

“Where Did It Go?” to “Now I See It”: Contrast Imaging Improves Resident Mental Models of Local Anesthetic Spread.

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1. THE EDUCATIONAL PROBLEM: THE VISUALIZATION GAP



The “Needle-Tip Success” Paradox

Ultrasound needle placement success does not always guarantee reliable 3D anesthetic spread.



The Expertise Gap

Novices struggle to translate flat 2D ultrasound views into three-dimensional compartment dispersion.



High Complication Risk

Traditional teaching fails to address a 4.1–6.8% incidence of preventable vascular punctures.



2. THE WORKFLOW: CONTRAST- CONFIRMED SPREAD REVIEW



1. Image Curation (The Ground Truth)

Collect de-identified Fluoroscopy or CT images where contrast corroborated actual perineural spread.



2. Structured Teaching Session

Conduct sessions focusing on 3D anatomy review, image interpretation, and troubleshooting.



3. Cognitive Debriefing

Residents identify anatomic boundaries, predict sensory coverage, and recognize

3. THE OUTCOME: BUILDING A “SPREAD LANGUAGE”

Improved Interpretative Literacy

Residents successfully differentiate between plane/sheath filling versus focal pooling of anesthetics.



Transferable Clinical Proficiency

Faculty observed more consistent block planning during routine ultrasound-onl techniques after training.



Opioid-Sparing Success

Workflow leads to more effective analgesia without increasing catheter or neurologic complications.