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Research Article

Open Cholecystectomy Under General Versus Thoracic Spinal Anaesthesia : A Comparison from The Viewpoint Of Surgeons

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ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC), one of the most common surgeries performed worldwide, is the effective surgical procedure for gallstone disease. However, many surgeons today still continue to conduct Open cholecystectomies (OC) due to a lack of resources, experience, and patients' personal preference. Both open and laparoscopic cholecystectomies are mostly performed under General Anaesthesia (GA) worldwide. Regional anaesthesia can achieve an acceptable level of anaesthesia without compromising the patient's consciousness, enabling a quicker recovery and hospital discharge. An understudied aspect of patient care, particularly in the operating room, is the comfort of the surgeon.
Aims: To compare the safety and feasibility of Open cholecystectomy under general versus thoracic spinal anaesthesia through a Surgeon Satisfaction Score (SSS), intra op monitoring and post-operative care.
Methods and Materials: 100 cases of Chronic Calculous Cholecystitis belonging to ASA Grade I and II, without any comorbidities underwent Open cholecystectomy under Thoracic spinal anaesthesia and General Anaesthesia, in Tezpur Medical College and Hospital, a rural tertiary care centre. After the surgery, a Surgeon Satisfaction Score was calculated on following parameters - I) Absence of intra-operative complications II) Absence of intra operative movements III) Abdominal relaxation during the surgery IV) Absence of Post-operative complications after surgery and V) Timely discharge from hospitalusing 5-point Likert's scale.
Results: Open cholecystectomy under Thoracic Spinal Anaesthesia has good satisfactory results when compared to under GA by reducing post operative pain and stress, allowing for early discharges though intra-operative difficulties related to the sympathetic blockade, and awake patient were present.
Conclusion: Open Cholecystectomy is feasible and safe under Thoracic Spinal Anaesthesia when compared to General Anaesthesia with excellent Surgeon Satisfaction and minimal post-operative complications for healthy patients.

Keywords*: Open Cholecystectomy; Thoracic Spinal Anaesthesia; General Anaesthesia; Surgeon Satisfaction Score.*

INTRODUCTION

In today's era, the gold standard management of gallstones is Laparoscopic Cholecystectomyunder General Anaesthesia. However, in many resource-poor regions of the world, Open Cholecystectomies are still being performed due to lack of resources and expertise. Cholecystectomies are generally carried out under GA. (1,2)

In recent times, regional anaesthesia is gaining more prominence, especially in cases where a higher risk of morbidity due to GA is present. Regional Anaesthesia has the advantage of providing excellent pain relief postoperatively, reducing usage of opioid analgesics and shortening duration of hospital stay. This provides patients with better outcomes.
However, the comfort of the surgeon is an under-studied area of interest, which carries a minor but crucial role in the management of patients, especially in the operating room.

The aim of this study is to evaluate the safety and efficacy of Thoracic Spinal Anaesthesia (TSA) in Open Cholecystectomy in comparison to General Anaesthesia, from a surgeon's perspective through a Surgeon Satisfaction Score (SSS), intra op vitals monitoring and post-operative care.

MATERIALS AND METHODS

Study Design and Ethical Considerations

This prospective, randomized controlled study was conducted at Tezpur Medical College and Hospital, a tertiary careacademic medical centre in India. The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants following detailedexplanation of the procedure, potential risks and benefits, and the possibility of conversion to general anaesthesia ifnecessary. All participants were free to withdraw from the study at any time.

The following ethical guidelines were put into place for the research period:

a) The dignity and well-being of patients was protected at all times.

b) The research data remained confidential throughout the study and the researcher obtained the patients permission to use real names in the research report.

c) Research protocol was presented in institutional ethical review board and due permission was obtained to undertake the study.

