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Local Anesthesia for Percutaneous Thoracic Endovascular Aortic Repair

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Abstract

Background: **Thoracic endovascular aortic repair (TEVAR) requires large-bore vascular access due to the considerable diameters of the endoprosthesis and delivery device. The preclose technique preceding endograft delivery has opened the door for an evolved access strategy. In addition, treatment under local anesthesia offers the advantage of optimal neuromonitoring. The goal of this study was to analyze the efficacy and safety of percutaneous TEVAR under local anesthesia.**

Methods: **All patients undergoing TEVAR in an elective setting at the Antwerp University Hospital between June 2012 and June 2015 were prospectively entered into an endovascular database. This database was queried for demographics, procedural details, and access-related complications. All patients underwent a percutaneous approach with the Perclose Proglide under local anesthesia.**

Results: **This review identified 34 patients in whom 37 percutaneous TEVAR procedures were completed under local anesthesia. All patients experienced adequate analgesia, and no conversions to general anesthesia were implemented. The mean size of the arteriotomy was 23.8 ± 1.3 French (F). The number of Proglide deployments was 80, with an 8% rate of failure on deployment. There were no conversions to surgical cutdown, and adequate hemostasis was obtained in all procedures. The incidence of postprocedural access-related complications was 3%.**

Conclusion: **Local anesthesia for percutaneous TEVAR can be performed safely and effectively. The percutaneous approach facilitates local anesthesia, which provides the added benefit of early recognition of neurologic complications while maintaining a low risk of access-related complications despite the need for large-bore vascular access.**

Key Words

Thoracic endovascular aortic repair • Percutaneous • Local anesthesia

Introduction

Abbott's suture mediated closure devices (SMCDs) have revolutionized the field of thoracic endovascular aortic repair (TEVAR), making preclosing with the Perclose Proglide or the Prostar XL (Abbott Vascular, Redwood City, CA, USA) a crucial step in limiting procedure invasiveness. Several recent articles have described the noninferiority of this percutaneous approach over the classic femoral cutdown for endovascular aortic repair [1-4]. In addition, patients who underwent percutaneous access had shorter hospital stay, reduced procedure-related complications and overall improved patient satisfaction compared with open femoral access.

Several reports have appeared regarding the analysis of risk factors as a determinant of success for percutaneous access [5-8]. However, the size of the arteriotomy can be seen as the major limiting factor for the percutaneous approach [4, 9]. The size of the arteriotomy is determined by the outer diameter (OD) of the vascular sheath or the sheathless delivery device. The use of ultrasound-guided access also significantly decreases the rate of access-related complications [9, 10].

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The use of local anesthesia can facilitate the percutaneous approach in TEVAR by further minimalizing procedure invasiveness and allowing early recognition and treatment of neurologic impairment. This neuromonitoring for cerebrovascular accidents and spinal cord ischemia delays the time to treatment for these devastating complications and avoids the need for routine spinal drainage. The goal of this study was to analyze the efficacy and safety of percutaneous TEVAR under local anesthesia.

Materials and Methods

Patient Selection

We performed a prospective analysis of three-year period between June 2012 and June 2015 on all patients who underwent an elective endovascular repair for thoracic aortic disease. Patients were presented the option of treatment under local or general anesthesia. Patients preferring treatment under general anesthesia were excluded. Patient demographics, procedural details, and access-related complications were recorded.

Endovascular exclusion of the thoracic aneurysm, dissection, or endoleak was performed with either the Valiant Captivia thoracic stent graft (Medtronic, Santa Rosa, CA, USA) or the Zenith TX2 endoprosthesis (Cook, Bjaeverskov, Denmark). The delivery device of the Valiant stent graft has an OD range of 22 to 25 French (F, 7.3–8.3 mm), whereas the delivery device for the TX2 endoprosthesis has an OD range of 23 to 26 F (7.6–8.5 mm). Patients were excluded if the OD of the delivery device exceeded the inner diameter of the access site at the common femoral or external iliac artery.

