



A COMPARATIVE STUDY OF SINGLE PORT LAPAROSCOPIC CHOLECYSTECTOMY VERSUS MULTIPLE PORT LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Laparoscopic cholecystectomy is the gold standard in the management of symptomatic gallbladder stones. In the quest for making minimal access surgery more patient friendly in terms of fewer complications and better cosmesis, single-port laparoscopic cholecystectomy (SPLC) has emerged as a novel technique. This prospective study was conducted at a tertiary hospital over a period of two years who underwent laparoscopic cholecystectomy by single port or multi-port technique and were assessed postoperatively to evaluate efficacy & effectiveness of SPLC in comparison with multi-port laparoscopic cholecystectomy (MPLC). The parameters assessed are intra-operative findings, complications, rate of conversion of single port surgery to either multi-port or open surgery and duration of the surgery.

KEYWORDS : Minimal access surgery, symptomatic gall stones, Single port laparoscopic cholecystectomy (SPLC), Multi-port laparoscopic cholecystectomy (MPLC).

INTRODUCTION

Cholelithiasis is one of the most common illness. Its treatment has evolved markedly since open cholecystectomy was first described by Langenbuch in 1882^[1,2]. At present laparoscopic cholecystectomy is the gold standard treatment of cholelithiasis^[3,4]. Minimal invasive surgery has been widely accepted with proposed benefit of smaller incisions for better cosmesis, decreased recovery time and postoperative pain. This further led to the concept of no scar surgery or beginning of Natural orifice Transluminal Endoscopic Surgery (NOTES)^[5,6,7] where natural orifices like trans-oral, trans-vaginal or trans-anal are being used as portals for surgery. Based on its application is the natural orifice transumbilical surgery or single port incision laparoscopic surgery (SILS)^[8]. This review will attempt to evaluate the efficacy of SILS and compare it with the traditional multi-port laparoscopic cholecystectomy.

MATERIALS AND METHODS

A prospective analysis was carried for a period of 2 years from October 2016 to September 2018. A total of 100 patients with symptomatic cholelithiasis were enrolled in the study after taking an informed written consent while patients with acute calculous cholecystitis, gall bladder mass and cholelithiasis with choledocholithiasis were excluded from the study. The patients were divided into two study groups, of 50 patients each.
GROUP 1: Single Port Laparoscopic Surgery
GROUP 2: Multi-Port Laparoscopic Surgery

OPERATIVE TECHNIQUE

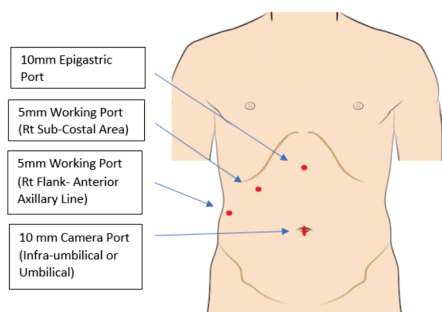


Figure 1: Surgical procedure Multi-Port Cholecystectomy

The patients were placed in supine position and operated under general anaesthesia. For MPLC, ports were placed as shown in the Figure 1. Pneumoperitoneum was created after inserting the 10mm umbilical port and then remaining ports (Figure 2) were inserted. The gallbladder was grasped at fundus and retracted over liver edge and infundibulum was retracted laterally. Calot's Triangle was visualized. (Calot's triangle bounded by the inferior surface of liver

superiorly, cystic duct laterally and right hepatic duct medially). The peritoneum, loose areolar tissue and fat around gall bladder and cystic duct dissected off carefully towards the bile duct. After the cystic duct identified and dissected free, identification of cystic artery was done. Three titanium clips were placed on cystic duct and divided between clips. The cystic artery similarly clipped & divided. Gallbladder dissected off liver bed from neck to fundus. Gallbladder fossa checked for bleeding. Ryles tube number 20 kept as drain in Morrison's pouch. Gallbladder extracted via the epigastric port. The ports were removed while checking for hemostasis, abdomen was deflated and the incisions were sutured with ethilon 2-0 (Figure 3).

