◆ TECHNICAL NOTE ◆

Axillary Artery Access for Interventional Procedures

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Purpose: To evaluate axillary artery access for the interventional treatment of carotid or splanchnic arteries that have angulated takeoff or complex anatomy when larger catheters (up to 9 F) are needed.

Technique: The axillary artery approach was used to treat the left internal carotid artery (ICA) in 3 patients (2 angulated takeoffs and 1 bovine arch) and a celiac axis aneurysm. An 8-F, 45-cm-long introducer sheath was inserted for the carotid procedures, whereas a 9-F, 90-cm sheath was chosen for the celiac aneurysm. Cerebral protection and stenting were successfully performed in all carotid patients; an 8×40-mm stent-graft was implanted to exclude the celiac artery aneurysm. An 8-F vascular closure device was used in the axillary arteries; hemostasis was immediate, and no hematoma or other complications were recorded in follow-up.

Conclusions: This preliminary experience revisits the axillary approach as an alternative access route for interventional procedures. In association with a vascular closure device, this approach should be considered as a useful and safe option for those interventional procedures in which larger sheaths or catheters are required to cope with difficult arterial anatomies.

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Percutaneous access to the arterial system for endovascular procedures is usually achieved via the femoral arteries. When femoral access is precluded, the radial, brachial, or axillary artery can serve as alternatives. Nevertheless, complications associated with the use of the axillary artery have discouraged many authors from continuing to use this approach, particularly for interventional procedures involving larger introducer sheaths and intensive antiplatelet therapy. In fact, though a complication rate <2.5% has been reported for transaxillary access in diagnostic studies,[1,2] the use of larger introducer sheaths for interventional procedures has often led to serious problems, such as nerve plexus injuries, arterial thrombosis, and pseudoaneurysm.[3] Such complications have also been reported in other series following the use of the axillary access for diagnostic purposes; AbuRahma et al.[4] reported a puncture site complication rate for transaxillary angiography as high as 27%, with respective incidences of 11% and 13% for nervous system and brachial plexus injuries.

However, the large diameter of the axillary artery, its favorable anatomy, and its proximity to the carotid and splanchnic arteries makes it a useful approach in these cases, particularly when a femoral puncture is not possible or a different route is required to cope with difficult arterial anatomies. If he-

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mostasis could be secured safely and expeditiously, such as has been done at the femoral artery with a percutaneous closure device, then the axillary artery could become a safe and valuable vascular approach for endovascular interventions, with a considerably reduced rate of complications at the puncture site.

TECHNIQUE

To re-evaluate the axillary artery approach for interventional procedures, we treated the left ICA in 3 patients with difficult anatomy (Figure, A) and a celiac axis aneurysm suitable for endovascular graft exclusion. The carotid patients were selected for this access because of an angulated left common carotid artery (CCA) takeoff in 2 and a common origin from the innominate artery (bovine arch) in the other. In the fourth patient, the choice of the axillary artery access was suggested by the presence of significant bilateral iliofemoral occlusive disease, which prevented safe and straightforward cannulation of the splanchnic artery from a retrograde access.

All patients were pretreated with antiplatelet therapy consisting of ticlopidine 250 mg/d

