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The Feasibility of Three-port Technique in Laparoscopic Cholecystectomy

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Abstract

Background: *Nowadays, laparoscopic cholecystectomy is the gold standard treatment for symptomatic gall stone diseases. Traditionally, laparoscopic cholecystectomy has been performed through four ports. According to the literature, three-port technique is technically feasible, safe, and cost advantages over the four-port technique. However, three-port technique should not be used at the expense of safe dissection of Calot's triangle.* ***Objective:*** *The main aim of this study is to evaluate the feasibility of three-port technique without affecting patient safety in laparoscopic cholecystectomy.* ***Methods:*** *This is the hospital based interventional prospective descriptive study. All patients who underwent laparoscopic cholecystectomy at No (2) Military Hospital (500-Bedded) during October 2023 to April 2024 were included. The same surgeon performed all operations. The demographic data, intraoperative and postoperative outcomes such as bleeding, visceral injury, bile spillage, requirement of added port, conversion to open surgery, operating time, postoperative complications and postoperative pain were determined. Results and discussion: This study included 66 patients. The mean age of patients was 54.7 years. The number of patients required added port was 4 out of 66. One patient needed conversion to open surgery. The success rate of the present study was 92.4 percent. The mean operative time was 62.4 minutes. Intraoperative and postoperative outcomes were illustrated in tables. Most of the patients, 97 percent, encountered mild postoperative pain.* ***Conclusion:*** *Three-port technique is feasible without additional event to patient safety. It is also cost effective, as it needs fewer assistants and instruments. Therefore, laparoscopic cholecystectomy should be initially attempted with three ports. However, the surgeons need to have low thresholds for adding four ports if necessary.*

Keywords: *bile spillage, gall stone, laparoscopic cholecystectomy, three-port technique.*

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1. Introduction

Prof. Dr. Erich Mühe from Germany performed the first laparoscopic cholecystectomy (LC) in year 1985 (Reynolds Jr, W. 2001). Nowadays, LC is the gold standard treatment for gall stone diseases (Tazuma, S., et.al 2017). Traditionally, four-port technique is the standard procedure for LC (Bittner, R. 2004). Several studies have consistently shown that the reduction in either the number or the size of the port is associated with reduced recruitment of pain medications. These techniques also have disadvantages such as lack of adequate exposure (Hauters, P., et.al 2013). According to the literature, three-port technique is technically feasible, safe, and cost advantages over the four-port technique (Chalkoo, M., et.al 2010).

In the three-port technique, the lateral-most port used for retracting the gallbladder fundus over the surface of the liver is absent (Figure -1). Instead, the gallbladder infundibulum is held via the right upper quadrant port (mid-clavicular line), and that is used to facilitate critical view of safety at the Calot's triangle. The rationale behind the three-port technique is that good views of Calot's triangle may still be gained without fundal retraction. With one less stab incision and port, tissue trauma is reduced, which may lead to less pain and inflammation. Several early studies demonstrated that the three-port technique was feasible and had comparable outcomes to the four-port technique (Nip, L., et.al 2022).

However, three-port technique should not be used at the expense of safe dissection of Calot's triangle. The aim of this study is to study the feasibility of three-port technique in LC at No.(2) Military Hospital (500-Bedded), Yangon, Myanmar.

2. Material and Methods

This is the hospital based interventional prospective descriptive study. The study was commenced after approval from ethical review board of Defense Services Medical Academy. All patients who underwent LC at No (2) Military Hospital (500-Bedded) during October 2023 to April 2024 was included. The demographic data of patients who underwent LC with three-port technique were identified. The same general surgeon performed all operations with the assistance of one junior surgeon and one nurse. All patients were operated upon in the supine with reverse Trendelenburg position and slight turn to the left side of patient. The first port was 10-mm sub umbilical using the open (Hassan's) technique. After that, pneumoperitoneum was created by maintaining a maximum pressure of 12 mmHg and a flow rate of 8 L/min. A camera head with a 30-degree telescope was introduced in the peritoneal cavity, and diagnostic laparoscopy was performed. A 10-mm subxiphoid port and a 5-mm subcostal port were placed under vision. The gallbladder was retracted using long 5-mm grasping forceps through the subcostal port. The Calot's triangle was dissected using Maryland forceps. The cystic duct and cystic artery were identified, and, critical view of safety was established (Figure-2). Then, these structures were clipped using a 10-mm clip applicator and divided. The gallbladder was dissected off the liver using a hook and monopolar cautery. Retrieval of gallbladder was performed via the umbilical port. All ports were removed under vision, and the pneumoperitoneum was deflated. The rectus sheath of the umbilical port was closed with Silks 0 suture, and the skin was approximated using Silks 3-0 suture. The prophylactic antibiotics and postoperative analgesia were given according to the standard hospital guidelines. The intraoperative and postoperative outcomes such as bleeding, visceral injury, bile spillage, requirement of added port, conversion to open surgery, operating time, postoperative complications and postoperative pain were determined. These data were collected in proforma and inserted into the Microsoft excel sheets. Finally, the data was analyzed using SPSS software.

