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Transesophageal echocardiography with Blood Flow Imaging during Atrial Septal Defect closure: A comparison with the current references

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Introduction:
Flow visualisation before transcatheter atrial septal defect (ASD) closure is essential to identify the number and size of ASDs and to map the pulmonary veins. Previous reports have shown improved transthoracic visualisation of ASD and pulmonary veins using Blood Flow Imaging (BFI), which supplements Colour Doppler Imaging (CDI) with angle-independent information of flow direction. This study aimed to compare transesophageal BFI with the current references in ASD sizing (Balloon stretched diameter, BSD) and pulmonary vein imaging (pulmonary angiography).

Methods:
28 children referred to interventional ASD-closure were investigated with transoesophageal echocardiography including BFI scanning of the ASD and the pulmonary veins before the closing procedure. BFI and CDI cineloops were prepared offline and presented to four observers (senior cardiologists) who were blinded to the patient data. They measured the ASD in two planes twice in each patient with BFI and CDI. The maximum ASD-diameter measured with BFI by each observer was compared to the corresponding BSD- and CDI-measurements. Repeatability of the BFI-measurements was calculated as the residual coefficient of variation when accounting for patient and interobserver variance.

The pulmonary veins were evaluated during the procedure. BFI investigations were completed and documented before the pulmonary veins were examined by routine angiography.

Results:
The mean maximum diameter measured by BFI was 12.1 mm (SD 2.4 mm). The corresponding BSD- and CDI-measurements were 15.9 mm (SD 3.0 mm) and 11.8 mm (SD 2.5 mm) respectively. The residual standard deviation was 1.2 mm and the corresponding residual coefficient of variance was 9.6 %.

Compared to pulmonary vein angiography the sensitivity of BFI in detecting the entry of the pulmonary veins was 0.96 (95% CI: 0.82-1.0).

Conclusions:
Transesophageal echocardiography with Blood Flow Imaging of the pulmonary veins and BFI-ASD sizing agreed well with the references pulmonary vein angiography and balloon stretched diameter, respectively. The repeatability of the BFI-measurements was close to the inherent measurement error of the ultrasound measurement itself.

Improved echocardiographic imaging in connection with transcatheter ASD-closure may reduce radiation exposure and possible also the need for balloon sizing. BFI may be a suitable supplement in this complete echocardiographic ASD evaluation.