

# Single Incision Laparoscopic Appendectomy (SILA) using Conventional Instruments vs Classical Laparoscopic Appendectomy (CLA)

Subhash Chawla<sup>1</sup>, AK Gupta<sup>2</sup>, Lipika Chawla<sup>3</sup>, Himani Chawla<sup>3</sup>

## ABSTRACT

**Introduction:** Laparoscopic appendectomy is a widely accepted minimally invasive procedure due to its advantages like reduced postop pain, shorter hospital stay, quicker recovery and improved cosmesis. In laparoscopic appendectomy, three ports are required for the placement of trocars. Single incision laparoscopic appendectomy (SILA) has more advantages of being further minimally invasive in form of further reduction in ports, post operative pain, improved cosmesis and is being accepted as a technically viable option for removal of the appendix.

**Material and methods:** The study was conducted over a period of 3 years from April 2012 to April 2015 at the department of General Surgery in two tertiary care service hospitals. We performed appendectomy in fifty patients by classic three port and single incision laparoscopic approach technique successfully. SILA was performed by the single experienced laparoscopic surgeon. 50 patients were randomized into two groups. Group I underwent SILA and Group II three port appendectomy. The patients were followed up till Dec 2016 thus the period of follow-up ranged from 8 months to 24 months.

**Results:** There was significant difference with mean operative time for SILA being longer (mean 49.32±11.75 minutes) ranging from a maximum of 70 minutes to a minimum of 30 minutes. Whereas for three port laparoscopic appendectomy mean time was 25.64±6.28 minutes ranging from a maximum of 35 minutes to 15 minutes minimum. It is seen that there was a significant difference between the pain suffered after first 6 hours of operation but no difference was associated in pain after 12 hours and 24 hours. Fifteen patients were discharged on the first postoperative day on semisolid diet. Analgesic use and visual pain score was less than multiport laparoscopic appendectomy. One patient developed stitch abscess which required drainage through port scar. Surgical wound healed well in all patients with inconspicuous umbilical scar.

**Conclusion:** SILA is technically feasible and safe in the hands of experienced minimally invasive surgeons. It is a new technique developed for performing appendectomy with invisible scar and is becoming popular amongst surgeons and patients.

**Keywords:** Single Incision Laparoscopic Surgery, Single Incision Laparoscopic Appendectomy (SILA), Classical Laparoscopic Appendectomy (CLA)

## INTRODUCTION

Open appendectomy is the commonest emergency surgery done by a general surgeon. The first laparoscopic appendectomy was performed by Kurt Semm<sup>4</sup>, a gynaecologist from Germany. In 1992, Pelosi<sup>1</sup> first described a single-puncture laparoscopic appendectomy in 25 patients. However, since last few years this new minimally invasive technique called the single incision laparoscopic appendectomy (SILA) is becoming a popular technique for laparoscopic appendectomy.

Single incision laparoscopic appendectomy is performed by two different techniques. One involves the application of traditional, low profile laparoscopic ports that are clustered within a single skin incision, but penetration of the peritoneal cavity is done through separate fascial points. The other technique involves the adoption of specialized ports created to provide multiple channels through a single port. Both the techniques have a good cosmetic effect. First single-puncture laparoscopic appendectomy was performed in 1992 and showed the new approach as a safe, inexpensive and effective alternative to the currently used multiple-puncture method.<sup>1</sup> It's a new technique developed for performing operations without a visible scar and is becoming popular amongst surgeons. Patients have a quicker recovery time and less post-operative pain scores, reduced post-operative complications such as infection, port site hernias, and hematomas. SILA procedure is associated with significantly less bleeding, while providing an improved cosmetic outcome despite a modest increase in the ratio of conversion.

The new transumbilical approach reduces the trauma of surgical access with its improvement of the postoperative pain and patient cosmesis compared to standard laparoscopic approach. However, other important issues must be critically analyzed such as time consumed, complications, and difficulties to perform this novel technique. The aim of the present study is to evaluate the feasibility and safety of single incision laparoscopic appendectomy as an alternative surgical procedure in making diagnosis and also performing surgery in patients presenting with symptoms suggestive of appendicitis.

## MATERIAL AND METHODS

From April 2012 to Apr 2015, 50 consecutive patients underwent laparoscopic appendectomy for appendicitis performed by single surgeon at tertiary care hospitals. Patients with appendicular lump, abscess, perforation requiring drainage procedure and with lower abdominal scars were excluded. Eligible patients were divided into two groups. The type of surgery was selected based on patient preference after written informed consent was obtained. General anaesthesia was used for all patients. SILA

<sup>1</sup>Associate Professor, <sup>2</sup>Professor, <sup>3</sup>Med Officer, Department of Surgery, Command Hospital (Western Command), Chandimandir-134107, Panchkula, Haryana, India

**Corresponding author:** Dr Ashok Gupta, Professor, Department of Surgery, Command Hospital (Western Command), Chandimandir-134107, Panchkula, Haryana, India

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was performed by a single umbilical incision in 25 patients. The other 25 patients underwent CLA. Duration of surgery was noted from the beginning of umbilical incision to closure of the same in both. Conversion was considered on addition of a single 5mm port in SILS. The same waterproof dressings, at the same sites, were applied in all patients in order to prevent nursing and other staff from knowing the technique carried out.

