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Cardiovascular Medicine



The First Application of Transcatheter Caval Valve Implantation for Severe Tricuspid Regurgitation in a Patient With High Surgical Risk

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A 52-year-old female patient was transferred with dyspnea (New York Heart Association classification IV), edema and abdominal distention for 5 months. She had a history of hypertension, type 1 diabetes with gastropathy and nephropathy requiring maintenance hemodialysis. Her body mass index was 15.3, and activity was poor due to pelvic bone fracture. Echocardiogram demonstrated right atrium (RA) and right ventricle (RV) dilatation, and incomplete coaptation of tricuspid valve, resulting in severe isolated tricuspid regurgitation (TR) without left heart disease (**Figure 1A, Supplementary Video 1**). Endoscopy revealed esophageal varices and congestive gastropathy and computed tomography showed hepatic congestion and marked ascites.

The patient had surgical high risk (calculated Society of Thoracic Surgeons score 17%) and family members strongly refused the surgery. After several rounds of heart team discussion, we finally decided to perform transcatheter caval valve implantation (CAVI), which can block the caval backflow in highly selected inoperable patients.¹⁻³⁾

Firstly, the locations of the RA, inferior vena cava (IVC), and hepatic vein were confirmed with cavogram. Before valve implantation, a bare-metal stent (Niti-S® 30×60 mm; TaeWoong Medical, Seoul, Korea) that served as a supporting structure was placed at the junction of IVC and RA (**Supplementary Video 2**). After then, Pulsta® (30×38 mm; TaeWoong Medical) valve was implanted onto the supporting stent (**Figure 2, Supplementary Video 3**). After valve implantation, valve migration and hepatic vein obstruction were not observed (**Figure 3**).

The patient recovered well clinically without complication and chest X-ray showed improving cardiomegaly and bilateral pleural effusion dramatically (**Figure 4**). In conclusion, CAVI may be an alternative treatment option for selected patients with severe TR with surgically high risk.

Written informed consent was obtained from the patient.

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Conflict of Interest

The corresponding author, Kiyuk Chang has no financial conflict of interest with TaeWoong Medical. The other authors have no financial conflict of interest with TaeWoong Medical. There is no conflict of interest to declare regarding 'TaeWoong Medical' in Figure 2.

Data Sharing Statement

The data generated in this study is available from the corresponding author(s) upon reasonable request.

Author Contributions

Conceptualization: Byeon J, Lee KY, Oh GC, Choo EH, Hwang BH, Chang K; Data curation: Byeon J, Lee KY, Oh GC, Choo EH; Formal analysis: Byeon J; Investigation: Byeon J, Hwang BH; Methodology: Hwang BH, Chung WB, Chang K; Validation: Chang K; Writing - original draft: Byeon J; Writing - review & editing: Chang K.

