Three port laparoscopic cholecystectomy with or without a marionette sling: A randomized controlled trial

Original Article

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ABSTRACT

Objectives: To compare between the three-port cholecystectomy versus adding a marionette sling to the three-port cholecystectomy.

Patients and Methods: We operated on 52 patients through a three-port (group T) cholecystectomy and operated on another 52 patients through a three-port plus a marionette sling inserted percutaneously through the gallbladder fundus (group M).

Results: All the preoperative demographic data for patients of both groups were comparable. In group T, operative duration was 46±12 min versus 47±11 min for group M (nonsignificant differences). The rate of conversion to four-port technique was (9.6%) in group T versus (1.9%) in group M (a statistically significant difference). Bile leakage occurred in only one (1.9%) patient in group T versus seven (13.5%) patients in group M (a statistically significant difference). Patients of group T were discharged within 15±2 h of the operation while patients of group M were discharged within 15±3 h. (a statistically nonsignificant difference). In group T, the amount of fluid discharged in patient's drain was about 100±20 ml while in group M patient's drain discharged about 150±50 ml of fluids per patient (a statistically significant difference). The incidence of SSI (Surgical Site Infection) in group T was 5.8% (3/52 patients) but in group M the incidence of SSI was much higher than that (17.3%, 9/52 patients). Infections were mainly at the third port (drain site).

Conclusion: Adding an extra marionette sling to the three-port cholecystectomy decreased the rate of conversion to four-port cholecystectomy but it was associated with an increased incidence of superficial SSI.

Key Words: Laparoscopic cholecystectomy, marionette sling, three port.

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INTRODUCTION

One of the challenges that faced the evolution of laparoscopic surgery is to become even less invasive. Laparoscopic cholecystectomy (LC) has been performed commonly with four ports which is a simple, efficient and at low cost[1]. Reduction of pain and duration of hospital stay postoperatively has been attempted through reduction in the size and number of ports[2].

Other less invasive ways have been described. Mini laparoscopy is the same as conventional LC but uses a much smaller diameter trocar with thinner instruments. But this increased the technical difficulties, the risk of complications and also increased the costs[3].

With increased experience, it was noted that the trocar that inserted in the right subcostal area was used only to retract the fundus of the gallbladder to achieve a clear exposure of Calot's triangle. Therefore, we can replace this trocar used for simple retraction with a suture inserted through the abdominal wall[4]. So reducing the number of ports from four to three is the most practical option[2,5–8]. However, McMahon[9] and Ng[10] warned that the three-port LC without proper retraction of the gallbladder may increase the incidence of common bile duct injuries[11].

Aim

To compare LC through three-ports versus the same technique plus insertion of a marionette sling to the fundus (±body) of the gallbladder.

PATIENTS AND METHODS:

This was a prospective randomized trial conducted at Qena University Hospital, Qena Faculty of Medicine, South Valley University, Egypt. Patients are randomly assigned into two groups by the by the closed envelope method. The study was approved by the local institutional ethical committee. We recruited 104 patients with symptomatic cholecystolithiasis or gallbladder polyp (s) who underwent

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LC; 52 patients of them were operated on by the three-port technique (group T) and the other 52 patients were operated on by the three-port technique with the addition of a marionette sling (group M). The inclusion criteria were patients aged between 18 to 60 years, ASA grade I, II, or III, and signing of an informed written consent. Exclusion criteria were patients with any contraindication to laparoscopy, suspected Mirizzi syndrome, previous upper abdominal surgery, long-term anticoagulant treatment, and history of cholangitis.

The main points of comparison: the technical feasibility and operative safety (operative time 'time from incision until closure of the wound', incidence of conversion to classic four-port technique or conversion to open surgery, intraoperative complications), and duration of hospital stay (patients were discharged home when they can tolerate oral fluids and made ambulant), postpostoperative complication rates within first 30 days postoperative period. Patients were followed-up weakly for 3 months after the operation.

