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## Relevance of laparoscopic appendicectomy in Indian scenario: An analytical study

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### Abstract

**Introduction:** This article by means of data analysis obtained from our study have tried to evaluate feasibility and acceptability of laparoscopic appendicectomy in Indian scenario.

**Objective:** Through this prospective study an effort have been made to find ideal technique for appendicectomy which can serve masses in low middle income group countries like India where patient load outnumber resources both in expertise and facilities.

**Methods:** A prospective analysis of two groups of population which have undergone appendicectomy (laparoscopic versus open conventional) was done as per inclusion criteria. Results obtained were analysed on grounds of cost benefit, time taken for surgery, pain, post-operative complications, hospital stay, time to resume routine activities, subjective cosmesis and finally patients preference. Data obtained was statistically analysed.

**Results:** The mean age of patients in laparoscopic group was 22.5 years and 27.6 years in open appendicectomy group. Out of 287 patients included as per inclusion criteria 69.69% (200) patients opted for open appendicectomy. Mean operative time for laparoscopic procedure was more than open conventional procedure (98 minutes compared to 51 minutes). Post-operative complications and median length of hospital stay were comparable in both groups. There was no significant statistical difference related to pain, time duration to resume routine activities, and subjective cosmesis. Cost of overall procedure in laparoscopic appendicectomy was significantly higher than open conventional group.

**Conclusion:** conventional open appendicectomy is reliable, easy, safe and cost-effective technique and its use can dramatically reduce cost burden of surgery as compared to laparoscopic surgery.

**Keywords:** open appendicectomy (OA), laparoscopic appendicectomy (LA).

### Introduction

Term 'appendicitis' and procedure of removing it as "appendectomy", was coined by a pathologic anatomist at Harvard, Reginald H. Fitz in 1886<sup>[1]</sup>, almost 150 years after the first recorded appendicectomy in 1735 in the form of right lower quadrant drainage alone by Claudius Amyand (1681–1740), surgeon at St. George Hospital, London. With regular use of anaesthesia appendicectomy remained the commonest intra-abdominal pathology requiring emergency surgery, with an overall lifetime risk of about 8%<sup>[3]</sup>. Open appendicectomy (OA), as described by McBurney in 1894, is still a time tested gold standard<sup>[4]</sup>. With increasing demand of the people from surgery for minimum loss of working days and minimum morbidity, laparoscopic appendicectomy was introduced in 1982, by Kurt Semm, a Professor of Gynaecology at the University of Kiel, Germany<sup>[5]</sup>. Since then Despite numerous meta-analyses<sup>[6-9]</sup>, randomized trials<sup>[10-12]</sup> and critical analytical reviews<sup>[13, 14]</sup> which have tried to compare both techniques still a definite consensus on benefit of laparoscopic appendicectomy in low-middle income group countries have yet to be established.

We are working in tertiary care health set up in a low -middle income group country. We offer both open and laparoscopic procedures. Major determining factor while going for laparoscopic surgery is financial status of patient as we being a private medical college, lack government aid for healthcare, the cost of surgery is mostly borne by institute with subsidized cost to patient in a technically advanced procedure like laparoscopy. In this study an effort was made to compare the outcomes of laparoscopic versus open appendectomy in terms of:-

- Operative difficulties
- Operating time
- Postoperative nausea/vomiting

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- Postoperative pain and analgesic use
- Return of bowel function
- The resumption of liquid and subsequent solid diet
- Rate of infection, both surgical site and intra-abdominal infections
- Number of days of hospital stay
- The number of days to return to near normal work, cosmesis.
- Patients preference
- Cost of procedures

### Materials and Methods

**This prospective study was designed for a period of 2 year from:** February 2014 to March 2016 in the Department of Surgery at Sri Aurobindo Institute of Medical Sciences and Research centre Indore MP. We have included cases with diagnosis of appendicitis with Alvarado score of 7 or more or an equivocal score (5-6) with supportive imaging report by either ultra- sonography or C T Scan. Both emergency and elective cases of patients of age 12 years and more of both sexes with clinical diagnosis of acute appendicitis were included in the study.

### Exclusion Criteria

- Presence of generalized peritonitis.
- Appendicular lump
- Pregnancy.
- Previous abdominal surgery.
- Presence of any cardiac or pulmonary disorder that would affect the overall prognosis of the patient.
- Any known coagulation disorder.
- When imaging technique such as ultrasound/ CT scan revealed some non-appendicular pathology, the patients were excluded.

