

CASE REPORT

Anaesthetic management of cases where Thoracic segmental spinal anesthesia a suitable alternative to general anesthesia

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ABSTRACT

This manuscript describes six cases of thoracic spinal anaesthesia for patients with for certain cases such as laparoscopic surgeries who are considered at high risk while under general anesthesia. Anesthesiologists are hesitant to perform spinal anesthesia above the termination of the conus medullaris due to fear of injuring the spinal cord. However, thoracic spinal anesthesia has been demonstrated as a safe and effective method for various surgeries. Although not routinely used, the procedure has been shown as beneficial in maintaining hemodynamic stability for these patients and reducing side effects encountered with general anesthesia. This activity describes the procedure of thoracic segmental spinal anesthesia and explains the role of the interprofessional team in managing patients who have undergone this procedure.

Keywords: Thoracic segmental spinal anesthesia, general anesthesia, Complications, Outcome

INTRODUCTION

Thoracic segmental spinal anesthesia is a technique of regional anesthesia that can potentially be a suitable alternative to general anesthesia for certain cases such as laparoscopic surgeries, particularly in patients who are considered at high risk while under general anesthesia. Although not routinely used, the procedure has been shown as beneficial in maintaining hemodynamic stability for these patients and reducing side effects encountered with general anesthesia. Thoracic segmental spinal anesthesia is typically utilized for patients undergoing surgery with major medical problems where they are considered a greater risk for general anesthesia.^{1,2} General anesthesia is the standard for most surgeries; however, some drawbacks can include negative drug side effects, prolong recovery, and inadequate pain control. There is currently renewed attention to thoracic segmental spinal anesthesia for several common surgeries. Injection of anesthetics intrathecally into the preferred body height and above where the spinal cord terminates has been revealed to be valuable in these certain circumstances. Thoracic spinal anesthesia has been demonstrated as a safe and effective method for various surgeries, including laparoscopic cholecystectomies, breast cancer lumpectomies, and abdominal cancer surgery.^{3,4} Giving thoracic spinal anesthesia may provide another option for these common surgeries improved patient safety, reduced post anesthesia care stay, and better postoperative pain relief

CASE 1

A female patient age 43y presented with right upper quadrant pain diagnosed as cholelithiasis planned for laparoscopic cholecystectomy her weight was more than 120kgs .saturation at supine position is 89-91% with 4lts of oxygen >96%.Pulmonary function tests showed a severely restrictive pattern. Arterial (radial sample) blood gas analysis showed moderate hypoxemia at rest.Gallstones were discovered during assessment and cholecystectomy was considered a necessary preliminary procedure to avoid the possibility of acute cholecystitis. However, the patient's respiratory state and high BMI raised considerable anesthetic concerns and surgery was deferred at two other hospitals before she was referred to us.

after discussing high risk of recovery problem and post-operative ventilator requirement with patient attenders our team (surgeon anesthetistpost-operative team) decided to go for surgery without hampering her spontaneous breathing.

Thoracic segmental spinal anesthesia is planned .in right lateral position under aseptic precautions,23G QB spinal needle introduced into t7-t8 intervertebral space ,after ensuring free flow of csf local anaesthesia drug is injected .the drug mixture used is 2.5ml 0.5% bupivacaine heavy 2cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 5cc.within 5 min sensory block obtained from T2 to L1 dermatomes without any motor weakness/block in the legs,upper limbs and respiratory distress.

The distribution of block remained same trough out the procedure, but blood pressure decreased from 132/80 to 92/65 mm Hg, and heart rate from 80 to 56 beats min⁻¹,although there was no nausea or vomiting. The hypotension responded well to i.v.mephenteramine 6mg and cholecystectomy, using a laparoscopic technique, was started.

The circulation remained hemodynamically stable during the operation (during which 1500 ml of i.v. crystalloid fluid was given) .during intraoperative period patient received 5 L of oxygen per min through oronasal mask.no extra sedation was given as patient was in comfortable position. The same extent of sensory block, still without lower limb weakness, was present at the end of the operation as at the beginning, and the patient was able to move himself without help back from the operating table to her shifting trolley. Postoperative recovery was uneventful, and there was no further deterioration in pulmonary function tests, allowing the patient to be discharged from hospital on Day 3.

