論文發表注意事項

【口頭論文發表】

- 試片室：7 樓 701C 會議室及 701G 會議室外小房間

- 口頭報告者請務必於該場次開始前 30 分鐘將隨身碟自行攜帶送至試片室進行測試，以避免中途影響會議速度進行，請先行測試檔案與隨身碟讀取正常。

- 一般論文口頭發表，每題 12 分鐘(報告 10 分鐘，討論 2 分鐘)，請各演講者務必控制報告時間，演講時間結束後即開燈結束演講。

- 學會於90年新增『年會論文優秀論文獎』，口頭發表及壁報發表分別評分。優秀論文獎得獎名單於會員大會公佈並頒獎。

- 得獎公佈—會員大會
  時間：112 年 12 月 10 日(星期日)上午 11:30 至 12:00 (請得獎者務必在現場)
  地點：701B會議室

- Our Preview Room are located outside of conference rooms 701B and 701F
- *Oral Presentation*

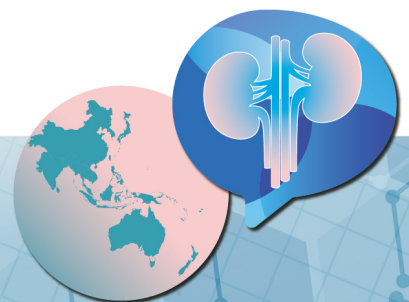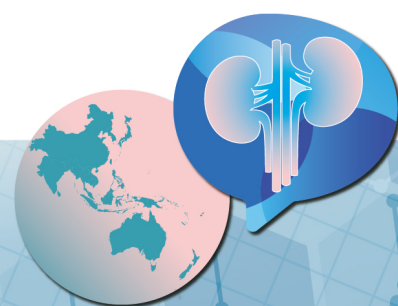| Presentation Time |
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| **12 Minutes**:
including 10 minutes of presentation and 2 minutes of Live Q&A |
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Oral Presentation 6 (English)

December 9 (Saturday), 2023 10:30 ~ 12:00   **Room 3 (701-D)**

【Clinical-4】   *Chair(s)：張哲銘/ Jer-Ming Chang、施宏謀/ Hong-Mou Shih*

10:30—10:42 1. A Pilot Study on the Architecture of Renal Ultrasonography AI Systems: Predicting Patient eGFR
Jing-Ru He[1], Yi-Chin Chen[1], Yen-Hua Huang[1,*], Kung-Hao Liang[3], Wei-Cheng Tseng[4], Shuo-Ming Ou[4], Wayne Huey-Herng Sheu[5], Der-Cherng Tarng[1,2,4,*]
[1]Institute of Biomedical Informatics, and [2]Department and Institute of Physiology, National Yang Ming Chiao Tung University; [3]Department of Medical Research, and [4]Division of Nephrology, Taipei Veterans General Hospital; [5]Institute of Molecular and Genetic Medicine, National Health Research Institute, Taiwan

10:42—10:54 2. Shear-Wave Elastography Predicts Kidney Function and Fibrosis in Glomerular Disease
Tyng-Shiuan Gau[1], Hao-Hsiang Hsu[1], Ruey-Yun Du[2], Wan-Ting Chiu[2], Ming-Shiou Wu[1], Fan-Chi Chang[1]
[1]Renal Division, Department of Internal Medicine, National Taiwan University Hospital
[2]Divison of Ultrasound, Department of Integrated Diagnostics and Therapeutics, National Taiwan University Hospital

10:54—11:06 3. Impact of SGLT2 inhibitors on patient outcomes: a network meta-analysis
Jui-Yi Chen[1], Heng-Chih Pan[2], Chih-Chung Shiao[3], and Vin-Cent Wu[4]
[1]Division of Nephrology, Chi-Mei Medical Center, Tainan, [2]Division of Nephrology, Keelung Chang Gung Memorial Hospital, Keelung, [3]Division of Nephrology, Camillian Saint Mary's Hospital Luodong, [4]Department of Internal Medicine, National Taiwan University Hospital, Taipei

