Comparative study between Single Port Laparoscopic Cholecystectomy (SPLC) and Traditional Laparoscopic Cholecystectomy (TLC)

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Abstract: **Background:** Laparoscopic Cholecystectomy (LC) provides a safe and effective treatment for most patients with symptomatic gallstones and has become the treatment of choice for many patients and with development of the traditional technique and with seeking of the surgeons and patients to less scaring, the SPLC developed. **Objective:** comparison between single port and traditional multiple ports LC and explain if single port can be an alternative to multi-port or not. **Patients and methods:** Forty patients presented to the outpatient clinic during the duration between January 2015 and January 2017. These patients were randomly divided into two equal groups: group (A) was subjected to TLC, and group (B) was subjected to SPLC. All patients were submitted to preoperative assessment (history taking, physical examination, laboratory investigations, imaging studies, cardio-pulmonary assessment), abdominal ultrasonography (U/S), magnetic resonance cholangiopancreatography (MRCP) if needed and preoperative quality of life assessment. Patient education about the Gall Bladder (GB) function and several ways for removal was provided. All patients of the two groups were informed about the advantages and disadvantages of the procedure that will be dine for him/her and consented to be involved in this study. The patient signed written consent for the procedure to be performed for him/her. **Results:** Patients were followed up for overall outcome and postoperative complications. The operative time in TLC was (45.3±7.1) and in SPLC was (61.4±6.9) with P value P<0.05 which was statistically significant, no cases required conversion with TLC, 4 cases with a percentage of 20% with SPLC with P value= 0.037 which was statistically significant, Cosmetic appearance with TLC1 month post-operative satisfied (7.5± 3.4) patients and after 6 month satisfied(8.6 ±2.1) patients and with SPLC 1 month post-operative satisfied (8.8±4.1) patients and after 6 month satisfied(9.1 ±3.6) patients with p value <0.05 which was statistically significant, length of hospital stay after TLC (53.1 ±7.27) and after SPLC (68.4±11.5) with p value <0.05. **Conclusion:** SPLC appeared to be as safe and effective as TLC.SPLC is feasible and safe for treatment of uncomplicated GB disease. SPLC is a promising alternate method to TLC.

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Keywords: Traditional Laparoscopic Cholecystectomy, SPLC, GB stones diagnosis and treatment.

Abbreviations: GB: GB, **MIS**: Minimally Invasive Surgery**, MRCP**: Magnetic Resonance Cholangiopancreatography**, NOTES**: Natural Orifice Transluminal Endoscopic Surgery, **SPLC**: Single Port Laparoscopic Cholecystectomy and **TLC**: Traditional Laparoscopic Cholecystectomy

1. Introduction

The most common indication for cholecystectomy is presence of GB stones (chronic calcular cholecystitis)**.** Gallstones can form when certain substances in the bile are present in concentrations that approach the limits of solubility. The excess solutes primarily cholesterol and calcium bilirubinate precipitate to form microcrystals (nudes), which may fuse together to form gallstones[1].

Surgical treatment of symptomatic gallstones was initially conducted via open cholecystectomy, which was first undertaken in the 1880s and typically involved a single 10 to 18 cm incision[2].

However, since the 1970s small-incision open cholecystectomy has been used whereby the incision is typically 8 cm or less[2].

LCwas first undertaken by Philippe Mouret in France in 1987 and is now the standard procedure for GB removal and the most commonly performed laparoscopic surgical procedure in the world[3].

TLC typically uses three or four small incisions to allow the insertion of operating ports through which a camera and instruments gain entry[2].

With the increased popularity of minimally invasive surgery, several new techniques have been developed to further reduce the number and size of the incisions used during LC, aimed at reducing

postoperative pain and recovery time and improving cosmetic outcomes[3].

Natural Orifice Transluminal Endoscopic Surgery (NOTES) is the only technique which eliminates skin incisions by using natural body openings. The NOTES technique has been used to perform a cholecystectomy via a transvaginal approach, but the drawbacks include difficulties with access, orientation and closure, a lack of appropriate instrumentation, and the risk of infection[4].

