Reduced contrast media volumes for CT imaging of TAVI candidates

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Pre-procedural computed tomography angiography (CTA) is currently becoming a gold standard for the evaluation of patients considered for transcatheter aortic valve replacement (TAVI)/transcatheter aortic valve replacement (TAVR). The superiority of CTA-based over 2D transoesophageal echocardiography-based procedural planning is mainly explained by the improved outcomes with reduced rates of relevant paravalvular aortic regurgitation.1,2

CTA imaging for the TAVI procedure remains challenging as a large imaging volume needs to be covered from the aortic arch to the ilioc-femoral arteries and as the aortic root needs to be imaged free of pulsation artefacts to allow for precise assessments of the aortic annulus. Furthermore, patients considered for TAVI are usually elderly, frail, and often present with severe co-morbidities including chronic renal failure, which predispose those patients for contrast-induced nephropathy. In fact, a recent study demonstrated that the risk for contrast-induced nephropathy is as high as 10.5% after CTA for TAVI.3 Contrast media volumes above 90 cc were identified as independent predictor for contrast-induced nephropathy. The risk for contrast-induced nephropathy is even further increased due to the repeated administrations of contrast media during CTA and during the TAVI procedure itself. Contrast-induced nephropathy is not trivial as it has been linked with increased mortality as well as increased medical costs.4

Accordingly, the reduction in contrast media volumes as well as the adherence to protocols for the prevention of contrast-induced nephropathy is an important goal. In this regard, Pietro Spagnolo et al. have been congratulated to their study presented in this issue of EHJ-CVI.5 In their study, they investigated the feasibility of very low-contrast media volumes for computed tomography (CT)-based TAVI planning. With the use of dedicated protocols for contrast media injection rates and volumes, which were adjusted to the body mass index (BMI), they were able to demonstrate that diagnostic information can be obtained from pre-procedural TAVI-CTAs with contrast volumes of only 55 cc or even 40 cc. The mean vessel attenuations in the ascending aorta and the iliac arteries were 398 and 329 HU, respectively, which was sufficient to analyse accurately the dimensions of the aortic annulus and the iliac arteries. Unfortunately, the incidence of contrast-induced nephropathy was not assessed in this study, but it can be expected that the incidence was very low with such low-contrast media volumes.

Despite the use of low-radiation tube potentials of 80 and 100 kVp, which also improved the vessel attenuation, the overall estimated radiation exposure was relatively high. This is explained by the used image acquisition protocol. Usually, electrocardiogram (ECG)-gated image acquisition, which is associated with higher radiation exposures, is necessary for the aortic root to avoid pulsation artefacts, but ECG gating is unnecessary for imaging of the abdominal and ilioc-femoral arteries, where pulsation artefacts are negligible. In the current study, ECG-gated image acquisition was used for the entire scan, because the switch of acquisition protocols would have been associated with an increase in scan duration and consequently with higher-contrast media volumes. However, the cancerogenic risk of radiation exposure is very small and negligible in the elderly patient population currently investigated for TAVI, but such radiation exposures would be of major concern if younger patients are investigated for TAVI procedures.

Patients with BMIs above 29 kg/sqm were excluded from the current study to reduce the potential variability in vessel opacification. Although this exclusion criterion was relevant only for a small proportion of the initial study population (18% of patients), similar contrast media injection protocols with slightly higher volumes should also be feasible in patients with higher BMIs.

In summary, CT protocols with very low-contrast media volumes are feasible for imaging of TAVI candidates. The current study and future investigations in this regard are of great importance to reduce the incidence and sequelae of contrast-induced nephropathy.

References

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