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Comparative Evaluation of Intraoperative and Postoperative Parameters in Laparoscopic vs Open Appendicectomy in Cases Of Acute Appendicitis

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ABSTRACT
Appendectomy is the most common surgical procedure performed in emergency surgery. Appendectomy is still being performed by both open (OA) and laparoscopic (LA) methods as no other technique is formulated. In this study, we aimed to compare the laparoscopic procedure and the standard technique in the treatment of acute appendicitis. Retrospectively collected data from 60 consecutive patients with acute appendicitis were studied. These comprised 30 patients who underwent conventional appendectomy and 30 patients treated laparoscopically. The two groups were compared for Intra operative parameters like duration of surgery, conversion, complications, and post-operative parameters like pain, requirement of pain medications, wound complications, hospital stay, any other complications, and cosmetic outcome. In our study Laparoscopic Appendectomy have a shorter hospital stay (Mean duration of hospital stay after surgery was 3.1 & 1.9 day in OA & LA group respectively), Operative time was significantly less in the open group (Mean duration of surgery was 71.2 minutes in OA group and 48.8 minutes in LA group). Total number of complications were fewer in the LA group with a significantly less incidence of wound infection (5 Vs 11, P <0.04). The laparoscopic method is a safe and competent operative method in appendicectomy. Post-operative pain in our study is notably lesser in laparoscopic group as compared to open appendectomy, also post-operative complication especially wound infections are less frequent in laparoscopic group of patients. Patient's recovery from operation is also better in laparoscopic appendicectomy group which includes early bowel activity, minimum hospital stay and early return to work. Overall cosmetic outcome is preferable in laparoscopic group of patients.
KEYWORDS: *Open appendectomy (OA), Laparoscopic appendectomy (LA), Hospital cost, Appendicitis.*

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INTRODUCTION

Appendicitis is the inflammation of vermiform appendix. Appendicitis is the most common cause of surgical abdomen in all age groups [1-2]. Persons between 10 and 19 years of age have the highest incidence of appendicitis, with males having a higher rate than females for all age groups. The lifetime risk for appendicitis has been estimated at 8.6% for males and 6.7% for females. Overall, the incidence appears to be approximately 120 per 100 000 population.

The classical features of acute appendicitis begin with poorly localized colicky abdominal pain. This is due to midgut visceral discomfort in response to appendiceal inflammation and obstruction. The pain is frequently first noticed in the periumbilical region and is similar to, but less intense than, the colic of small bowel obstruction. Central abdominal pain is associated with anorexia, nausea and usually one or two episodes of vomiting that follow the onset of pain (Murphy). Anorexia is a useful and constant clinical feature, particularly in children. The patient often gives a history of similar discomfort that settled spontaneously. A family history is also useful as up to one-third of children with appendicitis have a first-degree relative with a similar history. Acute appendicitis sometimes become difficult to diagnose as it differs in the presentation in other surgical emergencies.

The differential diagnosis differs in patients of different ages; in women, additional differential diagnoses are diseases of the female genital tract. In a meta-analysis review it is said that acute appendicitis is diagnosed clinically. There are many clinical methods and scoring systems are available for diagnosis of acute appendicitis. The most broadly used scoring system is the Modified Alvarado score [3]. Removal of appendix (Appendicectomy) is standard treatment for appendicitis. It is done preferably before development of phlegm on or after an interval of 6-8 weeks (Interval appendicectomy). Since the first

description of laparoscopic appendicectomy by Kurt Semm in 1983, it is being used more and more commonly [2].

But role of laparoscopic appendicectomy for the treatment of acute appendicitis is still not clearly defined. Studies done so far have given mixed results, some favoring one or the other technique. A study at Israeli Hospital [4] favors open appendicectomy over laparoscopic approach but another study published in American journal of surgery is in favor of laparoscopic approach [5].

Hence role of laparoscopic appendicectomy viz a viz open appendicectomy and its benefits and risks need to be clearly defined. Further studies are required to be clear about the most beneficial surgical approach to appendicitis. Present study is an effort in the same direction.

MATERIAL AND METHODS

This study was done on adult patients undergoing appendicectomy for appendicitis at Santosh Medical College & Hospital, Ghaziabad. This study design is a prospective one. The duration of study was taken from May 2015 to May 2016 in Department of General Surgery, Santosh Hospital & Medical College, Ghaziabad. Thirty patients of each of open appendicectomy and laparoscopic appendicectomy were taken in this study.

STATISTICAL ANALYSIS

All information was recorded on the standard proforma attached. Descriptive Statistical analysis was employed to describe data for frequencies, percentages, ratios, range and mean value with one standard deviation. Data were tabulated and entered in Microsoft excel. Analysis was done with the help of IBN SPSS Statistics version 17/GeNIe/Open Bug. Descriptive statistics of the variable from the data collected was carried out. Statistical analysis was performed using the chi-square test or student's t-test Fischer test as applicable. Statistical significance was defined if the p value was <0.05.

