were a total of 40 patients who underwent colon transit study in our department, ranging in age from 20 to 73 years (with an average age of 44.3 years).

Results:

Among them, 15 were normal patients with an average half-clearance time of 21.72 hours, and 24 were abnormal patients with an average half-clearance time of 88.25 hours. Additionally, one patient was unable to complete the scan for personal reasons. Imaging from normal patients showed the activity of the isotope in the colon: the ascending colon (A) became visible at 6 hours and had almost no radioactive residue after 72 hours; the transverse colon (T) and descending colon (D) were visible around 24 to 48 hours; and the sigmoid colon (S) and rectum (R) were visible from 24 to 72 hours.

Conclusions:

Nuclear medicine offers significant advantages in the diagnosis of constipation, providing clinicians with critical functional information that enables more accurate identification of the underlying causes and the development of appropriate treatment strategies.

Establishing a Low-Cost Mini PACS System for Nuclear Medicine Department by Combining Commercial NAS and Open-Source PACS

¹Chih-Wei Chang, ¹²Jui-Yin Kung, ¹Yao-Wen Chen, ¹²Shih-Chuan Tsai

¹Department of Nuclear Medicine, Taichung Veterans General Hospital, Taichung, Taiwan

²Department of Medical Imaging and Radiological Science, Central Taiwan University of Science and Technology, Taichung, Taiwan

Introduction:

Traditional nuclear medicine image backup relies on CDs or external hard drives, which are inconvenient, space-consuming, and prone to data loss. Commercial Mini PACS systems solve these issues but are expensive. To reduce costs, Taichung Veterans General Hospital developed a low-cost Mini PACS system using a commercial NAS combined with open-source PACS software.

Materials and Methods:

A Synology DS3617xsII NAS with four 12TB hard drives in a RAID5 array was configured to ensure fault tolerance and performance. Open-source PACS components, including dcm4chee, Keycloak, and Wildfly, were integrated to establish a DICOM-compliant storage and query platform. Imaging devices and workstations were connected through the hospital's internal network.

Results:

The system was built at a cost of about NTD 200,000, far less than commercial solutions. It enabled both manual and automatic backup from imaging devices, as well as direct image retrieval via workstations, reducing storage space use while enhancing efficiency and data security. RAID5 provided adequate protection, with the option to upgrade to RAID6 or RAID10 for greater safety and performance.

Conclusions:

This low-cost Mini PACS system achieved reliable image backup and query functions at a fraction of the commercial cost, meeting the needs of nuclear medicine departments.

Differentiation Between Compression Fractures and Degenerative Arthritis Using Bone Scintigraphy Combined With SPECT/CT

¹Shih-Tsung Lin, ¹Yu-Ching Hsu, ^{1,2}Tzyy-Ling Chuang,

¹Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan

²School of Medicine, Tzu Chi University, Hualien, Taiwan

Background:

Technetium-99m methylene diphosphonate (Tc-99m MDP) is the most widely used radiopharmaceutical for whole-body bone scintigraphy. Following intravenous administration, Tc-99m MDP binds to bone mineral and deposits in amorphous calcium phosphate, showing increased uptake in areas with active osteogenesis. Lesions with both elevated blood flow and bone formation appear as foci of increased radiotracer activity. Degenerative joint disease and osteoarthritis are common in weight-bearing joints, resulting from chronic mechanical stress that damages cartilage and stimulates adjacent bone repair. While radiographs and CT can demonstrate structural abnormalities, bone scintigraphy provides functional insight into whether a lesion is pain-related. The integration of single-photon emission computed tomography/computed tomography (SPECT/CT) further enhances diagnostic accuracy by combining metabolic and anatomical information, making it valuable for identifying the cause of low back pain.

Case Report:

A 75-year-old woman presented with persistent low back pain following a fall. CT revealed a compression fracture at the 12th thoracic vertebra (T12), and vertebroplasty was planned. Preoperative bone scintigraphy confirmed intense focal uptake at T12 but also revealed abnormal uptake from L1 to L5. To determine the nature of these findings, lumbar SPECT/CT was performed, which demonstrated degenerative arthritis rather than compression fractures. Based on this, vertebroplasty was limited to T12. Postoperative recovery was uneventful, and the degenerative lumbar changes were managed conservatively with follow-up and rehabilitation.

Conclusions:

Bone scintigraphy offers high sensitivity for detecting skeletal abnormalities related to increased bone turnover. When combined with SPECT/CT, it enables precise differentiation between compression fractures and degenerative changes, ensuring accurate surgical targeting, preventing unnecessary interventions, and improving patient outcomes in the management of spinal trauma and low back pain.

