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RADIAL TO PERIPHERAL: Yesterday, Today, and Tomorrow

TERUMO INTERVENTIONAL SYSTEMS

R2P Portfolio | Data | Future Perspectives | Training

Why the R2P Portfolio Is a Game Changer

By Amit Srivastava, MD, FACC

We are on the cusp of a new era in endovascular treatment, with the inception of devices being brought to the market that can treat peripheral artery disease from the radial approach. I would venture to say that this is a period of evolution in endovascular treatment.

The endpoints for intervention in the endovascular space are clear. For patients with claudication, the treatment goal is improvement in functional capacity and quality of life. For those with chronic limb-threatening ischemia (CLTI), the goal is limb salvage. However, how we approach this disease state can significantly affect patient outcomes.

Contemporary literature is clear regarding the impact of access site complications. The glycoprotein IIb/IIIa trials were the first to demonstrate that significant access site bleeding correlates with mortality. This was further demonstrated by ACUITY and HORIZONS-AMI.[1,2] The moral of the story remains that hemorrhagic complications have a direct relationship with patient death. In the coronary space, this led to the advent of the approach to achieve outcomes equivalent to femoral access but with less risk of bleeding. RIVAL and RIFLE-STEACS were key in providing sound evidence that reduction in bleeding for interventional procedures correlates with reduced morbidity and mortality.[3,4]

The most common access site for endovascular interventions has historically been common femoral access. This allows for a variety of introducer sheath diameters and subsequently allows for the most complete treatment scope, as bailout options such as covered stents are generally compatible with 7-F delivery systems. The inherent risks of retroperitoneal bleed, difficult-to-control access site bleeding for diseased accessed arteries, and pseudoaneurysm are well established.

However, the question remained: Is there a way to achieve equivalent procedural outcomes with less access site–related complications? This ultimately led to the advent of alternative access sites to explore this possibility.

As in coronary intervention, radial access for endovascular interventions was developed to circumvent some of these issues. Innovation has resulted in longer, fully hydrophilic sheaths to avoid radial entrapment and facilitate equipment delivery. Longer wires, balloons, and stents with long shaft lengths and longer transit catheters followed in suit. Atherectomy and plaque modification devices were developed to improve outcomes. We now have a nearly complete treatment portfolio to achieve the goal of outcomes equivalent to transfemoral access with less bleeding site complications. This was further demonstrated in an article by Castro-Dominguez et al in *Journal of the Society for Cardiovascular Angiography & Interventions* (*JSCAI*).[5]

There are certainly theoretical barriers to the early adoption of radial access for endovascular procedures. There is a perception of increased procedural times, increased radiation exposure, need for significantly more equipment, and increased stroke risk, as well as a lack of appreciation for the true incidence of femoral access site complications. These issues were addressed and shown to be insignificant based on the data presented in the *JSCAI* article.

Having performed the first radial-to-peripheral procedure in the world with the current generation of R2P (Terumo Interventional Systems) technology and having seen the evolution of endovascular radial products in the past decade, I can certainly say that R2P is an exciting innovation that is here to stay. Radial operators are becoming the norm rather than the exception as training programs are focusing on radial access. As will be seen later in this supplement, an interdisciplinary approach is being taken with interventional cardiologists, interventional radiologists, and vascular surgeons who are adopting radial access for their procedures. As my esteemed coauthors will also demonstrate, not only can the lower extremities be treated

CASE EXAMPLE

A man in his early 90s presented with prior medical history significant for coronary artery bypass graft, an ejection fraction of 25% to 30%, and CLTI of the left leg. We selected the radial approach to ensure he could sit up immediately postprocedure. The patient experienced same-day discharge with no access site complications or procedure site complications.

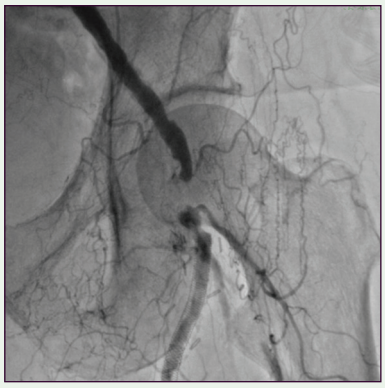

Figure 1. Preprocedure angiogram of the left common femoral artery (CFA).