RESULT AND DISCUSSION

In this study 63.3% of OA group and 60.0% of LA group of study population belonged to age group 15 to 24 years whereas 23.3% & 33.3% of OA group and 13.3% & 6.7% of LA group of study population belonged to 25 to 35 years and 35 to 45 years respectively. But distribution of age among study participants in two groups was statistically not significant (p>0.05). Mean age of study participants was 25.3 years with 7.8 SD in OA group and 25.3 years with 6 SD in LA group but difference between mean age was statistically not significant (p<0.05). All male and female patients were included in this study.

Table 1. Age distribution

Age (in years)	Open Group (N=30)		Lap Group (N=30)		p value
	Number	Percentage	Number	Percentage	
15 -24	19	63.3	18	60.0	0.54* (NS)
25-35	7	23.3	10	33.3	
>35	4	13.3	2	6.7	
Mean ± SD	25.3 ± 7.8		25.3 ± 6.0		0.98**

*Chi-square test, **t-test

Table 2. show Modified Alvarado Score (MAS) in both groups. 76.7% of OA & 63.3% LA group of study participants had ≥7 MAS score. 23.3% of OA & 36.4% LA group of study participants had <7 MAS score. Difference between score of study participants of two groups was statistically not significant (p>0.05). Mean MAS score was 5.2 with 0.8 SD in OA group and 4.4 with 0.6 SD in LA group and difference was statistically significant (p<0.05).

Pre-operative USG was suggestive of acute appendicitis is 60% (18/30) of OA group & 73.3(22/30) of LA group of patients. In 9 & 8 patients respectively in OA and LA group pre-operative USG was not done due to non-availability of USG at that time. In 3 patients in PA group pre-operative USG was not suggestive of acute appendicitis. Table 3 shows that surgery was completed in 30 to 60 minutes in 36.7% of OA group & 63.4% of LA group of study participants. In 60 to 90 minutes 40.0% of OA group & 33.3% of LA group of study participants completed surgery. In 23.3% cases of OA & 3.3% cases of LA group have surgery time 90 to 120 minutes. This difference in time of surgery completion between OA & LA group was statistically significant (p<0.05). Mean duration of surgery was 71.2 minutes with 8.6 SD in OA group and 48.8 minutes with 8.7 SD in LA group and difference was statistically significant (p<0.05).

Table 4 shows comparison of post-operative VAS score between OA and LA group on the day of surgery. 23.3% of OA & 30.0% of LA group of cases had VAS score 0 to 3. 56.7% of OA & 40.0% of LA group of cases have VAS score 4 to 6 and 20.0% of OA & 10.0% of LA group cases had VAS score 7 to 10. This

difference in VAS score between these groups was statistically not significant (p>0.05). Mean VAS score on the day of surgery of OA group was 7.0 ± 1.1 & of LA group was 6.0 ± 1.1 and difference was statistically significant (p<0.05).

Table 2. Modified Alvarado Score (MAS)

MAS Score	Open Group (N=30)		Lap Group (N=30)		p value*
	Number	Percentage	Number	Percentage	
≥7	23	76.7	19	63.3	0.39 (NS)
<7	7	23.3	11	36.4	
Mean ± SD	5.2 ± 0.8		4.4 ± 0.6		0.004 (S)

Fisher-exact test

Table 3. Duration of surgery

Duration (in minute)	Open Group (N=30)		Lap Group (N=30)		P value*
	Number	Percentage	Number	Percentage	
30 – 60	11	36.7	19	63.4	0.03(S)
60 – 90	12	40.0	10	33.3	
90 – 120	7	23.3	1	3.3	
Mean ± SD	71.2 ± 8.6		48.8 ± 8.7		0.002

*Chi-square test

Table 4. Post-operative Visual Analogue Scale (VAS) on the day of surgery

POD 0	VAS Score			Mean ± SD	P value*
	0-3	4-6	7-10		
Open Group	7 (23.3)	17 (56.7)	6 (20.0)	7.0 ± 1.1	0.0001
Lap Group	15 (30.0)	12 (40.0)	3 (10.0)	6.0 ± 1.1	

*Chi-square test

Table 5 shows comparison of post-operative VAS score between OA and LA group after day 3 of surgery. 76.7% of OA & 96.7% of LA group of cases had VAS score 0 to 20.0% of OA & 3.3% of LA group of cases had VAS score 4 to 6 and 3.3% of OA cases had VAS score 7 to 10. This association of VAS score between these groups was statistically not significant (p>0.05). Mean VAS score on POD3 of OA group was 1.9 ± 0.3 & of LA group was 1.2 ± 0.5 and difference was statistically significant (p<0.05).

