Modified technique for two ports laparoscopic cholecystectomy: combined safety and economic value

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Context
The surgeons have tried to reduce the size and number of ports to reduce morbidity and improve the cosmetic appearance in laparoscopic surgery.
Aims
Assessment of safety and economic value of two-port laparoscopic cholecystectomy using traction stitches after adding left-sided traction stitch to Hartman's pouch (third stitch) to increase the range of movement (dynamicity) of gall bladder neck (puppet show technique).
Patients and methods
Between July 2017 and January 2019, 50 patients with symptomatic cholelithiasis were involved into this study (36 females and 14 males) their age 18–65 years (mean±SD=41.6±11.4 years). All the cases were done using two ports; umbilical and epigastric. Three traction stitches were used; one to the fundus and two to the Hartman's pouch to its right and left sides to increase its range of movement during dissection of the Calot's triangle (puppet show technique).
Statistical analysis used
The decreptive data were presented as mean & standard deviation (SD). Data were analyzed using the SPSS package for Windows, version 23, SPSS Inc., Chicago, Illinois, USA.
Results
The mean operative time was 55.80±18.60 min (30–120 min). There was no need for more trocars or conversion to open surgery. Intraoperative complications occurred in three cases; one had a small liver tear in the gall bladder fossa. The second case had a small diaphragmatic injury (was repaired) and the third case had bleeding from the posterior branch of the cystic artery (was controlled) and spillage of gall stones (were extracted). The postoperative pain was mild in majority of patients (48 cases) and moderate in two patients. All patients started oral feeding and movements 4 h postoperative. The mean hospital stay was 0.950±0.35 days (0.5–2 days). Economically, about $600 were saved for every case (the price of unused disposable two trocars and two graspers).
Conclusion
Two ports laparoscopic cholecystectomy with three traction stitches (after adding third stitch) (puppet show technique), is an applicable and a safe technique with more patients' satisfaction due to less scars and better economic value.

Keywords:
cholecystectomy, laparoscopic cholecystectomy, laparoscopy, puppet show laparoscopic cholecystectomy, two incisions, two ports, two trocars

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Introduction

Laparoscopic cholecystectomy (LC) is considered the 'gold standard' for treatment of cholelithiasis [1]. The operation is routinely performed using four or three ports of entry into the abdomen. Recent developments regarding LC have been directed towards reducing the size or number of ports to achieve the goal of minimal access surgery [2]. Over time, improved operative techniques and devices, including single incision laparoscopic surgery, natural orifice transluminal endoscopic surgery, single port access surgery, and laparoendoscopic single site surgery have led to single port surgery, which leaves only one scar. However, these techniques require special single port devices and instruments and are technically more demanding than the conventional one [3]. Two-port LC has been reported in the international literature to be safe and feasible [2].

