

The Role of Radial Access in Current Practice

What can transradial access offer today?

BY JENNIFER A. TREMMEL, MD, MS

Transradial access (TRA) is an old technique that is getting a new look. When TRA was first described,^{1,2} it was often believed to offer little beyond novelty in a world where concerns about coronary dissections and abrupt vessel closure kept interventionists awake at night. However, times have changed, and with quality and cost containment at the forefront of medicine, TRA has suddenly come of age.

WE'VE COME A LONG WAY

When TRA was introduced in the early 1990s, interventionists used large-diameter devices and were still becoming familiar with stents.³ In addition, antithrombotic regimens were in evolution, with iterations of high doses of heparin, warfarin, dextran, dipyridamole, aspirin, and ticlopidine being used.⁴ Although bleeding and vascular complications were a concern, successfully completing the procedure and avoiding ischemic complications were of primary importance. Now, 20 years later, percutaneous coronary intervention (PCI) is slick. The equipment is small and agile, the stents allow for “perfect” and generally long-lasting results, and outcomes have significantly improved.⁵ In addition, the availability of TR-designated devices, including hydrophilic

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sheaths, universal catheters, and nonocclusive hemostatic devices, along with an understanding of the need for heparin and a spasmolytic cocktail have drastically improved an operator's chances of successfully mastering TR procedures. As ischemic complications have fallen away, bleeding has emerged as the leading periprocedural complication.⁶

A NEED TO REDUCE BLEEDING AND VASCULAR COMPLICATIONS

Bleeding complications after PCI are most commonly related to the vascular access site, and the predominant vascular access site for PCI in this country is the femoral artery.^{7,8} Vascular bleeding and blood transfusions not only increase patient discomfort, length of stay, and hospital costs⁹ but have also been associated with an

TABLE 1. BLEEDING AND VASCULAR COMPLICATIONS

Patients More Likely to Benefit From TRA	Patients Less Likely to Benefit From TRA
Women	Men
Patients with small body surface area	Patients with normal body surface area
Morbidly obese patients (BMI > 40)	Overweight/obese patients (BMI 25–35)
ACS patients, particularly those with STEMI	Patients undergoing diagnostic procedures
Elderly patients	Young patients
Abbreviations: ACS, acute coronary syndromes; BMI, body mass index.	

increased risk of mortality.^{10,11} Certain patients are at higher risk of bleeding, including women, the elderly, those with a small body surface area, and those presenting with ST-elevation myocardial infarction (STEMI).¹²⁻¹⁷ These are the patients who stand to benefit the most from TRA (Table 1).

As catheterization laboratories and individual operators are increasingly scrutinized on quality and outcome measures, bleeding and vascular complications are obvious targets for improvement. Although there is evidence of lower bleeding rates over time,^{18,19} we have only just begun to see how infrequent this complication could become. Improvements thus far in vascular access site complications can be attributed to efforts in optimizing femoral access²⁰⁻²² and adjustments in antithrombotic strategies.²³ However, recent advances in antithrombotic pharmacology have been aimed more at reducing bleeding complications and less toward reducing ischemic events, when a compromise between bleeding and ischemia may not be necessary.²⁴ Likewise, vascular closure devices, a once promising strategy, have also failed to reduce bleeding and vascular complications.²⁵⁻²⁷ On the other hand, using TRA and avoiding the femoral artery altogether can reduce major bleeding by 70% to 80%.²⁸⁻³⁰ In addition, there is evidence that TRA may lead to decreased mortality through reductions in bleeding and transfusion rates.³¹ Further data are needed to confirm this, but if proven, it will make it exceedingly difficult to continue justifying the femoral approach as the default strategy, particularly for higher-risk patients.

PATIENT COMFORT AND ECONOMIC CONSIDERATIONS

With the current focus on quality in health care, the goal is not only to reduce morbidity and mortality rates, but to do so while maximizing patient satisfaction and minimizing cost. TRA is making a bid as the new standard of care in the United States because it appears to achieve this trifecta.