Another developed technique is SPLC. This technique aims to provide the benefits of NOTES, such as fewer incisions and less visible scarring, without requiring additional specialist training beyond that required for TLC[5].

Indications for SPLC are the same indications for TLC which includes biliary colic, biliary dyskinesia, GB polyp larger than 1 cm, porcelain GB[6].

Absolute contraindications for SP cholecystectomy are pregnancy. Relative contraindications include acute cholecystitis and previous upper abdominal surgical procedures. These patients should not be considered for SPLC, and TLC should be performed instead[7].

Complications seen after SP cholecystectomy are similar to those seen after TLC, including bile duct injury, port-site hernia formation, wound infection, bleeding, and bowel injury[8].

When single port compared with traditional multi-port laparoscopic cholecystectomy, benefits of SPLC techniques include less postoperative pain, less blood loss, faster recovery time, and better cosmetic results[9].

Despite the potential advantages of SPLC techniques, there may also be complications. These complications include injury to organs, bleeding because of less instrumental triangulation and instrumental conflict, infection, incisional hernia and scarring[9].

SPLC can be considered an alternative to TLC technique because of its safety and efficacy despite of long operative time and its complications because these factors refer to surgeon skills [(9)].

2. Patients & Methods

In this randomized comparative study, 40 patients with diagnosis of chronic calcular cholecystitis were admitted to surgical department in Al-Azhar University Hospital (Damietta) for LCfrom January 2015 to January 2017. These patients were classified in randomized manner into two groups each of 20 patients: -Group A: for TLC and Group B: for SPLC. The acceptance of ethical committee was taken, and all patients had a written consent explaining the technique, advantages, disadvantages and complications of the operation. Inclusion Criteria included 1) Diagnosis: chronic calcular cholecystitis, 2) Age: above 18 years 3) Gender: both 4) Fit for general anesthesia. Exclusion Criteria included 1) Refusal of patient 2) Any contraindication to general anesthesia 3) Pregnancy 4) Previous upper abdominal procedures 4) Acute cholecystitis 5) Suspicion of malignancy 6) Obesity based on body mass index classification > 35 (BMI = Weight (kg)/ (Height (m^2)).

All patients were subjected to: 1) Complete history and physical examination 2) Routine laboratory Investigations including Complete Blood Count (CBC), Liver Function Test (LFTs), Kidney Function Test (KFTs), Fasting Blood Glucose level (FBG), Coagulation Profile and Hepatitis Markers 3) Abdominal Ultrasound (Abd. U/S) 4) Electrocardiography 4) Plain chest X-Ray 5) Respiratory function tests.

Operation steps

Group (A)of TLC: General endotracheal anesthesia. Broad spectrum antibiotic with anesthesia induction. The nasogastric tube was inserted and removed immediately after surgery. All patients were operated in supine position with the table tilted 30 degrees in a reverse Trendelenburg position and rotated to the patient's left side by 15 degrees. The surgeon and the camera man were standing on the left side of the patient while the assistant and the scrub nurse on the right side. The skin of the abdomen was prepared with bovidon iodine solution from the nipple to the pubic region, then the patient was wrapped. The first incision for insertion of the Veress needle was done most often in the midline above the umbilicus, which is commonly used. The Veress needle was tested first for its spring action and patency, then it was held between the thumb and index finger of the right hand of the operator while the abdominal wall at the umbilical region was elevated by the surgeon's left hand and the assistant. The Veress needle was then inserted at right angle to the abdominal wall, usually towards the midline. Once the needle was intra-peritoneal, its placement should be confirmed. First, it should be aspirated gently with a syringe to exclude accidental entry into blood vessels, bowl, or urinary bladder. Second, from 3 to 5 ml of normal saline solution should then be injected through the needle. Insufflation of carbon dioxide was initiated, when pneumoperitoneum was established as proved by reaching a pressure of 15-mm Hg, the Veress needle was withdrawn.10-mm trocar was introduced through the supra-umbilical incision after pneumoperitoneum was established. The carbon dioxide was connected to the supra-umbilical cannula and insufflation was continued all through the operation with the pressure adjusted at 15 mm Hg. The laparoscope was then introduced and the whole abdomen was inspected.

