CASE CONFERENCES

Mark A. Chaney, MD
Victor C. Baum, MD
Section Editors

Case 3—2015
Preventing Adverse Outcomes in the Very Elderly Cardiac Surgical Patients

Shamsuddin Akhtar, MBBS

BY 2035 MORE than 1.1 billion people, 13% of the population, will be above the age of 65.[1] This demographic change has significant health and economic implications. Elderly patients represent a significant proportion of the estimated annual 200 million surgical procedures conducted globally.[2] Elderly patients suffer from significant comorbidities. By some estimates, there are just 5 major chronic diseases among older individuals in the United States who have 1 disease, 53% to 85% will have at least 2 of those 5 conditions.[3] In another study, 16 common conditions (type-2 diabetes mellitus, secondary prevention for people with myocardial infarction, osteoarthritis, chronic obstructive pulmonary disease, and depression) were assessed and 95% of the patients >85 years had more than 1 chronic medical condition. Similar results have been noted in other investigations.[4]

In contemporary surgical practice, managing an elderly patient with multiple morbidities is universal. Anesthesiologists and perioperative physicians should be knowledgeable in managing very elderly patients who undergo cardiac procedures.

The risk of cardiovascular diseases rises exponentially with ageing.[5] Many patients in the past, who were not considered surgical candidates because of multimorbid conditions, are now routinely undergoing major cardiovascular interventions. Though technologic advances have made certain procedures less invasive and possible, they also have introduced and exposed unique risks of their own, especially in elderly patients. Transcutaneous aortic valve implantation (TAVI) is a less-invasive procedure compared to surgical aortic valve replacement (SAVR), and is being adopted rapidly by practitioners. This case helps to highlight some of the specific challenges in managing very elderly patients, with multimorbid conditions, who are undergoing cardiac procedures.

CASE PRESENTATION

An 84-year-old man with nonischemic cardiomyopathy with reduced systolic function and critical aortic stenosis (AS) was scheduled for TAVI. He presented with shortness of breath with minimal activity; exercise tolerance was estimated to be <4 METS. Electrocardiogram showed sinus rhythm with premature atrial contractions. Cardiac catheterization showed 50% proximal right coronary artery lesion, right coronary dominant, otherwise no significant coronary stenosis. Echocardiogram showed severely decreased systolic function and severe global hypokinesis. Visually estimated ejection fraction was 30% with severe diastolic dysfunction, consistent with restrictive physiology. Right ventricular size was normal with mildly decreased systolic function. Estimated right ventricular systolic pressure was 42 mmHg. Trileaflet calcified aortic valve with severe aortic stenosis was noted. Aortic valve peak velocity was 4.7 m/s with aortic valve mean gradient of 40 mmHg. Estimated aortic valve area was 0.44 cm^2. No significant aortic regurgitation was noted. Mild tricuspid and mitral valve regurgitation were noted. There was no significant pericardial effusion.

He had severe chronic obstructive pulmonary disease (COPD) (steroid-dependent with inhaled steroids, not on home oxygen); type 2 diabetes mellitus controlled with insulin; hypertension; hypercholesterolemia; and degenerative joint disease. His past surgical history was remarkable for tonsillectomy and adenoidectomy as a child, cholecystectomy and a right total knee replacement in 2001. He had a 60-pack-years smoking history and quit in 2006. His current medications were aspirin, atenolol, pravastatin, furosemide, amlodipine, and prednisone, 10 mg daily; fluticasone and salmeterol daily; albuterol PRN and multivitamins. On physical examination, the blood pressure was 161/95 mmHg; pulse 66 bpm; respiratory rate 18/min; temperature 36.6°C; SpO_2 94% on room air. He was 162.6 cm tall with a weight of 67.6 kg and a body mass index of 25.6.

In general he was awake, alert, and oriented. He was edentulous with upper and lower dentures. There was mildly decreased range of motion of his neck. His lungs were clear to auscultation. On cardiac examination S1 was normal, S2 was diminished, and there was a late peaking III/VI systolic ejection murmur. His abdomen was soft, nondistended, and nontender. All pulses were palpable, and there were no clubbing, cyanosis, or edema.

Labs: Hemoglobin 10.5 g/dL; BUN 28 mg/dL; Cr 1.4 mg/dL; Glu 116 mg/dL. The remainder of his labs were within normal limits.

The patient was taken to the operating room. After placement of standard ASA monitors, an arterial catheter was placed in the left radial artery. Cerebral oximetry and bispectral index (BIS) monitors were placed preoperatively. Anesthesia was induced with midazolam, 2 mg, fentanyl, 200 μg, and sevoflurane. Paralysis was achieved with rocoronium, 40 mg. A right internal jugular 9.5F introducer sheath was placed under sterile technique with ultrasound guidance. A transesophageal echocardiogram probe and a continuous cardiac output pulmonary artery catheter were placed. His pulmonary artery pressures were similar to his preoperative values.

The patient had a relatively uneventful intraoperative course. He received an insulin infusion to maintain his glucose <180 mg/dL. His mean blood pressure was kept at 70 mmHg with the administration of

From the Department of Anesthesiology, Yale University School of Medicine, New Haven, Connecticut.

Address reprint requests to Shamsuddin Akhtar, MBBS, Department of Anesthesiology, Yale University School of Medicine, New Haven, CT 06520. E-mail: shamsuddin.akhtar@yale.edu

1053-0770/2602-0033$36.00/0

http://dx.doi.org/10.1053/j.jvca.2014.07.014

Key words: elderly, frailty, delirium, transcutaneous aortic valve implantation, geriatric

phenylephrine. Total duration of the procedure was 4 hours. His lowest hemoglobin during the procedure was 8.4 gm/dL. Neuromuscular blockade was reversed at the completion of the procedure, and he was taken to the intensive care unit (ICU) on a propofol infusion for sedation. He received 400 μg of fentanyl for the case. He was discharged from the ICU the next day and left the hospital on postoperative day 4.

