



Combined Transfemoral Aortic Valve Replacement and Endovascular Repair of Abdominal Aortic Aneurysm in Nonagenarians is Feasible

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Abstract

Geriatric population is the fastest growing age group in the United States. Traditionally, high risk procedures are not offered to elderly, high risk patients. With increasing number of aging patients and evolution of endovascular technology, more and more minimally invasive procedures are being offered to geriatric patients. Transfemoral aortic valve repair and endovascular repair of abdominal aortic aneurysms have been successfully performed in patients above 90 years of age. We describe a unique case of a nonagenarian, who presented with severe aortic stenosis and a large, infrarenal abdominal aortic aneurysm. She underwent a successful combined endovascular repair of both these pathologies at the same time. This case highlights the feasibility of combined procedures in select group of nonagenarians.

Keywords: Nonagenarian; Abdominal aortic aneurysm; Aortic stenosis; Endovascular repair of abdominal aortic aneurysm; Transfemoral aortic valve replacement

Introduction

Improvements in healthcare quality have allowed the geriatric population to live and remain independent longer [1]. Population demographics are changing, and it is expected that nonagenarian population will quadruple by year 2050 [2]. Calcific aortic stenosis is the most common structural cardiac disease in the elderly population, and medical management of severe aortic stenosis is associated with poor outcomes as compared to surgical treatment [3]. The incidence of Abdominal Aortic Aneurysm (AAA) increases with increasing age and its rupture is associated with significantly high morbidity and mortality rates. Both of these disease entities can be life threatening. The majority of patients in the tenth decade of life are so frail that physicians are hesitant to offer them surgical therapy. We present a case of a nonagenarian, who presented with worsening of severe aortic stenosis and an enlarging AAA. We treated her with simultaneous Transfemoral Aortic Valve Replacement (TAVR) and Endovascular Repair of Abdominal Aortic Aneurysm (EVAR).

Case Presentation

A 94-year-old female with a past medical history significant for aortic stenosis and abdominal aortic aneurysm presented with worsening shortness of breath and fatigue. Previously, she was asymptomatic and was deemed not a surgical candidate for treatment of either of these conditions due to her advanced age. Now for the past year, she was becoming more and more short of breath upon exertion and had four hospitalizations for the treatment of dyspnea. On physical examination, she was awake and alert and hemodynamically stable. Her jugular venous distension was 8cm above the sternal notch in the sitting position. On auscultation of her chest, she had a loud systolic murmur in the aortic area. Her abdominal examination revealed a large, pulsatile aortic aneurysm. Her echocardiogram showed an ejection fraction of 55% with peak aortic gradient of 70 mmHg with a mean gradient of 40 mmHg. Her aortic annulus was about 2cm (Figure 1 and 2). Her abdominal CT scan showed a 7.8 cm infrarenal abdominal aortic aneurysm (Figure 3), which was a dramatic increase, as compared to diameter of 6 cm the year before. The patient and her family had multiple long discussions with her physicians. Options for management included conservative management and minimally invasive surgical treatment. After long deliberations regarding risks, benefits and alternatives, the patient and her family opted for surgical management. From a technical standpoint,

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Figure 1: Transesophageal echocardiogram showing severe aortic valve stenosis in transverse view.



Figure 2: Transesophageal echocardiogram showing severe aortic valve stenosis in the 120 degrees view.

she was a candidate for TAVR and EVAR. The next decision point was whether to perform these procedures simultaneously, in the same setting, or to do them in a staged fashion. Each approach has its own pros and cons. It was decided to perform both procedures in the same setting.

The patient was brought to the operating room and placed in supine position. Right internal jugular central venous line was inserted and right radial arterial line was placed. Due to patient's advanced age, we opted to choose Monitored Care Anesthesia (MAC) with judicious use of intravenous fentanyl and versed. A transverse cut-down was performed on the left groin. The skin was incised with scalpel. Dissection was continued until the femoral sheath was reached, which was incised longitudinally to expose the common femoral artery. Now, under ultrasound guidance, a micro puncture needle was inserted into patient's right common femoral artery and using Seldinger's technique and a wire was placed followed by placement of 5 French sheaths. After angiographic confirmation that the entry was in the common femoral artery, a 7 French 24 cm sheath was placed in the right femoral artery. Using a modified Seldinger technique, a 7 French 24 cm sheath was placed in the right femoral vein. A 5 French, balloon-tipped pacing wire was advanced into the right ventricular apex and adequate pacing thresholds were confirmed. An angled Glide catheter was inserted through the right femoral sheath, and advanced to the ascending aorta with the aid of a Bentson wire. The Bentson wire was then replaced with a 260 cm J-tipped wire, and the wire was advanced to the aortic valve. The Glide catheter was removed and replaced by a 5 French pigtail catheter. The pigtail catheter was positioned in the right coronary sinus. Diagnostic aortography was performed to identify a coplanar

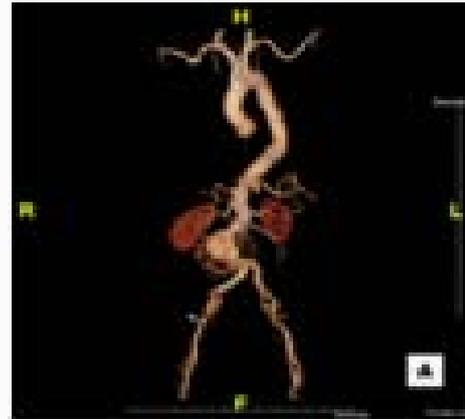


Figure 3: Three- Dimensional reconstruction of Computed Tomography scan showing infra renal abdominal aortic aneurysm.

