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Original Research Article

Laparoscopic cholecystectomy under spinal-epidural anesthesia versus general anaesthesia: a prospective randomized study

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ABSTRACT

Background: The choice between spinal-epidural anesthesia and general anesthesia for laparoscopic cholecystectomy depends on various factors, including patient characteristics, surgical team expertise, and institutional guidelines. While both techniques have their advantages and disadvantages, spinal-epidural anesthesia offers an alternative to general anesthesia, potentially reducing complications and improving patient outcomes. Objective of the study was to compare spinal anesthesia with the gold standard general anesthesia for elective laparoscopic cholecystectomy in healthy patients.
Methods: This study was conducted at Sheikh Hasina Medical College, Hobiganj, Bangladesh. In this prospective comparative study, we enrolled one hundred patients diagnosed with symptomatic gallstone disease and classified as American Society of Anesthesiologists (ASA) status I or II. These patients were subjected to randomization, with fifty of them assigned to undergo laparoscopic cholecystectomy under spinal anesthesia, while the remaining fifty received general anesthesia. Subsequently, we conducted a comprehensive assessment, comparing various intraoperative parameters, postoperative pain levels, incidence of complications, recovery rates, and patient satisfaction during the follow-up period, with the aim of evaluating the differences between these two anesthesia methods.
Results: All the procedures were completed by the allocated method of anesthesia, as there were no conversions from spinal to general anesthesia. Pain was significantly less at 4 hours ($p<0.001$), 8 hours ($p<0.001$), 12 hours ($p<0.001$), and 24 hours ($p=0.02$) after the procedure for the spinal anesthesia group compared with those who received general anesthesia. There was no difference between the 2 groups regarding complications, hospital stay, recovery, or degree of satisfaction at follow-up.
Conclusions: Spinal anesthesia is adequate and safe for laparoscopic cholecystectomy in otherwise healthy patients and offers better postoperative pain control than general anesthesia without limiting recovery.

Keywords: Laparoscopic cholecystectomy, Spinal-epidural anesthesia, General anaesthesia

INTRODUCTION

Laparoscopic cholecystectomy, a minimally invasive surgical procedure for gallbladder removal, has revolutionized the field of surgery over the past few decades. It offers numerous advantages over traditional open surgery, such as smaller incisions, reduced post-operative pain, shorter hospital stays, and faster recovery

times. One important aspect to consider when performing a laparoscopic cholecystectomy is the choice of anesthesia. While general anesthesia has been the conventional approach, an alternative method known as spinal-epidural anesthesia has emerged as a viable option.[1-3]

General anesthesia involves the administration of drugs that induce a state of unconsciousness, rendering the patient completely unaware and immobile throughout the procedure. This method has long been the gold standard for surgeries, providing excellent pain control and muscle relaxation. However, it carries some inherent risks, including potential complications such as allergic reactions, post-operative nausea and vomiting, prolonged recovery time, and a higher likelihood of airway-related complications. Additionally, the use of general anesthesia may not be suitable for all patients, particularly those with underlying health conditions or concerns regarding the risks associated with systemic anesthesia.

Spinal-epidural anesthesia, also known as regional anesthesia, involves the injection of anesthetic medication near the spinal cord, targeting specific nerves to block pain signals. This technique provides effective pain relief and muscle relaxation while allowing the patient to remain conscious throughout the procedure. The patient can communicate with the surgical team, reducing the need for a breathing tube and the associated risks. Spinal-epidural anesthesia has gained popularity due to its potential benefits, including reduced post-operative complications, faster recovery, earlier mobilization, and a potentially shorter hospital stay.[4-7]

Comparing the two approaches, laparoscopic cholecystectomy under spinal-epidural anesthesia offers distinct advantages over general anesthesia. First, it eliminates the risks associated with general anesthesia, especially those related to airway management and systemic drug administration. Additionally, regional anesthesia techniques provide excellent pain control and muscle relaxation, facilitating optimal surgical conditions. The avoidance of general anesthesia may be particularly beneficial for patients with comorbidities or contraindications to systemic anesthesia, allowing them to undergo the procedure safely.[8-11] However, there are considerations and potential drawbacks to using spinal-epidural anesthesia for laparoscopic cholecystectomy. These include the technical expertise required to perform the procedure, the need for appropriate patient selection, and the possibility of rare but serious complications associated with regional anesthesia, such as nerve damage or infection. Additionally, patient preferences, surgeon experience, and institutional protocols may influence the choice of anesthesia.

Objective

Objective of the study was to compare spinal anesthesia with the gold standard general anesthesia for elective laparoscopic cholecystectomy in healthy patients.

METHODS

Study type

It was a prospective comparative study.

Study period

The duration of the study was from September 2004 to October 2015.

