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核醫心臟影像處理：從定量檢查到陷阱辯識

Nuclear Medicine Image Processing Software: From Quantitative Analysis to Pitfall Identification

時　　間：115 年 6 月 27 日(星期六) 08:20~12:00
地　　點：臺北榮民總醫院 三門診 9 樓 創意谷
主辦單位：中華醫學會 中華民國核醫學會

08:20-08:25	***Opening Remarks***	王昱豐主任 Yu-Feng Wang
	座長：吳彥雯 理事長 (Yen-Wen Wu) **胡蓮欣 科主任 (Lien-Hsin Hu)**	
08:25-08:55	應用擴散場成像技術於 SPECT 定量心內膜至心外膜灌注梯度(線上演講) SPECT Quantification of Endocardial to Epicardial Perfusion Gradients with Spread Field Imaging Technology **(Remote)**	劉義華教授 Yi-Hwa Liu (美國)
08:55-09:00	問答(遠距) Q&A (Remote)	劉教授及座長
09:00-09:30	動態 SPECT 心肌血流定量的臨床應用 Clinical Applications of Quantitative Myocardial Blood Flow Assessment Using Dynamic SPECT	Yuka Otaki 大滝 由香 (日本)
09:30-10:00	4DM 心肌血流處理經驗分享 Experience Sharing on 4DM Myocardial Blood Flow (MBF) Processing	施鈺呈醫師 Yu-Cheng Shih
10:00-10:10	討論時間 Discussion	座長、兩位講者
10:10-10:30	***茶敘 Coffee Break***	
	座長：吳東信 教授 (Tung-Hsin Wu) **楊邦宏 副理事長 (Bang-Hung Yang)**	
10:30-11:00	QPS/QGS 影像處理與重建之臨床實務經驗 Clinical Practice in QPS/QGS Image Processing and Reconstruction	李建穎 醫事放射師 Chien-Ying Li
11:00-11:50	Cedars-Sinai 心臟影像套裝軟體（QGS/QPS/QPET/AutoQUANT）的過去、現在與未來(線上演講) The Past and Future of Cedars-Sinai Cardiac Suite (QGS/QPS/QPET/AutoQUANT)	魏志君 首席程式分析師 Jack Chih-Chun Wei (美國)
11:50- 12:00	討論時間 Discussion	座長、兩位講者

SPECT quantification of endocardial to epicardial perfusion gradients with spread field imaging technology

應用擴散場成像技術於 SPECT 定量心內膜至心外膜灌注梯度之定量

Yi-Hwa Liu

劉義華

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Endocardial (endo) and epicardial (epi) perfusion gradients in the transmural myocardium are fundamental markers of early ischemia, microvascular dysfunction, and subclinical cardiomyopathy. Despite the widespread availability of single photon emission computed tomography (SPECT) myocardial perfusion imaging, current systems lack the spatial resolution adequate to resolve transmural heterogeneity and the quantitative rigor needed to measure subtle endo/epi perfusion differences. This results in missed diagnoses and poor phenotyping of microvascular disease. Recent advances in gamma detection and collimation technology as well as SPECT reconstruction algorithms offer the unprecedented opportunity to achieve high resolution SPECT and precise quantitative analysis capable of measuring transmural gradients with accuracy approaching positron emission tomography, at a fraction of the cost and with far greater accessibility.

This study was to establish clinically deployable, high-sensitivity and high-resolution SPECT that enables early detection of subendocardial ischemia and microvascular disease. We have developed a quantitative SPECT framework with spread field imaging (SFI) technology to measure endo/epi myocardial perfusion gradients in patients with suspected or established coronary microvascular dysfunction. Our preliminary data demonstrate (1) sub-5-mm effective spatial resolution using our novel SPECT collimation and reconstruction techniques, (2) accurate measurement of endocardial–epicardial regional perfusion in cardiac phantoms, and (3) feasibility of endo/epi quantification in phantom datasets. We believe that the advanced SFI technology will enable SPECT to noninvasively quantify transmural perfusion gradients, potentially transforming the diagnosis and management of ischemic heart disease and significantly reducing cardiovascular morbidity.

Clinical applications of quantitative myocardial blood flow assessment using dynamic SPECT

動態 SPECT 心肌血流定量的臨床應用

Yuka Otaki

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Quantification of myocardial blood flow (MBF) has long been established using positron emission tomography (PET). In contrast, MBF quantification with single-photon emission computed tomography (SPECT) has traditionally been limited because of its lower spatial resolution. Recently, the development of semiconductor detector–based SPECT systems has enabled dynamic acquisition and quantitative MBF assessment with an accuracy comparable to that of PET.

