

Original Research Article

Comparative study of single incision versus conventional three port laparoscopic appendectomy

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ABSTRACT

Background: Appendicitis is primarily a disease of adolescents and young adults with a peak incidence in the second and third decades of life. Appendectomy for appendicitis is the most commonly performed emergency operation in the world. For more than a century, open appendectomy remained the gold standard for the treatment of acute appendicitis. Laparoscopic surgery has become popular universally during the last couple of decades. Efforts are still being made to decrease abdominal incision and visible scars after laparoscopy. Single incision laparoscopic surgery (SILS) is a new innovation allowing minimal access surgery to be performed through a single umbilical incision.

Methods: It was a prospective study carried out on 50 patients diagnosed as acute appendicitis. They were divided into two groups of 25 each. One group underwent Conventional Laparoscopic Appendectomy (CLA) and other group underwent Single Incision Laparoscopic Surgery (SILS). Results were compared with regard to mean operative time, complications, post-operative pain and discomfort (vas score at 12 hours), post-operative morbidity, duration of hospital stay and condition at discharge and cosmesis.

Results: There was no statistically significant difference between the two groups with respect to the parameters like postoperative pain, hospital stay and complication profile. However, operative time for SILS appendectomy were found to be significantly higher compared to conventional group.

Conclusions: Single incision laparoscopic appendectomy using standard laparoscopic instruments is safe and effective, feasible surgery with better cosmetic results.

Keywords: Appendicitis, Appendectomy, SILS

INTRODUCTION

For many years, the appendix was erroneously viewed as a vestigial organ with no known function. It is now well recognized that the appendix is an immunologic organ that actively participates in the secretion of immunoglobulins particularly immunoglobulin A (IgA).

Although it is an integral component of the gut-associated lymphoid tissue (GALT) system, its function is not

essential, and appendectomy is not associated with any predisposition to sepsis or any other manifestation of immune compromise.¹

Appendicitis is primarily a disease of adolescents and young adults with a peak incidence in the second and third decades of life.

There is a slight male to female predominance (1.2 to 1.3:1). It is the most common intra-abdominal condition

requiring emergency surgery and carries a lifetime risk of 6 to 7%.²

The aetiology of acute appendicitis remains poorly understood but is likely to be caused by luminal obstruction.² Causative agents include faecolith, hyperplastic lymphoid tissue, foreign bodies, parasitic infection, and luminal obstruction due to primary and secondary tumor.

Following obstruction of the lumen, continued mucus secretion subsequently results in increased intraluminal pressure and luminal distension. This may culminate in thrombosis and occlusion of small blood vessels and lymph flow stasis, resulting in tissue ischaemia. A damaged mucosal barrier allows bacterial invasion of the luminal wall causing transluminal inflammation. Continued ischemia can result in appendiceal infarction and perforation.^{3,4}

Appendectomy for appendicitis is the most commonly performed emergency operation in the world, 6% of all the surgical procedures.⁵ For more than a century, open appendectomy remained the gold standard for the treatment of acute appendicitis. However, laparoscopic surgery has become popular universally during the last couple of decades.

The increased interest in minimally invasive surgical approaches has been driven largely by the need to reduce patient morbidity following surgery, and thus increase postoperative recovery rates and shorten the length of stay in hospital.

However, despite these advantages, efforts are still being made to decrease abdominal incision and visible scars after laparoscopy.

Conventional laparoscopic appendectomy (CLA) uses three incisions, but a method using a single incision was developed through the accumulation of experience and the development of instruments. Single incision laparoscopic surgery (SILS) is a new innovation allowing minimal access surgery to be performed through a single umbilical incision.

As the umbilicus is located in the middle of the abdomen, so diverse intra-abdominal approaches can be performed; blood vessels and nerves are absent, so incision windows can be readily created; even after the surgery, wounds become depressed within the umbilicus and thus leading to "surgery without scar".

This cosmetic benefit may well lead to improved patient satisfaction with Surgery.⁶ The present study was conducted in order to assess benefits, if any, of single incision laparoscopic appendectomy over the conventional multiport laparoscopic appendectomy in terms of operative time, complication profile, postoperative pain, hospital stay, cosmesis and

conversion rate to multiple port laparoscopic appendectomy or to open appendectomy.

METHODS

This study was conducted in the Postgraduate Department of General Surgery, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu from November 2012 to October 2013.

