Feeling Blocked? Another Pain Management Tool in the Emergency Department

Casey Wilson, MD, RDMS*

*Corresponding Author. E-mail: cwilso99@jhmi.edu, Twitter: @CaseLWilson.

Why does pain management matter?

As emergency physicians, we are tasked with managing pain as a cornerstone of compassionate care, often under challenging circumstances: patients who are hypotensive from polytrauma, elderly, or with opioid abuse histories. Great variation exists in the use of analgesic strategies in emergency departments (EDs) across the country, but the term *oligoanalgesia* is widely used to describe that analgesics are commonly delayed and underused in emergency pain management.1,2

In the climate of a national opioid crisis and increased scrutiny of analgesic prescribing, emergency physicians are often called on to be vigilant of the statistic that in 2016, more than 42,000 deaths in the United States were related to opioid overdoses.3 Although commonly caused by accidental overdoses for recreational purposes, in the therapeutic setting opioid overdose is also possible, and untoward adverse effects of opioid analgesics are commonplace in emergency care. Nonopioid and adjuvant analgesics such as ketamine have gained increasing attention for their utility in procedures and acute pain management in the ED.4 Ultrasound guided regional anesthesia can also be used as part of a multimodal analgesic strategy for fractures,5-10 joint reductions,11-16 complex laceration repairs,17,18 chest tube placement,19 and even paraphimosis reductions (Table 1).20 In geriatric patients with femur fractures, nerve blocks significantly reduced the amount of opioid analgesics required.21,22 Ultrasound guided regional anesthesia is an emerging skill within emergency medicine, and several small pilot studies have demonstrated feasibility and low rates of complications to support more widespread use.23

SAFETY IMPLEMENTATION

It has been well established that nerve blocks should be placed under ultrasound guidance to decrease complications and improve success rates and patient safety.2-7,9,12-14,21,23-27 More than 30% of nerve blocks will fail by anatomic landmarks alone, and ultrasound guidance has led to greater than 95% block success rates.16,21 For more proximal brachial plexus blocks, ultrasonography use decreases the risk of pneumothorax, intravascular injection, and systemic toxicity.1,28 With this in mind, it is difficult to make a case for performing nerve blocks without an ultrasound adjunct.

Evidence supporting the safety and efficacy of ultrasound guided regional anesthesia continues to emerge across specialties. Anesthesia has been using this skill for some time, and now the pediatric and orthopedic literature also suggests a role for its routine incorporation into emergency pain management.22,23,29-32 When applied to emergency medicine practice, nerve blocks are the ideal alternative to procedural sedation in an American Society of Anesthesiologists patient with a painful musculoskeletal complaint. At times, interdepartmental politics can encumber progress, but an improved understanding of current attitudes and practice helps to transcend interdepartmental barriers and may allow collaboration. Some EDs have been successful in developing a multidisciplinary nerve block protocol in alliance with their anesthesia and orthopedic colleagues.22 One such protocol is shown in Figure 1.

As with all procedures, one must understand and balance the associated risks and benefits. Nerve blocks are generally safe, but in patients at risk for compartment syndrome, the first sign of pain could be masked. Although the risk of this is exceedingly low, these patients would not be ideal candidates for a peripheral nerve block. One of the most dreaded complications of peripheral nerve blockade is local anesthetic systemic toxicity, with an incidence of less than 1 in 1,000 operating room–performed nerve blocks. Ultrasonographic guidance decreases this risk by approximately 65%, mainly because of direct needle visualization to avoid the vasculature and infiltration of smaller anesthetic volumes. Any practitioner performing ultrasound guided nerve blocks...
needs to be familiar with the appropriate diagnosis and treatment of local anesthetic systemic toxicity.28 The American Society for Regional Anesthesia has published a checklist for the administration of intravenous lipid emulsion in the management of local anesthetic systemic toxicity, and this should be routinely available for any practitioner performing peripheral nerve blocks.24,33