**SURGICAL TECHNIQUE**

The standard three port laparoscopic appendectomy patient is placed in a supine position. The surgeon and assistant stands on the left side of the patient, with the monitor placed on the opposite side. Pneumoperitoneum is created with veress needle puncture. A 10 mm umbilical port passed, a 5 mm suprapubic port used for insertion of the laparoscopic camera, and a 5 mm right lower abdominal port used for instruments. Adhesions were separated and mesoappendix was divided up to base of appendix by harmonic scalpel. Two endo loops were used to ligate the stump of the appendix. After transection of the appendix with harmonic scalpel, appendix removed from 10 mm port, the wounds are closed with 2-0 polyglactin sutures.

In SILA, umbilical incision is made and pneumoperitoneum is established using veress needle up to 12 mm Hg with CO2 and fish mouth space is created by reflecting the umbilicus caudally and three ports passed in micky mouse pattern.<sup>2</sup> We use conventional instruments and three 5 mm ports. We prefer a half moon incision window 1.5 to 2 cm in the umbilical fold so that resultant scar is buried in the umbilicus. One 5-mm port is used for a 0 degree 5-mm laparoscopic camera, two 5-mm ports are passed through the different fascial openings to reduce sword fighting of the instruments. The appendix is identified, mesoappendix is divided with harmonic scalpel and the base of the appendix is ligated with two or three endo loops. The appendix is then removed through 5 or 10 mm port depending on size of appendix. For cases difficult to resect because of perforation or severe inflammation, such as an abscess in the vicinity of the appendix and requiring drainage, an additional 5-mm port is inserted. If the appendix is swollen or contamination is severe, it is removed by inserting a lap bag, the abdominal cavity is washed with normal saline. The umbilical fascia is closed with nonabsorbable suture and the subcutaneous layer is sutured with 4-0 monocrlyl. Patients received a 1.0 g (adult) or 20 mg/kg (child) dose of cefotaxime before the operation. Intravenous antibiotics were continued during the hospital stay. Postoperatively, all patients received identical protocol of care. They were given injection Diclofenac 75mg x 8 hourly for one day and thereafter on demand. All patients were allowed fluid diet after subjective full recovery from general anesthesia and

semisolid diet once patient passed flatus. Postoperative pain was measured using the VAS (visual analogue scoring) every six hours except during sleep and whenever patients complained of pain. VAS score was graded from 0 to 10. All VAS scoring was performed by the attending nurse who was unaware of the ongoing study. Duration of hospital stay was taken from date of admission to date of discharge. Follow up of the patients was done at 1 week, 4 weeks, 12 weeks and 6 months and one year after the operation on the outpatient basis.

**STATISTICAL ANALYSIS**

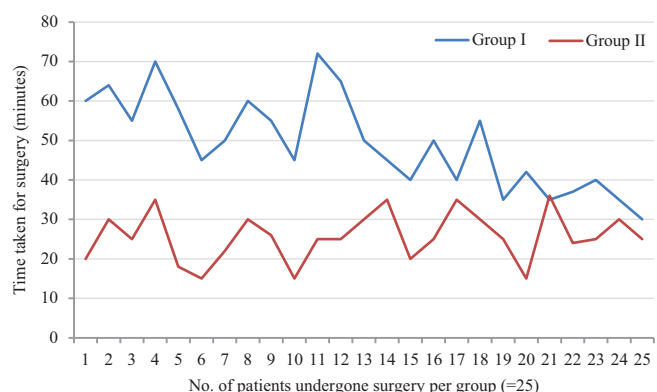
Primary outcome measures included postoperative pain and cosmetic result. Secondary outcome measures included operating time, conversion rate, hospital stay, nausea/vomiting, quality of life questionnaire, port site hernia. The data was collected as per standardized format and statistical analysis was performed using SPSS ver.13.0 (SPSS Inc., Chicago, IL, USA). A probability of 0.05 or less was considered statistically significant.

**RESULTS**

A total of 50 patients with acute and recurrent appendicitis were included in the study. 50 patients were randomized into two groups. Group I underwent SILA and group II three port appendectomy in the 36 month period from April 2013 to April 2015. The patients were followed up till Mar 2016 thus the period of follow-up ranged from 11 months to 24 months.

