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COMPARATIVE ANALYSIS OF POST OPERATIVE RESULTS OF SINGLE PORT LAPAROSCOPIC SURGERY VERSUS CONVENTIONAL LAPAROSCOPIC SURGERY

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ABSTRACT

Background: Conventional multiport laparoscopic colectomy has proven to be an effective and safe procedure in expert hands. Aiming at further decrease in surgical trauma and to improve the overall outcomes, Single Incision Laparoscopic Surgery (SILS) has emerged in the field of colorectal surgery. **Patients and Methods:** This prospective randomized controlled trial was conducted on 34 patients in the period from Feb. 2015 to Feb. 2017 in Mayo Hospital, Lahore. Patients were allocated into either Group A who were operated upon using conventional laparoscopy, or Group B in which SILS was used. Demographic data, operative and post operative results were assessed and compared in both groups. **Results:** There were significant differences in operative time and post operative pain in the favor of SILS colectomy with *p*-value of 0.0001 and 0.009 respectively. There were no significant differences between the two groups as regards rate of conversion to open, wound infection, length of hospital stay, post-operative mortality, safety margins and number of lymph nodes extracted. **Conclusion:** SILS colectomy is feasible when preformed by experts in laparoscopic surgery and can be used as a substitute to the conventional multiport laparoscopy.

KEYWORDS: Conventional, Surgery (SILS).

INTRODUCTION

It was the state of art for a long period that abdominal surgeries were better performed through large incisions. Although effective as regards exposure and radicality, it did not come free of complications such as pain, wound infection, delayed recovery and late restoration of normal activities. Open surgeries were also associated with longer hospital stay and hence increased cost.[1] The idea of laparoscopy was raised aiming at decreasingsurgical trauma and hence the morbidities that came with open surgery. Laparoscopic cholecystectomy was one of the first attended fields in laparoscopy the late 80's and early 90's of the past century. Outcomes were outstanding as regards postoperative pain, need for narcotics, less respiratory complications, better cosmetic results and earlier return to work. After a short period, laparoscopic cholecystectomy became the standard of care.[2,3] On the other hand, laparoscopic colectomy did not gain the same acceptance. The slow rise in laparoscopic colectomy was partially due to steep learning curve and also fears of inadequate resection and theoretical port site metastasis. The latter two concerns were proven to be wrong and the only hinder became the steep learning curve. The rate of laparoscopic colectomies grew from about 2% in nineties of the past century to be more than 30% by the end of the first decade in the 21 st century.[4] Single-Incision Laparoscopic Colectomy (SILC) emerged to eliminate multiple port incisions. Published complications, morbidity, and hospital length of stay were comparable to conventional laparoscopy and provided excellent cosmetic results and morbidity seems similar to conventional laparoscopy.[5] Our aim in this study was to compare between single port laparoscopic colectomy and conventional multi-port laparoscopic colectomy as regards operative time, operative and postoperative complications, and hospital stay.

PATIENTS AND METHODS

This prospective study was conducted on 34 patients in the period from Feb. 2015 to Feb. 2017 in Mayo Hospital, Lahore; on patients who were candidates for colonic resection. They were randomly assigned into one of two groups; Group A with patients operated upon using conventional laparoscopic surgery and in Group B patients were operated upon using single port laparoscopy. Both malignant and benign lesions were included in this study. Patients with a T4 malignancy, or those undergone a previous median laparotomy, or those with an indication for an emergency colectomy were excluded. All patients who were treated for malignancy

underwent a colonoscopy with biopsy of the suspected lesion. When the pathology report confirmed the malignancy, a CT scan of the abdomen and chest was made for pre-operative staging. Informed consent was received from all patients explaining the procedure, possibility of conversion and suspected complications.

Surgical technique

For Single Incision Laparoscopic Colectomy (SILC) we used SILSTM port by covidien for all cases that accommodates up to three instruments and separate insufflation attachment Fig. (1). Conventional straight instruments were used for both SILC and multi-port colectomy.