CASE 2

A pregnant female patient age 28 yr 14 wks gestation came with severe pain in right illiac region on ultrasound scanning diagnosed as acute appendicitis which was correlating clinically .she was posted for laparoscopic appendicectomy , patient is nurse by profession and we gave an option for open appendectomy under spinal anaesthesia but patient refused for open and wanted laparoscopy surgery under spinal anaesthesia as she want to avoid general anaesthesia drug effects on her early pregnancy. After discussing with surgeon and patient decided to do laparoscopy surgery under thoracic segmental spinal anaesthesia without using nitrous oxide and other sedative and inhalation drugs. After aseptic skin preparation, patient positioned in right lateral position. T11-t12 intervertebral space identified and local anesthetic mixture injected intrathecally after seeing free flow of cerebrospinal fluid.

drug mixture used is 2.5ml 0.5% bupivacaine heavy 2cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 5cc.within 5 min sensory block obtained from T4 to L1 dermatomes without any motor weakness/block in the legs,upper limbs and respiratory distress. The distribution of block remained same trough out the procedure, but blood pressure decreased from 120/80 to 82/60mm Hg, and heart rate from 86to 60beats/ mi. Hypotension responded well to mephenteramine 6mg. Surgery started and procedure completed in 40 min without any complications. During the procedure patient was conscious

tolerated CO₂ gas inflation without any discomfort and no sedative drugs are given .Patient received 1.2 L crystalloid fluid and 2 Lo₂/min ,post-operative period uneventful. Fetus doing good and patient discharged on day 3.

CASE 3

A middle aged neglected patient suffering from stage 4 breast cancer with multiple metastatic lesions came for palliative surgery.The breast lesion is erythematous necrosed and infested with full of maggots foul smelling.Even maggots are in intra pulmonary and intrapleural region .To make her life unmiserable surgeon decided to toilet mastectomy.Here in this case we wanted to avoid general anaesthesia as there can post-operative recovery problem and need of ventilator.As duration of surgery less than one hour we decided to go for thoracic segmental spinal anaesthesia and maintain her spontaneous breathing .Segmental thoracic spinal anesthesia has some advantages when compared with general anesthesia and can be considered as a sole anesthetic in breast cancer surgery with axillary lymph node clearance.

After aseptic skin preparation , patient positioned in right lateral position .T7-T8 intervertebral space identified and local anesthetic mixture injected intrathecally after seeing free flow of cerebrospinal fluid. Drug mixture used is 2.5ml 0.5% bupivacaine heavy 2cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 5cc.within 3min sensory block obtained from T2 to L1 dermatomes without any motor weakness/block in the legs and upper limbs .

During the procedure there was respiratory distress as her pulmonary function is in compromised state. patient ventilated with bair circuit for 10 min then surgery continued on oronasal mask with 5L/min. In this case there was no hypotension and patient was supplemented with low dose ketamine 25mg every 15 min . surgery lasted for 1 hr. procedure went uneventful. Patient received 1.5L crystalloid fluid and 5Lo₂/min ,post-operative period uneventful. patient doing good and patient discharged on day 5.

CASE 4

A male geriatric patient aged 85 yrs. came with severe pain in rt iliac region on ultrasound scanning diagnosed as acute appendicitis which is posted for laparoscopic appendectomy.Patient has generalized weakness and pedal edema , chronic alcoholic and smoker on investigation 2D echo showed grade 2 diastolic failure and EF 45 % ,liver function tests are abnormal elected SGOT SGPT Levels protein levels decreased on scanning showed mild cirrhosis.BT CT and platelet count normal. Usually for laparoscopy we go for general anaesthesia but in this case there is risk of recovery problem and post-operative ventilator requirement.as the procedure is short our team decided to go for segmental spinal anaesthesia and maintain spontaneous breathing.

After aseptic skin preparation, patient positioned in right lateral position .T11-t12 intervertebral space identified and local anesthetic mixture injected intrathecally after seeing free flow of cerebrospinal fluid.Drug mixture used is 2.0ml 0.5% bupivacaine heavy 1.5cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 4cc.within 4 min sensory block obtained from T4 to L1 dermatomes without any motor weakness/block in the legs,upper limbs and respiratory distress.

The distribution of block remained same trough out the procedure, but blood pressure decreased from 140/90 to 100/70mm Hg, and heart rate from 72 to 66beats/ mi. Hypotension responded well to mephenteramine 6mg. Surgery started and procedure completed in 30 min without any complications.During the procedure patient was conscious tolerated CO₂ gas inflation without any discomfort and intraoperatively 50 MCG fentanyl given .Patient

received 1.0 L crystalloid fluid and 3 Lo₂/min ,post-operative period uneventful. patient discharged on day 3.

