ABSTRACT

The 2021 ACC/AHA/SCAI coronary artery disease revascularization guideline recommends radial artery (RA) access for coronary angiography and RA grafting over saphenous vein grafting in patients referred for coronary artery bypass grafting. We present a case of a patient who underwent coronary angiography via both RAs and therefore could not receive RA bypass grafts. (Level of Difficulty: Advanced.) (J Am Coll Cardiol Case Rep 2022;4:27-30) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

LEARNING OBJECTIVES

- To discuss the potential implications of RA access for angiography in patients with advanced CAD.
- To appreciate the need for individualized decision making regarding arterial access strategies in patients with suspected or known advanced CAD who may ultimately require CABG.

The use of the transradial access (TRA) for cardiac catheterization reduces bleeding and vascular complications compared with femoral access (1). In addition, TRA is associated with reduced mortality in patients with acute coronary syndromes (2). The 2021 ACC/AHA/SCAI coronary artery disease (CAD) revascularization guideline (2) recommends TRA as the preferred arterial access for coronary angiography or percutaneous coronary intervention. In patients referred for coronary artery bypass grafting (CABG), the 2021 CAD revascularization guideline (3) recommends radial artery (RA) grafting over saphenous vein (SV) grafting (SVG) based on clinical trials and meta-analyses showing improved patency rates with RA as compared with SVG and observational data reporting lower mortality with RA conduits (4,5). However, TRA leads to damage of the RA, and the patency rate of RA CABG conduits after TRA is suboptimal (6). Some patients undergoing coronary angiography may ultimately...
require CABG, and TRA may limit the use of the RA as a conduit for CABG in those patients.

**HISTORY OF PRESENTATION**

The patient is a 52-year-old man presenting with exertional chest pain radiating to the jaw for 2 months’ duration. On physical examination, the patient was obese, with a body mass index of 38 kg/m². Laboratory test results were significant for a total cholesterol of 256 mg/dL and hemoglobin A₁C of 9.9%.

**PAST MEDICAL HISTORY**

The patient’s past medical history was significant for diabetes mellitus (DM), hypertension, hyperlipidemia, obstructive sleep apnea, a remote stroke with residual left-sided facial droop, peripheral neuropathy, depression, and arthritis.

**INVESTIGATION**

The patient initially presented to an outside hospital, where coronary angiography was performed via the left RA, revealing 80% stenosis of the distal right coronary artery and distal obtuse marginal artery and 80% to 90% stenosis of the second diagonal branch. There was 60% stenosis of the proximal and mid left anterior descending artery (LAD) of uncertain hemodynamic significance; however, fractional flow reserve was not available (Figure 1). The left ventricular end-diastolic pressure was 10 to 15 mm Hg. To investigate the hemodynamic significance of the LAD lesion, the patient was referred for dobutamine stress echocardiography. The stress test was nondiagnostic because of an inadequate heart rate response (77% of the maximum predicted heart rate) but did not show regional wall motion abnormalities at peak stress.

**MANAGEMENT**

After initial treatment with medical therapy, the patient’s symptoms improved. However, he was admitted to another hospital 1 month later with chest pain at rest. A repeat coronary angiogram was performed through the right RA, showing 70% stenosis of the proximal LAD and 60% stenosis midvessel (Figure 2). Fractional flow reserve of the LAD was abnormal (0.74).

In view of his history of diabetes and the presence of triple vessel disease, the patient was referred for CABG. He underwent quadruple bypass with a left internal thoracic artery to the LAD, an SVG to the posterior descending artery, an SVG to the distal obtuse marginal artery, and an SVG to the diagonal branch. Because bilateral TRA was used for the cardiac catheterizations, both RAs were not available for CABG. The use of bilateral internal thoracic arteries (ITAs) was contraindicated because of DM and obesity and the consequent high risk of sternal wound complications (7). He had an uneventful postoperative course.

**FIGURE 1** First Cardiac Catheterization in July 2020

(A) Multivessel coronary disease with 80% stenosis in the right coronary artery (black arrow) and 80% stenosis in the marginal branch (white arrow). (B) The lesion on the left anterior descending artery (black arrow) had 60% stenosis. Also seen is a lesion of the mid left anterior descending artery (white arrow).
DISCUSSION

EXPERT OPINION. DM is an independent predictor for complex CAD (8) and for long-term mortality after CABG (9). Additionally, the CABG strategy may be different for those with and without DM (7).

TRA has been associated with improved outcomes compared to the transfemoral approach (1,2). From 2011 to 2014, the rate of TRA catheterization increased from 10% to more than 25% (9). The 2021 CAD revascularization guideline (3) recommends the use of TRA for coronary angiography to reduce access site bleeding and vascular complications (Class 1, Level of Evidence [LOE]: A). In this patient with stable angina, the benefits of TRA should be balanced with the possibility of requiring CABG.

The 2021 CAD revascularization guidelines (3) recommend CABG in patients with diabetes and multivessel CAD with involvement of the LAD who are appropriate surgical candidates (Class 1, LOE: A). The ITA is the conduit of choice when grafting the LAD and is recommended by the 2021 CAD revascularization guidelines (3) to reduce mortality and long-term cardiovascular events (Class 1, LOE: B-NR). The RA is emerging as the conduit of choice for the second graft (4,5) and is recommended by the 2021 CAD guidelines for grafting the second most important artery (Class 1, LOE: B). However, the patency rate of RA subjected to TRA and then used for CABG is suboptimal (6) and is therefore a contraindication for use, which is why the patient described here received SVG. The RA has a thin intima and internal elastic lamina and may have significant structural damage after TRA. Intimal dissection and reactive intimal hyperplasia with endothelial dysfunction are seen nearly twice as frequently in the RA of patients who underwent TRA compared to those who did not (6). Medial hemorrhage and adventitial inflammation and fat necrosis are also seen more frequently in patients who underwent TRA. Although the 2021 CAD guidelines (3) recommend bilateral ITA grafting to improve long-term cardiovascular outcomes (Class 2a, LOE: B-nonrandomized), this benefit should be balanced by the increased risk of sternal wound complications, which are independently associated with worse long-term survival and whose risk is significantly increased with bilateral ITA grafting (10,11).

Because of the expanding role of the RA for percutaneous diagnosis/intervention and for CABG, close coordination between the cardiac surgeon and cardiologist is crucial. Before coronary angiography, if the cardiologist has a high index of suspicion that a patient may need surgical revascularization and the surgeon generally uses the RA as a conduit for CABG, a femoral approach may be warranted. Alternatively, ulnar compensation should be assessed, and the site with the best compensation should be reserved for potential use at surgery. If the patient has undergone previous TRA procedures, using the same arm would ensure that the contralateral RA can be used for CABG.

(A) Diffuse coronary disease with 70% disease of the proximal left anterior descending artery (white arrow), (B) 90% ostial stenosis of the second diagonal, and 80% stenosis of the first marginal branch (black arrow).
CONCLUSIONS

When considering arterial access, it is important that the potential benefits of TRA be balanced by the possible future need for bypass surgery with an RA conduit. Increasing knowledge of the benefits of using the RA for coronary angiography and CABG is key to tailoring treatment strategies for optimal patient outcomes.

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