

This analysis is similar to previous observational studies that have reported an increase in radiation exposure associated with using radial access. The significance and interpretation of these observations are contentious (2). Although Mercuri et al. (1) have adjusted for a variety of patient-related factors, they have not been able to meaningfully adjust for operator skill, expertise, and experience. In the present study population, over 70% of the cases evaluated were performed via the femoral approach. This indicates that in this institution, femoral access is preferred for most cases. The 1,764 radial cases were performed by 16 cardiologists over a 30-month period. This suggests that each individual cardiologist was performing only a very small number of radial cases each month. These factors ensure that the operators studied are more proficient as femoral operators. The observed increase in radiation exposure can be entirely accounted for by the discrepant levels of operator experience mandated by this practice pattern.

Operator volume and learning curve issues are powerful mediators of radiation exposure. In our institution, observational data indicate that expert radial operators are not associated with an increase in fluoroscopy time or patient or operator radiation exposure for diagnostic or therapeutic cardiac procedures (3). When we compared expert radial operators with trainee femoral operators, radiation exposure values were 25% higher in the femoral group (4). This is remarkably similar to the observed difference in the Mercuri study and suggests that a comparison of expert radial operators and less-skilled femoral operators would produce very similar results to Mercuri's study (1), but would favor radial access. In support of this, Hetherington et al. (5) report exactly this favorable pattern for radiation exposure in expert radial operators.

Radiation exposure to patients and catheterization laboratory staff is a cause for concern in contemporary cardiac practice and worthy of study. The observed differences in the study of Mercuri et al. (1) can be entirely explained by different expertise levels in the 2 studied groups. This, in conjunction with data on learning curve issues, suggests that trainee cardiologists or more experienced operators performing procedures with which they are less familiar need to pay rigorous attention to radiation protection. This type of data should not be used as a means of inhibiting the uptake of transradial access, which has important benefits in terms of patient comfort, cost savings, bleeding prevention, and mortality reduction.

*Karim Ratib, MB ChB
Mamas A. Mamas, DPhil
Douglas G. Fraser, MD
Helen Routledge, MD
Rodney Stables, MD
James Nolan, MD

*University Hospital of North Staffordshire
Stoke on Trent ST4 6QG
United Kingdom
E-mail: kratib@mac.com

REFERENCES

1. Mercuri M, Mehta S, Xie C, Valettas N, Velianou JL, Natarajan MK. Radial artery access as a predictor of increased radiation exposure during a diagnostic cardiac catheterization procedure. *J Am Coll Cardiol Intv* 2011;4:347-52.
2. Lo TS, Zaman AG, Stables R, et al. Comparison of operator radiation exposure with optimized radiation protection devices during coronary angiograms and ad hoc percutaneous coronary interventions by radial and femoral routes. *Eur Heart J* 2008;29:2180-7.
3. Lo TS, Nolan J. Radiation protection in relation to transradial cardiac procedures. In: Hamon M, Mcfadden EP, editors. *Trans-Radial Approach for Cardiovascular Interventions*. Carpiquet, France: Europa Stethoscope Media, 2003:381-90.
4. Lo TS, Fountzopoulos E, Freestone B, Gunning M, Nolan J. Radiation exposure and procedural duration: implications for transradial and transfemoral coronary angiography. *Heart* 2007;93 Suppl I:A89.
5. Hetherington SL, Adam Z, Morley R, et al. Primary percutaneous coronary intervention for acute ST-segment elevation myocardial infarction: changing patterns of vascular access, radial versus femoral artery. *Heart* 2009;95:1612-8.

Reply

We would like to thank Dr. Ratib and colleagues for their valuable comments on our recent paper (1) in *JACC: Cardiovascular Interventions*. Dr. Ratib and colleagues expressed concern that the increase in radiation exposure with the radial (versus femoral) artery approach might be due to systematic differences in operator experience with the radial technique. Although we agree that operator experience is likely to have some impact on radiation exposure, it is unlikely to account for all the increase in exposure versus the femoral approach. All the operators included in our study (1) are high-volume operators, and our center performs in excess of 7,600 diagnostic and percutaneous coronary intervention procedures annually. In addition, the RIVAL (Radial Versus Femoral Access for Coronary Intervention) study, a randomized comparison between radial and femoral approaches, demonstrated a 22.5% increase in fluoroscopy time for radial access procedures (2). Although this difference was attenuated in very-high-volume operators, it remained significantly higher than for the femoral approach.

The study by Hetherington et al. (3) should not be seen as a direct contradiction to our results, because it focused on patients specifically excluded from our study (i.e., primary percutaneous coronary intervention cases) and used a different outcome variable (i.e., dose area product; we believe air kerma is more appropriate for this type of study). Furthermore, it is not clear how the operators in this study exhibit a higher level of expertise with the radial technique than those we studied, as Dr. Ratib and colleagues suggested.

The current published data neither offer conclusive evidence that the discrepancy in exposure can be explained by operator (in)experience, as Dr. Ratib and colleagues stated, nor support their claim of a reduction in mortality. Although we do not advocate for or against the radial technique, we believe the current evidence suggests increased radiation exposure related to that technique, independent of operator experience.

*Mathew Mercuri, PhD(C)
Shamir Mehta, MD, MSc
Madhu K. Natarajan, MD, MSc

*Heart Investigation Unit
Hamilton General Hospital
237 Barton Street East
Hamilton, Ontario L8L 2X2
Canada
E-mail: matmercuri@hotmail.com

doi:10.1016/j.jcin.2011.06.002

REFERENCES

1. Mercuri M, Mehta S, Xie C, Valettas N, Velianou JL, Natarajan MK. Radial artery access as a predictor of increased radiation exposure during a diagnostic cardiac catheterization procedure. *J Am Coll Cardiol Intv* 2011;4:347-52.
2. Jolly SS, Yusuf S, Cairns J, et al., for the RIVAL Trial Group. Radial versus femoral access for acute coronary angiography and intervention in patients with acute coronary syndromes (RIVAL): a randomized, parallel group, multicentre trial. *Lancet* 2011;377:1409-20.
3. Hetherington SL, Adam Z, Morley R, et al. Primary percutaneous coronary intervention for acute ST-segment elevation myocardial infarction: changing patterns of vascular access, radial versus femoral artery. *Heart* 2009;95:1612-8.