CASE 5

A male young patient aged 28 yrs. with known history of acidity problem came with complaint of severe abdominal pain in epigastrium treated on outpatient basis then next day he came to hospital with toxic look whole abdomen tenderness tachycardia tachypnoea and white blood cells raised .serum lactates were raised and x-ray erect abdomen show gas under diaphragm .whole scenario suggesting patient having hollow viscous perforation mostly duodenal perforation in sepsis.Patient resuscitated with crystalloid fluids around 2 L ,given higher antibiotics and posted for exploratory laparotomy. Our team explained the high risk of surgery and anaesthesia, post-operative ventilator and recovery problem from general anaesthesia.patient attenders were very worried and not given consent for general anaesthesia and requested for any other alternative,so we explained about segmental spinal anaesthesia and epidural catheter placement .

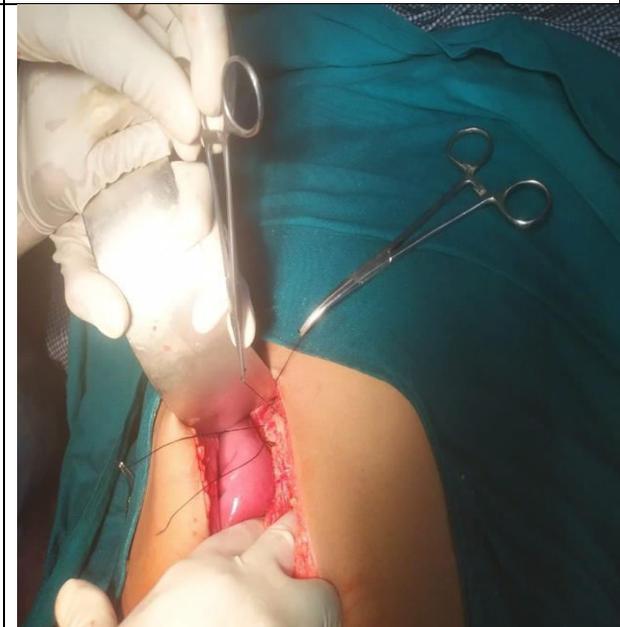
After aseptic skin preparation patient positioned in right lateral position . epidural catheter placed at T11-T12 intervertebral space with loss of resistance to air technique.T7-T8 intervertebral space identified and local anesthetic mixture injected intrathecally after seeing free flow of cerebrospinal fluid, drug mixture used is 2.0ml 0.75% ropivacaine heavy 1.5cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 4cc.within 4 min sensory block obtained from T4 to L1 dermatomes without any motor weakness/block in the legs,upper limbs and respiratory distress. The distribution of block remained same trough out the procedure, hemodynamic changes are minimal. Surgery started found to be duodenal perforation, omental patch done procedure completed in 45 min without any epidural top up but still due to sepsis patient having tachycardia tachypnoea.Post-operative period we used CPAP of 10cm of H₂o pressure and epidural top-up of ropivacaine 0.25% and higher antibiotics. His general condition improved and discharged on day 9.

CASE 6

A 82 yr geriatric male patient came to hospital for ryle tube insertion as he was suffering from bulbar palsy unable to swallow food and liquids, and he used to get ryles tube inserted in regular basis since 2 years .As his suffering became serious he was unable to tolerate tube and his frequency of insertion increased and every time it was a difficulty naso gastric tube insertion sometimes it required sedation, laryngoscopy and magill forceps . Attenders discussed with surgeon and posted for feeding jejunostomy .His 2D echo showed moderate mitral regurgitation X-ray showed emphysematous changes .Thin built patient , malnourished and very sick.definitely if we go for general anaesthesia there can be risk of recovery problem so the best option is regional anaesthesia .Here the incision will be upper midline so options could be bilateral lower 6 intercoastal nerve block, or upper thoracic epidural or thoracic segmental spinal anaesthesia.

As the procedure is short duration one thoracic segmental spinal anaesthesia and local anesthetic infiltration of incision site is planned. After aseptic skin preparation patient positioned in right lateral position .T7-T8 intervertebral space identified and local anesthetic mixture injected intrathecally after seeing free flow of cerebrospinal fluid, drug mixture used is 2.0ml 0.75% ropivacaine heavy 1.5cc sterile water and 0.5cc fentanyl(25mcg) making a total volume of 4cc.within 4 min sensory block obtained from T2 to L1 dermatomes without any motor weakness/block in the legs,upper limbs and respiratory distress. Proximal jejunum was chosen for feeding jejunostomy. procedure completed in 40 min . patient was quite cooperative and hemodynamic changes are minimal.Patient received 1.2 L crystalloid fluid and 3 Lo₂/min ,post-operative period uneventful. patient discharged on next day.