11:06—11:18 4. Beneficial Effects of Angiotensin Receptor-Neprilysin Inhibitors in Patients with Acute Kidney Disease and Heart Failure
Jui-Yi Chen[1], Heng-Chih Pan[2], Vin-Cent Wu[3*]
[1]Department of Internal Medicine, Chi-Mei Medical Center, Tainan, Taiwan
[2]Department of Internal Medicine, Keelung Chang Gung Memorial Hospital, Taiwan
[3]Department of Internal Medicine, National Taiwan University Hospital, Taipei, Taiwan

11:18—11:30 5. Assessing the impact of tirzepatide on mitigating major adverse kidney and cardiac events in individuals with type 2 diabetes mellitus
Min-Hsiang Chuang[1], Zheng-Hong Jiang[2], Jui-Yi Chen[1], Vin-cent Wu[2]
[1] Division of Nephrology, Department of Internal Medicine, Chi Mei Medical Center.
[2] Division of Nephrology, Department of Internal Medicine, National Taiwan University Hospital and National Taiwan University College of Medicine

11:30—11:42 6. Enhancing renovascular service with a multidisciplinary model of care: an Australian tertiary hospital experience.
LH Jin [1], A Jones [1]
[1]Department of Vascular Surgery, The Canberra Hospital, Canberra, ACT, Australia

Oral Presentation 6 (English)

December 9 (Saturday), 2023   10:30 ~ 12:00   **Room 3 (701-D)**

11:42—11:54   7. Predicting Major Adverse Kidney Events in Patients with Heart Failure and Reduced Ejection Fraction by Deep Learning-Based Algorithms

Cheng-Chien Lai[1,3], Shao-Sung Huang[2,3], Der-Cherng Tarng[1,3,4], Wei-Cheng Tseng[1,3,4,*]

[1]Division of Nephrology and [2]Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital; [3]School of Medicine and [4]Center for Intelligent Drug Systems and Smart Bio-devices (IDS2B), National Yang Ming Chiao Tung University, Taiwan

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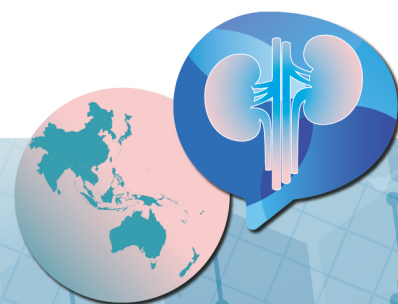
A Pilot Study on the Architecture of Renal Ultrasonography AI Systems: Predicting Patient eGFR

決定腎臟超音波影像 AI 系統架構之先導性研究：以推斷病人 eGFR 為例

Jing-Ru He[1], Yi-Chin Chen[1], Yen-Hua Huang[1,*], Kung-Hao Liang[3], Wei-Cheng Tseng[4], Shuo-Ming Ou[4], Wayne Huey-Herng Sheu[5], Der-Cherng Tarng[1,2,4,*]

何璟汝 [1], 陳奕瑾 [1], 黃彥華 [1,*], 梁恭豪 [3], 曾偉誠 [4], 歐朔銘 [4], 許惠恒 [5], 唐德成 [2,4,*]

[1]Institute of Biomedical Informatics, and [2]Department and Institute of Physiology, National Yang Ming Chiao Tung University; [3]Department of Medical Research, and [4]Division of Nephrology, Taipei Veterans General Hospital; [5]Institute of Molecular and Genetic Medicine, National Health Research Institute, Taiwan.

國立陽明交通大學 [1] 生物醫學資訊所、[2] 生理所; 臺北榮民總醫院 [3] 醫學研究部、[4] 腎臟科; [5] 國家衛生研究院分子與基因醫學研究所

Background：

Serum creatinine levels and estimated glomerular filtration rates (eGFR) are commonly used for kidney function assessments. Nonetheless, The process of drawing blood for the purpose of determining creatinine levels is cumbersome and the results are not immediately available. Therefore, utilizing non-invasive ultrasound imaging analyses to predict eGFR values remain an unmet medical need. Previously, variability of ultrasound images and noise from non-target organs hinders the accuracy of eGFR prediction and the severity of kidney disease. This pilot study aimed to find suitable architectures and training hyperparameters for developing a deep learning model to predict eGFR by renal ultrasound images.

