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Research Article

Comparative analysis between single incision and conventional laparoscopic appendectomy for acute appendicitis

Sreeram Sateesh[1], Harsha Subraj[2], Gangaiahgari Mahesh[3], Pasupuleti Sreenivasa Rao[4*]

[1]Professor, [2,3]PG Student, Department of General Surgery, [4]Research Scientist, Department of Advanced Research Centre, Narayana Medical College and Hospitals, Nellore, AP-524002, India

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***Correspondence:**
Dr. Pasupuleti Sreenivasa Rao
E-mail: sraopasupuleti@yahoo.com

ABSTRACT

Appendicitis is an acute inflammatory condition of appendix. Since it is a surgical emergency, needs early diagnosis and treatment strategies which include clinical examination, followed by Laboratory investigations and Imaging studies. The scoring systems like Alvarado score have been considered for better diagnosis. In most studies surgery has been reported as the best modality of treatment. Several studies clearly mentioned the impact of various surgical procedures which include Open appendectomy (OA), Conventional laparoscopic appendectomy (CLA) and Single incision laparoscopic appendectomy (SILA). Hence, the present study is carried in an aim to assess and compare the merits and demerits between the surgical procedures Like SILA and CLA. The patients were randomly selected from the surgical department (NMCH) who presented with acute pain abdomen and diagnosed as acute appendicitis. 50 patients were enrolled in the study after fulfilling the inclusion and exclusion criteria. The various demographic variables have been studied between the surgical procedures to demonstrate their impact, which include wound infection rate, pain scores at 24 and 48hrs, the amount of time period for surgery in minutes, patient satisfaction scores and post-operative stay tenure at the hospital in days. The laparoscopic hand instruments used in both techniques are similar, except covidien port which was reused in SILA, following gas sterilization to reduce the cost. Findings reveal that the pain score was significantly lower in SILA than CLA group. The procedure time is comparatively more in SILA than CLA group. Patients had significant satisfaction score in SILA measured at 6 weeks after appendectomy. However the post operative stay, wound infection rate was almost similar in both the groups. There was no conversion to open Appendectomy performed in either of these groups. Results also clearly suggest that the SILA procedure is the safe, alternative and effective technique for the better management of acute appendicitis and seems to be better choice.

Keywords: Acute appendicitis, Laparoscopic, Single incision, Appendectomy

INTRODUCTION

Acute appendicitis is a surgical emergency causing significant mortality and morbidity.[1] In other words it is referred as an acute inflammatory condition of the appendix. Most cases require immediate action to avoid unnecessary complications through surgical procedures like open or laparoscopic appendectomy.[2] Appendicitis is one of the leading cause for abdominal surgical emergencies. Worldwide statistics reveal its incidence is more than 8%.[3] The majority of the patients suffering with this mainly present with abdominal pain followed by vomiting, fever and migration of the pain to the right iliac fossa.[4] Recent studies also demonstrated that the patients up to 50% will present with features of classical presentation related to pain in the right iliac fossa.[5] Moreover rupture of appendix leads to inflammation and infection in the intestinal lining, which paves a way to sepsis, clinically called as peritonitis, which further directs to circulatory shock.[1] Hence, early diagnosis and intervention strategies were necessitated to overcome mortality and morbidity.[5]

Few studies indicated that the surgical removal of appendix leads to economical burden to the patients associated with various health and psychological issues.[6] Earlier studies also revealed that the effective and timely diagnosis, followed by appropriate intervention procedures which achieve the target for the better management of acute appendicitis.[7-8] However, difficulties will also arise in diagnosing acute appendicitis which varies across various age groups ranging from 5-70 years, either in males or females.[9]

