

## Bleeding Edge Technology

### Retroperitoneal Hemorrhage and Its Implications for Transradial Access

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Retroperitoneal hemorrhage (RPH) is the most dreaded form of access site bleeding that can complicate percutaneous coronary intervention (PCI). It is associated with high in-hospital mortality (as high as 12%), high transfusion requirements, and prolongation of hospital stay.<sup>1-4</sup> Early recognition of RPH is confounded by the fact that the symptoms are vague and nonspecific, often consisting of lower abdominal, groin, and back pain,<sup>3</sup> which are common among patients who are supine on the procedure table, and recognition is often delayed until the patient is significantly volume depleted and often hypotensive. In 1 series, 58% of RPHs were observed >90 minutes after completion of the PCI procedure, and 27% were observed >3 hours later.<sup>3</sup> Although not all RPHs are consequences of access site puncture, and may occasionally be the response of friable and diseased vessels to an anticoagulation regimen, the vast majority are mechanical in origin. Most occur as a result of femoral artery or external iliac puncture at or above the border of the inferior epigastric artery or above the femoral head.<sup>5</sup> Precise localization of the puncture is particularly concerning as in 1 study, even among experienced operators, >10% of femoral punctures involved a vessel other than the common femoral artery.<sup>6</sup>

#### See Article by Kwok et al

Thankfully, RPH is uncommon, and its frequency has been decreasing. In a report published in 2008, Doyle et al<sup>1</sup> reported on major vascular access bleeding among 17 901 patients undergoing PCI between 1994 and 2005. During this time, the frequency of RPH fell from 0.8% to 0.3%. The investigators attributed this change to smaller sheath size, reduced intensity and duration of periprocedural heparin anticoagulation, and shorter procedure times.<sup>1</sup> The report by Kwok et al<sup>7</sup> in the current issue of *Circulation: Cardiovascular Interventions* should be viewed as the next iteration of this series, as it chronicles this decrement into the current era of PCI. Kwok et al<sup>7</sup> report on the frequency and management of RPH among 511 106 consecutive patients enrolled in the British Cardiovascular Intervention Society database who underwent PCI between 2007 and 2014. This database has

the advantage of including all patients undergoing PCI in the United Kingdom. During this period, a total of 291 patients with RPH were identified and characterized. The frequency of RPH declined from 0.09% in the first year to 0.03% in the last. Declines were most notable among patients in what were previously recognized as the highest risk subgroups: patients with ST-segment-elevation myocardial infarction, women, and the elderly (age >80 years). What distinguishes this series from prior reports of RPH is that during this 8-year period, the use of transradial access for PCI increased from 21% to 74% within the registry. The curve illustrating this rise stands in stark juxtaposition to that showing the fall in RPH; the 2 lines are nearly perpendicular. In the current report, the odds ratio for developing RPH was 19.66 (95% confidence interval, 11.22–34.33). In other words, >95% of RPHs were access site related. Further support indicating that the transition from transfemoral to transradial access was responsible for the decreased incidence of RPH comes from the observation that the rate of RPH for the transfemoral route remained constant at ≈0.1% during the 8-year period while that for the transradial approach also remained constant at <0.01%.<sup>7</sup> The latter findings would make it difficult to argue that further changes in femoral sheath size and technique or antithrombotic strategy akin to those observed by Doyle et al<sup>1</sup> were responsible.

The evidence base that ultimately defines standard clinical practice usually relies on data from select populations in randomized clinical trials that are ultimately confirmed in broader populations in real-world settings. Two large randomized clinical trials (and several smaller ones) have studied transradial PCI in patients with acute coronary syndromes. The first one, RIVAL (Radial Versus Femoral Access for Coronary Intervention), found that vascular access complications were considerably less common when the radial approach was used and that bleeding tended to be less common, but the trial did not find the composite of bleeding and ischemic events to be less frequent with transradial catheterization.<sup>8</sup> In the second trial, MATRIX (Minimizing Adverse Haemorrhagic Events by Transradial Access Site and Systemic Implementation of AngioX), not only was access site bleeding less common in the transradial versus transfemoral cases, but a composite of ischemic and hemorrhagic events was also reduced by ≈25% and all-cause mortality was reduced by 28%.<sup>9</sup> In both trials, the benefits were observed primarily in centers with more extensive transradial experience. These points have been reiterated multiple times. Extension of these trial findings to a broader population was provided by the authors of the current study. In an earlier analysis of 444 853 PCIs within the British Cardiovascular Intervention Society database, they reported that performance of transradial PCI was independently associated with a decreased risk of mortality (odds ratio, 0.70;

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95% confidence interval, 0.66–0.74), and they estimated that actual adoption of the technique resulted in a total of 450 fewer deaths between 2005 and 2012. Moreover, the mortality reduction was greatest in areas of the United Kingdom where transradial PCI was most frequent and much less pronounced in regions where this approach was least frequently used. These estimates do not reflect predictions of lives that might have been saved, but rather are estimates of deaths that were actually prevented.<sup>10</sup> Although the randomized trials placed what were at the time fairly rigorous restrictions on operator experience with transradial PCI (minima of 50 diagnostic or interventional cases in RIVAL<sup>8</sup> and 75 interventions in MATRIX<sup>9</sup>), the British Cardiovascular Intervention Society data represent the experience of all PCI operators in the registry and include their learning curves.

A recent update to the European Society of Cardiology assigned a class I indication to transradial PCI in patients with acute coronary syndromes.<sup>11</sup> Although this approach now seems to be used in the majority of patients around the world, most estimates suggest that only about a third of patients undergoing PCI in the United States do so via the transradial approach.<sup>12</sup> Multiple causes have been proposed for this transoceanic difference. However, the most likely explanation is that a considerable amount of energy, a fair amount of evidence, and a hefty dose of courage are required to make major changes in the way an experienced operator performs a procedure with which he or she is already comfortable. It is even conceivable that the benefit of transradial PCI and the subsequent reduction in RPH may be even greater in the United States. This would seem likely given several dynamic factors including the increasing number of patients with atrial fibrillation who require oral anticoagulants (expected to reach nearly 9 million by 2020<sup>13</sup>), the increasing number of patients with ST-segment–elevation myocardial infarction who undergo primary PCI (>600 000 between 2009 and 2015<sup>14</sup>), and perhaps most pointedly, the growing epidemic of obesity (nearly 40% of adults and 20% of children)<sup>15</sup> which would predict increasing complexity of transfemoral access.

Taken alone, reduction in a rare event is rarely adequate to justify a broad shift in practice. However, RPH is the most visible and perhaps most feared manifestation of the broader spectrum of access site complications that are avoidable when the transradial approach is selected. Although mortality statistics can rapidly become overwhelming, they are often convincing on an intellectual rather than a visceral level. Often, they seem less credible when a clear causal mechanism cannot be identified. In contrast, events such as RPH are likely to provoke a more rapid response because they are usually fairly dramatic occurrences, occur while the patient is still being observed in hospital, and are more clearly procedure related rather than simply a consequence of the patient's underlying illness. In other words, the responsibility falls more squarely on the shoulders of the operator. If RPHs are viewed as the leading edge of the spectrum of periprocedural bleeding, perhaps the demonstration in the current study that these events are virtually eliminated after adoption of the transradial approach may provide impetus to foster wider adoption of this technique.

## Disclosures

None.

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