

Use of the distal radial artery remnant for autogenous radial-cephalic wrist fistula after radial artery harvest for coronary artery bypass grafting

Ignatius Lau, MD, C. Y. Maximilian Png, BA, Parth Trivedi, BA, and David Finlay, MD, *New York, NY*

ABSTRACT

Harvesting of the radial artery is a common technique used to provide conduit for coronary artery bypass graft surgery. We report the case of a patient with exhausted left upper extremity access options, history of left upper extremity dialysis access-associated steal syndrome, and prior right radial artery harvest for coronary artery bypass graft who received an autogenous distal radial artery remnant to cephalic vein wrist fistula. (*J Vasc Surg Cases and Innovative Techniques* 2018;4:73-5.)

Dialysis access-associated steal syndrome (DAASS) has an incidence ranging from 1% to 2% with distal radial artery inflow and from 5% to 25% with brachial artery inflow.¹⁻¹⁶ The higher incidence of DAASS with brachial artery inflow supports the decision of many surgeons to choose radial artery inflow whenever possible. We describe the case of a patient with exhausted hemodialysis (HD) access options in the left upper extremity (LUE), history of LUE steal syndrome, and prior right upper extremity (RUE) radial artery harvest for coronary artery bypass grafting who received an RUE autogenous radial-cephalic wrist fistula using the distal remnant of the radial artery. The patient's consent for this case report was obtained during follow-up.

CASE REPORT

An 80-year-old man with end-stage renal disease, 10-pack-year smoking history, coronary artery disease status post coronary artery bypass grafting with right radial artery and left great saphenous vein harvest in 2001, and multiple failed LUE HD accesses presented as a referral for HD access. A remotely placed LUE brachiocephalic arteriovenous fistula (AVF) had thrombosed and was unable to be recanalized. Most recently, a LUE brachial axillary arteriovenous graft was complicated by DAASS and had to be coil embolized.

During the initial clinic visit, the patient was found to have normal findings on RUE digital pulse oximetry and a palpable radial artery remnant pulse. Preoperative RUE venous

ultrasound demonstrated a patent cephalic vein from the wrist to the antecubital fossa and a patent basilic vein from the antecubital fossa to the brachial vein. A preoperative RUE arterial ultrasound examination demonstrated a patent right radial artery that was contiguous with the palmar arches and the ulnar artery. A right autogenous radial-cephalic wrist fistula using the distal radial artery remnant was planned.

A longitudinal incision was made at the wrist over the previous harvest scar. The distal radial artery remnant and cephalic vein were isolated and brought together between vessel loops in a side-to-side configuration. A running side-to-side anastomosis was used to preserve the orientation of the vein and to reduce the risk of rotation. The proximal cephalic vein was hydrostatically dilated with heparinized saline administered through a 21-gauge intravenous catheter before completion of the anastomosis. There was a palpable thrill and audible bruit at the end of the case. The [Fig](#) demonstrates the anatomy of the fistula. The fistula required subsequent balloon angioplasty for maturation and fistulography with balloon angioplasty at 6 months. The functional patency as of October 2017 was 8 months.

DISCUSSION

Multiple case series have examined the risk factors for DAASS, which include a history of diabetes mellitus, coronary artery disease, peripheral arterial disease, use of the brachial artery as inflow, straight configuration (vs looped), and female sex.^{4,17,18} An increased risk of DAASS with digital-brachial indices <0.45 to 0.6 has been reported.^{5,19-22} However, these studies had minimal numbers of patients with radial artery inflow, limiting their applicability to the prediction of DAASS in patients receiving autogenous radial-cephalic wrist fistulas. Although the low incidence of DAASS has precluded a series with enough patients to comment on the risk of contralateral steal syndrome in a patient requiring intervention for ipsilateral steal syndrome, this patient was likely to be at higher risk of DAASS with the creation of an RUE HD access.

The role of a radial artery harvest in the development of DAASS after HD access creation with brachial artery

From the Division of Vascular Surgery, Department of Surgery, Icahn School of Medicine at Mount Sinai.

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Correspondence: Ignatius Lau, MD, Division of Vascular Surgery, Department of Surgery, Icahn School of Medicine at Mount Sinai, 1425 Madison Ave, 4th Fl, Box 1273, New York, NY 10029 (e-mail: ignatius.lau@m Mountsinai.org).