Patient Selection

Inclusion criteria were –

- Age 18-60 years
- Body Mass Index 18.5-23 kg/m²
- Chronic calculous cholecystitis
- ASA Physical Status Classification Grade I or II
- No significant comorbidities
- Scheduled for elective open cholecystectomy

Exclusion criteria were –

- Acute cholecystitis or signs of systemic toxicity
- Complicated Cholecystitis like Gallbladder perforation
- Choledocholithiasis or suspected common bile duct obstruction
- Gallbladder carcinoma
- Pregnancy
- ASA Grade III or above
- Spinal deformity or vertebral pathology precluding neuraxial procedures
- Active coagulopathy or anticoagulation therapy
- Allergy or contraindication to local anaesthetics (levobupivacaine or fentanyl)
- Refusal to consent for thoracic spinal anaesthesia

One hundred eligible patients were sequentially enrolled and randomly allocated to receive either general anaesthesia (GAgroup, n=50) or thoracic spinal anaesthesia (TSA group, n=50) using a simple lottery selection method. Randomizationwas performed by an independent investigator not involved in patient care or data collection.

Pre-operative preparation

All patients were comprehensively assessed preoperatively.Detailed history, physical examination, andreview of baseline investigations were done. Upon arrival to the operating room, patients were positioned supine on the operating table, and standard monitoring equipment was applied includingcontinuous electrocardiography, non-invasive blood pressure measurement, pulse oximetry, and capnography (GAgroup). Baseline vital parameters including heart rate, systolic and diastolic blood pressure, mean arterial pressure(MAP), electrocardiographic findings, and oxygen saturation (SpO_2) were recorded. All patients received intravenouspremedication consisting of pantoprazole 40 mg and ondansetron 4 mg.

Anaesthetic Techniques

General Anaesthesia Group

Patients in the GA group received standard general anaesthesia with induction using propofol (2 mg/kg IV) or thiopentalsodium, followed by succinylcholine (1-1.5 mg/kg IV) for rapid sequence intubation. Maintenance was achieved withnitrous oxide in oxygen supplemented with volatile anaesthetic (sevoflurane or isoflurane) and intermittent IV opioids asrequired. Neuromuscular blockade was maintained with intermediate-acting agents. At completion of surgery, residualneuromuscular blockade was reversed using appropriate agents, and patients were extubated following confirmation ofadequate spontaneous ventilation and airway reflexes.

Thoracic Spinal Anaesthesia Group
Patients were positioned upright (sitting posture) for the procedure. Under strict aseptic precautions, dural puncture was performed through the interspinous space at T9-T10 or T10-T11 level, using a 25-gaugespinal needle.The placement into subarachnoid space was confirmed by identifying Cerebrospinal fluid aspiration. Two millilitres of hyperbaric levobupivacaine0.5% (10 mg) mixed with fentanyl 25 mcg was injected into the subarachnoid space at a controlled rate. Patients wereimmediately positioned supine and monitored closely.

Sensory block was assessed by pinprick sensation using a needle at 2-minute intervals, with motor function evaluatedusing the modified Bromage scale (0=full motor strength; 1=hip flexion weak; 2=hip and knee flexion weak; 3=completemotor blockade). Surgery commenced only after confirming adequate sensory blockade extending from T4 to L2dermatomes bilaterally and motor block with Bromage score ≥2.

Intraoperative Monitoring and Management
Vital parameters (heart rate, blood pressure [systolic, diastolic, and MAP], SpO_2, and core temperature) were recorded at5-minute intervals throughout the operative period. All patients breathed room air supplemented with oxygen titrated tomaintain SpO_2 >94%.

Hemodynamic management protocols were predetermined:

- Hypotension (defined as ≥20% decrease in MAP from baseline) was managed with IV fluid bolus (500-1000 mL crystalloid) and Mephenteramine 6 mg IV if hypotension persisted
- Bradycardia (<50 beats/minute) was managed with atropine 0.6 mg IV
- Tachycardia (>120 beats/minute) or hypertension (>20% increase in baseline MAP) was managed with IV opioids or vasodilators as appropriate.

Surgical Technique
All procedures were performed through a right subcostal (Kocher's) incision by experienced general surgeons. Operativetime was recorded from skin incision to closure of the fascial layer. Standard open cholecystectomy technique wasemployed for all cases.

Postoperative Assessment
In the immediate postoperative period, patients were assessed for recovery of sensory and motor function to rule outneurological deficits. Pain was systematically assessed using the Visual Analog Scale (VAS, 0-10) at regular intervals forthe first 24 postoperative hours. Analgesia was provided according to protocol:

- Intramuscular diclofenac 75 mg (NSAID) if VAS >4
- Intravenous paracetamol 1 gram if pain persisted despite NSAID administration

Postoperative nausea and vomiting (PONV) were managed with antiemetic agents as clinically indicated. All patientswere monitored for postoperative complications including wound complications, infections, urinary retention, andcardiovascular events. Hospital discharge criteria included stable vital signs, return of bowel function, ability to maintainoral intake, and absence of significant complications.

