Training for Proficiency in Transradial Access for Lower Extremity Interventions

A stepwise approach to utilizing transradial access for iliac and femoropopliteal interventions.

BY ANDREW M. T. L. CHOONG, MBBS, FRCS (GEN SURG), FEBVS (HONS), MFSTED, FAMS (GEN SURG); IAN J. Y. WEE; NICHOLAS L. SYN; AND STANLEY E. K. LOH, MBCHB, MRCS, FRCR

Transradial (TR) access as the primary access point to the arterial tree is a technique that is nearly 30 years old. The first description of its use was published in 1989 by Campeau from the Montreal Heart Institute.[1] This first series described using TR access for diagnostic coronary angiography with an 88% technical success rate and a 6% asymptomatic radial artery occlusion rate. Progress was rapid, with the first TR coronary angioplasty procedure being performed by Kiemeneij et al in 1992, followed by the first TR coronary stent placement being performed the following year.[2] Fast-forward to 2018, and the American Heart Association (AHA) has recently proposed and supported a "radial-first" approach for patients in the United States presenting with acute coronary syndromes.[3]

However, the use of TR approaches for the treatment of peripheral vascular disease of the lower limbs has lagged behind our interventional cardiology counterparts. We have traditionally been limited by the lack of suitably long catheters and wires to reach the target vessels and lesions, with perceived loss of steerability and control at the distal end of long wires being an additional barrier to its use and uptake.

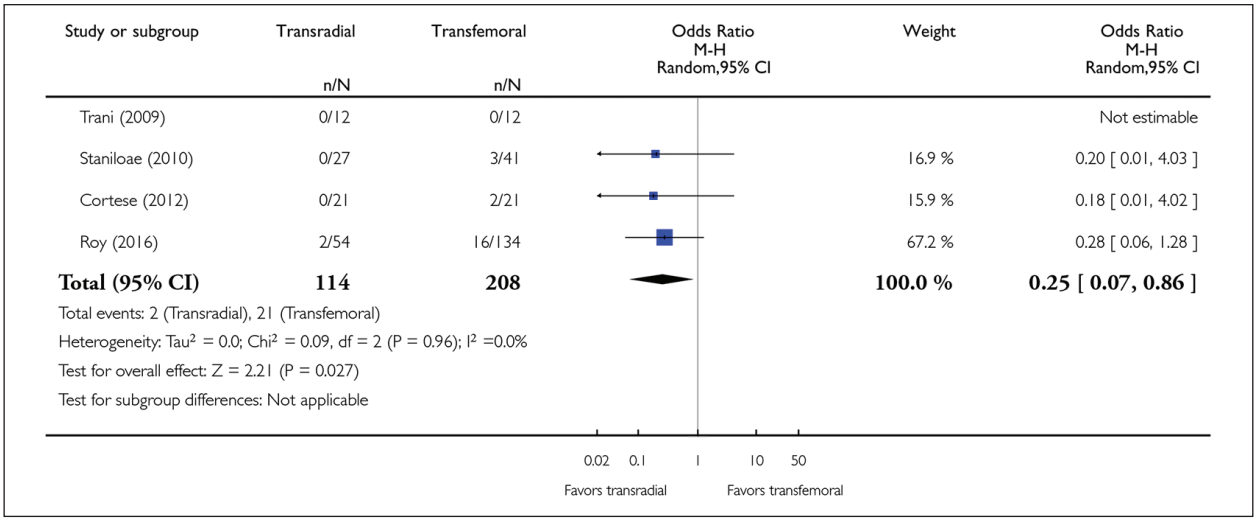

Figure 1. Forest plot of TR versus TF complications.