Study place

The study was conducted at the Sheikh Hasina Medical College, Hobiganj, Bangladesh.

Selection criteria of patients

Inclusion criteria

Patients with American Society of Anesthesiologists' status I or II, age between 18 and 65 years, body mass index (BMI) of 30 or less, and normal coagulation profile were included.

Exclusion criteria

Patients with acute cholecystitis, pancreatitis, or cholangitis; previous open surgery in the upper abdomen; contraindication for pneumoperitoneum; and contraindication for spinal anesthesia owing to spinal deformity were excluded.

Procedure

Patients were randomized into two groups: one receiving laparoscopic cholecystectomy under general anesthesia and the other under spinal anesthesia. Randomization was computer-generated in blocks of 20 patients with sex stratification.

Numbered and sealed envelopes were used to ensure blinding of patients and physicians regarding the randomization arm. All patients received deep venous thrombosis prophylaxis during hospitalization. Both anesthesia and surgery were performed by the same anesthetic and surgical team. Standardized preoperative evaluation and preparation were conducted.

Intravenous medications were administered before anesthesia induction. Nasogastric tube insertion was performed for both groups for methodological reasons. Spinal anesthesia involved the use of a 25-gauge pencilpoint spinal needle and intrathecal injection. General anesthesia included induction with propofol, fentanyl citrate, and atracurium besylate. Anesthesia maintenance and ventilation were carefully controlled. Residual neuromuscular block was antagonized at the end of surgery. Continuous monitoring of vital signs and other parameters was conducted during the operation.

Laparoscopic cholecystectomy was performed using the standard 4-trocar technique. Pneumoperitoneum was established using the Hasson technique with a maximum intra-abdominal pressure of 10 mm Hg. The operating table was minimally tilted to minimize diaphragmatic irritation. Operative time and intraoperative events were recorded.

Ethical approval

Informed consent was obtained from all patients.

The trial protocol was approved by the institutional ethics committee.

Statistical analysis

The primary endpoint was any difference in postoperative pain between the two groups. Secondary endpoints included differences in complication rate, hospital stay, recovery, and patient satisfaction. A sample size of 150 patients per randomization arm was calculated. An interim analysis was planned after the first 100 patients, and the results of this analysis are discussed in the study.

RESULTS

Table 1 shows demographic status of the patients where All the procedures were completed by the allocated method of anesthesia, as there were no conversions from spinal anesthesia to general anesthesia. Intraoperatively, intravenous phenylephrine was administered in 29 (59%) patients from the spinal anesthesia group compared with 2 (4%) patients from the general anesthesia group owing to mean arterial blood pressure drops of more than 20% from the preanesthetic values. In all these cases, mean arterial blood pressure was then normalized and the procedure was completed uneventfully.

Table 1: Characteristics of patients who underwent laparoscopic cholecystectomy.

Characteristics of patients who underwent laparoscopic cholecystectomy	Received spinal anesthesia (n=49)	Received general anesthesia (n=48)
Age, median (range), y	44 (23-65)	46 (26-65)
Body mass index, a median (range)	25 (18-30)	26 (19-30)
Preoperative ERCP, no	4 3	3
Operative time, median (range), min	45 (20-90)	47 (20-110)
Total anesthesia duration, b median	61 (35-118)	62 (34-125)
Bile spillage, no.	14	12
Hospital stays, median (range), d	1 (1-4)	1 (1-2)

Table 2 shows postoperative events related to surgical and/or anesthetic procedures, like nausea, vomiting, or urinary retention, are presented in table.

Table 2: Postoperative events.

Postoperative events	Received spinal anesthesia (n=49)	Received general anesthesia (n=48)
Nausea/vomiting	7	8
Dizziness	0	1
Pruritus	1	0
Urinary retention	3	0
Sinus rhythm tachycardia	0	1

Table 3 shows pain scores in patients who underwent laparoscopic cholecystectomy. pain assessed by the visual analog scale was significantly less for the spinal anesthesia group at 4, 8, 12, and 24 hours postoperatively, including both relaxed and stressed conditions. Supplementary postoperative opioid analgesia was administered in only 1 of the 49 (2%) patients who received spinal anesthesia compared with 12 of the 48 (25%) patients who received general anesthesia (p=0.001, Fisher exact test). At 2 weeks' follow-up, the quality of life and patient satisfaction scores were similar in the 2 groups: patients who received spinal anesthesia had a median score of 19 (range, 4-26) compared with a median score of 20 (range, 6-26) for patients who received general anesthesia (p=0.2, Mann-Whitney U test). Overall, 96% of the spinal anesthesia group and 94% of the general anesthesia group were highly or fairly satisfied with the anesthetic procedure they had. No late complications were reported at week 4 through telephone contact in any of the patients.

