

# A Comparative Study of Open Versus Laparoscopic Appendicectomy in a Tertiary Care Center in North India: A Randomized Controlled Trial

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## ABSTRACT

**Introduction:** To compare the outcome of laparoscopic appendicectomy versus open appendicectomy in a tertiary care hospital.

**Material and methods:** This was a randomized controlled trial study conducted in the Department of General Surgery, Prasad Institute of Medical Sciences, Lucknow, Uttar Pradesh. A total of 80 patients who consented and fulfilled the inclusion criteria of the study were included in the study and subdivided into two groups of 40 each by using computer generated random number table. Post operative pain was calculated using visual analogue scale. Cosmesis score was given at the time of discharge.

**Results:** The mean age of patients of Open appendicectomy and laparoscopic appendicectomy was 42.12±11.11 and 43.10±10.23 years respectively. Majority of patients in both Open appendicectomy (77.5%) and laparoscopic appendicectomy (80%) were males. Inflamed appendix with omental adhesions was the most common feature amongst more than half of the patients in both open appendicectomy (65%) and laparoscopic appendicectomy (75%). The mean operative time was significantly ( $p=0.001$ ) lower among patients of laparoscopic appendicectomy compared to open appendicectomy. The mean postoperative pain and cosmesis was found to be significantly ( $p=0.001$ ) lower among patients of laparoscopic appendicectomy compared to open appendicectomy. Wound infection was the most common post-operative complication in both Open appendicectomy (7.5%) and laparoscopic appendicectomy (5%).

**Conclusion:** This study observed that Laparoscopic appendicectomy is better as compared to open appendicectomy in relation to post-operative pain, post-operative hospital stay, early return to normal activity, diagnosis of additional pathologies and subjective cosmesis.

**Keywords:** Laparoscopic appendicectomy, Laparoscopic appendicectomy, Cosmesis

appearance of the symptoms of appendicitis, the time course varies from case to case. There is a 20% risk of perforation of the appendix within 24 hours of the appearance of symptoms (Smink et al, 2004; Marudanayagam et al, 2006).

Open appendicectomy, first described in 1894 by McBurney, performed through the right lower quadrant muscle splitting incision has for long been applied as the gold standard procedure. This procedure has mainly remained unchanged for about 100 years due to its favorable efficacy and safety (Guller et al, 2004).

Intra-abdominal abscesses are a concern when performing laparoscopic appendicectomies in case of complicated appendicitis. A meta-analysis conducted on children with appendicitis revealed that intra-abdominal abscess formation was more common following laparoscopic appendicectomy, although this was not statistically significant. In adults, laparoscopic appendicectomy has been associated with a higher rate of intra-abdominal abscesses with a consequent higher rate of readmission and interventions. However, one study using a nationwide inpatient sample database in the United States revealed that laparoscopic appendicectomies were associated with lower morbidity, lower mortality, shorter hospital stay and a reduction in hospital charges (Masoomi et al, 2012).

Laparoscopy has the advantages of minimal incision, a better view of the peritoneal cavity, and safe exploration (Mohamed and Mahran, 2013). The feasibility and validity of the laparoscopic approach in complicated appendicitis cases remain controversial, as it is associated with an increased incidence of intra-abdominal collection, but several other trials have statistically found that the laparoscopic approach is associated with fewer postoperative complications (Tiwari et al, 2011). Due to the lack of randomized prospective studies, there is a gap in the literature about the comparison of laparoscopy and laparotomy in the management of perforated appendix. Laparoscopic management has now

## INTRODUCTION

Appendicitis is the inflammation of the vermiform appendix. Acute appendicitis is the most common abdominal emergency worldwide, and it is the most common cause of abdominal surgeries in all the age groups. Appendicitis has an overall lifetime risk of 8.6% in men and 6.7% in women (D'Souza and Nugent, 2014; Schellekens et al, 2013).

Of all the patients presenting with acute appendicitis, 13% to 20% have a perforated appendix. Men have a greater risk of perforation of the appendix (18%) than do women (13%). Although the risk of perforation is eminent 24 hours after the

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become the preferred mode of management because it can diagnose and remove the appendix at the same time (Lin et al, 2006).