Operative technique

For group T patients procedures were performed under general anesthesia in the supine position. Both the operating surgeon and the camera man stood to the left of the patient, while the assistant stood to the right of the patient. A 12 mm umbilical port, a 12 mm subxyphoid port, and a 5 mm right flank port were used. Pneumoperitoneum was established with an open Hasson's technique. We used 30° (Karl Storz, Germany) that was inserted into the umbilical port. A long grasping forceps inserted through the 5 mm port was used for retraction of the gallbladder, so dissection was accomplished through the 12 mm subxyphoid port. The cystic duct and cystic artery were clipped by a manual clip applicator. The position of the operating telescope was changed to the epigastric port and the gallbladder was retrieved through the umbilical port (Fig. 1).

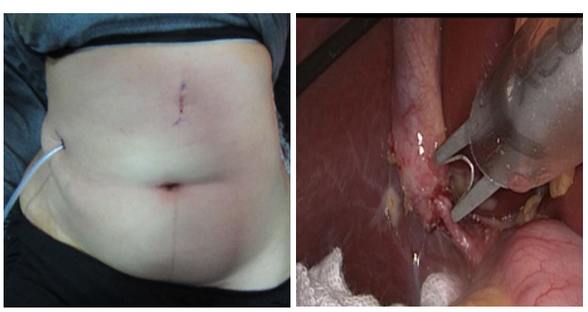

Fig. 1: Three-port cholecystectomy.

For group M patients an additional marionette sling was used to elevate the fundus (±body) to facilitate exposure of the Calot's triangle. The marionette suture was passed through the abdominal wall from outside to inside, passing the gallbladder (fundus±body), and then returned from inside to outside using a laparoscopic needle holder. This suture (1 Vicryl) was passed in the right subcostal region, halfway between the midclavicular and anterior axillary line to be stitched to the gallbladder. Then the procedure was completed in the same way (Fig. 2).

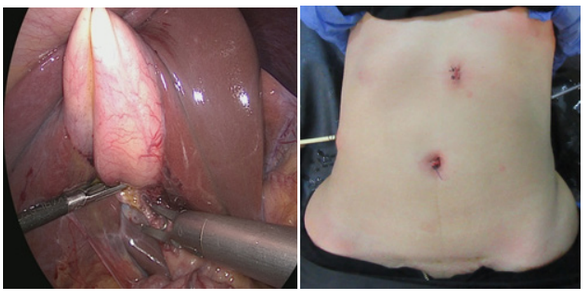

Fig. 2: Marionette Cholecystectomy.

Statistical analysis

Data were collected, tabulated, and analyzed by SPSS version 20 (Statistical Package for Social Sciences, PSS, Inc., Chicago, Illinois, USA). Quantitative variables are presented as the mean and SD and were compared using Student's t test. Qualitative variables will be described using frequency and percentages (n (%)) and compared using the χ^2 test for parametric variables and the Mann–Whitney U test for nonparametric variables. The significance level was set to 0.05.

RESULTS:

All the preoperative demographic data of the patients was listed in (Tab 1). In this study we categorized 104 patients into two groups: group T which included 52 patients [39 (75%) female and 13 (25%) males] and group M which included 52 patients [40 (76.9%) female and 12 (23.1%) males]. The age range for group T was 38.2±12.6 years while for group M it was 37.6±11.6 years. BMI was 28.3±3.2 and 29.1±3.1, respectively. The preoperative ultrasound (US) finding showed: group M showed gall stone (s) in 50 (96.1%) out of 52 patients and showed gallbladder polyp (s) in the other two (3.9%) patients, But group M patients showed gallstone (s) in 51 (98.1%) out of 52 patients while the last patient showed gallbladder polyp (s) (1.9%). Fifty (96.1%) patients out of 52 in each group presented with chronic manifestations while the last two (3.9%) patients presented with acute manifestations (Table 1).

Table 1: Preoperative demographic date of the patients

	Group T 52 patients	Group M 52 patients	*P* value
Age (year)	38.2±12.6	37.6±11.6	NS
Sex (*n*, %)			
F	39 (75)	40 (76.9)	NS
M	13 (25)	12 (23.1)	NS

BMI	28.3±3.2	29.1±3.1	NS
US Findings (*n*, %)			
Stone (s)	50 (96.1)	51 (98.1)	NS
Polyp (s)	2 (3.9)	1 (1.9)	NS
Symptoms			
Chronic	50 (96.1)	50 (96.1)	NS
Acute	2 (3.9)	2 (3.9)	NS

Operative and postoperative data were collected in (Table 2).

