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Original Research Article

Thoracic segmental spinal anaesthesia vs general anaesthesia for laparoscopic cholecystectomy: a comparative study

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ABSTRACT

Background: Regional anaesthesia techniques are now being preferred over General anaesthesia in patients with major medical problems and those at high risk for GA. Thoracic segmental spinal anaesthesia has recently gained popularity because of its safety and efficacy in procedures like laparoscopic cholecystectomy, breast surgeries etc.
Methods: A comparative study involving 50 patients of ASA grade I & II of both genders with age group of 25-55 years, weighing between 50-85 kg posted for lap. Cholecystectomy in GGH, Kakinada for a study period of 5 months. 50 Patients were divided into Group A & Group B with 25 patients in each group. After taking informed & written conscent, Group A patients were given Thoracic Segmental Spinal Anaesthesia at T10 level with Inj.0.5% isobaric Levo-bupivacaine 1.75 ml (13.75 mg) with Inj. Fentanyl 0.25 ml (25 mcg) and Group B patients were given GA with fentanyl, propofol, sevoflurane, succinylcholine and vecuronium.
Results: conscious patients with less hemodynamic variability, greater duration of post operative analgesia, greater duration for first rescue analgesia were observed in Group A. Whereas greater hemodynamic variability, intubation response, more requirement of intraoperative opioid, less duration of post operative analgesia, lesser time for first rescue analgesia were observed in Group B.
Conclusions: TSSA is safe alternative as it provides excellent analgesia. With TSSA, GA can be avoided in patents with comorbidities.

Keywords: Segmental spinal anaesthesia, General Anaesthesia, Laparoscopic cholecystectomy.

INTRODUCTION

Segmental spinal anaesthesia means "Blocking of the required dermatomes essential for the proposed surgical procedure with very low effective local anesthetic drug dose." GA is the standard procedure for laparoscopic cholecystectomy; however, some drawbacks can include negative drug side effects, greater Hemodynamic variations, prolong recovery, and inadequate pain control.[1,2] Thoracic segmental spinal anesthesia (TSSA) is a technique of regional anaesthesia that can potentially be a suitable alternative to general anaesthesia for certain cases such as laparoscopic surgeries, mastectomies. It may be performed for patients with major medical problems where they are considered a greater risk for GA. Unlike conventional spinal below L1, here dura is punctured at

high lumbar or thoracic levels. Lower the dose of local anaesthetic drug used more likely it is to produce a true segmental blockade. Since, there is minimal blockade of the lower extremities, significant venodilatation of lower extremities is not exhibited. This may offer a compensatory buffer to adverse changes in blood pressure intraoperatively. Further, as the dosing of the anaesthetic is excedingly low, so hemodynamic consequences are also expected to be minimal.[3] Serial MRI Studies on anatomy of the thoracic and lumbar spinal canal confirms that, The distance between Dura and spinal cord in thoracic region is greater when compared to lumbar region ie., the spinal cord is touching the dura mater posteriorly in the lumbar region and anteriorly in the thoracic region, and this provides better safety during procedure. Intrathecal injections at mid-thoracic levels, hence provide a minimum safe distance before the spinal needle contacts the spinal cord tissue, so that spinal cord injury can be avoided.[4,5] This explains the low incidence of neurologic complications during accidental perforation of the dura while performing a thoracic epidural block. Hence, we aimed to determine the comparative efficacy of GA vs. TSSA for laparoscopic cholecystectomy surgeries.

METHODS

Informed and written consent was taken from all the participants. Present study was done in GGH, Kakinada, a tertiary care hospital for a study period of 5 months. Study involves 50 patients of both genders divided into Group A and Group B with 25 patients in each group.

Inclusion criteria

Inclusion criteria for current study were; patients undergoing lap. cholecystectomy, ASAI and II, Age: 25-55 years and body weight: 50-85 kgs.

Exclusion criteria

Exclusion criteria for current study were; patients who refused to give consent, contraindications to spinal anaesthesia such as bleeding diathesis or local infection, ASA Grade III and IV.

