Comparative study between two-port and four-port laparoscopic cholecystectomy

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Background/aim
Laparoscopic cholecystectomy has become the standard of care for patients requiring removal of the gallbladder. Traditional laparoscopic cholecystectomy is performed using the four-port technique. The aim of this study was to compare two-port with four-port laparoscopic cholecystectomy and to determine whether there are extra benefits with two-port laparoscopic cholecystectomy.

Patients and methods
Between March 2010 and March 2012, 70 adult patients with symptomatic cholelithiasis were enrolled into this study, which was carried out at New Dameitta University Hospital. They were randomly divided into two equal groups: group A underwent four-port laparoscopic cholecystectomy and group B underwent two-port laparoscopic cholecystectomy.

Results
The mean follow-up time was 13.18 months (range 6–23 months). The mean operative time was 36.285 min for group A and 39.142 min for group B. As regards group A, the severity of postoperative pain was mild in 11 patients (31.42%), moderate in 19 patients (54.28%), and severe in five patients (14.28%). As regards group B, the severity of postoperative pain was mild in 22 patients (62.85%), moderate in 12 patients (34.28%), and severe in one patient (2.85%). As regards cosmetic appearance and patient satisfaction for the scar, for group B they were excellent in 31 patients (88.57%) and good in four patients (11.42%); however, for group A they were excellent in 22 patients (62.85%) and good in 13 patients (37.14%).

Conclusion
In our study, we found that the use of two-port laparoscopic cholecystectomy did not affect the procedure's safety and conversion rate. Two-port laparoscopic cholecystectomy patients needed less analgesia and had a shorter hospital stay. Other advantages include fewer scars, more patient satisfaction, and cost effectiveness.

Keywords:
four port, laparoscopic cholecystectomy, two port

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Introduction

Laparoscopic cholecystectomy is considered the 'gold standard' for treatment of cholelithiasis. Short length of hospital stay, immediate regaining of physical activity, low prevalence of postoperative pain, morbidity and mortality, and good cosmetic outcomes contribute to the benefits of laparoscopic cholecystectomy [1].

The first laparoscopic cholecystectomy was performed in 1987 by Phillip Mouret and was later established by Dubois and Perissat in 1990 [2].

Since then, it has met with widespread acceptance as a standard procedure. Standard laparoscopic cholecystectomy is performed using four trocars. The fourth (lateral) trocar is used to grasp the fundus of the gallbladder so as to expose Calot's triangle. With increasing surgeon experience, laparoscopic cholecystectomy has undergone many refinements including reduction in port size. Two-port laparoscopic cholecystectomy has been reported in the international literature to be safe and feasible [2].

A report on two-port laparoscopic cholecystectomy showed that all patients would prefer this technique over the four-port approach, as the postoperative pain is significantly reduced, and the procedure is cosmetically more acceptable to the patients [3].

The aim of this study was to compare two-port with four-port laparoscopic cholecystectomy and to demonstrate whether there are extra benefits with two-port laparoscopic cholecystectomy.

Patients and methods

Between March 2010 and March 2012, 70 fit adult patients with chronic calcular cholecystitis were enrolled into this

study, which was carried out at New Dameitta University Hospital. Unfit patients who had an acute attack of cholecystitis, those with a past history of upper abdominal operations, and those who had contraindications for open cholecystectomy were excluded from the study.

The 70 patients with symptomatic cholelithiasis were randomly divided into two equal groups: patients of group A underwent four-port laparoscopic cholecystectomy and those of group B underwent two-port laparoscopic cholecystectomy. Randomization was done according to the order of admission. Routine investigations and cardiological assessments were carried out. Prophylactic intravenous antibiotics (1 g cefuroxime) were administered routinely at induction. Patients were operated in the supine head-up position and were tilted to the left side.