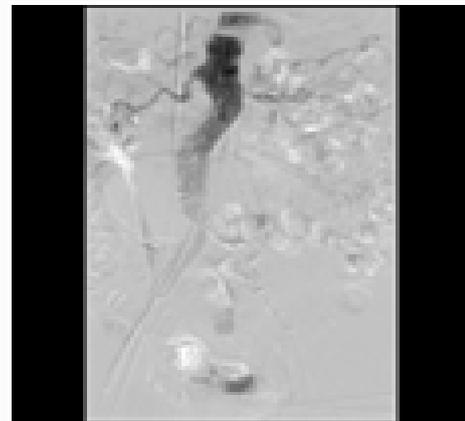


Figure 4: Aortogram status post deployment of endograft, showing successful exclusion of abdominal aortic aneurysm.

view. The left femoral artery was then punctured with a needle under direct visualization. A soft wire was advanced to the distal aorta, and a 7 French 24 cm sheath was inserted and flushed. Heparin was given as a 7500 unit bolus with Activated Clotting Time (ACT) monitoring, and the ACT kept above 250 seconds. A pigtail catheter was inserted into the sheath in the left femoral artery, and advanced over a soft wire into the abdominal aorta. The catheter was used to steer the wire into the thoracic aorta, and the pigtail catheter was advanced to the aortic arch. The soft wire was removed and replaced with a Lunderquist wire. After removal of the 7 French sheath, 16 French and 18 French dilators were introduced, after which an Edwards 18 French eSheath™ was inserted under fluoroscopic guidance with the end placed in the upper abdominal aorta.

Simultaneously, a 23 mm Edwards Sapien XT™ valve was prepared on the back table. The aortic valve was crossed with an AL1 catheter. An exchange wire was placed in the apex of the left ventricle, and a pigtail catheter was advanced over the wire and positioned in the left ventricular apex. The wire was then exchanged for a 260 cm Safari wire, and the pigtail catheter was removed. We then performed aortic valvuloplasty and deployed the 23 mm Edwards Sapien XT™ valve during rapid ventricular pacing (170 bpm). Transthoracic echocardiography showed motion of the leaflets and trivial aortic insufficiency. The guidewire was then removed from the LV. The valve appeared stable by echocardiography and fluoroscopy. The

pigtail catheter was withdrawn.

The patient tolerated the TAVR procedure without any problems and without any change in hemodynamics. Therefore, we decided to proceed with EVAR. An exchange-length wire was inserted via the pigtail catheter in the right femoral sheath, after which the pigtail was removed. A 1 cm skin incision was made over the sheath in the right femoral artery, and the tract was spread with hemostats. Two Perclose ProGlide vascular closure devices (Abbott Vascular, Abbott Park, IL) were deployed at 10 o'clock and 2 o'clock positions, after which the wire was reinserted, and a 7 French 14cm sheath was inserted. The soft wire was removed and replaced by a Lunderquist wire, and a 16 French sheath was inserted. An Omniflush catheter was inserted via the left femoral sheath. The 18 French sheaths in the left femoral artery was withdrawn so that its tip was in the aneurysm. Now using the 20-French sheath on the left side, we placed a marking pigtail catheter into the aorta. Aortography showed the location of the renal arteries and location of the neck. Next, the sheath was withdrawn, and the main body of the endograft (Medtronic Endurant device, Medtronic (Minneapolis, MN) was then placed just below the origin of the lowest renal artery. The device was then deployed keeping the gate at 10 o'clock position and the main body was then deployed until the contralateral gate opened. Next, due to tortuosity of the iliac, we kept a large sheath in the left iliac over a stiff wire and used a buddy wire to cannulate the contralateral gate. The catheter was confirmed to be inside the endograft by swirling it multiple times inside the aortic graft. Now the contralateral gate was deployed via the left side. A Reliant balloon (Medtronic, Minneapolis, MN) was then used to perform inflation at the proximal neck as well as at the junction points. Completion angiography was performed, which showed patent renal arteries and patent bilateral hypogastric arteries. The aneurysm was successfully excluded (Figure 4). There was some delayed, most likely a type 2, endoleak, but overall flow in the aneurysm was remarkably diminished. At this point in time, the sheath from the right side was then removed and closure devices were then deployed. Adequate hemostasis was achieved. The left femoral artery was repaired primarily with 5-0 prolene sutures. The incision was closed in multiple layers and skin was closed with dermabond.

