

EDITORIAL COMMENT

Observations From a Transradial Registry

Our Remedies Oft in Ourselves Do Lie*

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*Our remedies oft in ourselves do lie
Which we ascribe to heaven.*

—Helena, in William Shakespeare's
All's Well That Ends Well (1)

Transradial coronary angiography and intervention has long been considered a niche procedure; however, over the past few years, the excitement around the radial approach has been palpable. Whether it is increased exposure at national conferences with “standing room only” crowds, or the proliferation of radial training programs throughout the United States, it is clear that the radial approach has come into the national consciousness.

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Along with this tide of interest has come a slew of studies examining various aspects of transradial procedures, including the RIVAL (Radial Vs. Femoral Access for Coronary Intervention) trial, the largest randomized trial ever conducted comparing radial and femoral access in 7,021 patients with acute coronary syndrome undergoing coronary angiography or intervention (2). Review of PubMed using the search term “transradial” shows 159 articles between 2004 and 2007; the same search conducted between the years 2008 and 2011 results in 391 articles. Aspects of radial procedures long considered dogma have been challenged by many of these studies and have taken the radial world of “tips and tricks” into a new era of evidence-based medicine. Compared with femoral access, radial access has consistently been shown to be associated with lower resource use (3–5) lower risk for vascular complications (2), and greater patient satisfaction (2,4).

Despite this abundance of recent data, there are still many unresolved issues; additional studies that refine radial technique, delineate advantages and disadvantages, and further improve the safety of the procedure are welcome. In this issue of *JACC: Cardiovascular Interventions*, Uhlemann et al. (6) present data from the Leipzig Prospective Vascular Ultrasound Registry in Radial Catheterization examining the association between sheath size and radial arterial complications. In their observational analysis of 455 patients, the rate of radial artery occlusion (RAO) with 6-F sheaths was significantly higher than with 5-F sheaths. They also treated patients with “symptomatic” RAO with a short course of subcutaneous low molecular weight heparin and found that there was a higher rate of recanalization compared with patients who had “asymptomatic” RAO not treated with anticoagulation. Finally, the investigators conclude that the rate of RAO in the registry is much higher than previously reported.

The investigators should be congratulated for developing a prospective registry and reporting their findings. But what are the lessons that interventionalists can learn from this study? Should the findings affect clinical care? Let us discuss the major findings and put them into the context of what is already known about RAO and its prevention. In the Leipzig Registry, the rate of RAO ranged from 13.7% in the 5-F sheath group to 30.5% in the 6-F sheath group. The relationship between sheath size and RAO has been previously shown in a randomized trial (7), and the results by Uhlemann et al. (6) confirm the randomized trial findings. However, what is concerning about the findings from the Leipzig Registry is that the rates of reported RAO are substantially higher than previously reported (Fig. 1) (8–13). Therapeutic approaches associated with a reduced risk for RAO (“RAO-avoidance strategies”) are listed in Table 1. RAO is a known risk of transradial catheterization, and the use of RAO-avoidance strategies should be considered “best practice.” In the study by Uhlemann et al. (6), 85.5% of the patients did not undergo percutaneous coronary intervention and thus received only 2,500 units of unfractionated heparin. Given that the body mass index of the registry patients was >25 kg/m², thereby defining them as “overweight” or “obese,” this is a significant underdosing of anticoagulation and clearly not enough to reduce the risk of RAO. Two randomized trials have shown that maintaining antegrade radial artery flow during radial artery compression—so-called patent hemostasis—significantly reduces both early and late RAO (11,12). The investigators do not report the duration of radial artery compression and did not provide any confirmation that patent hemostasis of the radial artery was actually achieved. Thus, it appears that best practices to reduce RAO were not followed in the registry, and the unacceptably high rates of RAO in their study should be interpreted with caution.

