Minimizing contrast medium dose during transapical aortic valve implantation: it is worth the effort

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Madershahian et al. [1] have examined a clinically important issue—the influence of contrast media dose on adverse outcomes post-transapical aortic valve implantation (TA-AVI). The authors retrospectively examined 50 TA-AVI patients with an elevated preoperative creatinine (>1.3 mg/dl) and determined that an elevated dose of contrast media (>100 ml) was associated with higher mortality, as well as a trend towards increased intensive care unit (ICU) length of stay. Although the investigators failed to find that elevated contrast media dose was an independent predictor of mortality, this may have been due to the relatively small sample size of the study.

The described association between contrast media dose and adverse outcomes post-TA-AVI is an important finding, but not particularly surprising. Pre-existing renal impairment is a fairly common finding in TA-AVI patients. Such patients have a high incidence of congestive heart failure, peripheral vascular disease, diabetes and hypertension—all known risk factors for renal impairment. Contrast-induced nephropathy may frequently occur in such patients, particularly if they have recently undergone cardiac catheterization or computed tomography. It is for these reasons that we try to maximize the period of time between transcutaneous aortic valve procedures and preoperative contrast-based investigations in patients with pre-existing renal impairment.

Acute renal failure post-TA-AVI is a fairly common complication. A previous study from our centre revealed a 16% prevalence of acute kidney injury (AKI), defined as a decrease in estimated glomerular filtration rate of >50% in 270 TA-AVI patients [2]. Patients with AKI had increased ICU and hospital lengths of stay. In addition, AKI was an independent risk factor for in-hospital mortality (odds ratio 5.9), and 1-year survival was markedly decreased in AKI patients (45 vs. 80% in patients without AKI, P < 0.001). The administration of more than 90 ml of contrast dye during the TA-AVI procedure was an independent predictor of postoperative AKI. We concluded that contrast media dose should be minimized during TA-AVI in order to decrease the risk of postoperative renal failure.

Acute renal failure can occasionally lead to multiple complications, such as respiratory insufficiency, intubation, prolonged intensive care stay and even mortality in TA-AVI patients, probably because of their pre-existing comorbidities and reduced physiological reserve. Acute renal insufficiency post-cardiac surgery most frequently arises on postoperative days 1–3, and may occur without any recognizable preceding factors [3]. The occurrence of AKI with the abovementioned cascade of complications can be particularly vexing in patients with a heretofore completely uncomplicated TA-AVI procedure.

The main drawback of the study from Madershahian et al. [1] is the inability to determine if the relation between increased contrast media dose and worse post-TAVI outcomes is associative or causative. That is, was the increased contrast media dose a consequence of a complicated TAVI procedure that subsequently lead to worse outcomes, or did the contrast media in and of itself lead to renal failure and subsequent morbidity and mortality? The longer operative time in the high contrast media dose group would suggest that these patients experienced a more complicated intraoperative course, although this may also be explained by their operations being performed in the earlier part of the operators’ learning curve. Unfortunately, the authors were unable to assess for other possible markers of procedure complexity including valve deployment difficulties, coronary obstruction, catecholamine requirement or low cardiac output syndrome. In addition, patients who received a higher contrast media dose had a higher risk preoperative profile, including...
prevalence of coronary disease and EuroSCORE predicted risk of mortality, further complicating interpretation of the results. However, the authors’ conclusion that excessive contrast media usage should be avoided in patients with pre-existing renal impairment seems prudent and logical.

Some investigators have reported that TA-AVI procedures can be performed with the administration of minimal or no contrast media [4]. The potential beneficial effects of contrast media avoidance, however, need to be weighed against the risk of possible difficulties in precise valve positioning during deployment.

Although complete elimination of contrast media may not be feasible in the majority of the TA-AVI patients, contrast dose minimization is a reasonable and worthy goal. In addition, awareness of the nephrotoxic effects of contrast media within the cardiac surgery community needs to be increased. At our centre, we currently use only three doses of contrast media during uncomplicated TA-AVI procedures: during Dyna-CT imaging of the aortic root in order to ensure coaxial imaging and landmarking of crucial structures [5], during rapid pacing at the time of valve deployment in order to make last second adjustments in valve position [6] and post-implantation as a method of assessing valve function and coronary perfusion. In patients with renal insufficiency, the last dose can be eliminated as long as the echocardiographic findings are normal and the patient has no signs of haemodynamic instability. With the implementation of these techniques, we are currently able to perform uncomplicated TA-AVI procedures with less than 50 ml of contrast media.

Acute renal failure can be a clinically important complication in elderly, high-risk patients undergoing TA-AVI procedures. Methods to avoid acute renal failure, and the rapid progression of serious adverse events that may arise therefrom, should be an important focus of continued investigation in this area.

REFERENCES