Radial Access Technique

Coronary and Bypass Graft Angiography Via the Right Radial Approach Using a Single Catheter

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ABSTRACT: Transradial cardiac catheterization in patients with previous coronary artery bypass graft surgery can be technically challenging. The presence of a left internal mammary artery (LIMA) graft was previously considered a relative contraindication for a right radial procedure, but there are several reports demonstrating the feasibility and safety of LIMA angiography from a right radial access. This case report demonstrates that transradial coronary and bypass graft angiography including LIMA angiography from the right radial approach is technically feasible with a single catheter. Catheter options for LIMA angiography from right radial access will also be discussed.

Key words: access approaches (radial artery), coronary angiography

Transradial cardiac catheterization in patients with previous coronary artery bypass graft (CABG) surgery can be technically challenging. Since the majority of CABG patients have a left internal mammary artery (LIMA) graft to the left anterior descending artery (LAD), many radial operators choose to perform catheterization procedures in CABG patients from a left radial approach using standard femoral diagnostic catheters. The presence of a LIMA graft was previously considered a relative contraindication for a right radial procedure, but there are several reports demonstrating the feasibility and safety of LIMA angiography from a right radial access. This case demonstrates that transradial coronary and bypass graft angiography including LIMA angiography from the right radial approach is technically feasible with a single catheter. Catheter options for LIMA angiography from right radial access will also be discussed.

Case Description

The patient is a 70-year-old man who had 4-vessel CABG in 1998 with LIMA to LAD, sequential saphenous vein graft (SVG) to diagonal artery and obtuse marginal artery, and SVG to posterior descending artery. He was transferred to our institution for management of common hepatic duct injury and biliary leak secondary to iatrogenic injury from a cholecystectomy operation. The patient had episodes of hypotension that were associated with ischemic changes on electrocardiogram and elevated troponins. He was referred for cardiac catheterization for non-ST elevation myocardial infarction. The patient has severe peripheral vascular disease and both femoral arteries had been bypassed surgically. The left radial artery had an arterial line already in place. Due to limited vascular access, the right radial artery was chosen as the access route. A 5 Fr arterial sheath was inserted into the right radial artery using standard technique. A 5 Fr Optitorque Radial TIG 4.0 catheter (Terumo Medical Corporation) was advanced over a 0.035˝ Versacore guidewire (Abbott Vascular) to the ascending aorta. The catheter was used to engage the left coronary artery first (Figure 1A). The LAD was occluded. The ramus intermedius had moderate disease proximally, and a jump graft from the ramus to the diagonal artery was seen. There was no retrograde flow of this graft beyond the diagonal artery anastomosis. The circumflex artery was patent. After left coronary angiography, the catheter was disengaged and manipulated to engage the right coronary artery (RCA) (Figure 1B). The RCA was occluded in its mid-portion. After right coronary angiography, the catheter was disengaged and pulled higher up the aorta and the SVG to the PDA was engaged (Figure 1C). This SVG was widely patent. The catheter was disengaged from the SVG and the Versacore wire was manipulated into the descending aorta after pulling back and rotating the catheter. The catheter was advanced past the origin of the left subclavian artery. The wire was removed and the catheter was retracted back with the tip pointing in the cranial direction and the left subclavian artery was engaged (Figure 1D). The Versacore wire was then advanced into the left subclavian artery and manipulated down the left arm. Over the wire, the TIG catheter was advanced past the LIMA. The wire was removed and the catheter was pulled back and torqued to semi-selectively engage the LIMA. LIMA angiography was performed, and showed the LIMA to be widely patent (Figure 2). The catheter was then removed over a guidewire. The etiology of the elevated troponins was deemed to be from demand ischemia from biliary sepsis and hypotension. A TR Band (Terumo Medical Corporation) was used to obtain hemostasis after sheath removal.