Various strategies were employed for the better diagnosis of appendicitis, which includes clinical examination, supported by diagnostic modalities like Ultrasound scan or CT scan.[10-12] Moreover, traditional clinical scoring systems like Alvarado scoring is also helpful in early diagnosis of acute appendicitis and its co relation with histopathology.[13] The best treatment for acute appendicitis is through surgical removal, prior to perforation and its related complications.[1] Previous studies clearly demonstrated various surgical interventions for treating acute appendicitis. For instance the procedures like the open appendectomy needs 2 to 3 inches incision, near lateral border of the right rectus abdominus muscle, with muscle splitting, followed by opening of peritoneum and the appendix is identified. The mesoappendix is dissected, ligated and appendix is transected at the base and the stump is burried.[14]

However, due to technological revolution various surgical interventions have been introduced.[15] Out of these, the minimal invasive surgical procedures like laparoscopic appendectomy is the best choice for the management of acute Appendicitis. The First introduced version was conventional Laparoscopic Appendectomy (CLA), which has standard three port technique. The advantages are shorter hospital stay, reduced risk of complications, better view of the entire abdomen and better cosmetic satisfaction.[16-17] The latest introduced version has one port technique, which has several advantages in performing surgical interventions without scars (scar less surgeries).[18] Out of all the latest versions, currently used Trans umbilical Single incision laparoscopic surgery (SILS) has been stated as scar less surgery as the healed scar was concealed within the umbilicus.[19-20] However, for every procedure there are advantages and as well as disadvantages. Therefore, the present study is carried in an aim to assess and compare the merits and demerits between the surgical procedures.

METHODS

Study Design: An Open randomized prospective study has been conducted in the surgical unit of Narayana Medical College & Hospital, (NMCH) Nellore, Andhra Pradesh, India, which has been situated near the seacoast within a radius of 10 km.

Period of Study: The study has been carried out in the period of May 2010 to May 2012.

Inclusion Criteria: Patients with symptoms of acute appendicitis of any age group and of both sexes presenting to Surgery department were included with their informed consent after obtaining the permission from the institutional ethical committee. Total 50 patients have been enrolled in the present study.

Exclusion Criteria: Patients presenting with appendicular abscess, perforation, peritonitis and patients with prior open laparotomy with incision through the umbilicus were excluded. Patients enrolled in the study were subjected to routine investigations as described. The investigations like, C.B.P., C.U.E., R.F.T., Viral screening, Ultra sound Abdomen, X-ray Chest, X-ray KUB and ECG has been performed. A proforma containing information about the patients and significant variables were included to compare advantages and disadvantages of Conventional and Single incision Laparoscopic Appendectomy.

Patients were assigned to either Single Incision Laparoscopic Appendectomy (SILA) or Conventional three port Laparoscopic Appendectomy (CLA) in 1:1 ratio. Same surgical team has performed these surgeries using either of these technique. Primary end points include operative time, complication rate, postoperative pain, post operative hospital stay and patient satisfaction score has been documented. Operative time was from the time of incision to time of wound dressing. The pain intensity was measured by using Numerical Rating Scale (N.R.S.) at 24 hours and 48 hours respectively, as described ealier.[21] Postoperatively, analgesia was maintained in all the patients with Injection Tramadol 100mg, slow IV, for consecutive three doses. The first postop day onwards the patients were subjected to oral analgesia drugs for 2 days. Data from these patients, who were discharged prior to 48 hours post operatively, was documented through verbal communication. Patients included in the present study are in regular follow up with surgeon to know early post-operative complications. Statistical analysis was performed using statistical software (SPSS version-16) as described.[22-24]

Surgical Procedures

Mainly two procedures were selected for the present study.

CLA procedure

In this procedure after inducing general anaesthesia, the patient is placed in supine position as described.[25] The surgeon and the assistant stands on the patients left side, where as the video monitor is placed on the right side. Initially, 11mm port is placed supra umbilically. An open technique is used to gain access in to the peritoneal cavity. 30 degrees telescope is used for this procedure. Once adequate CO_2 pneumoperitoneum (12mmHg) is established, laparoscopic abdominal exploration is performed. The second 6mm port is placed in the left iliac fossa. The third 6mm port is placed at the right iliac fossa, to maintain the triangulation. The appendix is

identified and its base is dissected from mesoappendix. Then the appendix is transected after applying endoloop or with laparoscopic linear stapler. The appendix is removed from the 11mm supraumbical port. For this, 5mm telescope has been used in the right iliac fossa port.

