Multi-Modality imaging of complex functional tricuspid regurgitation successfully addressed by a patient-tailored “zipping by clipping strategy” with the K-Clip tricuspid annuloplasty system

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Short title: Complex functional tricuspid regurgitation successfully addressed by a “zipping by clipping strategy”

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Contributor and guarantor information

The first author, Zhi-Nan Lu, MD planned, conducted, and reported of the work described in the article.

The second author, Yutong Ke, MD provided the image information and participated to write the original manuscript.

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A 78-year-old female with 10-year chronic atrial fibrillation was admitted for refractory peripheral edema. She was extremely weak but hemodynamically stable. Examination showed a grade 3/6 systolic heart murmur, abdominal swelling with shifting dullness, and severe lower extremity edema. Electrocardiogram confirmed atrial fibrillation. Transthoracic echocardiography revealed biatrial dilatation, torrential tricuspid regurgitation (TR), moderate mitral regurgitation, normal biventricular dimension and preserved systolic function. Transesophageal echocardiography (TEE) demonstrated marked dilated tricuspid annulus (TA) leading to a stellate-shaped regurgitant orifice among four leaflets with the maximal coaptation gap of 8.15mm (Panel A and B, Supplementary material online, video S1-S3).

She was evaluated for surgery but declined because of advanced age, frailty and severe kidney dysfunction with a high society of thoracic surgery (STS) score of 15.8% and the European System for Cardiac Operation Risk Evaluation II (EuroSCORE II) of 6.83%. The multidisciplinary heart team suggest the K-Clip™
transcatheter annuloplasty system (Huihe Medical, China) was a feasible choice. Cardiac computed tomography (CT) was arranged to size the tricuspid annulus (Panel D) and generate procedural plan to avoid right coronary artery (RCA) injury (Panel E).

Considering the posterior annular length was dilated to 51.7mm (Panel F), a patient-tailored “zipping by clipping strategy” was proposed to maximumly plicate the posterior annulus. The first clip (12mm) was moved forward to anteroposterior commissure, plicating anterolateral segment of posterior annulus. Then the second clip (12mm) was used to clamp the remaining posteroseptal segment, resulting in bicuspidalization and mild residual TR without tricuspid orifice stenosis (mean trans tricuspid valve gradient post procedure=2 mmHg) (Panel G1-G3, Supplementary material online, Video S4). Repeated coronary angiography was performed to confirm unaffected RCA flow during the procedure (Panel H1-H3). At 6-month follow-up, the patient’s condition greatly improved with resolved edema and sustained mild TR.

This is the first case to show based on modality imaging evaluation, the complex functional TR can be successfully addressed by a patient-tailored “zipping by clipping strategy” with the K-Clip system.
Supplementary material

Supplementary material is available at European Heart Journal-Case Report online.

Consent: the authors confirm that written consent for submission and publication of this case report, including images and associated text, has been obtained from the patient in line with Committee on Publication Ethics guidance.

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Figure Legends

(A) Significant tricuspid annulus dilatation with extensive huge coaptation gaps among four leaflet was shown in 2-dimensional (2D) transgastric short axis view. (B) Torrential tricuspid regurgitation with a stellate-shaped orifice and the maximal coaptation gap of 8.15mm was demonstrated in 2D transgastric short axis view with color Doppler. (C) Significant tricuspid annulus dilatation with extensive huge coaptation gaps among four leaflet was confirmed in 3-dimensional (3D) enface view. (D) Tricuspid annulus (TA) circumstance measured by cardiac CT was dilated to 135mm. (E) The distance between the tricuspid annulus and right coronary
artery (RCA) was measured at multiple points, with a distance of ≥4 mm considered safe for K-Clip implantation without causing RCA injury. (F) Posterior tricuspid annulus length was 51.7 mm. (G1-G3) Under live 2D and 3D transesophageal echocardiography guidance with multiplanar reconstruction technique, a novel “zipping by clipping” strategy was employed to close the extensive dilated posterior annulus by segmental clipping the posterior annular tissue from anteroposterior commissure to posterior commissure with two clips (12 mm), resulting mild residual TR. (H1-H3) Repeated coronary angiographies was performed post devices anchoring, clamping and released to confirm unaffected RCA flow during the procedure. A, anterior leaflet; AV, aortic valve; P, posterior leaflet; RCA, right coronary artery; RV, right ventricle; S, septal leaflet; TA, tricuspid annulus.
Figure 1

559x397 mm (x DPI)