Ultrasound Guided Serratus Plane Blocks for Multiple Rib Fractures

Aim:

To improve management of patients with rib fractures to reduce respiratory failure, requirement for invasive ventilation, ICU admissions, mortality, opioid requirement and hospital length of stay by creating a standard of care pathway in the Emergency Department.

Introduction:

Rib fractures are very painful. Without appropriate analgesia regimes, patients are more likely to sustain respiratory failure and acidosis, atelectasis and both hospital and community-acquired pneumonias. Current multimodal analgesia regimes not including regional anesthesia require higher opioid consumption which further lead to respiratory depression and other complications such as increased falls, delirium and tolerance.

Multiple regional anesthetic techniques exist, which boast various rates of success, but also differ in complication rates. Techniques such as intercostal nerve blocks require increased time resources to administer for multiple rib levels and purport a higher risk of iatrogenic pneumothorax. Other techniques such as erector spinae, paravertebral blocks or epidural infusions require alternate skills, time resources and have familiarity barriers to perform and monitor within the emergency department setting at present. Ultrasound-guided superficial serratus plane blocks have shown decreased opioid requirement in patients with multiple rib fractures or post thoracic surgery, have demonstrated a lower risk of complications, have small training requirement (*particularly in operators already trained in ultrasound guided fascia iliaca blocks*), can be performed in supine or lateral positions and can be easily facilitated in the Emergency setting. Superficial serratus plane blocks have been shown to be equivalent to deep blocks with lower risk of pneumothorax. Analgesia is achieved by bathing the lateral cutaneous nerves which run in this potential space and in turn, feeds back into the intercostal nerves over multiple rib spaces.

Erector Spinae plane blocks appear to have better efficacy for posterior rib fractures; however, serratus plane blocks have also been shown to improve outcomes in this patient group.

Indication:
Patients with multiple anterolateral, one-sided, acute or subacute rib fractures

Alternatives:
1. <u>Multiple posterior rib fractures</u>

- Call Acute Pain Service Registrar to request availability of an erector spinae plane nerve block
- If no availability within 1 hour, perform Serratus anterior plane block.

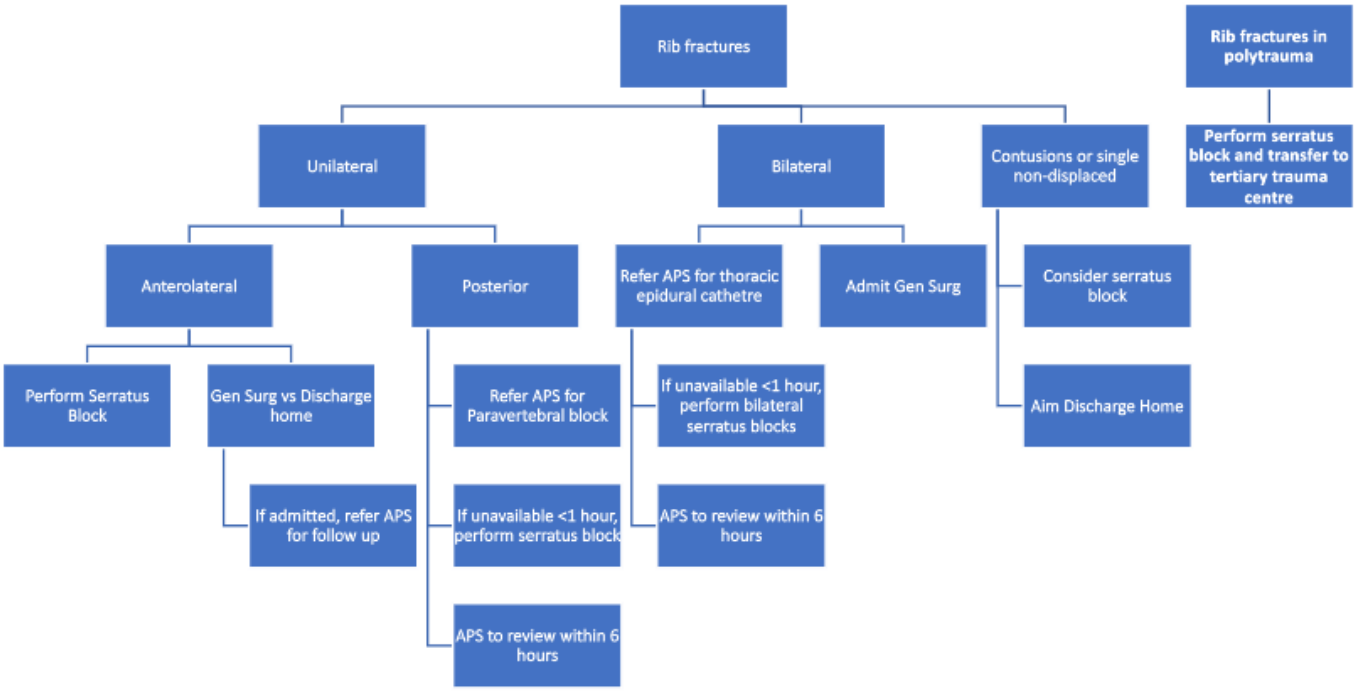
2. <u>Multiple bilateral rib fractures</u>

