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Regional Anesthesia in Emergency and Trauma Patients

An evidence-based review of the latest studies and clinical guidelines

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Objectives and Roadmap

- Review the role of regional anesthesia in multimodal analgesia for trauma
- Examine current evidence for key techniques: SAPB, ESPB, FICB and PENG
- Special considerations: traumatic brain injury, coagulopathy and antithrombotics, compartment syndrome
- Practical points for implementation in the ED and prehospital setting

Untreated Trauma Pain Is an Injury in Itself

- Severe pain after trauma is common and frequently undertreated
- Consequences: atelectasis and pneumonia, respiratory failure, delayed mobilization, chronic post-traumatic pain
- Opioids: delirium, nausea and ileus, respiratory depression, tolerance and dependence — especially in the elderly and multiple trauma
- J Trauma 2024 acute pain guideline: acetaminophen, NSAIDs, ketamine and regional anesthesia carry the highest level of evidence

Why Regional Anesthesia? Unique Advantages

Opioid sparing	Powerful analgesia without CNS depression; fewer drug side effects
Better respiratory function	Earlier deep breathing, coughing and physiotherapy; less pneumonia
More stable hemodynamics	Avoids GA-related hypotension in the hemorrhaging patient
Preserved neurologic exam	Repeatable GCS assessment in head trauma; no sedation
Earlier mobilization and discharge	Integration into ERAS pathways; shorter hospital stay

The Toolbox: Three Families of Techniques

Family	Examples	Main use in trauma	Key point
Neuraxial	Thoracic epidural, spinal	Chest and abdominal pain, flail chest	Strongest analgesia; limited by coagulopathy, hypotension, spine injury
Peripheral nerve block	Femoral, sciatic, brachial plexus	Limb fractures, reduction without sedation	Rapid onset; pre-block neuro exam is mandatory
Fascial plane block	ESPB, SAPB, FICB, PENG	Ribs, hip, trunk and abdominal wall	Superficial and safe; preferred in relative coagulopathy and hemodynamic instability

SECTION 1

Thoracic Trauma

The most common source of disabling pain in blunt trauma — and where fascial plane blocks changed practice most

Chest Wall Analgesia Techniques at a Glance

Technique	Coverage	Main advantage	Limitations
Thoracic epidural	Bilateral T4–T9	Gold standard for bilateral pain and flail chest	Coagulopathy, hypotension, technically demanding
Paravertebral	Unilateral, segmental	Epidural-equivalent in unilateral trauma	"Deep" block per ASRA; pneumothorax risk
SAPB	Lateral branches T2–T9	Simple, superficial, fast; anterolateral ribs	Weaker coverage of posterior ribs and sternum
ESPB	Multisegmental posterior spread	Posterior and lateral ribs; continuous catheter	Comparative evidence still limited

Latest Evidence: SAPB and ESPB

SAPB — Serratus Anterior Plane

- RCT of 210 patients: significant 4-hour pain reduction (41% vs 20%) and lower opioid requirement
- Meta-analysis of 3 RCTs (310 patients): less pain up to 24 h and reduced opioid use
- Feasible and safe when performed by emergency physicians in the ED

ESPB — Erector Spinae Plane

- Military prehospital interventional study (54 patients): NRS from 9 to 1 at hour 12
- Scoping review of 37 studies: ~40% pain reduction at 24 h and improved spirometry
- Frontline option in anticoagulated and hemodynamically unstable patients

Chest Trauma: Realism About the Evidence

- EAST guideline (2016): conditional recommendation for epidural plus multimodal analgesia; evidence for other techniques rated "very low quality”
- No guideline yet prefers one thoracic block over another — choice depends on patient, expertise and resources
- Epidural: bilateral pain and flail chest, in the hemodynamically stable patient without coagulopathy
- Fascial plane blocks: coagulopathy, instability, concomitant head trauma, avoidance of sedation
- Sternal and parasternal fractures: pecto-intercostal fascial block is the only dedicated anterior coverage, usually combined with SAPB

