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Collaboration Allows TAVR to Reach its Potential

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The advent of transcatheter aortic valve replacement (TAVR) has ushered in a new era of interdisciplinary collaboration in valve therapy and transformed the fields of both cardiology and cardiac surgery. Much of the attention to date has appropriately centered on optimizing the valve and delivery system design to reduce procedural complications and rates of paravalvular leak. Certainly, we can look forward to other technologic advancements in the coming years. On the other hand, it behooves the medical community to ensure the optimization of all aspects of patient care and the seamless integration of these technologic advances in order to allow TAVR to reach its full potential. This impetus drove a transformation in TAVR care at the Piedmont Heart Institute in Atlanta, Georgia.

THE PIEDMONT EXPERIENCE

In the spring of 2014, our center felt the effect of having a TAVR program. We had an average length of stay of more than 7 days, struggled with care efficiencies, and were at a significant financial loss. We had recently received a grant of $20 million from the Marcus Foundation to start the Marcus Heart Valve Center to enhance the outcomes and experience of patients diagnosed with valvular heart disease and thought this would be a perfect opportunity for change.

Implementation of a broad range of strategies designed to optimize all aspects of TAVR began in August 2014. Our primary goal was to provide the best possible outcomes for our patients, with a secondary goal of measuring the effect of these interventions on the length of stay and the average per-patient cost of TAVR. Although these measures seem logical, intuitive, and had been proven in other areas of medicine, they remained to be fully validated for TAVR.

Our center used a three-tiered approach involving an explicit transition away from general anesthesia, staff education initiatives, and the implementation of postprocedure clinical pathways. Over a period of 3 months, our goal was to transition to optimized care for our patients. During this time, the most significant changes were the transition from 100% general anesthesia to 100% conscious sedation for transfemoral cases and the implementation of postprocedure pathways.

Transition to Conscious Sedation

To accomplish our goal, we held numerous sessions to explain both the rationale and the implementation of the proposed care changes to cardiologists, anesthesiologists, and cath lab and operating room staff. We worked at length with our supportive anesthesia team to help form a system using light sedation that focused on patient safety while keeping the patients comfortable and giving them the ability to recover quickly. There were also multiple meetings made with our imaging team to ensure that our transition away from transesophageal echocardiograms would not compromise our ability to detect paravalvular leak. These included having excellent transthoracic echocardiograms, optimizing our hemodynamic assessments, and using more aortography. Such efforts paid off by fostering broad stakeholder buy-in for the transition.

Our first cases involved a few select patients that had tolerated their pre-TAVR cardiac catheterization with minimal sedation. After the first patients did well, we then met as a valve team to determine additional ways to optimize the experience. Several small changes

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were made after several cases, staff became more comfortable, and we then expanded treatment to the majority of our patients. Within 3 months, we transitioned from 100% general anesthesia to close to 100% conscious sedation for our transfemoral patients.

Postprocedure Pathways

We worked closely with a dedicated team of clinical efficiency experts to develop concrete postprocedure care pathways that were specifically tailored for our institution and patients (Figure 1). The goal of pathway development was standardization of postprocedure care to reduce variation in management. After the development of the pathways, we had numerous meetings with care providers to educate them on the changes as well as the goal of our changes. In order to achieve consistent implementation of the pathways, we spent numerous hours educating the staff, implementing them, and then providing accountability for those who did not. The pathways focused on clinical objectives to be met in the first 0 to 6 hours, 6 to 12 hours, and the day after the procedure, as well as criteria for discharge and follow-up. A detailed list of objectives are shown in Figure 1. Highlights included the avoidance of narcotics and sedatives, early extubation and line removal, and early mobilization and ambulation.

Piedmont Heart Clinical Pathway

Transcatheter Aortic Valve Replacement (TAVR)