- Refer to Acute Pain Service for consideration of thoracic epidural catheter insertion

- If unavailable, perform bilateral serratus anterior plane blocks without infiltrating more than maximal safe dose of the local anesthetic
- Refer to Alfred Trauma registrar to facilitate transfer and cardiothoracic review (if required).

*Regional anesthesia should not delay the transfer of patients.

Decision flow chart:



Contraindications:

Absolute:

- Allergy to 'amide'' local anaesthetics
- Informed consent not gained from patient of medical decision maker

Relative:

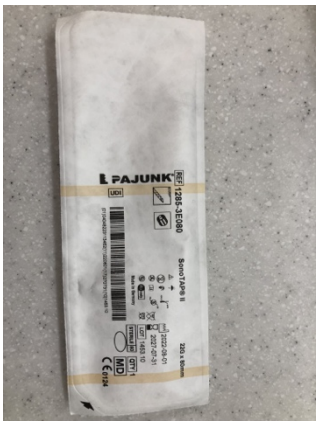
- Skin infection over site
- Major coagulopathy (Ie platelets <50, INR >3.0)
- Unable to fully appreciate Sono anatomy (ie obese patient)

Complications:

- Local anesthetic toxicity see Management of Local Anaesthetic Toxicity guideline
- Paresthesia, abnormal taste in mouth

- Tachyarrhythmias such as VT/VF
- Seizures
- Inadvertent vascular injection
- Pneumothorax/ haemothorax
- Abscess formation/ skin infection
- Wing of the Scapula (rare)

Equipment:



- Ultrasound machine
- Linear high frequency transducer probe
- Sterile probe cover with elastic bands and sterile gel
- 22g x 80mm Echogenic Nerve block needle (SonoTAP II).
  **Use lumbar puncture needle with introducer and inner needle removed if unavailable*
- 1.5mg/kg of Ropivacaine
- 1 x 5ml ampoule of 1% lignocaine + adrenaline
- 20-30ml of sterile 0.9% saline solution
- 2 x 20ml Luer lock syringes
- 1 x 5ml Luer lock syringe
- 1 x minimum volume extension tubing
  **If SonoTAP II needle is not available*
- Indwelling Urinary Catheter starter pack or major procedure pack
- 20ml Chlorhexidine + cetrimide solution
- Blunt drawing up needle
- 25-gauge hypodermic needle
- Appropriately sized sterile gloves
- Drape
- Small clear adherent dressing (eg Tegaderm or equivalent)
- 1 x assistant (*if available*)

Scope:
To be administered by credentialled and appropriately trained Emergency Department Doctors.

Procedure:
<u>Prepare:</u>

1. Obtain patient's weight. **If obese, use ideal body weight*
https://www.calculator.net/ideal-weight-calculator.html

2. Lay patient supine or in lateral position with broken ribs facing the ceiling. Ipsilateral shoulder should be flexed and may rest forward or above patients head in sunbaking position.

3. Place plugged in Ultrasound to face you on the opposite side of the bed and set to linear transducer probe plus 'small parts' or 'vascular' mode.

