# Single Port Laparoscopic Cholecystectomy versus Conventional Four Port Laparoscopic Cholecystectomy

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**Abstract: Background**: In an attempt to decrease operative trauma and improving cosmetic results, Single-incision laparoscopic surgery is used via a single incision in the umbilicus. Single port laparoscopic cholecystectomy (SPLC) is a minimally invasive surgical technique for treatingbenign gallbladder diseases. Reticulating forceps, and specially designed ports have facilitated SPLC. Theaim of this study was to compare the outcome of two laparoscopic techniques (Single and multiple ports laparoscopic cholecystectomy). **Materials and methods:** This prospective comparative study was done at elite hospital, Riyadh, and military hospital, Taif, KSA. between October 2014 and April 2016 and included 80 patients admitted with diagnosis of Gall bladder stones, of which 40 patients underwent single port laparoscopic cholecystectomy (SPLC), and 40 patients underwent conventional multi-port laparoscopic cholecystectomy (MPLC). **Results:** The mean operative time for Group A (SPLC) was 66.4 ± 14.0 ranged from (35 -105) minutes with median time 44.5 minutes which was longer than that in group B (MPLC) (46.45 ± 36.3) ranging from (22-83) with a significant statistical difference. In group A (SPLC) an extra port was needed in 3 cases for proper dissection of the Calot's triangle. Nomajor intraoperative complications. Hematoma at incision site occurred in two cases in group A and one case in groupB. The length of hospital stay and post-operative pain score were similar in both groups. **Conclusion:** SPLC is considered as a safe, effective and feasible surgical technique in selected patients. With better cosmetic result but longer operative time.
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**Keywords:** Laparoscopic cholecystectomy – Single port -Multiple port

## 1. Introduction

Laparoscopic surgery has many Advantages compared to open surgery likeless postoperative pain, better cosmesis, shorter hospital stay and absence of intra-abdominal adhesions. Laparoscopic cholecystectomy is a broadly performed procedure all over the world and has shown its effectiveness since it was introduced in 1985 by Erich Mühe in the County Hospital of Böblingen[1] while the first published laparoscopic cholecystectomy (LC) was in 1987 by Phillipe Mouret[2].

Nowadays, four-trocar conventional laparoscopic cholecystectomy is the gold standard operative method for treating acute cholecystitis and chronic cholelithiasis[1]. The surgeons' aim has always been to introduce new minimally invasive techniques todecrease the patients' pain, recovery time, complications, and blood loss, considering the improvement of the cosmetic outcome [3].

In an attempt to decrease operative trauma and improve cosmetic results following laparoscopic cholecystectomy, there has been a trend to decrease the number of ports and incisions required. One of these new operative techniques is the single port laparoscopic surgery (SPLC)[4, 5]. In 1997, the first paper of single incision laparoscopic cholecystectomy (SILS) described the use of two separate periumbilical incisions that were later connected to remove the gallbladder[6].

Natural orifice transluminal endoscopic surgery (NOTES) is a long and difficult technique, and has a little consensus about the safety and requires multidisciplinary cooperation[7].

The technique of SPLCinvolves three working ports placed through single incision via a trans-umbilical route. Theoretically, SPLC can be safe and feasible technique with faster operating time if done by an experienced surgeon. Also, Single Port Laparoscopic Cholecystectomy can have the best cosmetic outcome that increases the satisfaction of the patients which in turn can increase the popularity of this technique[8]. Single-port laparoscopic cholecystectomy (SPLC) is perhaps the most common single-port surgery. Development of minimally invasive surgical concept helps us to performcomplicated surgical interventions with a minimum amount of trauma and better cosmetic results[9].

Cholecystectomy through a single access has many advantages over conventional laparoscopic cholecystectomy. In addition to less postoperative pain and better cosmetic results, complications related to the extra incisions like hematoma, bleeding, infection, and keloids are less. SPLC is more difficult tobe executed due to lack of triangulation and distance

between incisions, compared to the conventional laparoscopic cholecystectomy [10]. Reticulating forceps, and specially designed ports have facilitated SPLC, but with great concern about the added cost especially in low economiccountries.

In this study, we report the results of our experience in SPLC and comparing these results with theconventional four ports laparoscopic cholecystectomy.