SILA procedure

Similarly, in this procedure also, after inducing general anaesthesia, the patient is placed in supine position as described.[25] The surgeon and the assistant stands on the patient left side, where as the video monitor was placed on the right side. The covidien port was used for all the SILA procedures. Initially, umbilicus is everted by employing Kocher's forceps. Local anaesthesia, 5ml of 2% xylocaine is infiltrated along the line of incision. A vertical 1.8 -2cm, incision is placed along the groove of umbilicus. Covidien port is placed through umbilicus, where it accommodates 3 trocars, one with 11mm and the other two with 6mm. Appendix is identified and removed as done in CLA. For initial cases, roticular instruments was used later conventional laparoscopic instruments was used.

RESULTS

The present study is carried in an aim to assess and compare the merits and demerits between the surgical procedures Like SILA and CLA. All the cases were randomly selected from the surgical department (NMCH) who presented with acute pain abdomen and diagnosed as acute appendicitis. 50 patients were enrolled in the study after fulfilling the inclusion and exclusion criteria. Initially various demographic variables have been studied. The variable age represents all the patients were in between the age group of 11-76 years. Out of these females were found to be in between the age group of 13-50years, whereas males were in between age group of 11-76years.We also assessed the age pattern among these procedures. Findings reveal that distribution of age in S.I.L.A. group was found to be in between of 12- 57 years and CLA group were in between 11-76. Males 29 (58%) were found to be dominant when compared with females21 (42%). These 50 patients were distributed equally (25+25) for both the procedures. Among 29 males, 15 were subjected to SILA whereas 14 were subjected to CLA procedure. Similarly, among the 21 females, 10 were subjected to SILA and 11 for CLA.

Further we compared between the procedures based on the selected variables (Table 1& 2), which include wound infection rate, pain scores at 24and 48hrs, time period for surgery in minutes, patient satisfaction scores and post-operative stay at the hospital in days. The findings reveal that wound infection was noticed in 2(8%) patients of CLA and in 3(12%) patients of SILA respectively. Next, we compared the pain scores between the procedures at 24 and 48 hrs respectively as described[21] (Jensen MP et al 1989). The observed pain scores at 24hrs interval reveal that in CLA procedure, the score found to be in between 4- 8 with mean value of 5.16, whereas in the SILA procedure score was in between 3-8 with mean value of 5.04 respectively. Similarly, at 48hrs the CLA score was in between 1-6 with mean value 2.92, whereas SILA score was in between 1-4 with mean value of 2.08, which was significant ($P \leq 0.003$). Pain scores measured at 24 hours were similar between two groups with P value of 0.72, where as the pain scores at 48 hours exhibited P value of 0.003, which was significant.

Table 1: Comparison of demographic variables between the surgical procedures.

Variables		C.L.A.	S.I.L.A.	Total
Sex	Male	14(56%)	15(60%)	29(58%)
	female	11(44%)	10(40%)	21(42%)
Total		25	25	50
Wound infection				
Present		2(8%)	3(12%)	5(10%)
Absent		23(92%)	22(88%)	45(90%)
Total		25	25	50

Table 2: Comparison of demographic variables between C.L.A and S.I.L.A.