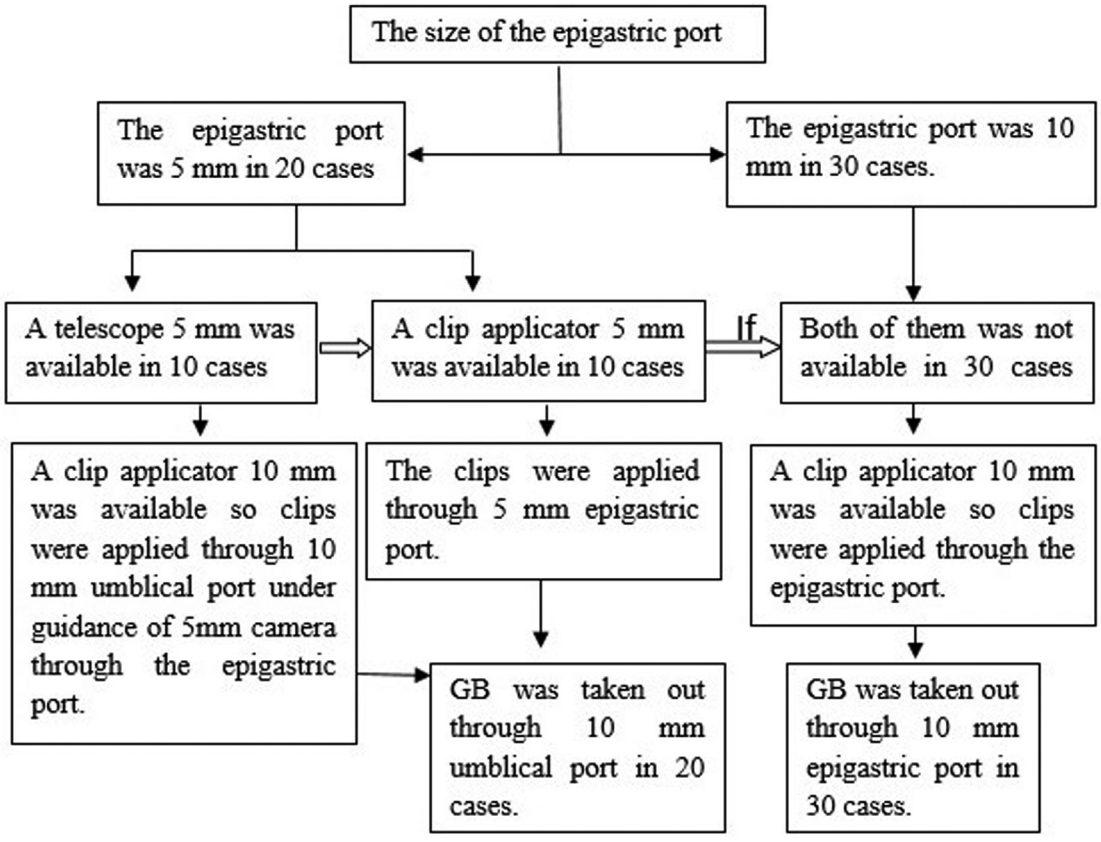
Patients and methods

This prospective descriptive study was performed between July 2017 and January 2019 and it involved 50 cases with symptomatic cholelithiasis. Their ages ranged between 18 and 65 years (mean±SD=41.6

±11.4 years) and their BMI ranged between 22 and 33 (mean±SD=27.7±3.28) and the American Society of Anesthesiologists classification was class I in 32 (64%) cases and class II in 18 (36%) cases. There was no control group involved. All cases presented with symptomatic cholelithiasis during this period were involved into this study with exclusion of any case with calcular obstructive jaundice or previous upper abdominal surgery. Any comorbid conditions such as diabetes mellitus, hypertension, were optimized before the surgery. An informed written consent was obtained at least 1 day prior to the surgery. All the cases were done by HPB surgeon with experience of more than 200 operations for LC, who works at National Liver Institute Hospital, Menoufia University, Egypt. Preoperative laboratory investigations were done for all the cases including liver functions tests, complete blood count, renal functions, coagulation profile, and hepatitis viral markers, all laboratory tests were within normal except two cases (one male and one female) had positive test for hepatitis C virus antibody, for the female patient laparoscopic liver biopsy was done to assess degree of fibrosis before starting anti-HCV treatment. All cases were done under general anesthesia with the patients in supine anti-Trendelenburg's position and pneumoperitoneum was done by an open technique with a subumbilical 12–15 mm skin incision was made and the subcutaneous fat was dissected by an artery forceps down to the rectus sheath which was opened between two Kocher's forceps and the peritoneum was opened by a blunt tipped artery forceps then a blunt 10 mm plastic rod was inserted intraperitoneal and the 10 mm port was introduced over it, and pneumoperitoneum by CO_2 insufflation was established. All the cases were done using two ports; umbilical port 10 mm for the telescope and epigastric port (was placed about 7 cm below the xiphoid process, just to the left of the falciform ligament) its size were 5 mm in 20 cases and 10 mm in the remaining 30 cases according to an algorithm shown in Fig. 1. Three transabdominal traction stitches were used to retract the gall bladder during the surgery, one to the fundus and the other to the Hartman's pouch to its right side and the third stitch was added to the Hartman's pouch to the left side to increase the range of movement of the gall bladder neck (puppet show technique).

