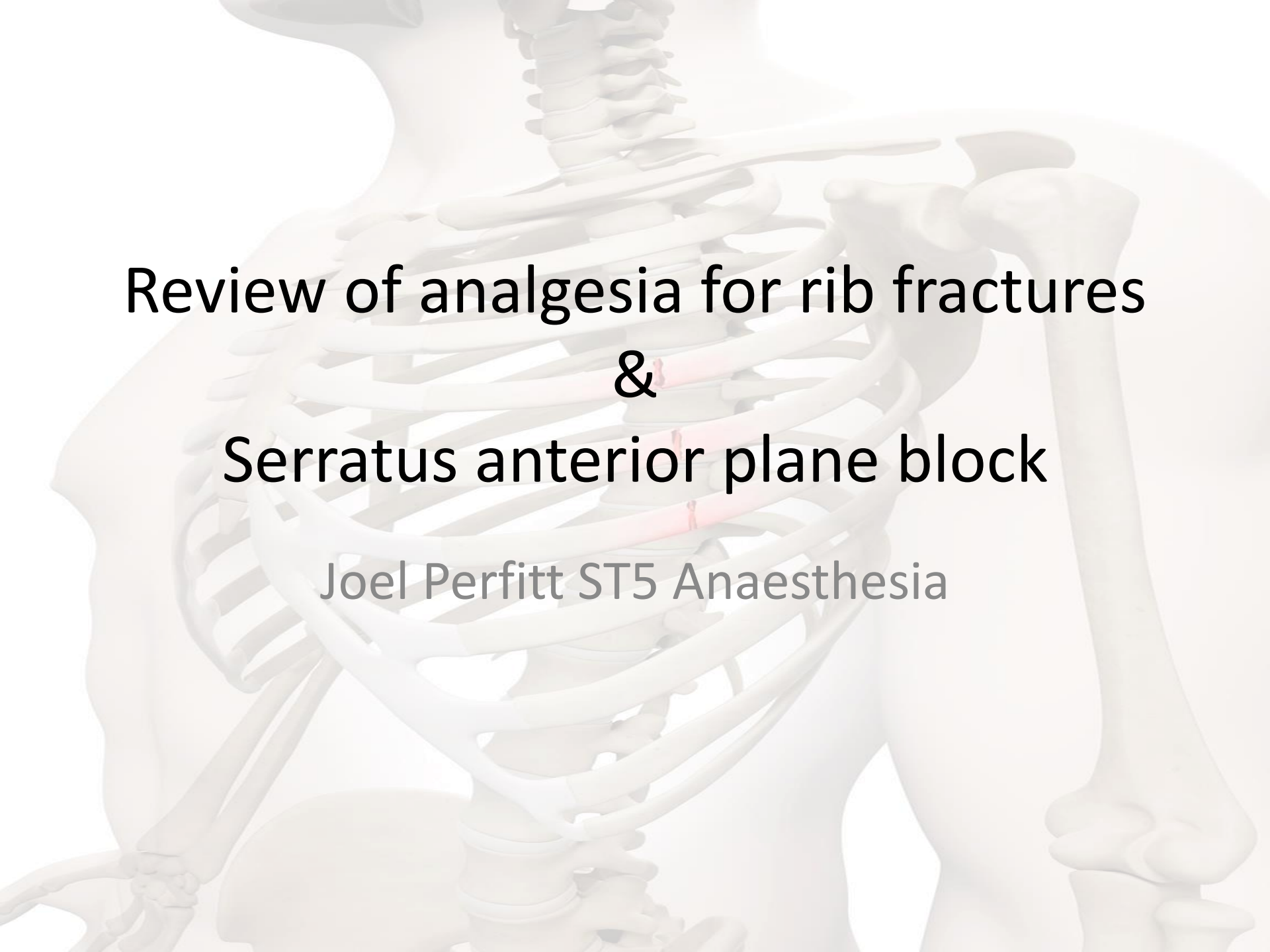

Review of analgesia for rib fractures
&
Serratus anterior plane block

Joel Perfitt ST5 Anaesthesia

Rib fractures

- Trauma is a common cause of morbidity and mortality worldwide
- Rib fractures are detected in at least 10% of traumatically injured patients
- Significant mortality is reported varying between 2.9 - 14%
- Mortality risk factors include;
  - Number of fractures (>6)
  - Age >45

- Lung injury
  - Damage to underlying lung – contusion, oedema, shunting
  - Occurs largely at point of injury ‘primary injury’
- Impaired mechanics
  - Flail segment, chest deformity
  - Decreased tidal volume, collapse/atelectasis
  - Increased work of breathing
  - Difficulty weaning from ventilator
- Pain
  - Pain induced hypoventilation, poor cough and sputum clearance
  - May increase risk of pulmonary complications
  - Associated respiratory depression from opioids

Improving outcomes

- Some evidence suggests Epidural analgesia may improve mortality and complication rates – not consistently demonstrated

- Meta-analysis 2008 did not show a significant reduction in mortality with epidural analgesia
    - Hospital LOS, ICU LOS or ventilator days were no change (232 patients)

- Another meta-analysis 2009 did not show any statistically difference in outcomes but the epidural group was significantly more injured

Can J Anaesth. 2009 Mar;56(3):230-42. doi: 10.1007/s12630-009-9052-7. Epub 2009 Feb 11.