In patients with multivessel coronary artery disease, conventional perfusion imaging provides relative assessment of myocardial perfusion and may fail to detect ischemia due to balanced ischemia. Quantitative MBF analysis can improve the detection of myocardial ischemia in such cases.

At our institution, dynamic SPECT imaging is performed in patients with multivessel coronary artery disease scheduled for coronary artery bypass grafting (CABG). Identification of ischemic myocardial territories using quantitative MBF helps guide surgical revascularization strategy. In addition, postoperative dynamic SPECT is used to evaluate improvement in myocardial perfusion.

More recently, we have applied dynamic SPECT in patients with angina symptoms without obstructive coronary artery disease (ANOCA). We are currently investigating the relationship between SPECT-derived MBF parameters and invasive coronary wire–based assessment of coronary microvascular dysfunction (CMD). These findings may contribute to the noninvasive diagnosis and therapeutic evaluation of ANOCA using SPECT.

In this presentation, we will introduce our institutional experience with dynamic SPECT for quantitative assessment of myocardial blood flow and its potential clinical applications.

Experience sharing on 4DM Myocardial Blood Flow (MBF) processing

4DM 心肌血流處理經驗分享

Yu-Cheng Shih

施鈺呈

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Quantification of myocardial blood flow (MBF) and myocardial flow reserve (MFR) has traditionally been performed with PET imaging, but recent advances in detector technology and reconstruction algorithms have enabled dynamic acquisition with SPECT. In this presentation, we will describe the workflow for calculating MBF using dynamic SPECT data processed with 4DM software. The talk will cover practical steps including dynamic image acquisition, reconstruction, motion correction, time–activity curve generation, and kinetic modeling required to derive MBF and MFR.

In addition to the technical aspects, we will share our institutional experience with dynamic SPECT MBF analysis, focusing on image interpretation and common pitfalls encountered in routine practice. Particular attention will be given to factors that may affect measurement accuracy, such as attenuation artifacts, extracardiac activity, limited temporal resolution, and patient motion. We will also discuss current limitations of SPECT-based MBF quantification.

Finally, we will review the clinical implications and prognostic value of MBF and MFR derived from dynamic SPECT, highlighting how these quantitative parameters may improve risk stratification and aid in the evaluation of coronary artery disease. Our experience suggests that, when properly performed and interpreted, dynamic SPECT MBF analysis can provide valuable physiologic information that complements conventional perfusion imaging.

Clinical practice in QPS/QGS image processing and reconstruction

QPS/QGS 影像處理與重建之臨床實務經驗

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李建穎

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臺北榮民總醫院 核醫部

Drawing from extensive clinical experience in a high-volume tertiary center, this presentation explores the optimization of Tl-201 myocardial perfusion imaging (MPI) using the GE NM530c (CZT) system. The focus is on the empirical development of standardized protocols necessary to ensure robust QPS/QGS quantification.

We first address the critical nature of patient positioning, detailing the clinical workflow for centering the heart within the 19 cm “sweet spot”— a vital step to prevent truncation and sensitivity degradation inherent in the NM530c’s stationary detector geometry. To ensure consistent results, we emphasize the implementation of standardized reconstruction requirements, utilizing optimized iterative parameters and filtering to maintain a uniform diagnostic baseline.

The core of this session highlights that achieving high-quality, high reproducibility images ultimately depends on the synergy between precise centering and sufficient acquisition time. By establishing rigorous standards for patient alignment and compensating for Tl-201’s specific photon flux through optimized scan duration, clinicians can minimize artifacts and stabilize diagnostic metrics in a demanding clinical environment.

The past and future of Cedars-Sinai Cardiac Suite (QGS/QPS/QPET/AutoQUANT)

Cedars-Sinai 心臟影像套裝軟體（QGS/QPS/QPET/AutoQUANT）的過去、現在與未來

Jack Chih-Chun Wei

魏志君

Quantitative Diagnostic Software Group, Cedars-Sinai Medical Center, USA

As part of Cedars-Sinai Medical Center, the Quantitative Diagnostic Software Group (formerly known as Artificial Intelligence in Medicine Program) has been developing software and algorithms that are considered the gold standard in nuclear cardiology. Our software applications have been available through licensing partners like GE, Siemens, and Philips for over 20 years, under names such as AutoQUANT, QGS, QPS, QPET and more.

We are constantly improving our software by incorporating new research and adding new features. A timeline of various software features introduced over the years and their clinical relevance will be given. It is also a great opportunity to bring developers behind the software and the end users, i.e., the healthcare professionals, together in the same forum. Therefore, part of the presentation will be expanded Q & A, with questions collected and forwarded by the organizer beforehand for more rounded and in-depth answers.