The fundus traction stitch was done by inserting 3/0 stitch on straight needle though the right eighth intercostal space just above the ninth rib at level of anterior axillary or mid-axillary line (Fig. 2) and passed through the seromuscular layer of the gall bladder

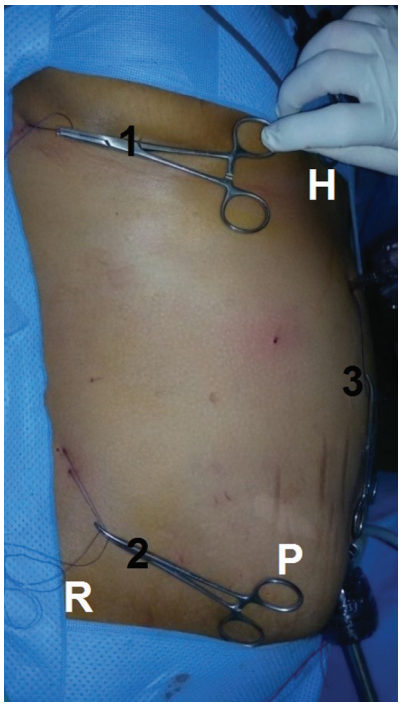
Figure 1



The size of epigastric port. GB, the gall bladder.

fundus, pulling this stitch and fixing it by an artery forceps from outside of the chest wall lead to traction of the fundus upward and lateral to the right side (Fig. 3). Second stitch passed though the abdominal wall at level of umbilicus or just below it and on the mid-axillary line (Fig. 2) this stitch passed through the neck of gall bladder at the Hartman's pouch and used for lateral and downward traction of the Hartman's pouch to open the Calot's triangle from its anterior view for its dissection (Figs 4a and 5) so the critical view of safety (CVS) can be seen from in front of the gall bladder. The third stitch is inserted through the epigastric port to pass through the Hartman's pouch (Figs 5 and 6) then pulled to outside through the port. The port is then removed and reinserted through the same opening next to the thread (Fig. 2), this stitch is used to move the neck of gall bladder medially for dissection of peritoneum on the lateral border of gall bladder, freeing the peritoneum from the posterior view of the Calot's triangle (Fig. 4b). The CVS can now be seen from the posterior view of the triangle of Calot.

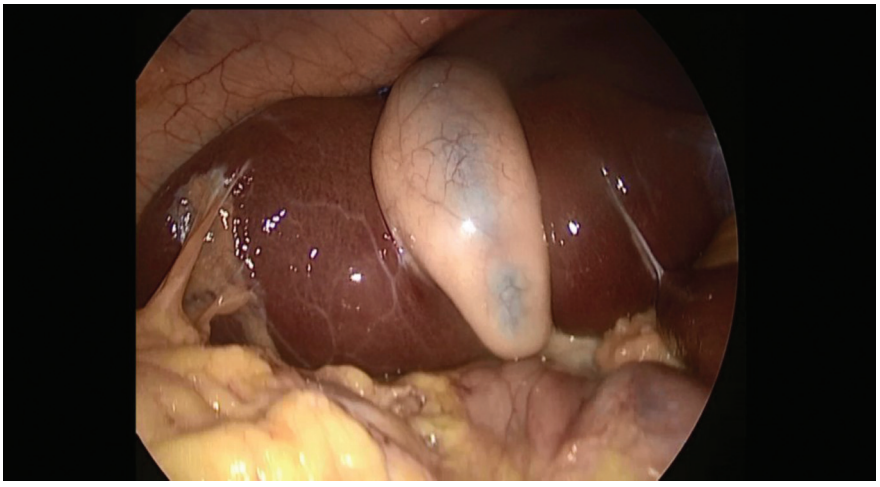
Figure 2



Photograph showing intraoperative view of modified two ports laparoscopic cholecystectomy. Stitch no. 1 was applied to the fundus of GB, stitch no. 2 was applied to the neck of GB to the right side, and stitch no. 3 was applied to the neck of GB to the left side. GB, the gall bladder; H, head side; P, pelvis side; R, right side.