Methods：

This pilot study investigates deep learning architecture for renal function classification and eGFR value regression.In the first part of the study, classification models were tested using the ResNet family architecture, including binary and multiclass classifications. Binary classification distinguishes patients with eGFR in the normal and abnormal ranges, while multiclass classification assigns patients based on international kidney function index standards. In the second part of the study, regression models were built using architectures of ResNet, DenseNet, and SqueezeNet. These models predict kidney function index directly from kidney ultrasound images. Various pre-training methods, such as using Monai's MedMNIST as a pre-training dataset, were employed to enhance machine learning effectiveness.

Results：

In binary classification tests, the accuracy was 0.60, while in multiclass scenarios, it decreased to 0.23, indicating the difficulty of classifying patients with different levels of renal functions. We further increased the difficulty by targeting at the prediction of eGFR values. Different machine model architectures were tested for regression problems, with one of the best results achieved using EfficientNet-b0, showing a correlation coefficient of 0.33 between predicted and actual values. Furthermore, employing transfer learning/pre-training methods increase the correlation coefficient to 0.41.

Conclusions：

The EfficientNet-b0 was found to be more suitable for developing deep learning models for renal ultrasound imaging. Utilizing publicly available medical image datasets (such as MedMNIST) for model pre-training enhanced the prediction accuracy. To date, there remains significant rooms for improvement. Higher correlation might be achieved by increasing the volume and quality of training data. The pre-training with a diverse range of medical image datasets from various categories and sources could further enhance the deep learning model's predictive capabilities.

Key words：

Deep Learning, Estimated Glomerular Filtration Rate, Renal Ultrasound Imaging, Transfer Learning

2

Shear-Wave Elastography Predicts Kidney Function and Fibrosis in Glomerular Disease
利用剪力波彈性超音波預測腎絲球腎炎的腎功能及腎臟纖維化

Tyng-Shiuan Gau[1] Hao-Hsiang Hsu[1] Ruey-Yun Du[2] Wan-Ting Chiu[2] Ming-Shiou Wu[1] Fan-Chi Chang[1]

高廷瑄[1] 許皓翔[1] 杜瑞雲[2] 邱婉婷[2] 吳明修[1] 張芳綺[1]

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[1]台大醫院內科部腎臟科 [2]台大醫院綜合診療部超音波科

Background：

Kidney fibrosis is the cardinal histological feature of chronic kidney disease (CKD), which is associated with increased tissue stiffness and correlates with declining kidney function. Shear wave elastography (SWE) estimates tissue stiffness by applying a pulse wave to the region of interest and measuring the shear wave velocity. This cross-sectional study aims to validate the predictive value of SWE in assessing kidney function and chronicity in patients undergoing native kidney biopsy.

Methods：

From December 2021 to August 2023, a total of 194 patients underwent SWE at National Taiwan University Hospital. Clinical parameters and laboratory tests evaluating kidney function were recorded. The histological features of kidney biopsy specimens were quantified, including the percentage of inflammation, tubular atrophy, interstitial fibrosis, and a TIS score, which was the sum of these features. Univariate and multivariate analyses were conducted to assess the correlation between SWE findings, kidney function and the index derived from the histological features.

Results：

A total of 152 patients were included in the analysis. Higher elasticity was associated with a lower estimated glomerular filtration rate (eGFR), a higher blood urea nitrogen level, and a lower hemoglobin level ($P = 0.03165$, 0.03192, and 0.01653, respectively). While a higher percentage of inflammation and TIS score appeared to be linked to increased elasticity, these associations did not reach statistical significance ($P = 0.17806$ and 0.09113, respectively). Further analysis of patients with glomerular disease revealed that higher elasticity was associated with a higher serum creatinine level, increased inflammation, tubular atrophy, interstitial fibrosis, and TIS score ($P = 0.0083$). Multivariate regression analyses demonstrated a significant association between elasticity and the TIS score.

Conclusions：

SWE proves to be a feasible and noninvasive tool for estimating kidney stiffness in glomerular diseases. Given the invasiveness of kidney biopsy, these findings may assist clinicians in determining its necessity, particularly for advanced CKD patients.

Key words：

Shear wave elastography, kidney biopsy, chronic kidney disease, glomerular disease, fibrosis

3

Impact of SGLT2 inhibitors on patient outcomes: a network meta-analysis
SGLT2 抑制劑於各族群的預後，網絡統合分析

Jui-Yi Chen[1], Heng-Chih Pan[2], Chih-Chung Shiao[3], and Vin-Cent Wu[4]
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[1]奇美醫院腎臟科 [2]基隆長庚腎臟科 [3]羅東聖母醫院腎臟科 [4]臺灣大學附設醫院內科部

Background：

A comprehensive network meta-analysis comparing the effects of individual sodium-glucose cotransporter 2 (SGLT2) inhibitors on patients with and without comorbidities including diabetes mellitus (DM), heart failure(HF), and chronic kidney disease (CKD) has not been conducted.