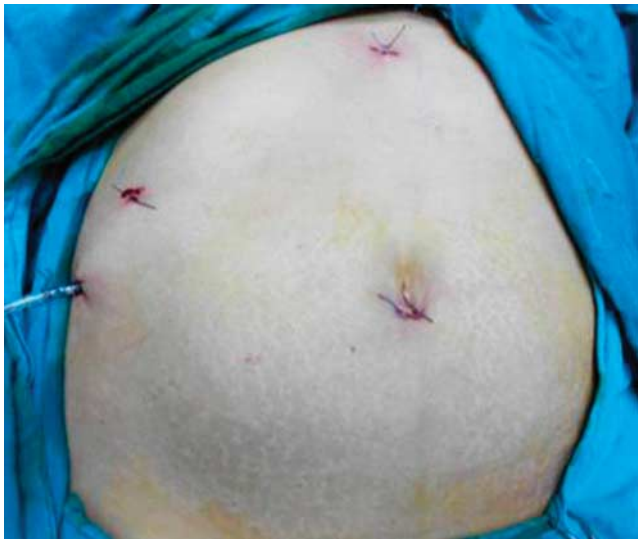
As regards operative details for group A, after insufflation of the abdomen with CO_2, four ports were inserted into peritoneal cavity: one 11 mm optical port above or below the umbilicus, one 11 mm operating port in the epigastria area, one 5 mm operating port in the right hypochondrium, and one 5 mm assistant port in the anterior axillary line (Fig. 1). The fundus of the gallbladder was grasped and flipped upward, followed by dissection of the cystic duct and artery. The cystic duct and artery were clipped and the gallbladder separated from the liver bed and extracted through the 11 mm epigastric operating port. When a drain was needed, it was introduced through the anterior axillary line port (Fig. 2).

As regards operative details for group B, after insufflation of the abdomen with CO_2, two ports were inserted into the peritoneal cavity: one 11 mm optical port above or below the umbilicus and another 11 mm operating port in the epigastric area. The gallbladder was manipulated through two strategically placed traction sutures: one was passed placed higher up in the right hypochondrium, just below the tip of the ninth costal cartilage, and passed through the fundus of the gallbladder; the other was placed in the right flank at a lower level to hold the neck of the gallbladder and was passed through Hartman's pouch (Fig. 3). Both sutures were kept free to adjust the level of traction during the different stages of the procedure (Fig. 4). Manipulation of the gallbladder with sutures to reveal Calot's triangle could only be performed by more experienced surgeons. The cystic duct and artery were dissected and clipped; the gallbladder was then separated from the liver bed and extracted through the 11 mm epigastric operating port. When a drain was needed, it was introduced through the epigastric port (Fig. 5).

Figure 1

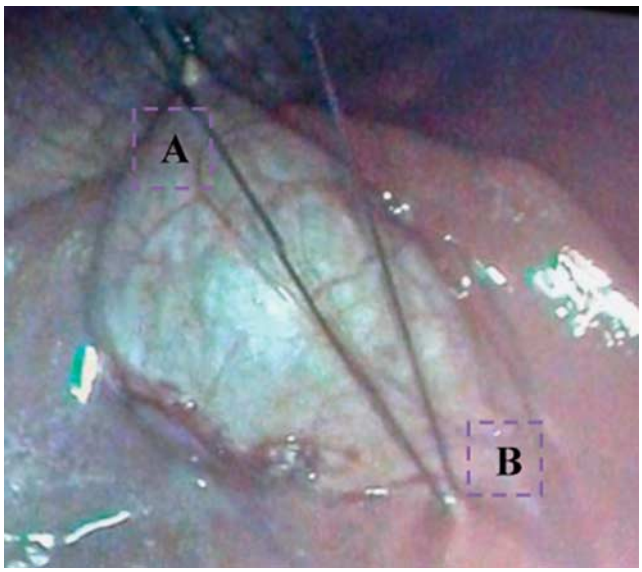
The sites of four-port laparoscopic cholecystectomy.

Figure 2



Postoperative appearance of four-port for laparoscopic cholecystectomy with drain.

Figure 3



Two traction sutures, passed through the fundus of the gallbladder (a) and Hartman's pouch (b).

Postoperative pain was measured using the visual analogue scale, which consists of a line, usually 100 mm long, whose ends are labeled as the extremes ('no pain' and 'pain as bad as it could be'). The patient is asked to put a mark on the line indicating his/her pain intensity [4].

The cosmetic appearance was assessed using the Hollander Wound Evaluation Scale [5], which addresses six clinical items: (i)step-off borders, (ii) contour irregularities, (iii) scar width, (iv) edge inversion, (v) excess inflammation, and (vi) overall cosmetic appearance. Each of these items was graded from 0–1; the optimal score was 6, and any score less than this was considered suboptimal.

Figure 4

The sites of two-port laparoscopic cholecystectomy with two strategically placed traction sutures.

Figure 5

Postoperative appearance of two-port laparoscopic cholecystectomy with drain.