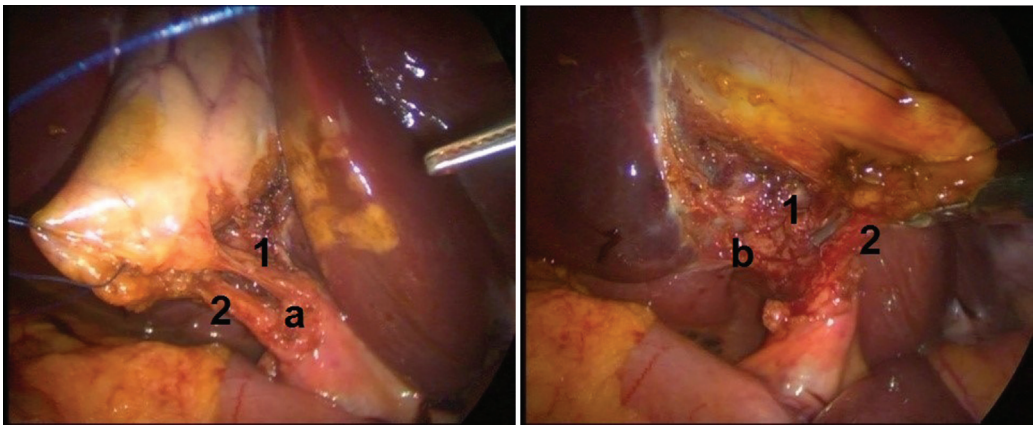
During the operation the surgeon used his right hand to control the dissecting instruments which were introduced through the epigastric port and used his left hand to pull the second or the third stitches from outside during dissection of Calot's triangle anterior and posterior, respectively. The third stitch added a wider range of movement to the gall bladder neck medially and laterally. This changed the two-port cholecystectomy from being static maneuver with the use of the first two stitches to a dynamic maneuver by adding the third one (puppet show cholecystectomy). We used Nassar difficulty grading score for LC (Table 1) [4] to grade the difficulty of the operation. The severity of postoperative pain was assessed using the numeric pain rating scale from 0 to 10 which considered 0 as there was no pain, from 1 to 3 as mild pain, from 4 to 7 as moderate pain, more than 7 as severe pain and 10 as the worst pain [5]. We gave intravenous third-generation cephalosporin antibiotic intraoperative and postoperative oral ciprofloxacin 500 mg twice daily for 5 days. All patients started oral feeding and movement out of the bed 4 h postoperative.

Figure 3



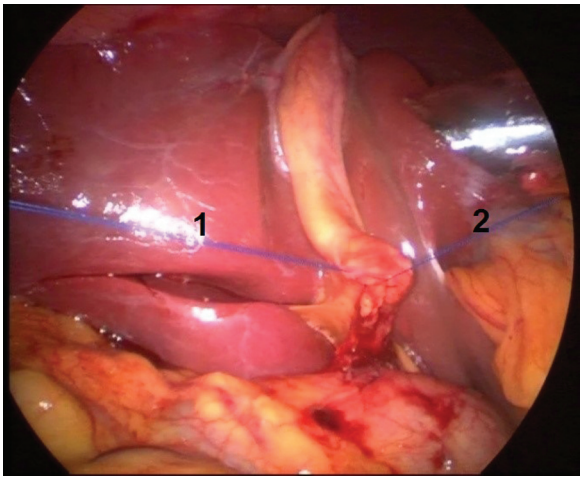
Photograph of upward traction of the fundus by traction stitch.

Figure 4



(a) Photograph of the Calot's triangle showing CVS. a, Anterior; b, posterior; 1, cystic artery; 2, cystic duct. (b) Photograph of the Calot's triangle showing CVS. a, anterior; b, posterior; 1, cystic artery; 2, cystic duct. CVS, critical view of safety.