For SILS right hemicolectomy, the patient was placed in supine position. The surgeon and the assistant stood on the left side (the assistant holding the camera at the head of the patient). For SILS sigmoid resection or low anterior resection, the patient was placed also in supine position. The surgeon stood at the head end of the patient; standing on the right side when mobilizing the sigmoid and standing on the left side when dissecting the rectum. No difference was made in the surgical technique between benign and malignant cases Fig. (2).

The umbilicus was thoroughly disinfected, everted, and opened longitudinally with a 2 to 3cm incision through the skin and fascia, retraction of skin and fascia to expose the linea alba which was then incised Fig. (3).

After incision of linea alba and peritoneum, the port is introduced aided by artery forceps Fig. (4).

Pneumoperitoneum should start and introduction a standard 10mm 30º laparoscope is used, as well as a straight atraumatic grasper and the 5mm ligasure or harmonic scalpel was used.

For right hemicolectomy, we have started as usual from terminal ileum and ileo-cecal valve up to the right colon maintaining attachment of hepatic flexure to use it as if it is another port. Dissection was performed in a medial to lateral approach. The cecum was lifted and the mesentery was divided up to the basis of the ileocolic artery. The ileocolic vessels were divided using harmonic scalpel or ligasure sealing device. The retroperitoneal plane was developed until the duodenum was identified. The lateral peritoneum was then opened and the mesentery was divided up to the middle colic artery. After complete mobilization of the right colon, both ends of the bowel were grasped and both the port and the specimen are taken out. If necessary, the umbilical incision was enlarged to a maximum of 4.5cm for specimen extraction. An extra-corporeal hand-sewn anastomosis was ensued using polyglactin 910 (Vicryl) 3/0 Fig. (5).

For sigmoid resection, the patient was placed in supine position. If necessary, the uterus was retracted with a trans-cutaneous stay suture, this maneuver was employed once in this study. The sigmoid was mobilized from medial to lateral. The peritoneum of the mesentery was opened, and the avascular plane was dissected identifying the ureter and the gonadal vessels. The inferior mesenteric artery and vein were dissected at the origin and divided. Next, the lateral peritoneum was then cut along the white line of Toldt.

Depending on the distance of the tumor from the anal sphincter, the rectum was mobilized, starting with the opening of the peritoneal reflection. The mesocolon and mesorectum were then divided. After complete mobilization distal to the marked tumor, the bowel was transected using endostaplers. The endostapler is inserted directly through the SILS port without a trocar. If needed, the descending colon was mobilized up to the splenic flexure to guarantee a tension-free anastomosis.

The specimen and the SILS port are extracted and the proximal resection line was marked. In some procedures, the incision was enlarged for retrieval of the specimen to a maximum of 4.5cm depending on the size of the tumor or mesorectum. A hand-sutured end-to-end anastomosis is made using Vicryl 3/0 sutures.

Linea alba was closed using prolene or PDS. Skin was closed by prolene 3/0 simple interrupted sutures.

Fig. 1: Covidien SILS port.

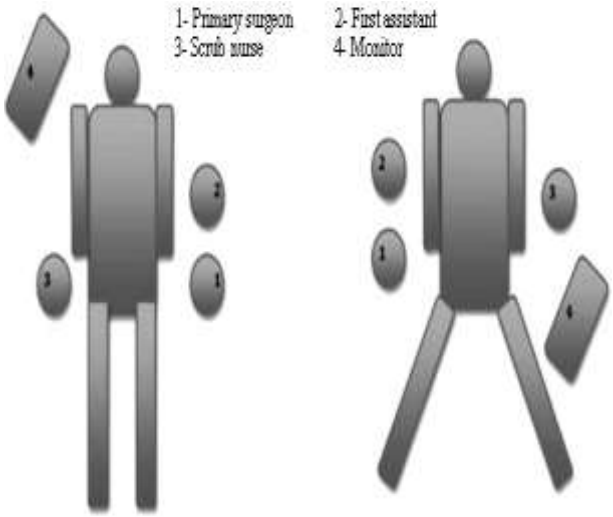

Fig. 2: Lt. image position for Rt. hemicolectomy, Rt. image is for Lt. colon surgery.

