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EDITORIAL COMMENT

# The Plan Was to Replace the Valve, Not the Kidneys*

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Nowadays, as transcatheter aortic valve replacement (TAVR) procedure is performed in a wide range of patients, the challenges for physicians are greater than ever in predicting the risk versus benefit of the procedure for the individual patient and the economic impact of adverse outcomes and procedure futility. It is the role of the heart team to identify patients who will not benefit from the procedure, or when the procedure is futile. Over the years various parameters have been identified as predictors for post-procedural complications and outcome. Without doubt, the most powerful parameter that has been constantly shown as associated with poor outcome is post-procedural acute kidney injury and its associated baseline chronic kidney disease, which significantly increases the risk for post-procedural acute kidney injury (1–3). Whether acute kidney injury itself is independently associated with poor outcome or just a marker for sicker patients needs to be further investigated.

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With this notion, the study by Hansen et al. (4) in this issue of *JACC: Cardiovascular Interventions* contributes meaningful data regarding the risk of early and late renal replacement therapy (RRT) among TAVR patients. Data were derived from the U.S. TVT registry and included more than 40,000 patients stratified according to baseline glomerular filtration rate (GFR), thus providing robust real-life data regarding TAVR outcomes. The combined primary outcome of all-cause mortality, the need for RRT or both, up to 1 year, was associated with baseline GFR, indicating a significant increase in the rates of the composite outcome with every decrease of 5 ml/min/m$^2$ in GFR (when baseline GFR is <60 ml/min/m$^2$).

The composite outcome was driven by its 2 components: risk for RRT and mortality. Mortality risk was independently associated with baseline kidney disease (especially among patients with GFR 15 to 59 ml/min/m$^2$) but was less evident among patients with very poor GFR (<15 ml/min/m$^2$). Conversely, the risk for RRT was independently associated with all levels of baseline chronic kidney disease.

Acute kidney injury after TAVR typically occurs 2 to 10 days after the procedure. Interestingly, Kaplan-Meier curves of cumulative incidence of RRT indicated that incidence of RRT is not limited to the early period after TAVR (4). Indeed, RRT hazard continued during long-term follow-up in all groups, but especially in patients with baseline moderate to severe kidney disease. Thus, the long-term risk for RRT cannot be attributed directly to the procedure, but is probably related to progression of the primary chronic kidney disease.

Overall, these finding are in agreement with yet another, recently published U.K. registry of TAVR patients, which indicated that risk for RRT after TAVR was associated with baseline kidney disease (5). However, in that analysis several procedural aspects were strong predictors of this adverse outcome. Such factors as nontransfemoral approach, the use of a balloon expandable valve, and significant paravalvular leak were all independently associated with post-procedural RRT. Of note, the study by Hansen et al. (4) did not incorporate such procedural factors into the analysis. Similarly, procedural complications, such as bleeding and vascular complications, have

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been shown to be associated with post-procedural kidney injury and were not incorporated into analysis. The addition of these factors might have provided additional insights into the interpretation of RRT risk and mortality among this large patient cohort.

In-depth analysis of the presented data may also provide some reassuring message. The absolute rates of RRT at 30 days among patients with normal baseline GFR is low (0.68%) (4). Furthermore, even patients with moderately reduced GFR demonstrate low absolute rates of RRT at 30 days (2.2%). Thus, only patients with advanced chronic kidney disease (GFR <30 ml/min/$m^2$) experience high rates of RRT (8.9% to 35%) at 30 days. In this context, it should be emphasized that this high-risk group represents a small minority of the entire TAVR population, <6% of the patients.

In this respect, the manuscript by Hansen et al. (4) provides the physician invaluable information by identifying a small subgroup with an extremely high risk of RRT or death. Physicians should be advised that patients with severely reduced GFR who experience additional comorbidities beyond chronic kidney disease may not benefit from TAVR because of high short- and long-term hazard. If a procedure is planned, these patients should be meticulously informed of the high risk for post-procedural RRT and mortality.

Furthermore, in this subgroup of high-risk patients, special focus in reducing the risk for kidney injury should be used. We now have data to support certain measures that reduce the risk for kidney injury. First, judicious use of iodinated contrast dye before the procedure and during the procedure itself. The implementation of technologies for advanced overlay of real-time echocardiography images and computed tomography images in the catheterization laboratory may facilitate procedures with reduced use of contrast dye. Second, appropriate hydration should be administered. Routine hydration is somehow limited in patients with severe aortic stenosis, especially in more acute settings when TAVR is performed in critical patients with congestive heart failure. The RenalGuard system (RenalGuard Solutions Inc., Milford, Massachusetts) allows renal flushing by carefully matching intravenous infusion of isotonic saline solution to furosemide-forced diuresis thus allowing optimal hydration during the procedure. Several studies have shown the potential of this system to reduce acute kidney injury (6). Finally, other measures should also be considered, such as minimizing hypotensive episodes that impact renal blood flow and perhaps use of a self-expanding valve (5). Without a doubt, novel technologies should be sought to provide improved renal protection during transcatheter aortic valve implantation.

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**KEY WORDS** hemodialysis, renal failure, transcatheter aortic valve