Effect of epidural analgesia in patients with traumatic rib fractures: a systematic review and meta-analysis of randomized controlled trials.

Carrier FM[1], Turgeon AF, Nicole PC, Trépanier CA, Fergusson DA, Thauvette D, Lessard MR.

- 8 studies included (232 patients)
- Studies comparing epidural analgesia to any other modality
- No statistically significant difference in
    - Mortality
    - ICU/Hospital stay
    - Duration of mechanical ventilation
- Two studies comparing epidural vs Parenteral opioids showed duration of mechanical ventilation -4.17 days (-5.45 to -2.88)

OPUS 12 Scientist 2009 Vol. 3, No. 3
Submitted 09/2010; Revised 10/2010; Re-revised 11/2010; Published 11/2010

Comparison of epidural versus parenteral analgesia for traumatic rib fractures: A meta-analysis

Amy M. Jarvis, MD [1], Charles H. Cook, MD [1, 2], David E. Lindsey, MD [1,2], Thomas E. Reilley, DO [3], Steven M. Steinberg, MD [1,2], Paul R. Beery II, MD [1, 2], Melissa L. Whitmill, MD [1,2], Thomas J. Papadimos, MD [3], S. Peter Stawicki, MD [1, 2]

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[3] Department of Anesthesiology, The Ohio State University Medical Center, Columbus, OH, USA

- 2009 Meta-analysis
- Epidural vs IV/IM opioids
- 217 patients
- No difference in mortality, ARDS, length of stay
- Epidural group had higher ISS, number of RF's and higher APACHE II scores
- Epidural group spent less time on ventilator, and had a lower incidence of pulmonary complications

Epidural analgesia

- Largely regarded as the gold standard of care
- Recommended by major trauma network guidelines
- Trauma patients may have multiple injuries which preclude insertion of epidural
- Hypotension may be a particularly undesirable side effect in trauma patients
- Generally a familiar technique to most Anaesthetists

Paravertebral block

- Advantages include
  - Less hypotension than epidural
  - Less risk of neuraxial complications
  - Patients can mobilize if elastomeric pump used
- Disadvantages
  - Limited experience by most anaesthetists
  - Unilateral
  - Limit of spread of LA may require multiple blocks

Intercostal block

- Able to provide very effective analgesia
- Risk of pneumothorax, LA toxicity
- Single site of injection may provide analgesia to adjacent ribs
- Technically challenging above T7
- Catheter insertion possible

Serratus plane block

- Regional anaesthesia facial plane block described for surgery on the anterolateral chest wall
- Serratus anterior muscle attaches to the anterolateral surface of ribs 1-8
- Single block 12h analgesia
- Catheter can be inserted for prolonged duration of block
- Few absolute contraindications, but ICD placement and surgical emphysema may make placement challenging
- ‘TAP block of the thorax’

- Described in 2013
    - Anterolateral chest wall analgesia demonstrated on volunteers T2 to 7-9
- 2016 anatomical cadaveric analysis
  - Dye involvement of intercostal nerves. Dye and latex involvement of lateral cutaneous branches
- Multiple case reports for thoracic surgery and rib fractures
- Catheter based techniques have been described