## 2. Materials and Methods

This study; a prospective comparative study, was done between October 2014 and April 2016 at Elite hospital, Riyadh, and Military hospital, Taif, KSA.

**Patients:**

The study included 80 patientswho were candidates for elective laparoscopic cholecystectomy that were divided into 2 groups. Group (A) included 40 patients who underwent SPLC and group (B) 40 patients who underwent conventional four ports laparoscopic cholecystectomy. For patients in group A (SPLC) an Informed consent for the procedure was prepared, explaining the differences between the SPLC and the standard four-incision technique.

**Inclusion criteria**:

Patients presented to our outpatient clinic diagnosed as chronic calcular cholecystitis, biliary colic or gall bladder polyps by abdominal Ultrasound (U/S).

**Exclusion criteria**:

Included acute cholecystitis, severe obesity, and previous operations in upper abdomen, pancreatitis, pregnancy, liver cirrhosis and patients on anticoagulant medications.

**Diagnostic studies:**

All patients involved in this study underwent. History and physical examination in addition to Preoperative investigations (blood tests including complete blood picture, coagulation profile, liver function tests, renal function tests and ECG) and abdominal U/S.

All patients had preoperative assessment by anesthesiologist. Preoperative antibiotics were administered intravenously with the induction of anesthesia.

**Surgical technique:**

**For group A (SPLC);** Skin and facial incision through the umbilicus 2 to 2.5 cm was done, thenthe peritoneum was opened and a SILS™ PT12 Port (Covidien Inc., Norwalk, California, USA) is introduced through this opening (Figure 1). This port has four openings one for gas insufflations and threeopening for introducing three trocarstheir sizes ranging from 5mm to12 mm.

Figure 1a


Figure 1b

**Figure 1(a, b)**: skin incision through the umbilicus and SILS port by Covidien and reticulating instrument

After pneumoperitoneum was done and introduction of scope 30 degree the patients was placed in anti-Trendelenburg position with the operating table tilted towards the patient's left. Initially, the gall bladder fundus was suspended to abdominal wall using 2/0 polypropylene suture through the abdominal wall as retractors (Figure 2). In some cases, to facilitate dissection of Callot's triangle we take another suture through the body or Hartmann's pouch. After that the infundibulum by using a reticulating grasper was then retracted to the right and slightly cephalic. Then dissection of Callot's triangle was done with a hook instrument to identify critical view of safety while cystic duct and artery were clipped and divided (Figure 3, 4). After that gall bladder dissection was completed (Figure 5), Extraction of the gall bladder through umbilicusthen closure of the fascia was done using polypropylene 0sutures, finally the umbilical wound wasclosed by using polypropylene 4/0 sub-cuticularto ensure

cosmoses. In cases where a drainwas needed, it was put through the umbilicus.

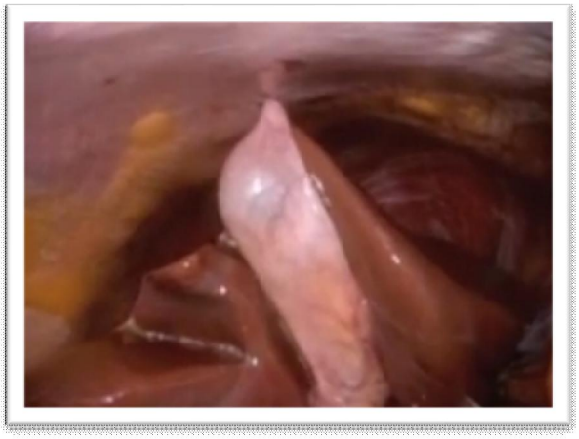

Figure 2

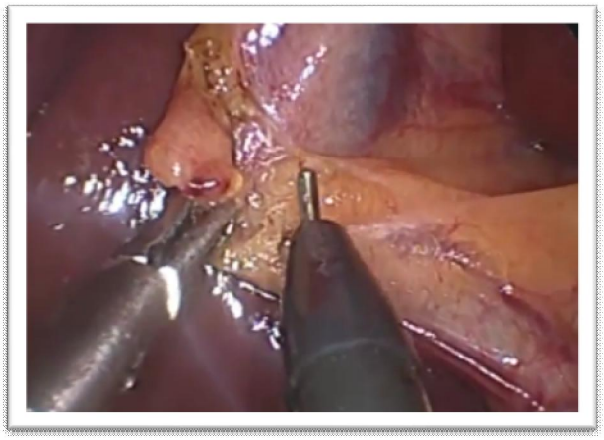

Figure 3

**Figure (2&3):** suspension of the gall bladder to anterior abdominal wallusing 2/0 polypropylene suture in figure (2). Dissection of Callot's triangle, cystic duct and artery in figure (3).