The two groups used in our study were similar in age (Table-1) and sex distribution.

As shown in Figure-1, the comparative profiling of operative time in both groups showed significant difference with mean operative time for SILA being longer (mean 49.32±11.75 minutes) ranging from a maximum of 70 minutes to a minimum of 30 minutes after initial few cases. Whereas for three-port



**Figure-1:** Comparative profiling of operative time

Age group	Group I (n=25)		Group II (n=25)		p value
	No. of patients	Percentage	No. of patients	Percentage	
10-20 years	02	8%	02	8%	
20-30 years	12	48%	14	56%	
30-40 years	09	36%	07	28%	
40-50 years	02	8%	01	4%	
50-60 years	00	0	01	4%	
60-70 years	00	0	00	0	
	Mean age: 32.3 years		Mean age: 31.9 years		0.09

**Table-1:** Age distribution

laparoscopic appendectomy mean time was 25.64±6.28 minutes ranging from a maximum of 35 minutes to 15 minutes minimum.

The comparative profiling was also performed for the pain suffered by the patient post-surgery after both procedures respectively. The pain rating was done after 6 hours, 12 hours and one day (24 hours). The confidence level of the analysis was 95% giving p values of 0.003, 0.351 and 0.406 for 6 hours, 12 hours and 24 hours respectively (Table 2). It is seen that there was a significant difference between the pain suffered after 6 hours of operation but no difference was associated with pain after 12 hours and 24 hours.

During SILA in two cases where we found omental adhesions one extra port of 5mm was needed whereas in one case with adhesions with abdominal walls two extra ports were used.

In group of conventional laparoscopic appendectomy, one case turned out to appendicular lump which was converted to open and appendectomy was successfully completed.

The comparative profiling of the factors governing the post-operative follow-up was done for cosmesis, post-operative patient hospital stay and nausea/vomiting experienced (Table 3). The confidence level of the analysis was 95% giving the p values of 0.004, 0.078 and 0.60 for cosmesis, post-operative patient hospital stay and nausea respectively. Statistically, except for cosmesis none of the other factors had any significant relation with respect to operative types.

Was assessed using the EuroQoL EQ-5D3L questionnaire at 6th week postoperatively.

The EQ-5D questionnaire is a generic measure of the quality of life, in which health status is defined in terms of 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The quality of life was equally good in both groups with no significant difference.

No port site hernia was seen in both groups.

There was one case in which an additional 5mm port outside the umbilicus was inserted due to adhesions with ileum during SILA. The median operative time was longer with SILA ( $P < 0.001$ ). There were no intraoperative complications, although one wound infection (omphalitis) developed in patients who underwent SILA. Time to pass flatus was achieved earlier in the CLA group ( $P < 0.001$ ), but there was no difference in time to regular diet and length of postoperative hospital stay.

Median and mean postoperative pain scores are listed in Table 2. When a discrepancy in pain scores presented within the same period, the highest scores were analyzed. Pain score in the 24 hours after surgery was higher in patients who underwent SILA ( $P = 0.009$ ). However, there were no differences for 24 to 48 hours and 48 to 72 hours after surgery. The change in postoperative pain score over time was significantly different between the two groups ( $P = 0.021$  by repeated measures analysis of variance). Patients in the SILA group tended to receive more total doses of analgesics (NSAIDs) in the 24 hours after surgery, but the difference was not statistically significant.

## DISCUSSION

Acute appendicitis is one of the most common acute surgical emergency reporting to a general surgeon. The first appendectomy was performed by a British army surgeon Amyon in 1735 to remove a perforated appendix. Diagnosis

Characteristic	SILA	CLA	P
N	25	25	
Operative time	49.32±11.75	25.64±6.28	<0.001
Pain_6hours	2.88±1.54	4.24±1.56	0.003
Pain_12hours	2.00±1.15	2.28±0.94	0.351
Pain_24hours	0.88±1.01	1.12±1.01	0.406

**Table-2:** Comparative profile of post-operative Pain in SILA and TPLA

Characteristic	SILA	TPLA	p
N	25	25	
Cosmesis(mean/SD) [Range 0-7]	5.8/1.0	3.8/1.1	0.004
Hospital Stay(mean/SD) [days]	1.56/0.45	1.67/0.52	0.078
Nausea/Vomiting (mean/SD) [Range 0-3]	1.4/0.32	1.8/0.46	0.60