Transfemoral and Subclavian

Time Zero: _____ Goals: 0-4 hours
Extubate within 1 hour, if not extubated in OR.
Wean off all drips within 1 hour of arrival. Saline lock all IVs except renal protection intravenous fluids. Continue 6 hours post op if ordered.
Remove pulmonary artery catheter within 1 hour, if present. Continue central line.
Remove arterial line within 1 hour, if blood pressure is stabilizing.
Out of bed to chair after 4 hours of bed rest.
Discontinue foley catheter once patient has been out of bed.
Discontinue oxygen within 4 hours if oxygen saturation ≥ 90%.
Avoid all sedatives and narcotics.
Goals: 4-12 hours
Restart oral antihypertensive medications in 4 hours, if able to swallow. Hold if SBP <100.
Restart BPH medications in 4-6 hours. Double dose for first dose.
Begin incentive spirometry, cough and deep breathe every 2 hours.
RN bedside evaluation for dysphagia. Consult speech therapy on POD #1 if patient unable to swallow.
Begin ice chips, advance to clear liquids, and then advance to regular diet.
Walk within 6 hours.
Reinforce early ambulation with family. Educate family how to mobilize patient.
Goals: Post Op Day 1
Transfer to 3 North.
Aggressive blood sugar control.
Antiplatelets: Begin aspirin 81 mg/day. Begin Plavix 75 mg/day, unless contraindicated.
Anticoagulation: Begin Coumadin at 1700 if patient was taking preoperatively.
Insert peripheral IV and removed central line POD #1.
Ambulate 6 times a day. Encourage all meals out of bed.
Patient Care Coordination consult, if indicated.
Discharge if discharge criteria met on POD #1-3.

Discharge Criteria and Follow-up
1. Baseline neurological function.
2. Stable heart rhythm and has not required pacing within 24 hours.
3. Vital signs stable: HR 60-90, SBP 90-140 (or at baseline).
4. Voiding without difficulty, emptying bladder.
5. Blood sugar <150.
6. Creatinine at or below baseline.
7. Oxygen weaned off with oxygen saturation ≥90% with effective cough and airway clearance.
8. Effective pain control on oral medications.
9. Independent in ADLs and ambulation, or has appropriate assistance and equipment.
10. Able to ambulate 200 feet, or baseline.
11. Groins without bleeding or hematoma.
12. Patient and family voice appropriate understanding of post TAVR discharge instructions.
13. Discharge studies completed: TTE, CXR, EKG, BMP, PT, PTT.
14. Return to Marcus Heart Valve Clinic for appointment at 30 days.

Figure 1. Piedmont's transfemoral TAVR pathway.

Results

Although there were challenges along the way, the results have been remarkable. After a run-in period where we field tested and refined the pathways, we set an ambitious goal of a 1- to 2-day length of stay for all transfemoral patients. Since implementation, our median length of stay has been 2 days in all TAVR patients in the past 24 months compared to a median length of stay of 6.5 days in the year before implementation (Figure 2). This remarkable reduction in length of stay has been accomplished with mortality and stroke rates well below the national average. At discharge, 88% of our patients go directly home without assistance, compared to a national average of 68%, according to Medicare data from 2015. Of the 12% requiring any level of assistance after discharge, 72% were requiring the same level of assistance before admission. Most importantly, we have seen no adverse events from an early discharge and the patients and families are grateful for the quick recovery.

To prevent readmissions and ensure optimal care for patients, we have them check their heart rate, blood pressure, and weight on a daily basis, and we make follow-up phone calls on postdischarge days 1, 5, 14, and 21. This has allowed us to identify any potential issues, which can frequently be addressed by phone. As a result, our 30-day readmission rate is < 6%.

Not only have the clinical outcomes been outstanding, with extremely high levels of patient satisfaction,

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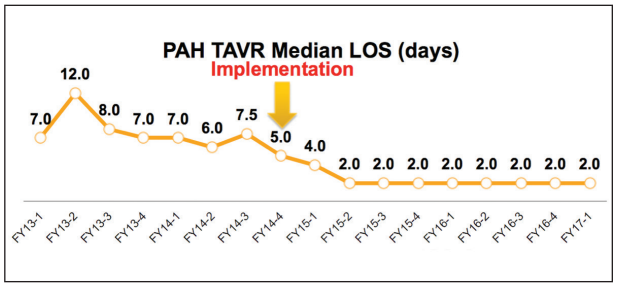

Figure 2. Trends in median length of stay for Piedmont's TAVR program.

but there has been a significant financial effect as well. On a per-patient level, there has been a reduction in cost of $9,913 per hospital stay. We have had success utilizing the Post-TAVR Optimization app* to stay advised on any early patient discharges, which are subject to Medicare's postacute care transfer (PACT) policy.

SUMMARY

Although TAVR appears destined to be a lasting technology, the field continues to evolve, and there are still significant opportunities for improving patient care. Many opportunities exist for optimization and each center must determine how they can customize the program to enhance the outcomes and experience for their patients. At Piedmont, we have accomplished this by transitioning to conscious sedation and by implementing postprocedure clinical pathways. This transition has fostered greater engagement on the part of the medical team and administrators, improved patient outcomes and patient satisfaction, and has led to an ancillary benefit of both improving the financial viability of our TAVR program and ensuring that we can further fulfill our mission of providing excellent care to the largest number of patients. Optimizing patient care for TAVR can therefore be to the benefit of patients, programs, and society as a whole. ■

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