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# ANESTHESIOLOGY 2012

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TRANSFORMING PATIENT SAFETY THROUGH EDUCATION AND ADVOCACY

## Regional Anesthesia and the Trauma Patient

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Objectives:

Learning Objectives:

1. Choose techniques of nerve blockade that would be applicable to the trauma patient
2. Explain the current rationale of the beneficial effects of pain relief to the trauma patient
3. Discuss the practical problems in the trauma population such as compartment syndrome, nerve injury
4. Apply continuing catheters and multiple catheters in the trauma patient with multiple injuries and operations

### Overview of Trauma Physiology

1. Why pain relief is important
  - i) Minimize opioid need
    - (1) Minimize side effects
    - (2) Respiratory depression
    - (3) Excessive sedation precluding assessment
  - ii) Minimize immune suppression
2. Physiology of pain in the trauma patient
  - i) Hormonal, biochemical
  - ii) Hypermetabolic response
  - iii) Proinflammatory state
    - (1) NF-Kappa Beta
  - iv) Neurochemistry
    - (1) Neurotransmitters
    - (2) Inflammatory mediators
      - (a) Interleukins
      - (b) Cytokines
3. The differences in the pain in trauma versus pain in elective surgery
  - i) Advantages of regional anesthesia: How regional anesthesia and analgesia can be beneficial
  - ii) The role of multimodal therapy in pain relief in trauma
4. Additional benefits of regional anesthesia and local anesthetics on perioperative outcome
  - v) Alternative effects—systemic absorption
    - (1) Intravenous effects of local anesthetics

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## **Regional Anesthesia in Other Environments**

- i) Ambulance
- ii) Emergency Room
- iii) Battlefield

## **Chronic Pain in the Trauma Patient**

- i) Traumatic Amputation
  - (1) Phantom Limb Pain
- ii) The Chronic Pain Patient with Acute Pain

## **Practical Problems in Trauma Patients**

- (1) Consent
- (2) Positioning
- (3) Performing Regional Anesthesia in the presence of nerve injury
- (4) The trauma patient with Coagulopathy
- (5) Compartment syndrome

## **Situations Unique to the Trauma Patient**

- (1) Thoracic Trauma
  - (a) Treatment of Pain from Rib fractures
    - (i) Paravertebral
    - (ii) Epidural

## **Peripheral Nerve Block and Peripheral Catheters**

- (1) Single Shot vs Continuous Catheter(s)
  - (a) Indications
- (2) Upper Extremity Blocks and Catheters
- (3) Lower Extremity Blocks and Catheters
- (4) Ultrasound and Nerve Stimulators \
- (5) Complications

## **Case Examples of Application of Regional Analgesia**

- (1) Multiple Catheters and Blocks in the Polytrauma Patient
- (2) Case of Traumatic Amputation with Prolonged Quad Catheters
- (3) Simultaneous Surgery on Bilateral Upper Extremity Trauma