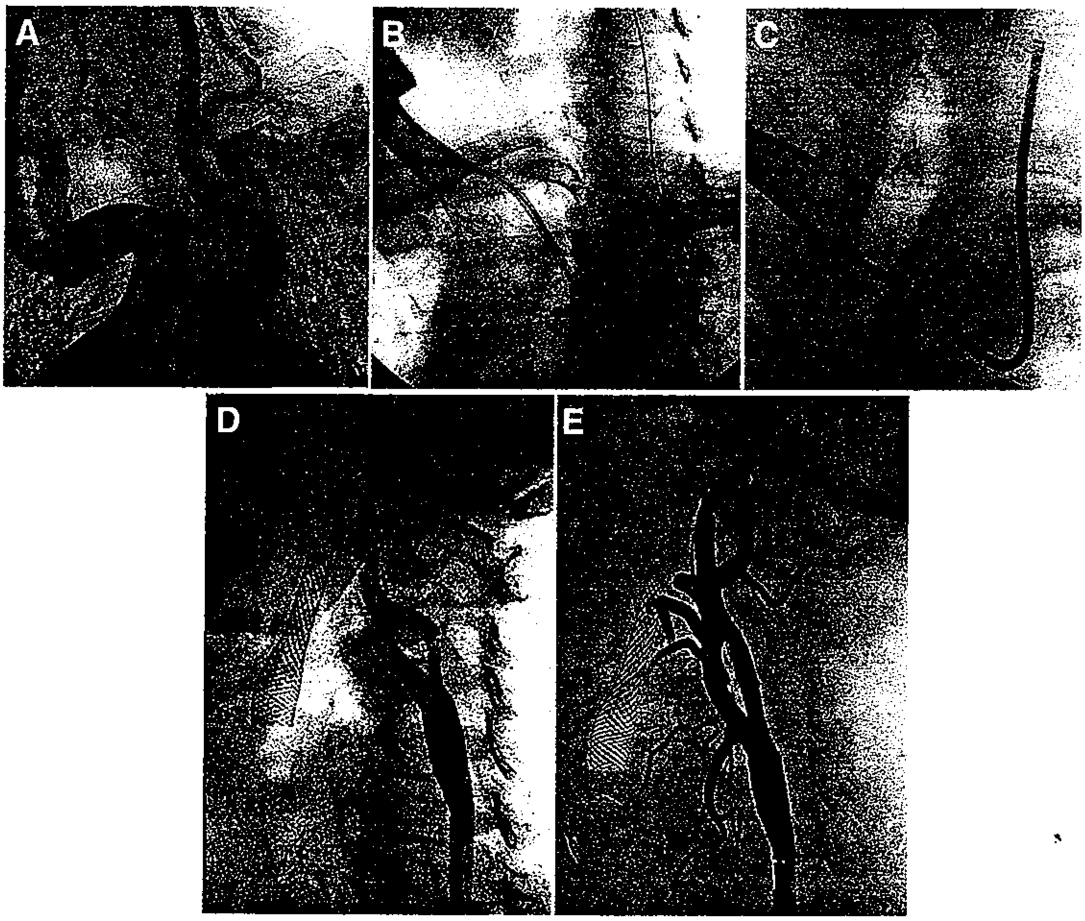

Figure ◆ **(A)** Baseline angiogram showing a bovine arch with an angulated takeoff of the left common carotid artery (CCA). **(B)** Via the right axillary puncture, an 8-F, 45-cm introducer sheath is positioned in the innominate artery, and a 0.035-inch guidewire is negotiated into the external carotid artery. **(C)** Over the wire, the introducer sheath is advanced into the CCA. **(D)** Selective angiography through the sheath shows a tight ICA stenosis. **(E)** Final result after deployment of a 7×30-mm monorail carotid Wallstent.

or clopidogrel 75 mg/d (begun 72 hours prior) and aspirin (100 to 325 mg/d 1 day prior). A 5000-unit heparin bolus was administered at the time of intervention. For the carotid lesions, an 8-F, 45-cm introducer sheath (Arrow International, Inc., Reading, PA, USA) was positioned over a 0.035-inch Glide guidewire in the subclavian artery (Figure, B). The 8-F sheath was selected because of the possible need for a covered stent owing to ulcerated lesions. The ostium of the left CCA was engaged by the guidewire, which was advanced into the external carotid artery (Figure, C). The sheath was then advanced over the guidewire into the CCA (Figure, D). Cerebral protection was provided by an EPI-E2 Filter (Boston Scientific, Natick, MA, USA); a monorail Carotid Wallstent (Boston Scientific) was successfully deployed in each case according to standard procedures (Figure, E).[5] One patient received a glycoprotein IIb/IIIa platelet antagonist at the end of the procedure.

The celiac axis artery was approached from a left axillary artery puncture and engaged with a 9-F, 90-cm Arrow introducer sheath over a 0.035-inch Glide guidewire. The left axillary approach allowed easy advancement and deployment of an 8×40-mm Viabahn stent-graft (Gore, Flagstaff, AZ, USA), with complete exclusion of the aneurysm.

In all cases, hemostasis was immediately achieved with an 8-F AngioSeal closure device (St. Jude Medical, Minnetonka, MN, USA); no hematoma or other complications were recorded in the 2-month follow-up.