Sample size

The α value taken as 0.05, β power taken as 80%, confidence interval of 95%, margin of error is 5%. Using mean difference, sample size is calculated as 46 with 23 patients in each group. Considering the drop outs, round figured to 25. Mean difference between groups with respect to duration of postoperative analgesia, mean difference considered to be >25%.

Procedure

After proper pre-anaesthetic evaluation and informed and written consent, patients were shifted to operation room. base line vitals like heart rate, respiratory rate, ECG, MAP, SpO2 and ETCO2 were recorded in patients of both the groups. An 18G IV Cannula is secured and connected to IVF. In Group A the patients were placed in sitting position, under strict aseptic conditions, Thoracic segmental spinal was given between T9 and T10 with 26G Quincke needle with Inj. 0.5% Isobaric Levo-bupivacaine 1.75ml (13.75 mg) + Inj. Fentanyl 0.25 ml (25 mcg), Total volume made to 2 ml. After giving sub arachnoid injection, patients position was changed from sitting to supine position and following parameters were monitored. Maximum height of the blockade, Number of segments anaestheized, 2 segment regression time. Hemodynamic parameters like HR, PR, BP, SpO2 were monitored every 2min till 10min, every 5min till 20min, later on for every 15min till the end of surgery. Other parameters like Nausea, vomiting, shivering, shoulder tip pain, chest or abdominal discomfort. Maximum height of sensory blockade achieved is T1-T2. Average time taken to reach maximum height of sensory level of blockade is 3.2min. 2 Segment regression time is 40-45min. Bradycardia is transient and treated with Atropine if required and Hypotension was corrected with adequate IV Fluids and Inj. Phenylephrine 1 mcg/kg. In Group B, patients were given General Anaesthesia with Standard GA regimen using Inj. Fentanyl 2 mcg/kg, Induced with Inj. Propofol 2mg/kg, intubated with Inj. Vecuronium 0.1mg/kg and maintained on controlled ventilation with oxygen, N2O and Sevoflurane. At the end, patients were reversed with neostigmine and glycopyrrolate. patients hemodynamic parameters were monitored closely pre intubation, during and post intubation. Bradycardia is heart rate <60 bpm, hypotension is reduction in blood pressure >20% from the baseline. Patients in both the groups were monitored postoperatively for VAS Score for 6 hrs, incidence of post operative nausea and vomiting, shivering, duration of first rescue analgesia, postoperative oxygen requirement and early mobilisation.

Statistical analysis

Statistical analysis done by using Quick calcs-Graphpad. Demographic data analysed with unpaired T-test. Comparison of mean duration of Analgesia with unpaired t test. Peri operative complications between groups is analysed with Fischer exact test. Hemodynamic parameters like Mean HR, Mean SBP, DBP and Mean MAP were compared using mean at different time intervals. VAS Scores compared using mean at different time intervals. Data was represented as mean ± SD and absolute number, p value <0.05 considered statistically significant.

RESULTS

The present study was done in a sample of 50 patients undergoing laparoscopic cholecystectomy and they were divided into two groups of 25 each. Group A were given Thoracic segmental spinal Anaesthesia and Group B were given General Anaesthesia. Demographic data like Age, Height, Weight and ASA Grading and duration of surgery

were compared between both the groups and no statistically significant difference were observed. Male predominance is seen among total Study population. Mean duration of surgery was found to be 67.8±26.7 in Thoracic spinal group and in general anaesthesia group it was found to be 74.8±25.1 (Table 1).

Table 1: Comparison of patient characteristics in both groups (n=50).

Patient characteristics	Group A	Group B	P value
Age	43.96±12.15	38.80±13	0.61
Height	153.76±5.69	154.92±4.28	0.21
Weight	63.12±12.49	62.16±13.26	0.06
ASA (I:II)	15:10	11:14	0.25
Duration of surgery	67.8 ±26.7	74.8±25.1	0.17

Table 2: Comparison of peri operative complications in both groups (n=50).