Surgeon Satisfaction Score
Following patient discharge, each operating surgeon completed a standardized questionnaire assessing satisfaction using a 5-point Likert scale (5=Excellent, 4=Good, 3=Satisfactory, 2=Poor, 1=Very Poor). The parameters were derived from a study by El Durgham et al. (3)Five parameters wereevaluated:

1. **Absence of intraoperative anaesthetic complications**

Defined as no major complications directly attributable tothe anaesthetic technique that substantially altered surgical management or patient outcome

2. **Absence of intraoperative patient movement**

Scored based on the degree and character of patient movement;scores of 5 were assigned if ≤3 minor movements (e.g., finger flicking), with 1 indicating significant movement thatinterfered with the surgical field

3. **Abdominal relaxation during surgery**

Assessed as the quality of abdominal wall and visceral muscle relaxationthroughout the procedure

4. **Absence of postoperative complications**

Defined as absence of significant complications in the immediatepostoperative period

5. **Timely discharge from hospital**

Determined by meeting discharge criteria within the anticipated timeframe (24-48hours for uncomplicated cases)

Statistical Analysis
Continuous variables are presented as mean ± standard deviation. Categorical variables are presented as frequenciesand percentages. Comparison between the two groups was performed using Student's independent samples t-test

forcontinuous variables. Chi-square test was used for categorical variables. A p-value <0.05 was considered statisticallysignificant. Statistical analyses were performed using Microsoft Excel and SPSS.

RESULTS

Among the 100 patients who underwent Open cholecystectomy, 65 patients were females and the rest 35 were male. The mean age of the population was 40.11 ± 10.86 years. The mean BMI of the patients was found to be 20.95 ± 1.32kg/m^2. No surgeries were converted to General Anaesthesia.

The following table depicts the Intra-operative parameters, namely, operative time, pneumoperitoneum time, average intra-operative vital values namely, Blood pressure (MAP), Pulse rate, oxygen saturation.

	TSA	GA	p-value
Operative time (mins)	37.74 ± 6.09	36.94 ± 5.15	0.48
Blood Pressure (MAP) (mm Hg)	87.90 ± 8.73	90.88 ± 7.48	0.07
Pulse Rate (beats/min)	84.61 ± 6.12	81.89 ± 9.90	0.10
sPO2 (%)	97.90 ± 0.51	97.92 ± 0.38	0.83

Table 1: Comparison of intra operative vital parameters

The following table depicts complaints and complications faced during the surgery. As elaborated above, the complications were managed, and did not drastically alter the outcome of the surgery.

Intra-operative complications	TSA	GA
Hypotension	3	1
Abdominal discomfort	2	
Pruritis		1
Nausea	2	2
Vomiting	1	2
Bradycardia	1	

Table 2: Comparison of intra operative complications

The following table depicts the complications in the postoperative period.

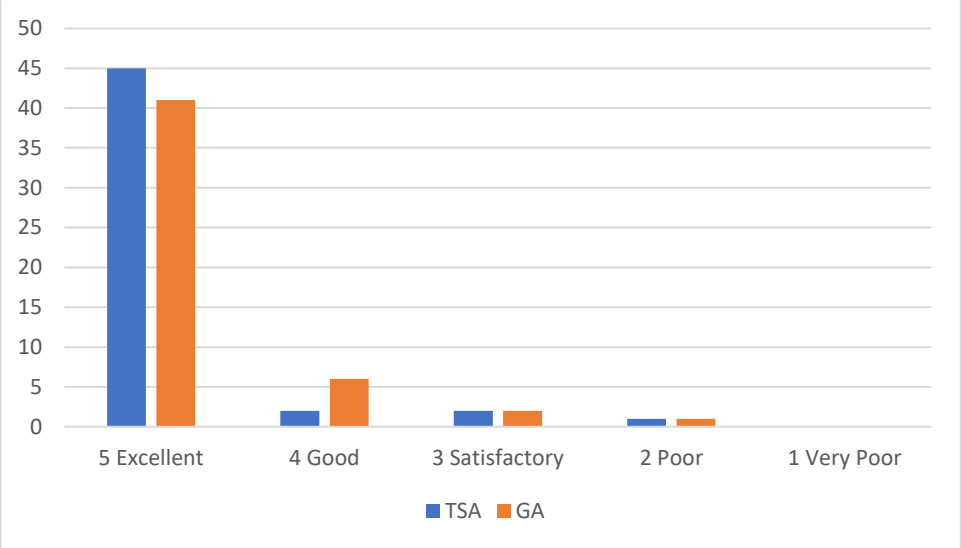
Post-operative complications	TSA	GA
Post operative Nausea, Vomiting	4	6
Abdominal discomfort	2	3
Wound site pain	1	5
Urinary Retention	1	