SECTION 2

Limbs and Pelvis

From hip fracture in the elderly to joint reduction without sedation in the ED



Hip Fracture: Early FICB in the Emergency Department

- AAOS guideline: strong evidence for preoperative regional analgesia in the ED; reduced VAS pain
- Meta-analyses: ~11 mg less morphine over 24 h and lower resting pain scores
- Dutch ED RCT (53 patients): delayed first opioid request; 24% completely opioid-free vs 4%
- RCT in older adults: continuous FICB reduced postoperative delirium (13.9% vs 35.7%)
- Paramedic-delivered FICB at the scene is feasible (RAPID trial)
- RCoA: formal ED fascia iliaca pathway, competency-assessed operators, minimum 1-hour monitoring

Pelvis: Rise of the PENG Block and Technique Rivalry

- PENG (pericapsular nerve group block): dedicated hip joint capsule coverage while sparing femoral motor function
- ED study: greater pain reduction than FICB (1.4-point VAS difference)
- ED randomized trial: PENG superior to FIB for pain and rescue analgesia requirement
- Multicenter CPFF-ED trial (254 patients, 5 centers) underway for a definitive answer
- Message: no block has proven definitive superiority yet — choose by experience, equipment and patient status

Upper Limb, Clavicle and Head

Upper limb

- Brachial plexus blocks: fracture and dislocation reduction without procedural sedation
- Clavipectoral fascial plane block: dedicated coverage for clavicle fractures
- Supraclavicular/axillary approaches: complete coverage of hand and forearm

Head and face

- Scalp nerve blocks (supraorbital, auricular, occipital): scalp wound repair without sedation
- Alternative to opioids and procedural sedation; preserves neurologic examination
- Facial blocks for facial lacerations in adults and children

SECTION 3

Special Situations, Safety and the Future

Head trauma, coagulopathy, compartment syndrome and block safety

Traumatic Brain Injury: Analgesia Without Obscuring the Exam

- Opioids and sedation confound GCS, pupils and serial neurologic assessment
- Strategy: analgesia without CNS depression — peripheral blocks for wounds and associated fractures
- Scalp and limb blocks plus small titrated fentanyl doses with full monitoring
- In severe TBI: sedation and analgesia balanced against ICP control and daily exam windows
- Avoid neuraxial techniques in raised ICP and traumatic coagulopathy

Coagulopathy and Antithrombotics: ASRA 2025 Guideline

- In major trauma, assess (trauma-induced) coagulopathy before any regional technique (ESRA)
- ASRA 5th edition (2025): deep plexus and paravertebral blocks follow neuraxial rules
- High-dose DOACs: hold 72 hours; residual level < 30 ng/mL or anti-Xa ≤ 0.1 IU/mL acceptable
- Superficial, compressible blocks (SAPB, ESPB, FICB): decide by site, vessels and consequences of bleeding
- Practical result: in the anticoagulated or coagulopathic patient, superficial fascial plane blocks are the logical choice

Compartment Syndrome: Does the Block Mask It?

- Classic concern: blunting ischemic pain and delaying the diagnosis
- Masking reports are almost exclusively case reports (class IV); ischemic pain often breaks through the block
- Large level-1 trauma center study (2024): routine regional use in long bone fractures did not delay ACS diagnosis
- Solutions: dilute concentrations, monitored catheter techniques, multidisciplinary protocols, documented pre-block exam
- WA DOH: limb regional anesthesia is not contraindicated in trauma — just be aware of potential masking

Safety: LAST and Complications in Real Numbers

~1.3 per 10,000
local anesthetic systemic toxicity (LAST)

~0.03%
transient or permanent nerve injury

3.5 per 10,000
serious events in a 160,000-block series

- Prevention: gradual aspiration and aliquots, weight-based maximum doses, monitoring during injection
- Readiness: 20% lipid emulsion and a LAST protocol wherever blocks are performed
- Monitor the patient for at least 1 hour after an ED block (RCoA recommendation)

