ISSN : 2350-0743

www.ijramr.com

International Journal of Recent Advances in Multidisciplinary Research
Vol. 05, Issue 12, pp.4363-4365, December, 2018

RESEARCH ARTICLE

ANAESTHESIA FOR DAY CARE SURGERIES: COMPARASION BETWEEN THORACIC AND LUMBAR SPINAL ANAESTHESIA

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ARTICLE INFO

Article History:
Received 29th September, 2018
Received in revised form
07th October, 2018
Accepted 04th November, 2018
Published online 26th December, 2018

Keywords:

Bupivacaine, Day care surgery,
Thoracic spinal anaesthesia,
Lumbar spinal anaesthesia,
Laparoscopic cholecystectomy.

ABSTRACT

Background: Day care surgeries are becoming increasingly popular in the modern times. Hence day care anaesthesia has emerged as one of the fastest growing branches in modern anaesthetic practice. Laparoscopic cholecystectomy is one of the most commonly performed day care surgeries. In this study we aimed at evaluating two different approaches for day care anaesthesia in laparoscopic cholecystectomies – thoracic vs lumbar. **Materials and methods:** 60 ASA 1 and 2 patients who were scheduled for elective laparoscopic cholecystectomies were divided into two groups. Group T received 10mg (2 ml) of 0.5% hyperbaric bupivacaine + 25 µg (0.5 ml) fentanyl in thoracic spinal anaesthesia. Whereas group L received 15mg (3ml) of 0.5% hyperbaric bupivacaine + 25 µg (0.5 ml) fentanyl in lumbar spinal anaesthesia. **Results:** Thoracic approach provided a faster onset, shorter duration of sensory and motor block and minimal haemodynamic alterations than lumbar approach. **Conclusion:** Thoracic spinal anaesthesia is more suited to day care surgeries than lumbar spinal anaesthesia.

INTRODUCTION

According to cofounder of IAAS, *surgical day case is a patient who is admitted for investigation or operation on a planned non-resident basis and who none the less requires facilities for recovery. The whole procedure should not require an overnight stay in a hospital bed*. The surgical procedure should be such that there should be no expectation of continuing blood loss, large perioperative fluid shifts, or the need for complex or specialized postoperative care. Similarly the anaesthesia for such procedures should provide adequate intraoperative anaesthesia as well as quick street readiness with minimal complications. Most of the day care surgeries are performed under general anaesthesia. However in the recent times regional anaesthesia is rapidly developing as an effective alternative to general anaesthesia. Regional anaesthesia offers benefits like decreased oro-pharyngo-laryngeal morbidity, reduced blood loss, reduced stress response and decreased chances of thromboembolism.Also it provides the flexibility to extend the analgesic effect into the post operative period. Traditionally regional anaesthesia has been synonymous with lumbar spinal anaesthesia. However recently works of Lee and Imbelloni have established the safety of thoracic spinal anaesthesia. This was followed by Ellakany (1) and Zundert (2) who studied the efficacy of thoracic spinal anaesthesia for laparoscopic cholecystectomies and found it to be suitable alternative to general anaesthesia in high risk as well as normal patients.

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The aim of this study was to determine which of the two approaches- thoracic or lumbar is better suited for day care anaesthesia in laparoscopic cholecystectomies.

MATERIALS AND METHODS

A total of 60 patients who were posted for laparoscopic cholecystectomies were selected and randomly divided into two equal groups. ASA1 and 2 patients aged 18-65 years with normal coagulation status were selected for the study. Exclusion criteria were ASA status 3 and 4, acute cholecystitis, acute pancreatitis, severe cardiovascular/renal disability and BMI >30 kg/m^2. All patients were kept fasting for 6 hours prior to surgery and received tablet *al*prax 0.25 mg, pantoprazole 40 mg and domperidone 10 mg at bed time on the night prior to surgery. Pre-operatively, every patient received pre-loading with Ringer lactate 10 ml/kg over 30 minutes and premedication with Ondansetron 0.1 mg/kg iv and Ranitidine Hydrochloride 50 mg intravenously. The patients were then shifted to Operation theatre and all routine monitoring namely, non invasive blood pressure (NIBP), pulse oximetry (SpO2), end tidal Carbon dioxide (ETCO2) and electrocardiogram (ECG) was started. Inj. Midazolam 1mg i.v. was given to the patient just prior to the start of the procedure in order to allay the anxiety and apprehension. In all the patients spinal anaesthesia was administered in the sitting position using 27G pencilpoint needle. In group I spinal anaesthesia was administered either at the T9-T10/T10-T11 interspace using 2ml (10mg) of isobaric preservative free bupivacaine 0.5% (5 mg/ml) + 0.5 ml (25µg) of Fentanyl. In group L spinal anaesthesia was given at L2-L3/L3-L4 using 15mg (3ml) of 0.5% hyperbaric bupivacaine + 25 µg (0.5 ml) fentanyl.