Preliminary Report on Bone Mineral Density Among Indigenous Peoples in Taitung, Taiwan

¹Ssu-Tzu Chang, ¹Xue-Wei Qiu, ¹Hui-Ping Chen, ¹Shu-Hui Lin, ¹Man-Jie Chen, ¹Yan-ting Huang, ¹Sheng-Pin Changlai

¹ Department of Nuclear Medicine, Taitung Christian Hospital, Taitung, Taiwan

Introduction:

According to the latest National Health Interview Survey (2021) conducted by Taiwan's Health Promotion Administration, osteoporosis is recognized as a chronic disease. Among the general population, the prevalence of osteoporosis is 3.5% in individuals aged 18 to 64, and 18.2% in those aged 65 and above. However, the incidence of osteoporosis may vary across different regions and ethnic groups. The aim of this study is to investigate the bone mineral density (BMD) and the prevalence of osteoporosis among the indigenous population in Taitung, Taiwan.

Materials and Methods:

Bone mineral density measurements were collected using the Dual-energy X-ray Absorptiometry (DXA) system (GE Prodigy series, GE Healthcare) at Taitung Christian Hospital. The study included 23 indigenous individuals aged 65 and above, and 34 individuals aged 18 to 64. Osteoporosis was diagnosed based on the World Health Organization (WHO) international reference standards, with a T-score of ≤ -2.5 at the lumbar spine or femoral neck. Subjects with abnormal BMD values, a history of lumbar spine surgery, or hip replacement surgery were excluded from the analysis. These criteria were used to determine the prevalence of osteoporosis among the indigenous population in Taitung.

Results:

Among the 23 participants aged 65 years and older, three were excluded from analysis due to abnormal bone mineral density (BMD) results or a history of surgery, leaving 20 individuals for evaluation. Among these, six participants had a T-score ≤ -2.5 , corresponding to an osteoporosis prevalence of 30%. The mean T-scores in this age group were -0.89 for the lumbar spine, -1.21 for the left hip, and -1.29 for the right hip ($n = 20$). In the younger group, comprising 34 participants aged 18 to 64 years, no individuals were excluded. Two participants had a T-score ≤ -2.5 , resulting in an osteoporosis prevalence of 5.88%. The mean T-scores in this group were 0.10 for the lumbar spine, 0.00 for the left hip, and -0.38 for the right hip ($n = 34$).

Conclusions:

The Indigenous population in Taitung exhibits a higher prevalence of osteoporosis than the national average, highlighting the need for targeted screening and preventive strategies.

Evaluation of Radiation Contamination Associated with Safety Needles in Nuclear Medicine

¹Yi-Ling Pan, ¹²Jui-Yin Kung, ¹Cheng-Tao Hsieh, ¹²Shih-Chuan Tsai

¹Department of Nuclear Medicine, Taichung Veterans General Hospital, Taichung, Taiwan

²Department of Medical Imaging and Radiological Science, Central Taiwan University of Science and Technology, Taichung, Taiwan

Introduction:

Safety needles can effectively reduce the risk of needlestick injuries among healthcare workers. However, due to their structural differences from conventional needles, concerns remain regarding potential radiation contamination during retraction. This study compared the risk of radiation contamination following intravenous injections using conventional needles and safety needles in nuclear medicine practice.

Materials and Methods:

A radiation contamination detector (Canberra Radiagen 2000) was used to measure radioactivity at the injection site before and after radiopharmaceutical administration in 40 patients. Subjects were divided into two groups: 20 received injections with conventional needles and 20 with safety needles. All potential interfering objects were removed during measurement, and a single operator performed both injection and detection to minimize procedural variability. Local background counts were measured before injection and reassessed afterward. Contamination was defined by the fixed multiple method, with values exceeding twice the background considered contamination.

Results:

In the conventional needle group, the mean background value was 6.16 ± 0.30 cps and the mean post-injection value was 6.86 ± 0.54 cps, with none exceeding the contamination threshold of 12.32 cps; in the safety needle group, the mean background value was 6.18 ± 0.46 cps and the mean post-injection value was 7.09 ± 0.76 cps, with none exceeding the contamination threshold of 12.36 cps.

Conclusions:

In clinical nuclear medicine intravenous injections, neither conventional nor safety needles resulted in radiation contamination when assessed by the fixed multiple method. Safety needles reduce needlestick risk without increasing radiation exposure, supporting their safe application in nuclear medicine practice.