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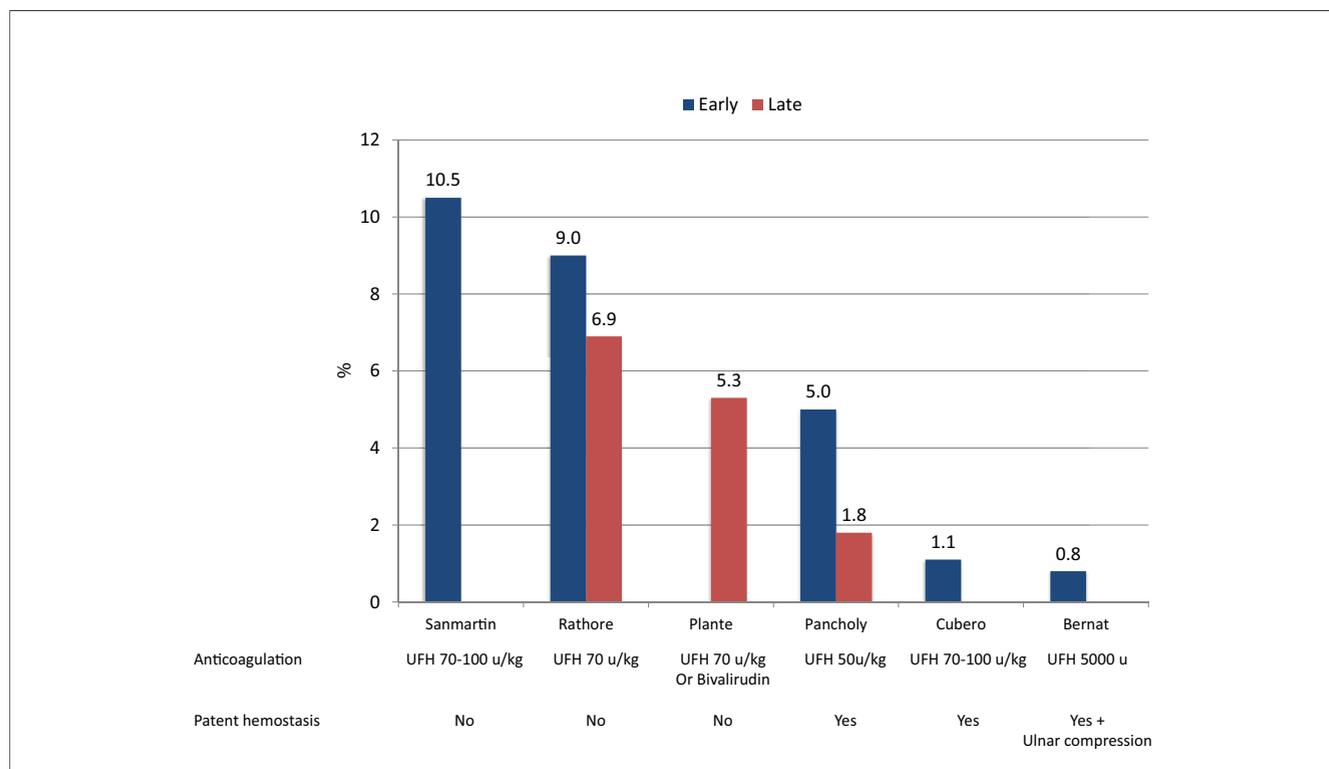


Figure 1. Rates of RAO in Previously Published Studies According to RAO-Avoidance Strategies Used

Early = 7 days post-procedure in Sanmartin et al. study (8); hospital discharge in Rathore et al. study (9); 24 h post-procedure in Pancholy et al. study (11); 24 to 72 h post-procedure in Cubero et al. study (12); and 4 to 5 h post-procedure in Bernat et al. study (13). Late = 4 to 6 months post-procedure in Rathore et al. study (9); 4 to 8 weeks in Plante et al. study (10); and 1 month post-procedure in Pancholy et al. study (11). RAO = radial artery occlusion; UFH = unfractionated heparin.