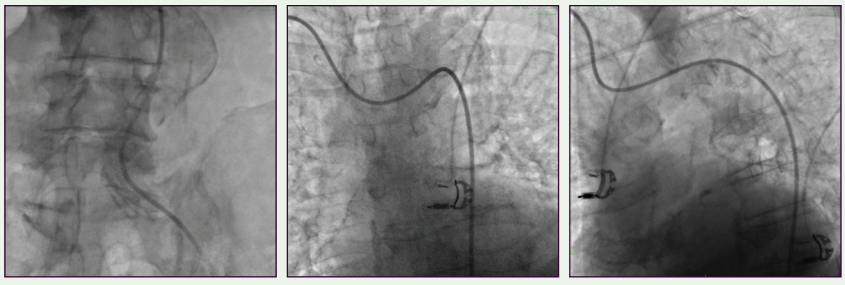

Figure 2. Angiograms showing the tortuosity of the abdominal aorta.

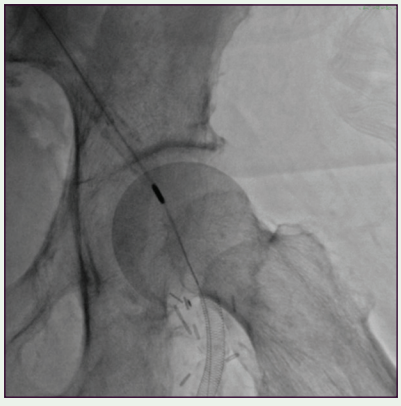

Figure 3. Angiogram of the left CFA showing the Diamondback atherectomy device (Abbott).

Figure 4. Postprocedure angiogram of the left CFA.

via radial access but mesenteric, renal, upper extremity, and carotid interventions can be effectively and safely performed as well.

In addition to the safety benefits, radial endovascular procedures also achieve significant financial endpoints. Procedures performed transradially involve less intense nursing care postprocedure. Rather than having patients in individual beds for recovery, radial lounges allow for more patients to recover with fewer nursing resources, which translates into less expense for periprocedural care. Additionally, patient satisfaction scores are higher with radial procedures, thus improving metrics that affect reimbursement. There is no need for expensive closure devices with radial procedures, making procedures more cost-effective. Same-day discharge is the norm rather than the exception with these procedures. This translates into overall improved cost-effectiveness, which patients, payers, and hospital systems appreciate.

We have certainly learned some lessons during the trek of radial evolution. It is important to realize that these procedures are team based, not operator based. Although the operator learns the nuances of treating transradially, the techs involved need to be facile in managing the longer equipment on the back end of the table. Nursing should be aware of the need for sedation and anticoagulation and helping manage radial artery spasm. From a procedural standpoint, sedation is key to minimizing radial artery spasm, as is the administration of

a radial cocktail that includes a longer-acting vasodilator such as verapamil. As with any procedure, operators should also know the contraindications for radial procedures: radial arteries < 2 mm in diameter, prior significant vasospasm, radial artery loops that are painful when straightened, and advanced renal disease where radial access may limit hemodialysis options in the future. The learning curve is short. Radial operators quickly become comfortable treating more advanced lesions, and prepping alternative access sites for crossing chronic total occlusions and complication management soon becomes the norm.

Industry has provided an excellent opportunity for those seasoned in practice, as well as those new to practice, to hone their skills and expand their radial education. The Terumo Learning Edge training programs are excellent because they are tailored to the educational needs of the attendees. Both the basics of radial procedures and advanced techniques are taught. Other alternative access site procedures are also addressed, such as tibial/pedal access. Most importantly, they help create professional relationships that strengthen our endovascular community.

Intervention with Terumo's R2P Portfolio is an excellent tool in our endovascular treatment toolbox. The future looks bright as more products come to market to refine this process further and efforts are made to achieve better patient outcomes. ■

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Why I Went Radial: Confessions From a Vascular Surgeon

Using the radial approach with the Terumo R2P Portfolio offers distinct advantages for physicians, their teams, and their patients.

By Edvard Skripochnik, MD, RPVI

If you are reading this article from either the standpoint of "why radial" or "why not radial," you are missing the point. In preparation for an endovascular intervention for peripheral artery disease (PAD), you assess your access points, determine lesion location and severity, establish acuity versus chronicity, consider prior interventions, and ultimately devise an endovascular treatment plan. Intraoperatively, you are constantly juggling bailout options one through five in your mind, all while also considering your open surgical alternatives. The point I am making here is that every case requires individual attention and consideration, and choosing radial as your access point should be evaluated as such. Once a comfort level is established, it becomes clear that the radial approach can and should be your primary access in many standard and complex cases.