3. Results

Collectively, this study included 66 patients. Out of these, 27 men and 39 were women. Table (1) illustrated the demographic data of patients. The mean age of patients was 54.7 years. Among sixty-six, 63 patients underwent elective surgery and remaining three underwent emergency operation. The 47 patients had multiple gallstones and 19 had single stone only. Three patients with single stone had gallbladder polyp also.

The indications for LC in this study group were acute cholecystitis (10.6 %), chronic cholecystitis (80.3 %), empyema gallbladder (4.5 %) and asymptomatic gall stone disease (4.5 %), as shown in Table (2). Table (3) showed the intraoperative outcomes. Overall, mean operative time was 62.4 minutes. The number of patient required added port was 4 out of 66. Intraoperative bleeding occurred in four patients and 37 patients encountered intraoperative bile spillage. Most of the bile leakages occurred during the retrieval of gall bladder. One patient (1.5 %) needed conversion to open LC.

Postoperative outcomes were illustrated in Table (4). Overall, none of the study group needed redo operation but one patient had postoperative bile leakage that was treated with percutaneous drain. Among 66 patients, 64 patients experienced mild pain and two had moderate pain.

3.1 Tables and Figures

Table (1) Demographic data of patient

Demographic data		No. of patients	%
Sex	Male	27	40.9
	Female	39	59.1
Urgency	Elective	63	95.5
	Emergency	3	4.5
Number of gall stone	Single	19	28.8
	Multiple	47	71.2
Gall bladder polyp		3	4.5
Gall bladder wall thickness	Normal	49	74.2
	Thickened/oedematous	17	25.8
Adhesions	Yes	31	47.0
	No	35	53.0
Mean age (Mean SD) (year)	54.7 (+/- 11.07)		

Table (2) Indication for LC

Indication	No. of patients	%
Acute cholecystitis	7	10.6

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Chronic cholecystitis	53	80.3
Asymptomatic gall stone	3	4.5
Empyema gall bladder	3	4.5
Total	66	100

Table (3) Intraoperative outcomes

Intraoperative outcomes		**No.**	**%**
Bleeding	Yes	4	6.1
	No	62	93.9
Injury	Yes	0	0
	No	66	100
Bile spillage	Yes	37	56.1
	No	29	43.9
Added port required	Yes	4	6.1
	No	61	92.4
Conversion to open cholecystectomy	Yes	1	1.5
	No	65	98.5
Operative time (minute) (Mean SD)	62.4 (+/- 20.5)		

Table (4) Postoperative outcomes

Postoperative outcomes		**No. of patients**	**%**
SSI	Yes	0	0
	No	66	100
Bile leakage	Yes	1	1.5
	No	65	98.5
Redo operation	Yes	0	0
	No	66	100
Postoperative pain	Mild	64	97.0
	Moderate	2	3.0
	Severe	0	0

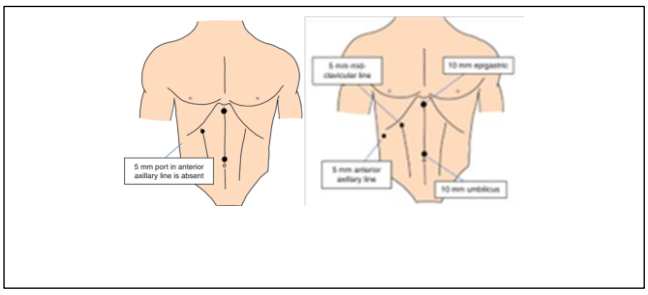

Figure (1) Port placement in three-port and four-port technique (Nip, L., et.al 2022)

Figure (2) Critical view of safety in three-port LC

1. Discussion

Nowadays, the gold standard operation for gall stone diseases is laparoscopic cholecystectomy and which is the most commonly performed laparoscopic procedure. Many researches modified to reduce the size and number of laparoscopic ports in laparoscopic cholecystectomy. Conventionally used four port technique for laparoscopic cholecystectomy provides better anatomic views. However, there are multiple studies which report that three- port technique is comparable to conventional four-port technique (Chatterjee, A., et.al 2024).

