

Surgical Outcomes of Needlescopic Cholecystectomy Versus Laparoscopic Cholecystectomy- A Comparative Study in A Specialized Hospital in Bangladesh

Mamtaz Begum^{1*}, Mohammad Farid Hossain², Agatha Prianka Rozario³

1. Specialist,
General & Laparoscopy Surgery,
Evercare Hospital Dhaka.
2. Associate Prof. & Sr. Consultant,
General & Laparoscopy Surgery,
Evercare Hospital Dhaka.
3. Specialist,
General & Laparoscopy Surgery,
Evercare Hospital Dhaka.

Address for Correspondence :

Dr. Mst. Mamtaz Begum
Specialist,
General & Laparoscopy Surgery,
Evercare Hospital Dhaka.
mamtazmukta55@gmail.com

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ABSTRACT

Background: Needlescopic cholecystectomy (NSC) and laparoscopic cholecystectomy (LC) are both minimally invasive surgical techniques used for the removal of the gallbladder in patients with gallbladder disease, primarily gallstones. The comparison of surgical outcomes between needlescopic cholecystectomy (NSC) and laparoscopic cholecystectomy (LC) has been a subject of interest among surgeons and researchers.

Aim of the study: The aim of the study was to compare the surgical outcomes of needlescopic cholecystectomy versus laparoscopic cholecystectomy.

Methods: This was a prospective observational study conducted in the Department of General & Laparoscopy Surgery, Evercare Hospital, Dhaka-Bangladesh from December 2022 to October 2023. A total of 50 symptomatic cholelithiasis patients were randomly selected as the study population. The total 50 patients were equally divided into two groups, Group A underwent Needlescopic cholecystectomy, and Group B underwent laparoscopic cholecystectomy. Data analysis was performed using MS Office tools and SPSS version 23.0 program.

Results: In this study, intraoperative incidents were less frequent, with 28% in the Needlescopic group and 36% in the Laparoscopic group. Wound length in the epigastrium was significantly smaller in the Needlescopic group (3.9 mm vs. 13.1 mm in Laparoscopic). In the hypochondrium, Needlescopic patients had a 3.7 mm wound, while Laparoscopic patients had 7.9 mm. In the flank region, Needlescopic patients had a 4.2 mm wound, compared to 8.8 mm in Laparoscopic patients. According to a 10-grade VAS scale, satisfaction scores were 9.8 for Needlescopic and 9.6 for Laparoscopic cholecystectomy patients.

Conclusion: Needlescopic cholecystectomy has clear advantages over laparoscopic cholecystectomy, with fewer intraoperative incidents, reduced post-operative pain, and smaller wounds, resulting in less discomfort, minimal scarring, and a quicker recovery. Late postoperative complications are also less frequent, and patients tend to be slightly more satisfied with needlescopic cholecystectomy.

Keywords: Needlescopic cholecystectomy, Laparoscopic, Pain, Gallbladder, Gallstone.

INTRODUCTION

For over two decades, laparoscopic cholecystectomy has stood as the preferred treatment for symptomatic gallstones. This approach offers patients several advantages, including shorter hospital stays, reduced postoperative pain, and quicker recovery compared to open cholecystectomy^{1,2}. Traditionally, conventional laparoscopic cholecystectomy (CLC) has been performed using the 4-trocar technique, which involves trocars of various sizes (12, 5, 5, and 5 mm). However, there has been a growing trend in the

use of alternative techniques such as single-incision laparoscopic cholecystectomy (SILC), needlescopic cholecystectomy (NSC), and natural orifice transluminal endoscopic cholecystectomy (NOTEC). These approaches aim to minimize tissue trauma and achieve improved cosmetic results^{3,4}. Laparoscopic cholecystectomy (LC) was initially recognized as the gold-standard surgical procedure for gallstone disease in 1992. This distinction was primarily due to the numerous advantages it offered

through minimally invasive techniques⁵. Since then, there have been significant technological advancements in the field, with a growing focus on further reducing surgical trauma by decreasing the size of the instruments used. As part of these efforts, Gagner and Garcia-Ruiz introduced the term "needlescopic" to describe operations performed with laparoscopic instruments that have a diameter of up to 3 mm⁶. This definition has been adopted by other authors as well^{7,8}. In recent years, there has been a growing body of literature advocating for the feasibility of needlescopic surgery in a wide range of abdominal procedures. These procedures include appendectomies, adrenalectomies, splenectomies, gastric fundoplication, urologic procedures, and cholecystectomies^{9,10}. As laparoscopic techniques have continued to advance, cholecystectomies are now being performed with even smaller incisions and/or fewer ports, a practice often referred to as mini-laparoscopic cholecystectomy¹¹. Notably, needlescopic surgery represents a subcategory of mini-laparoscopic cholecystectomy. It involves using the standard four incisions/ports but utilizes instruments that are ≤ 3 mm in diameter, as opposed to the traditional 5-mm instruments¹². This approach aims to further reduce surgical trauma while maintaining the benefits of minimally invasive surgery. While certain observational studies have suggested that mini-laparoscopic procedures might extend the time needed to complete a cholecystectomy,¹³ there have been prospective clinical trials comparing conventional laparoscopic cholecystectomy (CLC) to single-incision laparoscopic cholecystectomy (SILC) or needlescopic cholecystectomy (NSC) to establish the feasibility and safety of these techniques.¹⁴ However, as of now, there have been no published prospective studies directly comparing SILC and NSC. The objective of this current study was to compare the surgical outcomes of needlescopic cholecystectomy versus laparoscopic cholecystectomy.