I started using the radial-to-peripheral approach out of necessity. PAD patients often have significant comorbidities, prior surgeries, and anatomic difficulties that could preclude the use of traditional transfemoral

access. Examples include obesity, prior endovascular aneurysm repair, kissing iliac stents, severe tortuosity, groin scarring from previous surgical infections, severely diseased access vessels, occluded contralateral iliac arteries, and the list goes on. Early on, I treated an obese patient with chronic limb-threatening ischemia and chronic obstructive pulmonary disease who was on 4 L of oxygen and could not tolerate lying flat. We placed his upper body on a 30° wedge and managed to treat him effectively via radial access. Success in these elevated-risk, stressful scenarios led to a comfort level that allowed for expansion of this technique to the office-based lab (OBL).

THE OBL ADVANTAGE

The OBL is where the true value of radial access shines. Immediately after my first radial access case, the OBL nurses raved about it and requested more. The team was thrilled to bring the patient to the postanesthesia care unit (PACU) already sitting up. They could foresee the absence of frequent groin checks, hematomas, and prolonged recovery time. Best of all, with the TR Band (Terumo Interventional Systems), there is no need to deal with closure device failure. Many of us can recall holding pressure on a groin for 1 hour, making small talk with the patient to pass the time, followed by a 3- to 6-hour flat time prior to discharge. In the hospital, a trainee is assigned to endure the associated hand paresthesias from prolonged manual pressure for every groin bleed. In the OBL space, there are no such luxuries—no trainees for "manual pressure education," no blood bank on standby, and no overnight stay option. In the rare case that access failure leads to symptomatic bleeding or acute limb ischemia, this becomes a life-threatening event requiring rapid transport to the hospital, which carries significant morbidity and stress and is a reportable event. With the R2P Portfolio (Terumo Interventional Systems), access complications are avoided and discharge occurs consistently within 1 hour, leading to faster turnover times, more productive case volumes, and early staff departures. These benefits don't even include those of the patient, who yields the greatest advantage.

PATIENT PERKS

The patient experience can be highlighted with a case I reintervened on for recurrent symptoms. As I solemnly approached the patient to deliver the bad news that another procedure was necessary, he said, "Oh, through the wrist again? No problem. When are we doing it?"

Radial access seems to be as pleasant and memorable of an experience for the patient as any endovascular intervention could possibly be, if it is successful of course. The patient can sip a coffee in the PACU minutes after the intervention is complete, without enduring the typical back spasms associated with 1- to 3-hour flat bed rest. They can walk over to the bathroom as needed, avoiding uncomfortable bladder expansion or bedpans. Groin pain, pseudoaneurysms, and retroperitoneal bleeding are all complications my patients do not have to deal with.

THE LEARNING CURVE

While crossing over from traditional access sites to the radial artery, there are some adjustments for first-time users, such as navigation of difficult arch anatomy, proper evaluation of hand circulation, and positioning of the operating table. A short learning curve is required to understand target lesion locations and treatment ranges of key devices.

CONCLUSION

Overall, Terumo's portfolio of R2P devices provides the tools for successful treatment of iliac, femoral, and tibial occlusive disease in both the hospital and the OBL. The same skills can be applied to treating visceral vessels, performing embolization procedures, and assisting in complex aneurysm repairs, all through radial artery access. A few minor steps outside the transfemoral algorithm can open an array of possibilities.

I encourage other endovascular specialists to overcome the initial trepidation of radial-to-peripheral generalizability and see how radial access can quickly become the preferred approach for you, your patients, and your team. ■

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CLINICAL STUDY SUMMARY

Prospective, Multicenter Registry to Assess Safety and Efficacy of Radial Access for Peripheral Artery Interventions

A summary of the recently published Terumo R2P study evaluating radial access for endovascular lower extremity intervention.

By Yulanka Castro-Dominguez, MD; Jun Li, MD; Ankur Lodha, MD; Suntosh Parvathaneni, MD; Justin Ratcliffe, MD; Amit Srivastava, MD; Sanjum S. Sethi, MD, MPH; Mitul Patel, MD; Vamsi Krishna, MD; and Mehdi H. Shishehbor, DO, MPH, PhD

STUDY OBJECTIVE

To prospectively evaluate the safety and feasibility of radial access (RA) for complex endovascular lower extremity interventions.

