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Original Research Article

Single incision laparoscopic appendicectomy versus conventional laparoscopic appendicectomy- a prospective study

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ABSTRACT

Background: The advent of Single incision laparoscopic appendicectomy (SILA) has encouraged surgeons to compare its benefits over conventional laparoscopic appendicectomy (CLA). We conducted a prospective study comparing SILA with CLA, evaluating parameters like operative time and complications, post-operative pain, duration of stay and the cosmetic outcome.
Methods: A prospective, comparative study of 94 consecutive patients was conducted at our institution between December 2014 and May 2016. The data regarding the various parameters were documented in both groups of patients.
Results: Among the 94 patients, 30 underwent SILA and 64 underwent CLA. We found statistically significant outcomes for SILA over CLA in variables such as operative time ($p=0.0018$), duration of hospital stay ($p\leq0.0001$) and cosmetic outcome ($p\leq0.0001$). Almost all patients in the SILA category showed no evidence of a scar after a three month follow up.
Conclusions: SILA was found to have a better outcome than CLA with regard to operative time, hospital stay and cosmesis. We conclude that this technique of SILA can be a better alternative to CLA.

Keywords: Appendicectomy, Laparoscopy, Single incision

INTRODUCTION

Appendicitis is one of the most common surgical emergency seen in young adults. Open appendicectomy was first carried out by Claudius Amyand in 1735, but was described in literature only later by McBurney in 1894.[1,2] For over a century open appendicectomy was followed as a gold standard for treatment of appendicitis. In 1983 Kurt Semm, a gynaecologist, first performed laparoscopic appendicectomy, which led surgeons to strive and improve upon it by drastically reducing operative duration, hospital stay, post op complications, post op pain, cosmesis, and quick return to oral feeding and routine work.[1] Since the first report of Single incision laparoscopic surgery (SILS) for acute appendicitis by Rispoli et al, it has been proposed as the next revolutionary milestone in minimally invasive surgery.[3] However, at that time evidence supporting the safety and efficacy of this approach was limited. The increased practice of SILS has led surgeons to ponder whether SILS can soon replace conventional laparoscopic surgery.

The ever-growing interest in SILA seems to be primarily focused on cosmesis, less post op pain with early recovery, reduction in hospital stay and expenses. SILA however has few limitations such as restricted degrees of freedom of movement, the number of ports that can be used, and the proximity of the instruments to each other, making it technically challenging. It is to be noted that a steep learning curve exists in all newer modalities and

can potentially serve as an area for future research. Present study aims to assess the comparability of SILA with CLA using conventional laparoscopic equipment, in various parameters such as operative duration, post op pain scores, intra operative complications, duration of hospital stay and the overall cosmetic outcome in both the groups.

METHODS

This was a prospective, comparative study of patients who underwent elective appendicectomy, in Mahatma Gandhi Medical College and Research Institute, Pondicherry, a tertiary care centre. This study commenced in December 2014, after ethical approval from the Human Ethics Committee of the Institute, and ended in May 2016. All patients falling under the inclusion criteria mentioned below, were included in this study after informed consent.

Inclusion criteria

All patients above the age of 18 years, undergoing elective appendicectomy.

Exclusion criteria

- Patients presenting with symptoms of appendicular perforation, abscess or localised peritonitis.
- Patients with contraindications for laparoscopic surgery.
- Patients who were contraindicated for general anaesthesia.

Laboratory investigations

Routine tests included complete hemogram, urine analysis and microscopy, serum electrolytes, renal function tests and ultrasonography of the abdomen to confirm the diagnosis of appendicitis.

The patients were divided into two groups,

- Group A- 30 patients who underwent SILA
- Group B- 64 patients who underwent CLA

Parameters such as operative duration, intra operative complications, post-operative pain score, duration of hospital stay and cosmetic outcome after 3 months' post op were documented. Pain was scored using Visual analog pain scale along with Wong-Baker Faces pain rating scale, and a simple bedside, 6-point wound evaluation scale was used to assess the cosmetic outcome (Table 1). A wound with a score of 6/6 was considered as having an optimal scar.[4,5]

In the SILA group, a 2-cm vertical transumbilical incision is made under direct vision down to the peritoneum. The single-incision laparoscopic surgery Port is then inserted into the cavity, using curved artery forceps. The triple-entry port is used to create a pneumoperitoneum of 12-15 mm Hg, two 5mm trocars and one 10mm trocar are inserted, one of them being for the telescope.

Table 1: Wound evaluation scale.