All patients were evaluated in detail, including history and clinical examination to assess for other differential diagnosis. In female patients, menstrual history and gynaecological problems were given special emphasis. The patients were counselled about the benefits and risk associated with either of technique and patients decision for type of technique was accepted. Operative time was calculated as time from incision to dressing. Intra operative findings were recorded. Post operatively patients were assessed for analgesic doses, duration of hospital stay; postoperative complications in ward and follow up period were noted. Total cost of procedure which included cost of the hospital stay, operating room, anaesthesia charges and pharmacy charges were procured from the financial department.

For laparoscopic technique, pneumoperitoneum with carbon dioxide was created by introducing a 5 mm trocar at umbilical region. Two more working ports were established, one along the supra-pubic region and the other along the left iliac fossa both being directed to the right iliac fossa. A 10 mm 30 degree telescope was introduced through the umbilical port and a diagnostic inspection of the entire abdomen was carried out in a step wise fashion. The appendix was identified and the meso-appendix divided with harmonic scalpel. Care was taken to carefully ligate the appendicular artery. Base of the appendix was secured by using vicryl endo-loop. The specimen retrieval bag was used to retrieve specimen through 10 mm port. For open appendicectomy McBurney's grid iron incision was used

and layers were opened to reach the peritoneum. On opening peritoneum caecum was identified and taenia traced along the caecum to their confluence to reach the base of the appendix. Once the appendix is freed from the mesoappendix, the base is double ligated and cut. Preoperative antibiotic given was one gram cefotaxim half hour before surgery. Postoperative antibiotics administration was decided by the surgeon on the basis of intra-operative findings. For post-operative pain control, initial choice was non-narcotic analgesics followed by narcotic analgesics, if pain remain still uncontrolled. A visual analogue scale (a 10 cm horizontal line without gradations) to be filled by the patient 24 hours after the surgery was used to indicate the general level of pain during the previous 24 hours. Pain reading was taken after 6 hours of the last analgesic dose. They were given oral sips of liquids a 6 hours after surgery. Later on by assessing bowel sounds, complaints of nausea/vomiting, abdominal pain diet schedule was planned. The wounds were checked after 48 hours for the presence of any infection and the necessary measures taken such as drainage of subcutaneous abscess or stitch removal for stitch abscess. Finally once patient start tolerating oral diet, were afebrile, had good pain control they were discharged with proper information regarding post-operative care and follow up. Mean follow up time taken was 4.2 months, after suture removal, if wound was healthy routine monthly follow up was done. Suture removal was done after one week in all patients who had no wound infection. SPSS version 16 was used to analyse data. Descriptive data were summarized as mean/median and range. The two groups were compared by Chi-square test for analysing categorical variables and student t-test was used for continuous variables. The *P* value of <0.05 was considered as significant.

### Observations and Results

A total of 287 patients were included in the study as per the inclusion criteria. 200 patients underwent open appendicectomy, and 87 patients preferred laparoscopic appendicectomy, out of which 8 cases were converted from laparoscopic to open procedure. These patients were included in the LA group for comparison with OA group considering patients preference for procedure. Mean age of the patients was 22.5 years in the LA group and 27.6 years in OA group. Majority of the patients were males. Among total 287 patients, there were 151 males and 136 females. The mean age of the study population was 26.2 years (Range: 12-55 years).

Intraoperatively, 10 patients in LA group were found to have perforated and/or gangrenous appendix as compared to 24 patients in OA group. Eight patients in LA group were found to have appendicular abscesses and they were converted to open laparotomy for optimal drainage and washout. Mean operative time was 98 (range: 40-180) minutes in LA group as compared to 51 (range: 30-90) minutes in OA group, the difference was statistically significant (*P* value < 0.001). Median length of hospital stay (*P* value: 0.672) and postoperative complications (*P* = 0.779) were comparable in both groups. There was a trend towards lower wound infection rate with LA (17.24% vs. 26%), but the difference was not statistically significant. The cost was calculated in Indian Rupees for each patient and the median cost of hospital stay was significantly higher for LA group (*P*<0.001). There were no readmissions or significant symptoms noted during follow-up visits. The results are summarized in as tables.

