

**To study the post operative outcomes between small incision open appendicetomy and laparoscopic appendicectomy - A propective comparitive study - ORIGINAL ARTICLE**

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**INTRODUCTION:**

The acute appendicitis regimen stayed essentially unchanged since it is first described by Charles McBurney in 1889, before the New York surgical society. Appendectomy by McBurney's incision still remained the procedure of choice for nearly a century until 1983 when Kurt Semm offered an alternative, "Laparoscopic Appendectomy". As McBurney's operation is well tolerated with less morbidity, the advantages of laparoscopic alternative have been difficult to establish. There are fewer postoperative complications, a speedier and less painful recovery, and improved cosmesis as potential benefits of the laparoscopic procedure.

## METHODOLOGY

**Study design:** - Comparative Study. **Study population:** - Patients diagnosed with appendicitis and admitted in Government Medical College, Srikakulam & King George Hospital. **Study period:** - The study was conducted between February 2021 to August 2022 for a period of 18 months. **Study sample:** 60 patients diagnosed with appendicitis, of which 30 underwent SIOA (small incision open appendectomy) and remaining 30 underwent LA (laparoscopic appendectomy).

The study was a Prospective Study the data was obtained from 60 patients who met a pre-defined criteria and consented to get operated for Appendectomy at Government Medical College, Srikakulam & King George Hospital during the study period of February 2021 to August 2022. Study was initiated after obtaining ethical clearance from the institutions ethical clearance committee.

### **Inclusion criteria:**

1. Patients of any sex and age group diagnosed with acute appendicitis in February 2021 to August 2022
2. Age group of patients between 18-40.
3. Patients without any co morbidity.
4. Patients with their BMI ranging between 18-25.
5. Patients who are willing to give consent

### **Exclusion criteria:**

1. Patients whose age is below 18 and above 40.
2. Patients with co-morbidities.
3. Patients with a history of symptoms for more than 5 days and/or a palpable mass in the right lower quadrant, suggesting an appendiceal abscess.
4. Patients with history of cirrhosis and coagulation disorders, generalized peritonitis, shock on admission.
5. Patients with absolute contraindication to laparoscopic surgery ('large ventral hernia, history of laparotomies for small bowel obstruction, ascites with abdominal distension').
6. Patients with contraindication to general anesthesia (severe cardiac and/or pulmonary disease)

### **Statistical analysis :**

1. The results of the two groups were compared and analyzed by using Chi-square test.
2. Descriptive statistics using proportions to describe the occurrence of BDI.

### **ETHICAL CONSIDERATIONS**

Prior permission will be taken from Institutional Ethics Committee, From each individual of the study a written informed consent will be taken.

### **AIMS & OBJECTIVES:**

- When comparing the two procedures, the duration of the operation is taken into account from the skin incision until wound closure.

- Post operative pain was recorded based on Visual Analogue Scale (VAS) on POD 1 and at the time of discharge.
- The requirements of analgesics in the form of oral or parenteral Diclofenac Sodium was noted in both groups in the post operative period.
- The choice of antibiotics relied on the appendicular disease without taking the approach into account.
- From the day of the operation to the day of discharge, the postoperative hospital stay was taken into account.
- The length of time needed to resume regular activities was determined by the patient's choice to resume household chores and social activities.
- Both the groups were observed for complications.
- The procedure had taken into account the conversion of SIOA into conventional open appendectomy when the incision had to extend in SIOA.
- Patients individually assessed the cosmetic outcome.
- Patients were closely followed up until the point of suture removal.

**OBSERVATION AND RESULTS**

**Age**

Age of the patients ranged from 18-40 years. Mean age being 27.13. This confirms that appendicitis is primarily a disease of young age.

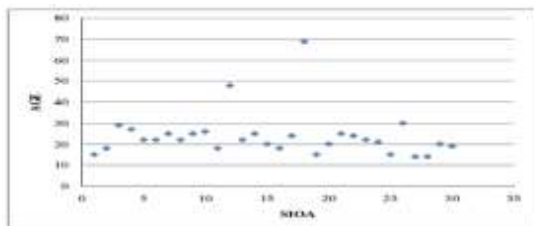


Figure 22 : Age distribution in SIOA group.

