USG IN ANESTHESIOLOGY, PAIN & INTENSIVE CARE

CASE REPORT

Ultrasound guided transversus abdominis plane (TAP) block for inguinal surgery in a case with severe kypho-scoliosis and pectus excavatum

Pranav Bansal[1], Jagdish Dureja[2], Nivesh Aggarwal[3], Davender Chahal[4]

[1]Associate Professor, [2]Professor and Head; [4]Medical Officer (Resident)
Department of Anesthesiology & Critical Care, BPS Govt. Medical College for Women, Khanpur Kalan, Sonipat, Haryana (India)
[3]Professor of Surgery, BPS Govt. Medical College for Women, Khanpur Kalan, Sonipat, Haryana (India)

Correspondence: Dr. Pranav Bansal, BPS Govt. Medical College for Women, Khanpur Kalan, Sonipat, Haryana (India): Phone: +91-8607466555 E-mail: pranavbansal1@gmail.com

ABSTRACT

Presence of severe thoracolumbar kyphoscoliosis with pectus excavatum (PE) is more than a cosmetic deformity and causes cardiopulmonary impairment with physiologic limitations. These patient have risk of rise in pulmonary artery pressures during laryngoscopy and intubation. Moreover, due to a non-compliant chest wall, these patients are prone to develop inadequate postoperative ventilation, post-operative hypoxemia, and difficult extubation with delayed weaning from ventilatory support. A case with both severe kyphoscoliosis (Cobb's angle >90°) and PE, presented for excision and debridement of infected inguinal swelling. We hereby discuss the anaesthetic challenges, and the importance of early planning of anaesthetic techniques for successful perioperative management in cases with anatomical deformities of thoracolumbar column and rib cage. The utility of ultrasound guided TAP block in providing surgical anaesthesia for inguinal or superficial abdominal surgeries has also been highlighted in this report.

Key words: Kyphosis; Scoliosis; Pectus Excavatum; Transverses Abdominis Plane Block; Cobb's Angle

Citation: Bansal P, Dureja J, Aggarwal N, Chahal D. Ultrasound guided transversus abdominis plane (TAP) block for inguinal surgery in a case with severe kypho-scoliosis and pectus excavatum. Anaesth Pain & Intensive Care 2015;19(3):386-389

INTRODUCTION

The word scoliosis has been derived from Greek that means 'Crook'. It is the deformity of vertebral column, resulting in lateral curvature of the spine with or without anterior rotation (kyphosis) and/or associated rib cage deformities. The incidence of kyphoscoliosis reaching an angle of 35° (mild) is 1 in 1000 and that more than 70° (severe) is 1 in 10,000. Severe scoliosis is associated with restrictive lung disease and hypoxemia that leads to pulmonary hypertension and respiratory failure by the fifth decade, if left untreated.[2] Pectus excavatum (PE) is another relatively uncommon skeletal disorder presenting as an isolated finding in South-East Asian countries. It has a strong association with connective tissue disorders as Marfan's syndrome and idiopathic scoliosis.[3] Administration of neuraxial anaesthesia in severe kyphoscoliosis is no easier than walking on a rocky terrain. Common problems include repeated attempts during procedure, failed blocks and difficulty in anaesthetic dose calculation. Proper pre-operative history taking, examination, anaesthetic plan and preparation can ensure a smooth conduct of anaesthesia and reduce the incidence of perioperative complications. The increasing use of ultrasonography in regional anaesthesia has paved a way for safe and effective use of alternative regional techniques in this subset of patients. The effective use of ultrasound in anaesthesiology requires a 3-D orientation of anatomical structures along with proper interpretation of sonographic images that can be best achieved by routine inculcation of this modality in clinical practice.

Figure 1-A: Preoperative anthropometric evaluation of the patient
B: Anterior view: Chest revealing PE and inguinal swelling
C: Posterior view: Severity of scoliosis in thoracolumbar region and kyphosis in lumbar area
D: Lateral view: Fixed flexion deformity of vertebral column as observed in resting state

CASE REPORT

A 33 year old male with severe thoracolumbar kyphoscoliosis and PE presented to surgical outpatient department with infected inguinal swelling. The patient was sent for pre-anaesthetic evaluation with a plan of surgical excision and debridement of swelling. History revealed the presence of scoliotic spine since childhood, with a gradual increase in deformity over the developmental period. Anthropometric measurements revealed his height of 4 feet 8 inches, upper/lower segment ratio: 24 inches / 32 inches and weight 40 kg. On systemic examination his upper airway and neck movements were normal, thoracic cage was malformed with depressed sternum (PE) &mal-aligned ribs and a small abdominal cavity. Echocardiography showed presence of pulmonary hypertension with slight shift of cardiac axis towards right side. Examination of back and spine revealed grossly deviated, stiff and immobile (probably calcified) vertebral column with no identifiable intervertebral spaces (Figure 1).