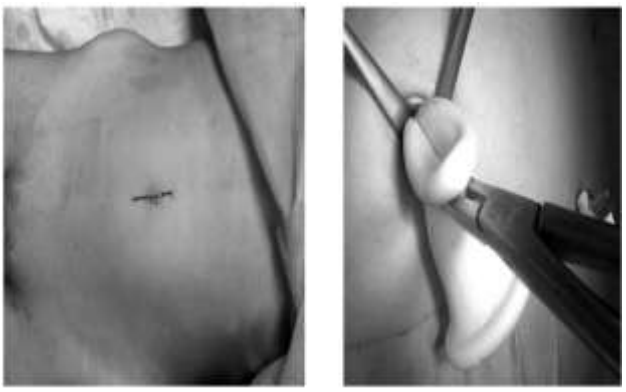

Fig. 4: Introduction of the port through the umbilical incision. Marking of the incision at the umbilicus before surgery.

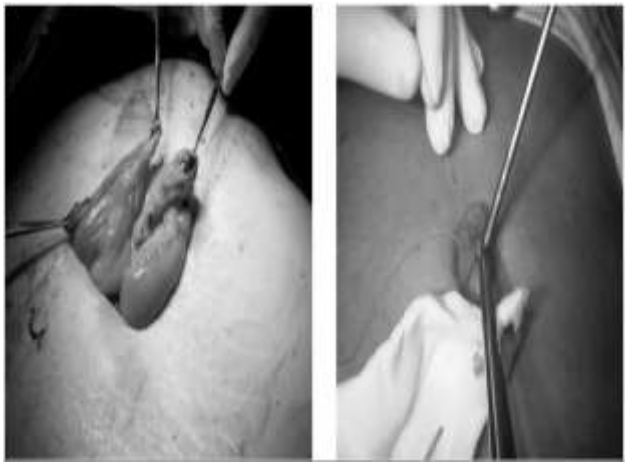

Fig. 5: Extra corporeal anastomosis through SILS incision.

RESULTS

Thirty four patients were included in this study and were divided into 2 groups; Group (A) which included 20 patients who were operated upon by conventional laparoscopy and Group (B) with 14 patients who were operated upon using SILS. The patients' ages in Group (A) ranged from 20 to 72 years old with mean age 52.85 and Group (B) 47.14. In Group (A) there was 1 1 males and 9 females, while in Group B there was 7 males and 7 females as shown in (Table 1).

In Group (A), 6 cases of right hemicolectomy was done, 2 cases of transverse colectomy, one case of left hemicolectomy, 4 cases of sigmoid colectomy, 6 case of abdominoperineal resection and one case of total colectomy. In Group (B), 6 cases of right hemicolectomy were done, 2 cases of left hemicolectomy, 3 cases of sigmoid colectomy, one case of abdominoperineal resection and one case of total colectomy (Table 2).

Operative and post operative data for two groups

A comparison was done between Group (A) and Group (B) in the operative details in the form of operative time and number of cases converted to open.

In Group (A) operative time ranged between

95min. to 480min. with mean time 225 minutes, while in Group (B) operative time ranged between 100min. to 180min., with mean time 137.5. There was significant decrease in operative time with SILS (*p*-value 0.0001). In Group (A), one case was converted to open due to uncontrolled bleeder, while in Group (B) 2 cases were converted; one because of uncontrolled bleeder and one due to markedly distended colon, *p*-value was insignificant (Table 3).

When it came to post operative pain, there was significant lower degree in Group (B) when com- pared to Group (A) with *p*-value=0.009. The degree of pain was assessed by visual analogue system.

In Group (A) length of hospital stay ranged from 6 days to 14, with mean 9. 1. In Group (B) it ranged from also from 6 to 14 days, but with mean 7.7 1. There was no significant difference in the two groups. As regards port site infection, there was no infection in Group (A), while there was two cases that had superficial infection in Group (B). That difference was insignificant (*p*=0. 162). There was no leakage in Group (A), while in Group (B) there was leakage in one case, pathology after that showed that it was Crohn's disease with affected margins. No significant difference between the two groups in this point (*p*=0.412).

