Purpose and Objectives

- Abdominal and Thoracic innervation anatomy
- Ultrasound-guided technique
- Risks and complications
- Para-vertebral Nerve block

Michael Major D.O.
Assistant Professor Anesthesiology
OUHSC
Abdominal field blocks have been around for a long time and have been extensively used as they are mostly technically unchallenging. They, however, provide limited analgesic fields, hence multiple injections are usually required. Traditionally these blocks have blind end points (pops) making their success unpredictable.

The description of the landmark technique for performing transversus abdominis plane (TAP) block advocated a single entry point, the triangle of Petit, to access a number of abdominal wall nerves hence providing more widespread analgesia. More recently, ultrasound guided TAP block has been described with promises of better localization and deposition of the local anaesthetic with improved accuracy.
Anterior Divisions

- Their pathway is within the neuro fascia
- Between internal oblique and transversus abdominal muscle
- 12th anterior division is the largest one

Innervation to the Abdomen

- Anterior rami T7 to T12
- Thoracicoabdominal intercostal nerves
  - Continue anteriorly as anterior cutaneous branch
  - Perforate the Rectus abdominis
- Skin, muscles and parietal peritoneum of the anterior abdomen
Lateral Cutaneous Branches

- Anterior
  - Digitations of Obliquus externus
  - Extend downward and forward to the margins of Rectus abdominis
- Posterior
  - Run backward to supply the latissimus dorsi and scapula

Anatomy Review

- Between Internal oblique and transversus muscle
- Neurofascial plane
  - Anterior cutaneous – Lateral cutaneous
- Branches off in mid-axillary line

Techniques

- Ultrasound guided
- If one deposits local anesthetic in the fascial plane between the internal oblique and transversus abdominis muscles, then the sensory innervation to the anterior abdominal wall can be blocked.
- By directly visualizing the spread of local anesthetic in the plane between the internal oblique and transversus abdominis muscles, one can ensure that the deposition of the anesthetic is occurring in the correct plane, which may improve success rates.
Advantages of Ultrasound

- Allows for direct visualization of:
  - Relevant anatomic landmarks
  - Unusual anatomy
  - Needle trajectory and depth
  - Detect branching vessels with colorflow
  - Local anesthetic spread confirmation in real time
  - Few reported complications
Ultrasound Guided Technique

- With linear, high frequency, transducer
- Axial plane above the iliac crest
- Adjust US depth to 4 cm
- Identify the muscle layers in the mid-axillary line near the triangle of petite
- Follow the needle trajectory
- The internal oblique is the most prominent muscle of the three

EQUIPMENT

- Ultrasound machine with a linear/high frequency probe.
- 20g Quincke-type spinal needle (a short bevel nerve block needle can be used, but the blunt tip causes significant image distortion).
- Injection tubing to connect the needle to the syringe of local anesthetic.
- 2-20cc syringes of local anesthetic (bupivacaine 0.25% or 0.375% ropivacaine).
- 1-10cc syringe of normal saline
- Sterile prep solution, sterile tray, sterile ultrasound dressing
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- Correct needle placement between the fascial planes results in an obvious splitting of the muscle layers. In addition, the local anesthetic will be extremely easy to inject. Conversely, needle placement in the muscle results in a speckling pattern in the muscle layer, and the local anesthetic will be more difficult to inject.

Benefits

- Decreased sedation & somnolence
- Decrease prolonged stays in the PACU
- Improved patient comfort
- May improve compliance with postop care such as ambulation and respiratory exercises
- May improve breast feeding abilities of neonate
Risk and Complications

- Infection, bleeding, and pain
- Neuronal and transient nerve palsy
- Leg weakness from femoral nerve effects • Vascular damage
- Visceral injury:
  - Bowel hematoma
  - Peritoneal puncture and peritonitis • Organ damage
- enlarged liver/spleen

Complications (cont.)

- Intravascular injection
- Neurologic: confusion, irritability, ---> seizures
- Cardiovascular: dysrhythmias, hypotension,-->
- CV collapse
Para-Vertebral Block

• Para-Vertebral Block (PVB) involve injection of local anesthetic in a space immediately lateral to where the spinal nerves emerge from the intervertebral foramina. This technique is being used increasingly for not only intra-operative and post-operative analgesia but also as a sole anesthetic technique for carrying out various procedures. This popularity is mainly due to the ease of the technique and fewer complications.