Then the 10 mm epigastric trocar was inserted under direct vision at a point in the junction between the xiphi-sternum and the umbilicus with variations according to the liver site. A gentile drilling motion for controlled entry into the peritoneal cavity used for introduction of all trocars. Then 2 (5 mm) trocars were placed under direct vision, one in the right mid-clavicular line, 2 fingers breadth below the costal margin with variability according to the position of the GB, the other one in the right anterior axillary line 2 fingers breadth below the costal margin. A tissue grasping forceps was introduced through the anterior axillary port to grasp the fundus of GB and retract it cephalic to expose the Hartman's pouch. Any adhesions between the GB and the omentum, duodenum, or colon were dissected by a dissecting forceps introduced through the epigastric port. Then, another tissue grasping forceps was introduced through the mid clavicular port to grasp the Hartman's pouch and retract it laterally. Dissection of the cystic pedicle was started after that using a blunt dissecting forceps introduced through the epigastric port. All the peritoneal folds over the cystic duct were pealed off till a good segment of the cystic duct was exposed. Then Maryland forceps was introduced to open a window behind the cystic duct. Once the cystic duct is identified, it clipped by two clips proximal and one distal. Identification and clipping of cystic artery. Separation of the GB from its bed in the liver was initiated using a dissecting forceps, a hook knife or a spatula with the aid of electrocautery. After the GB had been separated from its bed, it was placed on the surface of the liver. A claw grasper was then introduced and the neck of the GB was grasped. The GB was extracted together with the cannula till the neck appeared through the incision. The GB neck was grasped by an artery forceps and delivery of the GB was continued until complete delivery. The delivery was facilitated by moving the GB from side to side. The GB was extracted from the epigastric port. Then the epigastric trocar and cannula was re-inserted for inspection of the GB bed and stumps of cystic duct and artery. Any collection of blood or bile at the hepato-renal pouch was aspirated. Irrigation aspiration cannula was inserted through the anterior axillary port and irrigation with saline followed by aspiration was done. A drain tube was used for drainage of any abdominal collection. The fascia was closed with Vicryl 0. The skin of all incisions was closed by prolene 2/0. The nasogastric tube was removed in the operating room.

Figure (1): steps of TLC

Group (B) of SPLC:

General anesthesia with endotracheal intubation. Broad spectrum antibiotic with anesthesia induction. The nasogastric tube was inserted and removed immediately after surgery. All patients were operated in supine position with the table tilted 30 degrees in a reverse Trendelenburg position and rotated to the patient's left side by 15 degrees. The surgeon was standing on the left side of the patient while the camera man and the scrub nurse on the right side. The skin of the abdomen was prepared with bovidon iodine solution from the nipple to the pubic region, then the patient was wrapped. First the umbilicus was everted and elevated using a toothed forceps. A penetrating towel clip was used at its base to allow elevation of the umbilicus and therefore no injury of the underlying structures. A 2 cm vertical incision was done in the umbilicus. Two stay sutures were done on either side of the umbilicus. The underlying fascia was incised. The SILS port was clamped and lubricated to allow easy entry in the abdominal cavity by Hasson technique. The abdominal wall was elevated with a retractor to facilitate its entry into the abdominal cavity. After correct placement gas supply was connected with the pressure adjusted at 15 mm Hg and three (5 mm) trocars were gently pushed into the channels and left in different heights to allow better mobility. The surgeon held in his left hand the Reticulator grasper and in the right hand the Meryland dissector and the assistant held the camera (30 degree) which was placed in the lower channel. The fundus was grasped with Reticulator grasper while the Meryland dissector was used to dissect the Calot's triangle. After dissection of Calot's triangle the cystic

duct and subsequent cystic artery were clipped. The cystic duct and artery were transected. The GB was separated from its bed with electrocautery hook. Additional port was used on two cases with adhesions. The port was introduced in the right mid-clavicular line below the costal margin. After the GB had been separated from its bed, it was placed on the surface of the liver. Inspection of the GB bed and stumps of cystic duct and artery was done. Any collection of blood or bile at the hepato-renal pouch was aspirated.