Peri-operative complications	Group A	Group B	P value
Bradycardia	15	1	0.001
Hypotension	10	1	0.004
Shoulder tip pain	2	0	0.48
Pruritus	3	0	0.23
Postop shivering	0	2	0.49
Nausea and vomiting	0	3	0.23
Post operative oxygen requirement	0	8	0.004

Table 3: Comparison of mean duration of analgesia in both groups (n=50).

Duration of first rescue analgesia	Group A	Group B	P value
Mean duration (MIN)	126.80	98	0.031
SD	33.79	30.4	

When peri operative complications were compared between both the groups, the following were observed. Bradycardia was observed in 15 (60%) patients in Group A after Thoracic spinal anaesthesia which is transient and HR maintained between 60-75bpm. Only 5 patients required Inj. Atropine 0.02 mg/kg. Where as in group B, it is observed in only 1 (4%). P value was 0.001 which is statistically significant. Hypotension was seen in 10 (40%) patients in Group A and it is maintained with IV Fluids bolus and Inj. Phenylephrine 1 mcg/kg if needed. Where as in Group B only 1 (4%) the patients developed hypotension, p value is 0.004 which is statistically significant. Intra operatively shoulder tip pain was complained by 2 (8%) patients in Group A which is relieves by mild sedation. Pruritus which is caused by administration of intrathecal Opioids is observed in 3 (12%) patients in Group A. Post operative Shivering is seen in 2 (8%) patients in Group B postoperative nausea and vomiting were observed in 3 (12%) patients in Group B where as 0% of patients in Group A. Respiratory complications like Sore throat/ post operative pulmonary infections/Basal Atelectasis were observed in 8 (32%) patients in Group B whereas no such complications were observed in Group A. P value is 0.004 which is statistically significant (Table 2).

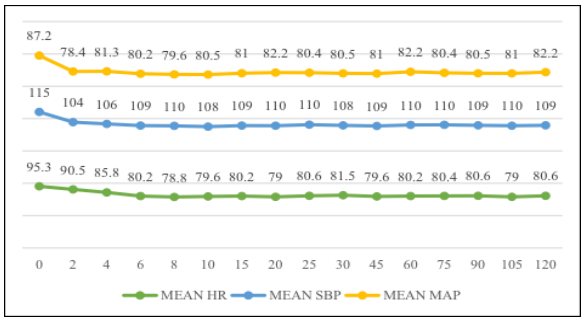

Figure 1: Mean HR, mean SBP, mean MAP in Group A.

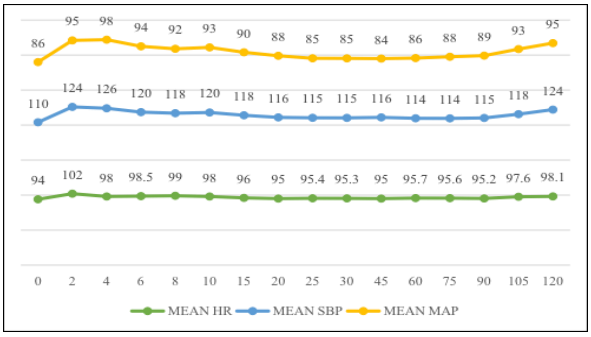

Figure 2: Mean HR, mean SBP, mean MAP in Group B.

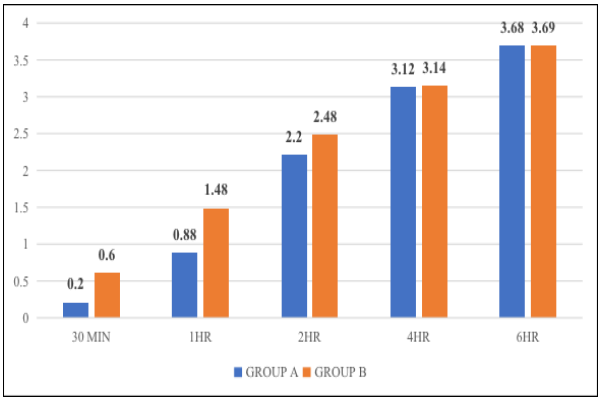

Figure 3: Comparison of mean VAS score for pain in post operative period in both the groups.