Vascular access was always obtained under ultrasound guidance. Ultrasound offers the advantage of meticulous localization of the entry site while avoiding calcifications and allows for precise infiltration of the local anesthetic, thereby increasing patient comfort. This study analyzed the data of one operator at the Antwerp University Hospital.

Data Collection

Each puncture site was assessed by clinical examination in the immediate postoperative period. One month postoperatively, patients were seen on an ambulatory basis for clinical assessment and duplex ultrasonography of the groin. Complication documentation and grading were in accordance with literature [11], and a period of one postoperative month was used for documenting all access-related complications.

Preclose Technique under Local Anesthesia

Under ultrasound guidance the ideal entry site was localized. Calcifications are avoided with this method, and the top of the artery is punctured in a monowall fashion, while the common femoral artery (CFA) is punctured well above its bifurcation. Local anesthesia was achieved using infiltration of lidocaine 1% with epinephrine. If necessary, intravenous (IV) sedation with midazolam IV or propofol IV was used to maximize comfort. However, the goal was to maintain the patient fully awake and cooperative. Pain was treated with fentanyl IV bolus or occasionally remifentanil continuous infusion.

We performed a preclose technique of the large- bore vascular access site after ultrasound-guided retrograde puncture of the CFA. Two 6 F Perclose Proglide devices were inserted and deployed in a standard manner after 30° rotation. Upon completion of the procedure, the preformed knots were lubricated with saline and gradually tightened. In the first step, the knots were tied with the guidewire in place to assess accurate hemostasis while maintaining access. In case of inadequate hemostasis, an additional 8 F Angioseal was used. In this case, the Angioseal was only placed after the Perclose Proglide wires were tightened. With this maneuver, the puncture hole was closed as maximally as possible, after which the Angioseal (anchor inside and sponge outside) could adequately cover the residual hole. If adequate hemostasis was achieved immediately, further tightening of the knots was performed upon guidewire removal. A detailed description of the preclose technique has been previously published [12].

Results

From June 2012 to June 2015, 37 TEVAR procedures were performed in 34 patients via a percutaneous approach. The mean (± SD) age was 68.9 ± 11.5, and 29 patients (78%) were male. Twenty-two patients were treated for a thoracic aortic aneurysm, 11 for an aortic dissection, and one for correction of an endoleak. Three patients required a second TEVAR procedure during the study period for the correction of an endoleak, for a total of 37 TEVAR procedures. Patients were followed for a period of one month to document all access-related complications. All patients completed the follow-up period.

All patients were treated in an elective setting under ultrasound-guided local anesthesia. All patients experienced adequate analgesia, and no conversions to general anesthesia were implemented. Local anesthesia has the added benefit of allowing neurologic monitoring for intraoperative cerebrovascular accidents and spinal cord ischemia. This was illustrated in one patient who developed a left-sided hemiparesis during the procedure. Due to early recognition, an immediate stroke protocol was implemented. A cerebral angiogram excluded large emboli

or a cerebral hemorrhage. The patient was placed on antiplatelet therapy, and an extra dose of heparin was administered. Moreover, controlled hypertension was implemented, after which complete recuperation of the impairment was noted.

The procedural characteristics are summarized in Table 1. Independent delivery and deployment of the Valiant and TX2 endoprostheses are possible without a vascular sheath. Arteriotomy sizes determined by delivery device ODs were 22 F (27%), 24 F (50%), 25 F (16.0%), and 26 F (8%). The Valiant Captivia thoracic stent graft was used in 86% of cases, and the Zenith TX2 endoprosthesis in 14%. The average number of endoprostheses per procedure was 1.6.

A total of 80 Proglide devices were used to preclose 37 access sites. Adequate placement of tandem Proglide devices is mandatory before delivery device insertion. Six (8%) Proglide devices failed on deployment, resulting in use of an extra Proglide before starting the procedure. Successful hemostasis was obtained in all procedures. There were no conversions to a surgical cutdown. One procedure, a 22 F arteriotomy, required an extra 8 F Angioseal after knotting the Proglide wires to obtain complete hemostasis. Immediate postoperative ultrasound showed excellent results without increased peak-systolic velocity.