Discussion

Coronary and bypass graft angiography can be successfully performed from either right or left radial access with success rates similar to a transfemoral approach. In cases in which a LIMA graft is present, left radial access is technically easier and the preferred route for many operators. Navigating the catheter and...
guidewire into the left subclavian artery from right radial access requires making a hairpin turn, and the tortuosity and increased friction can make catheter advancement difficult. In some cases, this can be impossible, forcing conversion to either left radial or femoral access. One of the downsides of left radial catheterization is that several catheter exchanges are necessary to engage both native coronary arteries and the bypass grafts. One advantage of using right radial access is that it is possible to perform coronary and bypass graft angiography including the LIMA with fewer catheters and possibly with a single catheter as in this case. Table 1 lists the catheters that can be used to engage the SVG grafts and the LIMA from either left or right radial access.

When approaching LIMA angiography from right radial access, the first hurdle to overcome is cannulation of the left subclavian artery. Judkins left, LCB, Tiger, and Vitak catheters are the commonly used catheters for left subclavian cannulation from the right radial approach. The catheter must not only engage the origin of the left subclavian, but also must provide enough support for guidewire passage into the left brachial artery. In this case, the Tiger catheter was used for native coronary angiography, and therefore, was the first choice.

The second hurdle is to position a guidewire into the left brachial artery. Deep positioning of the wire is necessary to allow advancement of the catheter through and around the
innominate artery, transverse aorta, the left subclavian artery, and beyond the origin of the mammary artery. The Versacore wire works well in this situation due to its soft tip and steerability. In addition, the body of the wire is stiff, providing extra support for catheter advancement. The Glidewire Advantage (Terumo Medical Corporation) is another useful wire. Its distal tip is hydrophilic-coated, allowing for easy passage through tortuous vessels, but the body of the wire is stiff, giving more support than the conventional Glidewire.

LIMA angiography can be difficult in patients with aortic dilation or distal origin of the LIMA. One technique to overcome these anatomic challenges is to position the wire in the brachial or radial artery and externally compress the wire (manually or with a blood pressure cuff), which allows for increased traction to allow catheter advancement. The Glidewire Advantage is another useful wire. Its distal tip is hydrophilic-coated, allowing for easy passage through tortuous vessels, but the body of the wire is stiff, providing extra support for catheter advancement. The Glidewire Advantage (Terumo Medical Corporation) is another useful wire. Its distal tip is hydrophilic-coated, allowing for easy passage through tortuous vessels, but the body of the wire is stiff, giving more support than the conventional Glidewire.

The last hurdle is to engage the LIMA for adequate angiography. Cha et al reported that selective LIMA angiography via right radial access was successfully performed in 164 out of 184 patients (89%) using a 5 Fr modified Simmons catheter. This technique, however, requires reshaping of the catheter. Alternatively, Tai reports that LIMA angiography can be successfully performed with the left coronary bypass (LCB) catheter. JL1 and IMA catheters have also been successfully used for LIMA cannulation (Figure 3). When selective engagement is not possible, contrast injection with a blood pressure cuff inflated on the left arm often will allow for adequate LIMA opacification.

There are both patient-directed and operator-directed advantages of using the right radial approach for LIMA angiography. Radial spasm occurs more frequently after multiple catheter exchanges, and therefore, the use of a universal catheter from the right radial approach will minimize this potentially painful complication and make the procedure more comfortable for the patient. For the operator, staying on the right side of the patient has many advantages, including reduced radiation exposure and reduced back strain by obviating the need to reach over the patient. This is especially true for obese patients and for operators of short stature.

**Conclusion**

Bypass graft angiography can be challenging from either transfemoral or transradial approaches. When planning catheterization for a patient with bypass grafts including a LIMA graft, the left radial approach is commonly used due to its simplicity. However, LIMA angiography from the right radial approach is technically feasible with high success rates. Right radial access for LIMA angiography offers many advantages, including need for fewer catheters, patient comfort (eg, prevention of radial spasm with catheter exchanges), and operator safety and comfort.

**Table 1. Catheter options for bypass graft angiography with radial access.**

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<tr>
<th>Access Site</th>
<th>SVG to Left Coronary Arteries</th>
<th>SVG to Right Coronary Artery</th>
<th>Left Subclavian Artery</th>
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**Details:**

- AL = Amplatz left; IMA = internal mammary artery; JL = Judkins left; JR = Judkins right; LCB = left coronary bypass; MP = multipurpose; TIG = Tiger; VTK = Vitek.

**References**