The overall operative time was around 120 minutes. Total amount of contrast used was about 50 ml. The patient tolerated the procedure well. On postoperative day number one, patient developed asymptomatic atrial fibrillation, which was treated with cardioversion. Patient was given regular diet on postoperative day one. Due to her advanced age and frailty, she required physical therapy and was discharged to a rehabilitation facility on ninth post-operative day. She progressed well in the rehabilitation center and was discharged to home after spending about twelve days in the rehabilitation center. She was seen in outpatient clinic a month after surgery and was found to be doing well. About 2 months after surgery, she was found by her primary care physician to be getting lethargic. Initially, her physicians felt that it was due to increasing azotemia, which was most likely due to poor oral intake. However, within next few days, her BUN and Creatinine returned to normal, but she persistently remained confused. She denied evaluation or transportation to a hospital and family supported this. Primary care physicians offered her hospice and she passed away peacefully.

Discussion

The geriatric population is a growing segment of US population [2]. In year 2000, people above 85 years of age constituted 1.5% of

entire US population and it is projected that by year 2050, this ratio will increase to 5% [2]. Current life expectancy for people aged 85 is about 6.4 years, implying that majority of these people will be enter the tenth decade of their lives [4]. Before the advent of minimally invasive procedures, the only treatment options for the treatment of aortic stenosis and AAA were open aortic valve replacement and open abdominal aortic aneurysm repair respectively. The geriatric population has routinely been denied open operations of this magnitude due to their frailty. The emergence or endovascular technique has changed the face of modern surgery with increasing numbers of patients being treated with TAVR for severe aortic stenosis and EVAR for AAA.

Calcific aortic stenosis is found in about 20% of geriatric population [5]. Operative repair of severe aortic stenosis in this population is associated with significant mortality [3]. Traditionally, about one third of patients with severe, symptomatic aortic stenosis were not deemed to be surgical candidates due to presence of significant comorbidities, advanced age being one of them [6,7]. The introduction of TAVR offers hope for high-risk patients who were traditionally denied surgical valve repair. Large clinical trials have clearly shown that TAVR is superior to medical treatment of aortic stenosis and is not inferior to open surgical repair [8-10].

Abdominal aortic aneurysms are a significant cause of morbidity and mortality. The risk of rupture increases with increasing diameter. The standard of care requires repair of AAA prophylactically to prevent rupture in patients who are deemed appropriate candidates [11]. EVAR has shown to improve short-term morbidity and mortality, as compared to open repair, without any difference in long-term survival [12-14]. EVAR has the advantage of avoiding the need for exploratory laparotomy with associated fluid shifts. It also avoids the need for aortic cross clamping with associated hemodynamic changes. Operative blood loss is lower with EVAR. EVAR can be performed with either femoral cut-downs or percutaneous femoral access under local anesthetic and is physiologically less stressful to the body. Recent literature shows that the incidence of complications after groin cut-down and percutaneous femoral access for EVAR is similar [15].

The geriatric population will especially benefit from endovascular operations, given the fact that these operations can be performed without much physiologic stress and in a much shorter operation time. Both TAVR and EVAR can be performed via Transfemoral access. The advantage of doing both operations at the same time is that they can be performed using the same access site and without the need for a second anesthetic for the second operation. The disadvantages of combined procedure are increased operative time and higher (combined) contrast dose. The key issue in offering these operations to nonagenarians is to determine if the patients will truly benefit from them. Traditionally, prophylactic operations, such as AAA repair, have not been offered to elderly patients on the assumption that their life expectancy would not justify the immediate operative risk. As life spans increase and newer operative techniques become less risky, this evaluation will have to be individualized, rather than mad on the basis of age alone. There will still be patients whose procedural risks will remain excessive in relation to any expected benefit in symptoms or longevity, but there will be fewer such patients than previously. Lindman et al. [16] have discussed the principle of therapeutic futility when dealing with high surgical risk in an elderly patient population. Therapeutic futility has been defined as "a lack of

medical efficacy, particularly when the therapy is unlikely to produce its intended clinical result, as judged by the physician; or lack of a meaningful survival, as judged by the personal values of the patient” [16]. Careful patient selection is the key—patients who are physically active and are expected to live a healthy, meaningful life should be offered the surgical operations. This case highlights the real life dilemma of practicing physicians who have to make decisions based on the information they have. Despite having multiple discussions with this patient and family to explain risks, benefits and alternatives, patient wanted to pursue all surgical options to prevent mortality. Yet, after a few months after surgery, she refused to get diagnostic work up for lethargy and ultimately chose hospice. Certainly, if she had expressed these wishes before, physicians involved in her care would have offered her no surgical intervention. This case depicts the real life scenario, in which patients play an active role in clinical decision-making and have the right to change their minds whenever they wish.

Our case shows that both TAVR and EVAR can be performed safely in nonagenarians. After careful screening and thoughtful process, suitable patients with severe aortic stenosis and large abdominal aortic aneurysms can be treated by simultaneous TAVR and EVAR.

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