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Efficacy of Segmental Spinal Anaesthesia in Laparoscopic Cholecystectomy: An Interventional Study

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Abstract:
Background*: Laparoscopic cholecystectomy (LC) is a minimally invasive surgery, indicated for the removal of a diseased gallbladder. It has replaced the open technique for conventional cholecystectomies since the 1990s. One previous study by Zudert conducted on Thoracic Segmental Spinal Anaesthesia (TSSA) for LC found to be effective and successful*
Aim:*Aim of the study is to evaluate the efficacy and safety of TSSA to provide surgical anaesthesia without general anaesthesia (GA) among patients scheduled for elective laparoscopic cholecystectomy****.***
Materials and Methods: *The current study was done on 25 patients belonging to American Society of Anaesthesiologists (ASA) grade I, II, posted for elective laparoscopic cholecystectomyat our tertiary care center named NRI Medical College and Hospital from July 2022 to December 2022. Patients aged above 18 years of either genderwho provided informed consent to participate in the study were included.*
Results: *Most of the patients were aged 41 to 50 years. Most of the patients were females. Most of the patients belonged to ASA grade I. TSSA block was successful in 96% of patients. Most of the patients required 2 attempts for successful block. Mean time for 1st rescue analgesia was 302min. Most common intraoperative side effect was hypotension and most common postoperative side effect was nausea/vomiting.*
Conclusion: *Our study results provided primary evidence that segmental thoracic spinal anesthesia can be a safe, effective and economical anesthetic procedure for laparoscopic cholecystectomy, avoiding complications of general anesthesia.*
Key Words: *Cholecystectomy, Efficacy, Interventional study, Safety, Segmental Spinal Anaesthesia*

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I. Introduction

Laparoscopic cholecystectomy (LC) is a minimally invasive surgery, indicated for the removal of a diseased gallbladder. It has replaced the open technique for conventional cholecystectomies since the 1990s.[1]LC is indicated for treatingcholelithiasis, acute or chronic cholecystitis, biliary dyskinesia, gallstone pancreatitis, and gallbladderpolyps or masses.[2]Cases of gallbladder cancers are treated best using open cholecystectomy. Around 20 million people in US had gallstones. Among them, around300,000 cholecystectomies were performed annually. Among patients with symptomatic gallstones, around 1% to 4% of patients will manifest complications likegallstone pancreatitis, cholecystitis, choledocholithiasis etc.[3] The incidence of gallstones raises with increasing age, and females are more likely to form gallstones compared to males. Around, 75% of gallstones contain cholesterol, and remaining 25% are pigmented[s]

One previousstudy by Zudert et al.[5]conducted on Thoracic Segmental Spinal Anaesthesia (TSSA) for LC found to be effective and successful. TSSA done using a minimal dose of isobaric local anaesthetic is enough to block various dermatomes required for one specific surgery. This reduces blocking unnecessary spinal segments, which may cause extra motor, sensory and sympathetic, blockades.[6]Efficacy was determined by no. of patients whowere converted to general anesthesia (GA) and safety was measured by adverse effects during and after surgery.

Aim:
Aim of the study is to evaluate the efficacy and safety ofTSSA to provide surgical anaesthesia without general anaesthesia (GA)among patients scheduled for elective laparoscopic cholecystectomy**.**

II. Material And Methods

This study was carried out at a tertiary care centre in India from July 2022 to December 2022.
Study Design: Interventional, single-centered study.

Study Location: This study was done at a tertiary care teaching institute in the Department of anaesthesia at NRI medical college and Hospital, Mangalagiri, Guntur, Andhra Pradesh, India.
Study Duration: July 2022 to December 2022
Sample size: 25Patients

Subjects & selection method:
The study included 25 patients who were scheduled for elective laparoscopy at our tertiary care center.

Eligibility criteria:

Inclusion criteria:
1. Patients aged above 18 years of either gender posted for elective laparoscopic cholecystectomy.
2. Patients who provided informed consent to participate in the study.
3. Patients with ASA grade I, II.