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## BIBLIOGRAPHY

1. Whitten, C.W. & Greilich, P.E. Thromboelastography (R): Past, Present, and Future. *Anesthesiology* **92**, 1226 (2000).
2. Wu, C.L. & Fleisher, L.A. Outcomes research in regional anesthesia and analgesia. *Anesthesia & Analgesia* **91**,1232 (2000).
3. Wu, C.L. et al. The effect of pain on health-related quality of life in the immediate postoperative period. *Anesthesia & Analgesia* **97**, 1078 (2003).
4. Wu, C.L. et al. Effect of postoperative epidural analgesia on morbidity and mortality following surgery in medicare patients. *Regional anesthesia and pain medicine* **29**, 525-533 (2004).
5. Wu, C.L. et al. Correlation of postoperative epidural analgesia on morbidity and mortality after colectomy in Medicare patients. *Journal of clinical anesthesia* **18**, 594-599 (2006).
6. Perkins, F.M. & Kehlet, H. Chronic pain as an outcome of surgery: a review of predictive factors. *Anesthesiology* **93**, 1123 (2000).
7. Popping, D.M. et al. Effectiveness and safety of postoperative pain management: a survey of 18 925 consecutive patients between 1998 and 2006 (2nd revision): a database analysis of prospectively raised data.429 Page 9 *British Journal of Anaesthesia* **101**, 832 (2008).
8. Cashman, J.N. & Dolin, S.J. Respiratory and haemodynamic effects of acute postoperative pain management: evidence from published data. *British Journal of Anaesthesia* **93**, 212 (2004).
9. Malchow, R.J. & Black, I.H. The evolution of pain management in the critically ill trauma patient: Emerging concepts from the global war on terrorism. *Critical care medicine* **36**, S346 (2008).
10. Cohen, S.P., Christo, P.J. & Moroz, L. Pain management in trauma patients. *American Journal of Physical Medicine & Rehabilitation* **83**, 142 (2004).
11. Holte, K. & Kehlet, H. Epidural anaesthesia and analgesia-effects on surgical stress responses and implications for postoperative nutrition. *Clinical nutrition* **21**, 199-206 (2002).
12. Rodgers, A. et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised. *British Medical Journal* **321**, 1493 (2000).
13. Richman, J.M. et al. Does continuous peripheral nerve block provide superior pain control to opioids? A metaanalysis. *Anesthesia & Analgesia* **102**, 248 (2006).
14. Tziavrangos, E. & Schug, S.A. Regional anaesthesia and perioperative outcome. *Current Opinion in Anesthesiology* **19**, 521 (2006).
15. Evans, H., Steele, S.M., Nielsen, K.C., Tucker, M.S. & Klein, S.M. Peripheral nerve blocks and continuous catheter techniques. *Anesthesiology Clinics of North America* **23**, 141-162 (2005).
16. Wu, C.L. et al. Efficacy of postoperative patient-controlled and continuous infusion epidural analgesia versus intravenous patient-controlled analgesia with opioids: a meta-analysis. *Anesthesiology* **103**, 1079 (2005).
17. Werawatganon, T. & Charuluxananan, S. Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery. *Anesthesia & Analgesia* **100**, 1536 (2005).
18. Schug, S.A. The effect of neuraxial blockade on peri-operative mortality and major morbidity: an updated meta-analysis. *Anesth Intens Care* **33**, 675 (2005).
19. Jørgensen, H., Wetterslev, J., Møiniche, S. & Dahl, J.B. Epidural local anaesthetics versus opioid-based analgesic regimens on postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery. *Cochrane Database Syst Rev* CD001893 (2000).doi:10.1002/14651858.CD001893
20. Steinbrook, R.A. Epidural anesthesia and gastrointestinal motility. *Anesthesia and analgesia* **86**, 837-844 (1998).
21. Turner, J.A., Cardenas, D.D., Warms, C.A. & McClellan, C.B. Chronic pain associated with spinal cord injuries: A community survey\*. *Archives of physical medicine and rehabilitation* **82**, 501-508 (2001).
22. Joshi, G.P. & Ogunnaike, B.O. Consequences of inadequate postoperative pain relief and chronic persistent postoperative pain. *Anesthesiology Clinics of North America* **23**, 21-36 (2005).