Figure 5



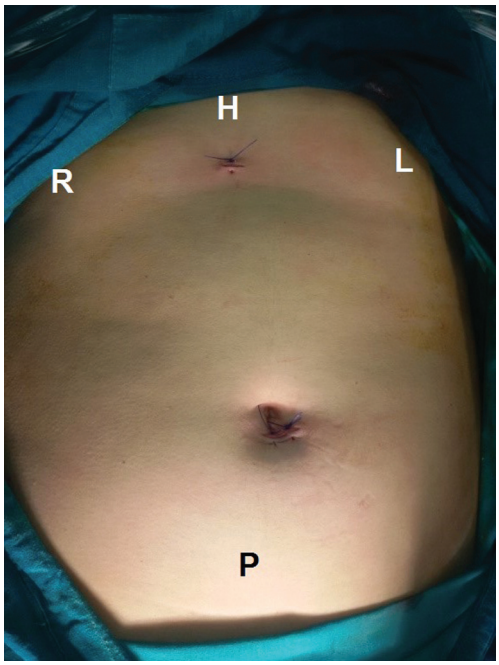
Photograph of intraoperative right and left stitches applied to neck of GB to increase its range of movement. 1, The right side stitch; 2, the left side stitch. GB, the gall bladder.

The decreptive data were presented as mean & standard deviation (SD). Data were analyzed using the SPSS package for Windows, version 23, SPSS Inc., Chicago, Illinois, USA.

Results

Fifty adult patients (14 males and 36 females) with symptomatic cholelithiasis were involved in this study. The mean operative time was 55.8±18.6 min (range, 30–120 min). The difficulty of the operations was classified according to Nassar's difficulty grading score for LC into: grade I in 37 cases, grade II in eight cases who had mucocele of gall bladder, grade III in four cases (had dense adhesions up to fundus), and grade IV in one case who had acute cholecystitis (empyema gall bladder). The severity of postoperative pain was mild in 48 patients (the

Figure 6



Photograph of closure of two ports sites postoperative. H, head side; P, pelvis side; L, left side; R, right side.

mean of the pain score=2.39±0.78) controlled with paracetamol only; moderate in two patients (the pain score was 5 and 6) for whom we used NSAIDs analgesics postoperative. As regards patient satisfaction, all patients reported being satisfied for the operation by using a simple questionnaire containing the satisfaction about the reduced number of ports, previous knowledge of four or three ports lap. Cholecystectomy for other patients and the cosmetic result. The procedure was successful in all cases (success rate, 100%), and no more trocars were added in any case. There was no conversion to open technique in any case.

Table 1 Nassar difficulty grading for laparoscopic cholecystectomy [4]

Grades	Gall bladder	Cystic duct structure	Adhesion degree
I	Soft, no adhesion	Clear, thin	Little adhesion in gall bladder neck or Hartmann bag
II	Mucous cyst, cystic stone	Rich in fat	Little adhesion in gall bladder body
III	Deep gall bladder fossa, atrophy, acute cholecystitis, Hartmann bag, common bile duct adhesion, impacted stones	Anatomic abnormalities, short gall bladder tube, expansion, secluded location	The Tight adhesion in gall bladder bottom, hepatic flexure of colon or duodenum
IV	Fully enclosed, purulent, gangrene, block	No clear position	Fibrous tissue encasing gall bladder, hepatic flexure of colon or duodenum adhesion

Intraoperative complications occurred in three (0.6%) cases. One had a 2 cm liver tear in the gall bladder fossa during obtaining a laparoscopic liver biopsy. The second case had small about 0.5 cm diaphragmatic perforation due to sudden movement of the tip of the dissecting hook during dissection of gall bladder fossa. This was closed with an extracorporeal knot using a 3/0 absorbable suture. The third case had bleeding from a posterior branch of the cystic artery (controlled by diathermy and clips) associated with spillage of stones from the gall bladder which were extracted by laparoscopic spoon forceps. A drain was inserted through epigastric port in four cases due to bile leak from the site of the needle passage through the wall of the gall bladder. The mean hospital stay was 0.950±0.35 days (range, 0.5–2 days). The mean follow up period was 5.5±3.69 months (range, 1–12 months) with no postoperative complications.