4. Open packing of consumables onto opened IDC starter pack sterile field. Wash hands and maintain aseptic technique throughout

5. Draw up a total of 1.5mg/kg ropivacaine, and then divide up evenly between each 20mL syringe

6. Fill the remainder of each syringe to the 20mL marker with 0.9% saline (40mL total volume between syringes)

7. Attach the minimum volume extension tubing to one of the 20mL syringes and then attach the other end to the procedural needle and prime the line. Place aside.

8. Draw up 2mL of 1% lignocaine + adrenaline in a 5mL syringe and attach 25-gauge hypodermic needle

9. Use tweezers to apply chlorhexidine-soaked gauze to procedure site. Include up to mid clavicular line, down to 8th rib and up into axilla.

10. Place Ultrasound gel into linear transducer, have assistant hold out probe, place sterile plastic sheath over top and secure in place with elastic bands around neck.

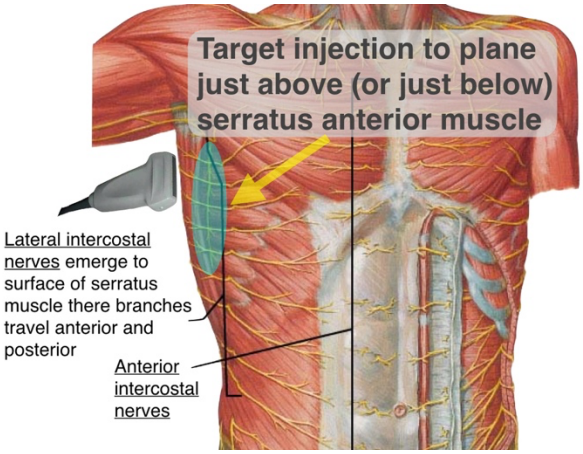
Your set up may look something like this:

Perform:

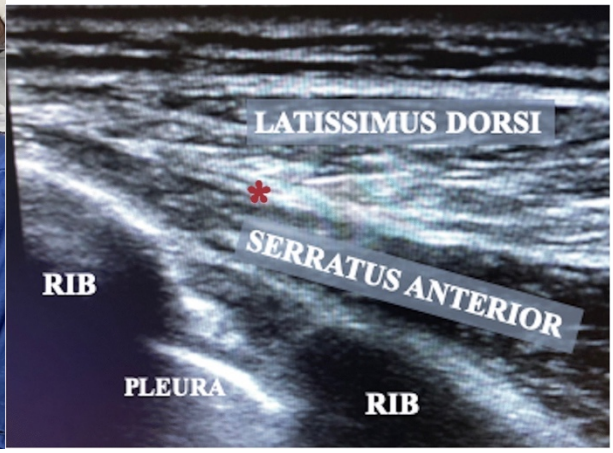
Please review this video of a successful serratus anterior plane block

Serratus Anterior Plane Block Demonstration Video 1

1. Identify landmarks of 5th rib (usually around the level of the nipple), anterior border or latissimus dorsi and mid axillary line. Place US probe horizontal, or between the transverse and coronal plane at the mid axillary line over the 5th rib and tilt posteriorly.



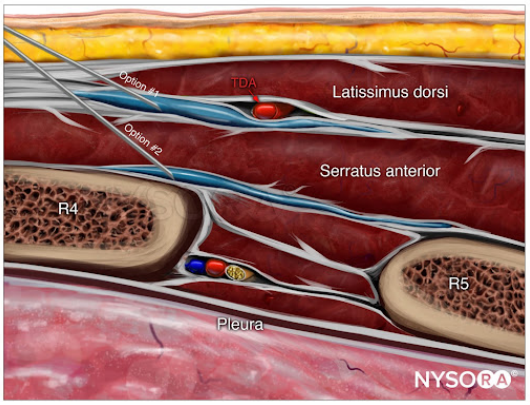
2. Identify structures of 2 ribs with pleura in between, overlying serratus anterior and more superficial latissimus dorsi and skin. Set depth so that pleura is in the bottom 1/3rd of the screen. Place on colour mode and locate thoracodorsal artery to reference and avoid accidental vascular infiltration of local anesthetic. Scan region to identify the best on-screen anatomy, you may need to translate the probe posteriorly.