STUDY DESIGN

- Prospective, multicenter, observational, postmarket study
- Designed to assess the safety and efficacy of RA for endovascular lower extremity interventions
- Eligible patients with peripheral artery disease (PAD) scheduled for intervention through RA were enrolled

PRIMARY ENDPOINTS

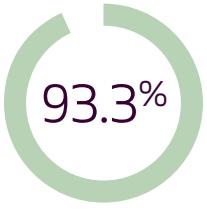
- Procedural success, defined as successful completion of the intended procedure without conversion to femoral access and without RA complications periprocedure
- The primary safety endpoint included evaluation of RA-related complications at 30 days

RESULTS

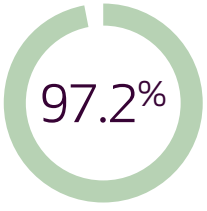
- The 224 lesions treated were in iliac (12.9%), femoropopliteal (55.3%), isolated popliteal (11.9%), and tibial (19.5%) vessels.
- The primary efficacy endpoint was achieved in 112 (93.3%) patients.
- No serious adverse events were adjudicated to the procedure.
- Mean procedure time and time to ambulation were 74 minutes and 3 hours 30 minutes, respectively, with 93.3% same-day discharge.
- At 30 days, 97.2% of patients recorded ultrasound-confirmed RA patency.

EDITORIAL

The study's findings demonstrate that RA is a safe and effective approach for treating complex multilevel PAD.[1] The technique allowed for early ambulation and same-day discharge for most patients, further enhancing patient satisfaction and reducing health care costs.[2]



Primary efficacy endpoint of procedural success without access complications was achieved in 112 (93.3%)



At 30 days, arterial duplex ultrasound showed radial artery patency in 97.2% of the patients with follow-up data (104/107)

TABLE 1. PROCEDURAL CHARACTERISTICS (N = 120)

Radial Artery Access Obtained	
Additional access sites	30 (25)
Femoral	5 (4.2)
Tibial	7 (5.8)
Pedal	17 (14.2)
Other	3 (2.5)
Devices Used	
R2P 0.018 Crosstella Balloon (Terumo Interventional Systems)	85 (70.8)
R2P 0.035 Metacross Balloon (Terumo Interventional Systems)	50 (41.7)
R2P Misago SES (Terumo Interventional Systems)	46 (38.3)
Orbital atherectomy	64 (53.3)
Laser atherectomy	3 (2.5)
Procedural Times, HH:MM	
Procedure length	1:14 ± 0:37
Time to ambulation	3:30 ± 2:55
Time to discharge (all patients)	3:57 (0:40-145:18)*
Time to discharge (radial access only)	3:41 (1:35-145:18)*
Same-Day discharge	
Total population	104 (86.7)
Radial access group only	84/90 (93.3)

Note: Values are presented as mean ± SD or n (%).
Abbreviations: SES, self-expanding stent.
*One patient had a preplanned multiday stay for a separate condition.

TABLE 2. PRIMARY EFFICACY AND SAFETY ENDPOINTS (N = 120)

Primary Periprocedural Efficacy Endpoint	
Procedural success	112 (93.3)
Required femoral conversion*	1 (0.8)
Radial access complication periprocedure†	7 (5.8)
Primary Safety Endpoint (30 D)	
Serious adverse events	0
Nonserious access site complications	20 (16.7)
Access site minor bleeding	9 (7.5)
Access site hematoma	6 (5.0)
Radial artery spasm	4 (3.3)
Access site swelling	3 (2.5)
Pseudoaneurysm	1 (0.8)
Radial artery thrombosis	1 (0.8)

Note: Values are presented as n (%).
*Owing to excessive iliac tortuosity and calcification.
†One pseudoaneurysm, four vessel spasm, and two access site bleeding.

CONCLUSION

In this prospective, multicenter registry, we show the safety and efficacy of the RA approach for the treatment of complex multilevel PAD. The RA approach allowed same-day discharge for most patients with no serious adverse events. Future randomized trials should examine the clinical and cost-effectiveness of this approach compared to femoral access for patients with PAD. ■

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Overarching Radial Data

The available retrospective and prospective data highlight the safety and efficacy of radial access for peripheral intervention.