### APPROPRIATE UTILIZATION

Nerve blocks have been well established in the anesthesia literature, and a recent exhaustive review supports that they offer excellent analgesia, faster recovery, decreased length of stay, and improved cardiopulmonary function postoperatively.1 Furthermore, ultrasound guided nerve blocks are increasingly being recognized for their simplicity and efficacy in the ED setting. One study found that the use of nerve blocks for traumatic limb injuries reduced the need for procedural sedation, took a median of 9 minutes to complete, and had no immediate complications.21 Emerging literature is demonstrating that more commonly performed blocks such as the femoral nerve block are safe, easy to learn and perform, and associated with decreased morbidity compared with intravenous opioid therapy for pain control, especially in elderly populations.21-23,25,34-37 One observational study in the ED reported no procedural complications with the femoral nerve block for patients with hip fractures.34 In the perioperative setting, this block has been shown to have a moderate reduction in the severity and duration of inpatient delirium, which is known to increase 30-day mortality.36

Military data suggest that more adequate pain control in the acute setting may reduce a “windup phenomenon” that can contribute to future chronic pain and posttraumatic stress disorders for these patients.38 International emergency medicine presents many opportunities for

### Table 1. Example of ED applications for ultrasound guided regional anesthesia.

<table>
<thead>
<tr>
<th>Location</th>
<th>Nerve</th>
<th>Indication</th>
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<tbody>
<tr>
<td><strong>More commonly performed nerve blocks in the ED</strong></td>
<td></td>
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<tr>
<td>Upper extremity</td>
<td>Radial nerve</td>
<td>Distal radius fracture</td>
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<td></td>
<td>Ulnar nerve</td>
<td>Boxer’s fracture</td>
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<td></td>
<td>Median nerve</td>
<td>Fifth digit injury</td>
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<tr>
<td>Lower extremity</td>
<td>Femoral nerve</td>
<td>Hip/femoral shaft fractures</td>
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<tr>
<td></td>
<td>Sciatic nerve</td>
<td>Patellar fracture/subluxation, proximal tibia fractures</td>
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<td></td>
<td>Posterior tibial nerve</td>
<td>Abscess/laceration to anteromedial thigh</td>
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<td></td>
<td></td>
<td>Ankle dislocation</td>
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<td></td>
<td></td>
<td>Achilles tendon rupture</td>
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<td></td>
<td></td>
<td>Calcaneal fracture</td>
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<td></td>
<td></td>
<td>Foreign body/laceration to sole of foot</td>
</tr>
<tr>
<td><strong>Less commonly performed nerve blocks in the ED</strong></td>
<td>Head</td>
<td>Laceration to posterior half of the scalp</td>
</tr>
<tr>
<td>Head</td>
<td>Occipital nerve</td>
<td>Laceration/abscess to ear lobe/helix</td>
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<tr>
<td>Neck</td>
<td>Greater auricular nerve</td>
<td>Clavicle fracture</td>
</tr>
<tr>
<td></td>
<td>Superficial cervical plexus</td>
<td>Submandibular abscess</td>
</tr>
<tr>
<td></td>
<td>Interscalene brachial plexus block</td>
<td>Upper arm or deltoid laceration/abscess</td>
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<tr>
<td></td>
<td>Supraclavicular brachial plexus</td>
<td>Shoulder dislocation</td>
</tr>
<tr>
<td>Trunk</td>
<td>Suprascapular nerve</td>
<td>Proximal humerus fracture (not humeral shaft fracture: risk of radial nerve injury)</td>
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<tr>
<td></td>
<td>Intercostal nerve</td>
<td>Elbow or wrist dislocation</td>
</tr>
<tr>
<td></td>
<td>Dorsal penile nerve</td>
<td>Shoulder dislocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adhesive capsulitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chest tube placement</td>
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<td></td>
<td></td>
<td>Isolated rib fracture</td>
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<tr>
<td></td>
<td></td>
<td>Priapism</td>
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<tr>
<td></td>
<td></td>
<td>Paraphimosis</td>
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</tbody>
</table>

IJ, Internal jugular.
residents and emergency physicians to practice in resource-limited settings. Nerve blocks have proven efficacy in combat and disaster settings, and the challenges of analgesia inherent in low-resource settings lend themselves to ultrasound guided regional anesthesia. With the increasing portability and affordability of newer ultrasonographic technology, nerve blocks have great potential to improve pain control in military and austere settings. One could surmise that the proven utility of nerve blocks in combat settings may warrant potential in domestic EDs with far more resources available, much like Medical Anti-Shock Trousers in the past, whose use was guided largely by limited military data.