Investigation of reconstruction parameters for optimal quantitative evaluation in the ^{18}F -fluciclovine PET imaging: phantom study

¹²Takuya SAITO, ¹Tomohiro SATO, ¹Yudai HASHIBA, ¹Masaki OKADA, ¹²Seiji KATO, ¹Shigeharu TAKENAKA, ¹Koichi MOTOYOSHI, ¹Yukari OKANO

¹Radiology Center, The University of Tokyo Hospital, Tokyo, Japan

²Radiation Safety, The University of Tokyo Hospital, Tokyo, Japan

Purpose:

The optimal imaging parameters for ^{18}F -fluciclovine (FACBC) PET imaging have not been fully investigated, particularly in relation to various lesion-to-normal tissue ratios (LNRs). The present study aimed to determine the optimal reconstruction parameters and duration time for the quantitative evaluation of glioma grading using ^{18}F -FACBC PET.

Materials and Methods:

PET/CT imaging was performed using a Biograph Vision 600 scanner (Siemens Healthineers). Brain ^{18}F -FACBC activity was estimated with reference to reported data. The Brain Tumor phantom was filled with ^{18}F -FDG, containing 0.8 kBq/mL BG activity at the start of image acquisition, and LNRs of 2, 4, and 6 were simulated under clinical ^{18}F -FACBC conditions. Image analysis was conducted using RAVAT and PETquactIE (Nihon Medi-Physics, Japan). Duration time and reconstruction parameters were investigated: matrix size, update number, full width at half maximum (FWHM) of Gaussian filter, with or without point spread function (PSF) correction. According to the ^{11}C -methionine PET criteria, SUV_{TOT} , $\text{SD}_{\Delta\text{SUVmean}}$, and SUV_{max} were calculated to evaluate the optimal parameters. Linearity between actual and imaged radioactivity was also evaluated to determine the optimal duration time.

Results:

The 220-matrix size underestimated SUV_{max} in small hot spheres. SUV_{max} also tended to vary when the FWHM of Gaussian filter was less than 2.0 mm, and the number of updates was excessively increased. PSF correction caused Gibbs artifacts, resulting in overestimation of SUV_{max} in the 27-mm hot sphere. Linearity between actual and imaged radioactivity deviated when the acquisition time was 10 minutes, but showed improvement at 20 minutes or more. The optimal parameters were determined: 440-matrix size, 60 updates, Gaussian filter of 3.0 mm, without PSF correction, and duration time of 20 minutes.

Conclusions:

This study identified optimal reconstruction parameters for ^{18}F -FACBC PET imaging. These findings may help improve the quantitative evaluation of glioma grading and contribute to standardized imaging protocols in clinical practice.

Verification of the reconstruction parameters that optimize image quality in ^{18}F -fluciclovine-PET: Phantom study

Tomohiro SATO, Takuya SAITO, Masaki OKADA, Yudai HASHIBA, Seiji KATO,
Shigeharu TAKENAKA, Koichi MOTOYOSHI, Yukari OKANO

Radiology center, The University of Tokyo Hospital, Tokyo, Japan

Purpose:

^{18}F -fluciclovine (FACBC) PET reflects amino acid metabolism and provides high-contrast glioma imaging, supporting surgical planning. Previous adjustments relied on phantom test procedures with ^{11}C -methionine (MET); however, because FACBC shows lower background activity and different lesion-to-normal ratio (LNR), optimal reconstruction parameters may differ. Only one prior study has investigated it at a single LNR, and no standards exist for pixel size or duration. This study aimed to determine reconstruction parameters that optimize image quality for glioma resection planning.

Materials and Methods:

PET/CT scans were performed using a Biograph Vision (SIEMENS) with 3.2-mm LSO crystals. A brain tumor phantom containing microspheres and filled with ^{18}F -FDG was scanned under 0.8 kBq/mL background activity with three LNRs. Radioactivity was measured with CRC-15R dose calibrator (Capintec), and image analyses used RAVAT and PETquactIE (NMP, Japan). Duration and reconstruction parameters (matrix size, update number, Gaussian filter full width at half maximum [GF FWHM], PSF on/off) were evaluated. Image-quality indices and visual scoring were compared with ^{11}C -MET criteria.

Results:

At LNR 2, microspheres of 7.5 mm or smaller were undetectable, while at LNRs 4 and 6, 440 matrix improved contrast without increasing standardized uptake value (SUV) variability. Contrast converged after 100 with PSF and 80 without PSF for 5- and 7.5-mm. With GF FWHM of 2 mm, SUV variability was below ^{11}C -MET criteria without PSF and below the prior report with PSF. PSF improved detectability of 5-7.5 mm spheres and visual scores, though Gibbs artifacts appeared in 10-27 mm. Longer acquisitions reduced noise, acceptable at 20 min and optimal at 30 min, meeting ^{11}C -MET criteria.