• There has been renewed interest in this technique for the treatment of acute and chronic pain. Because of the ability to provide long-lasting unilateral anesthesia, PVB have been successfully used to provide analgesia for multiple thoracic and abdominal procedures in both children and adults.

• The para-vertebral space is a wedge-shaped anatomical compartment adjacent to the vertebral bodies. In the dorsal region, the para-vertebral space is defined anterolaterally by the parietal pleura, posteriorly by the superior costotransverse ligament, medially by the vertebrae and intervertebral foramina, superiorly and inferiorly by the heads of the ribs.
Within this space, the spinal root emerges from the intervertebral foramen and divides into dorsal and ventral rami. The sympathetic chain lies in the same fascial plane, just anterior to the intercostal nerve and communicates with it via the rami communicantes. Hence, PVB produces unilateral sensory, motor, and sympathetic blockade.

Each space is not an isolated structure but can communicate superiorly and inferiorly across the heads and necks of the ribs with the spaces above and below.

Kairaluoma et al. (2006) studied the effects of PVB in the relief of chronic pain after breast surgery. They reported that preincisional PVB provides significant immediate postoperative analgesia after breast cancer surgery. The same patients (n = 60) were followed up for a year to find out whether PVB could also reduce the prevalence of postoperative chronic pain. The follow-up consisted of a 14-day symptom diary and telephone interviews at 1, 6, and 12 months after surgery. One month after surgery, the intensity of motion-related pain was lower in the PVB group. Six months after surgery, the prevalence of any pain symptoms was lower in the PVB group. Finally, at 12 months after surgery, in addition to the prevalence of pain symptoms and the intensity of motion-related pain, the intensity of pain at rest was lower in the PVB group. These findings were independent of whether or not axillary dissection had been performed. The incidence of neuropathic pain was low (two and three patients in the PVB and control groups, respectively). In addition to providing acute postoperative pain relief, preoperative PVB seems to reduce the prevalence of chronic pain 1 year after breast cancer surgery.
Advantages of PVB

- PVB is easier to learn and perform than thoracic epidural anesthesia.
- Analgesia is comparable with that provided by a thoracic epidural, in terms of success rate and analgesic efficacy.
- PVB can be performed safely in fully anesthetized patients.
- There is less risk of neurological complications than with most other regional anesthetic techniques.
- Pronounced hypotension is unusual because sympathetic block is rarely bilateral.
- Urinary retention does not occur, unlike neuraxial techniques.
- There is less sedation, nausea, vomiting and constipation compared with opioid-based analgesic techniques; opioid consumption is considerably reduced. Enteral nutrition and mobilisation should therefore be achieved earlier.
- Compared with interpleural blocks, PVB analgesia is more intense and longer lasting. Serum levels of local anaesthetic are lower.
- PVBs have been shown to reduce chronic pain after thoracic and breast surgery. This is possibly because of intense block of both the sympathetic and somatic nerves, preventing sensitisation of the central nervous system and N-methyl-D-aspartate receptor ‘wind up’.
- Tumor recurrence after breast surgery may also be inhibited.
- Less peri-operative morbidity and a shorter hospital stay could potentially result in cost savings.
Contraindications

- Local sepsis (cutaneous or intrathoracic);
- Tumors in the paravertebral space at the level of injection;
- Allergy to local anaesthetic drugs;
- Patient refusal.

Relative Contraindications

- Severe coagulopathy;
- Severe respiratory disease (where the patient depends on intercostal muscle function for ventilation);
- Ipsilateral diaphragmatic paresis;
- Severe spinal deformities (kyphosis or scoliosis). If the anatomy is abnormal, the difficulty and risks increase.

Conclusion

- PVBs are easy to perform, have a high success rate, and offer significant potential advantages to patients, compared with other regional techniques and opioid-based analgesia. PVBs are associated with a low rate of complications. The likelihood of significant long-term morbidity is low.
- PVBs should be strongly considered for all unilateral surgery in the thoracic or abdominal region as an alternative to thoracic epidural or systemic opiate analgesia.