After thorough evaluation through history, clinical examination and baseline investigations, patients were randomized into two groups:

Patients in the group A were treated with conventional three port laparoscopic appendectomy (CLA) and those in group B were treated with single incision laparoscopic appendectomy (SILS).

Inclusion criteria

Any case diagnosed as acute appendicitis regardless of age and sex.

Exclusion criteria

Bleeding diathesis, those with a history of major lower abdominal operation, pregnancy, appendicular lump, appendicular abscess. and patients in whom laparoscopy is contraindicated like severe cardiopulmonary disease in which the pneumoperitoneum under general anesthesia is contraindicated.

In both techniques intra operative assessment was done regarding time taken for surgery (time of incision to closure), complications, if any, conversion to conventional three port laparoscopic appendectomy or to open appendectomy.

Post-operative assessment was made and statistically compared about post-operative pain and discomfort (vas score at 12 hours), post-operative morbidity, duration of hospital stay and condition at discharge. Follow-up at first and second postoperative week to assess pain and discomfort, condition of wound and infection.

Cosmesis

The data was analyzed to assess the differences between the two groups viz., CLA and SILS for various parameters. Variables were presented as mean and standard deviation for quantitative and percentages for qualitative or as deemed appropriate.

Chi-square test was applied to evaluate statistical significance among proportions, paired 't'-test was applied to evaluate differences in mean values. A 'p'-value of <0.05 was considered as statistically significant. All 'p'-values used were two-tailed.

RESULTS

Comparison of both the groups on the basis of pre-operative parameters did not reveal any statistically significant difference between the two group (Table 1). Out of the 25 CLA patients, we found adhesions intra-

operatively in 4 patients. The appendix was gangrenous in another 4 of the cases. Amongst the 25 SILS cases, 4 patients had intra-abdominal adhesions, 7 had gangrenous appendix and peri-appendicular fluid was seen in 10 patients. This difference was not significant (Figure 1).

Table 1: Pre-operative parameters.

Parameters	CLA	SILS	Statistical significance
Mean age (years)	37.36±14.73	36.08±9.43	NS
Sex	Males	18	72%
	Females	7	28%
Mean BMI (kg/m ²)	22.81±3.22	23.76±1.54	NS
Symptom duration (hrs)	14.64±4.05	17.04±5.92	NS
Average TLC/mm ³	11232±1628.06	10944±151.17	NS
Neutrophils (%)	81.36±6.47	78.08±7.92	NS
USG diagnosis (%)	28	40	NS

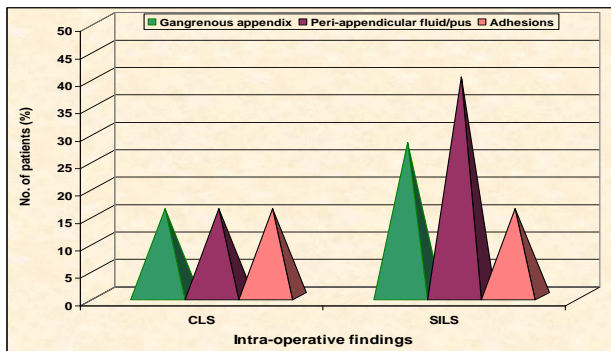


Figure 1: Intra-operative findings in patients of CLA and SILS group.

Mean operative time in the CLA group was 38.96±6.42 minutes and 62.21±10.42 minutes in the SILS group. This difference between the two groups was highly significant (Figure 2). The mean operative time was

significantly longer in the SILS group as compared to CLA group. In present study, only in one patient in the SILS group, the procedure had to be converted to open appendectomy because of technical problems due to adhesions. In all our patients, the intra-operative period was uneventful without any complications (Table 2).

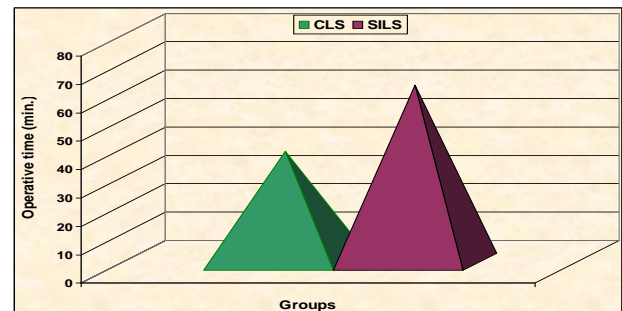


Figure 2: Mean operative time (minutes) in patients of CLA and SILS groups.

