Postoperative Care for Transcatheter Aortic Valve Replacement

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TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR), sometimes called transcatheter aortic valve implantation, is a relatively new therapy that was first approved for use in the United States in 2011.[1] Since the therapy's introduction, TAVR has increasingly become an effective alternative to surgical aortic valve repair to treat symptomatic aortic stenosis (AS) in high surgical risk or inoperable patients.[2-4] Demand for this procedure has continued to grow with an increase in the number of health care centers performing TAVR procedures nationwide and continuing research extending the procedure for populations with AS.[4,5] Although TAVR is effective as a treatment option for AS, it is not without significant risks.

Postprocedure TAVR patients may be cared for in postsurgical and critical care environments. As the rapid growth of this procedure continues, there is a developing need for nurses to be knowledgeable about postprocedure care considerations for TAVR patients. This column will provide a review of the primary nursing care priorities in the immediate hours after a transfemoral approach TAVR procedure.

AS and Aortic Valve Replacement Treatment Options

AS is a progressive and life-threatening condition commonly associated with degenerative calcific deposits on the aortic valve leaflets.[6] During systole, a normal aortic valve's leaflets open, allowing the ventricular blood to flow out into systemic circulation. With AS, the accumulation of lipoproteins, calcium, and chronic inflammation leads to fibrosis and progressive leaflet stiffness with orifice narrowing.[7] The narrowed ventricular outflow causes significant increases in afterload and ventricular wall stress with subsequent left ventricular hypertrophy.[8] Patients experience progressively worsening dyspnea, chest discomfort, lightheadedness, activity intolerance, and progressive heart failure. AS that is left untreated has a 2-year mortality estimated to be 50%.[6] Medical interventions are incapable of delaying or halting the progression of AS, and surgical interventions are required to treat the mechanical narrowing of the aortic valve.[8]

Historically, the only option available to treat severe AS was surgical aortic valve replacement.[3,9] However, the progressive nature of the disease and the incidence of AS primarily in older adults who frequently have medical comorbidities leads to significant concern for operative risk.[9] TAVR provides a nonsurgical option that takes advantage of improvements in miniaturization and catheterization technologies to implant a bioprosthetic valve within a diseased native aortic valve.[3,9] Simply stated, TAVR procedure compresses the disease aortic valve against the native annulus allowing space to secure a prosthetic valve.[7] The typical approach to TAVR is through a transfemoral

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The views expressed in this article are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the U.S. Government.

Conflict of interest: None to report.

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1089-9472/$36.00
https://doi.org/10.1016/j.jopan.2018.12.006

insertion similar to that of angioplasty. Occasionally, a transapical approach may be necessary for select patients.

Postprocedure patient care is similar to that of any transfemoral invasive procedures: assess for pulses, immobilize the extremity, observe for signs of bleeding, closely monitor vital signs. However, the nature of the TAVR procedure and patient comorbidities place the patient at risk for other postprocedure events. The immediate postoperative risks fall into three basic categories: vascular, neurologic, and cardiac complications. Although renal compromise and acute kidney injury is a concern (approximately 3% of patients), it is not likely to manifest in the immediate postoperative hours.[9,10]

Vascular complications represent the single largest adverse event.[4,9-11] Relatively large caliber sheaths are used to achieve arterial cannulation of the femoral artery. Female patients and patients with atherosclerotic arteries, renal insufficiency, or peripheral vascular disease are at higher risk of vascular trauma from these larger sheaths.[10,11] Careful blood pressure monitoring and assessment for signs of bleeding are essential in the immediate postprocedure environment Abdominal pain, severe back or lower quadrant pain, and abdominal distension should elicit clinical concerns, as retroperitoneal bleeding occurs in approximately 3.5% of patients undergoing TAVR.[11] In addition, as with all femoral cannulations, the affected limbs should be immobilized postoperatively and assessed for access site bleeding, groin hematoma, and arterial perforation or occlusion.[12]

Cerebral ischemic events are one of the most worrisome risks post-TAVR procedure. Types of ischemic events are classified by the Valve Academic Research Consortium as major or disabling stroke, minor or nondisabling stroke, transient-ischemic attack, and silent brain infarction.[13] Although post-TAVR cerebral ischemic event rates have improved with time,[14,15] ischemic event rates post-TAVR procedure[4,16] still exceed those of surgical aortic valve replacement.[4,10] There are two mechanisms that may lead to cerebral ischemia in TAVR patients. The first is embolic debris released during balloon angioplasty of the calcific native aortic valve.[12,16] The second is an ischemic state caused by decreased cardiac output during rapid ventricular pacing used during valve placement.[16,17] Vigilant neurologic assessments are vitally important in detecting neurologic changes early. The nurse should be attentive to signs and symptoms of cerebral ischemia such as change in level of consciousness, hemiplegia, hemiparesis, numbness or sensory loss affecting one side of the body, difficulty speaking or swallowing, and other global or focal neurologic deficit.[13] In addition, knowledge of the patient's history of a stroke before the procedure is important as the 30-day mortality is 3.5 times higher for these individuals than for patients without a history of a stroke.[12]