Methods：

We searched PubMed, Embase, Cochrane, and ClinicalTrials.gov for RCTs up to March 28, 2023. Network meta-analysis using a random-effects model was conducted to calculate risk ratios. Risk of Bias tool 2.0 was used to assess bias, and CINeMA to assess the certainty of evidence. In the subgroup analysis, the SGLT2 inhibitors were classified into highly (dapagliflozin, empagliflozin, and ertugliflozin) and less selective SGLT2 inhibitors (canagliflozin and sotagliflozin).

Results：

Fourteen trials with 75,334 patients were included, of whom 40,956 had taken SGLT2 inhibitors and 34,378 had not. One of the main results with particular findings was empagliflozin users had a significantly lower risk of all-cause death compared to dapagliflozin users in DM population (RR: 0.81). In HF population, sotagliflozin users had a borderline significantly lower risk of CV death or HHF than dapagliflozin users (RR: 0.90). In non-HF population, those who used canagliflozin had a significantly lower risk of CV death or HHF compared with those who used dapagliflozin (RR: 0.75). At last, for HF patients, those who used less selective SGLT2 inhibitors had a significantly lower risk of MACEs compared to those who used highly selective SGLT2 inhibitors (RR: 0.75).

Conclusions：

Our network meta-analysis found that empagliflozin users with diabetes had a lower risk of dying from any cause than those using dapagliflozin. Canagliflozin users had a lower risk of cardiovascular death or HHF than dapagliflozin users in non-heart failure patients. In HF patients, less selective SGLT2 inhibitors were associated with the best CV composite outcome, even outperforming highly selective SGLT2 inhibitors.

Key words：

SGLT2 inhibitor, Diabetes, Heart Failure, Chronic Kidney Disease, Network Meta-analysis

Beneficial Effects of Angiotensin Receptor-Neprilysin Inhibitors in Patients with Acute Kidney Disease and Heart Failure

血管張力素受體-腦啡肽酶抑制劑對於心臟衰竭合併急性腎疾病的效果

Jui-Yi Chen[1], Heng-Chih Pan[2], Vin-Cent Wu[3*]

陳銳溢 [1], 潘恆之 [2], 吳允升 [3]

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[1.]奇美醫院內科部 [2.]基隆長庚內科部 [3.]台灣大學附設醫院內科部

Background：

Angiotensin receptor-neprilysin inhibitors (ARNi) have benefits in improving CV outcomes in heart failure (HF) patients. However, the impact on HF patients with concurrent acute kidney disease (AKD) remains underexplored. This study aims to compare the effects of ARNI with angiotensin-converting enzyme inhibitors (ACEi) as a control in HF patients also diagnosed with AKD.

Methods：

We analyzed data from the TriNetX, which included 42,596,776 hospitalized patients diagnosed with both HF and AKD. The cohort was stratified into ARNI users and a control group on ACEi. Propensity score matching was employed. We assessed mortality, re-admission rates, 4-point Major Adverse Kidney Events (4p-MAKE), and 4-point Major Adverse Cardiac Events (4p-MACE). Both positive/negative outcomes and positive/negative exposure controls were examined for validation. Subgroup analyses were also performed.

Results：

During 5-year follow-up, the ARNI individuals had lower risk of mortality [aHR:0.67, $p < 0.001$], 4p-MAKE [aHR:0.69, $p = 0.001$], re-admission [aHR:0.64, $p < 0.001$], but there was no significant difference of 4p-MACE [aHR:0.90, $p = 0.12$]. Positive outcome controls indicated higher risks of hypotension [aHR:1.16, $p < 0.001$], in the ARNI group compared to the ACEi group, while negative outcome controls showed no significant differences in other outcomes. Besides, positive exposure controls with ACEi/ARB had lower risks of mortality and 4p-MAKE, while negative exposure controls with calcium channel blockers, or sedative drugs did not. Subgroup analyses based on the presence of DM, hypertension, proteinuria, different LVEF, eGFR, before/after 2020, and the use of beta-blockers, diuretics, and mineralocorticoid receptor antagonists, showed that the ARNI group had a lower risk of incident mortality, MAKE, readmission.