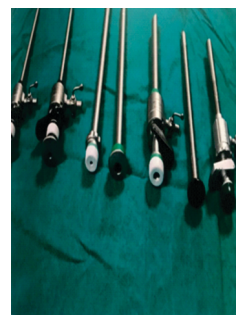


Figure 2: Ports Used in MPLC



Figure 3: Port-Site Incision Sutured in MPLC

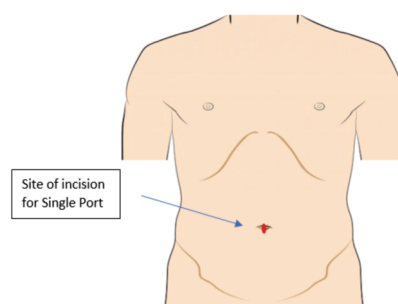


Figure 4: Surgical Procedure Single-port Cholecystectomy

The patients position and anaesthesia choice for SPLC was similar to MPLC. For port placement a 2.5 cm incision was taken through umbilicus to gain access to peritoneal cavity as shown in Figure 4. A covidien single port was inserted, which has three openings for trocar insertion. (Figure 5). The lower one was 10mm for camera and above two, 5mm each as working ports. A 30° telescope inserted through the lower 10mm hole and grasper inserted through upper 5mm hole to grasp gallbladder at infundibulum. Dissecting forceps were inserted through upper right hole. Once calot's triangle identified the cystic duct and cystic artery isolated, clip applicator (5mm jaw and shaft) used to clip cystic duct and artery, and subsequently divided. The gallbladder dissected from liver bed. Haemostasis checked and drain kept in Morrison's pouch (separate incision for insertion). The abdomen was deflated and the incisions were sutured with ethilon 2-0 (Figure 6).

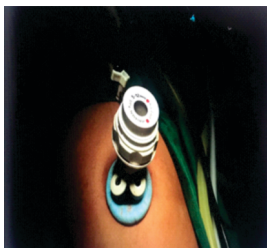


Figure 5: Port Used for SPL

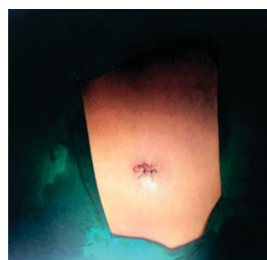


Figure 6: Port -Site incision Sutured in SPLC

RESULTS

A total of 100 cholecystectomies by either single port or multi-port laparoscopic method were performed over the study period of two years. Baseline analysis showed that majority of the patients belonged in the 41-50 years (31%) age group. Out of all operated patients 41% were males (SPC 42%, MPC 40%) and 59% were females (SPC 58%, MPC 60%). During the dissection of gall bladder intra-operative findings were noted. (Table 1)

TABLE 1: INTRAOPERATIVE FINDINGS OF STUDY GROUPS

Intraoperative Observation	Single Port (n=50)	Multi-Port (n=50)	Total
Anatomical Variation	3	2	5
Adhesions	12	13	25
Normal Anatomy	35	35	70

Adhesions were present in 12 cases of SPLC and 13 cases of MPLC while anatomical variation seen in 3 cases of single port and 2 cases of multi-port group. In single port group 8 (16%) cases were converted to multi-port/open, while in multi-port group 2 (4%) cases were converted into open cholecystectomy. The difference was found to be statistically significant. In single port group, 6 out of 12 patients with adhesions were converted and only 2 out of 38 patients without adhesions were converted. Hence, it was concluded that difficulty in dissection was the leading cause of conversion of surgery into either multi-port/open. The rate and reason of conversion was assessed in both study groups. [Table 2, Figure 7]

TABLE 2: REASON OF CONVERSION IN STUDY GROUPS

Reason of Conversion	Single Port (n=50)	Multi-Port (n=50)
Difficulty in dissection	6	1
Anatomical Variation	1	0

Hemorrhage	1	0
Structure injury	0	1
Total	8	2

In single port group, 6 out of 8 conversions were due to difficulty in dissection, 1 was due to anatomical variation and 1 was due to vessel injury. While in multi-port, 1 conversion was due to difficulty in dissection and another was due to CBD injury.