For patients who have experienced both radial and femoral access, there is a strong preference for the TR approach due to increased comfort and ability to function autonomously.³² Any operator who has performed TRA will confirm this sentiment, and as more patients hear about TRA, consumer awareness and demand will continue to rise. In addition, patients are increasingly cognizant when interventionists dismiss TRA—that it is not because of data showing it to be an inferior approach but because those interventionists do not have the technical skills and/or infrastructure to offer it.

Health care costs in the United States now exceed \$2.5 trillion and account for more than 17% of the gross



(Courtesy of St. Joseph's Heart and Vascular Institute and Dr. Jack Chen.)

Figure 1. TR lounge at St. Joseph's Heart and Vascular Institute in Atlanta, GA.

domestic product.³³ Within that system, approximately 1 million PCIs are performed annually, with related costs approaching \$10 billion.³⁴ Strategies to decrease expenditures are needed and are increasingly being forced upon hospitals and physicians by insurers who are reimbursing less and less. Cost analyses comparing vascular access sites have consistently shown a significant reduction in hospital and system costs with TRA.^{32,35-37} TR procedures reduce costs by lowering procedural costs, nursing care costs, length of stay, and costs related to complications. Same-day PCI, made truly possible by TRA, also has major health care cost implications and will likely result in a significant paradigm shift regarding how we approach PCI in the coming decade.^{38,39}

IMPROVED MANAGEMENT OF STEMI

Along with PCI in general, the management of patients with STEMI has changed dramatically over the years. We have gone from medical management as our only option to < 90-minute door-to-balloon times. Patients get on their cell phones as they are being wheeled out of the catheterization laboratory, looking back to ask us if they will be home in time for dinner. Their STEMI is but a blip among their activities for the week. Still, STEMI is associated with significant morbidity and mortality, including high rates of bleeding and vascular complications.¹⁹ It is in these patients that TRA really shines. TRA results in significantly lower bleeding, and possibly even MACE rates, with no loss in procedural times when performed by an experienced operator.⁴⁰⁻⁴³

TABLE 2. PROPOSED SCALED COMPETENCY STANDARDS

Level 1 competency	Able to perform simple diagnostic cases on patients with favorable upper limb anatomy (large men)
Level 2 competency	Able to perform simple diagnostic and interventional procedures on patients with more challenging upper limb anatomy (elective single-vessel PCI; bypass grafts, small women, radial and subclavian loops)
Level 3 competency	Able to perform complex interventional procedures even with challenging limb anatomy (CTOs, multivessel, AMI)
<i>Abbreviations: AMI, acute myocardial infarction; CTOs, chronic total occlusions.</i>	

It should be stressed that experienced operators are a key feature for efficiency and success in this patient population. Operators must have great confidence in their TR skills and have performed complex PCI in the face of unfavorable anatomy before facing such a challenge in a rushed situation. Primary PCI is the pinnacle procedure for an aspiring radialist in the current era, which highlights the fact that it is only by mastering TRA in the full range of patients that operators will be able to affect those who stand to benefit most.

SAME-DAY PCI IS A CURRENT REALITY

In this day and age, when we keep patients overnight, it is rarely because we fear a coronary issue; it is because of the groin. When pondering modern-day groin care, one cannot help but think how archaic it remains. Patients lie flat for hours, unable to easily eat or urinate. Gone are the days of C-clamps, but sandbags still lurk around, and noosing patients in a mechanical external compression device is common practice. Worse yet is if a femoral artery starts to bleed. In this situation, a nurse or physician, or several if necessary, will apply forceful manual pressure while the patient lies helpless, exposed, and often in tears. Ask any patient about the worst part of his or her procedure, and the most common answer will be “lying flat afterward.”

Instead, imagine your patient getting a bracelet around her wrist after you have completed her PCI. She gets off the table, into a wheelchair, and is wheeled into a lounge. There, she gets dressed, sits in an easy chair, and checks her e-mail while watching HDTV. She grabs a snack from the counter, along with a cup of tea, and perhaps takes it with her to a centralized sofa where she talks with other patients and plays a game of cards. After a few hours, she goes home, spending the night in the comfort of her own bed. This is not a futuristic fantasy. This is what PCI can and does look like today (Figure 1).

