A State-of-the-Art Percutaneous Endovascular Aneurysm Repair (PEVAR)

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ABSTRACT: Percutaneous endovascular aortic aneurysm repair (PEVAR) was initially reported in 1999. Since that time, a number of nonrandomized, single-center PEVAR studies using Prostar XL and ProGlide (Abbott Vascular) suture-mediated closure devices (SMCD) have been published. Multiple studies have revealed the benefits of PEVAR are present across the health care spectrum, including patients, physicians, and hospitals. The procedural advances discussed above provide many advantages with a minimally invasive fast-track approach to EVAR. At our institution, we have further reduced morbidity, mortality, and cost by implementing a PEVAR fast-track protocol. Our fast-track PEVAR protocol was implemented in 1997 and through 2014 it has been implemented in 1,457 patients. It has been utilized in 78% of our patient population over this time period. Since 2000 this protocol has been applied to 98% of our endovascular aortic aneurysm population with great success. Prostar XL and ProGlide have been used successfully in 97% and 96% respectively. Conversion from local anesthesia with conscious sedation to general anesthesia occurred in 0.1%, hospital mortality was 0.3%, and access site infection was 1%. Sufficient data exists from single-center randomized trials demonstrating the advantages of PEVAR compared to EVAR with appropriate patient selection. Our fast-track PEVAR protocol has allowed for reduction in morbidity, procedure time, length of hospital stay, hospital cost, and time needed for patients to return to normal daily activities. The new generation of closure devices offers an array of options, and there are new devices on the horizon that will further revolutionize the advances of PEVAR.

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Percutaneous endovascular aortic aneurysm repair (PEVAR) was initially reported in 1999.1 The initial description of the PEVAR technique used a 10 Fr Prostar XL device (Abbott Vascular) in a preclose fashion to close a 16 Fr sheath site after abdominal aortic aneurysm repair. The success rate in this study was reported to be 100%.1 Since that time, a number of nonrandomized, single-center PEVAR studies using Prostar XL and ProGlide (Abbott Vascular) suture-mediated closure devices (SMCD) have been published.
In 2011, Krajcer et al reported a 96% and 97% technical success rate of percutaneous abdominal aortic aneurysm repair with local anesthesia and conscious sedation.² The review of literature revealed that the average technical success for a 5 year period from 2009 to 2014 using Prostar XL was 96%. The review of these trials demonstrated that there is a considerable learning curve in the use of this device.

More recently, ProGlide was reported in a variety of nonrandomized single-center PEVAR studies.³ The average technical success with ProGlide has been 96%. Several investigators have reported that there is a considerably shorter learning curve with ProGlide than Prostar XL.⁴

Multiple studies have revealed that the benefits of PEVAR are present across the whole health care spectrum, which includes patient, physicians, and hospitals. Percutaneous endovascular aortic aneurysm repair benefits the patient by providing a minimally invasive approach with less anesthesia time and by avoiding the complications of general anesthesia. In addition, the procedure is performed under local anesthesia with minimal blood loss, fewer groin-related complications, less pain, and quicker recovery time.

The practitioner also benefits from utilizing PEVAR by providing patients with a quicker procedure and without the delays that accompany the use of general anesthesia. This approach also leads to improved patient satisfaction and operator efficiency.

The hospital benefits through decreased cost, lower infection rates, less need for blood transfusion, improved efficiency, and increased patient satisfaction. The percutaneous approach also precludes the use of general anesthetic and need for a long hospital length of stay. It also decreases operating room times. The advances in percutaneous access provide a mutually beneficial approach to endovascular aortic aneurysm repair.

Success with PEVAR is dependent on patient-specific, physician-specific, and device-specific attributes. Patient-specific attributes include gender, because females tend to have smaller diameter vessels. Generally accepted exclusion criteria for PEVAR include small vessel diameter, extensive calcification, severe tortuosity, morbid obesity, prior groin access or intervention, and presence of peripheral artery disease.⁵,⁶

Physician-specific attributes in the success of PEVAR were evaluated by Bechara et al.⁶ Their findings reveal that there was a trend for decreasing failure rates over time with increased experience with the closure devices. In a 30-month period of review, the failure rate was decreased from 45% to 5%. They experienced 2 access-related complications necessitating surgical repair. Success of the surgeon in PEVAR was improved with device experience and was not related to the type of closure device used.⁶ An increasing number of EVAR devices has been approved for percutaneous use, thus allowing for more options for endograft selection.⁷

The procedural advances discussed above provide great advantages with the least invasive fast-track approach to EVAR. At our institution, we have further reduced morbidity, mortality, and cost of EVAR by implementing a PEVAR fast-track protocol. Our protocol was implemented in 1997 with the use of local anesthesia, conscious sedation, and percutaneous femoral artery access and closure.

At our institution, a bilateral preclose technique using Prostar XL or Proglide with percutaneous access is employed whenever possible. The protocol also uses
local anesthesia and conscious sedation, minimizing potential costs, complications, and time delays of general anesthesia. In our PEVAR fast-track protocol, we do not use central line, radial arterial line, or Foley catheter placement, which allows for early patient ambulation, less discomfort, shorter hospital stay, and decreased cost. Post PEVAR the patients recover on an interventional floor rather than in the more costly intensive care unit. They usually ambulate in 2 to 4 hours after the procedure, receive a regular diet, and are discharged the next day from the hospital.

Our fast-track PEVAR protocol was implemented in 1997 and through 2014 it has been implemented in 1,457 patients. It was utilized in 78% of our patient population over this time period. Since 2000 this protocol has been applied to 98% of our endovascular aortic aneurysm population with great success. Prostar XL and ProGlide have been used successfully in 97% and 96% respectively. Blood transfusion was required in only 2% (n=29) of patients. Conversion from local anesthesia with conscious sedation to general anesthesia occurred in 0.1%, hospital mortality was 0.3%, and access site infection was 1%.

**CONCLUSION**

There are sufficient data from single-center randomized trials demonstrating the advantages of PEVAR compared to EVAR with appropriate patient population selection. Our fast-track PEVAR protocol has allowed for reduction in morbidity, procedure time, length of hospital stay, hospital cost, and time needed for patients to return to normal daily activities. The percutaneous approach allows for the use of local anesthetic, enabling a more expeditious procedure without the need for general anesthesia and its potential complications. The new generation of closure devices offers an array of options, and there are new devices on the horizon that will further revolutionize the advances of PEVAR.

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