From the Society for Clinical Vascular Surgery

Percutaneous axillary artery access for endovascular interventions

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ABSTRACT

Background: As endovascular therapy becomes increasingly complex, adjunct techniques such as upper extremity arterial access facilitate visceral branch interventions. The purpose of this study was to assess the viability of axillary artery percutaneous access in endovascular repair.

Methods: Records of all patients undergoing axillary artery percutaneous access as part of an endovascular intervention from December 2015 to December 2016 were examined. Demographics of the patients (age, sex, medical comorbidities, smoking status, and anticoagulation) were documented. Each case was examined for technical success and perioperative complications, including hematoma, brachial plexus injury, and return to the operating room. Early functional outcomes were assessed using clinic follow-up documentation.

Results: During the study interval, 25 axillary artery punctures in a total of 19 patients were performed for endovascular intervention. The mean age was 72 years; most patients were male (68%), and the cohort had a typical vascular comorbidity profile (hypertension in 84%, hyperlipidemia in 90%, diabetes in 21%, coronary artery disease in 58%, and chronic obstructive pulmonary disease in 47%; 90% were active or former smokers). Axillary access was obtained as part of complex endovascular aneurysm repair in 13 patients, mesenteric vessel intervention in 3 patients, and iliac intervention in 3 patients. Sheath size was most frequently 6F (6 punctures) or 7F (15 punctures). Closure devices included Perclose (Abbott Vascular, Santa Clara, Calif) in 36% and Angio-Seal (Terumo Interventional Systems, Somerset, NJ) in 64%. There were two perioperative deaths and one instance of return to the operating room for hematoma. There was no perioperative stroke, axillary occlusion, or severe brachial plexus injury. One patient had transient ipsilateral postoperative thumb numbness, and one patient had residual bleeding after closure requiring manual pressure.

Conclusions: Percutaneous axillary artery access is a viable strategy to facilitate complex endovascular interventions. This technique avoids the need for brachial or axillary artery exposure and allows larger sheath sizes because of the caliber of the axillary artery. There were no major neurologic or ischemic complications. This technique is a relatively safe and practical alternative to approaches involving exclusively femoral and brachial access. (J Vasc Surg 2018;■:1-5.)

During the last two decades, a primary endovascular approach has become standard in treating aortic and visceral aneurysmal and occlusive disease. Traditionally, percutaneous access in these settings has been transfemoral, and the common femoral artery remains the default vascular access site.[1] Whereas the femoral artery is the access site of choice in most modern vascular practices, upper extremity access can be critical in the setting of hostile iliac anatomy due to severe tortuosity or occlusive disease. Hostile iliac anatomy is relatively common as up to 13% of patients presenting for aneurysm repair had iliac anatomy that made them poor endovascular candidates in the European Collaborators on Stent/graft Techniques for aortic Aneurysm Repair (EUROSTAR) database.[2] Upper extremity access is also helpful to facilitate mesenteric or renal vessel access, allowing adjunctive procedures such as snorkel or parallel stenting. However, brachial and radial artery sheath size can be limited by small vessel size and spasm. The axillary artery represents an alternative upper extremity access that may accommodate larger sheath sizes for therapeutic interventions.

The existing literature on the safety of a transaxillary approach is conflicting. Early reports documented a 3.3% complication rate with transaxillary access, approximately double the rate of translumbar or transfemoral approaches.[3] Others site concern for complications like brachial plexus injury, pseudoaneurysm formation, distal embolization, and thrombosis with a percutaneous axillary approach.[4] Despite this, recent literature supports axillary access as a viable alternative to femoral access because the axillary artery is substantially less likely to have significant atherosclerotic disease.[1,5] Approximately 15% of transcatheter aortic valve replacement patients

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Author conflict of interest: none.

Presented at the Forty-fifth Annual Symposium of the Society for Clinical Vascular Surgery, Lake Buena Vista, Fla, March 18-22, 2017.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

https://doi.org/10.1016/j.jvs.2017.11.066

lack suitable iliac access for device delivery.[6] In vascular surgery, upper extremity access may relieve difficulty in visceral vessel cannulation because of more favorable angles, thus facilitating visceral intervention or parallel graft placement. Moreover, alternative vascular access points are critical in complex endovascular procedures, in which multiple deployment systems need to be inserted and bilateral femoral access is not sufficient.[7]

The existing literature on transaxillary interventions is largely composed of open axillary exposures for cannulation during cardiothoracic surgery or endovascular repair of aortic aneurysms. Reports on upper extremity access for vascular interventions have focused largely on open exposure of the brachial and axillary arteries for access.[4] As such, the purpose of this study was to document the clinical outcomes and complications of percutaneous transaxillary access and to assess its safety and feasibility for vascular surgery interventions.