Despite the exciting breadth of options for using ultrasound guided nerve blocks in the emergency setting, this skill is not routinely taught to all emergency medicine residents. Obstacles to incorporating this skill training into emergency medicine residency programs include lack of faculty training, interdepartmental political barriers, and perceived decreased efficacy compared with alternative analgesic modalities. More commonly performed nerve blocks, such as forearm and femoral nerve blocks, are promoted in practice by a wealth of supporting medical evidence and their relative ease (Table 1).

**Figure 1.** Sample femoral nerve block protocol.

**Training and Education Resources**

In 2012, the Accreditation Council for Graduate Medical Education mandated that emergency ultrasound be a core competency for graduating emergency medicine residents, and later included it as one of the 23 milestones for graduates of emergency medicine residencies, instituted in 2013. Emergency ultrasound is considered a skill integral to the practice of emergency medicine, and the American College of Emergency Physicians, the Society for Academic Emergency Medicine, the Council of Emergency Medicine Residency Directors, the American Academy of Emergency Medicine, and the American Institute of Ultrasound in Medicine have recognized and supported its integration into emergency medicine residency curricula. Trainees graduating today should complete a benchmark of 150 to 300 total emergency ultrasonographic examinations. Although nerve blocks are not specifically addressed within the milestones, they would fall under the procedural US application, with a minimum of 5...
quality-reviewed examinations. Given the breadth and availability of resources available for training programs to institute emergency ultrasound education, ultrasound guided regional anesthesia should simply be added to the core emergency ultrasound content and become a part of every emergency physician’s pain management armamentarium.

Consensus guidelines for anesthesia residents require a minimum of 20 total ultrasound guided nerve blocks to demonstrate competency. A national survey of emergency ultrasound directors and program directors indicated that most emergency medicine residents are learning nerve blocks in the clinical setting within their department, so 20 blocks could realistically be achieved during a 3-year emergency medicine training program. Given the demand on time in a busy academic ED, ready access to free open access medical education resources can aid clinicians in the appropriate selection and use of nerve blocks (Table 2). For further training in tertiary care centers with regional pain or anesthesia departments, emergency medicine residents could consider an elective rotation to gain experience with this skill in the perioperative and ICU settings. Additionally, some emergency medicine residencies require an orthopedics rotation, and opportunity exists to incorporate ultrasound guided nerve blocks into these curricula while caring for patients in the preoperative setting.

Outside of simulation and elective time, most emergency medicine residencies use an ultrasound quality assurance program to provide feedback and assess resident progress. Ultrasound guided regional anesthesia can be incorporated into any academic program’s currently existing quality assurance structure; when combined with asynchronous learning tools, this could ensure skill retention and enhance procedural success.

Current faculty members may lack formal training in ultrasound guided regional anesthesia and be less comfortable when supervising this procedure. Ideally, a standard education pathway would be developed at both the faculty and resident level. At many institutions, the emergency ultrasound faculty tend to champion regional anesthesia training initiatives, and some are incorporating this education early into residency training. Faculty education opportunities and credentialing pathways are few and far between; these would be pivotal to disseminate best-practice techniques and encourage widespread use in academic programs. Proper technique is imperative, and regional anesthesiologists often learn this skill in the cadaver laboratory, which could easily be assimilated into any emergency medicine cadaver laboratory workshop (Figure 2). More advanced or proximal blocks, such as brachial plexus blocks, should be learned under the supervision of experienced operators, or perhaps performed in conjunction with a regional pain consult team.

**SKILL ASSESSMENT**

As with any procedure, teaching can be time consuming and costly, and questions arise about assessing competence. No consensus exists in regard to ultrasound guided regional anesthesia training requirements for emergency physicians. Individual practice will be somewhat guided by credentialing obligations at the institutional level. There are adjuncts available to assist in credentialing should an institution be interested in prioritizing this skill. Newer technology exists that allows video guidance during ultrasound guided procedures to provide real-time feedback that improves speed and accuracy for novice users. One device can be mounted directly onto an ultrasound probe to display an expected needle trajectory onto a live image. Several low-cost, high-fidelity nerve block simulation models have also been used to allow trainees to develop more confidence and psychomotor skill.