Conclusions:

Optimal parameters for ^{18}F -FACBC PET were 440 matrix, 100 updates, GF FWHM of 2 mm, PSF applied, and 20–30 min scan. These parameters improved detection of small or low-LNR lesions over conventional settings, supporting glioma delineation and surgical planning.

Improving dose accuracy in amyloid PET: Residual activity analysis in automated infusion device administration with externally supplied tracers

¹Ryu Emura, ¹Ayana Tanji, ¹Kouki Suzuki, ¹Masayoshi Ikeda, ²Shigeru Kiryu

¹Department of Radiological Technology, IUHW Narita Hospital

²Department of Radiology, IUHW Narita Hospital

Background:

Reimbursement for amyloid PET imaging has been provided under Japan's National Health Insurance since June 2024. The imaging technique employs the UG-02 automated infusion device (PDR Pharma) to administer externally supplied tracers 18F-flutemetamol and 18F-florbetapir. The Japanese Society of Nuclear Medicine allows a $\pm 10\%$ deviation in the displayed injected tracer dose. However, residual activity within the device and optimal preset values for infusion line residuals remain unclear.

Purpose:

The present study aimed to evaluate residual radioactivity in UG-02 after administering 18F-flutemetamol and 18F-florbetapir and to optimize the preset residual activity for each tracer.

Methods:

Forty-one patients (16 with 18F-flutemetamol, 25 with 18F-florbetapir), who were administered tracers via UG-02 between April 2024 and August 2025 were analyzed. Radioactivity in the pre- and post-administration vials, circuit, route, and residual solution was measured using a dose calibrator with decay correction. Residual ratios were calculated relative to the pre-administration vial. Device-estimated preset residual activity was compared with measured values, and optimal preset route residual activity was determined using the least squares method.

Results:

The residual ratios for 18F-flutemetamol were 2.0%, 1.1%, 1.7%, and 1.4%, and for 18F-florbetapir, 14%, 1.9%, 0.93%, and 0.85% in the circuit, route, residual solution, and post injection vial, respectively. The findings showed significantly higher circuit and route residuals ($P < 0.01$) for 18F-florbetapir and higher post injection vial residuals for 18F-flutemetamol. Thus, device estimates exceeded measured values. The optimal preset route residual activity was 4.3% for 18F-flutemetamol and 16.3% for 18F-florbetapir.

Conclusions:

The study highlights that the residual activity during UG-02 administration varies by tracer. Adjusting preset route residual activity based on tracer characteristics can improve the accuracy of the displayed injected dose.

Myocardial Perfusion SPECT Image Analysis Using Pretrained Deep Learning

¹Kosuke Sasaki, ¹Koichi Okuda, ²Atsushi Narita, ¹Yutaro Sakamoto, ¹Ryutaro Mori,
¹Shota Hosokawa, ¹Yasuyuki Takahashi, ³Kenichi Nakajima

¹ Hirosaki University
² Nihon Medi-Physics Co., Ltd.
³ Kanazawa University

Objective:

Myocardial perfusion scintigraphy is widely used to evaluate cardiac function and perfusion, and it is particularly valuable for the assessment of myocardial ischemia. A polar map can represent the three-dimensional myocardial perfusion distribution into two-dimensional format. Incorporating artificial intelligence techniques is expected to improve the evaluation of myocardial perfusion. This study aimed to classify myocardial perfusion distribution using pretrained deep learning models and to compare the performance to determine the most suitable model.

Materials and Methods:

Polar map images were obtained from ^{99m}Tc myocardial perfusion studies (43 normal, 58 hypoperfusion) and ²⁰¹Tl studies (26 normal, 74 hypoperfusion). After data augmentation, a total of 1,111 images for ^{99m}Tc and 1,100 images for ²⁰¹Tl were prepared. Nine pretrained convolutional neural network models: ConvNeXtBase, DenseNet121, EfficientNetV2B0, InceptionV3, MobileNet, NASNetMobile, ResNet152, VGG16, and Xception were transfer learned for the classification of myocardial perfusion. Model performance was evaluated in terms of accuracy, loss, and area under the curve (AUC) across 0–100 epochs using five-fold cross-validation. Furthermore, local interpretable model-agnostic explanations (LIME) was applied to visualize the regions of the polar map that influenced the model predictions.