Immediately, the patient was turned to the supine position with a 10 -20 degrees head down tilt. Oxygen at four to five litres/minute was given to the patient by the face mask. Onset of sensory block was assessed every 2 minutes bilaterally (upper and lower levels) in midclavicular line till there was no sensation to pinprick with hypodermic needle. Onset of motor block was assessed every two minutes till complete motor block (grade 3) was achieved and graded according to modified Bromage scale. The time to reach T4 dermatome, peak sensory block height, the lowest segment blocked and the maximum motor block achieved was recorded before surgery. Once the desired sensory block (T4-T12) was achieved, surgery was commenced. After visualization of the abdominal cavity, lidocaine 1% 10 ml was sprayed under the right side of diaphragm. Intraoperative parameters (heart rate, SBP, DBP, MAP, SpO_2, respiratory rate and $ETCO_2$) were recorded in all patients every two minutes for first five minutes, every five minutes for next ten minutes and every twenty minutes thereafter till the completion of surgical procedure. The patients were monitored in PACU till sensory level regressed two dermatomes below the peak block height. Duration of the sensory block was taken as the time from the onset of sensory block at T4 dermatome to the time when the sensory block regresses to T12 dermatome and duration of motor block as the time from the previous recorded motor block till the patient regained the ability to raise extended legs, i.e. grade 0 of modified Bromage scale. Criteria for conversion to GA were: If the sensory level was found to be inadequate even after 15 minutes of an attempt to extend the block with epidural topup or bleeding was found to be difficult to control and if pt or the surgeon was uncomfortable with regional anaesthesia at any stage of the procedure. Intraoperative anxiety was treated with Midazolam 1 mg intravenous boluses upto total 5mg, any referred shoulder pain inspite of lidocaine instillation with reassurance and Fentanyl 25µg intravenous boluses upto total 100µg, hypotension (decrease in mean arterial pressure more than 20 % from baseline value) with fluid bolus 10 ml/kg ringer lactate or Mephentermine 6 mg boluses upto total 30mg and bradycardia (heart rate below 20% of baseline) with atropine 10 µg /kg intravenously.

The surgical technique involved two major modifications

- Using lower levels of intra-abdominal pressure, less than 10 mm Hg.
- Providing minimal right up tilt to the table to minimise diaphragmatic irritation.

RESULTS

Among all 60 patients who were enrolled in the study, no difference was observed between the two groups with respect to gender, age, height and weight (Table 1). The non parametric data was compared using Chi-square test and Mann- whitney U test. Parametric data was analysed using student t test using SPSS 16.0 software. The incidence of paraesthesia in group T was 4% whereas in group L the incidence was 6.5%. This difference was statistically significant. The onset of analgesia was faster in group T– 2min. Whereas in group L, the onset was slower- 4min. The peak block height achieved was lower for group L (T4-T5) than for group T (T2 –T4) . Time to reach peak block height was lesser in group T (4min) than in group L(8min) (Table 2). Maximum motor block achieved was bromage 1 in 19 patients in group T whereas maximum motor block achieved in group L was bromage 3 in 18 patients (Table 2). The duration of motor block was significantly higher with group L(180min) than with group T (60min) (Table 2) .The duration of sensory block was significantly longer in group L (120min) than in group T (90min). There was significantly lower incidence of bradycardia and hypotension in group T than in group L. In group T, 3 patients had bradycardia whereas in group L , 8 patients developed bradycardia. 5 patients in group T and 10 patients in group L developed hypotension (Table 3).

Table 1. Demographics

	Group Thoracic	Group Lumbar	P value
age	45.30	46.30	0.704
Weight	74.80	75.81	0.547
ASA(1/2)	19/11	18/12	0.532
Sex(F/M)	17/13	14/16	0.452

Table 2. Block characteristics

	Group Thoracic(T)	Group Lumbar(L)	P value
Onset of sensory block(min)	2.07	4.16	<0.0001
Peak block height(T3/T4/T5)	15/12/3	4/10/16	<0.0001
Time to peak block height(min)	4.03	8.05	<0.0001
Max motor block (B1 /B2/B3)	19/9/2	5/7/18	<0.0001
Sensory block duration(min)	90.10	120.03	<0.0001
Motor block duration (min)	60.33	180.10	<0.0001

Table 3. Characteristics in perioperative period

	Group Thoracic	Group Lumbar	P value
Surgical time (min)	25	27	0.42
Shoulder pain(no. of patients)	4	6	0.53
Hypotension(%)	16.67%	33.3%	<0.0001
Bradycardia(%)	10%	26.6%	<0.0001
Conversion to GA	nil	nil	

There was no difference in the incidence of shoulder pain between the two groups.The overall incidence of shoulder pain was 16.6%. No patient developed nausea, vomiting or pruritis during the surgical procedure (Table 3). No patient developed headache. All patients developed spinal anesthesia; there were no patchy blocks and in no case conversion to GA was done. No patient who experienced paresthesia complained of neurological symptoms at follow-up. There were no serious complications such as epidural hematomas, infection, or permanent nerve injuries in any patient.