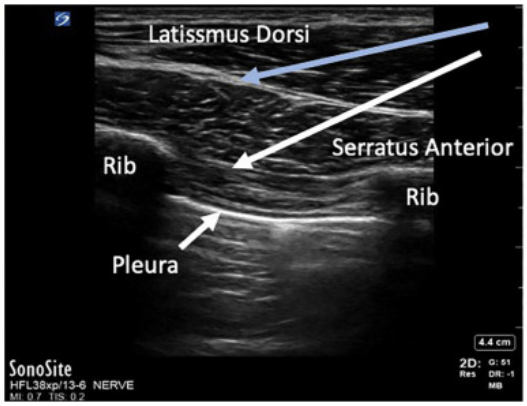


3. Inject 2mL of 1% lignocaine + adrenaline under the skin 2cm from edge of probe, where the nerve block needle will be introduced.

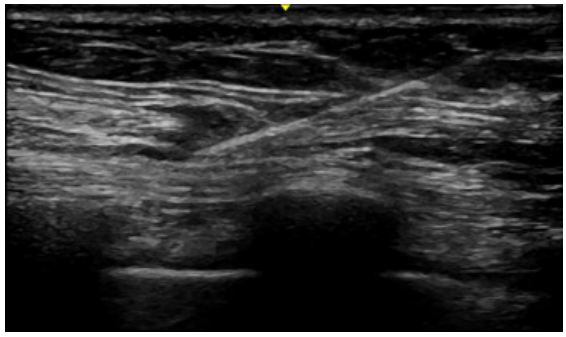
4. Perform in-plane technique by introducing nerve block needle through bleb at a 30–45-degree angle and always track the 'tip' of the needle before further advancing. If the tip is lost, retract needle to just underneath skin and realign.

5. Advance needle tip into the potential space just inferior to the latissimus dorsi and just superficial to the serratus anterior muscle. You may feel a pop. **See Option 1 or the blue arrow in images below*

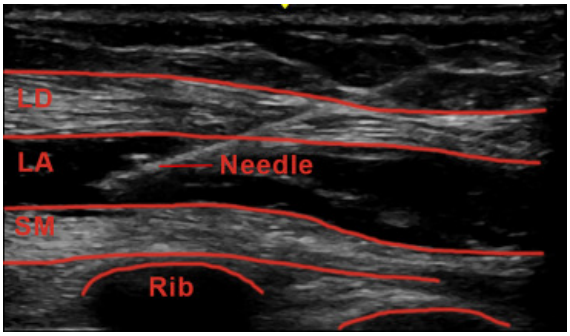




6. Have your assist aspirate the syringe to check for any blood draw through the tubing. Then inject 2mL of your anaesthetic mix from the 20mL syringe. You should see separation of fascial layers. If there is no separation, you are likely injecting into the muscle. Realign the needle and reattempt injection.



7. Continue to inject into this space and then advance needle into created pool as you go. **Always aspirate before each injection*



8. Withdraw needle and place clear dressing over injection site

Peninsula Health

Post-Procedure for Emergency Department Nursing Staff:

1. Monitor for complications such as local anaesthetic toxicity and pneumothorax with 4 lead telemetry and 15-minutely vitals for 30 minutes, followed by hourly vitals and numeric analogue scale pain scores for 4 hours on FirstNet(without telemetry).

2. If concerns for complications (such as increasing dyspnoea, hypotension, hypoxia, limb parasthesias), apply Hudson mask O2 at 10L/min and call senior Emergency Doctor/ Team leader for urgent review. If there is a seizure or tachyarrhythmia, press bedside emergency buzzer to assemble an emergency response team. Focus on assessment and management of complications, with particular attention to pneumothorax, local anaesthetic toxicity and anaphylaxis. See Management of Local Anaesthetic Toxicity guideline

3. The Serratus Plane block designed as an adjunct to and not instead of multimodal analgesia. It may take up to 30 minutes to begin to take effect. Please give charted oral analgesics if due, sit patient out of bed after the initial 30 minutes telemetry and hold a pillow to splint ribs. If still ineffective, please inform ward medical officer and acute pain service for review.