Irrigation aspiration cannula was inserted and irrigation with saline followed by aspiration was done when indicated. A grasper was introduced and the neck of the GB was grasped. The GB was extracted together with the port till the neck appeared through the incision. The GB neck was grasped by an artery forceps and delivery of the GB was continued until complete delivery. The delivery was usually easy through the wide incision. Drain was not used routinely until needed. The drain was fixed through the site of additional port incision in right mid-clavicular line below the costal margin. The fascia was closed with Prolene 0. The skin of all incisions was closed by prolene 2/0. The nasogastric tube was removed in the operating room.

Figure (2): steps of SPLC

Follow up: Post-operativenon steroidal anti-inflammatory drugs (NSAIDs) in the form of 75mg of Diclofenac Potassium (Cataflam®75mg ampoule) 8 hours after the operation. Nalbuphine Hydrochloride 20 mg (Nalufin® amp) diluted in 10ml of saline solution and 2 ml was given intravenous (i.v) for the patient when needed Then oral NSAIDs will start with the start of oral feeding in the form of 50 mg of Diclofenac Potassium (Cataflam ®50 mg Tablets) twice daily for another 3 days, the patient will be advised to stop analgesic when he/she can tolerate with pain and any increase of NSAIDs will be recorded in statistics. Post-operative broad-spectrum antibiotic 8 hours, 16 hours after the operation. Patients were followed closely during their stay in hospital until discharge and advised to be seen in the clinic two weeks and three months post operatively to record and deal with any complication if present.

Points of evaluation included 1) Operative time 2) Intraoperative hemorrhage (from injury of cystic artery or from injury of any other area) 3) Bile duct injury 4) Conversion rate 5) Hospital stay 5) Post-operative pain according to amount of analgesics needed 6) Wound infection 7) Post-operative hemorrhage or hematoma 8) Bile leakage 9) Port site hernia 10) Patient's satisfaction 11) Return to normal activity Post operative

Statistical methods

Data entry and statistical analysis were performed using SPSS (statistical package of social sciences) version 21 (SPSS Inc., Chicago, IL, USA). Categorical data were expressed in number and percentage. Continuous normally distributed data were expressed in mean and standard deviation (SD). The quantitative data were examined by Kolmogrov Smirnov test for normality of data. Independent sample t test (student t test) was used for continuous normally distributed data. Chi square test or fisher exact test were used to compare categorical data. Statistical significance was considered when probability (P) value was less than or equal to 0.05.

3. Results

1- Demographic characteristics of the study

The age in group A (TLC) range from 23 to 56 with mean± 37.15±7.72 and in group B (SPLC) range from (24-55) with mean± 36.75±5.64 which was insignificant when compared to each other (p=0.85) as shown in table (10-1) and figure (10-1), Also, there is insignificant difference between sex distribution in both groups TLC (F:M 3:1) and SPLC (F:M 2.3:1) (P=0.73) as shown in table (1).

Table (1): Demographic data in our study.

	TLC (Group A) No=20	SPLC (Group B) No=20	P value
Age mean±SD	37.15±7.72	36.75±5.64	P=0.85 t=0.187
Sex Female no (%) Male no (%)	15 (75%) 5 (25%)	14 (70%) 6 (30%)	P=0.73

2- Operation time

There is a statistical significant difference between in operative time which was longer in SPLC table (2).

Table (2): Operation time between 2 studied groups

Operative time /min	TLC (Group A) No=20	SPLC (Group B) No=20	P value
mean±SD	45.3±7.1	61.4±6.9	0.001* T=7.19

***P<0.05 significant**

Amount of over analgesia dose needed

There is no statistical significant differences between both groups in over dose analgesia used as shown in table (3). We have used Nalbuphine Hydrochloride 20 mg with just one patient at the first day in group B, most of over amount of diclofenac k^+ used at the 2nd and third day and tablets twice daily was sufficient for all patients and there is four patients of group A stopped analgesia completely at the 3rd day of operation, all patient stopped analgesia completely at the 5th day.