Conclusions：

In HF patients with AKD, ARNIs were associated with a lower risk of mortality, 4p-MAKE, and re-admission compared to ACEi. However, there are no significant differences in 4p-MACE.

Key words：

ARNI, heart failure, acute kidney disease, mortality, re-admission, major adverse kidney events

Assessing the impact of tirzepatide on mitigating major adverse kidney and cardiac events in individuals with type 2 diabetes mellitus

評估 tirzepatide 用於第 2 型糖尿病患減少主要腎臟及心臟不良事件之影響

Min-Hsiang Chuang[1], Zheng-Hong Jiang[2], Jui-Yi Chen[1], Vin-cent Wu[2]

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Background: The effect of tirzepatide in reducing adverse kidney or cardiac events and all-cause mortality in patients with type 2 diabetes mellitus remain not well-defined. We aim to investigate the potential role of tirzepatide in reducing mortality, adverse kidney and cardiovascular outcomes compared to glucagon-like peptide-1 receptor agonist (GLP-1 RA) in this population.

Methods: This retrospective cohort study included 32,284 individuals from the US Collaborative Network of TriNetX database. We identified patients with type 2 diabetes mellitus treated with either tirzepatide or GLP-1 RAs between 1 June, 2022 and June 30, 2023 and compared clinical outcomes between the tirzepatide and GLP-1 groups after propensity score matching to balance baseline characteristics. The primary outcome was all-cause mortality and secondary outcomes included major adverse kidney events (MAKE), major adverse cardiac events (MACE), acute kidney injury (AKI), the composite of MAKE and all-cause mortality, and the composite of MACE and all-cause mortality.

Results: Patients treated with tirzepatide had a lower hazard of all-cause mortality (adjusted hazard ratio [aHR]: 0.47, 95% confidence interval [CI]: 0.29–0.76, p=0.002), MACE (aHR: 0.78; 95% CI: 0.65–0.93; p=0.006), MAKE (aHR: 0.51; 95% CI: 0.29–0.88; p=0.013), AKI (aHR: 0.85; 95% CI: 0.72–1.00; p=0.047), MACE and all-cause death (aHR: 0.73; 95% CI: 0.62–0.87; p<0.001), and MAKE and all-cause death (aHR: 0.48; 95% CI: 0.33–0.71; p<0.001). The results were consistent when antidepressants were introduced as the negative control exposure, and there was no significant differences in the hazard of negative control outcomes between the two groups. Subgroup analysis revealed more prominent reduction in all-cause mortality among patients with HbA1c <7%, diagnosed with hypertension, prescribed insulin or ACE inhibitors/ARBs, without a history of ischemic heart diseases, and not utilizing metformin or SGLT2 inhibitors.

Conclusions: Treatment with tirzepatide is associated with reduced hazard of all-cause death, adverse kidney and cardiac events compared to GLP-1 RAs in patients with type 2 diabetes mellitus, highlighting the potential of tirzepatide in current clinical practice.

Key words: tirzepatide, all-cause mortality, major adverse kidney events, major adverse cardiac events, type 2 diabetes mellitus.

6

Enhancing renovascular service with a multidisciplinary model of care: an Australian tertiary hospital experience.

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Chronic kidney disease is a growing health issue worldwide. In Australia, the prevalence of end-stage renal failure (ESRF) receiving renal replacement therapy has continued to rise. In 2020, it reached 1,074 per million population with more than half relying on dialysis. Elderly and Indigenous recipients of renal replacement therapy were disproportionately represented at 3,037 and 2,423 per million population respectively. The Canberra Hospital is the major tertiary referral hospital for Australia's capital city. It serves the Australian Capital Territory and the surrounding regions with a total catchment of more than 650,000 population. The renovascular service cares for more than 4,000 ESRF patients. There are about 350 patients with fistulas; most of which are regularly accessed for dialysis.