Results:

MobileNet achieved the best performance with a loss of 0.015 and accuracy of 1.000 for the ^{99m}Tc dataset and a loss of 0.017 and accuracy of 0.999 for the ²⁰¹Tl dataset. MobileNet also demonstrated the highest AUC of 0.9999 and 0.9998 for the ^{99m}Tc and ²⁰¹Tl datasets, respectively. Furthermore, LIME-based evaluation confirmed that both MobileNet and InceptionV3 focused on the regions corresponding to hypoperfusion in the images for classification.

Conclusions:

MobileNet demonstrated the highest performance for detecting hypoperfusion in polar map images, suggesting its potential usefulness for clinical application in myocardial perfusion analysis.

Evaluation of the adsorption characteristics of ^{123}I -IMP on various materials

Mitsuha Fukami and, Tomoaki Yamamoto
Department of Medical Radiological Technology, Faculty of Health Sciences, Kyorin University

Introduction:

Certain radiopharmaceuticals can be adsorbed onto specific materials. Kvaternik et al. reported that $^{99\text{m}}\text{Tc}$ -succimer adsorbs to elastomer and isoprene rubber injection syringes. However, the extent of ^{123}I -IMP absorption across different materials remains unclear. This study aimed to evaluate the adsorption rates of ^{123}I -IMP on materials commonly used in experimental and clinical situations.

Materials and Methods:

The materials evaluated were polycarbonate, polyethylene, acrylic, polypropylene, natural rubber, polystyrene, polyurethane, nitrile rubber, fluorelin, and polyvinyl chloride. ^{123}I -IMP (0.36 MBq/mL, 0.5 mL) was placed on each sample using a micropipette for 15 min. Planar imaging was performed for 10 min using a gamma camera (pre-scan). The radiopharmaceutical was removed by suction or washing, followed by a second planar imaging (post-scan). The region of interest (ROI) was placed in the area of accumulation and background (BG) on the planar images, and counts were measured. The residual retention ratio was calculated as the ratio of background-subtracted post-scan to pre-scan counts. Comparisons were made across different materials.

Results:

Visual hotspots were observed in the post-removal planar images of natural rubber, nitrile rubber, and polyurethane. The residual retention ratios of natural rubber, nitrile rubber, and polyurethane after suction removal were 21.8%, 11.2%, and 11.2%, respectively. After washing, these ratios were 19.87%, 9.75%, and 11.2%, respectively. The ratios for all other materials were < 3.5%.

Conclusions:

Natural rubber, nitrile rubber, and polyurethane exhibited high residual retention. Adsorption may occur on phantoms made from polyurethane or gloves and gaskets of syringes made from rubber.

Key Words:

radiopharmaceuticals, ^{123}I -IMP, adsorption, quantitative accuracy

Development of a cardiac PET phantom to optimize reconstruction conditions

¹Taisei Komoda, ¹Koichi Okuda, ²Kotaro Suino, ³Hiroki Yamamoto,
¹Shota Hosokawa, ⁴Shozo Yamashita, ¹Hiroyuki Takahashi

¹Hirosaki University Graduate School of Health Sciences

²Hirosaki University School of Health Sciences

³Hirosaki University Hospital

⁴Matto Ishikawa Central Hospital

Introduction and Aims:

While conventional cardiac phantoms are available for single-photon emission computed tomography, a dedicated phantom for positron-emission tomography (PET) imaging has not been established. This study aimed to develop a novel cardiac PET phantom and define the optimal reconstruction conditions to reliably detect myocardial defects.

Materials and Methods:

We used a PRUSA MK3S+ 3D printer to create a cylindrical structure to simulate the short-axial view of the myocardium and fixed it in a NEMA body phantom. The wall thickness was set to 10 mm. Defect thickness and width continuously varied between 0–10 and 0–20 mm, respectively. The ¹⁸F-FDG concentrations were set to 2.65 kBq/mL for background and 21.1 kBq/mL for the myocardium. PET data were acquired for 10 minutes on a Discovery MI PET/CT system. Three reconstruction algorithms were evaluated: ordered subset expectation maximization (OSEM), OSEM with time-of-flight (TOF) correction (OSEMTOF), and OSEM with both TOF and point spread function (PSF) corrections (OSEMTOF,PSF). The number of subsets was fixed at 2 and the number of iterations varied from 2 to 12. The optimal reconstruction conditions were determined based on concentration linearity and differential uniformity.

Results:

Concentration linearity improved from 0.12 to 0.72 for OSEM, 0.33 to 0.94 for OSEMTOF, and 0.33 to 0.95 for OSEMTOF,PSF as the number of iterations increased. Similarly, differential uniformity deteriorated with increasing iterations, ranging from 10% to 20% for OSEM, 12% to 20% for OSEMTOF, and 12% to 18% for OSEMTOF,PSF. By setting thresholds (≥ 0.80 for concentration linearity and $\leq 17\%$ for differential uniformity), OSEMTOF,PSF with 8–10 iterations was identified to be the most effective.