Exclusion criteria:
1. Pregnant and lactating women
2. Patients with BMI above 37kg/m^2.
3. Patients with active cholecystitis
4. Patients with bradycardia and heart block
5. Patients with local infection
6. Patients with psychiatric or neurological disorders
7. Patients with spinal abnormalities.

III. Methodology:

After pre-anaesthetic check-up, written informed consent was obtained from every patient a day before surgery. They were told that if there is any distress, it would be managed by systemic medication or general anaesthesia as per the need.Patients were kept nil by mouth for 8 hours before surgery. ECG, pulse oximetry, respiratory rate, noninvasive BP and end-tidal carbon dioxide, along with baseline vitals were noted. IV line was secured using 20-gauge cannula. Ringer lactate was started. Premedication with given using glycopyrrolate, ondansetron, fentanyl and midazolam. Under strict aseptic conditions, TSSA was given using midline approach in between T7 to T12 spines, in sitting position. If there is any difficulty in the midline approach then paramedian approach was used. Spinal anaesthesia was given using 25 G Quincke spinal needle, until there is loss of resistance. After the flow of clear CSF, inj ropivacaine 0.75% (isobaric), 1.5 ml was given along with inj. dexmedetomidine 6mcg as an adjuvant into subarachnoid space. Maximum three attempts at dural puncture were considered in a patient due to ethical concerns, after the procedure was carried out under GA. Oxygen was given via Hudson's mask at the flow rate of 5 l/min.

Motor block was assessed using modified Bromage scale:[7]
0-able to lift extended leg
1- just able to flex knee
2-no knee movement and some ankle movement
3- complete lower limb paralysis.

Pain was assessed using visual analogue scale.[8]

Patient satisfaction score was assessed based on five points:
1. Postoperative pain
2. Awareness during surgery
3. Postoperative nausea vomiting
4. Postoperative urinary retention
5. Headache/backache
Absence of each of the above-mentioned side effects carries 1 point.

Parameters assessed:
Age
Gender
ASA grade
No of attempts

Success rate
Mean time for 1st rescue analgesia
Mean patient satisfaction score

Statistical analysis:
Data was analyzed using SPSS software version 25.0. Results were expressed as percentages and mean with standard deviation.

Ethical considerations:
Informed consent was taken from every patient participated in the study.

IV. Results

The current study included 25 patients scheduled for elective laparoscopic cholecystectomy.

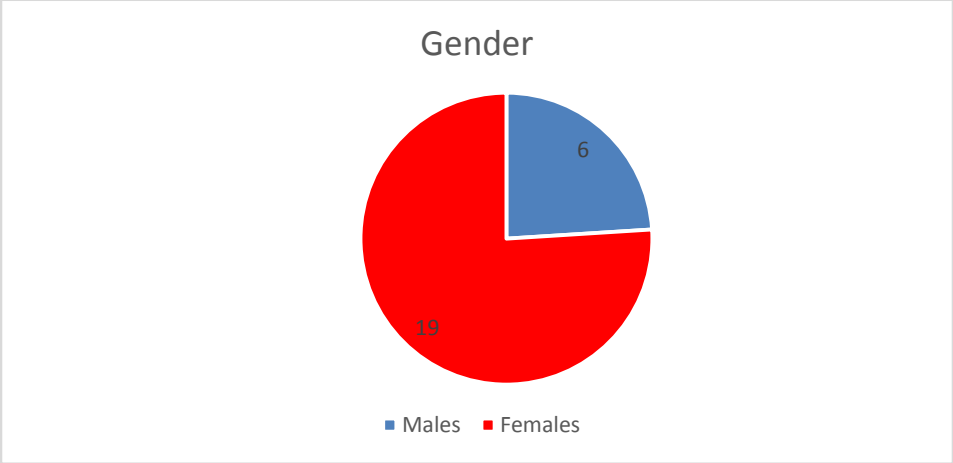
Age distribution:
Most of the patients were aged 41 to 50 years.