Statistical analysis

The collected data were organized, tabulated, and statistically analyzed using statistical package for social science (SPSS, version 16; SPSS Inc., Chicago, Illinois, USA) running on an IBM-compatible computer with a Microsoft Windows 7 operating system. For quantitative data, the mean, SD, and minimum and maximum values were calculated. For comparison between the two groups, the independent sample Student's *t*-test was used. Qualitative data were expressed as frequency and percentage distribution. For comparison between both groups, the χ^2-test was used. For interpretation of results, a P value of less than 0.05 was considered significant.

Results

The mean follow-up time was 13.18 months (range 6–23 months). The mean patient age was 33.73 years (range 18–50 years). There were 49 female patients and 21 male patients.

The mean operative time was 36.285 min for group A and 39.142 min for group B. There was no statistically significant difference between the two study groups as regards the resumption of oral feeding ($\sim$12.2 h). The mean hospital stay was 2 days for group A and 1.714 days for group B.

As regards group A, the severity of postoperative pain was mild in 11 patients (31.42%), moderate in 19 patients (54.28%), and severe in five patients (14.28%). As regards group B, the severity of postoperative pain was mild in 22 patients (62.85%), moderate in 12 patients (34.28%), and severe in one patient (2.85%).

Conversion to open surgery was not done for any group. Moreover, port site hernia was not observed in both groups, and there were no deaths during the time of study.

As regards group B, cosmetic appearance and patient satisfaction for the scar were optimal (excellent) in 31 patients (88.57%) and suboptimal (good) in four patients (11.42%); however, as regards group A, they were excellent in 22 patients (62.85%) and good in 13 patients (37.14%). Table 1 shows patient characteristic and follow-up results. The two-port method appeared financially affordable on using disposable instruments.

Discussion

Laparoscopic cholecystectomy has become the standard of care for patients requiring removal of the gallbladder. In 1992, an NIH consensus development conference concluded that 'laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones and has become the treatment of choice for many patients' [6].

There have been a number of modifications in the technique of laparoscopic cholecystectomy. The use of the fourth trocar, which is generally used for gallbladder

Table 1 Patient characteristics and operative results

Variables	Group A (four-port)	Group B (two-port)	Total	Test	*P* value
Age					
Mean ± SD	33.65 ± 9.49	33.80 ± 10.26	33.72 ± 9.81	0.06	0.95 (NS)
Minimum–maximum	18–50	18–50	18–50		
Sex [*n* (%)]					
Male	10 (28.6)	11 (31.4)	21 (30.0)	0.07	0.79 (NS)
Female	25 (71.4)	24 (68.6)	49 (70.0)		
Follow-up (months)					
Mean ± SD	12.97 ± 4.68	13.40 ± 4.84	13.18 ± 4.73	0.37	0.70 (NS)
Minimum–maximum	6–23	6–23	6–23		
Operative time (min)					
Mean ± SD	36.28 ± 9.80	39.14 ± 11.78	37.71 ± 10.85	1.1	0.27 (NS)
Minimum–maximum	20–55	20–60	20–60		
Oral feeding (h)					
Mean ± SD	12.11 ± 4.67	12.40 ± 5.01	12.25 ± 4.81	0.24	0.80 (NS)
Minimum–maximum	6–24	5–24	5–24		
Hospital stay (days)					
Mean ± SD	2.0 ± 0.60	1.71 ± 0.54	1.85 ± 0.59	2.07	0.042*
Minimum–maximum	1–3	1–3	1–3		
Postoperative pain [*n* (%)]					
Mild	11 (31.4)	22 (62.9)	33 (47.1)	7.91	0.019*
Moderate	19 (54.3)	12 (34.3)	31 (44.3)		
Severe	5 (14.3)	1 (2.9)	6 (8.6)		

*Significant.

fundus retraction, in the American technique was deemed unnecessary by some surgeons, whereas others used sutures to retract the gallbladder [7].

The use of miniaturized instruments has been associated with less postoperative pain and better cosmesis compared with conventional four-port laparoscopic cholecystectomy [8].

Traditional laparoscopic cholecystectomy is performed using the four-port technique. Reducing the size or number of ports did not affect the safety of the procedure but further enhanced the advantages of laparoscopic cholecystectomy over open cholecystectomy. These modifications actually reduced the pain and analgesia requirement [9].

