

Uptake of radial access in the United States: A glass half full?



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In the last 25 years, enormous time and effort has been devoted to investigating the impact of arterial access site practice on outcomes after cardiac procedures, triggered by an increasing awareness of the detrimental effects of access site complications and bleeding. A considerable body of research involving randomized trials and very large observational studies confirm that the use of a transradial approach unequivocally decreases these important complications. In high-risk populations, such as patients undergoing primary angioplasty in which these complications can have major deleterious effects, this translates into mortality reduction. As a result of this large body of evidence, transradial access is now the dominant route for cardiac procedures in most of Europe and in many other parts of the world. In the United Kingdom, transradial access is utilized in more than 70% of all percutaneous coronary intervention (PCI) procedures, with the rate rapidly increasing year after year (Figure 1). It seems clear that in the near future, almost all cardiac interventions will be performed transradially in the United Kingdom. In the United States, a very different picture has emerged. Uptake of transradial access has been slow, and the overwhelming majority of cases are still performed transfemorally.

It is interesting to consider the response of interventional cardiologists to different data sets. In 2003, Keeley et al published a meta-analysis of a relatively small number of patients involved in multiple, small, randomized trials comparing angioplasty or thrombolysis for the treatment of acute myocardial infarction.¹ There was a small mortality reduction associated with primary angioplasty. After this publication, interventional cardiologists enthusiastically advocated a change in practice away from thrombolysis and toward the use of primary angioplasty for acute myocardial infarction. In 2012, we published a meta-analysis of a relatively small number of patients involved in multiple, small, randomized trials comparing radial with femoral

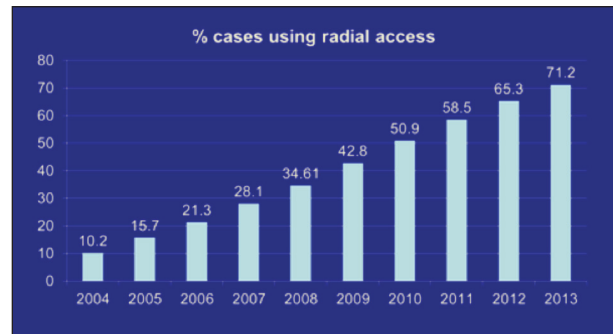


Figure 1. Increases in radial access for PCI procedures in the United Kingdom.

access for primary angioplasty.² Mortality was reduced by almost 50% in the radial access group. This meta-analysis is supported by a large unselected observational study that demonstrates that the results obtained in selected patients enrolled in randomized trials translate into real-world benefits in a large primary angioplasty population.³ These data did not prompt a universally enthusiastic response. Editorials were published arguing against widespread adoption of radial access for primary angioplasty.⁴ This divergent response to similar data may in part relate to the technical difficulties faced by established femoral operators seeking to change to a radial access–based practice. Rather than ignoring the data supporting radial access, the question has to be: How can we support people who are femoral operators making this sometimes difficult transition?

Most of the initial investigators and innovators responsible for developing and validating the transradial technique in the last 25 years have been European. Within the United Kingdom, a small group of motivated interventional cardiologists (who had been trained in high-volume European radial centers) established an interlinked series of training courses and fellowship programs. These served to educate and train the new generation of interventional cardiologists who are now overwhelmingly radial operators. The value of these training programs in changing national practice cannot be underestimated. It is only in recent years that a cohort of similarly well-trained and highly motivated radial operators has emerged in the United States, triggering a rapidly expanding United States–based transradial education program. This is supported by the major role played by United States investigators in the development of the litera-

ture supporting transradial access. In the United Kingdom, radial access initially developed predominantly in the centers with externally trained operators, mostly in the north of the country. In the United States, a geographically similar pattern is emerging, with radial access utilized more in the East Coast states. Over time, educational programs will facilitate change in practice from femoral to radial access, and ensure that these geographic variations disappear.

Another factor that may be important within the United States is operator volume. Many United States interventionists perform a very low volume of PCI procedures. In the United Kingdom, average procedural volume is well in excess of 150 cases per annum. High-volume operators usually find adapting their technique to become skilled radial operators easier than operators performing only a very low volume of transfemoral PCI. It is, however, encouraging to see that contemporary transradial learning curves are short enough to allow well-supported, low-volume femoral operators to successfully transition their access site practice.⁵ If femoral access complications could be reduced, the impetus to change to a radial program would be diminished. Considerable effort has been devoted to reducing femoral access complications by pharmacologic adjustments and the use of closure devices. Recent data suggest that these strategies are not effective and that radial access is still the best way to reduce access site complications and bleeding.^{6,7}

In the United States, radial access utilization remains a glass far less than half full. The overwhelming evidence of the beneficial effect of this procedural modification, and the growth of a United States–based education and training program, will be a powerful facilitator of change. Increasing patient knowledge will also contribute to change. A full glass (or at least a mostly full glass) is on the horizon, and this can only benefit patients. Until a mostly full glass is achieved, all operators should ensure that they include a discussion of the data relating to reduction of access-site complications via radial access in the consent process.