To this end, building upon our own experience, we sought to investigate the use of TR access in lower limb arterial intervention by systematic review and meta-analysis. Nineteen studies containing 638 patients with TR access for lower limb interventions were selected. Lesions were treated from the aortic bifurcation down to the popliteal artery. The mean technical success rate was 90.9%, conversion to a transfemoral (TF) approach was necessary in 9.9%, and complications were reported in 1.9%. The meta-analysis included four comparative studies involving 114 TR and 208 TF procedures. There was no significant advantage of either approach in terms of procedure success (odds ratio [OR], 5.0; 95% confidence interval [CI], 0.49–50.83; $P = .17$), but the risk of developing a complication was significantly lower (OR, 0.25; 95% CI, 0.07–0.86; $P = .03$) with the TR approach.[4] In summary, rates of technical success in treating the aortic bifurcation to the popliteal were similar but with a much decreased complication rate in the TR arm (Figure 1).[4]

Many centers that have adopted TR access began by initially observing and closely collaborating with their interventional cardiology colleagues who were already familiar with the TR approach. We suggest this as a good first step to gaining a TR access skill set. In addition, there are a number of industry-sponsored courses tailored to the development of a TR-based practice for peripheral intervention, such as Merit Medical's "Think Radial" workshops, as well as dedicated TR conferences such as the TREAT (TransRadial Endovascular Advanced Therapies) Symposium.

For those looking to gain hands-on proficiency in TR access for peripheral artery lower limb intervention, we suggest the following progressive steps:

1. Assessment of the radial artery and collateral arterial supply to the hand
2. Access
3. Diagnostic angiography
4. Iliac artery intervention
5. Femoropopliteal intervention
6. Use of radial artery hemostasis devices

These steps are further elucidated in the following sections.

ASSESSMENT OF THE RADIAL ARTERY AND COLLATERAL ARTERIAL SUPPLY TO THE HAND

We routinely perform a clinical assessment of the radial pulse, noninvasive testing for the collateral circulation to the hand by both an Allen and Barbeau test, as well as an ultrasound of the radial artery (prepuncture). However, the recent AHA scientific statement suggests that "performing an Allen or Barbeau test to confirm the patency of dual arterial circulation to the hand and intact palmar arch system is only of historical interest."[3] The argument is that "recent reports of patients with normal and abnormal preprocedural Allen test who subsequently underwent TRA did not demonstrate differences in thumb capillary lactate, grip strength, or incidence of ischemia between the two groups.[5,6] Routine application of the Allen or Barbeau test is not a useful triage strategy, and an abnormal test should not preclude TRA." However, they do agree that "ultrasound imaging or the reverse Allen or Barbeau test may be helpful in identifying an occluded RA that fills via retrograde collaterals. In addition, the use of ultrasound imaging that is inclusive of the antecubital fossa may help reduce crossover rates through the identification of radial loops and other vascular anomalies." We believe that our combination approach to assessing the radial artery and collateral circulation to the hand is comprehensive and should be encouraged, particularly in those units just beginning to gain experience with TR access.

ACCESS

The radial artery is obviously smaller in diameter compared to its femoral counterpart and is particularly prone to significant vasospasm, increasing the risk of iatrogenic injury. As such, particular care should be taken when gaining radial artery access. We routinely use ultrasound-guided micropuncture and radial-specific sheaths only. Additionally, a combination of medications is administered to prevent potential complications such as thrombosis. Our unit gives 2,000 IU heparin, 2.5 mg verapamil, and 200 µg glyceryl trinitrate intra-arterially, through the radial sheath, once access has been successfully obtained.

DIAGNOSTIC ANGIOGRAPHY

By using radial access for diagnostic angiography in the first instance, one is able to get used to the techniques of radial artery assessment, access, and basic wire and catheter manipulation prior to attempting intervention. It should be noted that we now routinely use a TR diagnostic pigtail catheter for our endovascular aortic interventions as well. We have found that it saves a significant amount of time and fluoroscopy by avoiding multiple pigtail catheter exchanges to perform diagnostic angiographic runs. This is, again, something to consider for those who are new to the TR approach.