# ANESTHESIOLOGY 2012

TRANSFORMING PATIENT SAFETY THROUGH EDUCATION AND ADVOCACY

23. Hahnenkamp, K., Herroeder, S. & Hollmann, M.W. Regional anaesthesia, local anaesthetics and the surgical stress response. *Best Practice & Research Clinical Anaesthesiology* **18**, 509-527 (2004).
24. Mikawa, K. et al. Effect of lidocaine pretreatment on endotoxin-induced lung injury in rabbits. *Anesthesiology* **81**, 689 (1994).
25. Schmidt, W., Schmidt, H., Bauer, H., Gebhard, M.M. & Martin, E. Influence of lidocaine on endotoxin-induced leukocyte-endothelial cell adhesion and macromolecular leakage in vivo. *Anesthesiology* **87**, 617 (1997).
26. Gallos, G., Jones, D.R., Nasr, S.H., Emala, C.W. & Lee, H.T. Local anesthetics reduce mortality and protect against renal and hepatic dysfunction in murine septic peritonitis. *Anesthesiology* **101**, 902 (2004).
27. Thompson, G.E. Anesthesia for battle casualties in Vietnam. *JAMA* **201**, 215-9 (1967).
28. Jenicek, J.A., Perry, L.B. & Thompson, G.E. Armed Forces anesthesiology comes of age. *Anesthesia and analgesia* **46**, 822
29. Jowitt, M.D. & Knight, R.J. Anaesthesia during the Falklands campaign. *Anaesthesia* **38**, 776-783 (2007).
30. Buckenmaier III, C.C. et al. Continuous peripheral nerve block in combat casualties receiving low-molecular weight heparin. *British Journal of Anaesthesia* **97**, 874 (2006).
31. Raja, S.N. Is an ounce of preoperative local anesthetic better than a pound of postoperative analgesic? *Regional anesthesia* **21**, 277
32. Castillo, R.C., MacKenzie, E.J., Wegener, S.T. & Bosse, M.J. Prevalence of chronic pain seven years following limb threatening lower extremity trauma. *Pain* **124**, 321-329 (2006).
33. Urquhart, D.M. et al. Outcomes of patients with orthopaedic trauma admitted to level 1 trauma centres. *ANZ JSurg* **76**, 600-606 (2006).
34. Jenson, M.G. & Sorensen, R.F. Early use of regional and local anesthesia in a combat environment may prevent the development of complex regional pain syndrome in wounded combatants. *Mil Med* **171**, 396-398 (2006).
35. Schley, M. et al. Continuous brachial plexus blockade in combination with the NMDA receptor antagonist memantine prevents phantom pain in acute traumatic upper limb amputees. *Eur J Pain* **11**, 299-308 (2007).429  
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36. Prantl, L., Schreml, S., Heine, N., Eisenmann-Klein, M. & Angele, P. Surgical treatment of chronic phantom limb sensation and limb pain after lower limb amputation. *Plastic and reconstructive surgery* **118**, 1562 (2006).
37. Bredahl, C., Kristensen, A.K. & Christensen, K.S. Treatment of reflex dystrophy with continuous peripheralnerve block. *Ugeskrift for laeger* **169**, 59 (2007).
38. Dadure, C. et al. Continuous peripheral nerve blocks at home for treatment of recurrent complex regional pain syndrome I in children. *Anesthesiology* **102**, 387 (2005).
39. Horlocker, T.T. et al. Regional anesthesia in the anticoagulated patient: defining the risks (the second ASRA Consensus Conference on Neuraxial Anesthesia and Anticoagulation). *Regional anesthesia and pain medicine* **28**, 172 (2003)updated 2010
40. Kariya, N., Oda, Y., Yukioka, H. & Fujimori, M. [Effective treatment of a man with head injury and multiple rib fractures with epidural analgesia]. *Masui* **45**, 223-226 (1996).
41. Fligel, B.T. et al. Half-a-dozen ribs: the breakpoint for mortality. *Surgery* **138**, 717-725 (2005).
42. Holcomb, J.B., McMullin, N.R., Kozar, R.A., Lygas, M.H. & Moore, F.A. Morbidity from rib fractures increases after age 45. *Journal of the American College of Surgeons* **196**, 549 (2003).
43. Karmakar, M.K. et al. Continuous thoracic paravertebral infusion of bupivacaine for pain management in patients with multiple fractured ribs. *Chest* **123**, 424 (2003).
44. Dhole, S., Mehta, Y., Saxena, H., Juneja, R. & Trehan, N. Comparison of continuous thoracic epidural and paravertebral blocks for postoperative analgesia after minimally invasive direct coronary artery bypass surgery. *Journal of cardiothoracic and vascular anesthesia* **15**, 288-292 (2001).
45. Matthews, P.J. & Govenden, V. Comparison of continuous paravertebral and extradural infusions of bupivacaine for pain relief after thoracotomy. *British journal of anaesthesia* **62**, 204 (1989).
46. Perttunen, K. et al. Extradural, paravertebral and intercostal nerve blocks for post-thoracotomy pain. *BritishJournal of anaesthesia* **75**, 541 (1995).

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TRANSFORMING PATIENT SAFETY THROUGH EDUCATION AND ADVOCACY

47. Grass, J.A. Surgical outcome. *Regional anaesthesia and analgesia versus general anaesthesia. Anaesth Rev* **20**,117-125 (1993).
48. Capdevila, X., Ponrouch, M. & Choquet, O. Continuous peripheral nerve blocks in clinical practice. *Current Opinion in Anesthesiology* **21**, 619 (2008).
49. Telion, C. & Carli, P. Prehospital and emergency room pain management for the adult trauma patient. *Techniques in Regional Anesthesia and Pain Management* **6**, 2-9 (2002).
50. Ritsema, T.S., Kelen, G.D., Pronovost, P.J. & Pham, J.C. The national trend in quality of emergency department pain management for long bone fractures. *Academic Emergency Medicine* **14**, 163-169 (2007).
51. Buckenmaier III, C.C. & Bleckner, L.L. Continuous peripheral nerve blocks and anticoagulation. *British Journal of Anaesthesia* **101**, 139 (2008).
52. Perlas, A. et al. Ultrasound-guided supraclavicular block: outcome of 510 consecutive cases. *Regional Anesthesia and Pain Medicine* **34**, 171 (2009).
53. Elliott, K.G.B. & Johnstone, A.J. Diagnosing acute compartment syndrome. *Journal of Bone & Joint Surgery, British Volume* **85**, 625 (2003).
54. Wiegel, M., Gottschaldt, U., Hennebach, R., Hirschberg, T. & Reske, A. Complications and adverse effects associated with continuous peripheral nerve blocks in orthopedic patients. *Anesthesia & Analgesia* **104**, 1578(2007).

## DISCLOSURE

Covidien ,Honoraria ; Cadence ,Honoraria