From the Scene to the Future

- Air Medical Journal review (2024): prehospital regional anesthesia is safe and effective across provider types
- Active experience: paramedic-delivered FICB and ESPB in the military prehospital setting
- EUSEM 2025 pain guideline: consider regional blocks in moderate-to-severe ED pain
- Future: trauma ERAS, artificial intelligence for ultrasound guidance, hybrid blocks
- Research gap: international Delphi study ranked regional anesthesia in trauma as the top research priority

Key Takeaways for Tomorrow on the Wards

1. Regional anesthesia is the backbone of multimodal trauma analgesia — not a luxury
2. Chest trauma: SAPB and ESPB are frontline in unstable or anticoagulated patients; epidural for stable flail chest
3. Older hip fracture: early FICB in the ED; potential effect on delirium and outcome
4. Head trauma: peripheral blocks rescue the neurologic examination
5. Coagulopathy is not absolute: superficial compressible blocks are the logical choice
6. Excellent safety record — conditional on protocols, monitoring and lipid readiness

References

1. Hancin E, et al. Regional, multimodal, and opioid-sparing strategies after trauma. Curr Opin Anaesthesiol. 2025. — pmc.ncbi.nlm.nih.gov/articles/PMC13141092
2. Integrating Peripheral Nerve Blocks in Multiple Trauma Care. J Clin Med. 2025;14(15):5598. — pmc.ncbi.nlm.nih.gov/articles/PMC12347497
3. Truncal Regional Analgesia for Thoracic Trauma. Curr Anesthesiol Rep. 2026. — link.springer.com/article/10.1007/s40140-026-00725-z
4. Non-operative Management of Traumatic Rib Fractures. Curr Anesthesiol Rep. 2024;14:567-575. — doi 10.1007/s40140-024-00645-w
5. Serratus Anterior Plane Blocks for Early Rib Fracture Pain Management (RCT, n=210). — pmc.ncbi.nlm.nih.gov/articles/PMC11063926
6. SAPB for Rib Fractures: Systematic Review & Meta-analysis of RCTs. 2026. — pubmed.ncbi.nlm.nih.gov/41752680
7. ESPB for Blunt Chest Trauma in Military Prehospital Medicine. Int J Med. 2024. — tandfonline.com (10.1080/11101849.2024.2359157)
8. Contemporary and Future Perspectives on Thoracic Trauma Care. 2026. — pmc.ncbi.nlm.nih.gov/articles/PMC12653104
9. UG-FICB in ED for Hip Fracture: RCT. 2025. — pubmed.ncbi.nlm.nih.gov/41054164
10. FICB after Hip Fracture Surgery: Systematic Review & Meta-analysis. BMC Anesthesiol. 2026. — doi 10.1186/s12871-026-03892-y
11. RAPID: Paramedic-administered FICB. BMJ Open. 2019;9:e026073. — bmjopen.bmj.com
12. PENG vs FIB for Hip Fractures in the ED. — pmc.ncbi.nlm.nih.gov/articles/PMC13660564
13. CPFF-ED Trial Protocol. 2026. — pmc.ncbi.nlm.nih.gov/articles/PMC12885299
14. ASRA Antithrombotic Guidelines, 5th ed. 2025. — asra.com/guidelines-articles/guidelines
15. Chembrovich S, et al. Regional Anesthesia and Compartment Syndrome. Reg Anesth Pain Med. 2024;49(7):505-510. — pubmed.ncbi.nlm.nih.gov/37696649
16. The Impact of RA in Masking Acute Compartment Syndrome. J Clin Med. 2024;13(6):1787. — pmc.ncbi.nlm.nih.gov/articles/PMC10971118
17. RCoA GPAS Chapter 8: Guidelines for the Provision of Regional Anaesthesia. 2024-25. — rcoa.ac.uk/gpas/chapter-8
18. Anderson ND, et al. Regional Anesthesia in the Austere Environment. Air Med J. 2024. — journals.sagepub.com (10.1177/10806032241231257)
19. Acute Pain Management After Trauma. J Trauma Acute Care Surg. 2024;96(4):537-541. — journals.lww.com
20. Research Priorities in Regional Anaesthesia: International Delphi. 2024. — pmc.ncbi.nlm.nih.gov/articles/PMC11103078