Retrospective, single-center study

Participants

179 patients with Chronic heart failure

Sample analysis

Echocardiography, liver CT image selection, histopathology

Deep neural network (DNN)

Residual Network (ResNet) – 110 for image classification

Dataset preparation

Image resizing of liver CT scans
Training: 80% of images,
Evaluation: 20%
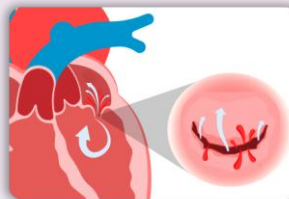
Deep learning model

ResNet-110 trained on labeled CT images

Evaluation

Comparison with expert-assessed images

Key predictors of tricuspid regurgitation (TR) severity
($P < 0.01$ for all intergroup comparisons)

- Inferior vena cava (IVC) diameter increases with TR severity
- total bilirubin (T-Bil), gamma-glutamyl transpeptidase (γ-GTP), The Model for End-Stage Liver Disease excluding the International Normalized Ratio (MELD-XI) score, TR pressure gradient (TRPG) significantly increases

TR severity prediction performance
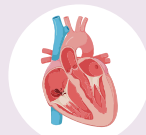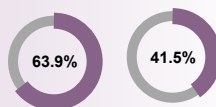
Mild TR　　**Moderate TR**　　**Severe TR**

AI recall values

- Severe TR - 1.000 (100% correctly classified)
- Moderate TR - 0.769 (Balanced performance)
- Mild TR - 0.375 (Some misclassification)

Comparative analysis

63.9%　　41.5%

AI accuracy - 63.9%
vs
Experts - 41.5%

- AI excelled in detecting severe TR cases
- F-measure highest for severe TR (0.737)
- Experts struggled more with mild TR cases

AI model strengths

- ✅ ResNet-110 detected morphological liver changes
- ✅ Potential for early congestive hepatopathy detection
- ✅ Clinical integration could improve diagnosis

- **Supplementary Figure 1** This graphical abstract summarizes a single-center comparative study evaluating the diagnostic performance of artificial intelligence (AI) versus human experts in predicting tricuspid regurgitation (TR) severity in patients with chronic heart failure. A deep residual neural network (ResNet-110) was trained on liver CT images and achieved superior accuracy in detecting severe TR compared with experts (AI: 63.9% vs. Experts: 41.5%). The model correctly classified 100% of severe TR cases, with balanced performance in moderate TR and partial misclassification in mild TR. Key predictors associated with TR severity included inferior vena cava (IVC) diameter, total bilirubin, γ-glutamyl transpeptidase (γ-GTP), MELD-XI score, and TR pressure gradient (TRPG). The results highlight the potential of AI-assisted image analysis to improve early detection of congestive hepatopathy and enhance clinical decision-making in heart failure management.