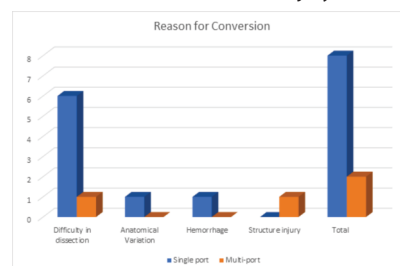


FIGURE 7: REASON OF CONVERSION IN STUDY GROUPS

Various complications encountered intra-operatively during the dissection were listed in Table 3. No statistically rise in surgical complications occurred in the patients operated by single port technique as compared to multi-port surgery. (Figure 8)

TABLE 3: COMPARISON OF COMPLICATIONS IN STUDY GROUPS

Complications	Single Port (n=42)	Multi-Port (n=48)	t value	p value
Vessel injury	1	0	1.0	>0.05
CBD injury	0	1	1.01	>0.05
Liver injury	1	1	0.094	>0.05
Injury to Bowel	0	0	0	>0.05

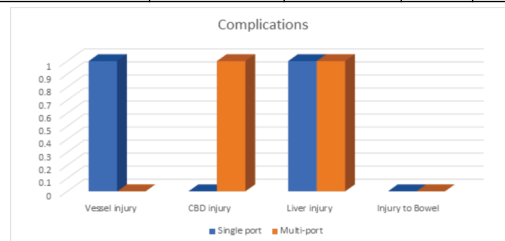


FIGURE 8: COMPARISON OF COMPLICATIONS IN STUDY GROUPS

Median time required to complete laparoscopic cholecystectomy by single port technique was significantly higher than that required for multi-port cholecystectomy. The operative interval for single port cholecystectomy steadily decreases with number of cases and expertise of the surgeon.

TABLE 4: COMPARISON OF DURATION OF STUDY IN STUDY GROUPS

Parameter	Single Port (n=42)	Multi-Port (n=48)	t value	p value
	Median	Median		
Duration(min)	80	55	6.68	<0.01
Range	50-130	30-90		

Postoperatively, patients were also assessed for postoperative pain, nausea, vomiting, bleeding, bile leak and duration of hospital stay. Postoperative abdominal pain was calculated at the end of 6 hours and 24 hours using the Visual Analog Score (VAS) which was significantly higher in patients operated by multiport technique than in single port group patients. There was no statistically significant difference in postoperative hospital stay in the patients operated by single port technique as compared to multi-port surgery. (mean duration : SPLC 21 ± 0.42 days and MPLC 2.32 ± 0.42 days; p value >0.05). All patients after discharge were followed up at the end of 1 week and after 2 weeks. The patients were examined thoroughly during their follow-up visits for any port site infection or

incisional hernia. The incidence of port site infection was significantly higher in the patients operated by single port technique as compared to multi-port surgery (Figure 9).



FIGURE 9: PORT SITE INFECTION AT FIRST FOLLOW-UP

Postoperative hernia occurred in 1 patient of single port group. There was no statistically significant difference in the postoperative incisional hernia in the patients operated by single port technique as compared to multi-port surgery.

DISCUSSION

One of the most common surgery performed is Laparoscopic Cholecystectomy, considered nowadays as a gold standard for the treatment of Cholelithiasis^[9,10]. Soon it gained popularity in the public domain, and replaced the traditional methods by offering patients a permanent cure for their gallstone disease with minimal postoperative pain and disability^[11-14]. Since the introduction of laparoscopic surgery, the surgeons have been trying to reduce the amount of invasion, costs and improve the aesthetic results. Single incision surgery allows laparoscopic surgery to be performed through one incision in the embryonic natural orifice giving all its advantages and virtually invisible scar. The transumbilical technique for cholecystectomy, without additional incisions, was first described by Navarre et al in 1997^[15], but failed to gain popularity due to lack of proper instrumentation. Due to growing experience and development of ports and instrumentation, the surgical technique of single incisional laparoscopic surgery (SILS) is rapidly evolving.