Figure 4

Figure 5

**Figure (4&5):** clipping and division of cystic duct and artery then division in figure (4), dissection of the gall bladder by Hooke diathermy in figure (5).

**For group B (MPLC);** A sub-umbilical incision was done through it a 10-mm port was inserted for 30-degree scope. Sub-xiphoid incision with port 10 mm for the working right hand of the surgeon, another 5-mm port was inserted through right sub-costal incision in mid-clavicular line for grasping the Hartman pouch and last 5-mm port in the right anterior axillary line for grasping and retracting the gall bladder fundus. The cystic duct and artery were dissected (figure 6&7), clipped and divided (figure 8). Then dissection of the gall bladder was done by hook (figure 9). Then the gall bladder was removed through the Sub-xiphoid incision. Closure of the four openings was done by polypropylene 4/0.

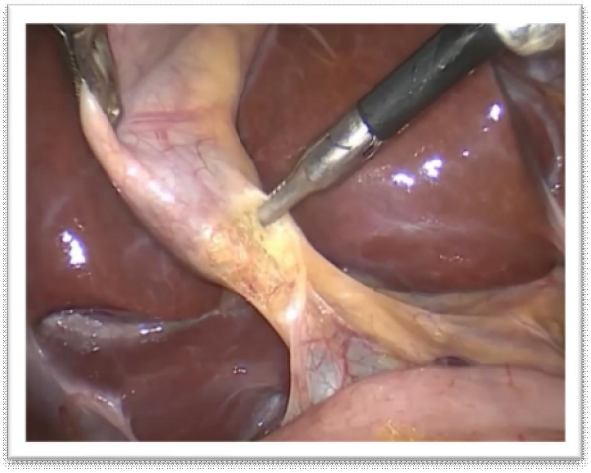

Figure 6

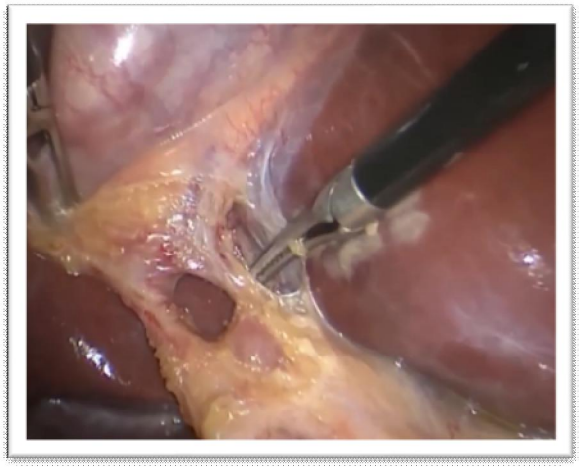

Figure 7

**Figure (6&7):** showing Dissection of Callot's triangle, cystic duct and artery

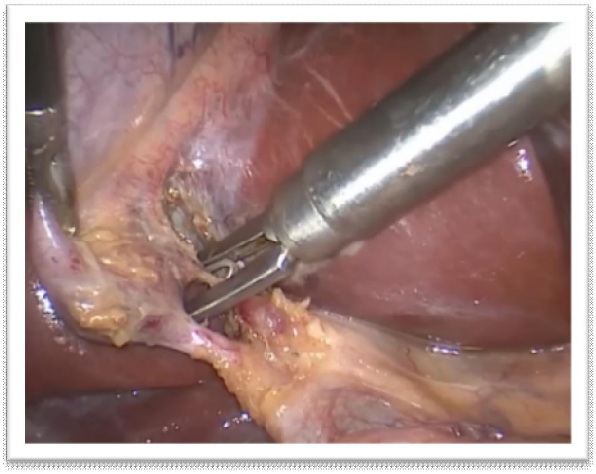

Figure 8

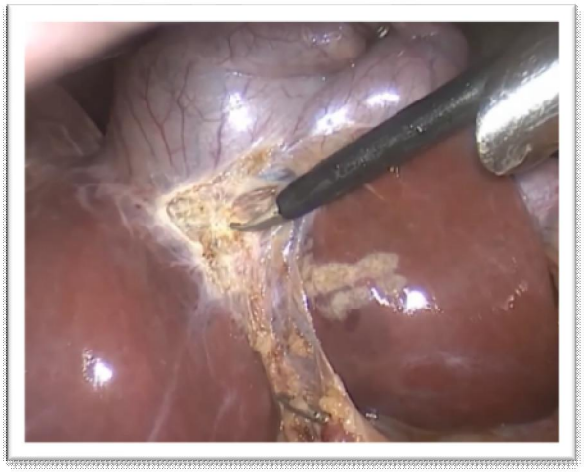

Figure 9

**Figure (8&9):** Showing clipping of the cystic duct and artery & dissection of the gall bladder from the liver

Demographic data (i.e., age, sex, BMI), operative time, length of hospital stay, and complications (bleeding, CBD injury, wound infection, hematoma, conversion rate and bile leak) and post-operative pain and post-operative cosmetic satisfaction in addition to procedure cost were reported. Then we compared these data forthetwo groups.

## 3. Results

This study included 80 patients (34males and 46 females). The mean age of the study group was 36.57 ± 6.53 years, BMI in our patients ranged from (26- 40) with 33 median BMI (**Table 1).** Statistical analysis showed no difference between thetwo groups regarding these preoperative characteristics.

**Table (1):** Preoperative data in the study groups (sex, age and BMI)

| Variables | | Group A | Group B | Total | Significance |
|---|---|---|---|---|---|
| Sex | Female | 24 | 22 | 46 | Ns |
| | Male | 16 | 18 | 34 | |
| BMI | | 34.25 ± 4.67 | 33.63±4.39 | 33.78 ±4.72 | Ns |