METHODOLOGY

This prospective observational study was conducted in the Department of General & Laparoscopy Surgery, Evercare Hospital, Dhaka, Bangladesh

from December 2022 to October 2023. The study comprised a total of 50 patients diagnosed with symptomatic cholelithiasis, and they were randomly assigned to two equal groups. Group A underwent needlescopic cholecystectomy, while group B underwent laparoscopic cholecystectomy. In strict adherence to ethical guidelines, we obtained informed and signed consent from all participants before initiating data collection. Our study also followed specific exclusion criteria, which encompassed patients with contraindications to pneumoperitoneum, such as chronic obstructive pulmonary disease (COPD), severe asthma, or severe cardiopulmonary insufficiency. We excluded pregnant females, individuals with a BMI exceeding 40 kg/m², patients with confirmed acute cholecystitis based on inflammatory markers and ultrasound, those with psychological disorders and cognitive impairments, as well as individuals with a history of upper abdominal surgeries. In addition to clinical assessments, we conducted a battery of routine laboratory tests before the surgical procedure. These tests covered a complete blood count, INR (International Normalized Ratio), liver function tests (GGT, Alkaline phosphatase, ALT, AST, Bilirubin total and direct), kidney function tests, and random blood sugar levels. Furthermore, we performed radiological assessments via ultrasound for all patients, documenting the results. We meticulously collected comprehensive data from all enrolled patients, including demographic information and clinical history. This encompassed details such as age, prior cholecystitis attacks, history of previous hospitalizations, and a thorough general and local examination. Specific examinations included assessing the body mass index (BMI), identifying any previous upper abdominal scars, checking for a palpable gall bladder (GB), and evaluating right upper quadrant pain and rigidity. Patient satisfaction was measured by 10-grade VAS (Visual Analogue Scale) scores¹⁵. Subsequent data analysis was conducted using MS Office tools to facilitate a comprehensive evaluation and interpretation of the collected information.

RESULTS

In this study, Group A had a mean age of 43.8±6.21 years, while Group B had a slightly higher mean age of 48.9±6.78 years. Gender distribution showed that Group A had 24% males and 76% females, whereas Group B had 28% males and 72% females. Both groups predominantly had individuals with symptomatic gallstones (96%), with a small percentage presenting gallbladder polyp (4%). The ASA (American Society of Anesthesiologists) score, varied between the groups. Group A had 76% with an ASA score of I, 20% with an ASA score of II, and 4% with an ASA score of III. In contrast, Group B had 64% with ASA score I, 28% with ASA score II, and 8% with ASA score III. (Shown in Table 1 and figure. 1)

Table 1: Baseline characteristics of participants. (N=50)

Characteristic	Group A (n=25)		Group B (n=25)	
	n	%	n	%
Age				
Mean age (Years)	43.8±6.21		48.9±6.78	
Gender				
Male	6	24.0%	7	28.0%
Female	19	76.0%	18	72.0%
Diagnosis				
Symptomatic gallstone	24	96.0%	24	96.0%
Gallbladder polyp	1	4.0%	1	4.0%
ASA score				
I	19	76.0%	16	64.0%
II	5	20.0%	7	28.0%
III	1	4.0%	2	8.0%
Body Mass Index (BMI)				
Mean in kg/m ²	25.6±2.4		25.1±2.2	

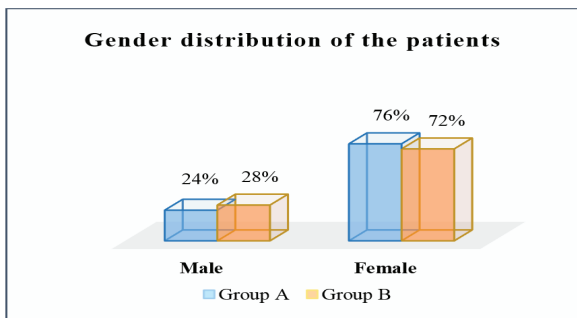


Figure 1: Column chart showed gender-wise patient distribution (N=50)