Open appendicectomy is typically completed using a small right lower quadrant incision and postoperative recovery is usually uneventful. Variability in the inflammatory process and in the location of appendix are the main causes of operative difficulties in open appendicectomy, besides providing only a limited space for abdominal exploration (Shrivastava et al, 2019).

The present study was designed to compare the outcome of laparoscopic appendicectomy versus open appendicectomy in a tertiary care hospital.

## MATERIAL AND METHODS

This was a randomized controlled trial study conducted in the Department of General Surgery, Prasad Institute of Medical Sciences, Lucknow, Uttar Pradesh. A total of 80 patients who consented and fulfilled the inclusion criteria of the study were included in the study and subdivided into two groups of 40 each by using computer generated random number table.

### Methods

All participants were explained about the objectives of the study and an informed written consent was obtained. Face-to-face interviews, history and physical examination were conducted. The purpose, benefits, risks, anonymity and confidentiality of the study was clearly explained

to the patients. Open appendicectomy was performed by the standard right iliac fossa approach. Laparoscopic appendicectomy was done by the three port technique.

Post operative pain was calculated using visual analogue scale (Jensen and McFarland, 1993). Cosmesis score was given at the time of discharge according to Modified Hollander Scale (Hollander et al, 1995).

### Statistical analysis

The results are presented in frequencies, percentages and mean±SD. The Chi-square test was used to compare the categorical variables. The unpaired t-test was used to compare continuous variables between the groups. A p-value<0.05 was considered significant. All data analysis was carried out on the SPSS version 16.0 (Chicago, Inc., USA).

## RESULTS

The mean age of patients of Open appendicectomy and laparoscopic appendicectomy was 42.12±11.11 and 43.10±10.23 years respectively. Majority of patients in both Open appendicectomy (77.5%) and laparoscopic appendicectomy (80%) were males. There was no significant (p>0.05) difference in gender between the groups showing comparability of the groups in terms of age and gender.

Inflamed appendix with omental adhesions was the most common feature amongst more than half of the patients in both open appendicectomy (65%) and laparoscopic appendicectomy (75%). There was no significant (p>0.05) difference in intra-operative presentation between the groups

	Open appendicectomy (n=40)	Lap appendicectomy (n=40)	p-value <sup>1</sup>
Age in years, mean±sd	42.12±11.11	43.10±10.23	0.55
Sex, no. (%)			
Male	31(77.5)	32 (80.0)	0.16
Female	9 (22.5)	8 (20.0)	
<sup>1</sup> Unpaired t-test/Chi-square test			

**Table-1:** Age and sex distribution of patients studied

Intraoperative diagnosis	Open appendicectomy (n=50)		laparoscopic appendicectomy (n=50)		p-value <sup>1</sup>
	No.	%	No.	%	
Inflamed appendix with omental adhesion	26	65.0	30	75.0	0.86
Inflamed appendix	3	7.5	1	2.5	
Enlarged appendix with dilated bowel loops	3	7.5	2	5.0	
Inflamed appendix with bowel adhesion	3	7.5	3	7.5	
Inflamed appendix with periappendicular collection	5	12.5	4	10.0	
<sup>1</sup> Chi-square test					