Cardiac events are primarily related to conduction disturbances. Because of the proximity of the atrioventricular node and the bundle of His to the native aortic valve, the deployment of the bioprosthetic valve may cause disruptions of the conduction system.[5,12] Unlike other procedural complications of TAVR, conduction disturbances have not decreased with improvements in device technology and physician experience.[5] The most common conduction disturbances include new-onset left bundle branch blocks, high-degree atrioventricular blocks necessitating pacemaker placement, and tachyarrhythmias such as atrial fibrillation. As most of these conduction disturbances occur within hours of TAVR,[5] patients should be on telemetry with alarms set to capture pauses, ventricular rates less than 65, and atrial arrhythmias for at least 48 to 72 hours.[5,12,18] If a temporary pacemaker is in place, confirm pacemaker settings match those ordered.

Additional cardiac complications include paravalvular leak, periprocedural myocardial infarction, and low cardiac output. In TAVR, paravalvular leaks are common[19] and generally caused by inadequate expansion of the prosthesis or by calcific deposits keeping the valve unit from seating and sealing properly.[9] Therefore, heart sounds, especially new or changed murmurs, should be assessed closely, as regurgitation is prone to change in the days after procedure.[9,19] It is estimated that most patients undergoing TAVR will sustain some degree of myocardial injury, but only 1% will sustain significant myocardial ischemia.[20] Vigilance for new ST segment changes, pathologic q-waves, hemodynamic instability, or ventricular arrhythmias allow for early management of periprocedure myocardial infarction.[20] Low cardiac

Table 1. Expert Consensus Recommendations for Post-TAVR Care[9,15]

Early Goal Directed Care	Pain Management	Postprocedure Monitoring
• Early extubation • Early mobilization • Embolic protection within 24 h • Complete perioperative antibiotics. Review and restart appropriate preoperative medications	• Pain management appropriate to procedure access site	• Hemodynamic stability and avoiding hypertension • Atrioventricular conduction • Fluid balance • Maintain core temperature >36°C • Renal status • Mental status • Access site hemostasis and distal blood flow • Early detection and intervention for bleeding, hematoma, and pseudoaneurysm

TAVR, transcatheter aortic valve replacement.

output manifests in low systemic blood pressure. Careful inotropic or mechanical support may be necessary in the immediate postprocedural period.[9] Although research is ongoing regarding thrombotic complications, there is currently little consensus as to the best antithrombotic therapy post-TAVR.[16,20]

Implications for Practice

As TAVR procedures continue to increase worldwide, it is increasingly likely that perianesthesia nurses will encounter TAVR patients more frequently and for longer periods of time. Anticipating the potential life-threatening complications post-TAVR procedure requires both knowledge of and vigilance toward possible postoperative complications. Early recognition of these complications requires close monitoring of the arterial access site, cardiac monitoring with appropriate alarm settings, and alertness toward mental status changes. Table 1 provides a summary of current postprocedure recommendations in the care of the TAVR patient. The perianesthesia nurse's expert practice and aggressive postprocedure management is essential to optimizing patient outcomes post-TAVR procedure.

Future Research Concerning TAVR Procedures

Future research is focused on methods to decrease complications from TAVR procedures. Manufacturers of TAVR devices are continuing to make advances in catheter and valve technologies leading to smaller devices and lower incidence of vascular compromise.[11,21] The Placement of Aortic Transcatheter Valves (PARTNER) 3 trial is currently evaluating the safety of using TAVR in the low-risk surgical populations.[22] In addition, recent trials have shown promise in curbing cerebral ischemic events through using intraprocedural embolic protection devices.[14,16] Finally, the concept of a minimalist approach to TAVR is being explored. This approach typically uses local anesthesia or moderate (conscious) sedation instead of general anesthesia alongside clinical pathways that allow for decreased lengths of intensive care unit and hospital stay.[23] As the science behind TAVR procedures continues to evolve, the perianesthesia nurse may need to become increasingly knowledgeable about the care of this patient population to optimize postprocedure outcomes.

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