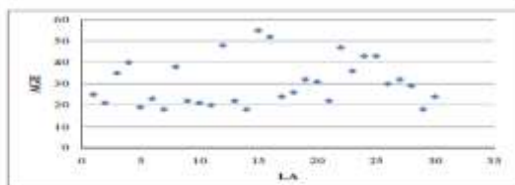


Figure 23 : Age distribution in LA group.

**Sex:** Male to female ratio was 1 : 1. There were 30 male and 30 female patients in the study.

**Operative Time**

Table 4: time taken for surgery (average)

Technique	SIOA	LA
Time(minutes)	25	44

The operative time for SIOA ranged from 20 to 35 minutes, and for LA it

ranged from 30 to 60 minutes. The mean time was 25 vs 44 minutes in SIOA vs LA respectively. As the above table shows, the time taken for surgery is significantly high in LA group.

**Pain perceived by Patient**

**Table 5: Pain perceived by patient in terms of VAS score at POD 1 and at discharge.**

Technique	Pain score (VAS)	
	POD1	DISCHARGE
SIOA	5.3	1.3
LA	5.9	1.6

The VAS scores for SIOA were 3-8 (POD 1), and 1-3 (Discharge). For LA the VAS scores were 4-8 (POD 1), 1-3 (Discharge). As the above table shows there is no much difference in terms of pain perceived by patient at Post-Op Day (POD) 1 and at Discharge. The pain was recorded by visual analogue scale.

**Analgesics Requirement**

**Table 6: Requirement of analgesics in doses**

ANALGESIC (iv and oral)	DOSE
SIOA	5.96
LA	5.93

Analgesic requirement in both the groups were almost equal. However the difference is not significant. Analgesic requirement is determined by size of incision, number of incisions, presence of underlying incision, dissection done, patients own pain threshold etc.

**Hospital Stay**

**Table 7: Post-Operative Stay in Hospital in days**

Technique	Stay, in days
SIOA	2.9
LA	3.5

Post-operative stay was comparable in both the groups.

It ranged 2-7 days in both groups with mean 2.9 days in SIOA group as compared to mean 3.5 days in LA group.

**Time to return to daily activity****Table 8: Time required returning to daily activity (RDA)**

Technique	RDA, in days
SIOA	4.8
LA	6.2

The time required to return to daily activity means patient is able to do his daily routine work. The time taken for return to daily activity was 4.88 days (3-9 days) in SIOA group compared to 6.2 days (4-10 days) in LA group which was significantly lower. This may be attributed to lesser invasiveness of SIOA technique which invades only RIF while LA invades whole peritoneal cavity.

**Complications**

In SIOA group one patient developed Vomiting in the post operative period. No local wound infection noted in SIOA. Umbilical post site infection was noted in a patient with perforated appendix who had underwent LA.

**Conversion Rate**

In SIOA group out of 30 cases, in 2 cases the incision had to be extended. 2 patients were obese in whom excessive fat obscured the vision through small incision and hence incision was extended. In LA group, none of the cases were converted to OA. Drains were not used in both the groups.

**Cost Effectiveness**

Equipment: SIOA doesn't require any special instruments. The routine OT instruments set costs around 2 lacs. LA requires, apart from routine instruments, laparoscopy set which costs additional 20-25 lakhs. LA is done with endo-loop costs Rs 500/- more. SIOA doesn't require such special equipment. SIOA is done under SA and LA done under GA. GA costs more than SA. Thus overall SIOA (Rs.15806) costs less to the patient when compared with LA (Rs.18033) and to the hospital as well.

**Cosmetic Effect**

Cosmetic result was recorded by patients own perception. Patients were asked to grade satisfaction in three

**Grades.**

- 1: not satisfied,
- 2: equivocal
- 3: satisfied with cosmetic result.

All the patients in both the group were satisfied with the cosmetic result.

The main advantage in LA is, the umbilical and supra-pubic scars are hidden by natural camouflages. Only visible scar is in LIF or RIF depending on the port placement. Even this scar is hardly visible as it is hardly a centimetre long. In SIOA group the final scar is 2-3cm (2.3 cm - mean) long which is when sutured by sub-cuticular sutures becomes almost invisible.

**Role of Anaesthesia**

General Anaesthesia (GA) is associated with more complications as compared to Spinal Anaesthesia (SA). GA costs more and associated with more complications. GA

is more invasive than SA. After GA patient may have respiratory tract complications ranging from sore throat to pneumonia as GA requires endotracheal intubation. Besides the expertise, equipment, man power, drugs, etc. required for GA are costlier than SA. SIOA and OA are usually done under SA and LA always done under GA. Thus SIOA costs less than GA and associated with lesser anaesthesia related complications.

