The 2nd ASRA Evidence-Based Medicine Analysis of Ultrasound-Guided Regional Anesthesia

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Learning Objectives:
After participating in this educational activity, participants should be able to:

- Cite new information that demonstrates an advantage of UGRA over other nerve localization techniques for reducing the likelihood of local anesthetic systemic toxicity
- Distinguish those complications that appear to be unaffected by the use of ultrasound-guidance
- Critique the evidence for UGRA affecting various block characteristics, such as success, onset time, duration, and patient satisfaction

Disclosure:

Dr. Neal has no conflict of interest and does not plan to discuss off-label uses of any drugs or devices.

Has Ultrasound Improved Block Characteristics?

- Peripheral nerve blocks
  - Motor and sensory onset marginally faster +/- offset for preparation time
  - Faster onset leads to greater "success" blocking individual nerves
  - However, true outcomes—readiness for surgery and ability to operate without GA or supplement—are unaffected
- Neuraxial blocks
  - Ultrasound is better than palpation at 'leading the way'—interspace level, depth to epidural space, etc
  - This results in fewer needle passes and faster blocks
  - But no evidence that block success or safety are improved
- Truncal blocks
  - Few comparative studies
  - Those available suggest that needle placement is more accurate, and block success is improved for rectus sheath and ilioinguinal-iliohypogastric blocks in children

Will Ultrasound Improve Patient Safety?

- Neurologic complications
  - No convincing evidence that UGRA reduces the frequency of transient or permanent peripheral nerve injury to levels below those previously reported for peripheral nerve stimulation
  - One or two small studies have shown a reduction in surrogate markers (early neurological symptoms), but larger studies have shown no difference in actual injury
  - Case reports increasingly document injury despite ultrasound
- Local anesthetic systemic toxicity
  - UGRA reduces the incidence of unintentional vascular puncture

    - UGRA also reduces episodes of LAST by about 60% as compared to nerve stimulation
- Hemidiaphragmatic paresis
    - Low volume UGRA reduces the incidence and severity of HDP, especially at the supraclavicular level
    - However, particularly at the interscalene approach, the incidence is not zero, and thus caution is still warranted in those patients most at risk of pulmonary compromise
- Pneumothorax
    - Despite visualizing the pleura, reports of pneumothorax exist for several approaches
- Unknown
    - Will advantages of UGRA become more apparent with increased experience, or at risk populations?

Indirect Safety Benefits From UGRA

- Can safety benefits be realized not from the direct use of UGRA itself, but rather from indirect benefits emanating from its use as a nerve localization tool. For instance,
    - Can the frequency of pneumothorax be reduced not just because UGRA allows us to visualize the pleura, but perhaps more so because the needle trajectory of ultrasound-guided supraclavicular block is now lateral-to-medial, rather than taking a more direct path towards the lung, as with the plumb-bob or subclavian perivascular techniques?
    - Can the frequency of hemidiaphragmatic paresis or delayed systemic local anesthetic toxicity be reduced not just because UGRA allows us to use lower volumes, but because it gives us the confidence to use lower volumes, which may have been just as effective even with PNS techniques?

Has Ultrasound Created a New Paradigm in Regional Anesthesia?

- No studies exist to answer this question, but
    - Similar to PNS 30 years ago, UGRA has vastly increased enthusiasm for regional anesthesia
    - Some of my partners who previously would avoid RA at all costs are now enthusiasts. That they are incorrect in their notion that UGRA is safer will be our little secret…
    - The 'perfect storm' of higher demand for peripheral catheters, new and powerful anticoagulants, and a new tool (ultrasound) to facilitate blocks is likely to increase the overall use of peripheral blocks, and in the future, truncal blocks. This will be somewhat offset by the concomitant reduction in neuraxial blocks
- Data or not, the excitement surrounding ultrasound and regional anesthesia in the past few years is palpable
    - Entire sections of journals
    - A new industry of ultrasound workshops
    - The rapidly developing use of ultrasound in pain medicine
- And of course, the fights regarding payment, credentialing, etc.
    - Should we be certified to use ultrasound?

Ultrasound and Research

- The hidden gem of ultrasound technology
- How ultrasound has changed what we thought we knew about needle-to-nerve proximity—paresthesia and peripheral nerve stimulation
- What ultrasound has taught us about the meaning of 'intraneural injection'
- What ultrasound has taught us about local anesthetic dosing
- And what ultrasound has done as an ego-modifier—we don't have it perfect yet…

- The future of ultrasound research
    - Starting to see a decrease in good manuscripts
    - Time to start asking the bigger questions regarding safety, effectiveness
    - Will ultrasound and pain medicine have a future?

Selected References[1]

1. Neal JM, Brull R, Horn JL et al. The second ASRA evidence-based medicine assessment of ultrasound-guided regional anesthesia. Executive summary of 2015 update. *Reg Anesth Pain Med* 2016;41:181-194.