Table 2: Comparison of Intra-operative parameters.

Parameters	SILS	CLA	Statistical significance
Mean operative time	62.21±10.42	38.96±6.42	HS
Conversion to open	1	0	NS
Complications	Port-site bleeding	0	NS
	Excessive haemorrhage	0	
	Injury to other organs	0	

Most of our patients (33) from both the groups were discharged on 2nd post-operative day. 14 patients were discharged on 3rd post-operative day. Only one patient from the conventional group was discharged on 4th post-operative day because she lived in a far-flung area. The

mean hospital stay in the CLA group was 2.40±0.48 days and 2.16±0.55 days.

This difference between the two groups is not statistically significant. (p=0.140) (Table 3).

Table 3: Comparison of mean hospital stay (days) of patients in CLA and SILS groups.

Hospital stay(days)	CLA	SILS	Total
1	0	2	2
2	16	17	33
3	8	6	14
4	1	0	1
Total	25	25	50
Mean±SD	2.40±0.48	2.16±0.55	P= 0.140

P>0.05; not significant; Student's 't' test used

There were no statistically significant differences between the two groups regarding the pain scores in the immediate post-operative period (at 12 hrs), time to pass flatus, time to start orals and number of days of hospital stay (Table 4).

Table 4: Comparison of Post-operative parameters.

Parameters	CLA group	SILS group	p-value
Mean pain scores (VAS) at 12 hrs	6.56±1.083	6.24±1.615	NS
Mean time to pass flatus (hrs)	23.08±4.20	22.24±2.54	NS
Mean time to start orals (hrs)	14.68±4.27	12.72±3.39	NS
Mean hospital stay (days)	2.40±0.48	2.16±0.55	NS

Table 5: Follow up at 1st week.

Parameters	CLA group	SILS group	p-value
Mean pain scores (VAS)	1.84±0.94	1.80±1.08	NS
Port-site infection	0	0	NS

None of our patients reported with port-site infection at the end of 1st week. Similarly, the mean pain scores between the two groups had no statistically significant difference (Table 5).

Table 6: Follow up at 2nd week.

Parameters	CLA group	SILS group	p-value
No. of cases with pain	0	0	NS
Port-site infection	0	0	NS
Port-site hernia	0	0	NS

In the follow up at the end of 2nd week, none of our patients reported with pain, port-site infection and port-site hernia (Table 6).

DISCUSSION

Appendectomy is frequently performed as an emergency procedure in the management of a patient suffering from

acute appendicitis, a condition in which the appendix becomes inflamed. Appendicitis presents a lifetime risk of 6-7% and is recognized globally as the most common cause of acute abdominal pain.²

Since its introduction appendectomy has been the primary treatment of choice for acute appendicitis, and although antibiotics do have some established use, surgery remains. The operation can be performed with minimally invasive surgery (laparoscopic) or as an open procedure. Possible advantages of laparoscopic techniques include quicker and less painful recovery, less postoperative complications and better cosmetic results.

A recent development in appendectomy has been the introduction of less invasive Single Incision Laparoscopic Surgery using a single multi-luminal port, or multiple mono-luminal ports, through a single skin incision. Today, single incision laparoscopic surgery, first proposed by Pelosi MM is technically feasible. It further minimizes the trauma of surgery and is increasingly being considered a safe alternative to conventional methods.⁸⁻¹⁰

A total of 50 patients were selected for the study and randomised into two groups of 25 each, with one group undergoing single incision laparoscopic appendectomy (SILS) and the other group undergoing conventional three ports surgery (CLA). Out of the 25 patients undergoing SILS, 16 were males and 9 were females. In the CLA group, 18 were males and 7 were females. The difference between the two groups regarding the gender ratio was statistically insignificant. The results were in accordance with the observations made by Raakow R and Jacob DA.¹¹

The mean age of patients undergoing SILS was 36.08±9.43 years and that of CLA group, it was 37.36±14.73 years. The difference was insignificant between the two groups. This is in accordance with the comparative study conducted by Vilallonga R et al and Kang KC et al.^{12,13}

Among the 25 patients who underwent SILS, the mean BMI was 23.76±1.54 kg/m² and those who underwent CLA, the mean BMI was 22.81±3.22 kg/m². This difference regarding the BMI between the two groups was not significant similar to observations made by Raakow R et al and Kang KC et al.^{11,13} There were no significant differences between the two groups regarding the average duration of symptoms and pre-operative WBC count.