## DISCUSSION

The acute appendicitis regimen stayed essentially unchanged since it is first described by Charles McBurney in 1889, before the New York surgical society. Appendectomy by McBurney's incision still remained the procedure of choice for nearly a century until 1983 when Kurt Semm offered an alternative, "Laparoscopic Appendectomy". As McBurney's operation is well tolerated with less morbidity, the advantages of laparoscopic alternative have been difficult to establish. There are fewer postoperative complications, a speedier and less painful recovery, and improved cosmesis as potential benefits of the laparoscopic procedure. It enables a better evaluation of other intra-abdominal pathologies. However, the validity of these arguments does not convince. Laparoscopic Appendectomy is significantly linked to higher expenditures and an increased risk of developing an intra abdominal abscess. Numerous Randomised Control Trials and meta-analyses show that one approach is superior than another in these situations. The SAGES appropriateness conference in 2003 concluded that open appendectomy is always preferable for the typical patient. However laparoscopic appendectomy may be a better option in morbidly obese patient. Saurland S. et al' in the Cochrane database review analyzed 54 studies comparing LA vs. OA. They observed less incidence of Wound infections in Laparoscopic Appendectomies. There was 3-fold increase in Intra Abdominal Abscesses after LA. In LA surgery is substantially more expensive. OA provides faster turnaround times. In both LA and OA returning to work was the same.

There was no evidence of a significant rise in hospital stay in any trial. After LA, there was less pain. Although the frequency of wound infection was high in Open Appendectomy, Laparoscopic procedure had a higher incidence of the more severe intra abdominal abscess. Laparoscopic Appendectomy saw a statistically significant reduction in pain, however this result was not clinically effective. Omar Aziz et al', performed a meta-analysis in Laparoscopic vs Open Appendectomy in children, discovered no appreciable complication rate. '18%' lower hospital cost in OA. '0.48 days' less Hospital Stay in LA group but it is not of much significance in paediatric population. 'Kathkuda N et al' in 2005 performed a double blind study between Laparoscopic vs Open Appendectomy:

- Wound infectivity rate: Laparoscopic '6.2%' vs. Open '6.7%'
- Intra-abdominal abscess: Laparoscopic '5.3%' vs. Open '3%'
- Operation time: Laparoscopic '80 min' vs. Open '60 min'
- No difference in activity of pain QOL scores.
- Time to take liquid/solid diet, length of stay, pain, oral analgesics – Not statistically significant.

‘Cohran C.C. et al’ in 2005 studied Laparoscopic vs. Open Appendectomy at a teaching hospital and observed,

- OR time (min) – Laparoscopic ‘ 95.7, vs. Open ‘90.5’
- Operating time (min) - Laparoscopic ‘57.4’ vs. Open ‘ 56.3’
- Length of stay(days) – Laparoscopic ‘ 2.2’ vs. Open ‘ 2.6’
- Equipment charges: Open ‘ \$125.32’ vs. Laparoscopic ‘ \$1,078.70’
- Operative time charge: Open ‘ \$3,022.16’ vs. Laparoscopic ‘ \$4065.24’
- Total Hospital Charges
- All appendectomies: Open ‘\$12,310’ vs. Laparoscopic ‘ \$16,773’
- Non-perforated: Open ‘ \$9,632’ vs. Laparoscopic “ \$14,251”
- Perforated: Open ‘ \$12,215’ vs. Laparoscopic ‘ \$27,639’

Unless the patient's circumstances need a laparoscopic procedure (questionable diagnosis, obesity), The most economic and efficient procedure in a teaching environment is still an open appendectomy.

‘Wei B. et al’ conducted a meta-analysis in 2010. Compared with Open Appendectomy, Laparoscopic Appendectomy showed advantages of ‘fewer postoperative complications (  $p = 0.04$ )’, ‘less pain (length of analgesia: weighted mean difference [WMD], -0.53)’, ‘earlier start of liquid diet (WMD: -0.51)’, ‘shorter hospital stay (WMD, -0.68)’, and ‘earlier return to work(WMD, -3.09)’ and ‘normal activity (WMD,-4.73)’, but a ‘comparable hospital cost (WMD of LA/OA ratio, 0.11)’ and ‘a longer operative time(WMD,10.71)’.