Table 5. Operative day 3

POD 3	VAS Score			Mean ± SD	P value*
	0-3	4-6	7-10		
Open Group	23 (76.7)	6 (20.0)	1(3.3)	1.9± 0.3	0.01(S)
Lap Group	29(96.7)	1 (3.3)	0 (0.0)	1.2 ± 0.5	

*Chi-square test

All patients were given diclofenac sodium 75mg by intramuscular route twice a day & switched to oral later. Extra analgesic was required in 23.3% of OA & 10.0% of LA group of study participants during surgery. This difference is statistically not significant (p>0.05). In OA group 2 patients had fever post operatively. Both patients recovered without any intervention. Equal number of patients in both groups suffered from nausea and vomiting. Antiemetic were given to the patient to subside the symptoms. 1 patient was catheterized postoperatively for urinary retention in OA group. 6 patients in OA group suffered from paralytic ileus, out of this, four patients recovered within 2 days and remaining patients within 4 days. In all patients only conservative treatment was sufficient. In LA only 1 patient had paralytic ileus, same treatment was given. Total of 6 patients in OA group had postoperative wound complication as compared to only 2 patients in LA group. 3 patients did not need any additional intervention as they only had superficial wound infection. 2 patients had leakage of seroma from wound site, which was relived with removal of suture. Remaining one patient had slough on operative site which was debrided

and was given local antibiotic treatment. Both patient in LA group had port site infection which resolved with dressing.

Table 6. Post-operative Complication

Post-operative Complication	Open Group (N=30)	Lap Group (N=30)	P value
Fever	2	0	0.04
Vomiting	1	1	
Nausea	1	1	
Urinary retention	1	0	
Breathlessness	0	1	
Paralytic ileus	3	1	
Wound complication	6	2	
*Total	11	5	

*Total number of patients with complication does not match the sum total of individual complications since some patients had more than one complication.

Table 7 shows that 73.3% of OA & 23.3% LA group of participants stayed for 3 days after surgery and 6.7% of OA & 43.3% of LA group of participants stayed in hospital for 2 days after surgery. 20.0% study participants of OA group stayed for 4 days after surgery. This difference between duration of post-operative stay at hospital was statistically significant ($p<0.05$). Mean duration of hospital stay after surgery was 3.1 & 1.9 day in OA & LA group respectively and difference was statistically significant ($p<0.05$).

Table 7. Duration of hospital stay

Duration (in day)	Open Group (N=30)		Lap Group (N=30)		p value
	Number	Percentage	Number	Percentage	
1	0	0.0	10	33.3	0.001* (S)
2	2	6.7	13	43.3	
3	22	73.3	7	23.3	
4	6	20.0	0	0.0	
Mean ± SD	3.1 ± 0.5		1.9 ± 0.8		0.05

*Chi-square test

Table 8 shows that 30.0% of OA & 83.3% of LA group of study participants had an excellent cosmetic end result. Patients were asked to grade the cosmetic outcome as very good, good, satisfactory or poor at 12 weeks follow up. 23.3% of OA & 3.3% of LA group of participants have satisfactory cosmetic end result. This difference was statistically significant ($p<0.05$).

Table 8. Post-operative cosmesis at 12 weeks

Response	Open Group (N=30)		Lap Group (N=30)		p value*
	Number	Percentage	Number	Percentage	
Very good	9	30.0	23	76.7	0.002 (S)
Good	13	43.4	4	13.4	
Satisfactory	6	20.0	2	6.6	
Poor	2	6.6	1	3.3	

* Chi-square test

Appendiceal disease is a frequent reason for emergency hospital admission, and appendicectomy is one of the most common emergency procedures performed in contemporary medicine. Although in this advanced world, we have much radiographic imaging system available with modern diagnostic tools, laboratories and accurate investigations, still the diagnosis of acute appendicitis made by clinical parameters.

In this study we involve total 60 patients out of which 30 in OA (Open Appendicectomy) & 30 in LA (Laparoscopic Appendicectomy) group.

In both groups, the participants belonged to 15 to 25 years age group which constitutes about 60% of total and shows that the younger age groups are frequent participants. This data establish that

appendicitis is the disease of young age group which is a worldwide fact. Mean age of participants was 25.3± 7.8 years in OA and 25± 6.0 years in LA & the difference between mean age of both the groups was statistically not significant as shown in table 1. It implies that distribution of patients regarding age in two groups was equitable. Similar statistically non-significant results of mean age [7-8].

There were 14 female & 16 male in OA group and 16 female & 14 male in LA group. Male to female ratio was 1.14:1 in open appendicectomy and 0.87:1 in Laparoscopic appendicectomy group which shows that female has higher number in LA group in comparison to OA group.