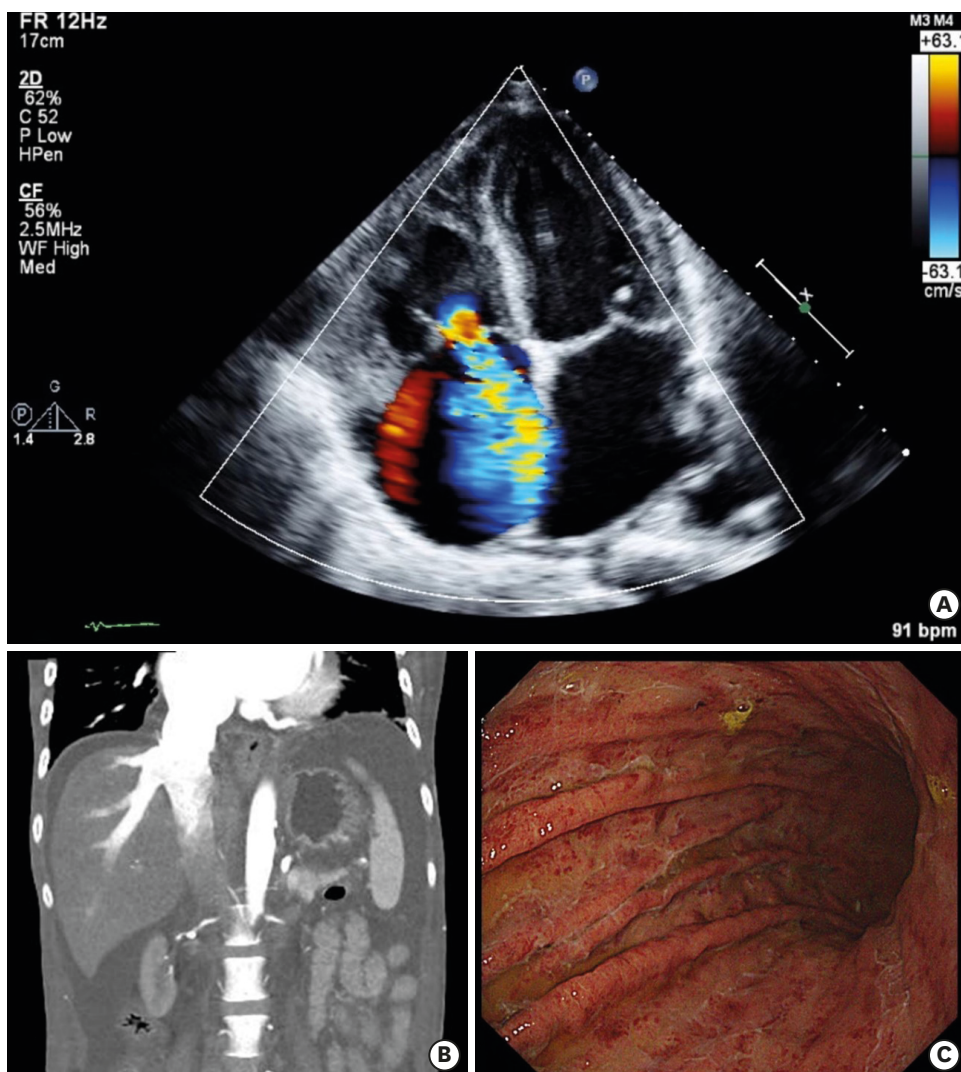


Figure 1. Echocardiogram, abdominal enhanced CT, and gastroscopy. (A) Apical 4 chamber view shows incomplete coaptation of tricuspid valve with severe tricuspid regurgitation by color doppler echocardiogram. (B) Abdominal enhanced CT scan illustrates significant contrast reflux into the hepatic veins and inferior vena cava. (C) Gastroscopy reveals submucosal congestion and erythema in the gastric body, suggesting congestive gastropathy. CT = computed tomography.