Table (3): Amount of over dose analgesia between 2 studied groups

	TLC No=20	SPLC No=20	P value
Ampoules (75mg diclofenac K^+) (no. %)	3 (15)	5 (25)	0.361
Tablets (50mg diclofenac K^+) (no. %)	0 (0)	0 (0)	
Nalbuphine Hydrochloride 20mg (no. %)	0 (0)	1 (5)	0.31

3- Operative and Post-operative complications

There were no statistical differences between both groups except in the rate of conversion, which is statistically significant. The two cases of difficult dissection with TLC completed cholecystectomy without conversion to open surgery and without intraoperative blood loss or postoperative complications. The five cases of difficult dissection in SPLC, 2 of them was converted to TLC, one of them because of increased bleeding from the adhesions and the other because of anatomy disturbance. Two of them have required an additional port for opening the Calot's triangle and the fifth case completed as SPLC, and intraperitoneal drain was inserted in these all five patients. One case of the converted cases, sudden bile leakage happened but of a little amount not exceeded 50c.c/ day, the patient remains under observation in the hospital and it closed spontaneously within 7 days and then the drain have been removed and the patient discharged to home. One case of intra-operative blood loss about 150 c.c (calculated by usage of the suction tube after subtract of irrigation amount) because of adhesions and this case was converted to TLC and required no post-operative treatment for this blood loss and with no decrease in blood elements. Four cases of SPLC was converted, 2 of them was converted completely to TLC, and 2 of them required just additional port and these cases was enveloped at the first 10 cases of our research but with the increasing the learning curve and orientation of the technique, the rate of conversion decreased to 0% at the last 10 cases in the SPLC group. No cases of TLC converted to open surgery. No cases of port site hernia, bile duct injury or wound infection in both groups (see table 4).

Table (4): Rate of complications

	TLC No=20	SPLC No=20	P value
Difficult dissection no (%)	2 (10)	5 (25)	0.235
Port site hernia no (%)	0 (0)	0 (0)	-
Bile leakage no (%)	0 (0)	1 (5)	0.31
Wound infection no (%)	0 (0)	0 (0)	-
Bile duct injury no (%)	0 (0)	0 (0)	-
Operative blood loss>100cc	0 (0)	1 (5)	0.31
Rate of conversion	0 (0)	4 (20)	P= 0.037 significant

4- Cosmetic appearance

There were a better cosmetic appearance in SPLC group when compared with TLC group at 1 and 6 months (p value 0.003 and 0.041 respectively) as shown in Table (5). All patient of group B that the SPLC operation completed with them have a full satisfaction about the scar.

Table (5): Cosmetic appearance

Cosmetic appearance	TLC No=20	SPLC No=20	P value
1 month mean±SD	7.5± 3.4	8.8±4.1	0.003*
6 month mean±SD	8.6 ±2.1	9.1 ±3.6	0.041*

***p<0.05 significant**

5- Hospital stay:

There is a higher hospital stay duration in SPLC rather than TLC with a significant difference (p=0.008) as shown in table (6).

Table (6): Hospital stay duration

	TLC No=20	SPLC No=20	P value
Hospital stay /hour Mean ±SD	53.1 ±7.27	68.4±11.5	0.008*

***p<0.05 significant**

6- Return to normal activity

There no statistical difference between both groups in return to normal activity as shown in table (7). Return to normal activity depends on the rate of post-operative pain. As when the pain is controlled, the return to normal activity will be more earlier.

Table (7): Return to normal activity

	TLC NO = 20	SPLC NO = 20
Third day no. (%)	4 (20)	3 (15)
Fourth day no. (%)	6 (30)	7 (35)
Fifth day no. (%)	9 (45)	8 (40)
Sixth day no. (%)	1 (5)	2 (10)

P value=0.717 insignificant

4. Discussion

Since 1985, many competitive approaches have been developed to minimize the invasiveness of LC, with surgeons developing new instruments and techniques to decrease postoperative pain and improve cosmoses by decreasing the number and size of necessary ports.