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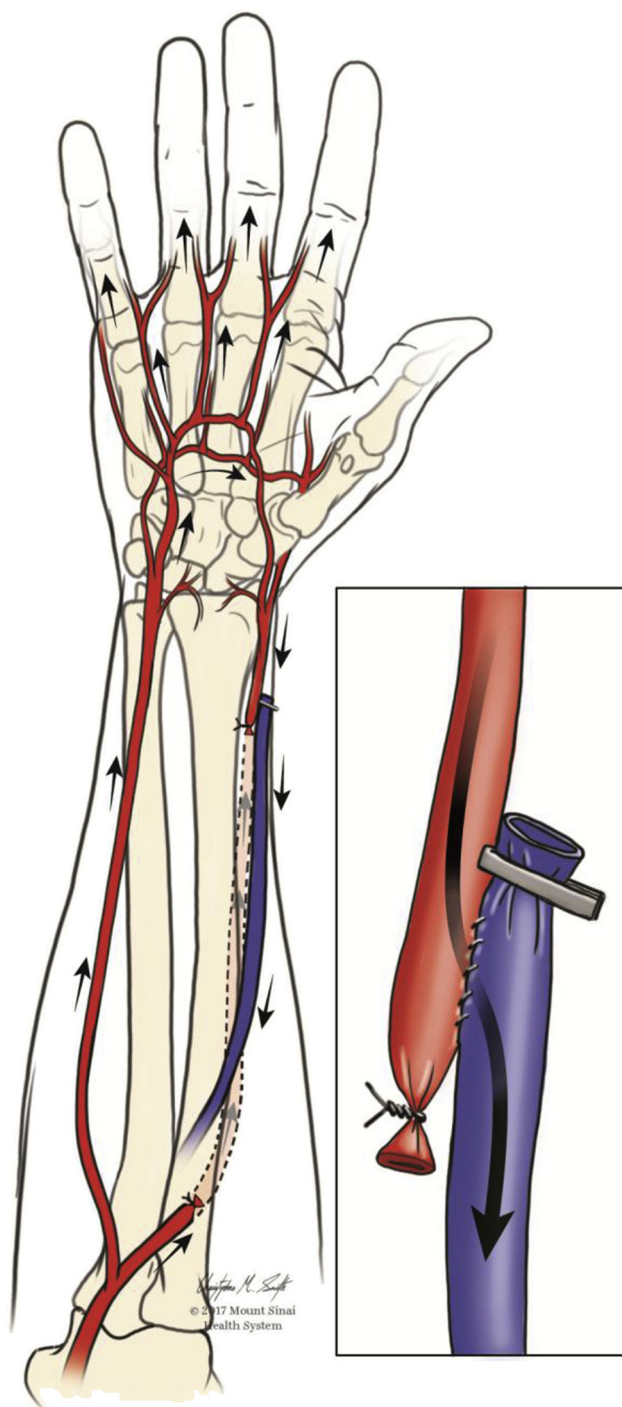


Fig. Forearm and hand arterial and venous anatomy with the autogenous distal radial artery remnant to cephalic vein wrist fistula. Unidirectional retrograde flow in the distal radial artery remnant supplies the fistula. Antegrade flow, as demonstrated by the arrows in the classic autogenous radial-cephalic wrist fistula, reduces the risk of steal syndrome in comparison to the autogenous distal radial artery remnant to cephalic vein wrist fistula. All rights reserved Mount Sinai Health System.

inflow is described only by case reports and thus is unclear. Asif et al²³ reported a single case of DAASS after a brachiocephalic fistula, whereas Liew et al²⁴ reported

two instances of brachial artery inflow AVFs with no consequent DAASS. Theoretically, the removal of the radial artery would increase the resistance of blood flow to the hand, favor the shunting of blood flow to an HD access with brachial artery inflow, and increase the risk of DAASS.

Given the adequate basilic vein from the antecubital fossa to the brachial vein and the cephalic vein from the wrist to the antecubital fossa, surgical options included a brachio-basilic AVF, a forearm loop arteriovenous graft, and an autogenous radial-cephalic wrist fistula using the proximal or distal remnant of the radial artery. The rationale for choosing an autogenous distal radial artery remnant to cephalic vein wrist fistula in this patient is twofold. First, prioritizing distal HD access preserves options for proximal HD access at a later date should the distal access fail. Second, the use of the radial artery as inflow reduces the risk of DAASS. In the large case series of DAASS patients of Yu et al¹⁸ and Kudlaty et al,⁴ all of the patients with DAASS received HD accesses involving the brachial artery as inflow. Specifically, Kudlaty et al described 303 total patients receiving HD access during a 3-year period, with a 0% incidence of DAASS in 69 patients with distal radial artery inflow. In addition, the review by Wu et al²⁵ demonstrated a 0.5% risk of DAASS with proximal radial artery inflow in 832 patients. If the distal radial artery remnant fistula had resulted in digital ischemia, an autogenous proximal radial artery remnant to cephalic vein fistula would have provided an excellent second option for HD access with a low risk of DAASS.

The comparison of the classic autogenous radial-cephalic wrist fistula and the autogenous distal radial artery remnant to cephalic vein wrist fistula deserves mention, given the inclusion of only autogenous radial-cephalic wrist fistulas in the case series. The cephalic vein is supplied by retrograde flow from the distal radial artery remnant, conceivably routing blood away from the digital arteries (Fig). However, retrograde flow is a well-documented benign phenomenon with traditional autogenous radial-cephalic wrist fistulas. Duncan et al¹⁶ studied the thumb-brachial indices of 24 patients who received an autogenous radial-cephalic wrist fistula and found reversal of flow in 21 of 24 (88%) of the patients, with only 1 of 24 (4%) patients having symptoms of digital ischemia. Sivanesan et al²⁶ reported the color flow duplex ultrasound examination of 30 patients who received autogenous radial-cephalic wrist fistulas and found retrograde flow in 23 of 30 (77%) patients, with 0 of 30 (0%) patients having symptoms of DAASS. The autogenous radial artery remnant to cephalic vein wrist fistula still in theory bears a slightly higher risk of steal, given the absence of proximal radial artery antegrade flow that would ameliorate the siphoning of blood away from the digital arteries (Fig). Indeed, the elimination of retrograde flow through the distal radial artery

with coil embolization has been shown to be an effective therapy for autogenous radial-cephalic wrist fistula DAASS.¹⁵ Although the higher risk of DAASS relative to the classic autogenous radial-cephalic wrist fistula has likely prevented use of the radial artery remnant in the past, we have demonstrated it to be a safe access option for HD access. If obtained, a preoperative digital-brachial index <0.6 would also strengthen the argument for choosing radial artery inflow. This case highlights the opportunities made available by creatively exploring all options for HD access inflow.

CONCLUSIONS

The autogenous distal radial artery remnant to cephalic vein wrist fistula is a good option for patients with a history of a radial artery harvest and adequate cephalic vein and radial artery remnant caliber.

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