By Sameh Sayfo, MD, MBA, FSCAI, FACC

Vascular access complications have been a leading cause of mortality in both coronary and peripheral interventions. Many trials evaluating the safety and effectiveness of the radial access approach in coronary intervention have been published over the years, as early as 2015 when the MATRIX trial showed a statically significant reduction of major bleeding and all-cause mortality. Other trials such as RIVAL, RIFLE-STEACS, and MORTAL have shown similar results. In 2022, Gargiulo et al published a meta-analysis in *Circulation* where 21,600 interventions were reviewed, showing that radial access is associated with lower all-cause mortality and major bleeding at 30 days compared with femoral access.[1] The decrease in major bleeding only partially explains the mortality benefit.

The radial approach for peripheral interventions faced many challenges in the past due to lack of a long shaft sheath and other devices designed specifically for the radial approach. In 2015, Coscas et al published their data assessing the success of radial access for peripheral intervention in 526 patients, with the majority of interventions using right radial access.[2] Although the study demonstrated the feasibility of radial access for peripheral percutaneous transluminal angioplasty, there was a higher than usual rate of radial artery occlusion (13%), and the authors emphasized the need for better, smaller-diameter equipment. Kumar et al published data from their first 80 patients and concluded that radial artery access for peripheral endovascular procedures appears to be safe and effective; they encouraged the adoption of this technique, as the complication rates are lower than those reported for femoral artery access.[3]

In March 2022, our team at Baylor Scott & White The Heart Hospital–Plano published data for our first 92 radial-to-peripheral interventions, demonstrating that peripheral vascular intervention performed via radial artery access is safe and feasible and allows for simultaneous bilateral and multilevel intervention.[4] One year later at the 2023 TCT meeting, we presented data for 165 procedures that reconfirmed the safety and efficacy of this approach.[5] This same year, Ansari et al published a retrospective analysis of 184 procedures comparing radial access to femoral access. The study concluded that the radial approach decreased not only perioperative times and contrast use but also radiation exposure.[6] The radial approach is undoubtedly a safe, feasible, efficient, and cost-saving route for peripheral interventions.

REVIEWING THE PROSPECTIVE DATA

The common issues with the previous papers are that the data were all retrospectively collected and analyzed. In October 2023, Castro-Dominguez et al published the first prospective registry to assess the safety and efficacy of radial access for peripheral artery interventions.[7] This was a multicenter observational study that enrolled 120 patients in eight United States sites who were scheduled for peripheral intervention via radial access. The primary efficacy endpoint was procedural success, defined as successful completion of the intended procedure without needing to convert to femoral access and without periprocedural radial access complications. The primary safety endpoint included evaluation of radial access–related complications at 30 days. There were 224 lesions treated, with most lesions being femoropopliteal (55.3%), followed by below-the-knee and iliac lesions (19.5% and 12.9%, respectively). Thirty (25%) patients required an additional access site to facilitate crossing and/or complete the planned treatment (5 femoral, 10 tibial, 17 pedal access). All procedures used ultrasound-guided access, followed by long, 6-F radial sheaths. Of the 168 patients screened, 48 patients were excluded due to various reasons, including radial artery diameter < 2.5 mm.

The dedicated radial-to-peripheral devices used in the study included, but were not limited to, the R2P Metacross balloon (Terumo Interventional Systems), Crosstella balloon (Terumo Interventional Systems), and Misago self-expanding stent (Terumo Interventional Systems). Other devices were used at the discretion of the operator. Hemostasis of the radial access sites was achieved using the TR Band (Terumo Interventional Systems). All patients were followed to 30 days, with evaluation of complications including stroke and access site complication. A radial

artery ultrasound was obtained for every patient at 30 days to assess patency.

Among all treated patients, 95% received plain balloon angioplasty, 7.5% received drug-coated balloon (DCB), and 38.3% received self-expanding stent; 53.3% of lesions were treated with orbital atherectomy.

The primary efficacy endpoint was achieved in 93.3% of patients. Radial access site complications were seen in seven patients and included one pseudoaneurysm, four spasms, and two minor site bleedings. Stroke was not documented in any of the patients. At 30 days, arterial ultrasound showed a radial artery occlusion rate of 2.8%.

Similar to previous reports in the radial-to-coronary intervention literature, same-day discharge was encouraged and achieved in this registry in 86.7% of all patients and 93.3% of patients who underwent radial access only. This prospective study is the first of its kind; the results of previously reported retrospective studies were confirmed, with the safety and efficacy of the radial access approach being proven again in patients with complex peripheral artery disease (PAD).