All cases in Group (A) had free margins after histopathological examination, while in Group (B) there were two cases with affected margins, one was Crohn's disease of the terminal ileum and the other was cancer rectum. In the later abdominoperineal resection was done. No mortalities happened in Group (A) with one mortality in Group (B) due to pulmonary embolism on the seventh day post operative. There was no significant difference between the two groups (*p*=0.412). In Group (A) minimum number of lymph nodes extracted was 14 and maximum 25 with mean number 18.70 of these positive number of lymph nodes was 7 and maximally 12. In Group (B) minimum number was 6 while the maximum was 27 with mean 13.27. Number of positive lymph nodes was minimally 0-benign disease- and maximally was 9. There was no significant difference between the two groups with *p*-value of 0.08.

Table 1: Mean age.

Mean age		**Gender**	
		Male	**Female**
Group A Group B	52.85 47.14	11 7	9 7
Table (2): Types of	operations.		
Extent of resection		Group (A)	Group (B)
Ascending colon=Rt. hemicolectomy		6 (30%)	6 (42.85%)
Transverse colon= Transverse colectomy		2 (10%)	0
Descending colon=Lt. hemicolectomy		1 (5%)	2 (14.27%)
Sigmoid colon= Sigmoid colectomy		4 (20%)	3 (21.45%)
Rectum=Anterior restorative resection		0	1 (7.14%)
Rectum=Abdominoperineal resection		6 (30%)	1 (7.14%)
Total colectomy		1 (5%)	1 (7.14%)
Total		20 14	
Table (3): Operative data.			
Conventional		SILS	*p*-
(n=20)		(no=14)	value
Mean operative time 225±90		137.5±21	0.0001
Conversion to open 1		2	0.800
Table (4): Post operative sequelae.			
	Conventional (n=20)	SILS (no=14)	*p*- value
Post operative pain	3.15±0.489	2.36±1.082	0.009
Port site infection	0	2	0.162
Post operative leakage	0	1	0.162
Length of hospital stay	9.10±2.78	7.71±2.268	0.098
Post operative mortality	0	1	0.412
Table (5): Pathological re	sults.		
	Conventional (n=20)	SILS (no=14)	*p*- value
*Pathologically affected:*Margins	0	2	0.162
Lymph nodes extracted: Total min.	14	6	0.08
Max	25	27	
Positive min	7	0	
Max	12	9	

Table (6): Comparison between SILC and laparoscopic colectomy.

	Rodrigo				**Ichiro**		**Champagne**				**Sang**	
	LAP n=50	**SILS n=50**	***p*-value**	**LAP n=150**	**SILS n=150**	***p*-value**	**LAP n=165**	**SILC n=165**	***p*-value**	**LAP n=263**	**SILC n=44**	***p*-value**
• Operative	126±63.3	127±37.5	0.9	173±35	172±33	0.720	133±56	135±45	0.85	139.2	185	0.001
• Conversion	1	0	0.31	(3.3)	(1.3)	0.251						
• Pain				5.1	4.2	0.01	5.6	4.9	0.005	1.9±0.5	1.8±0.5	0.193
• Infection				5	4					1	0	0.797
• Leakage				2	2							
• LOS	4.0±1.7	4.5±3.7	0.42	8.7±3.3	8.2±2.7	0.155	.4.3±1.4	4.6±1.6	0.35	8.8±4.6	8.2±2.3	0.410
• Mortality					0	0						
• Pathologic	0	0								0	0	
• LN margins	21±8.4	19.2±7.6	0.17	22.4±6.0	22.2±5.6	0.767				27.4±15.8	23.2±12.3	0.111
	(12-49)	(10-39)										

DISCUSSION

Laparoscopic colectomy remained an unattended field till the beginning of the 21st century due to its steep learning curve and fear of inadequate resection with theoretical possibility of port site metastasis. Nowadays it is considered as a safe and feasible procedure.[6] Moreover, SLIS has entered the field of colorectal surgery aiming at decreasing surgical trauma and so enhancing recovery, decreasing hospital stay and hence more rapid return to normal activities.[7]

This prospective study was conducted to delineate the possible benefits of the use of SILS in colorectal surgeries and to compare the outcomes, morbidity and mortality between this novel technique and the conventional laparoscopic technique.