‘ Xiaohang Li et al’ in 2011 in their meta-analysis observed that “operating time was 12.35 min longer for Laparoscopic Appendectomy”. ‘Hospital stay after LA’ was “0.60 days shorter”. Patients “returned to their normal activity 4.52 days earlier” after LA and “resumed their diet 0.34 days earlier”. “Pain after LA on the first post-operative day was significantly less ( $p = 0.008$ )”. The “overall conversion rate from LA to OA was 9.51%”. In terms of the frequency of complications, post operative ileus was not dramatically decreased, although wound infection after LA was unquestionably decreased. After LA, urinary tract infections, intraoperative haemorrhage, and intraabdominal abscess were more common. “Sporn E. et al” analyzed “235473 patients” who underwent appendectomy from “2003 to 2009 published data in Journal of American College of Surgeons’ that ‘LA is associated with 22% and 9% more cost than OA’ irrespectively uncomplicated and complicated appendectomy. “McGrath B. et al in 2011 reported, LA (\$19,978) is costlier than OA (\$15,714) based on normalized cost for simple and complex diseases”. Cost and Complications surge if the case is converted to open approach. OA remains the most cost effective approach for patients with acute appendicitis. A Cochrane database survey by Moore D.E. et al” to assess the cost differences between LA and OA. A decision-analytic model was created in that study to compare laparoscopic versus open appendectomies. While the societal approach addressed both direct and indirect health care expenses, the institutional perspective only addressed direct health care costs. Baseline values and ranges were gathered from Medicare databases, meta-analyses, and randomised controlled trials. The least expensive option from the institution's point of view was an open appendectomy, with a projected cost of \$5,171

as opposed to a laparoscopic appendectomy's \$6,118. If wound infection rates following open appendectomy reach 23%, the laparoscopic method was less expensive. Laparoscopic appendectomy was the least expensive method from a societal standpoint, with an expected cost of \$10,400 as opposed to \$12,055 for open appendectomy. The decision analysis showed that an open appendectomy was more cost-effective for the hospital. For the patient, a laparoscopic appendectomy is an improved economic option. Cost-wise, OA is more advantageous than LA, although LA supporters counter that the procedure's high direct costs are offset by a decline in LOS and a decrease in indirect costs. As a result, there are inconsistent results and no procedure is better than another. In our work, we attempted to integrate the advantages of the two approaches. Open access and small incisions address the technological simplicity, operating time reduction, cost-related difficulties, and pain management. The chosen patients had no substantial co-morbidities and were not obese. Numerous research have been conducted to explore this feature, and the findings are encouraging.

Below is the comparison between present and other studies:

Table 9 :Results of present study

Technique	SIOA	LA
Operative time, minutes	25	44
Post-op pain (POD 1)	5.3	5.9
Analgesic req.	5.96	5.93
Post-op Stay, days	2.9	3.5
RDA, days	4.8	6.2
Cosmetic result	3	3

Bhasin SK et al<sup>34</sup> did a similar study in 2005 where they did mini appendectomy in 72 patients.

They observed following results:

Table 10 :Results of similar study

Length of incision	2.5 – 3.5 cm (2.7 cm)
Operation time	16 – 45 min (22.3 min)
Incision extension	3 cases
Analgesic used	2 – 5 doses (2.2 doses)
Hospital Stay	2 – 7 days (2.3 days)
Return to routines	7 – 10 days (8.2 days)
Satisfaction	96% (n = 72)
Minor complications	4% (n = 3)

Li Huochuan et al<sup>35</sup>, in 2004 did a similar study in a general hospital in China, they reported following figures; Length of incision: 2.7cm .Duration of Surgery:30 minutes. • Post-operative analgesics:6 doses. • Post op stay:5 days. • Return to daily activity:7 – 10 days. • Cosmetic result: all patients satisfied.

LUO Zhi-fu et al<sup>36</sup>, in 200 cases study in 2008 did small incision appendectomy in selected group of patients under local anaesthesia and observed similar findings, comparable to LA. Hae-Hyeon S<sup>37</sup>, back in 1998 performed open appendectomy after



putting small incision (1.5-2 cm inMcBurney's point, microceiotomy) and examining the abdomen via a laparoscope through that incision. The appendix identified and brought out through that small incision with help of laparoscopic guidance and appendectomy was done.