Limitations of this study included that some patients were excluded due a smaller radial artery, thus emphasizing the importance of sheaths with small French sizes. Also, only 7.5% of patients in this registry received DCB. At the time of conducting this study, the 0.018-inch In.Pact balloon (Medtronic) with a 200-cm shaft for radial access was not available. This DCB is now commonly used as first-line therapy. With a growing experience in the radial-to-peripheral technique, increased operator skills, and advancement of device options (longer microcatheters, DCBs, other available atherectomy devices), operators are using fewer secondary access sites, thus lowering the risk of complications and increasing the rate of same-day discharge.

DISCUSSION

While these data validate the radial approach, larger prospective studies with longer follow-up duration and more inclusive criteria to mimic the real-world population are still needed. As more patients continue to develop, these future data have the potential to drive standards of care for PAD/chronic limb-threatening ischemia in years to come. ■

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Radial Training: How Far We've Come, and Where We Can Go

Experts discuss tips and tricks for learning radial techniques, methods for mastering the learning curve, and the value of the Terumo Learning Edge program.

With Edvard Skripochnik, MD, RPVI; David O'Connor, MD, FACS; and Sanjam Sethi, MD

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The Terumo Learning Edge platform offers peer-to-peer, collaborative education for health care providers looking to develop or advance their radial access skills. With procedural discussions and live case observations, the educational platform is designed to allow operators to optimize procedural outcomes while preserving arterial function after intervention.

This panel discussion, comprising Terumo Learning Edge faculty and former students, tackles the importance of radial access education. From tips and tricks for learning techniques and decision-making for device choice, to radial access wishlists and success stories, these physicians have a wide-ranging conversation about the past and present state of radial training, highlighting why a dedicated education program like Terumo Learning Edge is key to improving and advancing the future of radial intervention.

How were you trained in radial access? What was the learning curve like, and how has it changed in recent years?

Dr. Skripochnik: I was introduced to radial access in training, particularly for visceral embolization procedures and adjunctive access for complex aortic procedures. I gained an appreciation for the ease of access management and the anatomic advantages of "coming from above" the visceral vessels. The learning curve was quick; we learned how to manage navigating in a difficult aortic arch and the approximate length of the sheaths and catheters that were needed to optimize positioning in the aorta.

Now that there is a vastly expanded portfolio for radial-to-peripheral interventions, I think the learning curve is a little longer. With more options for treatment, I again had to learn the lengths of devices in relation to the arterial anatomy being treated.

Dr. O'Connor: As a vascular surgeon, I did not have any formal training in transradial interventions. The launch of the R2P Portfolio (Terumo Interventional Systems) made me realize the relevance of learning radial access for my practice. I used a combination of training videos and case observations from my interventional cardiology colleagues, who were regularly employing radial access during coronary catheterizations.

One of the most important milestones during my learning curve was in patient selection. I spent time practicing the Allen test and forearm ultrasound examinations of the radial artery on my patients preoperatively. During my first cases, I limited radial access to patients with larger radial arteries, less tortuosity, and minimal radial artery calcification.

Dr. Sethi: My process for training was a combination between fellowship and then seeking out more experience after fellowship. For somebody who is in training now, I would advocate that they obtain that initial radial experience in the training environment paired

RADIAL SUCCESS STORY

By Edvard Skripochnik, MD, RPVI

A woman in her mid 60s with diabetes and end-stage renal disease developed severe rest pain and coldness in her right below-knee amputation (BKA) stump. Her medical history included multiple endovascular femoral and tibial interventions, as well as bypasses in the right leg. Ultimately, a right axillary–femoral artery bypass was needed due to the occluded iliac and common femoral arteries to provide adequate inflow to heal the BKA. An ultrasound obtained in the office demonstrated a severe stenosis at the distal anastomosis on the profunda femoris artery (PFA). Given the limitations in traditional access points, I proceeded to treat her through the right radial artery with balloon angioplasty of the stenosis. Comfort with the radial approach allowed for a very simple solution to her problem.

Figure 1. Right radial artery access to cannulate a right axillary–femoral artery bypass.

Figure 2. Right leg angiogram demonstrated severe PFA stenosis and known superficial femoral and distal bypass occlusions.

Figure 3. Completion angiogram demonstrated resolution of severe stenosis with robust PFA outflow.

with a senior mentor. If you're out of training, there are a lot of different resources available today. One would be a dedicated training program like Terumo Learning Edge where you can go for a short period of time and get a really concentrated experience.

We need to see more and more physicians being trained in radial during fellowship so it becomes more of a default routine and they fully understand what radial equipment like the R2P Portfolio can do.