In our study, there was significant decrease in operative time when using SILS in comparison to conventional laparoscopy (p=0.001); this could be because in this trial all anastomoses done with SILS were done extracorporeally, in conventional right hemicolectomy anastomosis were done extracorporeal, while left sided colon surgery anastomoses were done intracorporeally. In Ichiro study which was conducted on 300 patients allocated as 150 in SILC group and 150 in MLC group, there was no significant difference with mean operative time 172 and 173min. respectively.[8] This also goes with Rodrigo who stated insignificant difference between the two groups with mean operative time in SILC and conventional laparoscopy 127.9 and 126.7min. respectively.[9] Hiroyuki also didn't find significant difference in operative time.[10] On the other hand, there was significant increase in operative time in SILC when compared to the conventional laparoscopic surgery group (185.0 minutes vs. 139.2 minutes, p<0.001) in Sang'sstudy.[11]

There was no significant difference between the two groups when it came to conversion to open. This goes with Hiroyuk in his study did not find significant difference as regards rate of conversion to open.[10] The same was mentioned by Ichiro with 2 and 5 cases converted to open in SILC and MLC respectively with no significance.[8] Sang in his study stated no conversion to open in either groups.

In this study, the post operative pain was significantly lower with the use of SILS technique when compared with the conventional laparoscopic technique (p=0.009). This goes with what mentioned by Poon et al., with significant decrease in post operative pain in SILS group versus multiport group.[12] This also goes with Ichiro et al., who stated significant lower post operative pain in SILC.[8] Chambgane stated that postoperative day one pain scores were significantly less for SILC (4.9 vs. 5.6; p=0.005).[13]

There was no significant difference between the two groups in the early post operative outcomes namely port site infection, anastomotic leakage, length of hospital stay (LOS) and mortality. Ichiro also stated no significant differences as regards the previously mentioned variables.[8] Hiroyuk is his study had no leakage in both SILC and MLC and also insignificant difference in the early post operative outcomes.[10] Similar results were found in a study conducted by Sang et al., in a study conducted on 300 patients.[11]

Pathological assessment revealed insignificant difference between the SILC and MLC as regards affected margins and number of lymph nodes retrieved. This goes Hiroyuk who stated median number of lymph nodes extracted in SILC group (median 15.0, range 3 to 30) and the MLC group (median 16.5, range 3 to 23) with no significant difference.[10] Chew and his colleague also showed insignificant difference between SILC and MLC as regards resected margins with mean number of lymph nodes extracted 19 and 18 for SILC and MLC respectively.[14] Poon et al., reported findings from a randomized controlled trial which enrolled 50 patients, 25 in each study group. The author found oncological outcomes comparable in the two groups.[12] Table 5 summarizes some results of different studies.

A more comprehensive study conducted by Champagne et al. In which three hundred patients were compared when operated upon using SILC to Multiport Laparoscopic Colectomy (MLC) from November 2008 to March 2010. SILC patients were matched with those undergoing MLC for gender, age, disease, surgery. The primary endpoint was length of stay and secondary endpoints included operative time, conversion, complications and postoperative pain scores. In this study, number of 165 patients operated upon using SILC versus 165 with MLC was evaluated. Operative time (135 ±45min. vs. 133±56min.; p=0.85) and length of stay (4.6±1.6 vs. 4.3±1.4; p=0.3 5) were not significantly different. Maximum postoperative day one pain scores were significantly less for SILC (4.9 vs. 5.6; p=0.005). Eighteen (1 1%) patients undergoing SILC were converted to multiport laparoscopy. There was no statistical difference between groups for conversions to laparotomy, complications, re-operations, or re-admissions.[13]

CONCLUSION

SILS is considered as a safe alternative to conventional laparoscopy in the field of colorectal surgery in hands of experts; however larger randomized controlled studies are to be performed to confirm these results.

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