In the present study, the success rate of three port laparoscopic cholecystectomy was 92.4%, and only one patient with empyema gall bladder needed open laparotomy due to dense adhesion. Four of 66 patients needed additional four-port. The success rate is comparable to other comparative studies. The rate of conversion in this study is 1.5% and which is comparable to other studies (Chatterjee, A., et.al 2024; Mayir, B., et.al 2014; Sharma, P. K., et.al 2015; Mohamed, A. A. E. A., & Zaazou, M. M. 2020). In the report of Krishnanard D, et al, the conversion rate is up to 7.4% of patients (Krishnanand, D., et.al 2022).

Among 66 patients, 6.2% needed additional fourth port because of adhesions and bleeding from cystic artery. In the other reports, similar result was obtained regarding the requirement of added port. The most common reason is adhesion that obscured the safety dissection of Calot's triangle similar to the present study (Chatterjee, A., et.al 2024; Mayir, B.,et.al 2014; Sharma, P. K., et.al 2015; Mohamed, A. A. E. A., & Zaazou, M. M. 2020; Krishnanand, D., et.al 2022; T Yuvaraj, K. S., et.al 2022; Zarbaliyev, E., et.al 2022).

The results of the present study regarding indications for surgery, number of stones, intra-operative and post-operative complications are similar to other studies. The present study included three patients who had gall bladder polyps. Three of 66 patients underwent emergency laparoscopic cholecystectomy for empyema gall bladder.

In the present study, mean operative time was 62.4 minutes and ranging from 30 minutes to 140 minutes. This study has longer operative time in comparative other reports of three port laparoscopic cholecystectomy (Irfan Ali, S., et.al 2017). As the researcher's insight, it may be due to the time spent for searching and clearing of spillage bile and stones. Present study has higher bile spillage rate in comparable to other reports. The researcher noticed that most of the bile spillage occurred during the extraction of gall bladder specimen from the umbilical port.

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In the present study, port reduction to three ports has been positive results without affecting patient safety. The post-operative complication occurred in one patient (1.5%) who had post-operative bile leakage that was successfully treated by percutaneous drainage insertion. There was no mortality in present study. A meta-analysis conducted by Nip. L et. al which included 18 trials with 2085 patients stated that there were no differences in adverse events between three-port and four-port techniques (Nip, L., et.al 2022).

In the researcher's study, all successful cases of three-port LC obtained critical view of safety at the Calot's triangle. To our insights, grasping of infundibulum of the gall bladder via the third port with surgeon's left hand and moving infundibulum upward and laterally can made the easier dissection of Calot's triangle. Furthermore, researchers use the small soft cotton gauze inserted from epigastrium port, for better visualization and blunt dissection in some cases.

In this prospective study, most of the patients 96.96% experienced mild pain only during 24 hours post-operative period. This result is similar to other reports. Some researchers stated decreased post-operative pain in three-port over four-port technique (Harsha, H. S., et.al 2013; Faraag, M. A. A. E. F., et.al 2023). In our study, only two patients had moderate pain, one had chronic empyema, detected intra-operatively and another patient needed to extend umbilical port incisions to remove lost large stone from peritoneal cavity.

After all, this prospective study has some limitations. It is a single center descriptive study and it represents the single surgeon's experiences. Nevertheless, this study highlights the feasibility and cost-effective benefits of three-port technique in LC. Conducting comparative studies with larger sample size will help to meet objective parameters.

2. Conclusion

In conclusion, three-port LC is feasible without additional event to patient safety. It is also cost effective as it can be performed with fewer assistants and instruments. Therefore, LC can be initially attempted with three ports. However, the surgeons should have low thresholds for conversion to four ports if necessary.

3. Conflict of interest

The author declares no conflict of interest.

4. Ethical approval

This study was ethically approved by ethical review committee of Defence Services Medical Academy, Yangon, Myanmar.

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