Findings are as follows:• Length of incision: 1.5 – 2 cm• Duration of Surgery: 30.7 minutes• Post-operative analgesics: 0.9 doses (nalbuphine 0.2mg/kg)• Post op stay: 4.1(2-7) days• Return to daily activity: 7.6 (5 – 14) days.

ZHOU Bing-kun<sup>38</sup> in Minimally Invasive Medical Journal of China in 2006 reported a study of 204 cases ofappendectomy performed through a mini-incision in the right lower abdomen. The length of incision was 2-3cm in the right lower abdominal wall. The average postoperative hospital stay was 3.5 days. The procedure improved wound healing and reduced postoperative pain. Normal activitieswere resumed 8-15 days after operation. Conclusion- Appendectomy performed through a mini-incision in the right lower abdomen can improve wound healing, reduce postoperative pain, and resume normal activities earlier. It can be applied to simple appendicitis, early-stage suppurative or gangrenous appendicitis. In paediatric age group also, in an article published in International Journal of Surgery, Malik AH et al<sup>39</sup> from Srinagar, India reported the feasibility of similar approach in 2007. The above data shows, the present study is in parallel with other similar studies. All the studies show, SIOA is comparable to LA in terms of post operative pain, analgesic requirement, length of stay, conversion rate and cosmetic effect. SIOA is better than LA in terms of operative time, return to daily activity, complications and cost. It is noticeable that studies on Small incision open appendectomies are done mostly in China and India, where public health system is bursting at the seams, patient load is huge and cost factor is very important. All studies have reported that in patients diagnosed with appendicitis, and who are not obese, Small incision appendectomy is a good choice. However, in obese patients Laparoscopic appendectomy is a better choice. In an article published in American Journal of Surgery, Varela JE, Hinojosa MW, Nguyen NT reported:“Compared to open appendectomy, laparoscopic appendectomy was associated with a shorter length of stay(3 vs. 4 days) and a lower overall complication rate (9% vs.17%). Most notably, a lower rate of wound infection. Was noted (1% vs. 3%). Within a subset analysis of morbidly obese patients who underwent appendectomy for perforated appendicitis, there was a higher overall complication rate(27% vs. 18%) and cost (\$16,600 vs. \$12,300) in the open appendectomy group. Laparoscopic appendectomy should be the procedure of choice for the treatment of appendicitis in obese population.

## SUMMARY

Numerous research comparing OA and LA have been conducted during the past 30 years. Some research indicate that OA is superior to LA, while others indicate the inverse. The Small Incision Approach combines the advantages of both methods. Open access concerns the operative time, ease of the treatment, and expense, whereas smaller incision addresses the post-surgical analgesic need, post-operative stay, and cosmetic outcome. In the current study, 60 appendicitis patients in total were

chosen, 30 of whom underwent SIOA and 30 underwent LA. At McBurney's Point, SIOA was performed using a 2–3 cm incision, while LA was performed using a normal 3 port approach. Operative time, post-operative pain, analgesic use, duration of stay after surgery, time to resume daily activities, complications, conversion rate, cost, and cosmetic results were compared for both techniques. The results indicated that SIOA is preferable to LA in terms of operative time (mean “ 25 vs. 44 minutes”), Time to return to daily activity (mean 4.8 vs. 6.2 days) .SIOA and LA were comparable in terms of ‘Post-operative pain’ (mean 5.3/1.3 vs. 5.9/1.9 at POD1 and discharge), analgesics requirement (mean 5.96 vs. 5.93 doses), ‘ post-operative hospital stay’ (mean 2.9 vs. 3.5 days) and cosmetic effect. LA group compared to SIOA was more expensive. In obese patients, Small Incision Open was converted to conventional Open Appendectomy in 2 patients and Laparoscopic Approach was done without any difficulty in obese patients as well.

### **CONCLUSION**

Thus it can be inferred that a Small Incision Open Appendectomy is a competent method. When an appendicitis diagnosis is certain, SIOA should be carried out. As LA gives no advantages over SIOA in this group of patients while raising costs, SIOA is the preferred treatment for thin and lean patients. For patients who are obese,

Laparoscopic Approach is the preferred technique. Small Incision Open Appendectomy takes comparatively less time than Laparoscopic Appendectomy. SIOA is compared to LA in terms of ‘ post-operative pain, analgesics requirement, hospital stay and return to daily activities’. SIOA is more economical and cost-effective than LA. SIOA is aesthetically comparable to LA.

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