DISCUSSION

In our study we showed that the thoracic approach is better suited for day care surgeries than lumbar approach. Thoracic approach allows adequate anaesthesia, early recovery of sensory and motor function with maximal haemodynamic stability. Conventionally, the term spinal anaesthesia has been synonymus with lumbar spinal anaesthesia. This being due to the fact that spinal cord ends at L1. Hence to avoid injury to neural tissue the needle was always inserted below this level. Contrary to this popular belief , workers have now shown that at the thoracic level the distance between the dura and spinal cord is more than that at the lumbar level (3) and this margin of safety is increased in the sitting position of the patient where the posterior separation of the duramater and spinal cord is increased (4).This is reflected in lesser incidence of paraesthesias in the thoracic approach than lumbar and no post operative neurological complication in any patient in our study. Our findings are similar to those of Imbelloni *et al* who

studied the incidence of paraesthesias with low thoracic puncture in 300 patients (5). The onset of analgesia was faster in thoracic group. This can be explained by the lower amount of CSF in the chest region compared to the lumbar segment (6). This produces lesser anaesthetic dilution per segment from the site of injection. Lesser dilution increases the concentration and potency of a given dose of drug in CSF. Also thoracic roots have been shown to be thinner compared to lumbar and cervical roots (7). This makes them prone to easy and efficient blockade . Our results are similar to other studies comparing thoracic spinal anaesthesia in patients undergoing different laparoscopic surgeries (8,9). The peak block height was higher with thoracic group (T2-T4) which is also the desired block height and also the time taken to reach peak block height was lesser with thoracic approach. We administered the block in the sitting position following which the patient was laid supine. After the patient lies down, the curvatures of the spinal column affect the drug distribution before the drug finally becomes fixed.When drug is given via lumbar approach the lumbar lordosis produces "splitting" of the local anaesthetic solution with some portion flowing caudad toward the sacrum and the remainder flowing cephalad into the thoracic kyphosis. The cephalad extent of the block then depends on what fraction of the injected drug flows cephalad. This explains the lower peak block height achieved with lumbar approach where lumbar lordosis caused a major fraction of the drug to flow caudad and the rest produced a block in the mid thoracic region after patient was made supine.The same phenomenon also explains the longer time to reach peak block height with lumbar approach.The thoracic approach provides a clear advantage in this scenario as it allows drug deposition close to the target dermatomes. Hence the splitting effect of lumbar lordosis is averted that not only allows the drug to achieve higher peak block height but also do so more rapidly. The lesser degree of motor block seen with thoracic approach than lumbar approach can also be explained by gravitation of drug to the lumbosacral plexus which is close to the site of deposition of the drug in lumbar approach.Whereas thoracic approach allows drug deposition close to the target dermatomes thus a lower dose is required for the desired effect and thus lesser chances of gravitation to the lumbosacral plexus. This manifests as lower degree of motor block seen with thoracic approach. But a lower degree of motor block doesn't translate into a disadvantage of thoracic spinal anaesthesia because an adequate relaxation of the abdominal musculature as required for the surgery is provided nevertheless. Hence this highlights another advantage of thoracic approach which provides adequate abdominal relaxation and avoids unnecessary paralysis of the lower limbs.

The duration of sensory and motor block seen with thoracic approach is lesser than with lumbar approach. Our results are similar to those seen by others (10, 11). This can be explained by the fact that thoracic approach allows drug deposition close to the target dermatomes. Hence dose requirement to produce the desired effect is decreased significantly (10). Lesser dose translates into lesser duration of sensory and motor block. Also what needs to be emphasised is that despite of the shorter duration of sensory and motor block than the lumbar approach our study showed that thoracic spinal anaesthesia provided adequate intraoperative analgesia and motor block for the surgery.This highlights the dose sparing effect of thoracic spinal anaesthesia. Thoracic approach also allowed more haemodynamic stability than lumbar approach. Hypotension caused by spinal anaesthesia is due to sympathectomy resulting in vasodilatation with corresponding decrease in venous return. More segments blocked means more sympathocoliosis, more vasodilatation and hence more haemodynamic changes (12). Thoracic spinal anaesthesia allows a lesser drug dose to be used to achieve the desired block height because of the proximity of the site of drug deposition to the target dermatome. Segmental blockade provided by thoracic spinal anaesthesia has advantage of limiting sympathectomy to fewer segments with consequent less vasodilatation than lumbar spinal anaesthesia and thus less hemodynamic changes.

Conclusion

Thoracic approach is better than lumbar for providing day care anaesthesia in laparoscopic cholecystectomies.

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