On x-ray evaluation, the vertebral column was grossly deviated with Cobb's angle >90°, thoracic cavity was small with crowding of ribs and lung fields were markedly reduced (baby lung) (Figure 2). His resting respiratory rate was 30-34 breaths per minute and Pulmonary Function Tests revealed a restrictive pattern on flow-volume loop with aFEV1: 42%, FVC: 52%, PF: 27%and FEV_{25-75} : 45%. Pre-operative arterial blood gas (ABG) analysis showed pH: 7.34, PO_2 96, PCO_2 -36, HCO_3 22 and SpO_2 98%.

It was planned to perform the case preferably under

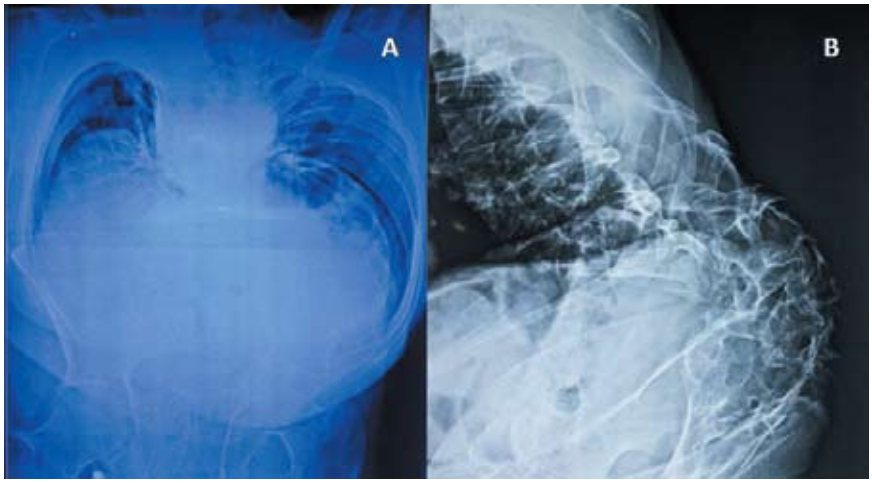

Figure 2-A: PA view of chest showing small volume of lungs and narrow intercostal spaces
B: Lateral view of lumbosacral spine

central neuraxial blockade due to poor respiratory reserve of the patient. In case of failure of above, a back-up plan was decided, where ultrasound guided transverses abdominis plane block or ilioinguinal nerve block or local infiltration technique, or a combination of above would be deployed. The patient was shifted in operating room and standard monitoring (including ECG, SpO_2, NIBP, RR, Temp. and $ETCO_2$) were attached. Initial attempts to spinal anaesthesia with 23 G Quinke's needle via midline, paramedian and Taylor's approach were not successful. The caudal space was obliterated and the bony landmarks were unidentifiable on palpation, so the approach to caudal block also failed. It was planned to next perform a Transverses Abdominis Plane (TAP) block under sonographic guidance. The portable ultrasound machine Micromaxx™ (Sonosite Inc. ltd.) with curvilinear probe was used for the procedure. Due to a small sized abdominal cavity of patient, the movements of ultrasound probe were restricted on abdomen (Figure 3-A).