The second part of the study by Uhlemann et al. (6) included the use of short-term anticoagulation for patients with “symptomatic” RAO. These patients were treated with either weight-adjusted or lower dose low molecular weight heparin for a mean of 6 days, and the recanalization rate 9 days after catheterization was 31.5% compared with 5.4% among patients not treated with low molecular weight heparin. This is a strategy that has been previously described (14), but it and the results from the Leipzig Registry raise several questions: What are the symptoms of RAO? Were the symptoms reported in the study due to RAO? Moreover, are the results of the study compelling enough to recommend a short course of low molecular weight heparin

for patients with RAO? The conventional wisdom among radial enthusiasts is that RAO is asymptomatic because of collateral flow in the hand from the ulnar artery through an intact palmar arch (among patients with normal Allen or Barbeau tests). Although this is generally true, there is plenty of evidence to suggest that not all RAO is clinically silent. The radial artery supplies blood flow to the hand, and RAO would be expected to result in hand ischemia manifest as blanching or cyanosis of the first 3 fingers or entire hand, ischemic ulceration, and hand pain (15). The patients in the study by Uhlemann et al. (6) reported pain in the forearm and thenar eminence, loss of handgrip strength, or paresthesias. There were no cases of critical limb ischemia. Based

Clearly Reduce Risk	Likely Reduce Risk	Limited Effect
Anticoagulation*	Enoxaparin†	Sheath length
Patent hemostasis	Hydrophilic sheaths	Sheathless guide catheters
Sheath diameter < arterial diameter	Routine use of spasmolytic drugs	
Limiting the number of times the same radial artery is accessed	Limited duration of arterial compression	

*Studied strategies include unfractionated heparin 70 U/kg up to 5,000 U and bivalirudin 0.75 mg/kg bolus followed by 1.75 mg/kg/h infusion during procedure. †Studied strategy includes enoxaparin 60 mg via the radial arterial sheath.

on what is known about radial artery anatomy and RAO, it is unlikely that these symptoms were solely due to RAO, but instead they were more likely due to radial artery thrombosis with overlying inflammation (arteritis) (16). In terms of the treatment strategy, only symptomatic patients were treated with anticoagulation, and all of them received therapy. Thus, there was no true control group. In addition, although no data are provided, it is highly probable that at least a portion of these symptomatic patients were treated with pain medications, some of which may have included nonsteroidal anti-inflammatory agents. These, along with corticosteroids, may be effective at treating the inflammation and pain. Whether they can increase radial artery patency is unknown and should be evaluated in future studies. Therefore, based on the results presented, it is impossible to assess the efficacy of anticoagulation in patients with RAO and at best, these data should be interpreted as hypothesis-generating. Recent data suggest that the use of ulnar compression increases the rate of radial artery recanalization in patients with RAO (13) and such a strategy may be more effective than anticoagulation at establishing radial artery patency.

In the Leipzig Registry, all patients underwent post-procedure ultrasound to assess for radial occlusion. However, pre-procedure ultrasound of the radial and ulnar arteries as well as the antecubital fossa may provide valuable information on arterial anatomy, such as diameter, tortuosity, or presence of loops, which can help guide clinical decision making regarding choice of right radial versus left radial access and/or sheath/catheter size. For patients who require large-bore guide catheters to accommodate large devices, for simultaneous 2-stent techniques, or for patients with smaller diameter radial arteries, sheathless techniques could be used (17). However, it is important to note that RAO is not eliminated when using sheathless guides; patent hemostasis and adequate anticoagulation are still necessary (18).

Despite its marked safety advantage, cost-effectiveness, and potential mortality benefit in high-risk patients (19) compared with the femoral approach, the radial approach is not without limitations. RAO should be recognized as an adverse consequence and routine assessment for post-procedure RAO should be an integral part of a catheterization laboratory's quality improvement program. The value of studies such as the one by Uhlemann et al. (6) is in reminding us that a cavalier attitude to management of the radial access site is no longer acceptable. It is incumbent on interventionalists to reduce the risk for RAO. When RAO does occur, the first place to look is at our own practice.

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