In our study, majority of operated patients were in 41-50 years age group with a female preponderance. Intra-operatively, adhesions were present in 24% patients in the single port and 26% in the multi-port group. Adhesions made the anatomy obscure during dissection and led to majority conversions in single port group mostly seen in patients with acute or chronic cholecystitis. During dissection, the cystic duct was found to be long and low inserting among 3 patients in single port and 2 patients in multi-port group. Thus, due to difficulty in dissection 8 cases were converted into either multi/open surgery while only 2 conversions occurred in the multi-port group in our study. In the study conducted by P.P.Rao et al^[16], single port surgery using Triport was performed in 17 patients. There was a 15% conversion rate noted with 2 patients requiring CBD exploration and 1 case being converted into two port surgery. Sang Kuon Lee et al (2009)^[17], in his study of single port transumbilical cholecystectomy in 37 patients reported conversion in 5 patients due to technical difficulties. In our study the conversion rate in single port group was 16% which was significantly higher than that of multi-port surgery. Most of the other studies have reported the conversion rate in the range of 1% - 5%. In this study, among all the converted cases, an extra port or grasper was inserted directly in right hypochondriac region to help with gallbladder retraction. One case had to be converted to open surgery due to injury to cystic artery. This was due to extensive adhesions of omentum and transverse colon to gallbladder and CBD. In single port technique, liver injury occurred in one patient and gallbladder perforation occurred in two cases however, it did not necessitate conversion of surgery. This was also cited in study by Sang Kuon Lee et al^[17] with 1 case of right hepatic duct injury, 11 gallbladder perforations and 2 mesenteric injuries in SPLC patients due to inadvertent grasping of the small bowel mesentery. No such complications occurred in case of multi-port surgery in our study. The median time required for SPLC in our study was 80 minutes which is significantly higher when compared to the 55 minutes

required for MPLC. Andre chow et al^[18] conducted a study describing SILC in 23 patients with carefully placed sutures used to puppeteer the gall bladder and thus aid retraction. He observed an average operative time of 127 mins. In a comparative study by Hodgett et al (2009)^[19], 29 patients participated in the study. The mean operative time was 72 min in the single port and 66 mins in multiport group. As this study was carried out in a teaching institute, operations were carried out by surgeons with variable experience and expertise that also affected the operative time and rate of conversion. The learning curve for the single port surgery primarily reflects the difficulty experienced in understanding the spatial restriction caused by closed proximity of the instruments and camera as all instruments pass through one fascial incision. Secondly, non-availability of additional instruments for gallbladder retraction made visualisation further difficult. The time required for placement of single port was much higher increasing the total operative time in our study. However, patients safety was always a priority in our study, so whenever any complication was predicted, we usually converted to multi-port surgery.

Postoperative abdominal was much less in patients operated by single port surgery pain. No postoperative complications like bleeding or bile leak occurred in either group in our study. Andre chow et al (2009)^[18] observed bile leak from the accessory duct of Luschka postoperatively in only one case. No mortalities seen in either of the groups in our study. In our study the length of postoperative stay for single port group (2.21 ± 0.42 days) was almost same as in the multi-port group (2.23 ± 0.42 days). In the converted cases, the open surgery patient was discharged on postoperative day 5. Both single and multi-port group patients were discharged on day 2 or 3. The duration of hospital stay in single port group in Chow et al^[18] study was 1 day, Hodgett et al^[19] study was 1 ± 0.61 days, and by Lee et al^[18] was 2.7 ± 1.5 days. After the discharge from the hospital, patients were followed up at the end of 1 and 3 weeks. On 1st follow-up, it was found that 9 patients operated by single port technique had postoperative port site infection while no infection occurred in the multi-port group. Most of the wound infections occurred at the site of umbilical incision. In all port site infected patients, umbilical swab was sent for culture and antibiotics were started accordingly. At 2nd follow-up, one patient of single port group had port site incisional hernia. The same patient had wound infection earlier.

CONCLUSION

Thus, it was concluded that difficulty in dissection was the main cause of conversion of single port to multi / open port surgery in majority of cases. No statistical rise in surgical complications occurred in the patients operated by single port surgery as compared with multi-port technique. Neither was there significant difference in postoperative hospital stay in patients operated by either technique. However, the median operative time to complete SPLC was significantly higher and postoperative complications were observed more in the single port technique.

With better cosmetic outcomes and patient satisfaction, SPLC has emerged as the most outstanding accomplishment in the endoscopic field. With a steep learning curve and various technical problems associated with it, there still remains an element of personal preference with the use of this technique. Nevertheless, in properly selected cases the single port cholecystectomy can serve as good alternate to multi-port surgery.

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