Table 3: Comparison of post-operative complications

A Surgeon Satisfaction Score was calculated at the time of discharge of the patients by the operating surgeon, based on a 5-point scale. The following tables depict the scores for each parameter.

Surgeon Satisfaction Score	TSA	GA
5 – Excellent	45	41
4 – Good	2	6
3 – Satisfactory	2	2
2 – Poor	1	1
1 - Very Poor	0	0

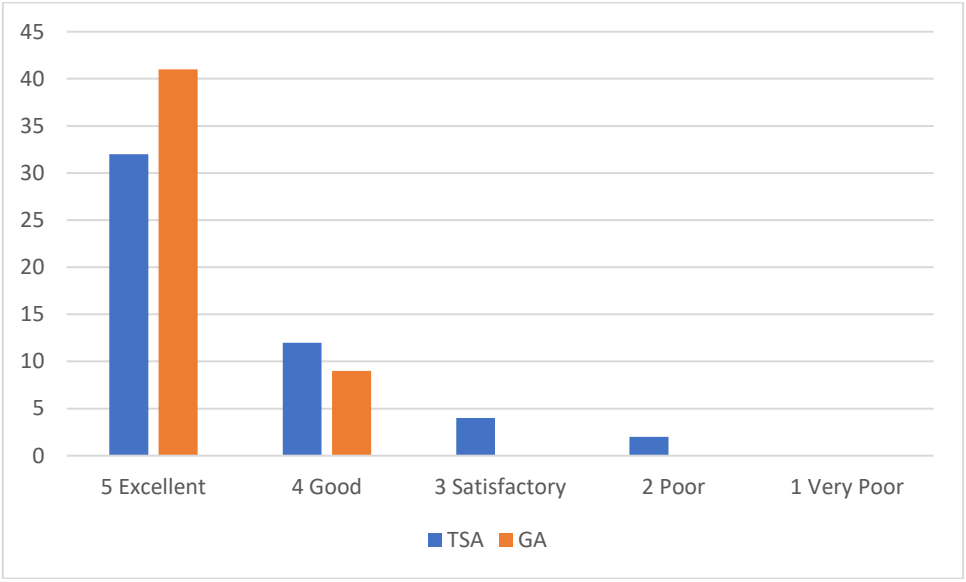
Table4: Comparison of Surgeon Satisfaction Score for intra-operativecomplications



Graph 1:Comparison of Surgeon Satisfaction Score for intra operativecomplications

Surgeon Satisfaction Score	TSA	GA
5 – Excellent	32	41
4 – Good	12	9
3 – Satisfactory	4	0
2 – Poor	2	0
1 - Very Poor	0	0