Table 1 shows age distribution of patients

Age distribution	No of patients	% of patients
18-30 years	3	12
31-40 years	5	20
41-50 years	14	56
51 -60 years	3	12

Gender distribution: Most of the patients were females in the current study.

Graph 1 shows gender distribution of patients



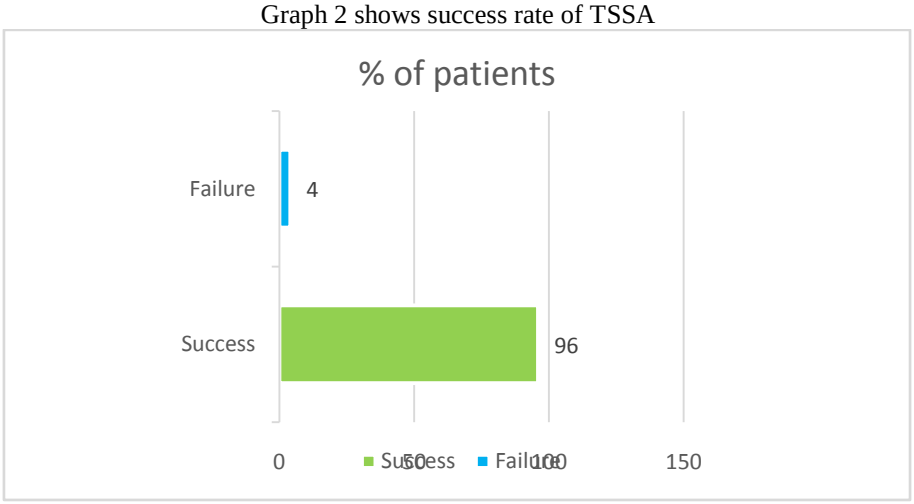
ASA Grade: Most of the patients belonged to ASA grade I.

Table 2 shows ASA distribution of patients

ASA Grade	No of patients	% of patients
I	16	64
II	9	36

Success rate: The block was failed in 1 patient1. For this 1 patient, conversion to general anaesthesia was done.

Graph 2 shows success rate of TSSA



No of attempts:
Most of the patients required two attempts for successful block (block was successful in 96% of patients).

Table 3 shows no of attempts taken

No of blocks	No of patients	% of patients
I	2	8
2	18	72
3	4	16

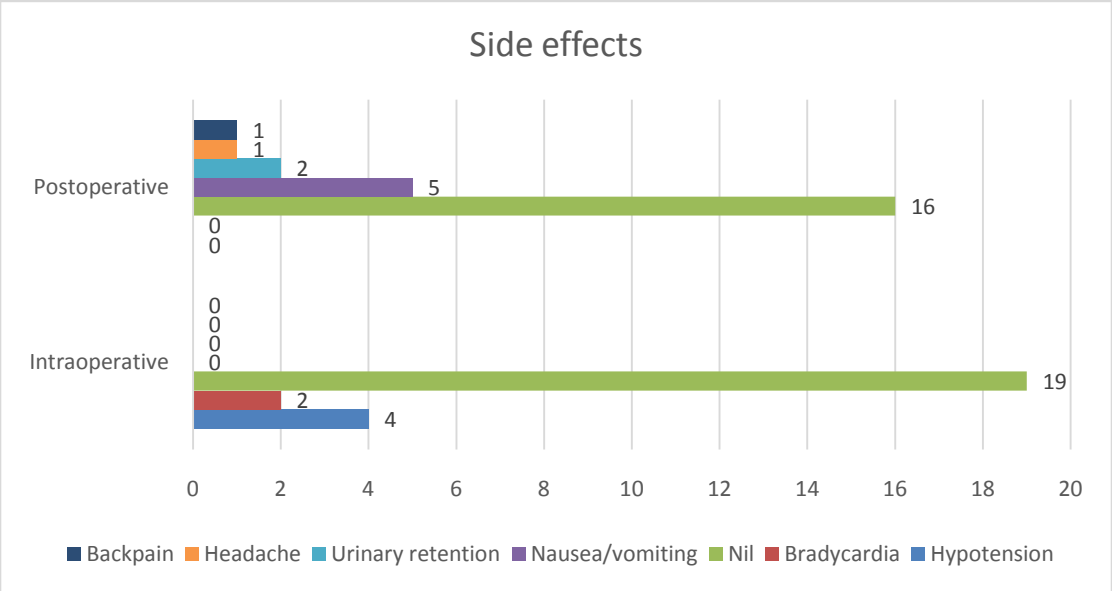
Motor block and sensory regression:
The motor blockade 2 was achieved by 21 patients, 1 by 3 patients and 0 by 1 patient.Mean time for full sensory regression was 90.2 ±10.2 min
Mean time for complete motor regression was 60.4±10.8min.