Conclusions:

Using 8–10 iterations with OSEMTOF, PSF, cardiac phantom images can be optimally reconstructed, and continuous defect changes reliably detected in the 3D-printed phantom.

Production method and quality control of [13N]Ammonia injection using cyclotron in-target method

Dae-Hong Kim, Gang-Bin Kim, Jeong-Yeon Kim, Min-yook Park, Jeong-Hun Lee

The Department of Nuclear Medicine, Chonnam National University Hospital

Purpose:

With the increasing demand for [13N]Ammonia at Chonnam National University Hospital, we'd like to introduce the manufacturing process and quality control of [13N]Ammonia injection using the in-target method.

Materials and Methods:

The [13N]ammonia solution for injection is manufactured using the in-target method. This method involves irradiating water containing 5 mmol of ethanol as the target material in a cyclotron. The manufactured [13N]NH₃⁺ is then placed in a vial through a sterile filter after removing impurities through an anion exchange cartridge. After this, it passes through a sterile filter and is collected in a closed vial. The final produced [13N]Ammonia solution for injection undergoes quality testing according to USP(United States Pharmacopeia) standards.

Results:

After being produced in the cyclotron, the [13N]Ammonia solution for injection passes through a cartridge and a sterile filter. The final product is approximately 200 mCi in a 2 mL volume, with a total production time of about 20 minutes. All quality test results were in compliance with USP standards. The average time for quality testing was less than 20 minutes from the completion of production, and the product was administered to patients after the quality tests were completed.

Conclusions:

[13N]Ammonia is an increasingly popular radiopharmaceutical due to its simple manufacturing process, uncomplicated quality testing, and good imaging quality. However, [13N] Ammonia is a valuable medical radioisotope, but its production and use face several challenges beyond its short half-life. Therefore, it is essential to minimize these variables through close inter-departmental cooperation to ensure efficient quality control.

Consideration of the Usefulness of ^{18}F -FET Brain PET/CT in Brain Tumor Diagnosis

¹ Kyuho YEON, Jaekwang RYU

¹ Asan Medical Center, Seoul

Purpose:

^{18}F -FET, a tyrosine-based radiopharmaceutical transported via the sodium- independent System L transporter, enables non-invasive imaging of brain tumors with minimal uptake in normal brain tissue. Unlike ^{18}F -FDG, which accumulates in both tumor and normal tissues, ^{18}F -FET shows selective uptake in tumor regions. This study aims to compare the diagnostic utility of ^{18}F -FET and ^{18}F -FDG PET/CT using quantitative imaging parameters.

Materials and Methods:

A total of 46 patients with brain gliomas (34 high-grade, 12 low-grade) underwent PET/CT scans: 40 minutes post- ^{18}F -FDG injection, and at 20 minutes (early) and 80 minutes (delayed) after ^{18}F -FET administration. Quantitative analysis included SUV_{max} , SUV_{peak} , and the SUV_{max} -to- SUV_{peak} ratio in tumor regions identified on MRI. Statistical analyses were performed using SPSS version 28.

Results:

Early-phase ^{18}F -FET scans yielded the highest SUV_{max} (4.59 ± 1.55), especially in high-grade tumors (4.85 ± 1.44 , $P < 0.0001$), compared to ^{18}F -FDG (3.72 ± 1.36) and delayed FET scans (4.12 ± 1.36). SUV_{peak} was greatest with ^{18}F -FDG (3.33 ± 1.13) and lowest with delayed FET (2.80 ± 0.96), with significant differences observed in high-grade tumors ($P < 0.001$). The SUV_{max} -to-Sub_{peaks} ratio was significantly higher in both early (1.54 ± 0.22) and delayed (1.48 ± 0.17) FET scans than in FDG scans (1.11 ± 0.09 , $P < 0.0001$), suggesting improved contrast, though no notable difference was found between early and delayed FET phases.

Conclusions:

This study highlights the diagnostic advantage of ^{18}F -FET PET/CT, particularly during early-phase imaging, in differentiating tumor activity through quantitative parameters. The SUV_{max} -to- SUV_{peak} ratio emerges as a novel and promising metric for evaluating tumor malignancy and enhancing brain PET/CT interpretation.