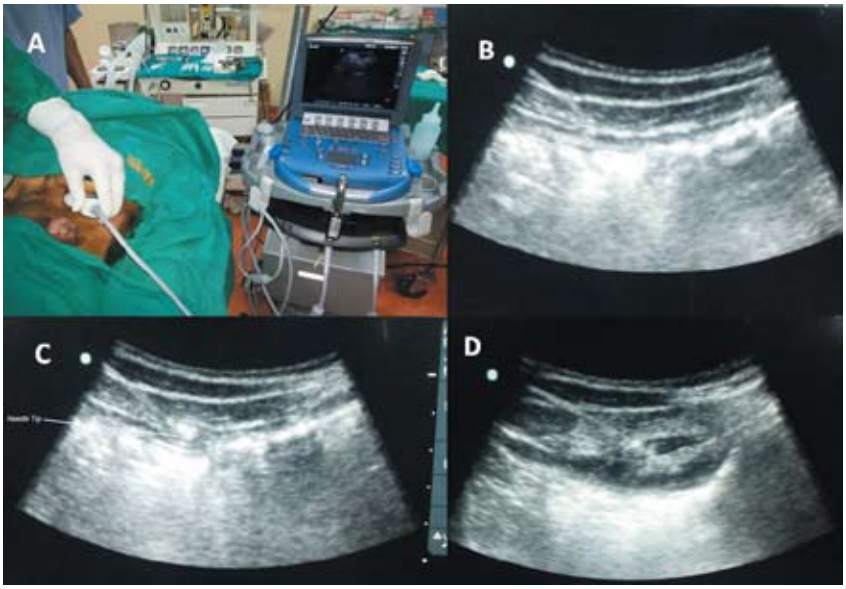

Figure 3-A: Manoeuvring of ultrasound probe for identification of transverses abdominis plane
B: Needle tip in internal oblique muscle
C: Needle tip in TAP during local anaesthetic administration
D: Walking of needle tip further in TAP (increase in needle obliquity observed)

The probe was tilted, rotated, or both to improve visualization of the three layers of the lateral abdominal wall, respectively, from superficial to the depth, external oblique, internal oblique, transversus abdominis, and, most deeply, peritoneal cavity. With an oblique orientation on abdominal wall, the muscle planes were identified and spinal needle 23 gauge was introduced in transverses abdominis plane on the side of planned surgery. The progression of the needle, visible as a bright hyperechoic line, was assessed under direct ultrasonography (Figure 3-B). The injection site was defined between aponeurosis of internal oblique and transversus abdominis muscles (Figure 3-C). The local anaesthetic solution containing Inj. Lignocaine 2% (with adrenaline 1:200,000 dilution) 5 ml + Inj. bupivacaine (0.5%) 7 ml + normal saline 8 ml (total volume 20 ml) was administered and needle walked further in this plane to assure the adequacy of block (Figure 3-D). After the surgery was completed successfully under TAP block, and the postoperative recovery was uneventful. The biopsy specimen revealed squamous cell carcinoma metastasized to lymph node (undifferentiated type with unknown primary) and the patient was referred to higher centre for further management.

DISCUSSION

Severe thoracolumbar kyphoscoliosis presents a unique challenge for attending anaesthesiologist. There is no accepted best practice or anaesthetic technique to manage their perioperative care, but only a choice of available regional anaesthetic techniques with different pros and cons, that may be tailored to meet individual needs.[4]

The severity of scoliosis depends primarily on the type, duration and on the curvature of spine (Cobb's angle). Patients with severe scoliosis (>60°) with or without associated PE suffer from restrictive lung disease which decreases tidal volume, vital capacity, functional residual capacity, FEV1, chest wall compliance and increases the work of breathing.[3-5] A significant reduction in the number of alveoli predisposes these patients to impairment in gas exchange and pulmonary hypertension. Sternal and cardiac compression can also reduce stroke volume and cardiac output, and mitral valve prolapse is found in as many as 25% of patients.[3]

Neuroaxial anaesthesia may also be unpredictable in presence of severe kyphoscoliosis and may present with technical problems ranging from failed spinal, inadequate block, partial blockade to inappropriately

high levels of anaesthesia. Placement of epidural catheters may lead to migration of catheter towards one side with a patchy effect.[5]

Transversus abdomins plane (TAP) block is a new regional anesthetic technique described first by Rafi et al (2001) and MacDonald et al (2004) that provides analgesia to anterior and lateral abdominal wall.[6] It blocks the abdominal wall neural afferents from skin, muscles and parietal peritoneum, by introducing local anesthetic into the neurofascial plane between the internal oblique and transversus abdominis muscles.

There are two techniques of TAP block, the classical technique where needle is placed in lumbar triangle of Petit and the other, subcoastal technique. The lumbar triangle of Petit is situated between the lower costal margin and iliac crest bounded anteriorly by the external oblique muscle and posteriorly by the latissimus dorsi muscle. The nerve segments of T11, T12 and L1 are most consistently blocked following a single classical TAP block technique, while T10 is blocked in at least 50% of the cases. In subcostal TAP block technique, the ultrasound probe is placed just beneath the costal margin and parallel to it. Augmentation with a subcostal injection can help attain a higher block up to T7 level.[6-10] In our case, as the iliac crest was in close approximation with rib cage, the abdominal surface was limited, and we placed the curvilinear probe in subcoastal region and achieved the effect in inguinal region.