ILIAC ARTERY INTERVENTION

The following case describes a typical scenario of ours where we use a left TR approach to treat a symptomatic left-sided iliac lesion. Figures 2 and 3 demonstrate stenotic and, importantly, nonocclusive disease, which

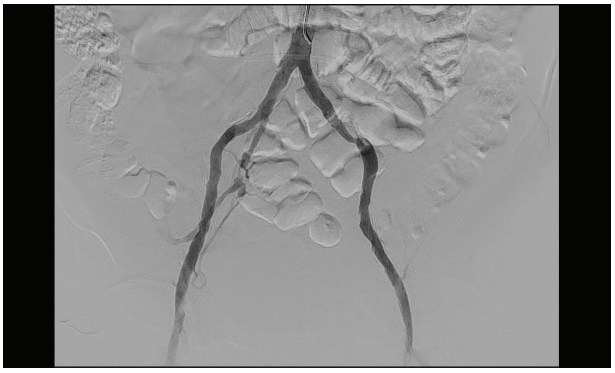

Figure 2. Left Iliac system, prestenting.

is simpler to treat and a good starting point for those beginning with TR access. We have also provided the details of the equipment that we typically use.

Case Example

Examination of the left radial artery revealed a Barbeau B waveform. The left radial artery was punctured with a 21-g needle under ultrasound guidance and a 5-F Prelude radial sheath (Merit Medical Systems, Inc.) was inserted. The sheath was later upsized to 6-F, 110-cm Flexor Shuttle sheath (Cook Medical). A cocktail mixture of 2,000 IU heparin, 2.5 mg verapamil, and 200 µg glyceryl trinitrate was administered through the sheath.

A 5-F, 125-cm Performa catheter (Merit Medical Systems, Inc.) was then inserted into the aortic bifurcation and an iliac angiogram was obtained as well. This demonstrated a focal 60% stenosis of the left external iliac artery. The left internal iliac artery was occluded, with a patent common femoral artery and mild-to-moderate stenosis of the proximal superficial femoral artery (SFA). There was a at least a 5-cm chronic total occlusion of the distal SFA, single-vessel runoff via the posterior tibial artery, and the peroneal artery was occluded. The proximal anterior tibial artery was occluded in the mid portion and reconstituted distally to supply the dorsalis pedis. The plantar arch was complete.

Stenting of the left external iliac artery was performed using a 9-mm X 6-cm Absolute Pro self-expanding stent (Abbott Vascular). This was then subsequently ballooned with a 6-mm balloon. No attempt was made to treat the occluded SFA. The sheath was removed and hemostasis was secured with a TR Band (Terumo Interventional Systems).

FEMOROPOPLITEAL INTERVENTION

Once comfortable with radial artery assessment, access, long wire and catheter manipulation, and basic iliac intervention, then the next logical step would be treating the femoropopliteal segment. We would advise similar caution

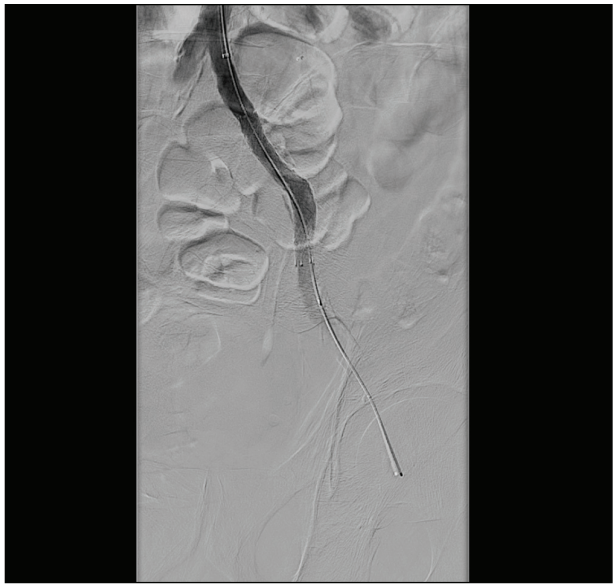

Figure 3. Left iliac system, poststenting.

