Symposium 11

次世代急診醫療：建立人工智慧驅動工具以輔助菌血症診斷與個人化復甦處置

Next-Gen Emergency Medicine: Developing AI-driven Tools for Assisting Bacteremia Diagnosis and Personalized Resuscitation Interventions

時間：2025 年 6 月 28 日(六) 09:20~10:20

會議室：202 會議廳

座長：黃俊諺醫師(亞東醫院)、陳祺偉醫師(高醫)

09:20~09:40 AI 眼中的心臟：用 3D TEE 讓 CPR 更有效

AI Eyes on the Heart: Making CPR Smarter with 3D TEE

主講人：陳家慶醫師(彰濱秀傳醫院)

09:40~10:00 開發一種基於智慧型手機的深度學習模型以預估個人化心肺復甦術的最佳胸部按壓位置和深度

The Development of a Smartphone-Based Deep Learning Model to Estimate the Optimal Chest Compression Location and Depth for Personalized CPR

主講人：呂宗謙醫師(臺大醫院)

10:00~10:20 人工智慧運用於菌血症的檢測

AI-Driven Approaches to Bacteremia Diagnosis

主講人：張裕鑫醫師(中國附醫)

課程簡介

- **AI 眼中的心臟：用 3D TEE 讓 CPR 更有效**

Background: High-quality cardiopulmonary resuscitation (CPR) and real-time hemodynamic assessment are critical in cardiac arrest management. While transesophageal echocardiography (TEE) is increasingly integrated into resuscitation, its use for real-time preload monitoring and optimization of compression location remains underexplored. This study evaluates the feasibility of using three-dimensional TEE (3D TEE) to assess left ventricular end-diastolic volume (LVEDV), end-systolic volume (LVESV), stroke volume (SV), and ejection fraction (EF) during CPR in out-of-hospital cardiac arrest (OHCA).

Methods: We conducted a prospective case series of adult patients with OHCA between November 2024 and March 2025. Following endotracheal intubation and initial fluid

resuscitation (500–1000 mL), a 3D TEE probe was inserted. Using a mid-esophageal four-chamber view and Philips QLAB 3D Quantification Advanced software, we measured LVEDV, LVESV, SV, and EF before and after TEE-guided optimization of the area of maximal compression (AMC).

Results: Four patients were enrolled. Initial AMCs varied, with compressions often over the aortic root, LOVT or RV. After TEE-guided repositioning toward the apex, LVEDV and SV increased significantly in three patients, all of whom achieved return of spontaneous circulation (ROSC). One patient with persistently low EDV and SV post-repositioning did not achieve ROSC. No right ventricular strain was observed.

Conclusion: 3D TEE enables continuous, real-time evaluation of preload and compression effectiveness during CPR. Increased LVEDV and SV were associated with ROSC, suggesting that 3D TEE may serve as a valuable tool for individualized, physiology-guided resuscitation. Further studies are needed to validate these findings and assess long-term outcomes.

- **開發一種基於智慧型手機的深度學習模型以預估個人化心肺復甦術的最佳胸部按壓位置和深度**

Background: CPR quality significantly impacts cardiac arrest outcomes. Despite anatomical differences, current guidelines recommend compressions at a specific depth on the lower sternum.

Objective: To develop a smartphone-based deep learning (DL) model for estimating optimal chest compression location and depth, enabling personalized CPR.

Methods: We prospectively enrolled adult Emergency Department (ED) patients undergoing chest CT scans. Patients' demographics and past medical history (PMH), including COPD and CHF, were collected. A smartphone with a LiDAR scanner captured front and lateral photos of the enrolled ED patients. CT scans were labeled for left ventricle (LV) location and measured chest wall depth, then were mapped onto the corresponding photos. These, along with demographics, PMH, and LiDAR data, were used for model training (70:30 train-test split). Customized Convolutional Neural Network (CNN) algorithms were developed to predict LV location and chest wall depth. Performance was evaluated using intersection over union (IOU) for LV localization and R-squared/RMSE for depth estimation.

Results: We included 347 cases (age 62.1±17.7, 38.0% female). Mean height was

163.9±9.1 cm, weight 63.6±16.3 kg, and chest wall depth 22.3±2.9 cm. The mean IOU for LV localization was 0.526±0.198. Chest wall depth estimation achieved R^2 = 0.731 (RMSE: 1.439).

Conclusion: Using smartphone photos, we successfully built a DL model to predict LV location and chest compression depth. This could support a mobile point-of-care CPR application, potentially improving CPR quality and patient outcomes if successfully implemented.

- **人工智慧運用於菌血症的檢測**

菌血症是一種潛在威脅生命的疾病。研究顯示，急診病患一旦發生菌血症，其 30 天死亡率顯著高於無菌血症的病患。然而，在臨床診斷中，傳統血液培養通常需時 1 至 3 天才能取得結果。因此，我們的研究目標是開發一種輔助工具，能夠在急診初步報告完成時，即刻向急診醫師提供病患當下菌血症風險的判斷，加速臨床風險評估，提升急診應用潛力。

我們採用全血檢驗作為資料來源，不依賴臨床資訊即可產出風險預測，提升模型應用的便捷性及普適性。此方法不僅加快預測速度，還能在臨床決策中提供即時輔助。

此外，除了急診菌血症辨識外，我們團隊也積極探討住院菌血症辨識及革蘭氏菌種預測，期望建立一個多場景應用的輔助診斷系統，以提升不同臨床情境下的預測準確性和實用性。