The most recent developments in LC have been the combined advances in NOTES and SPLC[10]. In this

study, we were trying to know if the SPLC can be a safe and easy alternative to TLC or not.

Forty patients were randomized for laparoscopic cholecystectomy, they were subdivided in 2 groups, group A of 20 patients for TLC operation and group B of another 20 patients for SPLC operation.

In this study, it was found that the average age of patients was 37.15±7.72 years and 36.75±5.64 years in group A and group B respectively.

Female predominance was found. Out of total 40 patients included in the study, 29 were females. There were 15 (75%) and 14 (70%) females in group A and B respectively while only 5 (25%) males in group A and 6 (30%) in group B.

The operative time from initial skin incision to closure of the wound was 45.3±7.1 min. and 61.4±6.9 min. in group A and group B respectively with significant higher mean operative time in group B than group A (p value < 0.001) was noted, it may be due to development of new surgical skill but with increasing the learning curve the time gradually reduced.

This result agreed with *many studie*[11,12,13]which reported a longer operative time in the SPLC group and also agreed with another research [14] whose operative time reported in their study was 38.50±8.92 minutes in TLC and 80.17±30.16 minutes in SPLC, while other group of researches[5,15,16,17]reported mean operation durations of SPLC of more than 75 minutes and this time agree with our time also, but a group of studies [18,19,20,21] reported no significant difference between TLC and SPLC and this results disagree with us may be due to their learning curve and increasing experience, study[22] found that the average difference in operative times among several studies is 12 minutes only.

Despite the long duration of surgery, surgeons should be patient. Our experience has shown that in subsequent cases, the operative time is shortened with increasing experience, with additional experience and improved instrumentation, SPLC and TLC can be of similar duration [23].

In our study, there were no cases of bile duct injury in both group A and group B and this agreed with several studies [23,24,25,26]no bile ducts injury reported butan other study [27]reported that the rate of bile duct injury with SPLC was 0.72% which was demonstrated that although the technique was feasible, there were inherent difficulties that require increased laparoscopic competency, namely, restricted instrument mobility and arguably reduced visualization of key components of a cholecystectomy.

In our study, there was no significant difference between group A and group B as regard to blood loss as there is only one case (5%) of group B with intra-operative blood loss of about 100c.c (calculated by usage of the suction tube after subtract of irrigation amount) because of increased adhesions and this case was converted to TLC.

This agreed withstudy[28], who found also that there is no significant difference between TLC and SPLC as regard to blood loss through Meta-Analysis of Randomized Controlled Trials from January 1997 to February 2013 and also agreed with study[29] that reported also no significant difference of blood loss but they mentioned in their discussion that ***a*** study[30]found increase in blood loss with SPLC and he referred it that they were at start of the learning curve.

In our study there were two cases (10%) in group B needed complete conversion to TLC due to difficulty identifying anatomic landmarks because of dense adhesions and for fear of bile duct injury and this agree with a study[20] reported that three SPLC patients (27.2%) required conversion to TLC, due to either poor visibility or unclear anatomy but disagree with another one[18] which reported that two SPLC patients (3.5%) required conversion to TLC and study[11] with one SPLC patient (0.85%) required conversion to TLC and also disagrees with other studies [12,21] which reported that all surgeries were successfully completed and there were no conversions from SPLC to TLC, this disagreement may be due to the patient of our research was so little in number or may be due to the difference in learning curve.

None of our patients in the TLC group required conversion to open cholecystectomy and this agreed with studies[11,20,31] as they reported that there were no required conversion to open surgery.

In our study there were two cases (10%) in group B needed additional port due to difficulty identifying anatomic landmarks because of dense adhesions and for fear of bile duct injury and this agreed with a study[19] which reported that one SPLC patient (6.3%) required conversion to TLC by placement of an additional abdominal port, due to extensive adhesions and technical difficulties and disagree with another study[25] which recorded that one patient from 104 patient under went SPLC needed an additional port because of an unexpected bleeding from the cystic artery and we think the statistical difference between his and our study may be the little number of cases included in our study.