Wound evaluation scale	
Step off borders	0 for Yes, 1 for No
Contour irregularity puckering	0 for Yes, 1 for No
Scar width >2 mm	0 for Yes, 1 for No
Edge inversion- sinking, curling	0 for Yes, 1 for No
Inflammation – redness, discharge	0 for Yes, 1 for No
Overall cosmesis	0 for poor, 1 for acceptable

The patient is placed in the 30- degree Trendelenburg position and 20-degree left lateral decubitus for adequate intra peritoneal exposure of the right iliac fossa. Conventional laparoscopic instruments(rigid) were used to perform the appendicectomy. The SILS port is removed and the wound was closed with an absorbable suture and inverted, aiming at a scar free surgery (Figures 1-3).

Figure 1: Triple entry single incision port with obturators.

Figure 2: Port in position with conventional rigid laparoscopic instruments.

Figure 3: SILA patient at 3 month follow up.

In the CLA group, the procedure was done according to the established standard 3 port technique for removal of the appendix. The three port sites were closed with sutures. All patients in both groups received the same regimen for post -op analgesia.

RESULTS

The data collected was then incorporated into an Excel Data Sheet. This data was further analyzed using the Statistical Package for the Social Sciences v20.0 software (SPSS). The comparative evaluation of operative duration, post op pain scores, duration of hospital stay, intra operative complications and cosmesis in both SILA and CLA groups were calculated using 'chi square' test and 't' test.

Distribution by age

The following table shows the distribution of patients according to their age. It showed that the majority of patients were between 30-40 years of age (36.7%) in SILA group and 20-30 years of age (38.3%) in CLA group. There were 33.3% patients between 20-30 years of age in the SILA group and 26.6% patients between 30-40 years of age in CLA group (Table 2).

Table 2: Demographic data.

Age in Years	SILA		CLA		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
<20 Years	4	13.3%	12	18.8%	16	17%
20-30 Years	10	33.3%	26	40.6%	36	38.3%
30-40 Years	11	36.7%	14	21.9%	25	26.6%
>40 Years	5	16.7%	12	18.8%	17	18.1%

Comparison of clinical parameters

The groups were compared by 't' test and the results of, duration of surgery (t=2.98, p=0.0018), duration of hospital stays (t=9.389, p<0.0001) and cosmetic outcome (t=44.954, p<0.0001) were significant. The result of pain score (t=1.065, p=0.144) shows that there is no significant difference between the groups in terms of pain score (Table 3). Intra operative and immediate post-operative complications. There was only one patient who was converted to open appendicectomy from SILA, due to extensive adhesions rendering dissection of the appendix difficult. Among the CLA group there were no intra operative or immediate post-operative complications in any patient.

Table 3: Comparison by clinical parameters.

Clinical Parameters	SILA		CLA		't' Value	'p' Value
	Mean	SD	Mean	SD		
Duration of surgery	37.133	15.19	48.703	15.528	2.98	0.0018 (S)
Pain Score	1.7	0.5959	1.8593	0.709	1.065	0.144 (NS)
Cosmetic	1.2	0.5508	2.703	0.7904	9.389	<0.0001 (S)
Outcome	0.133	0.7302	5.7968	0.477	44.954	<0.0001 (S)

(S – Significant, NS – Not Significant)

DISCUSSION

Acute appendicitis is a common condition prevalent in adolescent patients but at times also presents in adults. Early diagnosis and choice of treatment is pivotal as a delay, can lead to increased morbidity and mortality. Since the advent of laparoscopic surgery, surgeons throughout the world have constantly worked towards improving the surgical methods to treat this condition. The aim was to make the treatment, as patient friendly

and surgeon friendly as possible. Single incision laparoscopic appendicectomy, first published by Rispoli et al revolutionised minimal invasive surgery with regard to appendicectomies.[3] In this age of minimal access surgery, there has been a continuous debate among surgeons, on whether Single incision laparoscopic appendicectomy(SILA) is the treatment of choice for this condition. With more patients requesting for affordable day care surgery and better cosmesis in recent times, research work to evaluate the benefits of SILA over the conventional laparoscopic appendicectomy (CLA) has become the need of the hour.

The principle aim of the study was to assess the benefits of single incision laparoscopic appendicectomy over conventional laparoscopic appendicectomy while employing standard SILA technique but with rigid laparoscopic instruments instead of the routinely used expensive roticulating laparoscopic instruments. Hence various parameters such as operative duration, complications during surgery, post op pain, duration of hospital stay and cosmetic outcome were evaluated in both groups for the same.

The collected data of the aforementioned parameters in both groups were evaluated using simple 'chi square test' for direct comparison and 't test' for comparing the average of the outcomes in the clinical parameters in both groups. The results of a direct comparison showed statistically significant outcomes for SILA in duration of hospital stay ($p\leq0.0001$) and in the cosmetic outcome ($p\leq0.0001$). But there was no significant result with regard to operative duration (p=0.06) and post op pain on POD#1 (p=0.306).