What are some tips and tricks to keep in mind when learning and practicing radial access techniques?

Dr. O'Connor: One of the biggest obstacles of widespread adoption of radial to peripheral is the perception that it is an entirely new procedure and skill set. While there are several learning curves that need to be attained, a radial-to-peripheral intervention can prove to sometimes be easier or faster than a transfemoral intervention in some cases. The learning curve for radial-to-peripheral interventions is variable and depends on many factors. If patients with more favorable anatomy are chosen earlier in the process, it helps to gain confidence and a workflow by selecting less difficult cases in the beginning.

Dr. Sethi: A good first step is to get comfortable with diagnostics from the radial approach, whether you're doing coronary or peripheral. For those who have done radial interventions in the coronary space, this is a natural transition. Diagnostic catheters track really easily. There are certain techniques you can use to get into both the ascending and descending aorta. Once you get comfortable with that, then you can start delivering the sheath and other equipment. It's a step-by-step process.

The fundamental approach to keep in mind is to ensure patient safety is your number one priority. Training should take a stepwise gradual approach: learn the diagnostic, learn to deliver the sheath, and then move forward with the equipment. Begin with cases where you know up front that success is likely. You can then move on to more complex cases as needed.

RADIAL SUCCESS STORY

By David O'Connor, MD, FACS

As a vascular surgeon, I have several patients in my practice who have had a prior aortic repair or lower extremity bypass. In many of these patients, my options for femoral access are limited because an up-and-over technique is challenging after endovascular aneurysm repair or open aortic reconstruction. In patients with previous lower extremity bypass, there is always a risk that the bypass graft can compromise use of ipsilateral femoral artery access. Realizing the challenges in these patients motivated me to find a safer solution by coming from above. I traditionally have not been enthusiastic about brachial artery access due to its associated access complication rates, and the radial technique became a welcomed alternative.

Dr. Skripochnik:

- Tip 1: I check my access vessels in the preoperative area. I scan the radial and ulnar arteries up to the brachial artery to prevent hand complications and ensure a safe path up the arm. Establishing this as a routine is critical to making access complication a never event.
- Tip 2: I use a 100-cm angled glide catheter to traverse the arch in about 99% of cases, and this helps me estimate the sheath length I will need for each case. For example, if it reaches the aortic bifurcation when hubbed to the access sheath and I am planning a superficial femoral artery treatment, then I know I will need a 119-cm Glidesheath Slender guiding sheath (Terumo Interventional Systems).
- Tip 3: Know the available devices that can bail you out if you have reached the maximum length of your wires and catheters in the R2P Portfolio. The 0.014-inch ViperWire Advance (Abbott) is 475 cm in length. This has helped me reach and perform a distal tibial angioplasty with an over-the-wire balloon when necessary.

What is your process for deciding which devices you will use in radial access? What features are you looking for in a device for these procedures?

Dr. O'Connor: The minimum basic equipment needed for a radial-to-peripheral case includes low-profile hydrophilic sheaths, antispasmodic medications, longer wires (minimum, 300 cm), and longer balloons and stents (200-cm working length for infrainguinal interventions).

When deciding devices for radial access, I prefer devices that will provide pushability while minimizing the risk of radial artery spasm. Lower-profile hydrophilic sheaths are a core component in these cases since they have a greater likelihood of traversing through the upper extremity. In addition, longer wires and shaft working lengths are important to reach a lower extremity vessel. Rapid exchange balloons and stents are helpful for ease of device exchanges.

Dr. Skripochnik: Overall, the features I look for are safety and pushability. Whether it's a wire or atherectomy device, it must have a low risk for vessel injury or embolization because bailouts can get challenging from radial access alone. My favorite devices for radial access are the rapid exchange balloons, like the 0.018-inch R2P Crosstella (Terumo Interventional Systems). I like that I have full control of the wire while delivering the balloon so that I can minimize loss of wire position. Fortunately, the rapid exchange balloons have amazing pushability from the stainless steel core wire, so that important factor is never compromised.

What value does the Terumo Learning Edge radial program add to a physician's knowledge of and skill in radial? Why is a program specifically dedicated to radial training necessary?