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Transradial access (TRA), after initial introduction into mainstream practice in the early 1990s,¹ has been increasingly adopted across the world. Canada, Europe, and Asia have reached a point where it has become the access site used in the majority of procedures. The United States has been the latest developed country to join the radial revolution. The uptake of TRA lingered around 2% or less, well into the 2000s.² Over the past few years, there has been a steep increase in the adoption of TRA in the United States, with recent estimates around 30% for diagnostic procedures and 25% for coronary interventions.

Many reasons for the delayed adoption of TRA in the United States have been proposed. TRA has been observed to have a learning curve, with initial estimates of approximately 100 procedures before one starts observing high procedural success rates.³ Typically, the annual procedural volume for United States–based interventional cardiologists is much lower compared to their cohorts in other developed countries. This is largely because of a higher number of interventional cardiologists and decentralization, with a much larger number of catheterization laboratories compared to other countries. The combination of a skill that requires a threshold volume of procedures to develop expertise, and low volume per operator, has probably been the mechanism responsible for this 2-decade lag. The other potential mechanisms could have included a relatively slow accumulation of credible literature supporting the use of TRA over transfemoral access from a standpoint of safety,⁴ patient comfort,⁵ and cost,⁶ further dampening the enthusiasm of many interventionists in the United States. The steep rise in high-quality, peer-reviewed literature supporting TRA might have been another mechanism operating behind the adoption surge observed in the United States. Lastly, the lack of learning opportunities may have stunted the growth of TRA in the United States. During the last decade, a steady rise in didactic teaching programs and proctorship opportunities has allowed many practicing cardiologists to

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engage in the learning process. Programs such as the SCAI-TRIP, being offered multiple times a year and in multiple geographic sectors, have provided a platform for discussion of the evidence and reasons for adoption of TRA, as well as dissemination of the technique.

The United States interventional community has also seen a steady infusion of fellows who are trained in TRA and who use it as a tool to distinguish themselves from the establishment, putting further pressure to drive the change.

Although TRA adoption in the United States could be, and is viewed as “slow,” it is likely one of the more rapid adoptions of a technique by a community as large as the United States interventional community. In fact, a recent examination of the Cath-PCI registry indicated a shorter “learning curve” observed in the United States compared to previous estimates.⁷ This could have been partly due to maturation of the technique and equipment over the past decade, although certainly not a bad “grade” on the United States interventionists’ “report card.” Most estimates expect the proportion of TRA to rise in the near future, with the United States catching up to the rest of the world very soon (hopefully). From my vantage point, the glass certainly looks half full.

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Every single technique and technology goes through multiple phases of testing until it reaches the final phase of optimization. Once overall experience and data demonstrate the superiority of a particular treatment or technique, the natural devolution and extinction of an outmoded method occurs. Cardiac catheterization is a glaring example. The Sones’ brachial artery cutdown is long gone, having given way to Judkin’s percutaneous transfemoral approach (TFA) in a span of less than 5 years. Since Kiemeneij¹ demonstrat-

ed the safety of stenting through the transradial approach (TRA) without major bleeding risks engendered by TFA in intensely anticoagulated patients, the evolving data favoring TRA over TFA have led to strong opinions among interventional cardiologists aligned with one technique over the other. Which technique is safer, quicker, more comfortable, less expensive, and easily reproducible? Almost 2 decades passed before the interventional cardiology world could be convinced about the overall superiority of TRA over TFA.

During the first decade of its inception, TRA was largely guided by case reports, case series, and small studies.¹ Subsequently, there has been a proliferation of studies on TRA that have examined various technical aspects, outcomes, advantages, and limitations of this technique. By now, more than 1,400 positive articles have been published on transradial intervention (TRI)-related issues, creating a solid evidence base to guide its practice. Despite TRA being a globally acknowledged technique, the uptake in the United States seems to be the slowest when compared to most other parts of the world.^{2,3}

