Ultrasound guided vascular access in the electrophysiology lab: should it be a standard of care?

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Received: 22 February 2017 / Accepted: 5 March 2017 / Published online: 22 March 2017
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Catheter directed electrophysiology (EP) studies and ablations have emerged as common and widely accepted therapies for various types of arrhythmia. The femoral vasculatures serve as access sites, in the majority of instances. Despite the need for multiple venous sheath placement within a single vein, early reporting of vascular related bleeding complications was naught [1, 2]. With increasing frequency of complex procedures such as pulmonary vein antral isolation (PVAI) performed with maintenance of peri-procedural anticoagulation and those necessitating arterial access, vascular complication rates rose to 1–2% [3, 4]. In spite of advancements in catheter-based EP procedures in the past two decades leading to improved efficacy and overall safety, the incidence of vascular complication has remained unchanged [5, 6].

Vascular complications directly impact patient morbidity and increase health care costs. They are usually the consequence of inadvertent arterial puncture and cannulation, particularly when using large diameter sheaths and/or with aggressive anticoagulation. Baum et al. described overlap of the femoral artery (CFA) and common femoral vein (CFV) along some portion of their course in two-thirds of patients studied, predisposing to simultaneous puncture of the overlapping artery during intended venous cannulation and resulting in arteriovenous fistula formation. High bifurcation of the CFA at the level of the mid femoral head was also found to be not uncommon [7]. Such anatomic variation cannot be appreciated without real-time imaging, and increases risk for pseudoaneurysm formation due to accidental puncture of the superficial femoral artery [8].

Real-time ultrasound guidance (US) allows direct visualization of vascular structures, and its use has been shown to significantly improve procedural success and/or reduce complications. US has been endorsed in Practice Guidelines put forth by various societies [9–11]. Yet in spite of wide acceptance in the medical and surgical communities, US guidance has not been routinely utilized in all EP labs. The first reported comparative study was from our institution and included 3510 patients undergoing PVAI, requiring multiple femoral venous accesses [12]. US guided femoral venous access reduced total and major vascular complications by 3-fold and 7-fold. This result was even more significant, given that 73% of patients undergoing US guided venipuncture had an INR ≥ 1.9 on the day of the procedure. This was in comparison with the non-US guidance group, in whom only 9% of patients had an INR ≥ 1.9 on the day of the procedure. This finding is a testament to the protective effect of US, apparent even in the cohort at greater risk for bleeding. Similar improved outcomes have been corroborated by publications from three other institutions, forming a robust experience that confirms the effectiveness of US in reducing vascular complications during EP procedures [13–15]. A summary of these four publications by Sobolev et al., including over 4000 subjects, showed a 60% reduction of major vascular complications and 66% reduction of minor ones [16].

The article by Wiles and colleagues in the current issue provides excellent practical description of ultrasound guided femoral venous access in the EP lab. We applaud the authors on their clear outline of steps for implementing this important technique. US provides direct anatomic visualization of vascular relationships, simplifying the process of vascular access even in challenging situations, and ultimately minimizes complications. We agree with the authors that this technique is readily accessible in EP labs that already possess a high-quality echocardiography console for intracardiac echo

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imaging. For those without, US imaging can be attained via a portable and relatively inexpensive system. In our experience, this technique is easily mastered and requires only slight modification to the traditional approach of anatomic guided vascular access. While the authors focus upon the use of US guidance for femoral venous access, it is important to recognize that the same method can facilitate femoral arterial access. Particularly, in patients with high common femoral artery bifurcation, US provides direct anatomic visualization, improves arterial cannulation success, and reduces vascular complications [17, 18]. Ultrasound guidance has been routinely used when gaining vascular access from any site in all EP procedures at our institution, since July 2008. The occurrence of major vascular complications is 0.4%, among 12,680 catheter-based procedures performed in our EP labs from when routine US use was implemented till present. Even in spite of the high risk nature of PVAI and procedures that require arterial access, the vascular complication rates remain significantly lower, at 0.5%, than that reported by both historical and contemporary studies in the literature.

Real-time ultrasound guidance for vascular access is already recommended by some professional organization guidelines [9–11]. The assemblage of data from multiple centers now show a clear reduction in vascular complications when US guidance is used for gaining femoral venous access with EP procedures. The technique requires equipment that is readily accessible in a standard EP lab. Moreover, it is a skill that is easily mastered. Given this, we believe it is high time that US guidance in gaining femoral vascular access becomes a recommended standard of care in the EP community.

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