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## Minimizing the Risk of Intravascular Injection during Ultrasound-guided Peripheral Nerve Blockade

*To the Editor:*—We read with interest the recently published case reports by Loubert *et al.*<sup>1</sup> and Zetlaoui *et al.*<sup>2</sup> regarding suspected inadvertent intravascular injection of local anesthetic (LA) and LA toxicity during ultrasound-guided axillary brachial plexus blockade. While ultrasound likely reduces the risk of accidental vascular puncture compared with “blind” peripheral nerve stimulation,<sup>3</sup> these two case reports demonstrate that the risk of intravascular injection persists despite ultrasound guidance.<sup>1,2</sup> In 2006 and 2007 at the Toronto Western Hospital, we performed 1,797 ultrasound-guided brachial plexus blocks without any sign or symptom of LA toxicity. Good fortune notwithstanding, there are several important principles that merit thoughtful consideration to improve detection of accidental intravascular injection and possibly prevent LA toxicity during ultrasound-guided peripheral nerve blockade. We believe that the most reliable feature during real-time ultrasound imaging indicative of intravascular injection is the failure to visualize a hypoechoic fluid bolus on the ultrasound monitor during and/or after injection of as little as 1 ml of injectate. Indeed, we customarily initiate LA injection with a 1-ml bolus to exclude intravascular or intraneural<sup>4,5</sup> needle tip placement before proceeding with 5-ml increments of injectate. Visualization of the needle tip does not preclude intravascular injection *per se*; it is the real-time observation of hypoechoic fluid causing tissue dispersion that most consistently excludes intravascular injection. The absence of a discernible extraneural hypoechoic fluid bolus on the ultrasound monitor means that either the needle tip is intravascular or the plane of imaging is inaccurate.

We are also hesitant to recommend the use of ultrasound for perivascular block techniques as described by Loubert *et al.*<sup>1</sup> Rather, we contend that perineural LA deposition is the safest application of ultrasound technology. There can be multiple veins traveling alongside landmark pulsatile arteries, especially in the axilla. Veins are exquisitely collapsible with even the slightest amount of pressure applied by the transducer to the skin, and can therefore vanish from sonographic view, fooling even the most experienced providers, as demonstrated by these two recent case reports.<sup>1,2</sup> We therefore use systematic scanning of the intended block site before needle insertion. Our

systematic sonographic survey includes sliding the transducer distally and proximally to trace the target nerve along its expected course and examine the surrounding vasculature and tissues. Scanning is performed with varying degrees of pressure, with and without the use of color Doppler, to identify any hazards that may cross the planned trajectory of the needle. In addition, applying pulse wave Doppler over a nearby vessel during perineural injection may help to detect inadvertent intravascular injection by the characteristic high-pitch sound of turbulent flow associated with a sudden rush of fluid. Finally, however contentious,<sup>6</sup> we strongly believe that patients undergoing ultrasound-guided peripheral nerve blockade should remain awake with judicious sedation so that signs and symptoms of LA toxicity can be recognized, communicated, and treated immediately upon onset.

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## Ultrasound-guided Peripheral Nerve Blocks and Intravascular Injection

*To the Editor:*—In the April issue of *ANESTHESIOLOGY*, Loubert *et al.*<sup>1</sup> and Zetlaoui *et al.*<sup>2</sup> reported about possible intravascular injection after an ultrasound-guided axillary block. Their reports highlight the need for vigilance in the performance of ultrasound-guided blocks. This and similar reports of complications<sup>3-5</sup> after ultrasound-guided regional blocks reinforce the need for proper training, and the understanding that ultrasound, after all, is only a tool. Any tool should be used with full cognizance of its limitations. The major limitations of ultrasound-

guided blocks are technical,<sup>6</sup> including the angle of incidence, needle visualization, and possibly artifacts.<sup>7,8</sup> Training in the proper holding of the probe while analyzing and while injecting help overcome some of the complications. Sometimes even with proper training, complications do occur.<sup>4</sup>

The reports<sup>1,2</sup> have similarities and differences besides the ultrasound-guided axillary block and intravascular complication leading to seizure. One of them described the changes in vital signs,<sup>1</sup> and the