

Background

- ❖ The periosteum is densely innervated and is a major source of acute pain in bone fractures^{1,2}
- ❖ Hematoma block is one of the most common conventional analgesic techniques for forearm fracture manipulation
 - ❖ Inconsistent and may not provide reliable analgesic coverage
- ❖ Clinically, periosteal injection of local anesthetic along the distal forearm provides more effective analgesia than the hematoma block^{3,4}
- ❖ This study investigates the anatomic basis of periosteal forearm blocks

Methods

Figure 1: Ultrasound guided injection of 0.1% Methylene blue dye solution

Figure 4: Surgical dissection of forearms after ultrasound-guided periosteal injection of dye

Figures 2 & 3: Ultrasound image of dye injection lifting fascial plane over periosteum, as labeled by the arrows. Left shows a transverse (out-of-plane) approach, and the right image shows a longitudinal or in-plane approach.

Ultrasound-guided periosteal injection at the distal forearm: cadaveric dye spread to periosteum and adjacent nerves

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Methods

Figures 5 & 6: After surgical dissection, structures were identified and categorized based on whether or not they were stained and the dye density of the stain on a scale from 0-3 (0 = no stain, 3= dark stain). Left shows the radius periosteal staining, and the right shows staining of the ulna after a 10cc injection of dye solution on both.

- ❖ Forearms of two cadavers (four total) were injected under ultrasound guidance with methylene blue solution (see figures 1-3 for reference):
 - ❖ 6cm above wrist
 - ❖ Two with 10cc and two with 15cc
 - ❖ Volume injected among three aspects of both the radius and ulna (see figure from Tageldin, et al.³)

Results

Periosteal Spread Results

Average Length of Dye Spread (cm)	anterior	posterior	lateral	medial
radial periosteum	10	10.5	9	3.75*
ulnar periosteum	11.5	11.75	3.75*	10

*Red = only stained in 50% of forearms

Table 2A shows the average spread of dye along each of the four measured aspects of the radius and ulna of the four forearms used. The average of the medial radius and the lateral ulna are much lower given that there was no staining noted in two of the four forearms.

Total Average Length of Periosteal Spread (cm)	
radius	8.3125
ulna	9.25

Table 2B shows the total average dye spread along the radius and ulna including all four measured aspects of the four forearms.

Other Stained Structures

Other Nerves % Stained	
AIN	75
PIN	100
Ulnar nerve	100
Superficial Radial Nerve	100

Table 3 lists adjacent nerves and the percentage of forearms in which they were found to be stained

Other Structures % Stained	
Radial artery sheath	100
Ulnar artery sheath	100
Median nerve sheath	25
Flexor compartment muscles	75
Extensor compartment muscles	100
Tendon sheaths	100

Table 4 shows the percentage of staining of the above structures out of the four forearms tested.

CONCLUSIONS

- ❖ This study shows that forearm periosteal nerve blocks provide broad longitudinal dye spread along the radius and ulna periosteum suggesting blockade of the periosteal nociceptive nerve network.
- ❖ Dye also tracked to multiple nerves (AIN, PIN, superficial radial, and ulnar branches), implying additional analgesic pathways and helping explain improved clinical performance versus the traditional hematoma block.

References

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