For patients of group T, we recorded an operative duration of 46±12 min while the operative duration of group M was 47±11 min (nonsignificant differences). In group T there were five (9.6%) patients were converted into the classic four-port technique but in group M only one (1.9%) patient was converted into four-port technique (a statistically significant difference). The conversion was due to lack of clear visualization of the Calot's triangle structures. None of the patients in both groups were converted into open surgery.

As regards intraoperative events: there was bile leakage in only one (1.9%) patient in group T (from gallbladder itself during its dissection), while there was bile leak in seven (13.5%) patients in group M (a statistically significant difference). This leak arose from punctures of the gallbladder by the marionette stitches, gallbladder bed, or from an improperly clipped cystic duct which was reclipped by a larger one.

There were no major biliary nor vascular injuries among both groups.

Patients of group T were discharged within 20±2 h of the operation while patients of group M were discharged within 20±3 h. (a statistically non-significant difference).

In group T, the amount of fluid discharged in patient's drain was about 100±20 ml while in group M patient's drain discharged about 150±50 ml of fluids per patient (a statistically significant difference).

The incidence of superficial SSI (without deep extension to the operative bed as confirmed by Abdominal US) in group T was 5.8% (3/52 patients) but in group M the incidence of superficial SSI was much higher than that (17.3%, 9/52 patients). Infections were mainly at the third port (drain site). SSI was in the form of purulent discharge (even with the absence of bacterial culture). It responded well to repeated dressings and ABs.

Table 2: Operative and postoperative date of the patients

	Group T 52 patients	Group M 52 patients	*P* value
Operative duration (min)	46±12	47±11	NS
Conversion to (*n*, %)			
4-Port	5 (9.6)	1 (1.9)	S
Open surgery	0	0	NS
Intra-operative Events (*n*, %):			
Bile Leakage	1 (1.9)	7 (13.5)	S
Bleeding	1 (1.9)	1 (1.9)	NS
Major duct or vessel injury	0	0	NS
Postoperative hospital stay (h)	20±2	20±3	NS
Amount of Drained Fluid (ml)	100±20	150±50	S
SSI	3 (5.8)	9 (17.3)	S

DISCUSSION

In early 1990, Slim and colleagues documented their initial results with the three-port LC with promising results. They omitted the fourth port for the grasper used to retract the dome of the gallbladder. The three-port LC might be difficult in certain situations as a very thick gallbladder wall, gallbladder filled with calculi, a stone impacted at Hartman's pouch, and marked adhesions at Calot's triangle[12]. The increased risk of CBD (Common Bile Duct), damage with the three-trocar technique suggested by many studies minimized the feasibility and the safety of this laparoscopic procedure[9,10,13]. So, in this trial we added an additional marionette sling aiming to get better results.

The 104 patients in our study were grouped randomly into two equal groups, each one including 52 patients. In group T patients were operated on by the three-port technique while group M patients were operated on by the same three-port technique with addition of a percutaneous stitch at the right hypochondrium to suspend the fundus of the gallbladder.

The preoperative demographic data including age, sex, BMI, preoperative presentation, and US findings of both groups showed no statistically significant differences.

The operative duration of both techniques showed no statistically significant difference (46±12 min vs. 47±11 min for groups T and M, respectively).

There were 5/52 (9.6%) cases converted to the classic four-port technique in group T which is higher than that recorded for group M which showed a single case out of 52 case (1.9%). Endo and colleagues showed an 8% conversion to four-port 'instead of three-port + sling suture' among his patients. This conversion was due to of severe inflammation 'acute cholecystitis' or to control bleeding[4].

So, the addition of a marionette sling markedly reduced the rate of conversion into four ports.

None of our cases were converted to open surgery.

Patients operated by the classic three-port method showed no major intraoperative accidents such as vascular or biliary injury. This was contrary to what had occurred in patients operated with the addition of a sling. They showed intraoperative bile leakage in 13.5% of patients, mostly due to the gallbladder puncture. Endo and colleagues stated that bile leakage into the peritoneal cavity during the operation was little, with no postoperative peritonitis[4].