**Table-3:** Comparative profile of the factors that governs post-operative follow-up

of appendicitis is generally straightforward, made on clinical history, examination, supported by a routine blood investigation and urine test. However in Infants, elderly, pregnant women and young children, the diagnosis is difficult because 33% to 50% will have atypical presentation.<sup>2</sup> The mortality rate of uncomplicated appendicitis is less than 1 percent, however complications like perforation and abscess carry a higher mortality rate of around five percent.<sup>3</sup> Appendicitis is one of the most common surgical emergencies, particularly among children, with the risk peaking at the age of 11–12 years, and the lifetime risk is 7%–9%.<sup>4</sup> The classical three-port laparoscopic appendectomy is currently considered the best approach to achieve proper triangulation.<sup>5</sup> At present, there is no evidence that a single-port technique is an adequate alternative to standard laparoscopic appendectomy. A recent prospective randomized trial of single-incision versus standard three-port laparoscopic appendectomy was performed and found that operative time, doses of narcotics, surgical difficulty were greater with the single-site approach.<sup>6</sup> Several other minimally invasive single-port or single-incision techniques have been introduced for the treatment of acute appendicitis.<sup>7,8</sup> However, the majority of these studies have demonstrated only safety, feasibility or ambiguous cosmetic outcomes, without definitive advantages over conventional laparoscopic appendectomy.<sup>9-11</sup>

As the number of ports is reduced to one, the length of the single fascial incision tends to be longer. The length of the fascial incision is closely associated with postoperative wound pain. The single umbilical incisions reported in other studies typically reached lengths of 15 to 20 mm.<sup>12,13</sup> However, there are only a few studies that have assessed pain after single-port or single-incision appendectomy. One prospective study found more total doses of analgesia were given to single-site patients during their hospital stay, but not during convalescence.<sup>14</sup> Another prospective study reported that VAS pain score during the first 24 postoperative hours was significantly higher in patients who underwent SILA<sup>15</sup> whereas two retrospective studies did not find differences in postoperative pain between SILA and CLA.<sup>16</sup> The present prospective study focused on postoperative pain and showed that pain score in the 24 hours after surgery was

higher in patients who underwent SILA, and that the change in postoperative pain score over time was significantly different between the two groups. These discrepancies in findings among studies may be due to different surgical techniques, operative time, and study design. In this study, the longitudinal fascial incision made through the umbilicus to insert the SILS port had a length of 20 mm. In surgical techniques using a 15 mm single umbilical incision, there was no difference in terms of VAS pain score and postoperative analgesic requirements.<sup>17</sup>

Our other concern was operative time. Our study found SILA to have an approximately 15 minutes longer operative time, which was statistically significant. Longer operative time may translate to more stretching of the single umbilical wound, and subsequently more postoperative pain. A limitation of this study is that it was not a randomized double blind study. However, the postoperative pain assessment was somewhat blinded as all scoring was performed by the attending nurse who was unaware of the ongoing study.

The only advantage of SILA over CLA is improved cosmetic results which this study has proved as per patient satisfaction. To emphasize the cosmetic advantages of SILA, an objective assessment of cosmesis should be performed comparing SILA with CLA in the future. However, although cosmetic results may be better in SILA, cosmesis may not outweigh other perioperative disadvantages. The time to pass flatus was longer in the SILA group in this study, and postoperative pain may be associated with delayed passage of flatus.

Surgeons should make an effort to reduce postoperative pain in SILA patients, especially in the 24 hours after the SILA. In this study, patients who underwent SILA tended to receive more total doses of analgesics (NSAIDs) in the 24 hours after operation, but there was no statistical difference between groups due to the small sample size and the relatively small number of analgesic doses administered in both groups. The mean number of analgesic doses administered in the 24 hours after SILA was 1.2 in this study. The postoperative dose of analgesics was somewhat small in part due to a superstition in Korea in which surgical patients believe that postoperative analgesics impede wound healing. In another study, the mean number of analgesic doses during a mean of 22.7 hours in the hospital after SILA was 9.6.<sup>18</sup> A better cosmetic score, length of incision, and less postoperative pain within 12 h were found with SILA. CLC was associated with a shorter operating time and required fewer additional instruments. There was no significant difference between SILA and CLC in regard to blood loss, open conversion rate, postoperative complications, time of hospital stay, time to initial oral intake, and time to resume work.

In conclusion, SILA is a technically feasible and reliable approach in experienced hands with short-term results similar to those obtained with CLA. SILA has a similar operation time in adults but needs more time in children, has similar complications, wound infection and length of the postoperative stay.<sup>19</sup> SILA is technically feasible and safe in patients with complicated appendicitis in hands of experienced surgeons. Jyrki et al performed SILA in both uncomplicated and complicated cases even with peritonitis.<sup>20</sup> All were managed by SILA technique without conversions or additional ports and they had an uneventful recovery. SILA is more technically challenging than standard laparoscopic appendectomy.<sup>21</sup> Surgeon's experience

still however influences performance. Surgeons with single incision laparoscopic surgery (SILS) experience have the best results on SILA. Single incision laparoscopic surgery for an appendectomy (SILA) is widely accepted and has become the best option for treatment of appendicitis.<sup>22</sup>

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