Key Words:

Brain tumor, ^{18}F -FET PET/CT, SUV_{max} -to- SUV_{peak}

A Study on the Comparison of Quantitative Evaluation of Uptake Ratio in 2D Planar and Auto Lung 3D Images Using SPECT/CT in Pulmonary Ventilation/Perfusion Scan

Tae Heon Kim · Yoon Jae Kim and Hyun Soo Ko

Department of Nuclear Medicine, Asan Medical Center, Seoul, Korea

Purpose:

In pulmonary scans, 2D imaging has inherent limitations due to the overlap of anatomical lobes. Therefore, in this study, we aimed to compare the uptake ratio results between two methods: the traditional approach of dividing the lungs into three equal regions of interest (ROI) using 2D imaging, and the 3D SPECT/CT imaging method utilizing the Auto Segment function of Siemens Syngo.via Auto Lung 3D.

Materials and Methods:

Ventilation scans were performed first, followed by perfusion scans. In the 2D images, rectangular ROIs were set for the left and right lungs in anterior and posterior views, and the geometric mean of counts classified into three lobes was analyzed. In the 3D SPECT/CT images, the Auto Lung 3D function of Siemens Syngo.via was used to analyze counts divided into two lobes in the left lung and three lobes in the right lung, and a paired t-test was performed to compare the uptake ratios.

Results:

Uptake ratios of the total lungs and right lung lobes were compared between 2D planar and 3D SPECT/CT ventilation/perfusion scans. In the total right and left lungs, uptake ratios were similar between 2D and 3D, with no statistically significant differences ($P>0.05$). However, in the right upper, middle, and lower lobes, 3D analysis showed significantly different uptake ratios compared with 2D ($P<0.05$). These results suggest that while overall lung assessments may yield comparable findings between methods, 3D SPECT/CT provides more distinct lobe-specific information than conventional 2D planar imaging.

Conclusions:

3D image analysis that incorporates anatomical structures is emerging as a promising alternative to conventional 2D planar approaches. By offering a more detailed characterization of lung lobe proportions, 3D analysis enables improved accuracy in both quantitative measurements and visual interpretation. Accordingly, SPECT-based 3D analysis may provide superior precision and clinical utility in pulmonary evaluations.

Key Words:

Lung scan, Lung SPECT/CT, Ventilation, Perfusion, Auto Lung 3D

Comparative Analysis between Reagents for Hepatitis B Surface Antibody Titer Test

¹Se-Hee JEONG, ¹Yung-Ji LEE, ¹Sun-Ho LEE

¹Department of Nuclear Medicine, Seoul Asan Medical Center, Seoul, Korea

Purpose:

It is important for liver transplant patients to maintain a certain level of hepatitis B antibodies to prevent recurrence of hepatitis B after liver transplant surgery. The liver transplant and hepatobiliary surgery department at our hospital uses hepatitis B surface antibody titer testing as an important indicator in monitoring liver transplant patients. Recently, our hospital switched to reagents from company B due to an unstable supply of reagents and consumables from company A. Therefore, we evaluated the differences and correlation between those two reagents.

Materials and Methods:

A reagent comparison experiment between Company A and Company B was conducted on 69 samples of the hepatitis B surface antibody test requested in April 2022. Company A's reagent is a two-step test using beads, and Company B's reagent is a one-step test using a tube. For comparative experiments, samples diluted 10 times with stock solution and physiological saline were used, and the correlation between these reagents was analyzed by dilution factor.

Results:

The correlation graph between the two reagents shows the gradual upward gradient, and the result of B's reagent tended to be 5 times lower than A's reagent. The correlation between the 10-fold dilution of B's reagent, which is multiplied by 5, and the 10-fold dilution of A's reagent was compared for a similar value of A's reagent. Consequently, that was $y = 1.1426x - 145.44$, $R^2 = 0.9828$, which means a good correlation with an increased gradient. Furthermore, the B took 90 minutes to react, though the A took more than 120 minutes to test.

Conclusions:

Overall, B's reagent showed a lower value approximately 5 times rather than A's reagent, and there is the most valuable correlation between the 10-fold dilution of A's reagent and the 10-fold dilution of B's reagent multiplied by 5. If the 5-fold corrected value is referred to when reporting results using B's reagent, antibody trend analysis will be possible, similar to the result of the previous reagent. Also, it leads to an improvement in the laboratory's work efficiency significantly by the shorter test time.

Key Words:

Hepatitis B Surface Antibody Test, Correlation, Reagent Comparison

Prediction of Extravasation before PET/CT Scan

Seong Su YUN, Sundo Lee, Nam Ju LEE, Yong Cheol SHIN, Seongsu KIM, Chanhoo JOO, Seong Uk JU, Myoung Hyoun KIM

Department of Nuclear Medicine, Wonkwang University Hospital, Iksan, Korea

Purpose:

In this study, we investigated whether extravasation could be predicted by measuring the dose rate once at the injection site before PET/CT scanning .

