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**Background** Percutaneous paravalvular leakages (PVL) closure has emerged as a palliative alternative to surgical management in selected high-risk patients. Percutaneous procedures are challenging especially for mitral PVL. An accurate imaging of the morphologies of the defects is mandatory together with a precise guiding in the catheterization laboratory to enhance success rate. **Purpose** We aimed to describe imaging modalities used in clinical practice to guide percutaneous PVL closure and assess the potential interest of new imaging tools.

**Methods** Data from the FFPP ("Fermeture de Fuite paraprothétique") register were used. The FFPP register is an international multi-institutional collaborative register started in 2017. A descriptive analysis of multimodality imaging used to guide PVL closure in clinical practice was performed.

**Results** Data from 173 procedures performed in 19 centers from 3 countries (France, Belgium, Poland) were collected and included 8 cases of PVL following transcatheter valve replacement. Transesophageal echocardiography was used in 167 cases (96.5%) including 87.4% of cases with use of 3D-echocardiography. In one case 3D-echocardiography was combined and fused in real time with fluoroscopy images using echonavigator software. From a sample of 31 patients, details about multimodality imaging were available. Cardiac tomodensitometry (CT) was done before 10 procedures. In one case, fusion between pre-procedural cardiac CT angiography data and fluoroscopy data was used. In 2 cases, printing of a 3D model of the valve with PVL was done (Fig. 1).

**Conclusion** Echocardiography and in particular the 3D mode, is the cornerstone of paravalvular leakages imaging. Other imaging modalities such as cardiac computed tomography and cardiac magnetic resonance imaging may be of complementary interest. New techniques such as imaging fusion and printing may further facilitate the percutaneous approach of paravalvular leakages.

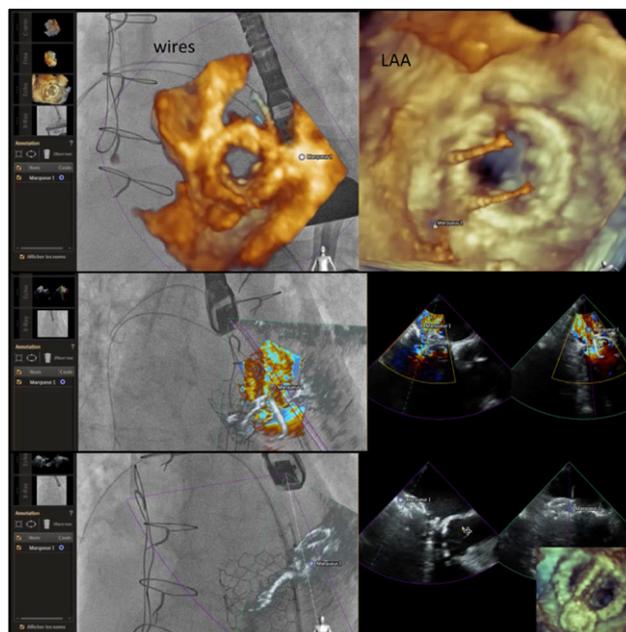


Fig. 1 Mitral paravalvular leak closure under 3D-Echocardiography-Fluoroscopy fusion guidance.

**Disclosure of interest** The authors declare that they have no competing interest.

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### Three-Dimensional inferior vena cava for assessing central venous pressure in patients with cardiogenic shock



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**Background** Evaluation of central venous pressure (CVP) by inferior vena cava (IVC) measurements is crucial in the management of patients with cardiogenic shock to optimize drugs therapy. IVC has a complex 3-dimensional (3D) shape but measurements used to estimate CVP remain based on 2-dimensional (2D) echocardiographic imaging.

**Purpose** The aim of this study was to investigate the accuracy of CVP estimation by IVC size and collapsibility index obtained using 3D-echocardiography compared with 2D in patients with cardiogenic shock.

**Methods** Eighty consecutive echocardiographic examinations performed in 33 patients (72 ± 15 years, left ventricular ejection fraction = 19 ± 10%) admitted for cardiogenic shock were prospec-

tively included. Two and three-dimensional images of the IVC, performed at baseline and when CVP was  $\leq 10$  mmHg, were acquired simultaneously with invasive measurement of CVP, both at rest and during sniff test. 2D and 3D IVC diameters, 3D IVC area and collapsibility index (IVCCI) were assessed. The eccentricity index (EI) was computed from 3D data as the ratio of maximum over minimum IVC diameter. The cut-off value of 10 mmHg of CVP defined patient with euvolemia hemodynamic status.

**Results** At rest, the IVC diameter averaged  $23 \pm 7$  mm by 2D and  $25 \pm 8 \times 19 \pm 7$  mm by 3D. IVC had an eccentric shape (EI = 1.3) that increased when CVP was  $\leq 10$  mmHg and during sniff test ( $P < 0.001$ ). IVC measurements by 2D and 3D were correlated with CVP. The best correlation was obtained with IVCCI derived from 2D diameters ( $R = -0.69$ ) and 3D areas ( $R = -0.82$ ). Using the cutoff value of 50% for IVCCI, a discrepancy between invasive CVP measurements and IVCCI has been observed for 11 examinations (13%) by 2D but only one was misclassified by 3D. Inter and intra-observer reproducibility for IVC area was  $7 \pm 6\%$  and  $5 \pm 3\%$ , respectively (Fig. 1).

**Conclusions** In patients with cardiogenic shock, IVCCI from area by 3D echocardiography is reproducible and accurate to evaluate CVP.

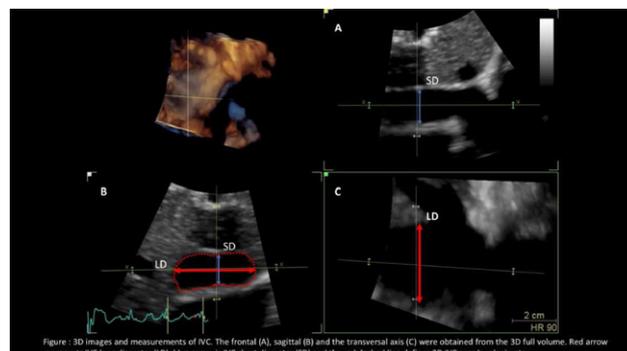


Fig. 1 Three-dimensional images and measurements of the IVC.

**Disclosure of interest** The authors declare that they have no competing interest.

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