**Table 1:** Patient Characteristics (Age)

Age (years)	OA		LA	
	No.	%	No.	%
12-20	40	20	27	35
21-30	115	57.5	23	57.5
31-40	30	15	20	5
41-50	10	5	17	2.5
51-60	5	2.5	0	0
Total	200	100	87	100
Mean Age	27.6 years		22.35 years	

\*OA-Open Appendectomy \* LA - Laparoscopic Appendectomy

**Table 2:** Sex Distribution

Sex	OA		LA	
	No.	%	No.	%
Male	125	62.5	30	34.48
Female	75	37.5	57	65.51
Total	200	100	87	100

\*OA-open appendectomy \* LA-laparoscopic appendectomy

**Table 3:** Degree of adhesions around the appendix

Degree of adhesions	OA		LA	
	No.	%	No.	%
No adhesion	20	10	8	9.2
Flimsy adhesions	125	62.5	51	58.62
Dense adhesions	55	27.5	28	32.18
Total	200	100	87	100

\*OA-open appendectomy \* LA-laparoscopic appendectomy

**Table 4:** Position of Appendix

Position of Appendix	OA		LA	
	No.	%	No.	%
Ret, cec	135	67.5	52	59.77
Pre, ileal	5	2.5	5	5.75
Post, ileal	10	5	5	5.75
Pelvis	40	20	20	22.99
Subcecal	0	0	0	0
Paracecal	10	5	5	5.74
Total	200	100	87	100

**Table 5:** Operating time

Operation time (min)	OA		LA	
	N	%	N	%
21-40	100	50	7	8.04
41-60	90	47.5	31	35.63
61-80	5	2.5	22	25.29
81-100	5	0	18	20.69
101-120	0	0	1	1.15
>120	0	0	8	9.2
Total	200	100	87	100
Mean Operating Time	51 min		98 min	

\*OA-open appendectomy\*LA- laparoscopic appendectomy

**Table 6:** Conversion Rate (Laparoscopic Appendectomy to open procedure)

LA	N	Percent
Completed	79	90.8
Converted	8	9.2
Total	87	100

**Table 7:** Post-operative Pain

VAS* (Pain)	OA		LA	
	N	%	N	%
0-2	20	10	42	48.27
3-4	85	42.5	24	27.59
5-6	65	32.5	10	11.49
7-8	20	10	8	9.2
9-10	10	5.0	3	3.45
Total	200	100	87	100
Mean VAS Score	3.41		2.98	

\*VAS-Visual analogue score \*OA open appendectomy \*LA laparoscopic appendectomy

**Table 8:** Post-operative Complications

Complications	OA		LA	
	N	%	N	%
Wound infection	52	26	15	17.24
Fever	35	17.5	14	16.09
Loose stools	10	5	03	3.45
Prolonged ileus	28	14	12	13.79
Nausea/vomiting	70	35	23	26.44

\*OA-open appendectomy \* LA - laparoscopic appendectomy

**Table 9:** Post-operative Hospital Stay

Stay (hours)	OA		LA	
	N	%	N	%
24-48	20	10	10	11.49
49-72	98	49	47	54.02
73-96	54	27	20	22.99
99-120	26	13	9	10.34
>120	02	1	1	1.15
Total	200	100	87	100
Mean Postoperative Hospital Stay	3.2 days		3.1 days	

\*OA-open appendectomy \* LA-laparoscopic appendectomy

**Table 10:** Subjective Cosmesis

Cosmesis	OA		LA	
	No.	%	No.	%
Satisfied	179	89.5	80	92
Not Satisfied	21	10.5	7	8
Total	200	100	87	100

\*OA-open appendectomy \* LA - laparoscopic appendectomy

**Table 11:** Resumption of liquid diet in hours:

Liquid diet in LA			Liquid diet in OA		
Time range (hours)	number	percentage	Time range (hours)	number	percentage
≤ 20	18	20.69	≤ 20	110	55
21-30	50	57.47	21-30	51	25.5
31-40	19	21.84	31-40	17	8.5
41-50	12	13.79	41-50	22	11
≥51	0	0	≥51	0	0

\*OA-open appendectomy \* LA-laparoscopic appendectomy

**Table 12:** Return to Routine Work in Days:

Laparoscopic appendectomy		Open appendectomy	
Post-operative days	Number (%)	Post-operative days	Number (%)
≤ 7 days	0	≤ 7 days	0
8-14 days	75(86.21%)	8-14 days	170 (85%)
15-21 days	11(12.64%)	15-21 days	26 (13%)
≥22 days	01(1.15%)	≥22 days	04 (02%)

**Table 13:** Total cost (Indian Rupees)

Laparoscopic appendectomy	Open appendectomy
Median (INR)	30121
Range (INR)	20365-65478

## Discussion

Technical advancement in form of minimal access surgery is widely accepted by virtue of many proposed advantages which it offers, still laparoscopic appendectomy till now have not proven its superiority over its open counterpart. In our study we have noticed that despite availability of expertise and equipments for both techniques majority of patients have opted for open appendectomy, there may be many possible reasons for this but most justifiable explanation appears to be economic. This is because most people in India live in rural areas with a much lower per capita income than their western counterparts. Rural population (% of total population) in India was reported as 66.46% in 2017, according to the World Bank collection of development indicators, compiled from officially recognized sources.

