

Radial Access Failure: Association with Both Physician and Patient Factors

Editorial comment on: Abdelaal E, MacHaalany J, Plourde G, et al. Prediction and impact of failure of transradial approach for percutaneous coronary interventions in acute ST-elevation myocardial infarction. *Heart* 2016

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Modern transradial access has evolved from a niche procedure undertaken by a few enthusiastic proponents to the default access site adopted across most of European and Asia, with data from the British Cardiovascular Interventional Society suggesting that over 75% of all primary percutaneous coronary intervention (PCI) procedures in the United Kingdom in 2014 were undertaken through the radial artery.[1] Transradial access (TRA) has been shown to be associated with a reduction in mortality, major adverse cardiac events (MACE) and major access site related bleeding complications in both randomised controlled trials and national registries in patients undergoing PCI at high risk from bleeding complications, particularly those in the setting of acute coronary syndromes, which has led to a Class IA recommendation for its use in the setting of acute coronary syndrome (ACS) in the latest European Society of Cardiology Guidelines for ACS.[2] Throughout this evolution, concerns about the generalizability of the transition from a default femoral to radial approach have been raised both from the question of learning curve, feasibility and access site failure rate. Confounding much of the earlier literature has been variable and heterogeneous operator experience between femoral and radial techniques resulting in uncertainty in interpretation, particularly around the feasibility and success rates of procedures undertaken through the radial approach.

Abdelaal, et al,[3] from Quebec Heart-Lung Institute have provided some insight into this question in patients referred for primary PCI. Their facility was one of the earliest adaptors of transradial approaches to catheterization and provides a practice environment with extensive expertise in both radial and femoral techniques. From their experience in primary PCI, the investigators examined the outcome from a period of 2006 to 2011 corresponding to a time that reflected greater than a decade of prior institutional transradial experience. Out of 2020 patients who underwent primary PCI, 95% were attempted radially while 5% defaulted to femoral due to operator choice in haemodynamically unstable patients such as those in cardiogenic shock or ventilated. In 44 patients initially started radially, cross over to femoral (TFA) occurred (2.3% of total population). These transfemoral PCI rates are probably underestimates of the institution's true transfemoral rate as this study excluded patients (n=73) with prior coronary artery bypass grafts (CABG) who presented with acute myocardial infarction; a sub-group others have previously identified at high-risk for transradial failure.[4] Allowing for some deflation in

transradial failure rate by excluding CABG patients, these results are consistent with some of the better rates reported elsewhere in randomized clinical trials of 4-10%.

Delving into this single site experience, interesting reflections of prior randomized trials can be seen. Much has been made of operator and center volume in the past, particularly their relationship with access site related outcomes[5] but it appears that the proportion of cases undertaken radially is also important. In the recent MATRIX randomized clinical trial,[6] that demonstrated decreases in all cause mortality, MACE and major Bleeding Academic Research Consortium (BARC) 3 or 5 bleeding rates in the radial arm, positive tests for trend across tertiles of the centers' percentage of TRA for PCI for both co-primary outcomes and all-cause mortality were observed, with a particularly pronounced benefit of TRA access in centers that did 80% or more radial percutaneous coronary interventions. The center in Quebec clearly falls within this later group with >90% overall transradial usage. Closer inspection of the present results based on operator proportion of radial procedures demonstrates a proportion-outcome relationship even within this expert center. While overall 95% of procedures are undertaken radially at this center, at the operator level there is heterogeneity with transfemoral rates ranging from 2-12%. Between these expert radial operators, physicians with a >10% TFA practice were independently predictive of TRA failure whereas those with a TFA rate of <5% appear to be protective against failure compared to the intermediate group of operators who did between 5-10% via a transfemoral route. Even in this expert center with a long history of transradial usage, those with TFA use of <5% had <50% the risk of failure versus the intermediate group while those with >10% femoral had a 2.2 fold increase over the intermediate group for transradial failure. This supports the concept that even in expert centers, the greater the proportion of cases of radial accomplished, the better the outcome.

While the actual causation of better outcomes in transradial patients has been debated, it has been generally associated with a reduction in access site related bleeding complications that are independently associated with decreased peri-procedural mortality. Previous data has suggested that the magnitude of mortality reduction associated with transradial access is associated with baseline bleeding risk [7]. Based on the "risk score" developed by the authors, those patients at highest risk of TRA failure are consistent with those also at highest risk of bleeding complications and, therefore, have the most to benefit from a radial approach. The unadjusted data that shows a significant increase in bleeding events with those patients in both groups that

underwent transfemoral catheterization, whether it was due to primary failure of the initial transradial approach or due to physician discretion without an attempt at radial. Given the adverse outcomes associated with bleeding events in patients undergoing PCI, these results suggest a concerted effort should be made to maintain a high proportion of procedures transradial and protocols to encourage transition to the contralateral arm, use of ultrasound for hypotensive patients should be instituted to avoid transfemoral access.

There may potentially be a variety of technical issues unique to this experience that are not readily apparent in this report. The range of available equipment is not specified such as smaller sized (5Fr) or thinner walled sheaths, or sheathless guide catheters that might facilitate access in smaller arteries, or whether micropuncture kits were routinely used. In addition it is unclear whether ultrasound equipment was readily available for difficult cases or shock patients that might further increase success rates. Another important risk for failure to obtain radial access was previous catheterization through the radial artery. While only 10% of patients in this study had previous transradial procedures, 20% of the transradial failures occurred in these patients suggesting a significant rate of radial injury from previous procedures. The history of the prior catheterizations and the techniques used to preserve radial artery function are not available, but if radial occlusion rates of less than 1% had been obtained using present best practices such as patent haemostasis, these group of repeat patients would have a better chance of having their next procedure successfully undertaken through the same radial artery. Institutionalized protocols to maximize radial artery patency rates at each catheterization episode of care will maximize long-term viability of this access and serve to minimize risk for conversion to femoral.

The applicability of the “risk score” for failure developed from this center’s experience to other institutions is unclear, particularly its applicability to cases undertaken in the non primary PCI setting, where the clinical demographics of the patients will be very different. Not many centers have the radial pedigree of this institution and its predictive accuracy is untested in an external validation cohort. The variability in operator proportion of transradial use suggests not only patient characteristics, but operator factors maybe playing into the risk model. Whilst operator variability might be remediated with a continuous quality improvement type program, this raises the question of broader applicability with every institution having its own operator characteristics and personalities. Patient factors may or may not be surmountable, but the risk of failure mirrors the same population at risk for bleeding from transfemoral use. Patients identified to be at

highest risk for failure are also those patients who have most to gain from transradial access site adoption, and this should result in all efforts to gain access via the radial artery rather than be used as an excuse to lightly go femoral.

The investigators should be congratulated on having the courage to transparently show the basis for their success and at the same time some of their weaknesses. Even at a center with high radial penetration, there is room for improvement and an understanding of what makes some of the best operators better than others. Avoidance of the transfemoral route results in minimization of adverse outcomes in the setting of primary PCI and even the best can become better. Given the hazard of the femoral approach, initial failure at one radial should prompt exploration of other alternatives such as the contralateral radial artery and in the situation of shock the use of adjunctive technology such as ultrasound to maintain access in the upper extremity may minimize access related problems. Finally, the hazard of radial occlusion and the need for minimizing this complication is highlighted as the loss of this access by poor technique in the initial catheterization places the patient at increased risk for needing a transfemoral procedure in the future. The future maintenance of radial patency should be considered an important part of all radial procedures.

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