Dr. Skripochnik: The Terumo radial program is helpful in preventing a failure-to-launch situation in your practice. The skills are the same as with any endovascular case, but the tool kit is almost entirely different. The last thing you want when adopting a new approach is to be in a position where you crossed a difficult lesion and don't have the tools you need to complete the case. An introduction to the Terumo R2P Portfolio prior to attempting a case is important for building out your lab to have the tools you need on the shelf. Hands-on models help visualize what it means to have a 200-cm shaft balloon on a 300-cm wire in a 105-cm R2P Destination Slender guiding sheath (Terumo Interventional Systems). Diagrams are helpful, but it is always different in vivo.

Dr. O'Connor: The Terumo Learning Edge radial program is a comprehensive resource that covers patient selection, access techniques, troubleshooting, radial artery closure demonstrations, case examples, and insights for further innovation. The brochures and videos provide details and tips for each device in Terumo's R2P Portfolio, and the training videos and case vignettes are great resources for after fellowship or residency training. Terumo Learning Edge can also help you prepare your program by giving examples of room setup and additional medications and ancillary equipment needed for radial cases.

This type of training is also important for residents and fellows—I think all programs should have some degree of R2P training. There will be instances where a transradial intervention may be the safest option for a patient, and exposure to this technique in training will help with familiarity and success once in practice. Formal conference training courses are available, as well as live case observations. Case observations may be virtual or in person. We have hosted several attending physicians at our institution to observe live cases of radial-to-peripheral interventions.

Dr. Sethi: Having a proctor or a company representative come to your institution or attending a dedicated training program like Terumo Learning Edge are both great options for hands-on, in-person training. Those trainings can be paired with online supplementation (videos, lectures, direct correspondence, etc). These are all great, necessary ways to ways to build your skill set in radial access. It can be challenging to integrate new skills and tackle the radial learning curve when you're already so clinically busy taking care of your patients. Therefore, understanding the ways we can optimize physician education even postfellowship is critical to expanding the rules for things that may help our patients.

Radial training is also important from a patient perspective. Patients select physicians who are willing to think outside the box and use different methods and approaches. That's who they feel they will give them the highest level of care. It's important for your forward-facing image to be perceived by patients as someone who is not only treating a broad spectrum of conditions but also is dedicated to skill development.

Looking ahead to the future, what are some areas related to radial procedures, training, devices, etc. where you would like to see innovation?

Dr. Skripochnik: The more long-length tools we get the better. That would quell any hesitation regarding widespread adoption of radial access. I am hoping to see a 0.014- or 0.018-inch Glidewire Advantage (Terumo Interventional Systems) in lengths ≥ 400 cm accompanied by 200-cm, 0.014- or 0.018-inch R2P NaviCross catheters (Terumo Interventional Systems). Taller patients and distal lesions will become more comfortably accessible.

For vascular surgery trainees, I hope the future brings more dedicated radial training programs. There are still many hospitals that are not using Terumo's R2P Portfolio, and this hinders that particular area of development for residents and fellows.

ADVANTAGES OF RADIAL ACCESS FOR DIAGNOSTICS

By Sanjam Sethi, MD

- If there's no intervention, the patient can go home in very short order.
- Patient satisfaction is high because they can sit up right away and their access site management is only a few hours long.
- You can visualize both legs—and treat both legs if needed.
- Radial access satisfies the ultimate goal of treating patients in an efficient, effective, and safe way.

Dr. Sethi: We need to expand the data set to understand both feasibility and safety, as well as time efficiency and length of stay. The data on radial are still being developed. Once those data come out, depending on what they show, people could be more persuaded to move in that direction if the outcomes are favorable. It is incumbent on all of us to develop that data so that we understand whether the benefits of radial are just theoretical or actually proven in a data set.

Dr. O'Connor: Looking ahead, we are anticipating additional longer devices to support these cases. Terumo has done a great job with wires, sheaths, balloons, and stents. There are some products, such as drug-coated balloons, mechanical thrombectomy devices, and chronic total occlusion crossing catheters that will not reach the lower extremity from a transradial approach. These are the patients and cases that would benefit greatly from having expanded lengths to support treatment. ■

Disclosures
Dr. Skripochnik: Has a financial interest/arrangement or affiliation with Terumo Medical Corporation, Cook Aortic, Inari Medical, and Shape Memory Inc.
Dr. O'Connor: Has a financial interest/arrangement or affiliation with Terumo Medical Corporation, Silk Road, and Integra LifeSciences.
Dr. Sethi: Has a financial interest/arrangement or affiliation with Janssen Pharmaceuticals, Boston Scientific, Terumo Medical Corporation, Chiesi USA, Inc., and Inari Medical.

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