Anaesthesia 2013, 68, 1107–1113 doi:10.1111/anae.12344

Original Article

Serratus plane block: a novel ultrasound-guided thoracic wall nerve block

R. Blanco,[1] T. Parras,[2] J. G. McDonnell[3] and A. Prats-Galino[4]

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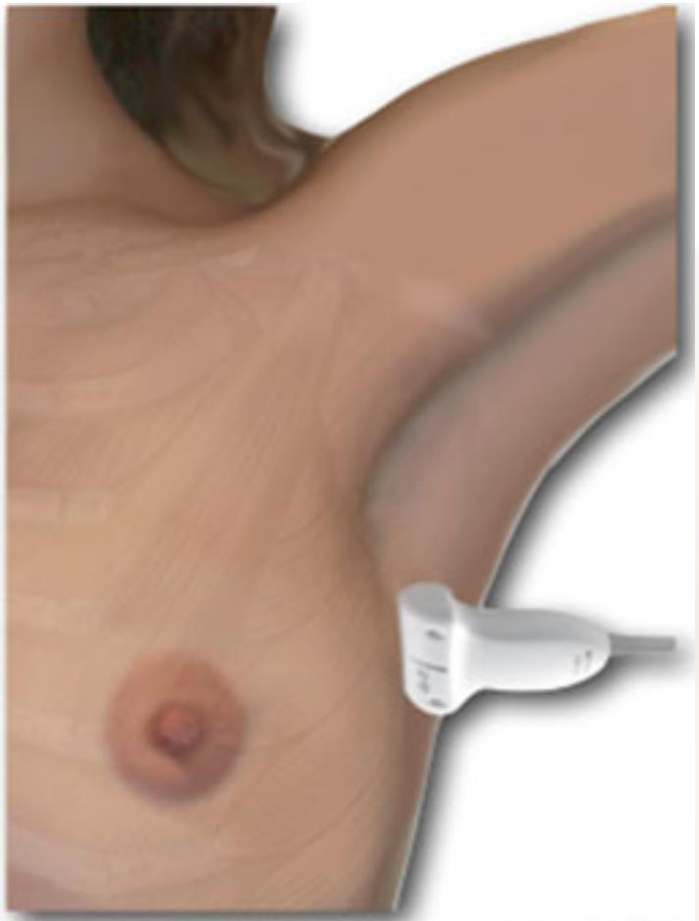
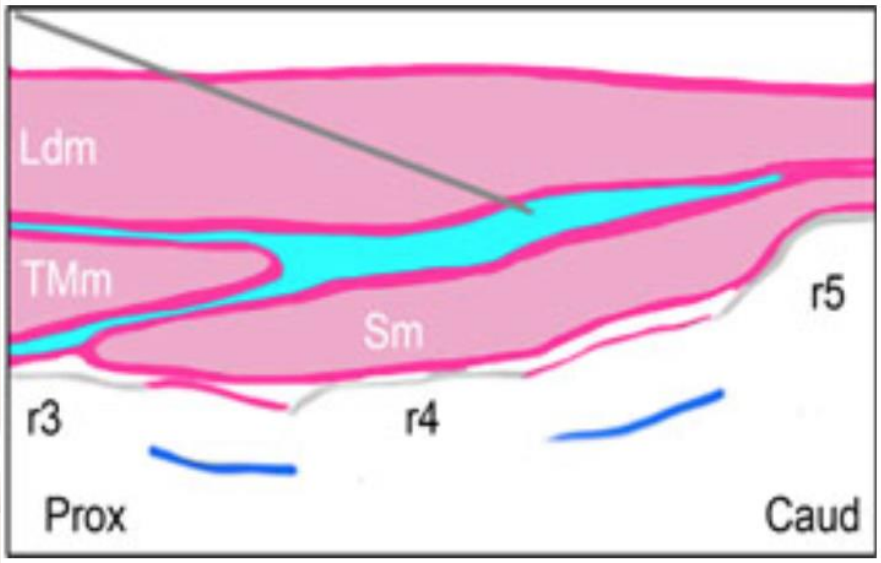
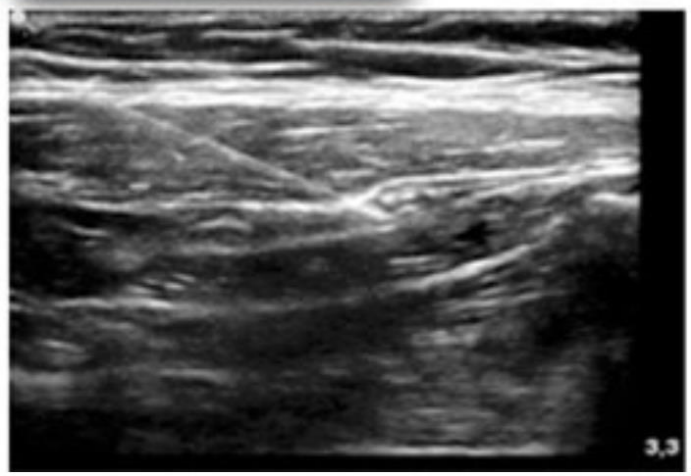
2 Clinical Fellow, Anaesthetic Department, University Hospital of Lewisham, London, UK
3 Consultant, Anaesthetic Department, Galway University Hospital, Galway, Ireland
4 Professor of Human Anatomy and Embryology, Faculty of Medicine, University of Barcelona, Barcelona, Spain

- Descriptive study, four female volunteers – Bupivicaine and Gadolinium
- Delineation of sensory loss described after 30 mins
- MRI scans to determine spread of local anaesthetic

- Patient in supine position
- 5th rib, mid axillary line identified
- 0.4ml/kg 0.125% levobupivicaine with gadolinium
- Bilateral blocks, one superficial and one deep to serratus
- After 30 mins area of anaesthesia was determined