Table 3: Pain scores in patients who underwent laparoscopic cholecystectomy.

Pain scores in patients who underwent laparoscopic cholecystectomy	Received spinal anesthesia (n=49)	Received general anesthesia (n=48)	P value
At 4 hours			
Resting	0 (0-4)	3 (0-8)	<0.001
Stress	2 (0-8)	5 (1-10)	<0.001
At 8 hours			
Resting	0 (0-6)	2 (0-7)	<0.001
Stress	2 (0-7)	5 (0-8)	<0.001
At 12 hours			
Resting	0 (0-2)	2 (0-7)	<0.001
Stress	1 (0-7)	4 (0-7)	<0.001
At 24 hours			
Resting	0 (0-4)	1 (0-6)	<0.001
Stress	1 (0-7)	2.5 (0-7)	<0.001

DISCUSSION

Our study's interim analysis not only confirmed the safety and feasibility of performing laparoscopic cholecystectomy under spinal anesthesia as the sole anesthetic procedure but also demonstrated the superiority of spinal anesthesia in controlling postoperative pain compared to standard general anesthesia. Patients who underwent spinal anesthesia experienced significantly lower pain levels during their hospital stay, both at rest and during periods of stress, when compared to those who received general anesthesia. Furthermore, a significantly smaller proportion of patients receiving spinal anesthesia required supplementary opioids compared to those receiving general anesthesia. This difference can be attributed to several factors, including the avoidance of discomfort associated with endotracheal intubation, the presence of effective analgesia due to the injected anesthetic in the subarachnoid space, and the potential for minimal stress response associated with the minimally invasive nature of spinal anesthesia.

While pain following laparoscopic cholecystectomy is generally not a major concern, it has garnered attention in recent studies due to its impact on postoperative recovery. Various approaches have been explored to control postoperative pain, such as intraperitoneal instillation or aerolization of local anesthetic agents, administration of COX-2 inhibitors, epidural analgesia, and the use of steroids, with varying degrees of success reported in different studies. In our trial, we chose postoperative pain control as the primary endpoint based on the promising results from our pilot study, where exceptional pain control was quickly observed. The data from our current study strongly support the superiority of spinal anesthesia over general anesthesia in achieving effective postoperative pain control.[12,13]

During the intraoperative phase, a decrease in mean arterial blood pressure of more than 20% below the preanesthetic value was observed in the spinal anesthesia group, a known adverse effect that is easily managed with the administration of phenylephrine. Additionally, some patients in the spinal anesthesia group experienced mild shoulder pain or discomfort, a symptom attributed to diaphragmatic irritation caused by carbon dioxide pneumoperitoneum. However, the majority of patients did not require treatment for this symptom, and it did not result in a conversion from spinal anesthesia to another method. Our careful approach, including a lower cutoff pressure for pneumoperitoneum and minimal tilting of the operating table, helped minimize diaphragmatic irritation. Future use of intraperitoneal aerosolization with local anesthetic agents before pneumoperitoneum induction may further alleviate this minor drawback.[14]

We maintained a low-pressure pneumoperitoneum throughout the trial to minimize diaphragmatic irritation, which did not compromise the surgical space or view, allowing procedures to be completed without technical difficulties. The use of spinal anesthesia eliminated the need for abdominal wall muscle relaxants, often required during general anesthesia, as spinal anesthesia provides comprehensive sensory, motor, and sympathetic blockade at a higher level. Although we set a body mass index cutoff of 30 for obese patients to avoid technical issues, our anecdotal experience outside the trial suggests that carefully selected patients with higher body mass indexes could undergo laparoscopic cholecystectomy under regional anesthesia.[15]

Regarding the early postoperative course within the hospital, the only notable event observed in the spinal anesthesia group was urinary retention, a known complication of regional anesthesia with reported rates of up to 20% in some series. Among our patients, three individuals (6%) from the spinal anesthesia group developed postoperative urinary retention. Two patients required immediate catheterization, which did not affect their recovery or time of discharge. However, the third patient experienced a urinary tract infection after catheterization, necessitating antibiotics and an extended hospital stay. At the two-week follow-up, the majority of patients from both groups expressed satisfaction with the anesthetic approach and reported equally successful recovery.

CONCLUSION

In conclusion, our findings indicate that spinal anesthesia is not only more effective than standard general anesthesia in controlling postoperative pain during the hospital stay but also yields comparable recovery outcomes to general anesthesia after discharge. Based on these preliminary results, spinal anesthesia shows promise as a potential alternative and superior method for elective laparoscopic cholecystectomy in healthy patients, with further refinements potentially leading to its establishment as the new gold standard for anesthesia in this surgical procedure.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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