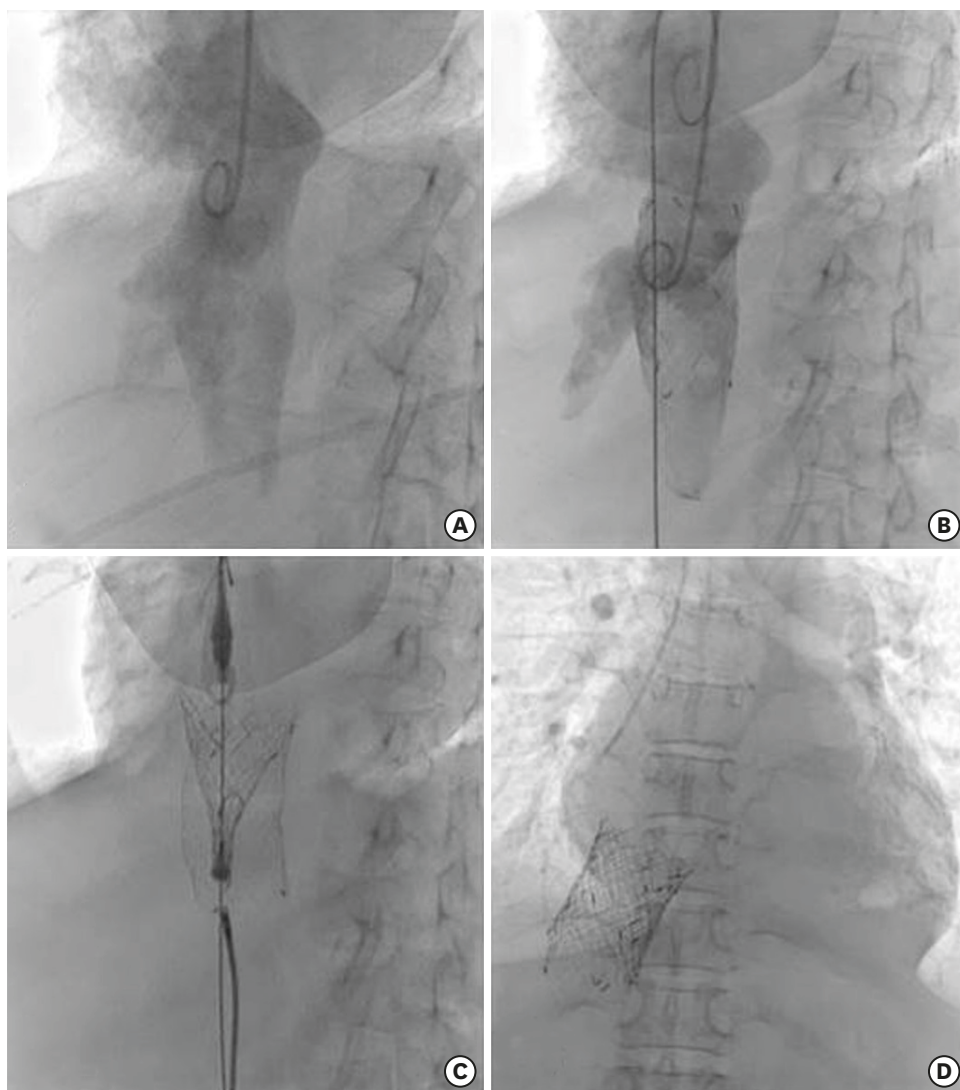


Figure 2. CAVI using self-expandable valve.

(A) Cavogram by using a pigtail catheter through the right jugular vein reveals the locations of the RA, IVC, and hepatic veins. (B) After the placement of a 20 Fr sheath through the left femoral vein, a small pre-shaped Safari wire was located at the right atrium. After then, a large-diameter bare-metal stent (Niti-S® 30×60 mm; TaeWoong Medical) was placed from the junction of the IVC and RA to distal IVC beyond hepatic veins for the supporting frame to prevent valve migration. (C) Pulsta® (30×38 mm; TaeWoong Medical) valve was gradually deployed in the IVC-RA junction with about 5 mm RA protrusion. During the implantation process, a snare was used to hold the Niti-S® stent not to be dragged up. (D) Final fluoroscopy shows successful CAVI without any complication. CAVI = caval valve implantation; IVC = inferior vena cava; RA = right atrium.