**Table-2:** Comparison of intraoperative diagnosis between the groups

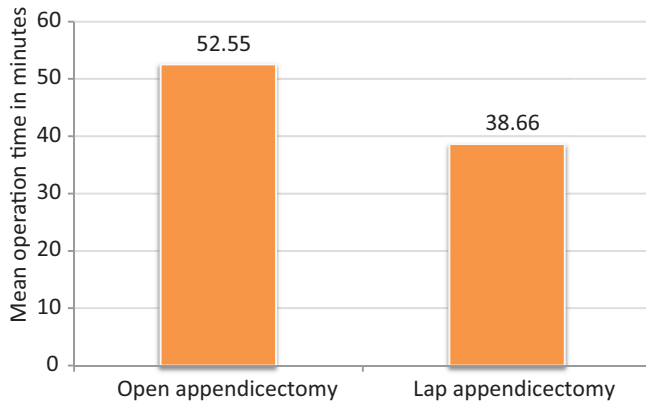
	Open appendicectomy (n=40)	Lap appendicectomy (n=40)	p-value <sup>1</sup>
Pain (VAS), mean±sd	6.38±1.44	3.10±1.10	0.001*
Cosmesis	1.76±0.12	1.21±0.11	0.001*
Normal daily activities in days	9.11±1.56	5.46±1.44	0.001
<sup>1</sup> Unpaired t-test, *Significant			

**Table-3:** Comparison of post-operative outcomes between the groups

Post-operative compli-cations#	Open appendicectomy (n=40)		Lap appendicectomy (n=40)	
	No.	%	No.	%
Caecal leak	1	2.5	0	0.0
Intra-abdominal abscess	4	10.0	1	2.5
Adhesive ileus	1	2.5	0	0.0
Wound infection	3	7.5	2	5.0

<sup>1</sup>Chi-square test, #Multiple response

**Table-4:** Comparison of post-operative complications between the groups



**Figure-1:** Comparison of operative time between the groups (p=0.001)

(Table-2).

The mean operative time was significantly (p=0.001) lower among patients of laparoscopic appendicectomy compared to open appendicectomy (Fig.1).

The mean postoperative pain and cosmesis was found to be significantly (p=0.001) lower among patients of laparoscopic appendicectomy compared to open appendicectomy (Table-3).

Wound infection was the most common post-operative complication in both Open appendicectomy (7.5%) and laparoscopic appendicectomy (5%) (Table-4).

**DISCUSSION**

The standard approach to laparoscopic appendicectomy employs 3 ports but appendicectomy using single incision is also being reported in the recent years. Medical literature has described 2-port techniques hybrid approaches and single-port assisted techniques (Meyer et al, 2004; Baik et al, 2013). In newer techniques, umbilicus is the site for removal of appendix, and a traditional open appendicectomy is then performed extracorporeally (Valla et al, 1999; D'Alessio et al, 2002). The single-port assisted technique is fascinating in that a stitch is placed through the anterior abdominal wall to pull the appendix to the abdominal wall; this creates tension necessary for performing the appendicectomy intracorporeally (Carus, 2013).

In the current study, the mean age of patients of Open appendicectomy and Lap appendicectomy was 42.12±11.11 and 43.10±10.23 years respectively. Mehta et al (2017) found that the mean age of the patients in open and laparoscopic appendicectomy was 27.2 and 25.5 years respectively. Simkhada et al (2018) found that the mean age of patients

in the open appendicectomy group was 26.53 ± 8.26 years and 24.45 ± 9.27 years in Laparoscopic appendicectomy group. Majority of patients in both Open appendicectomy (77.5%) and laparoscopic appendicectomy (80%) were males in this study. This finding is in disagreement with the study by Rahman et al (2014) in which predominantly female sex was in the Laparoscopic appendicectomy group. Mehta et al (2017) in a small series reported that 13(52%) patients of open appendicectomy and 8 (32%) patients of laparoscopic appendicectomy were males. In the present study, inflamed appendix with omental adhesions was the most common intra-operative diagnosis amongst more than half of patients in both open appendicectomy (68%) and Lap appendicectomy (62%).

