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Thoracic Segmental Spinal Anaesthesia as Useful Alternative to General Anesthesia in Patient with Respiratory Insufficiency: A Case Study

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Abstract

A patient scheduled for upper abdominal surgery labeled as ASA 3 or 4 due to their respiratory ailment can be challenging for anesthetist and such cases often require post-operatively admission in intensive care unit (ICU) for ventilation, and thereby subjected to all risks associated with ICU admission. We present a case report where we used thoracic segmental anesthesia as an effective alternative to general anesthesia for upper abdominal surgery in a patient suffering from COPD.

Keywords: Thoracic segmental spinal anesthesia; COPD; Upper abdominal surgery

Abbreviations: ICU: Intensive Care Unit; COPD: chronic Obstructive Pulmonary Disease; PET: Pulmonary Function Test; CSE: Combined Spinal Epidural.

Introduction

It has been the interest of Anesthetists from various parts of the world to evaluate the effectiveness and limitations of the thoracic spinal anesthesia [1-3]. This report shows the combined spinal/epidural anesthesia technique, applied at the lower thoracic level using a small dose of local anesthetic, for providing a sufficient segmental subarachnoid block to perform open cholecystectomy in a high risk patient (ASA 3) for General Anaesthesia.

Case report

A male patient aged 55 years, weighing 70 kilograms, suffering from severe COPD, with pulmonary function test (PFT) of FVC 3.50 L, FEV1 0.75L ,presented with cholelithiasis and had episodes of recurrent attacks of acute cholecystitis. The patient was planned for open cholecystectomy by surgical team. During pre-anesthetic evaluation the respiratory status of the patient raised considerable anaesthetic concerns, After discussing the anaesthetic options with the patient and his family, they

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emphasized to avoid requirement of post-operative mechanical ventilation as much as possible in order to prevent intensive care unit (ICU) related complications. After discussing the patients chosen option with the surgeon, a decision was taken to use a combined needle through needle spinal/epidural anesthetic technique, to avoid the need of any sedative or opioid agent during manipulation with the gall bladder and liver bed in addition to provide a good dense block. No premedication was given. With the patient in the sitting position, the local anesthetic was given at T9-T10 interspace, a combined spinal epidural (CSE) block system was placed at T9-T10 interspace using a 16 gauge Tuohy needle and a midline approach. The epidural space was identified at 50 millimeters from the skin surface with the help of loss of resistance technique. A 27 gauge pencil point spinal needle was advanced through the first needle until the resistance of dura was felt and the dura was penetrated at the distance of 4 millimeters from the tuohy tip needle and the two needles were secured together by a locking device which ensured that the spinal needle does not move further during administration of medication.

Once free flow of CSF was obtained, 1 ml of 0.75% isobaric ropivacaine with 20 micrograms of fentanyl was injected. The epidural catheter was then inserted for 4 centimeters into the epidural space and taped on the back of the patient who was then placed in supine position on the operation table and nasal oxygen 2 L/min was provided in order to keep spo_2 >92%.

Heart rate, Blood pressure and spo_2 were closely monitored. The sensory block (pinprick method) and motor block (modified Bromage scale) were assessed every 5 minutes until the start of surgery. Once the block was considered adequate (T4-L2 level as assessed by pinprick) the surgery was started. The modified Bromage scale score was 2. Intra operatively the patient received 1 gram of paracetamol intravenously and 4 ml of 2% xylocard through epidural catheter. The patient was comfortable throughout the whole procedure of open cholecystectomy. There was no need of any sedative agent or opioid. The blood pressure decreased from 114/80 to 90/60 and heart rate from 77/min to 51/min. The hypotension was managed well by fluid resuscitation and 6 mg of mephenteramine. The same level of sensory block was present at the end of the operation as at the beginning of surgery. There was no nausea or vomiting. An epidural infusion was started at the end of surgery 0.2% ropivacaine @ 5 ml/hr and continued for 2 days.

Post-operative recovery was uneventful without any neurological sequelae and there was no further deterioration in respiratory status. The patient was kept pain free to allow adequate breathing.

Anatomy of thoracic supine

The MRI of thoracic spine was used to study anatomy of thoracic spinal which showed the mean distance between the duramater and the spinal cord at different thoracic interspaces. It was observed that the space between the duramater and spinal cord is 5.19 mm at T2 level, 7.75 mm at T5 level and 5.88 mm at the level of T10. It was evident from the MRI findings that the spinal cord and the cauda equine are touching the duramater posteriorly in the lumbar region while as in thoracic region spinal cord is well placed anteriorly (Figure 1). This can explain the low incidence of neurological complications in case of accidental duramater perforation while performing the thoracic epidural block [4,5].

Figure 1: MRI Thoracic Spine demonstrating distance of spinal cord from dura at different levels.

Discussion

There are number of concerns involved in thoracic spinal anesthesia due to which it is often avoided by anesthetist, we will discuss here some of the main concerns.

The first anxiety is that puncturing the Dura in thoracic region can lead the damage to neural tissue, avoidance of this risk being the main reason why spinal anesthesia is traditionally performed at lumbar level. However consultation with radiological and neurological colleagues revealed spinal puncture at cervical and thoracic level was regular practice for myelography when that

investigation was in vogue. Here we would like to emphasize that this technique should be reserved for experienced clinicians and not be used in routine clinical practice [6,7].

The second concern is that the extensive thoracic nerve block produced might result in ventilator impairment. The main inspiratory muscle, Diaphragm, will be unaffected because it is innervated by cervical level and expiration is normally a passive process. The technique could have disastrous effects in an individual with obstructive airway disease that are dependent on active expiration to maintain lung ventilation. It is possible that the low dose of ropivacaine used was a factor which minimized the degree of thoracic motor block. The minor and transient degree of lower limb motor block was more likely due to minimal physical spread of the solution to the lumbo sacral nerve roots [8,9].

The amount of CSF at thoracic levels is lesser as compared to lumbar and cervical levels and the thoracic nerve roots are thinner as compared to segments above and below, resulting in less anesthetic dilution per segmental unit of distance from the site of injection and the roots are easily blocked due to their smaller size, both of these factors favor efficient blockade at thoracic level [10].

Conclusion

In the patient presented in this paper, thoracic subarachnoid block was shown to be safe and reliable technique allowing a surgical anesthesia with tolerable hemodynamic changes. Thus, thoracic spinal anesthesia is another anesthetic technique that may be used in some specific situations. One advantage of thoracic spinal anesthesia over thoracic epidural is reduction in volume of local anesthetic required. Probably, if a combined spinal epidural (CSE) set was available, it would be of added benefit in guiding the spinal needle through the epidural needle.

However before going for this technique the patient's medical condition, surgery to be performed, experience and familiarity of the anesthetist with the technique should all be considered.

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