Post operatively mean duration of time required for first rescue analgesia is 126.80 min in Group A and it is 98 min in group B with standard deviation of 33.79 min and 30.4 min in both groups respectively (Table 3). Mean HR, SBP and MAP were recorded throughout the surgery and compared between both the groups. In Group A, mean

baseline HR is 95.3 and mean HR after 5 min of giving thoracic segmental spinal is 80.2 i.e., there reduction in HR from the baseline and the Mean HR is maintained between 78 to 82. Baseline mean MAP is 87.2 mmHg and 5 min after the procedure, mean MAP is 80.2 mmHg and mean MAP is maintained between 78 To 80 mmHg (Figure 1). In Group B, mean baseline HR is 94 and immediately after intubation, mean HR is 102 due to press or response during intubation. Later it is maintained between 95 to 98. Baseline mean MAP is 86 mmHg and immediately after the procedure, mean MAP is 95 mmHg and mean MAP is maintained between 85 To 98 mmHg (Figure 2). VAS score was recorded among all patients of both the groups postoperatively up to 6 hrs mean VAS Score in initial 2hrs postoperatively is less in Group A when compared with Group B (Figure 3). Early mobilisation was seen in 12 (48%) patients among Group B while in Group A, all the 25 (100%) patients were mobilised early which was statistically significant (p=0.001).

DISCUSSION

Regional Anaesthesia offers several advantages over general anaesthesia including attenuation of surgical stress response, avoiding all complications related to GA. It provides good post operative Analgesia, decreases PONV and early mobilisation. Surgery creates a profound perioperative stress that manifests in neural, endocrine, metabolic, inflammatory, and immunological changes.[6]

General anaesthesia suppresses cerebral and thalamus functions while preserving the function of low brain and spinal circuits. In contrast, regional anaesthesia, due to direct neuronal blockade, attenuates the reflex circuit between noxious afferents and sympathetic efferents at the surgical level and thus attenuates the surgical stress and immunosuppression. Blockade of sympathetic activity also produces similar effect.[3] Regional anaesthesia offers superior analgesia over opioid-based analgesia, and a significant reduction in postoperative pain is still a worthwhile outcome.[7] In this study i.e., TSSA is performed by administering Small amounts of local anaesthetic in to subarachnoid space causes minimal hemodynamic changes. The level of hypotension is related to the level of the blockade. In this study we compared TSSA Vs GA for laparoscopic cholecystectomy. In TSSA, dermatomal blockade required for surgical field is confined to few dermatomes when compared to standard lumbar spinal anaesthesia. Few studies on TSSA administered for laparoscopic surgeries concluded that, there is minimal Hemodynamic variability in TSSA group compared to GA group. This minimal Hemodynamic variability could be due to neuronal blockade of few dermatomes along with less venous pooling compared to lumbar spinal anaesthesia. Previous studies proved and it is observed that, Hypotension is a frequent side-effect that can be seen in approximately 30% of patients during spinal anaesthesia.[8] Hypotension can be corrected with administration of rapid blouses of IV Fluids and Vasopressors like Inj. Phenylephrine 1mcg/kg if required.[9]