Powell and Siriwardena documented that manipulation of the suture needle within the gallbladder had increased the risk of damaging portal structures, and may lead to tearing of gallbladder wall with consequent spillage of bile[14].

Tien and colleagues in 2019 reported that taking the serosa of the gallbladder rather than the complete walls can avoid bile leakage from the gallbladder lumen during manipulation. Also, they got a better exposure of dissection for completion of the fundus-first cholecystectomy[15].

Puncture of the gallbladder wall by the marionette stitch causes a larger amount of fluids to be drained through the drain. This did not affect the duration of postoperative hospital stay but it was significantly associated with a higher incidence of superficial SSI among the M group patients.

Limitations of this study includes: The small sample size of this study, a too thickened gallbladder wall and the possible bile spillage during placement of suture. This is important if gallbladder carcinoma is incidentally discovered during cholecystectomy[16].

CONCLUSION

Adding an extra marionette sling to the 3-port cholecystectomy decreased the rate of conversion to 4-port cholecystectomy but it was associated with an increased incidence of superficial SSI.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Abaid RA, Cecconello I, Zilberstein B. Simplified laparoscopic cholecystectomy with two incisions. ABCD Arquivos Brasileiros de Cirurgia Digestiva (São Paulo) 2014; 27:154–6.

2. Mohamed AAE-A, Zaazou MM. Three-port versus conventional four-port laparoscopic cholecystectomy: a comparative study. Egypt J Surg 2020; 39:119–23.

3. Novitsky YW, Kercher KW, Czerniach DR, Kaban GK, Khera S, Gallagher-Dorval KA, *et al*. Advantages of mini-laparoscopic vs conventional laparoscopic cholecystectomy: results of a prospective randomized trial. Arch Surg 2005; 140:1178–83.

4. Endo S, Souda S, Nezu R, Yoshikawa Y, Hashimoto J, Mori T, *et al*. A new method of laparoscopic cholecystectomy using three trocars combined with suture retraction of gallbladder. J Laparoendosc Adv Surg Tech 2001; 11:85–8.

5. Hajong R, Khariong PD. A comparative study of two-port versus three-port laparoscopic cholecystectomy. J Minimal Access Surg 2016; 12:311.

6. 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.

7. Poon C, Chan K, Lee D, Chan K, Ko C, Cheung H, *et al*. Two-port versus four-port laparoscopic cholecystectomy. Surg Endos Other Interv Tech 2003; 17:1624–7.

8. Chohan S, Ch SM, Ch WM, Ghufran S, Sarfaraz K, Moeen H. Number of ports in laparoscopic cholecystectomy: 3 or 4. Age 2020; 41:6–8.

9. McMahon M. Laparoscopic Cholecystectomy: An Original Three-Trocar Technique: Invited Commentary. World J Surg 1995; 19:397-.

10. Ng W. Three-trocar laparoscopic cholecystectomy: a cautionary note. Surg Laparosc Endosc Percutan Tech 1998; 8:159.

11. Cheng Y, Jiang Z-S, Xu X-P, Zhang Z, Xu T-C, Zhou C-J, *et al*. Laparoendoscopic single-site cholecystectomy vs three-port laparoscopic cholecystectomy: a large-scale retrospective study. World J Gastroenterol: WJG 2013; 19:4209.

12. Kumar M, Agrawal CS, Gupta RK. Three-port versus standard four-port laparoscopic cholecystectomy: a randomized controlled clinical trial in a community-based teaching hospital in eastern Nepal. JSLS: J Soc Laparoendosc Surg 2007; 11:358.

13. Tuveri M, Tuveri A. Laparoscopic cholecystectomy: complications and conversions with the 3-trocar technique: a 10-year review. Surg Laparosc Endosc Percutan Tech 2007; 17:380–4.

14. SK L. One-wound laparoscopic cholecystectomy. Br J Surg 1997; 84:1626.

15. Tian MG, Zhang PJ, Yang Y, Shang FJ, Zhan J. Two-port laparoscopic cholecystectomy with modified suture retraction of the fundus: A practical approach. J minim access surg 2013; 9:122–5.

16. Lundberg O, Kristoffersson A. Port site metastases from gallbladder cancer after laparoscopic cholecystectomy. Results of a Swedish survey and review of published reports. Eur J Surg 1999; 165:215-22.