Operative time depends on the experience of the surgeon and competence of the operating team. With increasing experience the operative time also decreases significantly (Chung et al, 1999). This study found that the mean operative time was significantly (p=0.001) lower among patients of laparoscopic appendicectomy compared to open appendicectomy. Shrivastava et al (2019) reported a median operative time in Laparoscopic Appendicectomy as 58.22 minutes as compared to the open procedure which took 43.65 minutes (p<0.05). The operation time in this study was also in agreement with the study by Nazir et al (2019) in which the mean operating time for laparoscopic appendicectomy and open appendicectomy was 46.98 ± 2.99 minutes and 53.02 ± 2.88 minutes respectively (p<0.001). Simkhada et al (2018) reported that the mean duration of operation was less in open appendicectomy group than in laparoscopic appendicectomy group (47.25 ± 21.35 vs. 63.24 ± 23.78 min). McAnena et al (1992) and Schroder et al (1993) demonstrated that there was no statistically significant difference between the duration of laparoscopic appendicectomy and open surgery. In a study by Nazir et al (2019) the mean operating time for laparoscopic appendicectomy and open appendicectomy was 46.98 ± 2.99 minutes and 53.02 ± 2.88 minutes respectively (p<0.001). De (2005) found that the operating time was shorter {open appendicectomy: 25 min (median), laparoscopic appendicectomy: 28 min (median), 0.01 < P < 0.05} in patients undergoing open appendicectomy compared to laparoscopic appendicectomy.

This study showed that the mean postoperative pain and cosmesis was found to be significantly (p=0.001) lower among patients of laparoscopic appendicectomy compared to open appendicectomy. Pradhan et al (2015) found that the mean comparison of postoperative pain by visual analogue

scale, was significantly low in laparoscopic appendectomy, compared with Open appendectomy, 24 hours after surgery which is similar to our study. One of the most reported advantages of laparoscopic appendectomy is less post-operative pain. A meta-analysis from Pakistan (Ioannis et al, 2018) showed that laparoscopic appendectomy resulted in significantly less post-operative pain, shorter hospital stay and quick resumption to work.

Laparoscopic appendectomy in general has better cosmetic results both subjectively and objectively. The post-operative scars are small and hide easily as compared to a relatively longer scar in the right iliac fossa after open appendectomy. In this study, cosmesis was significantly ( $p=0.01$ ) higher among patients of Lap appendectomy ( $1.30\pm 0.50$ ) than Open appendectomy ( $1.66\pm 0.84$ ) representing better cosmetic results in laparoscopic appendectomy than open appendectomy which is similar to the study conducted by Patel et al (2018) who reported that laparoscopic appendectomy had better subjective cosmesis as compared to open appendectomy.

Wound infection was the most common post-operative complication in both Open appendectomy (7.5%) and laparoscopic appendectomy (5%) in the current study which is similar to the study conducted by Simkhada et al (2018) who reported that there were 12 (10.9%) wound infection cases in Open appendectomy group and 3 (3.3%) cases in laparoscopic appendectomy group. Shrivastava et al (2019) reported that surgical site infection was recorded in 10 patients (25%) in Open appendectomy group and 5 (13.9%) in laparoscopic appendectomy group. Nazir et al (2019) found that the frequency of wound site infection was significantly higher in open appendectomy (27.69%) than in the laparoscopic approach (10.77%;  $p=0.01$ ).

In this study, The mean operative time was significantly ( $p=0.001$ ) lower among patients of laparoscopic appendectomy compared to open appendectomy. This finding was in agreement with the study by Shrivastava et al (2019) in which mean post-operative stay in laparoscopic appendectomy group was  $3.2\pm 0.34$  days and in Open appendectomy group was  $2.3\pm 0.24$  days. Nazir et al (2019) found that the mean hospital stay was slightly longer in the laparoscopic approach ( $4.38 \pm 1.09$  days) than in open appendectomy ( $4.18 \pm 0.77$  days;  $p=0.23$ ). Simkhada et al (2018) found that the mean duration of post-operative hospital stay was  $3.65 \pm 1.23$  days in open appendectomy group and  $3.04 \pm 1.78$  days in laparoscopic appendectomy group.

In the present study, return to normal activity required a significantly higher time in patients of Open appendectomy as compared to Lap appendectomy. This finding is also supported by various other studies (Nana et al, 2007; Richard et al, 1994; Namir et al, 2005).

## CONCLUSION

This study observed that Laparoscopic appendectomy is better as compared to open appendectomy in relation to post-operative pain, post-operative hospital stay, early return

to normal activity, diagnosis of additional pathologies and subjective cosmesis.

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