Why is the glass half empty? I am still trying to find the answer. There are a number of dedicated radialists and transradial training centers in the United States. Moreover, there are many excellent radial dedicated teaching programs, including the Transradial Interventional Program (TRIP) by the Society for Cardiovascular Angiography and Interventions (SCAI), Duke’s Masters TRI course, the dedicated transradial session of transcatheter cardiovascular therapeutics (TCT), the AIM Radial course by a Canadian group, and several more that discuss practically every aspect of TRA, ranging from basic concepts to advanced levels. There is much enthusiasm to attend these programs, particularly from cardiology fellows and young cardiologists. However, many senior cardiologists (who have practiced TFA for several decades) are not very keen for change. Their reluctance stems from the occasional negative experience with a difficult patient in whom they are forced to use TRA. It is important to understand that there is a definite “new learning curve” for TRA, even for the most experienced femoral operator.⁴ During this phase, the operator is confronted with a few failures and changeovers, lengthier procedural time, and higher radiation exposure, which induce negative feelings and reluctance for TRA. However, once the learning curve is surmounted, the operator will have the confidence to overcome and eliminate all of the aforementioned obstacles. As the number of coronary interventions in the United States steadily increases, the number of interventional cardiologists rises exponentially, leading to a shrinkage of individual procedural volume. This poses a challenge for the individual cardiologist to overcome the learning curve. A practical solution for this problem is to work in groups of two or three, preferably having one reasonably experienced radial operator available. Without a concerted effort, the transformation of a femoralist into

an accomplished radialist will not be automatic, regardless of the superiority of the transradial approach! The perpetuation of a femoral operator's previous negative experience becomes their "Achilles' heel" and blinds them from being able to accept a slightly more complex procedure, despite its superior safety record. Nonetheless, most technical radial problems can be overcome with increasing experience and persistence, much like that required to conquer the occasional problems encountered in TFA.

Lastly, the industry has not focused on the refinement and advancement of transradial hardware.⁴ To establish universal acceptability of any procedure, it is important to give confidence of a reasonably high success rate, even for low-volume operators and beginners. Procedure friendly hardware should play a critical role in mainstreaming TRA, as the two work hand in hand. With the lack of industry resources and general ignorance of many interventional cardiologists, it took almost 2 decades for dedicated radialists to perform and complete clinical trials and observational studies to demonstrate the clinical advantage and other benefits of TRA over standard TFA.

In a nutshell, everyday practice is now driven by "evidence-based medicine" instead of "personal experience" or "anecdotal medicine." International guidelines are regularly published and periodically updated to provide busy professionals guidance on how their practice should evolve over time. Given the evident superiority of TRA over TFA, it is high time to change the mindset!

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Between 2004 and 2007, the adoption rate of the radial approach for percutaneous coronary intervention (PCI) in the United States was 1.3%. Patients undergoing transradial PCI tended to be lower risk compared with those undergoing transfemoral PCI.¹ By the third quarter of 2012, the rate had increased to 16.1%, but the risk-treatment paradox was still present.² Three years later, the radial approach is being used in approximately 27% of PCIs and 30% of diagnostic coronary angiographies. Is this good news?

As a radial-first operator, my answer is a qualified "yes." The adoption of radial access has significantly increased and follows the publication of studies demonstrating its safety advantage, cost-effectiveness, and patient preference. Radial experts around the world have also published on technical aspects of the procedure that have increased its applicability to higher-risk patients, such as the elderly, females, and those with ST-segment elevation myocardial infarction. There are now established strategies to reduce the incidence of radial artery occlusion and minimize radiation exposure to patients and operators. As the safest approach to coronary angiography and intervention, radial access should become the standard.

On the other hand, the majority of cases in the United States are still performed via the femoral artery. Furthermore, the risk-treatment paradox for the radial approach continues to persist, with lower-risk patients being more likely to undergo transradial PCI. This probably reflects the fact that some United States operators and centers are still early in their radial learning curve. Many other countries have passed the 50% mark, with more than half of PCIs being performed via the radial artery, and it is possible that the United States will approach this rate in the next few years. The challenge will be to maintain proficiency in femoral access as the adoption of the radial approach increases.

Thus far, the data have not shown a detrimental effect on femoral outcomes at centers that perform a large number of transradial procedures. In the NCDR CathPCI registry, which is the largest ongoing PCI registry in the world, sites that had the highest adoption of transradial procedures (going from 1% to 45%) had the greatest decrease in postprocedure bleeding complications.³ Therefore, despite the fact that higher-risk patients are being selected for femoral access, these sites are able to perform transfemoral PCI in a safe way. These data suggest that, at least at the centers participating in the NCDR, the adoption of the radial approach does not appear to be occurring at the expense of femoral outcomes. This may change as radial uptake continues to increase.

I view the United States' adoption of the radial approach as the glass being half full (or maybe 30% full). As the focus on patient-centered outcomes and cost-effective strategies sharpens, the incentive to adopt transradial PCI will continue to increase. As a community, we will need to be vigilant to ensure that proficiency and outcomes with femoral access do not decline. ■

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