other reports some technical difficulties in getting the data.\textsuperscript{2} Needle visualization was an issue in both reports. Using an out-of-plane approach may have prevented proper needle visualization because only a cross section of the needle anywhere in the length of the needle may be seen and mistaken for the tip, although tissue movement may have been seen. With the in-plane approach used in the other report, needle artifacts may have prevented proper visualization, which will only be discerned when the injectate spread is noticed. Both reports mention distortion of tissues, one due to probe pressure and the other due to local anesthetic already injected. There is no documentation in either of the reports of having seen other vessels in the proximity before the actual needle placement. Assuming they used color flow Doppler, the default settings for the color Doppler cannot detect small vessels unless the color velocity range and the angle of steering are adjusted. It is possible that they did not visualize the needle during the performance of the block and hence did not adhere to one of the safety principles that they have mentioned. Any of these situations could have led to the complication. Most importantly, they were both performed by residents.

My practice is to perform a preliminary scout scan, including a color flow study, to visualize the target and its associated neighboring structures and demonstrate to the trainee. This permits proper guidance during the actual performance of the block. Could they have avoided the intravascular injection by using landmarks or nerve stimulation? Probably not.

To elevate ultrasound-guided to the next level and call it a “bulletproof technique” by the more “vocal proponents”\textsuperscript{6} is a dream awaiting fruition with some more technological advancements and changes in needle design. In the meantime, adhering to some basic principles will avoid potential complications. To blame the ultrasound for complications due to technical and possibly inadequate training is, in my opinion, tarnishing a useful technique without understanding its advantages and mainly its limitations. There is an increasing need for a proper curriculum and training to fully understand the technique, the potential pitfalls, and the complications of ultrasound-guided blocks.\textsuperscript{9}

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In Reply—We thank Drs. Brull et al., Shankar, and Nelson for responding to our case report of accidental intravascular injection of local anesthetic and epinephrine during ultrasound-guided perivascular axillary block.¹

The suggestions provided by Dr. Brull’s group for improved safety during ultrasound-guided axillary block seem reasonable. The large case series of axillary blocks recently published by Dr. Brull et al. bears witness to their experience of significantly reduced (but not completely eliminated) rates of accidental intravascular injection with the adoption of ultrasound guidance compared with the blind transarterial or neurostimulator-guided techniques used and taught until recently at their institution.² Further large case series such as theirs, or the establishment of a complication registry will be needed to quantify the relative safety benefits of various preblock precautions and ultrasound-guided approaches to axillary blockade (including perivascular vs. perineural injection). However, there seems to be little doubt that future improvements in block safety lie in the optimal application of ultrasound training and imaging, and technical advances including echogenic atraumatic needles specifically designed for regional anesthesia.

To Dr. Shankar, the problems we wished to highlight in our case report include modification of anatomical relations by injection of local anesthetic leading to migration of the needle tip into a blood vessel, and the existence of small, compressible, low-flow veins that are difficult to detect with even the most sophisticated ultrasonic equipment, experienced operators, and careful scanning techniques. These problems may be mitigated by technical and educational improvements, but we wished to emphasize that continued adherence to traditional safety rules such as fractionated injection is necessary even in the ultrasound age of regional anesthesia. Blaming ultrasound guidance for the complication we present in our report would constitute in our opinion a misinterpretation of the events we related.

Dr. Nelson brings up the interesting point that 75–100 mg lidocaine would not be expected to result in the neurologic symptoms presented in our report, and proposes the alternative diagnosis of hypertensive encephalopathy or reversible posterior leukoencephalopathy secondary to the epinephrine in the block solution. Although we agree that the dose of lidocaine administered intravenously was relatively small (due to fractionated injection with ultrasonographic confirmation), we believe the time course of our patients’ symptoms (minutes, rather than days for the other evoked diagnostic possibilities) are more consistent with a high but transient peak concentration of lidocaine, possibly potentiated by the epinephrine in the solution.³

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