Dual guidewire placement to enhance arch vessel origin identification: A simple technique to facilitate ostial aortic arch vessel stenting

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Orificial occlusive lesion involving the aortic arch vessels is commonly treated with balloon-expandable stent placement. Stenting of such a lesion typically involves an initial aortogram to precisely identify the vessel origin, followed by deployment of a balloon-expandable stent to cover the ostial lesion. We report a simple technique of an antegrade femoral guidewire placement along the outer curvature of the aortic arch to facilitate the identification of the origin of aortic arch vessels. This enhanced ostial visualization enables a precise positioning and deployment of a balloon-expandable stent in aortic arch vessels. This dual guidewire technique facilitates the visual identification of arch vessel origin and reduces potential contrast requirement, which provides procedural benefit in patients with renal insufficiency or contrast allergy. (J Vasc Surg 2007;46:1274-6.)

Atherosclerotic disease of the aorta can extend into its branch vessels, such as innominate, left carotid, and left subclavian arteries. Intraluminal stent placement in these vessel orifices, using either an antegrade or retrograde approach, has become a widely accepted treatment strategy. This typically involves an initial arch angiogram to delineate the vessel origin, followed by deployment of a balloon-expandable stent to open the vessel orificial lumen. The precise identification of the aortic arch vessel origin may be hampered by patient movement or respiratory variation, which can result in suboptimal stent placement. In addition, contrast injection to identify vessel origin may not be desirable in patients with renal insufficiency or contrast allergy. In an effort to improve the endovascular treatment strategy of aortic arch vessel stenting and to reduce the use of iodinated contrast agents, we present a simple dual-guidewire technique to facilitate the visualization of arch vessel origin and deployment of the stent in these vessels.

TECHNIQUE

This technique of dual guidewire placement involves a femoral guidewire insertion over a 5F or 6F introducer sheath (Boston Scientific, Natick, Mass) in which the guidewire lies against the outer curvature of the aortic arch. This guidewire delineates the outer boundary of the aortic arch curvature in which the origin of arch branch vessels is located. The stenting procedure of the aortic branch vessels, such as innominate, left carotid, or left subclavian, is performed in a usual fashion by selectively catheterizing the artery, followed by stent deployment. For instance, when a stent is to be placed in a left subclavian artery ostial lesion, the following technical approach is used:

- A right femoral artery introducer sheath (Boston Scientific) is placed under local anesthesia. A 260-cm (0.035-in) stiff Glidewire (Terumo, Elkton, Md) is inserted in which the floppy tip of the distal guidewire is to loop back against the aortic valve such that the stiff portion of the Glidewire hugs the outer curve of the aortic arch, a technical step commonly performed in thoracic endografting procedures. This maneuver ensures the guidewire is positioned along the outer curve of the aortic arch, which delineates the origin of its branch vessels.

- Under ultrasound guidance, the left brachial artery access is obtained. After a 6F introducer sheath (Boston Scientific) is placed, a 180-cm (0.035-in) Glidewire is inserted in a retrograde fashion through the brachial sheath and placed in the descending thoracic aorta. The junction where these two guidewires cross represents the origin of the left subclavian artery (Fig, A).

- After appropriate anticoagulation with systemic heparin administration, a balloon-expandable stent is delivered over the brachial wire and positioned in the proximal subclavian artery. Because the antegrade femoral guidewire is positioned along the outer curve the aortic arch, the location of the left subclavian artery is precisely visualized throughout the entire procedure, regardless of the patient’s body movement or respiratory cycle.

- The stent is next deployed based on the position of the femoral guidewire (Fig, B and C).

The entire procedure can be performed without the use of iodinated contrast. A postprocedural anticoagulation

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0741-5214/$32.00

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doi:10.1016/j.jvs.2007.07.019
regimen such as oral clopidogrel bisulfate should be initiated, depending on the clinical practice preference.