	Superficial to serratus muscle		Deep underneath serratus muscle	
Subject	T_i; min	T_m; min	T_i; min	T_m; min
1	730	750	330	600
2	750	770	270	540
3	780	840	625	575
4	750	750	330	330

Deep underneath serratus muscle		
Anterior	Lateral	Posterior
T2–T6	T2–T7	T2–T8
T2–T5	T2–T7	T2–T7
T2–T6	T2–T8	T2–T9
T2–T6	T2–T8	T2–T8

	Superficial to serratus muscle		
Subject	Anterior	Lateral	Posterior
1	T2–T9	T2–T9	T2–T9
2	T2–T8	T2–T8	T2–T8
3	T2–T6	T2–T9	T2–T9
4	T2–T7	T2–T9	T2–T9

Service evaluation - method

- Retrospective data collection 3 month period
- All patients admitted to STH coded as rib fracture between 1/7/16 and 30/9/16 (Clinical coding numbers S2230/S2240/S2250/S224/S2251)
- Clinical information collected from;
    - ICE discharge summary
    - PACS radiology reports
    - EDMS A+E notes
    - Thoracic surgery operation lists database
    - Acute pain database

- Data collected:
  - Basic demographics
  - Length of stay
  - Injuries on radiological imaging
  - Interventions for pain – PCA, Epidural
  - Acute pain team involvement
  - Outcome (discharge or death)

Results

- 108 patients coded as rib fractures
- Mean age 60 years
- Mean length of stay = 12 days

Imaging

- 90 (83%) patients had CT thorax performed
- 82 (75%) patients had chest xray performed
- 26 (20%) patients had no CXR performed
- 33 (31%) had chest xray performed but rib fractures were not seen on Xray
- Sensitivity of CXR = 60% (95% CI 49-71%) – (Published sensitivity 50%)

Injuries

- Number of fractures ranged from 1- 24 (mean 4.75)
- 22 (20%) patients bilateral rib fractures
- Mean rib fracture score = 8.4
  - 38 (36%) rib fracture score >7
- 6 (5.6%) patients died prior to hospital discharge
- Published mortality range 4-16%

Analgesia

- 24 (22%) patients were reviewed by the acute pain team during their admission
- 4 (3.7%) patients received epidural analgesia
    - Inserted between day 1-3
    - Duration of epidural 3-5 days (mean = 4)
- 15 (14%) patients received IVPCA analgesia
- 3 (2.8%) patients received surgical fixation of ribs +/- intra-operative regional blocks (paravertebral blocks/ rib block)

Analgesic guidelines for the management of rib fractures and thoracic trauma

Diagnosis of injury as per Chest Injury Pathway

↓

Pain uncontrolled (Dynamic pain score 2-3)

Step 1

Calculate rib fracture score (see below) = _____

Commence analgesia
- •Regular paracetamol
- •Regular dihydrocodeine 60mg QDS/Tramadol 100mg QDS
- •+/- 400mg Ibuprofen TDS (if not contraindicated)
- •PRN Oramorph 0.4mg/kg
- •PRN antiemetics

Note- reduce doses in elderly or frail patients

→ Pain controlled

Pain controlled (dynamic pain score 0-1)
+ Continue regular analgesia

↓

Pain uncontrolled (Dynamic pain score 2-3)

Step 2

- •IV morphine up to 0.2mg/kg titrated to pain
- •Antiemetics
- •Oxygen prescribed
- •Referral to acute pain team (bleep 2764, or anaesthetist out of hours (bleep 2224)

Consider early regional analgesia technique if high risk of deteriation (Rib Fracture score >7), co-morbidities or opioid tolerant

→ Pain controlled

Pain controlled (dynamic pain score 0-1)
- •IVPCA
- + Follow up with acute pain team
- •Discontinue weak opiate

↓

Pain uncontrolled (Dynamic pain score 2-3)

Step 3

Regional analgesic technique unless contraindicated

- •Thoracic epidural
- •Paravertebral block/catheter
- •Serratus anterior block/catheter

↓

Follow up by acute pain team
Bleep 2764/ Ext 14630

RIB FRACTURE SCORE = (Number of fractures X number of sides) + Age factor

= (_____ X _____) + _____

= _____

Age factor:
- 0-50 yrs = 0
- 51-60 yrs = 1
- 61-70 yrs = 2
- 71-80 yrs = 3
- >80 = 4

Score >7 indicates high risk and should be referred to the acute pain team

- •Avoid NSAIDS in the elderly or those at risk of AKI
- •Dynamic pain should be assessed on coughing and deep breathing

0 = No pain

1= Mild pain

2 = Moderate pain

3 = Severe pain

Discussion

- Who
  - » Patient selection
- What
  - » Expertise, experience,
- Where
  - » Resus, ward, theatre, recovery
- When
  - » Timing of intervention – sooner the better
- Why
  - » Debatable evidence of improved outcomes

Divinum sedare dolorem