| Age | | 36.21 ± 6.38 | 37±65.46 | 36.57 ± 6.53 | Ns |

The mean operative time (minutes) for Group A (SPLC) was 66.4 ± 14.0 ranged from (35 -105) minutes with median time 44.5 minutes, which was longer than that in group B(MPLC) (46.45 ± 36.3) ranging from (22-83) with a significant statistical difference. For group A there was no cases Converted

to conventional laparoscopy or open cholecystectomy. For group B there was no cases Converted to open cholecystectomy.

In group A (SPLC) an extra port was needed in 3 cases for proper dissection of the Calot's triangle. The mean hospital stay for group A was 1.1 ±0.43 while it was1.0±0.62 for group B with no significant statistical difference **(Table 2).**

**Table (2):** The operative time, and the Hospital stay in the study groups.

| | **Group A (SPLC)** | **Group B (MPLC)** | **p-value** |
|---|---|---|---|
| **Operative Time (minutes)** | 66.4 ± 14.0 | 46.45 ± 36.3 | 0.031 |
| **Conversion to open** | None | None | NS |
| **Hospital Stay(days)** | 1.1 ±0.43 | 1.0±0.62 | 1.0000 |
| **Insertion of extra port** | 3(7.5%) | None | |

As regard to thepostoperative pain, the pain scores were checked 6 hours after surgery by using a visual analogue score (VAS). There was no significant statistical difference between the two examined groups. Wound infectionratewas (2.5%) in group A managed by systemic antibiotics and local dressing, while it was (0%) in group B. 2 cases in group A showed Hematoma at the incision site (5%) compared to 1 case in group B (2.5%) with no significant statistical difference. one case in group A (SPLC) showed bile leak due to slipped clip from the cystic duct which was managed by ERCP and stenting. No cases of bile leak were detected in group B **(Table 3).**

**Table (3):** showing postoperative complication in the study groups.

| | **Group A (SPLC)** | **Group B (MPLC)** | **p-value** |
|---|---|---|---|
| **Wound infection %** | 1 patients (2.5%) | 0 (0%) | NS |
| **Median pain score 6 h post op.** | 2.67 | 3.32 | 0.21 |
| **Bile leakage %** | 1 patient (2.5%) | None | NS |
| **Hematoma at incision** | 2 (5%) | 1 (2.5%) | 0.607 |

There was a significant difference in cost between the 2 examined groups. Ingroup A special portsand articulating instruments were used.