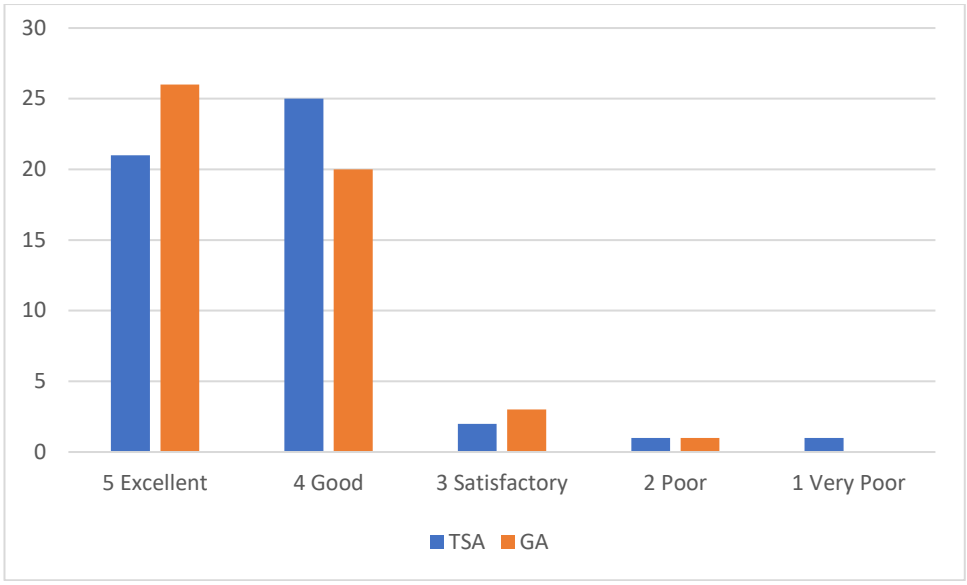
Table5:Comparison of Surgeon Satisfaction Score for intra-operative movements



Graph 2: Comparison of Surgeon Satisfaction Score for intra-operative movements

Surgeon Satisfaction Score	TSA	GA
5 – Excellent	21	26
4 – Good	25	20
3 – Satisfactory	2	3
2 – Poor	1	1
1 - Very Poor	1	0

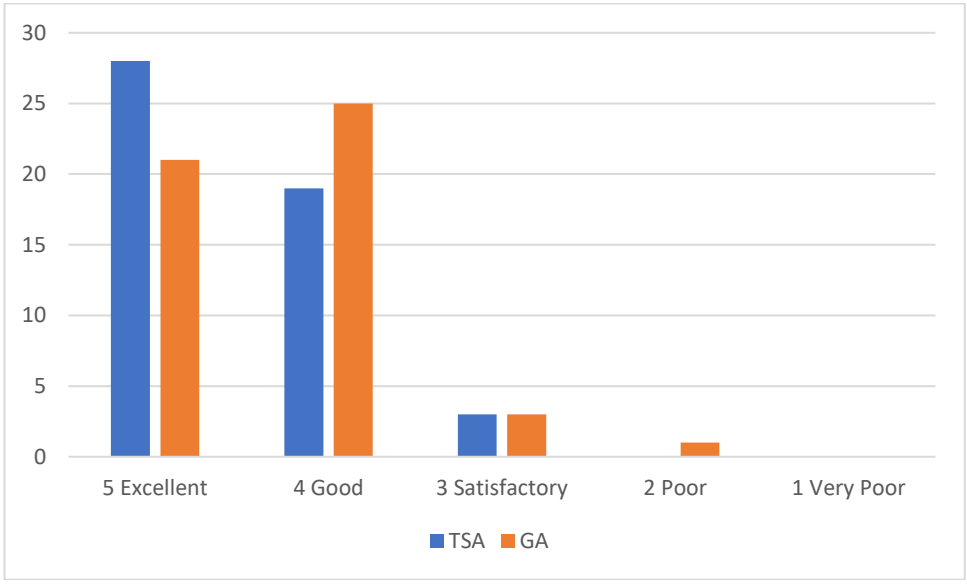
Table6:Comparison of Surgeon Satisfaction Score Abdominal relaxation



Graph 3: Comparison of Surgeon Satisfaction Score for Abdominal relaxation

Surgeon Satisfaction Score	TSA	GA
5 – Excellent	28	21
4 – Good	19	25
3 – Satisfactory	3	3
2 – Poor	0	1
1 - Very Poor	0	0