However, comparing the average of the outcomes in the same parameters showed statistically significant results for SILA in operative duration (p=0.0018), duration of hospital stay ($p\leq0.0001$) and cosmetic outcome ($p\leq0.0001$). The post op pain score was found to be comparable in both groups (p=0.144). Kim et al, and Wu et al compared the post op pain scores in patients who underwent SILA using a SILS port and conventional laparoscopic instruments and patients who underwent CLA. While the former suggested that in SILA patients there was an increase in use of analgesics in the post op period (p=0.009), the latter suggested results that were similar to our study (p=0.132), where the pain scores were comparable between the two groups with no significant p value (p=0.144).[6,7]

Wu et al, also found that operative time for SILA was more compared to the CLA group (p=0.000), whereas in our study we found SILA performed with less time when compared to CLA (p=0.0018). We believe this could be due to the result of one surgical team operating for SILA and the others operating for CLA in our study. The results of the remaining parameters such as duration of hospital stay and complications during surgery were similar to our results.[6] Comparing the results of studies that employed the glove port technique for SILA with the results of our study, we found that in the first study by Kang et al, they found that post op pain was less in the SILA category and also in view of cosmesis the result was similar(p=0.043) to present study where the three was better cosmetic outcome in SILA than in CLA ($p\leq0.0001$).[8]

Lee et al, in their study, found similar results to our study ($p\leq0.0001$) with regards to duration of hospital stay where patients operated with CLA required a longer period of admission (p=0.018). They also found that 27% of SILA patients required an additional port insertion for better dissection, which is contradicting to our results where we had to convert only one patient to open appendicectomy from SILA.[9]

Another study by Lee et al, stated that there was no significant difference between the two groups in operative time, duration of hospital stay and pain scores. Although our findings are similar to theirs with regards to pain scores in both groups, we found contradicting results with the remaining parameters as patients who underwent SILA had considerably less operative time and hospitalization.[10]

Baik et al showed that in their study, there was increased post op pain on POD#1 (p=0.048) in the SILA category, but this finding is not common between our study and theirs. Although the remaining variables were comparable in both groups which was similar to our study.[11] Kang et al in another study concluded that other than a marginal increase in operative time in SILA (0.276) all the other variables were quite comparable.[12]

The glove port technique although cost effective could considerably increase operative time as it has a steep learning curve, and surgeons require high technical skills to perform it. And some studies showed post op pain to be increased in SILA.[12] Hence our technique could be a simple alternative to the glove port technique with better results in operative time, pain scores, hospital stay and cosmesis.

Commercially available roticulating instruments have allowed surgeons to achieve triangulation and manoeuvre freely with the working instruments, but they have a steep learning curve and are not cost effective for the patient. St peter et al conducted a study to compare SILA and CLA employing this surgical technique for the former. They found that the operative duration, post op pain and cost of surgery were all considerably increased with the SILA patients which were contrary to our findings. They concluded that hospitalization was for a similar period in both groups, whereas in our study SILA patients required lesser hospitalization than CLA patients.[13]

Teoh et al concluded that all variables were comparable in both groups, but found that SILA patients complained of pain on stress eg. Coughing (p=0.001). They also

found that the cosmetic outcome in the SILA category was satisfactory compared to CLA (p=0.002) which is concurrent with our finding.[14] And three separate studies employing this technique showed that SILA had a minimally increased pain score when compared to CLA.[15,16]

Frutos et al, contrary to our results inferred that the operative duration was marginally longer in SILA (p=0.02), and less pain post op (p≤0.001).[17] These findings suggest that the post op pain scores in SILA in all these studies have been variable, which could be attributed to the heterogeneous methodology of pain assessment. A standard pain scale and post op analgesic administration is required to accurately assess these outcomes.

Karakus et al conducted a retrospective study from which they concurred that hospital stay and complications were less in SILA, similar to our findings.[18] Whereas, Liang et al conducted another retrospective study, and found that post op pain and operative time were comparable in both groups with a slight increase in hospital stay among SILA patients which is dissimilar to our outcomes. Again a standard protocol that is practiced in all hospitals, needs to be in place to assess the actual requirement for admission in both groups.

CONCLUSION

Single incision laparoscopic appendicectomy using rigid laparoscopic instruments is seen as a feasible and better alternative to conventional laparoscopic appendicectomy. The study concludes that SILA although having a high learning curve, with an experienced surgeon can be less time consuming, with reduced hospital stay and also have an excellent cosmetic outcome when compared to CLA. The highlight of this technique was that, we found no assessable scar in almost all our SILA patients after a three month follow up period.

The pain scores in both groups were found to be comparable but a standard protocol for pain management in these patients needs to be employed to further confirm this finding. The frequency of complications and conversion to open surgery were at a bare minimum. The technique however, requires further research through randomized trials to mandate its need in all age groups and hospital settings. The learning curve required for surgeons to perfect this technique is a potential area for future research.

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