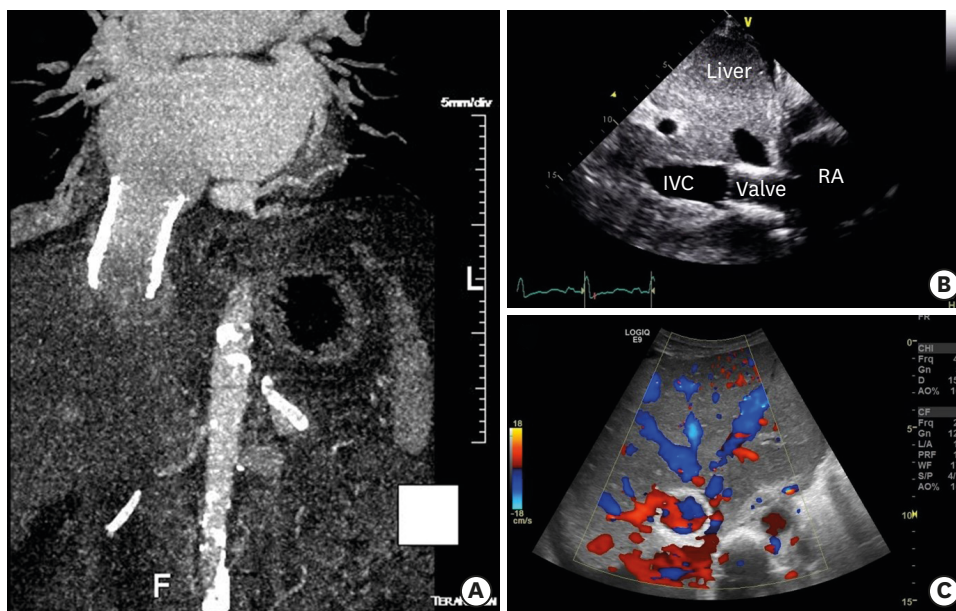


Figure 3. CT, echocardiogram, and liver sonogram after CAVI. (A) CT (post CAVI, reconstructed image) scan reveals blocking contrast reflux into hepatic vein compared to CT before CAVI. (B) Echocardiographic subcostal view shows implanted caval valve. (C) Liver sonogram demonstrates mild hepatic venous stenosis without obstruction. CAVI = caval valve implantation; CT = computed tomography; IVC = inferior vena cava; RA = right atrium.

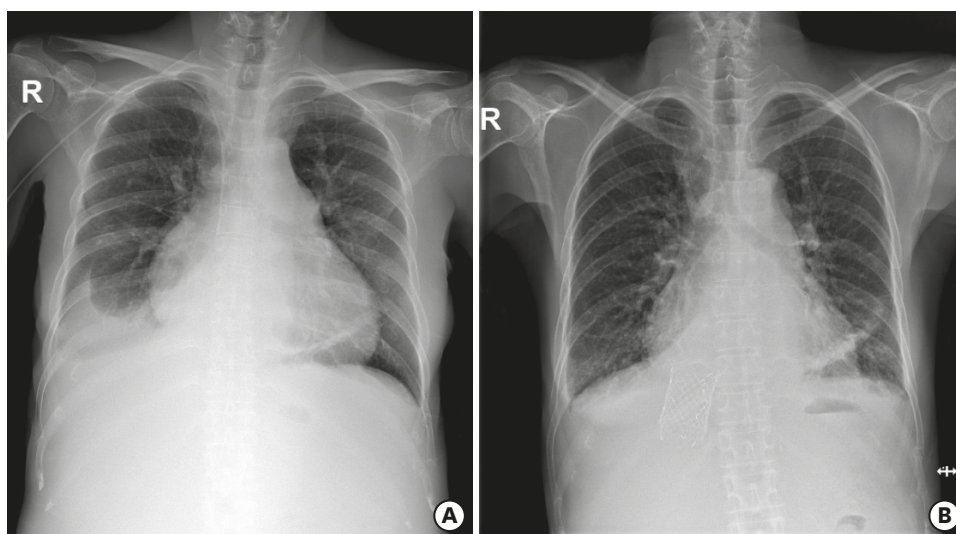


Figure 4. Pre-CAVI and post-CAVI chest X-rays. (A) Chest X-ray shows cardiomegaly and pleural effusion. (B) Chest X-ray after CAVI shows improving cardiomegaly and pleural effusion. CAVI=caval valve implantation.

SUPPLEMENTARY MATERIALS

Supplementary Video 1

Severe isolated tricuspid regurgitation on echocardiogram

[Click here to view](#)

Supplementary Video 2

Supporting bare-metal stent placement

[Click here to view](#)**Supplementary Video 2**

Caval valve implantation

[Click here to view](#)**REFERENCES**

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