ARTICLE HIGHLIGHTS

- **Type of Research:** Retrospective, single-center, cohort study
- **Take Home Message:** Twenty-five ultrasound-guided percutaneous axillary artery accesses in 19 patients undergoing endovascular procedures using 6F sheaths or 7F sheaths for 15 accesses resulted in no perioperative strokes, arterial occlusions, or brachial plexus injuries. One patient required evacuation of a hematoma.
- **Recommendation:** This study suggests that ultrasound-guided percutaneous axillary artery access is a safe strategy during complex endovascular procedures.

METHODS

This is a retrospective review of a prospectively maintained database of all surgical patients treated by the Vascular Group in Albany, New York. Records of all patients undergoing percutaneous axillary artery access as part of any endovascular intervention from December 2015 to December 2016 were examined. All procedures were performed in a hybrid operating room (OR) at Albany Medical Center or St. Peter's Hospital in Albany, New York. Operative reports and clinical patient follow-up documentation were reviewed. Basic demographics of the patients, including age and gender, and comorbidities, such as diabetes, hypertension, hyperlipidemia, smoking status, coronary artery disease, chronic renal failure (stage 3 or higher), and chronic obstructive pulmonary disease, were collected.

In all cases, preoperative computed tomography (CT) angiography was performed of the chest, abdomen, and pelvis to ensure that the axillary and subclavian arteries were patent and free of significant calcification or stenosis that would preclude safe access. All procedures were performed under general anesthesia. Intraoperatively, procedures adhered to the following technique: ultrasound-guided percutaneous axillary artery access was achieved using a micropuncture needle and upsized to 4F to 12F sheaths over a Bentson wire using the Seldinger technique (Figs 1 and 2). The axillary artery was preferentially accessed in the most proximal or first segment, between the lateral border of the first rib and the pectoralis minor muscle, to prevent pleural injury. Ultrasound guidance was used to visualize the axillary artery in the infraclavicular chest wall, with care taken to avoid the anterior and superiorly located axillary vein. Arterial closure was performed in all cases using an Angio-Seal (Terumo Interventional Systems, Somerset, NJ) or Perclose (Abbott Vascular, Santa Clara, Calif) device, depending on the surgeon's preference. The procedures included three main categories: complex endovascular aneurysm repair, mesenteric vessel intervention, and iliac intervention.

Outcomes included technical success of the axillary access, defined by target vessel cannulation. Major complications included perioperative (within 30 days) death, stroke, hematoma requiring return to the OR, pseudoaneurysm, axillary artery thrombosis or occlusion, and permanent brachial plexus injury. Minor complications included transient brachial plexus injury and hematoma managed conservatively. Pulse volume recordings were documented in the upper extremity after the procedure in many cases. Our standard follow-up interval for complex endovascular interventions includes a postoperative visit at approximately 2 weeks, followed by imaging with follow-up at 1-month and 3-month intervals for each patient. This study was approved by the Institutional Review Board of our institution, expedited review category 5 with waiver from the requirement to obtain informed consent (CFR 45.46.116(d)), collection of retrospective routine medical record information.

RESULTS

During the study interval, 25 axillary artery punctures in a total of 19 patients were performed for endovascular interventions. The mean age was 72 years (±10 years), and the majority of patients were male (68%). The cohort of patients had a typical vascular comorbidity profile with hypertension in 84%, hyperlipidemia in 90%, diabetes in 21%, coronary artery disease in 58%, and chronic obstructive pulmonary disease in 47%; 90% were active or former smokers (Table I).

There were three distinct clinical situations in which percutaneous axillary access was used: repair of complex aortic aneurysms with parallel stent grafting, mesenteric vessel intervention, and iliac intervention. A total of 13 patients (68%) underwent endovascular aneurysm repair with parallel grafting to treat juxtarenal and pararenal aortic aneurysms. In five patients, multiple axillary access