The renovascular service has significantly transformed over the years to best accommodate for the growing clinical demands from an expanding cohort of ESRF patients. Prior to 2017, the service was fragmented. The nephologists were the main drivers of care. They provided assessment of patients, instituted best medical therapy, determined dialysis commencement, as well as directed referrals to surgeons for access formation and interventional radiologists (IRs) for access salvage. The surgeons and IRs were regarded as technicians. The referral process was sluggish; the surgical treatment was episodic; and the approach to care was reactive. This resulted in considerable patient dissatisfaction. During 2018 and 2019, there was a transition to multidisciplinary model of care. The approach to care became more proactive and there was a shift towards focusing on continuity of care. "Complete access journey" was instituted where the surgeons extended their involvement beyond the initial access planning and formation to the subsequent surveillance and interventions to maintain access function and enhance access lifespan. This was supported by expansion of endovascular capabilities and addition of dedicated nursing liaison. Communication was direct and collaborative; this transpired to expedited reviews and procedures. During the COVID-19 pandemic, the service was refined through pragmatism. New strategies were implemented to reduce hospitalisation without compromising care. Duplex ultrasound imaging was introduced to the clinic for real-time access assessment rather than referring patients to the radiology department for imaging. Some minor procedures became day cases and were performed at secondary hospitals where there was a lower risk of COVID-19 transmission. Regular multidisciplinary meetings were established to adapt the service to the changing needs.

Since implementing the multidisciplinary model of care, we have observed improvement in several clinical outcomes. There was a 39% reduction in the time to access formation from referral (130 days vs. 213 days). There has been a 4% reduction in the use of prosthetic AV grafts (8% vs. 12%). Due to improved surveillance and assisted patency, there has been also a 44% reduction in fistula thrombosis (43 episodes/year vs. 24 episodes/year). With ongoing refinement of the multidisciplinary care model, we anticipate further improvements in outcomes in the years to come.

7

Predicting Major Adverse Kidney Events in Patients with Heart Failure and Reduced Ejection Fraction by Deep Learning-Based Algorithms
以深度學習演算法預測低收縮率心衰竭病人之重大不良腎臟事件

Cheng-Chien Lai[1,3], Shao-Sung Huang[2,3], Der-Cherng Tarng[1,3,4], Wei-Cheng Tseng[1,3,4,*]

賴政謙[1,3]，黃少嵩[2,3]，唐德成[1,3,4]，曾偉誠[1,3,4,*]

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臺北榮民總醫院內科部[1]腎臟科、[2]心臟科，國立陽明交通大學[3]醫學系、[4]智慧型藥物與智能生物裝置研究中心

Background：

Patients with heart failure and reduced ejection fraction (HFrEF) are at high risk of renal failure, and the Kidney Failure Risk Equation (KFRE) remains suboptimal for these patients. Whether deep learning-based algorithms improve prediction of major adverse kidney events (MAKE) is unclear.

Methods：

A longitudinal cohort of 12,012 patients undergoing transthoracic echocardiography between 2011 and 2018 for heart failure were screened and 1,486 HFrEF patients were enrolled. Thereafter, 994 eligible patients were randomly split into 70%/30% for model development and testing. Deep learning models including extreme gradient boosting (XGBoost), random forest (RF), and ensemble learning (Ensemble) were constructed to predict MAKE (renal death, renal replacement therapy, renal function decline, new-onset macroalbuminuria). Model performance was analyzed by area under curve (AUC) as well as Brier score, and compared against KFRE by net reclassification index. Top-ranked features were discovered by Shapley additive explanations analyses.

Results：

Of the 994 patients, 198 (19.9%) developed MAKE within 3 years. In the testing dataset, XGBoost (AUC 0.8423, Brier 0.135, $p < 0.001$), Ensemble (AUC 0.8418, Brier 0.127, $p < 0.001$), and RF models (AUC 0.836, Brier 0.128, $p < 0.001$) resulted in superior performance comparing with KFRE (AUC 0.634, Brier 0.178). XGBoost, Ensemble, and RF models more accurately reclassified 7.6%, 30.5%, and 26.4% patients for MAKE. Of the top predictors, mitral E/e' and tricuspid regurgitation pressure gradient (TRPG) had stronger influence on MAKE than NT-proBNP.

Conclusions：

XGBoost and Ensemble provided better prediction of MAKE in HFrEF, with mitral E/e' and TRPG as novel predictors, thereby allowing early diagnosis and treatment in such risky population.

Key words：

Heart failure; Kidney Failure Risk Equation; Machine learning; Major adverse kidney event.