Time for rescue analgesia:
The mean time for 1st rescue analgesia (with VAS ≥3) was 298±14.5 min.

Mean patient satisfaction score:
The mean patient satisfaction score was 2.4±0.9.

Side effects:
Most of the patients had hypotension as intraoperative side effects and nausea/vomiting, urinary retention as postoperative side effect.

Graph 3 shows intraoperative and postoperative side effects.



V. Discussion

Thoracic spinal anesthesia was demonstrated to be a safe and effective method for many surgeries, including breast cancer lumpectomies, laparoscopic cholecystectomies, and abdominal cancer surgery.[9-11]

The current study was done on 25 patients belonging to American Society of Anaesthesiologists (ASA) grade I, II, posted for elective laparoscopic cholecystectomy at our tertiary care center named NRI Medical College and Hospital from July 2022 to December 2022. Results showed that most of the patients were aged 41 to 50 years. Most of the patients were females. Most of the patients belonged to ASA grade I. TSSA block was successful in 96% of patients. Most of the patients required 2 attempts for successful block. Mean time for 1st rescue analgesia was 302min. Most common intraoperative side effect was hypotension and most common postoperative side effect was nausea/vomiting in our study.

Zundertet al.[5] included 20 ASA grade I or II patients scheduled for elective laparoscopic cholecystectomy. All patients received a segmental (T10 injection) spinal doseof bupivacaine along with sufentanil. Results showed that spinal anaesthetic was done easily among all patients, except for 1 patient who complained of paraesthesia, that responded to slight needle withdrawal. TSSA was found to be effectiveamong all 20 patients, but six patients experienced mild discomfort which was treated with fentanyl. No patient required conversion to general anaesthesia. In our study, 1 patientrequired conversion to general anaesthesia. Two patients reported anxiety and two reported hypotension in their study. No patient had anxiety in our study.

Geetha et al.[12] did a study on50 patients of ASA grade 1, 2, 3scheduled for elective laparoscopic cholecystectomy. Authors used ropivacaine with dexmedetomidine. Results showed that TSSA provided complete surgical anaesthesia in 96% of patients, similar to our study results. The median time for complete sensory regression was around 90 min and median time for complete motor regression was around 60 min, almost similar to our study findings.

Kejriwal et al.[13] did a case report and included a patient who underwent TSSA for laparoscopic cholecystectomy. Spinal anaesthesia was given in T10-11 interspace using bupivacaine that is mixed with fentanyl.He found no neurological deficit and hemodynamic parameters were in normal range during and after surgery and recovery was good.The patient has no dyspnea during abdominal insufflation and oxygen saturation was more than 96% at various time intervals, which could be due to usage of horizontal position and low gas pressure. Low dose of bupivacaine may havereduced the degree of thoracic motor block.

Some authors suggested that anxiety can be reduced using midazolam and intraoperative pneumoperitoneum can be treated using ketamine among patients scheduled for LC.[14-15]

VI. Conclusion

Our study results provided primary evidence that segmental thoracic spinal anesthesia can be a safe, effective and economical anesthetic procedure for laparoscopic cholecystectomy,avoiding complications of general anesthesia.

The study is self-sponsored. There were no conflicts of interest.

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