with regard to patient selection and suggest that stenotic nonocclusive disease be a good starting point. However, for femoropopliteal interventions, we are currently limited by the availability of devices in longer lengths. Such interventions require sheaths of at least 125 cm, catheters including angioplasty balloon catheters ≥ 150 cm, stents on delivery shafts ≥ 150 cm, and finally guidewires of up to 450 cm. Although Terumo has already introduced longer sheaths, catheters, and balloons, access to this equipment is currently limited to a few centers. We suspect that these limitations will remain until the necessary equipment becomes more widely available.

RADIAL ARTERY HEMOSTASIS DEVICES

There are a number of available postprocedure hemostasis devices for use after sheath removal. They all work on a similar principle of applying direct compression via an inflatable pressure cuff that the patient wears for a period of 4 to 6 hours postintervention. Assuming an accurate assessment of the collateral circulation to the hand has been carried out and has been determined to be normal, occlusion of the radial artery should not compromise the arterial supply to the hand. However, in addition to following the manufacturer's instructions for use, we recommend inflating the pressure cuff to allow for adequate hemostasis, while simultaneously being able to palpate the radial artery distal to the pressure cuff.

CONCLUSION

Our meta-analysis data have demonstrated that TR access for peripheral lower limb intervention allows for

equivalent technical success with a lower complication rate than TF access. Although further research is required on its use in treating lower limb peripheral vascular disease, we believe that the technique is easy to learn and its use is only currently limited by the availability of the necessary equipment. Collaboration with interventional cardiology colleagues, attendance at industry workshops or conferences on TR access, and local proctoring will enable those looking to develop a TR practice to do so safely and effectively. ■

1. Campeau L. Percutaneous radial artery approach for coronary angiography. Cathet Cardiovasc Diagn. 1989;16:3-7.
2. Kiemeneij F, Laarman GJ. Percutaneous transradial artery approach for coronary stent implantation. Cathet Cardiovasc Diagn. 1993;30:173-178.
3. Mason PJ, Shah B, Tamis-Holland JE, et al. An update on radial artery access and best practices for transradial coronary angiography and intervention in acute coronary syndrome: a scientific statement from the American Heart Association. Circ Cardiovasc Interv. 2018;11:e000035.
4. Meertens MM, Ng E, Loh SEK, et al. Transradial approach for aortoiliac and femoropopliteal interventions: a systematic review and meta-analysis. J Endovasc Ther. 2018;25:599-607.
5. Valgimigli M, Campo G, Penzo C, et al; RADAR Investigators. Transradial coronary catheterization and intervention across the whole spectrum of Allen test results. J Am Coll Cardiol. 2014;63:1833-1841.
6. Bertrand OF, Carey PC, Gilchrist IC. Allen or no Allen: that is the question! J Am Coll Cardiol. 2014;63:1842-1844.

Andrew M. T. L. Choong MBBS, FRCS (Gen Surg), FEBVS (Hons), MFSTEd, FAMS (Gen Surg)
SingVaSC, Singapore Vascular Surgical Collaborative
Cardiovascular Research Institute
Department of Surgery
Yong Loo Lin School of Medicine
National University of Singapore
Division of Vascular Surgery
National University Heart Centre
Singapore
suramctl@nus.edu.sg
Disclosures: None.

Ian J. Y. Wee
SingVaSC, Singapore Vascular Surgical Collaborative
Yong Loo Lin School of Medicine
National University of Singapore
Singapore
Disclosures: None.

Nicholas L. Syn
SingVaSC, Singapore Vascular Surgical Collaborative
Yong Loo Lin School of Medicine
National University of Singapore
Singapore
Disclosures: None.

Stanley E. K. Loh, MBChB, MRCS, FRCR
SingVaSC, Singapore Vascular Surgical Collaborative
Department of Diagnostic Imaging
National University Hospital
Singapore
Disclosures: None.