Economically, we saved two disposable trocars and two disposable graspers forceps in every case. The saving was about US$600 for every case in Egypt.

Discussion

In an effort to reduce morbidity and improve the cosmoses of laparoscopic surgery, surgeons have tried to reduce the size and number of ports [6]. Two-port LC can be a good alternative in the field of minimally invasive LC [7] as it has been reported in the international literature to be safe and feasible [2]. Different techniques were used for two-port LC; Poon and colleagues used a modified operating telescope (Karl Storz 26036 A zero degree) that was inserted into the supraumbilical port. Retraction of gall bladder was done by the long grasping forceps through the operating telescope, whereas dissection was accomplished through the 5-mm subxiphoid port [8]. Kagaya developed a 'twin-port' system that allows a 5-mm camera and a forceps to be inserted through a single port. A 5-mm trocar is inserted ~1 cm below the xiphoid process, and the LC is performed via two ports [9]. Transabdominal suture retraction of the gall bladder was first reported by Navarra *et al.* [10], who performed a LC via two transumbilical trocars: one for laparoscope and another for electric hook dissector with transabdominal suture retraction of the gall bladder wall. Another method has been reported where the gall bladder was manipulated through three strategically placed traction sutures, passed through the fundus, the body, and the neck area of the gall bladder, respectively [11]. However, the exposure was not as satisfactory as that by an instrument because the thread retraction was static and not sufficient. Some special instruments for dynamic retraction of the fundus have been reported recently; these include the mini-loop retractor and the endo-retractor that could adjust retraction strength and direction according to exposure requirement [12].

In this study, three traction stitches were used; one to the fundus and two to the Hartman's pouch to its left and right side to convert thread retraction of the Hartman's pouch from being static maneuver to be a dynamic maneuver. Also we used the ordinary instruments without need for special devices.

For CVS, the dissection is commonly performed from the front and the back of the triangle of Calot [13]. In this study the left and right stitches inserted in the Hartman's pouch moves it to the right and left side so the dissection is performed from the front and the back of the triangle of Calot so we can obtain CVS.

In this study the mean operative time was 55.8 ±18.6 min (range, 30–120 min). While in another study done by Leow *et al.* [3] the mean operative time was 44±18 min. Poon *et al.* [8] showed an average operative time of 53 min. In the study done by Lee *et al.* [14] the overall median operating time was 62 min (range, 33–168 min).

Reduced pain due to reduced number and sizes of the ports has been established by researchers. By omitting two ports resulted in decreased postoperative pain in the first 24 h [15]. In this study the severity of postoperative pain was mild in 48 patients controlled with paracetamol only; moderate in two patients for whom we used NSAIDs analgesics postoperative.

In this study the procedure was successful in all the cases, no more ports were added and no conversion to open cholecystectomy while in study done by Lee *et al.* [14] the success rate was 90%, conversion to open cholecystectomy in 1% of cases and conversion to three or four port technique occurred in 9% of cases. While in another study done by Leow *et al.* [3] the procedure was successful in 83% of cases, the conversion rate was 17% and consisted of 7% conversion to three-incision four-port LC and 10% conversion to open cholecystectomy. In the study done by Tian *et al.* [16] the procedure was successful in 92.5%, a third trocar was added in 7.5% of cases due to extensive and dense adhesion.

In this study intraoperative complications occurred in three (6%) cases. There were no postoperative complications during the follow up period which ranged between 1 and 12 months. Poon *et al.* [8] reported a 0% complication rate, whereas six (6%) patients had complications in Lee *et al.* [14] study, two patients had intraabdominal collection, one patient had umbilical port site infection, and a further two patients experienced acute urine retention. One patient was found to have common bile duct stones.

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Conflicts of interest
There are no conflicts of interest.

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