In both Group A and Group B, various intraoperative incidents were observed among the participants. In Group A, 12% experienced gallbladder pouch of the base of the liver (GPBL)

incidents, while 4% had cystic artery bleeding. Troublesome liver bleeding occurred in 8% of cases, and there was a 4% incidence of other intraoperative events. Conversely, Group B had 8% experiencing gallbladder pouch of the base of the liver (GPBL) incidents and 8% with gallbladder pouch of the common sheath (GPCS) incidents. Troublesome liver bleeding occurred in 12% of cases, and 8% experienced other intraoperative events. Overall, 28% of participants in Group A and 36% in Group B encountered intraoperative incidents during their procedures. (Shown in Table. 2)

Table 2: Intraoperative incidents among participants. (N=50)

Intraoperative event	Group A		Group B	
	n	%	n	%
GPBL	3	12.0%	2	8.0%
GPCS	0	0.0%	2	8.0%
Cystic artery bleeding	1	4.0%	0	0.0%
Troublesome liver bleeding	2	8.0%	3	12.0%
Other	1	4.0%	2	8.0%
Total	7	28.0%	9	36.0%

In Group A, 68% of participants did not require any post-operative analgesia, while 28% received a dosage of 1 to 5. Only 4% of participants in Group A required more than 5 doses of analgesia. In contrast, Group B had a lower percentage of participants (40%) who did not need any post-operative analgesia, and 41% required a dosage of 1 to 5. Additionally, 20% of participants in Group B needed more than 5 doses of analgesia. (Shown in Figure.2)

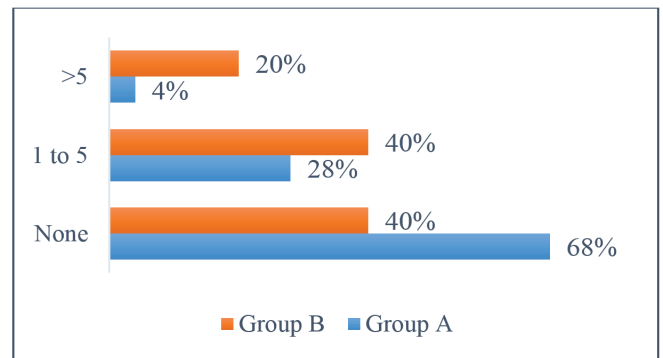


Figure 2: Bar chart showed post-operative analgesia usage (Dosage) wise patients' distribution. (N=50)

In the epigastrium, the mean wound length in Group A was 3.9 mm, while in Group B, it was 13.1 mm. In

the hypochondrium, Group A had a mean wound length of 3.7 mm, whereas Group B had a mean length of 7.9 mm. Finally, in the flank region, the mean wound length was 4.2 mm for Group A and 8.8 mm for Group B. (Shown in Figure. 3)

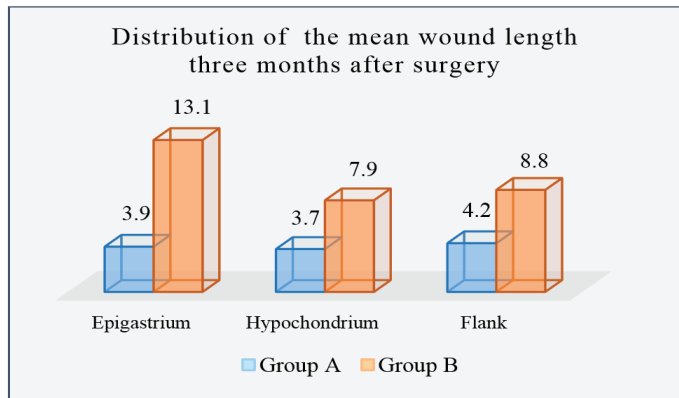


Figure 3: Column chart showed wound length-wise patients’ distribution after three months after surgery. (N=50)

In Group A, 16% of patients had late postoperative ailments, while 84% did not. In Group B, 20% of patients had late postoperative ailments, with 80% not experiencing them (Table 5). As per the 10-grade VAS scale score distribution, the satisfaction score was found 9.8 in Group A and 9.6 in Group B. (Figure. 4)

Table 5: Frequency of late postoperative ailments. (N=50)

Operative procedure	Present		Absent	
	n	%	n	%
Group A	4	16.0%	21	84.0%
Group B	5	20.0%	20	80.0%