As TSSA provides blockade of limited dermatomes required for surgical field, there is no much variability in Hemodynamics due to minimal venous pooling.[10] Other benefits of TSSA include better pain control and decrease in opioid requirement both intraoperatively and post operatively. MRI studies on anatomy of the thoracic spinal canal, which confirms that the spinal cord is touching the dura mater posteriorly in the lumbar region it is placed anteriorly within its thecal sac in the thoracic curve. In a study Lee et al., have found a larger distance between the dura mater and the spinal cord in T6 (9.5±1.8 mm).[6] In the study conducted by Imbelloni et al the largest distance between the dura mater and the spinal cord was found in T5 (5.8±0.8 mm), with the shortest distance in T2 and T10.[7] This may be explained with the fact that in Intrathecal injections, therefore, at thoracic levels may have a safety minimal distance before spinal needle contact with neural tissue.[11,12] Theoretically Thoracic spinal safety has also been confirmed in above mentioned MRI studies. This greater distance between Dura and Spinal cord in thoracic region explains the low incidence of neurologic complications during accidental perforation of the dura while performing a thoracic epidural block. In this study, administration of Thoracic spinal done with all meticulous precautions. In all the patients procedure was performed uneventfully with out difficulty and trauma to the spinal cord. Patients are awake and comfortable throughout the procedure except for 2 patients who complained of shoulder tip pain. In this study following parameters were compared between both TSSA group and GA group in peri operative period. They are, Hemodynamic (HR and MAP) variability, shoulder tip pain, PONV, shivering, post operative O2 inhalation, VAS scoring, time for first rescue analgesia, early mobilisation. In TSSA Group patients Showed Minimal variability in Hemodynamic parameters. Patient is awake and comfortable throughout the procedure. 8% of patients complained of Shoulder tip pain due to irritation of Diaphragm due to Pneumoperitonium which is Managed with sub analgesic doses of Inj.Ketamine. Incidence of PONV is 12% and No Post operative oxygen requirement is seen in patients of TSSA. Mean duration of time for First rescue Analgesia is 126±33 min and mean VAS Scores at 2hrs after post operative period is 2.2 which is lower in TSSA Group due to the presence of residual blockade. Early mobilisation is observed with in mean duration of 3 in TSSA group In 2006 Zundert et al used this technique by puncturing SAS at T10 for laparoscopic cholecystectomy in a patient with severe obstructive lung disease and concluded that segmental spinal anaesthesia can be used successfully and effectively for laparoscopic surgeries.[13] Imbelloni et al performed thoracic spinal anaesthesia in patients subjected to different types of open and laparoscopic surgeries, they concluded that thoracic spinal anaesthesia decreases latency time, motor block and cardiovascular changes.[14] In a study by Elakany, Abdelhamid conducted a study comparing Thoracic segmental spinal Anaesthesia and GA for Breast cancer Surgeries and they concluded that TSSA has advantages over GA.[15] Findings of the present study are similar to the

results of this study. Yousef et al conducted a study to compare spinal anaesthesia, (segmental thoracic or conventional lumbar) vs the gold standard general anaesthesia as three aesthetic techniques for healthy patients scheduled for elective laparoscopic cholecystectomy, The authors concluded that Segmental TSA provides better hemodynamic stability, lesser vasopressor use and early ambulation and discharge with higher degree of patient satisfaction making it excellent for day case surgery compared with conventional lumbar spinal anaesthesia.[16] A case report by Bethi in 2017 on TSSA for MRM in patient with bronchiectasis and conclude that TSSA is safer alternative to GA.[17] Till date, few studies have been done of Thoracic spinal anaesthesia for laparoscopic cholecystectomy surgeries. TSSA is potentially a safe alternative in ASA grade I and II patients, when compared to GA with minimal side effects. Advantages pertaining to TSSA are awake patient, high patient satisfaction, minimal Hemodynamic variability and early ambulation. Further multi centric studies are needed to evaluate usefulness of TSSA in laparoscopic cholecystectomies and evaluation of local anaesthetic drugs and optimal doses that can be used in TSSA techniques should be done.

CONCLUSION

Thoracic segmental spinal anaesthesia and general anaesthesia are comparably effective for laparoscopic cholecystectomy surgeries. TSSA is potentially safe and advantageous in ASA grade I and II patients posted for laparoscopic cholecystectomies with minimal side effects, prolonged post operative analgesia high patient satisfaction, minimal hemodynamic variations and early ambulation.

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