Same-day discharge after TR PCI has been shown to be safe and effective,⁴⁴⁻⁴⁶ and patient satisfaction appears to be high. Indeed, there are data to suggest that same-day PCI can be performed after femoral procedures, but few operators seem to feel comfortable

doing this. Same-day PCI also has favorable economic implications. Payor reimbursement for PCI has decreased, and the majority of patients no longer qualify for in-patient status. Instead, most elective PCIs are reimbursed as outpatient procedures (23-hour observation with overnight stay after procedure). Although there remains a profit margin for hospitals with outpatient PCI, it is less than in-patient PCI and is slowly dwindling. Same-day PCI is already financially attractive for the health care system as a whole and is becoming increasingly attractive for hospitals, particularly when they can fill a previously occupied outpatient PCI bed with a patient who has a more profitable in-patient status.^{38,39,47}

KEEPING ABREAST OF THE TRAINING

Although there is a growing recognition that TRA satisfies many of the gaps we have in current interventional practice, there is also an abundance of operators who do not know how to do it. At the end of 2007, only 1.32% of all PCIs in the United States were performed via the radial artery.⁸ That was said to have grown to 4.5% by the end of 2009, and estimates now hover around 10%. This is a tremendous growth in a short period of time, but much training remains to be done.

It is no small feat for an interventionist to go through the TR learning curve. They put themselves in a vulnerable and uncomfortable position, suddenly struggling at a procedure they had previously mastered. But those who stick with it find success and then have the opportunity to pass it on to colleagues and trainees. As of yet, competency statements are lacking but should be forthcoming to help define the standard of skills and knowledge expected for different levels of TR operators (Table 2).

As more invasive and interventional cardiologists become adept at TRA, they are graduating more fellows with the skill, and this is slowly changing the landscape of interventional cardiology across the country. There are no data on the number of fellows currently graduating with TR skills. However, a surprising number raise their hands at fellows courses when asked how many

have performed TRA. Fellows are eager to learn and recognize that TRA is a skill that can help them stand out in the job market.⁴⁸ Unfortunately, current training guidelines are outdated and lack specific information for TRA training.^{49,50} As with competency statements, training guidelines need to be updated to accommodate trainees in the current era. For fellowship training centers with a well-established TR program, it appears that TR training can begin on day one alongside femoral training. In fact, learning TRA may be like learning a foreign language, where the learning curve is only long once you have already established a different set of native skills.

AREAS FOR IMPROVEMENT AS TRA EVOLVES

Because it has received far less attention than the femoral approach, TRA still has some kinks to be worked out. Although rare, radial complications do occur. Radial artery occlusion, while not clinically important in a patient with intact ulnar circulation to the palmar arch, poses a problem for repeat percutaneous procedures, and efforts are ongoing to minimize it.^{51,52} Excess radiation exposure to both the patient and the operator remains a concern that also needs further attention, although it may simply be a matter of proper shielding and adequate operator experience.^{53,54} While there are data to suggest that fully anticoagulated patients can safely undergo TRA,^{55,56} there is little guidance on how concomitant antithrombotic agents should be modified in these patients, particularly if PCI is indicated. Similarly, patients with bleeding diatheses, such as those with end-stage liver disease, would seemingly benefit from TRA over the femoral approach, but data are lacking. Finally, like everything in interventional cardiology, TR devices and techniques must continue to evolve. Efforts should be focused on improving radial-designated catheters and guides that can easily maneuver subclavian tortuosity, sheathless systems that can minimize trauma to the radial artery,⁵⁷ and small, comfortable nonocclusive hemostatic devices that can keep radial arteries open for future re-entry.

CONCLUSION

TRA is clearly increasing in the United States. It has shown itself to be an approach that offers lower complications, increased patient satisfaction, and reduced costs and is finding a perfect fit in a transforming health care system that is demanding such outcomes. TRA is expected to be increasingly recommended by clinical practice guidelines and to become a benchmark for quality of care. Current invasive and interventional car-

diologists emerging from training will ultimately shape the next era of percutaneous procedures, with TRA as one of the many advances they can claim over their predecessors. ■

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