Variables	C.L.A			S.I.L.A.			
	Min	Max	Mean	Min	Max	Mean	P Value
Pain scores in 24 hrs.	4	8	5.16	3	8	5.04	0.72
Pain scores in 48 hrs.	1	6	2.92	1	4	2.08	0.003
Time of surgery in mints	20	60	34.2	25	70	39.01	0.161
Patient satisfaction score (1 to 10)	6	10	8.04	8	10	9.08	0.0001
Post op stay in days	1	4	2.08	1	4	1.8	0.245

Later we studied the amount of time period for the completion of these procedures and also compared. Findings reveal that the CLA procedure was completed in between 20- 60 minutes with mean value of 34.2, whereas SILA procedure was completed in between 25-70minutes with mean value of 39.01 respectively.

Further, we studied the satisfaction score of the patients between the procedures and also compared. The data suggests that the patient satisfactory score for CLA found to be in between 6-10, with mean valve of 8.04, whereas for SILA it was in between 8-10 with mean valve of 9.08, which has significance ($P \leq 0.0001$).). Patients had

significant satisfaction score in SILA group than CLA group with P value 0.0001 measured at 6 weeks after Appendectomy. Furthermore, we assessed the post-operative stay tenure at the hospital. The results clearly states that the score of CLA and SILA is found to be in between 1-4 days, the post operative stay was almost similar in both the groups.

DISCUSSION

As mentioned above appendicitis is an acute inflammatory condition of appendix. Since it is an surgical emergency, needs early diagnosis and treatment strategies.[5,7-8] Earlier studies demonstrated various investigative modalities for early detection of appendicitis which include Clinical examination, followed by Laboratory investigations and Imaging studies like U.S.G. &C.T.Abdomen.[10-12] Along with this various scoring systems[26-27] have been considered for its diagnosis. One of the studies[28] conducted by us based on the Alvarado scoring system[13] revealed its impact for better diagnosis of acute appendicitis. In most studies Surgery has been reported as the best modality of treatment in treating acute appendicitis.[6,8] Several studies clearly mentioned the impact of various surgical procedures,[6,8] which include either Open appendectomy (O.A.), Laparoscopic appendectomy or Conventional laparoscopic appendectomy (CLA)[15] and Single incision laparoscopic appendectomy (SILA).[18]

Earlier studies mentioned that Open appendectomy (O.A.) has been performed in majority of cases through McBurney incision, [14] along with other methods like lanz incision and right para median incision. Further advancements in the minimal invasive surgical procedures like Laparoscopic appendectomy (L.A.) have shown the new way for the better diagnosis and treatment. Moreover LA has more advantage over O.A, like less haemorrhage, decreased pain, less hospital stay, minimal infection rate, better view of the entire abdomen and better cosmetic appearance.[16-17] With the development of advances in laparoscopic instrumentation and handling, Single incision laparoscopic appendectomy (SILA) has been employed for appendectomy. Pelosi et al reported the first single-incision L.A. in 1992, although the technique did not attract much interest until recently. The R-port, Uni-X Single Port, Tri Port, Quad Port and Covidien Port systems are the major ports commonly used in SILA. Thus, the present study is carried in an aim to assess and compare the merits and demerits between the surgical procedures Like SILA and CLA as mentioned above, the cases referred to surgical department (NMCH) who presented with acute pain abdomen and diagnosed as acute appendicitis were included. Nearly patients up to 50 were enrolled in the study that fulfilled the inclusion and exclusion criteria. Various demographic variables have been studied between the groups, compared and documented (table-1and 2). Findings reveal that most patients of both sexes were in between the age group of 11-76 years, in which males are in 11-76 years, while females are in 13-50 years.

Comparison of age pattern among these procedures revealed that age distribution in SILA was in between 12-57 years, while in CLA group was in between 11-76 years respectively. Males were predominant when compare to females.