DISCUSSION

The incidence and prevalence of coronary artery disease rise precipitously with age. Based on the 2014 American Heart Association statistics, 35% of males and 19% of females older than 80 years have coronary artery disease.[5] Similarly, the incidence and prevalence of congestive heart failure and valvular heart disease also increase with age. By the year 2050, the >80 year age group is projected to reach 379 million worldwide. This is approximately a 5-fold increase from the year 2000, when there were 69 million persons aged >80 years.

Perioperative management of elderly is complex. Though the general format of management has remained consistent, shortcomings of conventional preoperative assessment, preoperative interventions, intraoperative goals, and postoperative interventions also are becoming apparent. Limitations of disease-specific guidelines, when applied to patients with multimorbidities, also are being recognized. Extrapolation of data from younger selected population to frail elderly patients can be more deleterious than helpful and should be applied carefully.[4] Recently, specific guidelines addressing perioperative care of the elderly have been published.[6] The case discussion will follow pre-, intra- and postoperative management issues in the elderly and will highlight some of the nuances that should be considered in the very elderly patient.

Aortic Stenosis in the Elderly

For patients who are ≥75 years, prevalence of *any* valve disease is reported to be 11.7%. The aging of the population has made AS a major health concern. The prevalence of moderate or severe aortic stenosis in patients ≥75 years old is 2.8% (95% CI, 2.1%-3.7%).[5] Aortic valve replacement (AVR) is indicated for survival benefit, improvement in symptoms, and improvement in left ventricular systolic function in patients with severe symptomatic AS.[7] Only 50% of patients with severe AS are referred for cardiothoracic surgery, and approximately 40% undergo AVR according to data from 10 U.S. centers of various sizes and geographic distribution.[5] Similarly, in the Euro Heart Survey, 33% of patients with severe symptomatic AS did not undergo surgery because of the expected excessive operative risk, principally because of advanced age. In 2011, Pierard et al[8] found that 40% of octogenarians with severe AS were treated conservatively. These patients had a very dismal prognosis (2-fold excess mortality), compared with surgically treated octogenarians. Common reasons for not undergoing AVR included high perioperative risk, age, lack of symptoms, and patient/family refusal.[9]

Indications for TAVI

SAVR is recommended in patients who meet an indication for AVR with low or intermediate surgical risk. Surgical intervention and AVR is recommended in patients with severe AS and should be considered over TAVI in patients who are at higher surgical risk but have severe multivessel coronary disease.[7] However, in patients with prohibitive risk, TAVI can be considered.[7] When TAVI is compared with medical therapy in patients who were not surgical candidates for AVR, 2-year mortality rates were 43.3% and 68% ($p < 0.001$) and 2-year hospitalization rates were 35% and 72.5% ($p < 0.001$), respectively.[10] Now, TAVI is considered a Class I recommendation in patients with severe symptomatic aortic stenosis who are, according to the "heart team," *unsuitable* for conventional surgery and have >1 year of life expectancy, a metric that also depends on associated comorbidities (Class I, level of evidence B). Moreover, among high-risk patients who are surgical candidates, TAVI should be considered as an alternative to surgery in those patients for whom TAVI is favored by the "heart team" (Class IIa, level of evidence B). Current European guidelines and 2014 AHA guidelines do not recommend TAVI in patients at intermediate surgical risk.[11] However, the TAVI technology is evolving rapidly and new and improved devices are being developed and trialed.[12] Innovations in devices and delivery system technologies are rapid and unceasing, and intermediate-risk patients could be treated with TAVI in the near future.

TAVI Versus SAVR

TAVI has emerged as an innovative technology for treatment of aortic stenosis in patients at high risk for preoperative complications. TAVI has a procedural success rate of >90%.[12] Immediate postoperative and 1-, 3-, 5-, and 10-year pooled survival rates from 48 studies of 13,216 octogenarians were 93.7%, 87.6%, 78.7%, 65.4%, and 29.7%, respectively.[5] However, TAVI does have an appreciable complication rate. These include major vascular complications 11.9% (8.6%-16.4%) and major stroke 3.2% (2.1%-4.8%). Paravalvular leaks also are common and about a third of the patients also require postoperative pacemakers. Data from the PARTNER A cohort showed that mortality rates of TAVI were noninferior to SAVR after 1 (24.2% and 26.8%, respectively) and 2 year (33.9% and 35%, respectively). However, stroke or TIA rates were higher in the TAVI arm (11.2% *v* 6.5%, $p = 0.05$) than in the SAVR arm, as were major vascular complications (11.6% *v* 3.8%, $p < 0.001$).[13] The new-generation TAVI devices currently are in early clinical evaluation. The developers hope that the new devices will decrease significantly the complication rates of the first-generation devices. The complication rate of valve insufficiency is 15% to 20% with new devices, compared to 0% to 3% after SAVR. Stroke that occurs within 48 hours typically is thromboembolic in origin, major stroke rate 4% to 7%, collectively 3.3% at 30 days. Vascular complication rate was 10.6% originally and is now 7.5%. Pacemaker implantation is >25%, compared 3% to 8% after SAVR.[12]

Preoperative Evaluation

Risk stratification: STS, EuroSCORE II, and frailty. The European System for Cardiac Operative Evaluation (EuroSCORE) is a cardiac risk model for predicting mortality after cardiac surgery.[14,15] The system has been highly successful and