DISCUSSION

In case of severe iliac occlusive disease, the axillary and brachial access routes have been widely used as alternative approaches to the femoral artery.[6] In experienced hands, low complication rates are reported, but the risks of brachial and axillary artery puncture may be higher when they are performed by less experienced operators. More recently, the use of the radial approach for the same purpose has been successful, with acceptable complication rates, although small (<7 F), long catheters are needed.[7,8] Levy et al.[9] implanted a stent in a cervical ICA stenosis via a percutaneous radial artery access. In a recent retrospective review of 1084 angiograms performed from the brachial artery, Armstrong et al.[10] reported complication rates as low as 1.28% for all patients, with reduced rates of failed access (2.1% in women versus 0% men) and brachial thrombosis (1.24% in women versus 0.28% men). Nevertheless, McIvor et al.[1] observed significantly higher technical success and fewer vascular complications requiring surgery or angioplasty in axillary artery catheterizations compared with 6 published series encompassing 290 attempted brachial artery accesses where the femoral route was contraindicated. According to these authors, the transaxillary approach has a high rate of technical success (99%) and should always be considered if the femoral route is not possible.[1] Currently, which approach (brachial or axillary) should be considered the best alternative to the femoral artery for diagnostic studies is still controversial.

No substantial data are available concerning angioplasty and/or stenting from the axillary artery. However, the high rate of complications following percutaneous interventions from this route has convinced interventionists to avoid the axillary artery approach over the past years. In addition, the concomitant reduction in size of balloon catheters and stents has allowed increasingly complex interventional procedures to be performed via the brachial artery,[11,12] with fewer complications than those reported for transaxillary puncture. For these reasons, the brachial approach is currently regarded as the most valuable alternative to transfemoral arterial puncture. In selected cases, this option can also be more advantageous than the standard approach in terms of accessibility of the artery and/or when the procedure is conducted in an outpatient setting.[13] The choice of the brachial artery as vascular access has been proven to be relatively safe and effective, but on the other hand, such an approach does not generally facilitate the use of devices larger than 7 F.

Although rarely used, the subclavian artery is another possible option for arterial catheterization. In a series of 569 patients who underwent subclavian artery puncture for diagnostic angiography, balloon angioplasty, and thrombolysis, Andros et al.[14] reported an acceptable complication rate of 1.2%. The authors concluded that whenever percutaneous femoral catheterization cannot be achieved or an alternative access point is indicated, the subclavian approach is a safe, expeditious, and versatile alternative to the axillary, brachial, or translumbar routes for virtually all types of systemic and cardiac catheterizations. In their series, the subclavian access was not used for arterial stenting, so further studies are required to evaluate the incidence of injuries and complications when introducing larger sheaths and devices via the subclavian artery.

In our cases, we had to use 8 and 9-F sheaths to deliver the stents and stent-graft,[15] so the choice of the brachial approach was inappropriate; it would have increased the risk of brachial artery rupture, pseudoaneurysm, or thrombosis. Moreover, because of the difficult anatomy of the diseased vessels in these patients, a closer and easier approach to the lesions via the axillary access was perceived to be more advantageous.

For the present authors, catheterizing angulated left CCA takeoffs, especially in a bovine arch, is more likely to be successful via this route than either the femoral or brachial artery approach. In our limited experience, the use of the axillary artery as an arterial access resulted in a relatively simple and straightforward treatment of both carotid stenosis and celiac axis aneurysm. No access-related local or systemic complications were noted at the end of the procedure. In fact, the systematic use of a vascular closure device prevented bleeding from the arterial puncture site. It is well know that both motor and sensory nerve injuries can occur when just a few drops of blood get through the sheath of the adjacent nerve plexus.[16] For this reason, the use of a closure device for arterial hemostasis after using >7-F catheters is highly recommended, particularly when the vascular entry point is obtained from a nonfemoral access, such as the axillary artery.[17,18] An arterial closure device should also be considered when dealing with anticoagulated patients or those at high risk for bleeding owing to concomitant treatment with potent antiplatelet drugs, which are routinely used in interventional procedures today.[19]

In conclusion, although our experience is still small, we believe that the axillary artery can be a very useful vascular access, particularly for approaching angulated CCA takeoffs or splanchnic arteries in which larger sheaths are needed. Nevertheless, in order to avoid bleeding-related complications at the axillary artery puncture site, the use of a percutaneous vascular closure device is mandatory to give immediate hemostasis.

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