4. Patients can be transferred to an inpatient ward bed after the 30-minute telemetry monitoring period post-procedure if no complications are identified. They do not need a nursing or medical escort due to receiving this regional anaesthetic. They do not require repeat medical officer reviews or further time in the Department to wait for efficacy. Patients going to a monitored Western Port Ward bed or a monitored HDU/ICU bed can be transferred after the first set of vitals – as long as there is no marked clinical deterioration or signs of major complications. ED Nursing staff will need to handover to ward nursing staff to continue to complete the 1 hourly observation and pain scores until 4 hours post-procedure. Please refer ward nursing staff to this document as they may be less familiar with the procedure.

Post procedure for Ward Nursing Staff:

1. Continue to monitor for complications such as local anaesthetic toxicity and pneumothorax with 1 hourly vitals and Numeric Analogue Pain scores on FirstNet for 4 hours (without telemetry).

2. If concerns for complications (such as increasing dyspnoea, hypotension, hypoxia, limb parasthesias), apply Hudson mask O2 at 10L/min and call for urgent Medical Officer of admitting team and anaesthetic pain registrar (APS) to review. If the patient has a seizure or any criteria for a MET response are fulfilled (without documented patient altered MET call criteria), call a MET response. Focus on assessment and management of complications, with particular attention to pneumothorax, local anaesthetic toxicity and anaphylaxis. See Management of Local Anaesthetic Toxicity guideline

3. The Serratus Plane block designed as an adjunct to and not instead of multimodal analgesia. It may take up to 30 minutes to begin to take effect. Please give charted oral analgesics if due, sit patient out of

bed after the initial 30 minutes telemetry and hold a pillow to splint ribs. If still ineffective, please inform ward medical officer and acute pain service for review.

Post Procedure for Doctors:

1. Document procedure using the Ultrasound template on FirstNet. You will find it in the same drop-down list as the inpatient handover form and short stay referral form. Must include indication, consent, if alternative techniques were considered and why, total dose used and any complications noted.

2. Ensure alternative analgesia charted:

A) Paracetamol 1g QID

B) Celecoxib 200mg BD (halve dose if eGFR 60-90, exclude if eGFR <60 or concurrent use of ACEi or ARB)

C) Oxycontin 10mg BD or Tapentadol SR 50mg BD for 5 days

D) PRN Tapentadol IR 50mg 4 hourly. (If cost is a factor to patient, consider tramadol 50-100mg QID PRN on discharge)

See upcoming blunt chest injury pathway from anaesthetics (will be hyperlinked when out of draft)

3. If pain scores still >5 at 2 hours post procedure, refer to acute pain service for review and consideration of Patient Controlled Analgesia Device (PCA) or other modalities such as catheter insertion and continuous infusion. If a patient is to be admitted, ensure Acute Pain Service has been referred for ward follow up. If pain score <3, has demonstrated effective cough and deep inspiration, are normoxic on room air and there are no other barriers to discharge, the patient may be discharged home. All patients discharged home are encouraged to follow up with GP in 48 hours and return to Emergency if they cannot control their pain, cannot cough effectively, experience dyspnea or have a fever.

Quality:

Protocol implemented on 20/12/2022

Junior doctors will be required to complete the ACEM procedural training module as well as participation in training sessions and have a minimum of 3 procedures supervised (*2 formative and 1 summative using ACEM procedural guidance* forms) by a consultant proficient in the technique prior to independent practice in performing serratus plane blocks. Competence and safe practice need to be witnessed and documented in writing by a senior member of the ED Ultrasound Faculty for a trainee to be credentialled. There will be 6 monthly auditing of trainees credentialling requirements by the Peninsula Health Emergency Department Ultrasound Faculty. All trainees assessment forms and workshop attendance will be kept in the Emergency Department Microsoft Teams ED POCUS Special interest group folders for reference as required. Trainees are also required to complete a personal log book of all ultrasound scanning and ultrasound-guided nerve block techniques which can be made

available for review on request by senior staff as part of the auditing process and as per ACEM requirements.

Protocol will be audited at the 6-month mark and the 1-year point. Focus will be on need to review efficacy through patient pain scores and opioid requirement, complication rate and type of complications as well as compliance to protocol. Changes made to protocol warrant a further 6-month review, otherwise 2 yearly ongoing guideline reviews are required. Yearly workshops will be offered to ensure ongoing competence in skill upkeep and to train new ED clinicians.

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