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Short Title: Zero Contrast TAVR

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Acute kidney injury (AKI) remains a major concern in the field of TAVR and is associated with increased mortality, up to 2-8 fold (1). Although the exact mechanism of post-TAVR AKI is unknown and seems to be multifactorial, contrast has been reported as a contributing factor (2). During TAVR, contrast is used for conventional aortic root angiography, for positioning of the TAVR valve device and assessing the peripheral vasculature. To our knowledge, for the first time we report transfemoral TAVR performed with zero contrast using fluoroscopy and ultrasound guidance. This was done in two patients with symptomatic, severe aortic stenosis and significant chronic kidney disease (stage III) who were deemed high risk for surgical aortic valve replacement after discussion in the multidisciplinary Heart Team meeting.

EchoNavigator system (Phillips Healthcare, Netherland) is a novel imaging technology which allows fusion of real time 2D and 3D echocardiography images on the fluoroscopy screen. It has the ability to identify the optimal perpendicular valve view without use of contrast (Figure 1), can provide a road map to assist crossing of the aortic valve in difficult cases and enables overlay of echocardiographic images on the X-ray screen so that the the soft tissue characterization of echocardiography is combined with excellent device visualization of X-ray to assure precise device deployment. Determining the optimal valve view is a crucial prerequisite for accurate positioning of the bioprosthetic valve to avoid potentially life-threatening complications. Although aortic root angiography is conventionally used to identify the valve view, EchoNavigator can be solely used for this purpose. Moreover, to further minimise exposure to contrast, 3D transesophageal echocardiography (TEE), which is the standard technique in our centre, was used for valve sizing.

Procedures were done under general anesthesia. As per routine practice in our centre, we used a handheld ultrasound device for establishing vascular access in both patients which also

allowed assessment of patency of the femoral arteries at the end of the procedure without the use of contrast.

For the first patient, a 27 mm Lotus valve (Boston Scientific) was positioned under combined fluoroscopy and fusion imaging guidance (Figure 2). Intra procedural 2D colour Doppler assessment of the positioned valve revealed mild to moderate paravalvular aortic regurgitation (AR) resulting from under-expansion of the valve at the site of severely calcified non-coronary cusp. Despite attempts to reposition the valve, the paravalvular AR remained unchanged. Although there is very limited data on post dilatation of the Lotus valve (3), based on previous successful experience in our centre, we decided to post dilate using a 24 mm balloon, which resulted in complete resolution of the paravalvular AR. A 26 mm Sapien 3 (Edwards Lifesciences) valve was used for the second case and deployed under fluoro-echo fusion imaging with no parvalvular AR assessed by TEE at the end of the procedure (Figure 3). A thorough echocardiographic assessment was performed at the end of each procedure to exclude new regional wall motion abnormalities.

Both patients had an excellent post-procedure recovery and were discharged home on day three with no change in renal function, no residual trans-aortic valvular gradient and no paravalvular AR.

Fluoro-echo fusion imaging can be used to minimise the contrast use in patients at high risk of developing AKI. The technique has the potential to be routinely used in performing TAVR with zero contrast. Further studies are required to assess the impact of zero contrast strategy on patients' outcome.

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No of figures: 3 (all colour)

Figure captions:

Figure 1. Identifying the valve view by EchoNavigator

Figure 2. Positioning of the Lotus valve using EchoNavigator.

Figure 3. Positioning of the Sapien 3 valve using EchoNavigator.

Figure 1 legend. After probe registration, a bi-plane echocardiographic view of the aortic valve is acquired. The annulus is marked in two perpendicular views. The Free view of EchoNavigator is rotated such that the annulus will look like a line, representing aligned aortic valve sinuses. The valve view is shown at the right lower corner of the screen.

Figure 2 legend. Fused real time 3D TEE image on the X-ray screen can be used for positioning of the TAVR valve in combination with fluoroscopy. Red line represents annulus, blue arrows: aortic valve leaflets, green arrow: Lotus valve radiopaque marker.

Figure 3 legend. Positioning of the Sapien 3 valve using fluoro-echo fusion imaging. Red arrows: aortic valve leaflets, blue arrow: Sapien valve radiopaque marker.