DISCUSSION

Undoubtedly, the critical aspect in this technique involves the placement of a long antegrade femoral guidewire to delineate the origin of arch branch vessels. A left brachial guidewire (double white arrow) is positioned in the descending thoracic aorta. The crossing point of these two guidewires (black arrow) denotes the origin of the left subclavian artery. As demonstrated in the Technique section, a left subclavian artery ostial lesion can be treated with retrograde stenting from the left brachial artery approach, whereas an antegrade femoral guidewire is used to achieve vessel origin identification. In the case of stenting of a left carotid artery ostial lesion, bilateral femoral access was obtained in which an antegrade guidewire was placed through one femoral sheath to delineate the outer curvature of the aortic arch and an antegrade carotid stenting was performed through a separate femoral sheath.

This dual-guidewire technique would still be applicable in patients with a difficult anatomy, such as a type II or III arch, whereby the innominate artery originates below the level of the apex of the aortic arch. In this scenario, the ostial innominate lesion should be stented in a retrograde fashion, either from a right brachial artery or right carotid artery approach, while an antegrade femoral guidewire is placed in the aortic arch to delineate the origin of the innominate artery.

Fig. A, An antegrade femoral guidewire (single white arrow) is positioned around the outer curve of the aortic arch, which delineates the origin of arch branch vessels. A left brachial guidewire (double white arrow) is positioned in the descending thoracic aorta. The crossing point of these two guidewires (black arrow) denotes the junction of the aortic arch and the origin of the left subclavian artery. B, On the basis of the crossing point of these two guidewires, a balloon-expandable stent is delivered and positioned at the origin of the left subclavian artery. Deployment of the balloon-expandable stent can be performed precisely at the origin of the subclavian artery based on the dual guidewire junction (black arrow).
In our experience, a 260-cm-long guidewire placed in the ascending aorta such that the floppy portion of the guidewire is looped back against the aortic valve provides sufficient force to allow this guidewire to oppose along the outer curvature of the aortic arch. It is not necessary to provide continuous antegrade force to maintain the guidewire in a forward motion during the stenting procedure. We prefer a Glidewire because of its flexibility and radiopacity.

This technique of guidewire placement is analogous to a guidewire placement maneuver during an endovascular thoracic aneurysm procedure in which the floppy portion of a stiff guidewire is looped back against the aortic valve so that the stiff segment of the guidewire is well positioned in the aortic arch.

Using this dual-guidewire technique, we have successfully treated 16 patients with stent placement in proximal aortic arch vessels. In all cases, the outline of the outer curvature of the aortic arch was precisely delineated with an antegrade femoral guidewire. Retrograde stenting of the innominate artery (n = 4) or left subclavian artery (n = 9) through a brachial artery approach was performed in 13 patients, and antegrade left carotid artery stenting was performed in three patients. No procedural related complications occurred in our series, and stent placement was performed precisely at the origin of the arch vessels in all cases.

This dual-guidewire technique can obviate the need of contrast agents because the crossing junction of these two guidewires represents the origin of the arch branch vessel (Fig. 1). Deployment of a stent by using this guidewire crossing point is a reliable method to ensure coverage of the proximal arch branch vessel.

The stenting of subclavian or innominate artery stenosis for vertebrobasilar insufficiency or upper limb ischemia has been reported with success rates of 90% to 96% in the literature. All available reports describing this procedure uniformly rely on an contrast aortogram to delineate the origin of the arch branch vessels, either by an antegrade femoral pigtail injection or a retrograde brachial or carotid sheath injection. Although many authors have described the utility of brachial or carotid approach for retrograde arch vessel stenting, the timing between the contrast injection and stent deployment may result in imprecise positioning of the stent due to factors such as diaphragmatic movement caused by the respiratory cycle. The described technique eliminates this respiratory variable because the antegrade femoral guidewire moves precisely in the outer boundary of the aortic arch, regardless of body movement or respiratory variation.

This dual-guidewire technique also avoids the need of contrast injection to identify the origin of arch branch vessels. It provides a constant view that allows physicians to identify the origin of arch vessel branches, which may be particularly advantageous in obese patients with a large torso in whom an arch angiogram may be obscured by the pulmonary shadow.

**CONCLUSION**

We have presented a novel and simple technique of dual guidewire placement for orificial arch vessel stenting. The technique we have described may potentially improve the technical success and reduce procedural difficulty in patients undergoing stent placement in arch branch vessel origin.

**REFERENCES**