The average monthly consumption expenditure of rural Indian households-agricultural and non-agricultural--was Rs 6,646 in 2015-16 (agricultural year between July 1, 2015-June 30, 2016), compared to the average monthly income of Rs 8,059. That leaves Rs 1,413, the monthly surplus we referred to.<sup>[15]</sup> This simply gives picture that even if minimal cost is offered to patient for laparoscopic surgery, will simply finish away his minimum of two years savings. This may be a strong factor for personal preference of patients for open appendectomy where expenses were almost half to one third as compared to laparoscopic procedure. Though among laparoscopic group percentage of female patients was more, reason may be choice for an acceptable cosmetic scar. The mean operative time in our study was 98 minutes for LA, which is relatively longer than that reported by other studies<sup>[12, 16, 17]</sup>. This can be explained by the fact that we have included cases converted to open exploration in laparoscopic appendectomy group. Because we have considered conversion to open procedure as a part of extended surgical procedure, which laparoscopic procedures often needs. In accordance with other studies,<sup>[18-20]</sup> there was comparatively less wound infections in the laparoscopic group in our study, but this difference was not statistically significant. A reduction in wound infection can be achieved by extraction of the specimen through a port, or by using an endobag. This finding has also been highlighted in the recent Cochrane review which consisted of more than 5000 patients<sup>[14]</sup>. Although wound infection were limited to sub cutaneous plane which were easily managed by opening few sutures, adding culture sensitive antibiotics. There were no case of intra-abdominal abscess post operatively, may be because of our routine practice of putting intra-abdominal drain in all infected cases; though studies by Frazee RC *et al.* (1994)<sup>[18]</sup> and Katkhouda N *et al.* (2005)<sup>[10]</sup> reported more incidence of intra-abdominal abscess after laparoscopic appendectomy. Question of reduced hospital stay after laparoscopic appendectomy is a matter of debate however in our study there was no significant difference in the mean

duration of hospital stay. Post-operative hospital stay is mainly determined by the pathological state of appendix and patient condition, rather than the approach used for appendectomy (open or laparoscopic). Similar inference was drawn by Moberg AC *et al.* (2005), Kurtz RJ *et al.* (2001) Pedersen AG *et al.* (2001).<sup>[12, 16, 21]</sup>

Assessment regarding cosmetic outcome is a subjective phenomenon; however, in both groups percentage of patients satisfied with cosmesis were comparable. We here would like to suggest that in experienced hands incision for open access is so small that it barely makes any difference to patient, making advantage of cosmesis in LA marginal as compared to OA. Duration of surgery and procedure-related cost were significantly higher for the laparoscopic group. Time to return to routine work was comparable in both groups; our results are in accordance with results of Ignacio *et al.*<sup>[22]</sup>. Study on military men in a tertiary care military-based hospital for accurate assessment of lost days and pain severity on the basis of mandatory documentation required for convalescence in the military. Study showed no difference in pain severity on post-operative days 1 and 7 or time taken for returning to work.<sup>[22]</sup>

## Sources of error

### Four potential sources of error are to be considered

1. Urinary retention as post-operative complication could not be assessed as all patients with laparoscopic appendectomy were catheterized before procedure.
2. Time taken for adjusting preoperative set up (monitor, camera, and carbon dioxide cylinder check) was not included as a part of our study.
3. Comparative time for general anaesthetic procedure and spinal anaesthesia was not evaluated as a part of surgical procedure.
4. Complications related to general anaesthesia versus spinal anaesthesia were not taken into account.

## Conclusion

- Laparoscopic appendectomy has no definite advantages over its open counterpart, in terms of postoperative pain, hospital stay, time to resume oral diet, time to return to work.
- Satisfaction related to cosmesis, being a subjective phenomenon was comparable in both groups in our study.
- Wound infection rate between two groups was not statistically significant.
- Higher cost for the laparoscopic procedure has resulted in lower preference of laparoscopic appendectomy over the open procedure.

To conclude, the socio-cultural-economic scenario of the majority of population of our country is different from that in the western world. Many a times an expensive technology is attractive but may not be that useful, that could replace a conventional technology. The combined population of North America and Europe is about 1317 million, while 1340 million people reside in India<sup>[23]</sup>. Surgical practices that are appropriate in America or Europe may not be applicable in a low middle-

income group country like India.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the institutional ethics committee

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