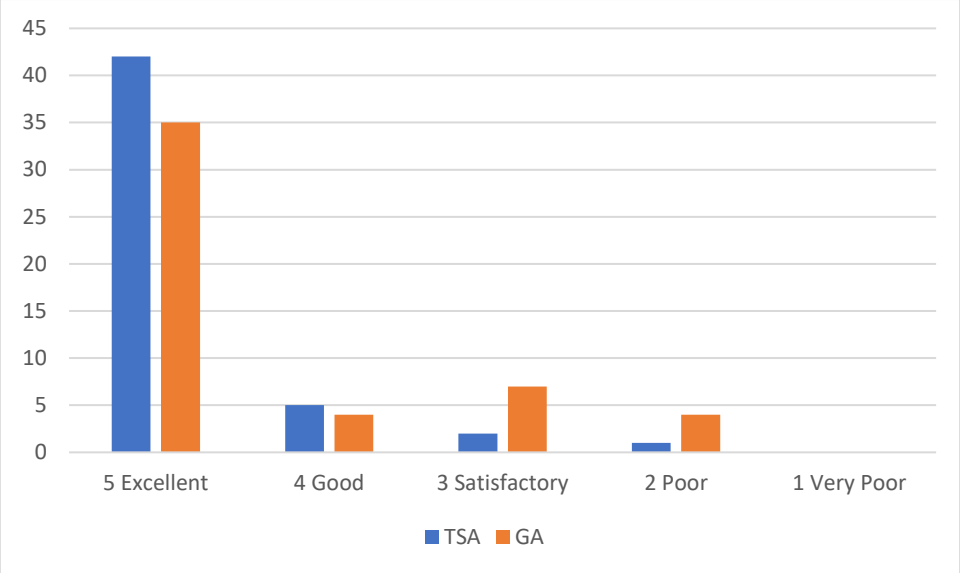
Table7: Comparison of Surgeon Satisfaction Score for post operative complications



Graph 4: Comparison of Surgeon Satisfaction Score for post operative complications

Surgeon Satisfaction Score	TSA	GA
5 – Excellent	42	35
4 – Good	5	4
3 – Satisfactory	2	7
2 – Poor	1	4
1 - Very Poor	0	0

Table8: Comparison of Surgeon Satisfaction Score for discharge time



Graph 5: Comparison of Surgeon Satisfaction Score for discharge time

DISCUSSION

Laparoscopic cholecystectomy is the surgery of choice for cholelithiasis. It is usually doneunder general anaesthesiabut patients with major cardiorespiratoryailments especially with hyperreactive airway disease and lung pathology cannot withstand GA and develop intra operative and postoperative complications,increasing morbidity and mortality rates(4,5). There can also be intra-operative complications related to the procedure like injury to bile ducts, lack of experience, requirement of bailout procedures, that warrant conversion to or perform the open technique. Thus, Open Cholecystectomies have its own importance and should be a part of the armamentarium of a surgery operating on biliary system, and is a part of training for surgical residents.(6)

In our study, Thoracic Spinal Anaesthesia (TSA) was associated with a marginally longer operative time compared to GA (TSA - 37.74 ± 6.09; GA - 36.94 ± 5.15) which was insignificant (p-value – 0.48). A study by Laoutid et al (7) reports an average time of 30 mins for open cholecystectomy under SA.

Intra-operatively, patients in TSA group had a lower mean arterial pressure (MAP) compared to GA (TSA – 87.90 ± 8.73; GA – 90.88 ± 7.48; p-value – 0.07). However, there was no significant difference in pulse rate (TSA – 84.61 ± 6.12; GA – 81.89 ± 9.90; p-value – 0.10). The sympathetic blockade effect of TSA can be deemed the reason behind this and did not impact the surgery.The study by Koju et al (8) found hypertension in a few patients who were given GA. Oxygen saturation levels were almost equal in both groups (TSA – 97.90 ± 0.51; GA – 97.92 ± 7.48; p-value – 0.38).
TSA group had complications such as hypotension (three), and bradycardia (one), which are well-documented side effects of spinal Anaesthesia (9–11). The incidence of hypotension was reported to be 20.5% to 36% (12,13)among laparoscopic cases and 25% (5 out of 20) in a study by Laoutid et al (7)which were managed by IV fluid bolus and IV Atropine for bradycardia.

Two patientsin the TSA group complained of abdominal discomfort, in the form of a dragging sensation over right upper abdomen. This could be attributed to the traction provided on the liver and other abdominal structures during the surgery, compounded by anxiety and stress of being awake through the procedure.It was managed by sedating the patients with Inj. Midazolam 1-2 mg and oxygen supplementation. However, none warranted abandonment of procedure of surgery ora change in the mode of anaesthesia.This is in line with previous studies, for both open and laparoscopic method. (7,13,14)
One patient from the GA group developed pruritis, which was managed with steroids and anti-histamines. Two patients in both groups developed nausea. Vomiting was seen in one and two patients of TSA and GA groups respectively. All these patients were managed by antiemetics.