Because emerging literature is now citing the femoral nerve block as the criterion standard for extremity trauma analgesia in the elderly, one may fear legal recourse when adverse outcomes result from alternative therapeutic modalities. For the emergency physician practicing in the community who may have graduated before the

### Table 2. Free open access medical education materials for nerve blocks.

<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
<th>High-Yield Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>iOS applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block GuRu®</td>
<td>Step-by-step guide for various blocks</td>
<td></td>
</tr>
<tr>
<td>NYSORA</td>
<td>Cervical plexus, interscalene brachial plexus, and forearm blocks</td>
<td></td>
</tr>
<tr>
<td>SonoAccess</td>
<td>SonoSite’s anesthesiology section</td>
<td></td>
</tr>
<tr>
<td>Nerve Whiz</td>
<td>Sensory and motor anatomic drawings</td>
<td></td>
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<tr>
<td>Web sites</td>
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<tr>
<td>Highlandultrasound.com</td>
<td>Highland Emergency Medicine’s fueled pain management site</td>
<td></td>
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<tr>
<td>5minsono.com/vids/NYSORA.com</td>
<td>Short nerve block videos Techniques and educational tools</td>
<td></td>
</tr>
<tr>
<td>Usra.ca</td>
<td>Regional anesthesia section</td>
<td></td>
</tr>
<tr>
<td>Podcasts</td>
<td>Ultrasoundpodcast.com</td>
<td>Episodes 24, 29, and 30</td>
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</table>

*Not free.
Accreditation Council for Graduate Medical Education milestone introduction, ultrasound guided regional anesthesia may seem like a daunting procedure to learn on one’s own. Given that the femoral nerve anatomy is already quite familiar to most emergency physicians for procedures such as central line placement, acquisition of this skill might come from online educational resources or on-the-job training, or by attending a weekend course that focuses on musculoskeletal and procedural ultrasonography (Figures 1, 3, and 4).

Amini et al. found that only 7% of academic EDs have developed credentialing pathways and 57% included ultrasound guided regional anesthesia in their basic credentialing applications. Credentialing pathways need to take into consideration that there is great variation in the psychomotor skills and learning curves of trainees at all levels. Competency assessments should include a minimum number of scans, as well as real-time clinical feedback and ongoing quality assurance. The 2016 American College of Emergency Physicians ultrasound guideline “Practice Based Pathway” can serve as a framework for community physicians seeking further emergency ultrasound training. There is no substitute for observed practice. Methods for assessing and maintaining competency for ultrasound guided regional anesthesia procedures, as well as credentialing pathways, should be a target for future research and development. In the meantime, collaborating with regional pain specialists to develop educational workshops and protocols can enhance faculty development and encouragement of best practice.

**CONCLUSION**

Ultrasound guided regional anesthesia is a new and exciting concept in the field of emergency medicine. As with any novel procedure, there will be barriers to its

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**Figure 2.** Suggested materials for commonly performed nerve blocks. I&D, Incision and drainage; LAST, Treatment of Local Anesthetic Systemic Toxicity.
routine incorporation into training and practice. The emergency ultrasound faculty, residency program director, or a resident champion can lead this initiative at the program level. Free open access medical education resources and even medical applications have paved the way for dissemination of these curricula (Table 2). In light of all of the emerging evidence supporting the safety and utility of ultrasound guided nerve blocks, including but not limited to prolonged pain relief and preservation of consciousness, this should be an integral part of core emergency medicine education. Adding this skill to the toolbox of all emergency physicians-in-training for multimodal analgesia will benefit their patients for years to come.  

Figure 4. Femoral nerve block. Visualize the needle tip (blue line) “in plane” and approach the femoral nerve (yellow circle) from a lateral position. Inject local anesthetic (white arrow) beneath the fascia iliaca (yellow line).

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Author affiliations: From the Department of Emergency Medicine, Johns Hopkins Hospital, Baltimore, MD.

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REFERENCES