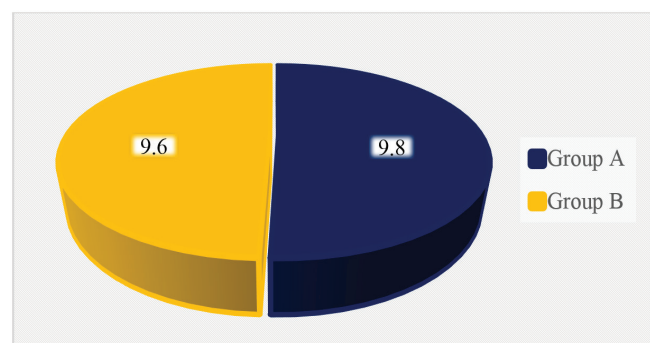


Figure 4: Pie chart showed the mean satisfaction score measured on a 10-grade VAS scale. (N=50)

DISCUSSION

This study aimed to compare the surgical outcomes of needlescopic cholecystectomy versus laparoscopic cholecystectomy. In this study, the mean age of participants in group A was 43.8±6.21 years, while in group B, it was 48.9±6.78 years. A similar study that examined similar procedures reported a mean age of 51.8 years among the participants¹⁶. It is noteworthy that both groups in our study were predominantly composed of female participants, with 76% in group A and 72% in group B. Symptomatic gallstones were equally prevalent in both groups, accounting for 96%. When assessing the grade of ASA score (American Society of Anesthesiologists) in group A, 76% were categorized as ASA I, 20% as ASA II, and 4% as ASA III. In contrast, in group B, 64% were classified as ASA I, 28% as ASA II, and 8% as ASA III. Regarding the Body Mass Index (BMI), the mean SD was 25.6±2.4 kg/m² in group A and 25.1±2.2 kg/m² in group B. These baseline characteristics of our study participants closely resemble those in another study,¹⁷ where the majority of patients were middle-aged women, with a mean age of 45.17 years in needlescopic cholecystectomy and 49.17 years in laparoscopic cholecystectomy. These similarities in baseline characteristics enhance the comparability of our study with existing research in the field. In Group A, a total of 7 intraoperative incidents were recorded, accounting for 28% of cases. These incidents included GPBL (gallbladder perforation with bile leakage) in 12% of cases, cystic artery bleeding in 4% of cases, troublesome liver bleeding in 8% of cases, and other incidents in 4% of cases. Conversely, in Group B, there were a total of 9 intraoperative incidents, which was slightly higher than that in Group A, representing 36% of cases. These incidents included GPCS (gallbladder perforation with calculi spillage) in 8% of cases, troublesome liver bleeding in 12% of cases, and other incidents in 8% of cases. Notably, the present study aligns with others in the literature, as it found that intraoperative incidents were not more frequent during needlescopic procedures¹⁸. In this study, postoperative analgesia was needed for varying durations in both groups: 4% of cases in Group A and 20% in Group B required it for more than 5 days,

while 28% in Group A and 40% in Group B needed it for 1 to 5 days. The mean wound length three months post-surgery in different areas showed varying results between the two groups. In Group A, the epigastrium, hypochondrium, and flank had wound lengths of 3.9mm, 3.7mm, and 4.2mm, respectively. Conversely, in Group B, these areas had larger wound lengths, measuring 13.1mm, 7.9mm, and 8.8mm, respectively. These findings align with previous studies,^{19,20} which also assessed wound length shortly after surgery. In our study, using a 10-grade VAS scale to assess satisfaction, Group A had a satisfaction score of 9.8, while Group B had a score of 9.6. Regarding the aesthetic outcome, non-convertible cholecystectomy (NC) was found to be superior to laparoscopic cholecystectomy (LC), consistent with findings from other studies^{21,22}. However, despite this significant advantage in aesthetics, LC patients were equally satisfied with the surgical results as those in the NC group.

CONCLUSION

Needlescopic cholecystectomy emerges as the procedure with notable advantages over laparoscopic cholecystectomy. Firstly, it demonstrates a lower occurrence of intraoperative incidents, encompassing GPBL incidents, cystic artery bleeding, and troublesome liver bleeding, all occurring less frequently. Secondly, needlescopic cholecystectomy leads to a higher proportion of patients not requiring postoperative analgesia, with fewer patients needing multiple doses of analgesia. Additionally, the procedure results in smaller wound lengths across various regions, implying potential benefits such as reduced post-operative discomfort, minimized scarring, and a faster recovery process. Furthermore, late postoperative complications are less prevalent in the needlescopic cholecystectomy group. Finally, patient satisfaction is slightly higher with needlescopic cholecystectomy.

LIMITATION OF THE STUDY

Several limitations must be considered when interpreting this study's findings. Firstly, it was conducted at a single center, limiting generalizability. Small sample sizes compound this

issue, possibly not fully representing the broader population. The relatively short study duration may affect comprehensive assessment and missing long-term outcomes. Thus, caution is needed when applying these findings broadly, and further research with larger, diverse samples and longer follow-up is necessary to confirm and extend these initial results.

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