Regarding the surgical satisfaction scores, a 5 – point Likert scale was used, with 5 being the best and 1 being the worst. The components that were used in this study were 1) Absence of intra-operative complications; 2) Absence of intra-operative movements by the patients; 3) Abdominal relaxation during surgery; 4) Post operative complications; 5) Hospital stay or Discharge time from the hospital.

1) For Absence of intra-operative complications

The scores were almost similar with no statistically significant difference (TSA – 4.80 ± 0.63; GA – 4.74 ± 0.63; p-value – 0.64). Surgeons were mostly satisfied with there being no major intra-operative complication that drastically altered the outcome of the surgery.There was no problem in respiratory status of the patients due to the minimal and transient nature of the motor blockade in Thoracic spinal anaesthesia, a fact supported by literature (14,15).

2) For Absence of intra-operative movements

In general, a score of 5 was given if the patient had less than three minor movements like flicking fingers or wrist. A score of 1 was considered if the patient was moving his entire body or brought the upper limb into the sterile zone, which did not occur during the study. The scores had a statistically significant difference between the groups (TSA – 4.48 ± 0.81; GA – 4.40 ± 0.72; p-value < 0.01). This could be attributed to the apprehension and anxiety brought awake state of the patient during the surgery. Sedating the patient is an appropriate response to this problem.

3) Abdominal relaxation during surgery

Surprisingly, the scores related to abdominal relaxation were found to be statistically insignificant among both groups. (TSA – 4.28 ± 0.80; GA – 4.40 ± 0.72; p-value – 0.43). The apprehension and voluntary contractions by the patients who were awake throughout the surgery, mildly impacted the score. This problem was ameliorated by reassuring and sedating the patient. Similar results were reported by Koju et al (8).

4) Absence of Post-operative complications

Overall, the incidence of thepost-operative complications was more in the GA group, which were manageable by conservative measures. Both groups had similar scores in the satisfaction scale (TSA – 4.50± 0.61; GA – 4.32± 0.68; p-value – 0.17). Most common complication encountered was PONV (four in TSA group and six in GA group).Severe wound site pain was found one patient in TSA group and five patients in GA group, owing to the sensory block provided by TSA. In the TSA group, there was a patient who developed urinary retention, which is a well-documented adverse effect. (16) Similar profile of adverse effects were found in other studies (7,8,17)

5) Discharge time from the hospital

There was a major difference between the hospital stay, discharge times and consequently, the satisfaction scores. (TSA – 4.76 ± 0.62; GA – 4.40 ± 1.00; p-value – 0.03). Most patients were fit to be discharged within 24 hours, including an overnight stay. This is because of reduced gastro-intestinal complications in TSA, early enteral feeding, thereby reinforcing the principles of ERAS. Reduced post-operative pain resulted in early mobilisation of patient and early recovery and thus early discharges, within 24 to 48 hours.

Study Limitations

Several limitations should be acknowledged. First, the study was conducted at a single tertiary care centre, potentiallylimiting generalizability. Second, patient selection was highly restrictive (BMI 18.5-23, ASA I-II, no comorbidities), whichmay not reflect broader surgical populations. Third, comparative cost analysis was not performed.

SUMMARY AND FURTHER SCOPE

To summarize the results, Open cholecystectomy under TSA has good satisfactory results when compared to under GA especially by reducing post operative pain and stress, allowing for early discharges though it does have its share of intra-operative difficulties, related to the sympathetic blockade caused by thoracic spinal anaesthesia.

Further studies in this domain, including multi centric studies are required to broaden the findings of this study and to check for financial, and resource implications for the patient, surgeons and the hospitals. Another scope of this study is to check the feasibility of continuing Thoracic Spinal Anaesthesia in cases that require conversion of laparoscopic to open procedure due to various causes.

CONCLUSION

Open Cholecystectomy is feasible and effective using Thoracic Spinal Anaesthesia with equal, comparable and satisfactory results with a better post-operative pain free recovery when compared to under General Anaesthesia.

Conflict Of Interests: None

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