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STRUCTURAL

Acute Kidney Injury With the RenalGuard System in Patients Undergoing Transcatheter Aortic Valve Replacement

The PROTECT-TAVI Trial (PROphylactic effecT of furosEmide-induCed diuresis with matched isotonic intravenous hydraTion in Transcatheter Aortic Valve Implantation)

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ABSTRACT

OBJECTIVES The purpose of this study was to investigate the effect of the RenalGuard System (PLC Medical Systems, Milford, Massachusetts) on prevention of acute kidney injury (AKI) in patients undergoing transcatheter aortic valve replacement (TAVR).

BACKGROUND TAVR is associated with varying degrees of post-procedural AKI. The RenalGuard System is a dedicated device designed for contrast-induced AKI prevention. Whether this device is also effective in patients with severe aortic stenosis undergoing TAVR is unexplored.

METHODS The present is an investigator-driven, single-center, prospective, open-label, registry-based randomized study that used the TAVR institutional registry of the Ferrarotto Hospital in Catania, Italy, as the platform for randomization, data collection, and follow-up assessment. A total of 112 consecutive patients undergoing TAVR were randomly assigned to hydration with normal saline solution controlled by the RenalGuard system and furosemide (RenalGuard group) or normal saline solution (control group). The primary endpoint was the incidence of Valve Academic Research Consortium-defined AKI in the first 72 h after the procedure.

RESULTS The AKI rate was lower in the RenalGuard group than in the control group (n = 3 [5.4%] vs. n =14 [25.0%], respectively, p = 0.014). The majority of patients (5.4% vs. 23.2%) developed a mild AKI (stage 1); severe damage (stage 3) occurred only in 1 patient in the control group (0.0% vs. 1.8%). No case of in-hospital renal failure requiring dialysis was reported. No significant differences in terms of mortality, cerebrovascular events, bleeding, and hospitalization for heart failure were noted in both groups at 30 days.

CONCLUSIONS Furosemide-induced diuresis with matched isotonic intravenous hydration using the RenalGuard system is an effective therapeutic tool to reduce the occurrence of AKI in patients undergoing TAVR. (J Am Coll Cardiol Intv 2015;8:1595–604) © 2015 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

AKI = acute kidney injury

CI = confidence interval

eGFR = estimated glomerular filtration rate

TAVR = transcatheter aortic valve replacement

VARC = Valve Academic Research Consortium

Acute kidney injury (AKI) is a frequent complication of contrast-guided interventional procedures (1,2). Not surprisingly, transcatheter aortic valve replacement (TAVR) is also associated with varying degrees of post-procedural AKI, ranging from 12% to 57%, which carries a negative prognostic effect (3–8). Preventive intravenous hydration with isotonic saline solution is known to decrease the risk of AKI (9,10). However, in patients with impaired left ventricular function and left side valvular heart diseases, hydration is usually suboptimal due to the perceived risk of overhydration and pulmonary edema. In previous studies, diuretic agents have been combined with hydration to increase urine output and prevent overhydration (11–13).

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The RenalGuard System (PLC Medical Systems, Milford, Massachusetts), a recently introduced device delivering intravenous fluids matched to the urine output, has emerged as an alternative strategy for AKI prevention. Studies conducted in patients undergoing percutaneous coronary intervention have recently demonstrated that furosemide-induced diuresis with matched isotonic intravenous hydration by the RenalGuard System significantly reduced AKI in high-risk patients undergoing coronary procedures (14–16). Whether these findings translate to patients undergoing TAVR is unexplored. To fill this gap, we performed a randomized study to assess the efficacy of the RenalGuard System to prevent AKI in patients with severe aortic stenosis undergoing TAVR.

METHODS

STUDY DESIGN. PROTECT-TAVI (PROphylactic effecT of furosEmide-induCed diuresis with matched isotonic intravenous hydraTion in Transcatheter Aortic Valve Implantation) was an investigator-driven, single-center, prospective, open-label, registry-based randomized study that used the TAVR institutional registry of the Ferrarotto Hospital in Catania, Italy (REPLACE [REgistry of Percutaneous aortic vaLve replacement]), as the platform for randomization, data collection, and follow-up assessment. All trial management activities including data management and statistical analyses were performed at the Ferrarotto Hospital, Catania. All subjects provided written informed consent before randomization. The study was conducted according to the principles of the Declaration of Helsinki and Good Clinical Practice. The authors wrote all drafts of the paper and vouch for the integrity of and completeness of the data and analyses.

THE REPLACE REGISTRY. REPLACE is a spontaneous registry created to monitor the institutional procedural, acute, and long-term outcomes of TAVR. A stream of patient demographics, medical history, concomitant medications, procedure details, and in-hospital clinical outcomes is routinely entered in the registry's electronic data collection system using standardized case report forms. Follow-up data are obtained at serial time points by clinical visits and phone calls. Trial-specific information, including renal outcomes of interest not obtained as part of the registry, was collected using additional case report form pages.

STUDY POPULATION. All consecutive patients with symptomatic severe aortic stenosis undergoing TAVI were considered eligible for the trial. Exclusion criteria included chronic end-stage renal failure on dialysis, ≥1 episode of acute congestive heart failure with left ventricular ejection fraction <30% in the past 30 days before randomization, contraindications to placement of a Foley catheter, urgent TAVI, and unavailability of the RenalGuard system before randomization. All analyses were performed following the intention-to-treat principle.

RANDOMIZATION. Patients were 1:1 randomly assigned to either RenalGuard or standard management. Randomization was obtained with computer-generated codes, which were sealed in sequentially numbered envelopes.

STUDY PROCEDURES. Study procedures are detailed in the **Central Illustration**. The iodixanol (Visipaque, GE Healthcare, Little Chalfont, Buckinghamshire, United Kingdom), a nonionic, iso-osmolar (290 mOsm/1 kg water) contrast agent was used during TAVR in all patients. Patients randomized to RenalGuard received hydration with a normal saline solution. The

Dr. Attizzani has served as a consultant and proctor to Medtronic and Edwards Lifesciences; and has served as a consultant to St. Jude Medical. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose. Drs. Barbanti and Gulino contributed equally to this work.

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