In our study, there is a higher length of hospital stay (LOS) duration in SPLC (68.4±11.5) rather than TLC (53.1 ±7.27) with a significant difference (P value=0.008) this is because need of more follow-up as almost of the patient without intraperitoneal drain and this agreed with a study[14] which found longer LOS in SPLC group 1.70±0.79 than TLC group 1.00±0.00 because of pain. In addition, surgeons discharged their patients late and observed them until

they were symptom free, while our results disagreed with another study[32] that noted that the mean postoperative LOS for SPLC patients was 12.7 hours shorter than that of TLC patients and also disagreed with group of studies[18,19,20,21,31] with no significant differences between the SPLC and TLC groups.

In our study there is no significant difference in the amount of analgesics needed in both groups and this denoting that there is no difference of pain in both groups and this agreed with prospective randomized study[33] that showed no statistical difference in average pain scores in all post-operative periods, similarly, study[34] determined SPLC does not significantly reduce systemic inflammatory response, postoperative pain or analgesic use compared with TLC and In several studies[23,24,25,26], there is no statistical difference between both groups in analgesia usage.

These results disagreed with studies[5,11,35,36] that reported potential benefits of decreasing the number of ports include less pain in the abdominal wall, less need for narcotic analgesics, earlier discharge from the hospital, quicker recovery and of course fewer scars, and also disagreed with others[37,38]conducted studies which showed that by reducing the number of ports the severity of pain reduced.

Butother studies[14,39,40] and found that Pain was the major problem in SPLC group. The reason for that was demonstrated that the placement of a big SPLC port causes more tissue trauma and the longer operative time with abdominal muscle stretching. The other possible reason may be the limited mobility of the instruments causing more damage to the abdominal wall, A study[11] published in 2012that showed higher pain scores for those undergoing SPLC, but no difference in analgesic use between SPLC and TLC patients. They also reported higher rates of superficial wound complications after SPLC. In another study[41]additional analgesic was required in 32.5% after TLC versus 45% after SPLC with (p= 0.251), Also another study[42]reported that there is increased pain at the site of the umbilical incision after SPLC and they get red of this pain by using preoperative local anesthesia.

A study[43] compared, prospectively, SPLC and TLC and they observed pain scores, requirement of analgesics and LOS were not statistically different between the groups.

There was one case (5%) of bile leakage through the drain in group B which stopped conservatively 7 days later this leakage was due to difficult dissection of the GB bed due to some adhesions, this case required conversion to TLC While there were no cases of bile leakage in group A which considered statistically insignificant and this agreed with study[21] that reported three patients, one SPLC patient (5.3%) and two TLC patients (11.1%) (P=0.54), experienced bile leakage for 2-4 days, and were treated and stopped conservatively and with a study[21] reported leakage occurred in three SPLC patients (2.5%) (due to an incomplete clipage of the cystic duct), and two TLC patients (1.7%) (P>0.05).

A study[20] in 2011 reported that there were no intraoperative complications in either group. While another one[12] reported t139hat there were no intraoperative or postoperative complications. In many trials, no significant difference in complication rate (intraoperative and postoperative) was found between SPLC and TLC[44].

In our study, no cases had port-site hernia post-operatively in the follow up period either in group A or group B and this agreed with a study done in a series of 125 patients with follow up as long as 22 months by astudy[18] done in 2012 that reported no patient had presented with port site hernia, and also agreed with several studies[23,24,25] that all described the possibility of port site hernia more after SPLC than after TLC but they record no cases of hernia during their follow up period and all recommend careful closure of the rectus sheath and fascia especially after SPLC, and our results disagreed with study[173] done in 2011 that reported an increased incidence in port site herniation in patients undergoing SPLC when compared with patients undergoing the TLC (8.4% versus 1.2%).

With multiple incisions in the fascia in such close proximity and a longer skin incision, there is a theoretical increased risk of incisional hernias and this makes the surgeons close the fascia carefully[45].