Earlier studies successfully demonstrated the significance of L.A., which was performed first in 1983.[15] later this procedure has been modified according to the individual patient requirements. Further advancements due to technological revolution has laid foundation for the identification of procedures like SILA.[18] Therefore, we studied the comparison between the surgical procedures to demonstrate their impact based on the selected variables, which include wound infection rate, pain scores at 24 and 48hrs, the amount of time period for surgery in minutes, patient satisfaction scores and post-operative stay tenure at the hospital in days (table-1& 2). The enrolled 50 patients were equally distributed between the surgical procedures. Out of 29 males, 15 were enrolled in SILA, whereas 14 in CLA procedure. Similarly, out of 21 females 10 were enrolled in SILA and 11 for CLA procedure. Among the variables assessed, wound infection was noticed in 2(8%) patients of CLA and in 3(12%) patients of SILA respectively. Thus the observations indicate that wound infection rate was almost similar in both the groups.

Further, assessment of pain scores between the procedures at 24hrs revealed that in CLA procedure, the score was in between 4-8 (mean value 5.16), whereas SILA procedure exhibited in between 3-8 (mean value 5.04) respectively. Similarly, at 48 hrs in CLA the score was 1-6 (mean value 2.92), where as in SILA the score was 1-4 (mean value 2.08), which was significant ($P \leq 0.003$). The above results indicate that pain scores were almost similar in both groups at 24, and 48hrs respectively however it was significant at 48hrs.[29] The postoperative pain score in our study was a 2.08 out of 10 at 48 hours versus 2.9-3.6 reported in various published series[3,30] and this pain scores were significantly lower in SILA group than CLA group. One of the possible reasons for such a less pain could be due to less number of incisions. As reported in other studies, our patients started on oral diet within the first 24 hours.[31] Thus, our findings are almost comparable with other studies which demonstrated in a similar way.[3,31-32]

Next, we assessed and compared the amount of time period required for the completion of these procedures and results reveal that the CLA procedure finished in 20-60 minutes (mean value of 34.2), whereas SILA procedure in 25–70 minutes (mean value of 39.01) respectively. Moreover comparison of our findings with other studies which described about laparoscopic Appendectomy[3] clearly indicate that the surgery time for Appendectomy varies in majority of cases from 35.7 to 86 minutes.[3,26] For any procedure the patient satisfaction is more important. Hence, we investigated and compared the satisfaction score of the patients between the

procedures. Findings indicate that in CLA procedure the patient satisfactory score was in between 6-10 (mean valve of 8.04), whereas in SILA procedure in between 8-10 (mean valve of 9.08), which has significance (P ≤0.0001). The above results clearly states that patients had significant satisfaction score in SILA group than CLA group, measured at 6 weeks after Appendectomy. Further, assessment of post-operative stay tenure at the hospital between the procedures revealed that score was almost similar in both the groups. Our findings in the present study are well correlated with studies which reported similar findings.[29,6]

Thus, above study states that the number of incisions made in each procedure shows considerable variations in comparing benefits between SILA and CLA While comparing the pain score post operatively at 24 and 48hrs, SILA exhibited significantly lower score than CLA group. Patient satisfaction score in SILA was high when compared to CLA group. There was good scar healing in SILA, which shows better cosmetic appearance than CLA group (three scars). But the mean time taken for SILA procedure is more than CLA procedure. The post-operative hospital stay tenure of both the procedures is almost similar. Moreover, there was no conversion to open Appendectomy in either of these procedures. However, further randomized controlled trials are needed in evaluating this new technique SILA to reveal its potential benefits.

CONCLUSION

This prospective study was designed to compare the significant merits and demerits of CLA and SILA procedures. The laparoscopic hand instruments used in both techniques are similar, except covidien port which was reused in SILA, following gas sterilization to reduce the cost. The pain scores were significantly lower in SILA than CLA group. The procedure time is comparatively more in SILA group (mean time 39.01mints) than CLA group (mean time 34.2mints). There was no conversion to open Appendectomy performed in both the groups. In the present study, it has been shown that the SILA procedure is the safe, alternative and effective technique for the better management of acute appendicitis. Till date, the apparent advantages of the S.I.L.A. technique are primarily related to patient satisfaction. Although significant patient satisfaction score has been well established for CLA, S.I.L.A. seems to be better choice.

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