Two-port laparoscopic cholecystectomy has demonstrated a higher patient satisfaction score [10]. A randomized study evaluating postoperative pain in patients undergoing three-port versus four-port cholecystectomy reported less analgesia use in the fewer ports group [2].

In one Hong Kong-based study, 120 patients candidate for cholecystectomy were admitted and randomized to remove stitches of two-port or four-port laparoscopic cholecystectomy. The patients were not informed about the type of operation to be performed. Four surgical dressings were placed on four port sites in both groups, and the operative dressings were not opened until 1 week. Patients in the two-port group had a shorter operation time (54 vs. 66 min) and lesser pain at the hypochondrial site. However, the duration of hospital stay was similar in both groups [10].

Reduced port and single incision approaches to access the abdominal cavity should follow the accepted standards for safe entry, including avoidance and recognition of complications. Adequate training should be obtained on any new device or instrument before its utilization on a patient. As with any new technique, the outcomes should be continuously assessed to ensure continued patient safety [11].

While dissecting during fewer port number and smaller size procedures, the 'best practice' approaches recommended for multiport cholecystectomy, including dynamic traction of the fundus of the gallbladder, dynamic lateral retraction of the gallbladder infundibulum, and identification and maintenance of the 'critical view' of the cystic duct and artery to avoid inadvertent injury to the common bile duct or hepatic arteries, should be followed [12].

Conclusion

In our study, we found that the use of two-port laparoscopic cholecystectomy did not affect the procedure's safety and conversion rate. Although two-port laparoscopic cholecystectomy needed more operative time and more experience to be performed, it has advantages over traditional four-port laparoscopic cholecystectomy in that the patients needed less analgesia and had a shorter hospital stay. The other advantages include fewer scars, more patient satisfaction, and cost effectiveness.

Two-port laparoscopic cholecystectomy can be a good alternative in the field of minimally invasive laparoscopic cholecystectomy. We recommend this technique be practiced only by surgeons experienced in laparoscopic techniques.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

1 Sari YS, Tunali V, Tomaoglu K, Karagöz B, Güneyi A, Karagöz I. Can bile duct injuries be prevented? 'A new technique in laparoscopic cholecystectomy'. BMC Surg 2005; 5:14.

2 Dubois F, Icard P, Berthelot G, Levard H. Coelioscopic cholecystectomy. Preliminary report of 36 cases. Ann Surg 1990; 211:60–62.

3 Leung KF, Lee KW, Cheung TY, Leung LC, Lau KW. Laparoscopic cholecystectomy: two-port technique. Endoscopy 1996; 28:505–507.

4 Bombardier C. Glossary of terms. Spine 2000; 25:3100–3202.

5 Ong CCP, Jacobsen AS, Joseph VT. Comparing wound closure using tissue glue versus subcuticular suture for pediatric surgical incisions: a prospective, randomised trial. Pediatr Surg Int 2002; 18 **(5–6):** 553–555.

6 [No author names available]. NIH releases consensus statement on gallstones, bile duct stones and laparoscopic cholecystectomy. Am Fam Physician 1992; 46:L1571–L1574.

7 Osborne D, Boe B, Rosemurgy AS, Zervos EE. Twenty-millimeter laparoscopic cholecystectomy: fewer ports results in less pain, shorter hospitalization, and faster recovery. Am Surg 2005; 71:298–302.

8 Bisgaard T, Klarskov B, Trap R, Kehlet H, Rosenberg J. Microlaparoscopic vs conventional laparoscopic cholecystectomy: a prospective randomized double-blind trial. Surg Endosc 2002; 16:458–464.

9 Dilawaiz MM, Fakhar H, Osman R, Muhammad S, Riaz H. Three ports versus four ports laparoscopic cholecystectomy. Annals of Punjab Medical College 2011; 5:80–84.

10 Poon C-M, Chan K-W, Ko C-W, Chan K-C, Lee DWH, Cheung H-Y, Lee K-W. Two-port laparoscopic cholecystectomy: initial results of a modified technique. J Laparoendosc Adv Surg Tech A 2002; 12:259–262.

11 Hodgett SE, Hernandez JM, Morton CA, Ross SB, Albrink M, Rosemurgy AS. Laparoendoscopic single site (LESS) cholecystectomy. J Gastrointest Surg 2009; 13:188–192.

12 Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). *Guidelines for the clinical application of laparoscopic biliary duct surgery*. Philadelphia: SAGES; 2010. pp. 1–37.