## 4. Discussion

Laparoscopic cholecystectomy is considered the gold standard surgical procedure for symptomatic gall bladder disease. It is associated with better cosmesis, shorter hospital stay and rapid convalescence[11].

An important factor with laparoscopic approaches to the gallbladder is the ability for the surgeon to obtain a "critical view of the Calot's triangle." Most surgeons who routinely perform laparoscopic cholecystectomy would consider the critical view as a basic requirement and would be greatly concerned by any new technique that compromised it.

One of the greatest advantages of SPLC is the reduction in incisions needed providing superior cosmetics results than conventional laparoscopy; hiding the incision in the umbilicus is particularly important to younger female patients. The technical issues faced by surgeons at the beginning of their learning curve were loss of triangulation and difficulty in obtaining adequate exposure of the field, asboth the laparoscopic camera port and all dissecting instruments ports were placed through a single umbilical incision [12]. This leads to cross-handedness and restriction of movement and viewing, as well asdifficult dissecting angles. When the critical view was compromised in one of our patients, an additional port was added to help in visualization of this view.

SPLC has attracted wide attention because of its potential cosmetic results. It may even be possible for this approach to become a gold standard for cholecystectomy[13]. However, there is still a long way to go before this approach becomes a gold standard, as standardization, safety, and the cosmetic results of SPLC require morevalidation [14].

Our operative time was 66.4 ± 14.0minutes, which was longer than the time required for classical 4 ports cholecystectomy 46.45 ± 36.3. The extra time reflected the degree of the procedure complexity and the learning curve of the operating surgeon, and there was a trend to decreasing operative time as more cases were done. In a study done by **Ming-Xin Pan et al**. [15], the operative time was 41.8 ± 17.0 minutes for SPLC and 38.5 ± 22.0 minutes for MPLC which was lower than our operative time. While it was 75 minutes (range 42-120) for SPLC group and 58 minutes (range 26-117) for MPLC group in a study done by **Muhammad et al.**[16]

**Brittney et al**. [17], reported an Operative time slightly longer for SPLC group (65 minutes, range 35–141)

compared to MPLC group (51 minutes, range 41–109) with a significant statistical difference. **Prasad et al**[18] reported an operative time (66.76 ± 5.78 minutes) for SPLC which was similar to our results. While **Downes et al** [19] reported a shorter operative timewith median 38.5 min for SPLC who explained that due to the use of LigaSure device. **Hernandez et al**, [20] noticed reduction in the operative times after doing 75 cases of SPLC procedures by the same surgeon. And so, by experience, and performing a lot of cases theoperative time needed for the SPLC was shorter. No statistically significant difference in both groups regarding hospital stay and postoperative pain.

In our study, there was no cases Converted to conventional laparoscopy for SPLC group or open cholecystectomy for both group. While In group A (SPLC) an extra port was needed in 3 (7.5%) cases for proper dissection of the Calot's triangle. The length of hospital stay was similar for the groups. 2 cases in SPLC group showed Hematoma at the incision site (5%) compared to 1 case in MPLC group (2.5%) with no statisticallysignificant difference. Fundal retraction of the gall bladder via stitch through the abdominal wall was used for better visualization and exposure of the Calot's triangle in all cases in group A (SPLC). No bile leak was detected in group B (MPLC) while in group A (SPLC) one case showed bile leak due to slipped clip from the cystic duct which was managed by ERCP and stenting. **Ahmad.**[21] reported one case of bile leak from duct of Luschka which was managed by ERCP and stenting of CBD. SPLC provided a better cosmetic results for patients.

**Conclusion**

The results of this prospective study demonstrated that SPLC is feasible and safe surgical technique for most cases of cholelithiasis when performed by experienced surgeons, with some outcomes similar to that of MPLC, however, SPLC has a better cosmetic outcome over the MPLC and less postoperative pain, but with longer operative time and increased cost. Still additional trials with bigger number of patients are needed forcomparing the results of SPLC and MPLC to recommend the SPLC as a standard procedure.

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