In our study, there was significantly higher mean cosmetic score in group B than group A and this results agreed with a study[31]which reported that the median cosmetic score was significantly higher for SPLC patients (7, range 4-8) compared with TLC patients (6, range 3-8) (P=0.023) and also agreed with a study[11] which reported that the results of the Body Image Questionnaire demonstrated that SPLC (mean score 5.5) was preferred over TLC (mean score 5.8) (P=0.04) and also our results agreed with studies[43,44]found that Cosmetic satisfaction is significantly higher in SPLC cholecystectomy, another study[7] reported that the cosmetic outcomes were similar in SPLC and TL which disagree with our results.

In our study, there is no difference between group A and group B in return to normal activity which agreed with studies[46,47]which reported that there no difference between both groups in return to normal activity and disagreed with a study[23] which reported that the whole patients of SPLC returned to normal activity at the fourth day but the patients of TLC returned to work from the day 4 to the day 6 and also disagreed with a study[47] which reported also earlier

return to normal activity after SPLC and they described that when the post-operative pain was controlled the return to normal activities will be earlier.

Summary

This study included 40 patients with diagnosis of chronic calcular cholecystitis admitted to surgical department in Al-Azhar University Hospital (Damietta) for LC from January 2015 to January 2017. This work was carried out to evaluate the outcome of SPLC in Al-Azhar University Hospital (Damietta) and to compare between SPLC and TLC. Age above 18 years, both genders, fit patient will be included in the study.

Patients were excluded from study if there is refusal of patient, any contraindication to general anesthesia, pregnancy, major organ dysfunction, previous upper abdominal procedures, acute cholecystitis or suspicion of malignancy.

Operative time, intraoperative hemorrhage, conversion rate, bile duct injury, hospital stay, post-operative pain, wound infection, post-operative hemorrhage or hematoma, bile leakage, port-site hernia and patient's satisfaction were encountered in the study.

All patients were subjected to: Complete history and physical examination, routine laboratory investigations including CBC, LFT, KFT, fasting blood glucose level, coagulation profile, hepatitis markers and abdominal ultrasound.

Patients were followed closely during their stay in hospital until discharge and advised to be seen in the outpatient clinic two weeks and three months post operatively to record any complication.

Patients were subjected to clinical, laboratory and radiological investigations as indicated in each individual patient with specific complication and data were collected and demonstrated in the results.

The results showed that:

Younger mean age of patients was found in group B than group A. Female predominance was found in both groups. There was significant higher mean operative time in group B than group A. Operative time was noted to decline over time with increasing the learning curve and the orientation technique.

The rate of complications was generally low**.** There were a case of significant intra operative hemorrhage in group B but not in group A and it is accepted as there is a lot of adhesions in the GB bed and we kept the patient safety by converting the operation to TLC.

There were no cases of bile duct injury in either group A or group B. Two cases in group B needed additional port and another 2 cases was converted to TLC while no cases in group A required conversion to open which was also insignificant.

No significant difference between mean hospital stay of group A and group B. The mean VAS pain score was statistically insignificant in response to casual analgesics in both groups. There were no cases of wound infection or post operative hemorrhage or hematoma in either group A or group B. There was one case of bile leakage in group B which stopped conservatively while no cases of bile leakage in group A which considered statistically insignificant. No cases of intra abdominal collection in either two groups.

No cases had incisional hernia post operatively either in group A or group B. Cosmetic scores were significantly higher following SPLC compared with TLC in both groups of this study.

Conclusion

SPLC appeared to be as safe and effective as TLC; SPLC is feasible and safe for treatment of uncomplicated GB disease. There were reductions in the operating time and increases in success rate with accumulation of experience. Nevertheless, surgeons should be cautious, and aware of the potential risks of this new technique. Disadvantages of SPLC include the conflict between the operative instruments, and the camera, smaller degree of instrument triangulation and high cost compared to that of TLC.SPLC is a promising alternate method to TLC. The major advantage is cosmoses.

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