The operating time was defined as the time period from skin incision to skin closure. The average operating time in present study was 62.21±10.42 and 38.96±6.42 minutes respectively for the SILS and the CLA group. Operative time was found to be significantly higher for the SILS group similar to observations made by Kim HO et al in their study of 50 patients, of which 17 underwent single port appendectomy and 33 underwent three-port

laparoscopic appendectomy. The average operative time was significantly higher in the single port group as compared to three ports group.¹⁴ Our results are contradictory to the observations made by Raakow R and Jacob DA, Vilallonga R et al Stanfill AB and Matilsky DK.^{11,12,15} where no statistically significant difference was found between the two groups regarding the operative times in their studies.

Increased operative time in our SILS study could be because of the fact that SILS is technically challenging compared to standard laparoscopy as there is restricted degree of freedom of movement causing proximity of the instruments to each other disobeying the laparoscopic concept of 60-degree angle between two working instruments to maintain good ergonomics.

All the patients were given intra-operative dose of analgesic and the subsequent doses were given 8 hourly. The pain score was assessed 12 hours after the surgery using visual analogue scale i.e. after receiving two analgesic doses. The mean VAS score was 6.24 ± 1.615 and 6.56 ± 1.083 for the SILS and CLA group respectively. No significant difference was found between the two groups. This was in accordance with the observation noted by Vilallonga R et al. in a multicentric comparative study in 87 patients with acute appendicitis. 46 patients underwent SPAA and 41 patients underwent LA. There was no significant difference in the pain scores at 12 hours between the two groups.¹²

A similar observation was made by Bhatia P et al. in their case series involving 17 patients who underwent SILS appendectomy and found that the analgesic usage and the pain scores were similar to those of conventional laparoscopic appendectomy.¹⁶ Our results are contradictory to those of Kang KC et al. where the analgesic requirement and pain scores were significantly higher for the SILS group as compared to CLA group.¹³

Kim HO et al. also observed higher pain scores for the SILS group but the difference was not statistically significant.¹⁴ No intra-operative complications like excessive haemorrhage, port-site bleeding and injury to any organ were observed in both the groups. In one patient from the SILS group, the procedure had to be converted initially to two port and then to open appendectomy because of the technical difficulties due to adhesions. The intra-operative period was uneventful in rest of the patients. None of our patients required use of abdominal drains. The average time to start orals was 12.72 ± 3.39 and 14.68 ± 4.27 hours respectively for the SILS and the CLA group. The difference between the two groups was not significant. Similar observations were made by Vilallonga R et al. and Kim HO et al. where no significant difference was found between the two groups regarding the mean time to start regular diet.^{12,14} The average time to pass flatus was 22.24 ± 2.54 and 23.08 ± 4.20 hours respectively for the SILS and the CLA

group. The difference was not significant. This was in discordance with the result of Kim HO et al. where the mean time to pass flatus was 42 hrs for the single port laparoscopic appendectomy and 19 hours for the three ports appendectomy. They found the difference to be highly significant.¹⁴

In present study the mean hospital stay was found to be 2.16 ± 0.55 and 2.40 ± 0.58 days for the SILS group and the CLA group respectively. No statistically significant difference was found. Our observations were comparable to those of Stanfill AB et al. and Lee J et al.^{15,17} All the patients were called for follow up and stitches removed on 8th post-operative day and their pain scores were assessed using the visual analogue scale. No statistically significant difference was found between the two groups. None of the patients reported with port site infection or any other complication. Almost all the patients reported early return to daily activities which indicated faster recovery. Patients were also asked about the cosmetic appearance of the scar. Almost all the patients of single incision laparoscopic appendectomy showed satisfaction with the inconspicuous, barely visible scar. In the post-operative follow up at 2nd week, none of the patients reported with pain, port site infection or port site hernia.

CONCLUSION

Single incision laparoscopic appendectomy using standard laparoscopic instruments is safe and effective, feasible surgery with better cosmetic results.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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