In this study, we have also focused on the access-related outcome (Table 2) and documented complications by means of the reporting standards for endovascular aortic aneurysm repair [11]. Only one patient developed an access-related complication by means of a subocclusive stenosis of the CFA requiring a surgical endarterectomy. This was not the patient in whom an additional Angioseal was placed. Clinical evaluation and duplex ultrasonography revealed no incidence of pseudoaneurysm formation at the access site. There were no incidences of significant hematoma or seroma formation, delayed wound healing, wound infection, prolonged pain, or femoral neuropathy during the follow-up period.

Discussion

Abbott guidelines state that the Perclose Proglide can be applied for an arteriotomy of 5 to 21 F, and tandem Proglide deployment is required in the 8.5 to 21 F range. In TEVAR, large-bore vascular access is required for endoprosthesis delivery and deployment, and all of our patients received an arteriotomy of more than 21 F. However, there were no conversions to a surgical cutdown, and adequate hemostasis was obtained in all procedures. In our previous study, we were successful in preclosing 14 and 16 F arteriotomies with only one Proglide device [13]. While expanding the indications and expectations of the Perclose Proglide, we are able to obtain a relatively low risk of 3% for access-related complications. It seems that one Proglide device can be

Table 1. Procedural Characteristics

Indication	*n* (%)
Aneurysm	22 (60%)
Dissection	11 (30%)
Endoleak	4 (10%)
Endograft type	
Valiant Captivia	32 (86%)
Zenith TX2	5 (14%)
Delivery device outer diameter	
22 Fr	11 (27%)
24 Fr	21 (50%)
25 Fr	6 (16%)
26 Fr	2 (8%)

FR = French.

Table 2. Access-Related Outcomes

Outcome	*n* (%)
Inadequate hemostasis	
Femoral cutdown	0 (0%)
Extra angioseal postclosure	1 (3%)
Complication	
Hematoma	0 (0%)
Seroma	0 (0%)
Pseudoaneurysm	0 (0%)
Sensibility disorder	0 (0%)
Delayed wound healing	0 (0%)
Prolonged pain	0 (0%)
Secondary intervention	1 (3%)

applied for preclosing an arteriotomy of 5 to 16 F and two Proglide devices can be used to preclose an arteriotomy of 17 to 26 F. Further research is required to assess the efficacy of the Proglide for preclosing larger arteriotomies. However, this may become a futile discussion as endovascular devices are continuously downsized.

The focus of this study was treating patients under local anesthesia. This approach offers many benefits, mostly due to early and direct recognition of complications, especially neurologic impairment at the cerebral or spinal level. We believe that treating patients under local anesthesia is the next step toward decreasing the stroke rate and the incidence of spinal cord ischemia, which remain among the most devastating complications following TEVAR. Several other benefits of local anesthesia have been described. Verhoeven et al. [14] stated that overstretching the arterial system with the delivery device induces discomfort, which alerts the physician of the risk of impending rupture. They also demonstrated that in a subset of TEVAR procedures, the average hospital stay is significantly longer with those operated under general anesthesia compared to local anesthesia [14].

Ultrasound offers the added benefit of precise distribution of the local anesthetic while avoiding calcified lesions during needle puncture, lowering the failure rate for placement of the Proglide system. All patients were perfectly able to complete the less than one-hour procedure without conversion to general anesthesia.

Our results show that percutaneous TEVAR in an elective setting under local anesthesia is effective and safe in a consecutive patient population. The percutaneous approach facilitates local anesthesia, which provides the added benefits of early recognition of neurologic complications and a low risk of access-related complications despite the need for large-bore vascular access.

Conflict of Interest

The authors have no conflict of interest relevant to this publication.

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