Figure-1

	
<p>Case-1 picture showing laproscopic cholecystectomy under thoracic segmental spinal anaesthesia, patient is comfortable and on oronasal mask without endotracheal tube.</p>	<p>Intraoperative picture of patient case 3 posted for toilet mastectomy, patient is comfortable on oronasal mask without endotracheal tube.</p>
	
<p>Case-6 showing difficult ryle tube insertion posted for feeding jejunostomy under thoracic segmental spinal anaesthesia</p>	<p>Intraoperative picture of case 5 showing duodenal perforation under thoracic segmental spinal anaesthesia</p>

DISCUSSION

As we all know it's general tendency of anaesiologists feel hesitant to give spinal anaesthesia above L1 so as to not injure spinal cord But many MRI studies performed and shown safety.MRI images have shown that the mid to lower thoracic segment of the cord lies anteriorly and there is greater depth of the posterior subarachnoid space in the thoracic spinal

cord .Imbelloni LE et al⁴ investigated anatomy of the thoracic spinal canal with magnetic resonance imaging (MRI) in 50 patients and shown low incidence of neurologic complications during thoracic segmental neuraxial anaesthesia.

Thoracic segmental spinal anaesthesia is indicated in patients with severe co morbidities having low pulmonary physiological reserves where we can maintain spontaneous breathing of patient. This is best suited for short procedures probably less than hour .Other indications where patient want to avoid general anaesthesia, polypharmacy ,post-operative cognitive dysfunction, post-operative recovery or ventilator problem.

There are major known contraindications to all neuraxial anesthesia. The absolute contraindications are patient refusal or lack of consent, local infection at the site of the procedure, a true allergy to drugs given, and elevated intracranial pressure, which increases the risk of uncal herniation when CSF is lost through the needle. In addition, spinal anesthesia is contraindicated when the operation is expected to take longer than the duration of the nerve block.⁶

The relative contraindications are preexisting neurological diseases (multiple sclerosis and other demyelinating diseases), sepsis, severe hypovolemia, and coagulopathy. In the setting of coagulopathy, performing spinal anesthesia can be considered depending on the level of severity. Other relative contraindications include severe mitral and aortic stenosis and left ventricular outflow obstruction, as seen with hypertrophic obstructive cardiomyopathy.

Once the patient is positioned correctly, the insertion level is identified by palpation and the use of anatomic landmarks to identify the corresponding spinous process. The space between 2 palpable spinous processes is the site of entry. The inferior angle of the scapula (T7 spinous process) and the 12th rib margin (L1 spinous process) are widely used as landmarks to estimate the level. Each thoracic vertebra articulates with ribs along the lateral border of its vertebral body, which helps determine the lower thoracic and upper lumbar areas. Other interspaces can then be identified, depending on where the needle needs to be inserted, using the 'counting up method.

Once the needle is through the ligamentum flavum, the stylet is removed, and a clear flow of CSF should be seen at the hub of the needle. Once the flow of clear CSF begins, approximately 1 to 2.5ml of 0.5%heavy or isobaric bupivacaine or isobaric 0.75%ropivacaine injected, plus the addition of 20 to 25 ug of fentanyl intrathecally. Depending on the operative location, a hyper, iso, or hypobaric anesthetic solution can be injected. Here due to non-availability of isobaric drug we mixed sterile water to heavy bupivacaine to make more isobaric drug.Here I used bupivacaine or ropivacaine heavy drug made to a total volume of 4cc or 5cc based upon requirement.

Definitely there is some hemodynamic changes but not as of regular spinal anaesthesia because here we used small amount of drug and due to dilution concentration of drug decreases and hence less hemodynamic changes.After spinal injection access for sensory block if inadequate there should be plan B plan c to give sedation or general anaesthesia accordingly. There is still some deficiency in literature about thoracic segmental spinal anaesthesia and lot more randomized studies are needed.^{5,6}

Certain high risk cases where there can be high chances of morbidity ,mortality post-operative ventilator requirement, we can go with this technique safely .Not every high risk case but few cases where duration of surgery less and simple sensory block is required. This technique offers many advantages like Post-operative analgesia, decrease requirement of opioid reducing their side effects, maintain spontaneous breathing, and being conscious decrease post-operative cognitive dysfunction, earlier recovery of bowel function and better pain control.If we can avoid ventilator for patient we can decrease in hospital stay ,unnecessary sedation or paralysis for ventilator ,and unnecessary burden of cost to patient.^{7,8,9}

CONCLUSION

With the background of sedation Thoracic segmental spinal anaesthesia is a suitable alternative to general anaesthesia in some high risk cases where mortality and morbidity is high. patient selection and type of surgery is important.

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