The Modified Alvarado Scoring System (MASS) has been reported to be a cheap and quick diagnostic tool in patients with acute appendicitis. Modified Alvarado Score (MAS) ≥7 was observed in present study in 76.7% of OA & 63.3% LA group of patients (Table 2). In 23.3% of OA & 36.7% LA group of study participants MAS score was <7. Results of present study are comparable [9-10].

USG is being increasingly used in diagnosing acute appendicitis. In our study only 60% of patients in OA group & 73.3% in LA group, had pre-operative USG findings suggestive of acute appendicitis. Most of the patients in OA group were operated in less than 90 minutes as compared to LA group, in which majority of patients were operated in less than 60 minutes. Mean duration of surgery was 71.2 minutes in OA group and 48.8 minutes in LA group as shown in Table 3. Open appendectomy took much higher time than the laparoscopic appendectomy and difference was statistically significant. This result is similar with the results of study done by Mwero and Puser where duration of surgery was significantly higher in OA group than LA group [11-12].

We observed visual analogue scale (VAS) for postoperative pain on the day of surgery, and 3rd post operative day after surgery where VAS score is between1 to 10. Every patient was assessed first for VAS scoring before giving any pain medication.

On the day of operation mean VAS score of OA group is 7.0± 1.1 and in LA group is 6.0± 1.1. This difference is statistically significant as shown in table 4. Lesser post-operative pain after laparoscopic appendicectomy as compared to open appendicectomy has been documented [13-15].

Extra analgesia was used on the basis of VAS scoring, clinical assessment & patient demand. Patients were given extra analgesia if VAS >5. In present study more patients experienced post-operative complication in OA group compared to LA group (Table 6). One patient in OA group experienced retention of urine which could be due to the effect of spinal anesthesia. One patient in LA group complained breathlessness in post-operative period which subsided in few hours, the cause of it could not be ascertained. Patients had complications as fever, nausea, vomiting, slightly more in OA group compared to LA group. Study done by Chitumalla et al had less wound infection following laparoscopic appendicectomy as compared to open appendicectomy [16]. The difference between two groups was statistically significant regarding post-operative wound infection. Postoperative complications were more in patients underwent open appendectomy as compared to laparoscopic appendectomy in a study done by Guller et al [17].

In our study Laparoscopic appendectomy group patients had earlier return of bowel activity as compared to those in open appendectomy group. 80% patients in LA group had post-operative bowel movements on POD1 as compared to only 50% in OA group. As shown by Ortega AE et al. and Hellberg et al show similar result of return of early bowel activity in LA group as compared to OA group [18-19].

As shown in table 7, large majority of patients (23/30) in LA group were discharged by 2nd post-operative day. In contrast in OA group maximum patients (22/30) were discharged on 3rd post-operative day. Mean duration of hospital stay after surgery was 3.1 & 1.9 day in OA & LA group respectively. Significantly longer post-operative hospital stays in LA group as compared to OA group in our study is in agreement with the studies done Moberg AC [20]. Primarily less postoperative pain accounts for shorter hospital stay, minimum requirement of extra analgesia, early bowel sounds, minimum postoperative complications and early starting of diet. For earlier return to normal activity minimum hospital stay is essential. This decreases hospital cost & burden on health care system. But studies done by previously found no statistically significant difference in hospital stay after surgery between two groups [21-23].

Appendicitis is disease of predominantly young people. Since significant number of patients undergoing appendicectomy are young females, cosmesis is an important factor. In our study we asked the patients at 12 weeks follow up to grade the cosmetic outcome of operative scar as excellent, good, satisfactory & poor. Patients in LA group graded their cosmetic outcome significantly better in LA group than in OA group (p value .002). 83.3% patients reported their cosmetic result as 'excellent' in LA group as compared to only 30% in OA group (Table 8). Study done by Chitumall *et al* [16] showed significant difference in cosmesis among two groups. Patients underwent Laparoscopic appendicectomy in their study group had excellent cosmesis.

CONCLUSION

In conclusion, Laparoscopic appendicectomy is a safe and promising procedure which requires a higher degree of technical skill on the part of a surgeon. Laparoscopic appendicectomy is a hopeful alternate method to conventional appendicectomy. Appendicitis is a clinical diagnosis. Post-operative pain in our study is significantly fewer in laparoscopic groups as compared to open appendicectomy. The post-operative complication most importantly wound infections are less frequent in laparoscopic group of patients. Recovery of patients from operation is also better in laparoscopic group including early bowel motion, shorter hospital stay and early return to work. Overall cosmetic outcome is preferable in laparoscopic group of patients. Thus, laparoscopic appendicectomy is a feasible, safe and reliable procedure. Availability of laparoscopic set up and expertise of surgeon is a challenge. Though conventional appendicectomy is widely used procedure for appendicectomy, laparoscopic appendicectomy is proving to be better procedure of choice in cases of acute appendicitis.

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