Previously, use of blind technique was associated with complications like intraperitoneal injection, bowel hematoma, liver laceration and transient femoral nerve palsy. Since the advent of sonography in anaesthesia practice, the safety profile and utility of this block has been on a progressive rise. Presently, TAP block is utilized to provide postoperative analgesia for abdominal hysterectomy, prostatectomy, cesarean section, cholecystectomy or any other abdominal wall surgery. It has also been reported to be as a sole anaesthetic for inguinal hernia repair and appendicectomy in adult and pediatric population.[10]

Recently, the utility of ultrasonography in anaesthesiology practice has been extended for easing the identification of epidural and intrathecal spaces in cases with a body mass index (BMI) of 30 or more, though; currently the available literature is very limited.[11] This novel technique relies on identification of bony landmarks and potential needle entry point where the user can guide the needle entry in dynamic (real time) fashion like other nerve blocks towards spinal canal and visualize the injectate on sonograph.[12]

CONCLUSION

In face of difficult neuraxial blockade, or gross anatomic deformities, TAP block can be utilized to provide surgical anaesthesia for inguinal or superficial abdominal surgeries.

Conflict of interest: None declared by the authors

REFERENCES

1. Veliath DG, Sharma R, Ranjan RV, Rajesh Kumar CP, Ramachandran TR. Parturient with kyphoscoliosis (operated) for cesarean section. J Anaesth Clin Pharmacol. 2012 Jan;28(1):124-6. doi: 10.4103/0970-9185.92463.[PubMed] [Free full text]
2. Korula S, Ipe S, Saramma SP. Parturient with severe kyphoscoliosis: An anesthetic challenge. J Obstet Anaesth Crit Care. 2011;1:81-4. [Free full text]
3. Jaroszewski D, Notrica D, McMahon L, Steidley DE, Deschamps C. Current Management of Pectus Excavatum: A Review and Update of Therapy and Treatment Recommendations. JABFM. 2010 Mar-Apr;23(2):230-9. [PubMed] [Free full text] doi: 10.3122/jabfm.2010.02.090234.
4. Bowens C, Dobie KH, Devin CJ, Corey JM. An approach to neuraxial anaesthesia for the severely scoliotic spine. BJA. 2013 Nov; 111(5):807-11. [PubMed] [Free full text] doi: 10.1093/bja/aet161.Epub 2013 May 9.
5. Bansal N, Gupta S. Anaesthetic management of a parturient with severe kyphoscoliosis. Kathmandu Univ Med J (KUMJ). 2008 Jul-Sep;6(23):379-82. [PubMed]
6. Townsley P, French J. Transversus abdominis plane block anaesthesia tutorial of the week 239. [Free full text] Available at https://www.aagbi.org/sites/default/files/239%20Transversus%20Abdominus%20Plane%20Block.pdf
7. Mishra L, Pani N, Mishra D, Patel N. Bilateral transversus abdominis plane block as a sole anesthetic technique in emergency surgery for perforative peritonitis in a high risk patient. J Anaesthesiol Clin Pharmacol. 2013 Oct;29(4):540-2. [PubMed] [Free full text] doi: 10.4103/0970-9185.119140.
8. Jankovic Z. Transversus abdominutesis plane block: The holy grail of anaesthesia for (lower) abdominutesal surgery. Periodicum Biologorum. 2009;111:203–8.
9. Mcdonnell JG, O'Donnell BD, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of TAP block after abdominal surgery: A prospective randomised controlled trial.Anesth Analg. 2007 Jan;104(1):193-7. [PubMed]
10. Galante D, Caruselli M, Dones F, Meola S, Russo G, Pellico G, et al. Ultrasound transversus abdominis plane (TAP) block in pediatric patients: Not only a regional anesthesia technique for adults. Anaesth Pain & Intensive Care 2012;16(2):201-204. [Free full text]
11. Bentley S, Lutsep HL. Emed. medscape. [Free full text]
12. Conroy PH, Luyet IC, McCartney CJ, McHardy PG. Real-Time Ultrasound-Guided Spinal Anaesthesia: A Prospective Observational Study of a New Approach. Anesthesiol Res Pract. 2013;2013:525818. [PubMed] [Free full text] doi: 10.1155/2013/525818. Epub 2013 Jan 10.

★★★★★