Materials and Methods:

The dose rate at the injection site was measured for 412 patients, and the severity of extravasation was evaluated in the F-18 FDG PET/CT images. Then, extravasation activity and %ID were calculated with VOI analysis.

Results:

The dose rate at the injection site and %ID showed significant differences in the mild and moderate extravasation groups. Dose rates were 15.9 ± 5.8 mR/hr, 18.7 ± 9.9 mR/hr and 57.1 ± 5.8 mR/hr in the no, minor and moderate extravasation groups, respectively. The extravasated %ID in the minor and moderate extravasation groups were 0.022 ± 0.020 and 0.438 ± 0.483 . Also, ROC analysis showed good performance of dose rate in distinguishing between mild and moderate extravasation.

Conclusions:

The dose rate at the injection site can predict moderate or severe extravasation, helping determine arm position during PET/CT scan and whether to conduct additional scans.

Key Words:

PET/CT, Extravasation, Radiation detector



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OC-001, OC-011, PB-014, PC-009, PC-010, PC-011, PC-020, PC-021, PC-024, PC-026, PC-045, PC-047, PC-050, PC-051, PC-064, PC-078, PC-079, PC-086, PC-087, PC-088, PC-089, PC-091, PC-096

非造影用 儀器

PB-021, PC-053, PC-077

解剖學 /CT/MR

PB-014, PC-005, PC-007, PC-008, PC-021, PC-026, PC-030, PC-053, PC-056, PC-057, PC-089, PC-094, PC-096

影像組學

PC-004, PC-018, PC-030, PC-041, PC-044, PC-052, PC-059, PC-060, PC-063, PC-064, PC-068, PC-076, PC-078, PC-081, PC-082, PC-083, PC-084, PC-089, PC-095

影像處理

OB-004, OC-006, PB-010, PB-014, PB-017, PC-011, PC-027, PC-042, PC-044, PC-047, PC-050, PC-051, PC-053, PC-057, PC-061, PC-064, PC-089, PC-093

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定量分析

OB-004, OB-007, OC-002, OC-010, OC-011, PC-015, PC-027, PC-042, PC-047, PC-064

治療劑量 評估

OB-007, OC-006, PB-018

工作曝露 劑量

OB-007, OC-004, OC-006, PB-005, PB-018, PB-021, PB-024, PC-006, PC-016, PC-035, PC-039

輻射防護

OB-005, OC-004, PB-004, PB-005, PB-008, PB-018, PB-021, PB-022, PB-023, PB-024, PC-006, PC-009, PC-012, PC-016, PC-035, PC-039, PC-048, PC-058, PC-071

智慧醫療 /ML/DL/ LLM

OC-008, PB-010, PC-015

實驗室 安全

PB-008, PB-009, PB-015, PB-022

實驗室 流程改善

PB-009, PC-038

流程優化

OC-009, PB-004, PB-009, PB-015, PC-002, PC-009, PC-019, PC-038, PC-042, PC-046, PC-047, PC-048, PC-065, PC-073, PC-093

品管圈

PB-009

衛教

PB-021, PC-019, PC-037, PC-043, PC-073, PC-077, PC-087

病人安全

PB-009, PB-021, PC-006, PC-009, PC-014, PC-036, PC-047, PC-048, PC-065, PC-071, PC-075, PC-080, PC-085

教學

PB-013, PB-019, PC-004, PC-009, PC-012, PC-013, PC-032, PC-033

有趣影像

PC-001, PC-003, PC-004, PC-005, PC-007, PC-008, PC-011, PC-017, PC-020, PC-021, PC-022, PC-026, PC-028, PC-029, PC-030, PC-031, PC-035, PC-049, PC-050, PC-054, PC-055, PC-056, PC-057, PC-062, PC-066, PC-067, PC-069, PC-070, PC-076, PC-078, PC-081, PC-091, PC-092, PC-094, PC-097, PC-098, PC-099

索引

數位化
系統

PB-004

行政管理

PB-001, PB-002, PB-003, PB-004, PB-007, PB-020, PB-027, PC-024, PC-074

主管單位
查核

PB-015

危險因子

OC-003, OC-005, PB-002, PB-028, PC-009, PC-078

ASNMT

ASNMT-01, ASNMT-02, ASNMT-03, ASNMT-04, ASNMT-05, ASNMT-06, ASNMT-07, ASNMT-08, ASNMT-09, ASNMT-10, ASNMT-11, ASNMT-12, ASNMT-13, ASNMT-14, ASNMT-15, ASNMT-16, ASNMT-17, ASNMT-18