

# Comparison of Wound Infection rate in Open Appendectomy (OA) vs Laparoscopic Appendectomy (LA)

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## ABSTRACT

**Background:** There are two methods for removal of appendix: Conventional Open Appendectomy and Laparoscopic Appendectomy. Open appendectomy technique is associated with shorter operating time, more post operative pain, and more wound related complications. On the other hand, Laparoscopic appendectomy is associated with reduced infection rates, lesser post operative pain, early return to work, better cosmesis, but at the expense of longer duration of operation. None of the local studies so far have succeeded in proving statistically significant difference in frequency of wound infection between the two groups. This study has been designed with a large sample size to give a clear picture regarding wound infection in both treatment modalities.

**Aim:** To compare frequency of wound infection following open versus laparoscopic appendectomy.

**Methods:** Study was conducted at North Surgical Unit, Mayo Hospital, Lahore. This was a prospective randomized controlled trial. Total 300 patients who fulfill the inclusion criteria were included in the study. Patients were randomly divided into 2 groups i.e., those undergoing laparoscopic appendectomy (LA group) and those undergoing open appendectomy (OA group) on arrival in operating suite by pulling an envelope method. There was no ethical issue associated with this study (certificate attached). Each group was prepared for surgery in the same manner. For data entry and analysis SPSS version 10 was used.

**Results:** Mean age of patients in Group-OA and in Group-LA was 23.40±9.93 and 25.20±6.52 years respectively. Overall female patients were greater as compared to male patients. None of the patients in both treatment groups had infection at 30<sup>th</sup> day. Whereas at 7<sup>th</sup> day 11.3% patients had infection in OA and in LA group only 2.7% patients had infection. Infection rate was less in LA group as compared to OA group.

**Conclusion:** Laparoscopic appendectomy is associated with a statistically significant lower rate of wound infection as compared to open appendectomy. Although laparoscopic appendectomy is relatively expensive, but it is a safe and effective procedure for the removal of appendix over open appendectomy

**Keywords:** Acute Appendicitis, Appendectomy, Open vs Laparoscopic, Wound infection, Surgery

## INTRODUCTION

Acute appendicitis is the most common cause of acute abdomen<sup>1</sup>. The treatment of acute appendicitis is appendectomy, which is the most frequently performed urgent abdominal operation. Urgent operation is essential to prevent the increased morbidity and mortality of peritonitis due to perforated appendix<sup>1,2</sup>. About 7-10% of general population develops acute appendicitis with maximum incidence being in the 2<sup>nd</sup> and 3<sup>rd</sup> decades of life<sup>2,3</sup>.

There are two methods for removal of appendix: Conventional Open Appendectomy (OA) and Laparoscopic Appendectomy (LA)<sup>1,3,4</sup>. Open appendectomy technique, as described by Mcburney, is associated with shorter operating time, more post operative pain, and more wound related complications<sup>5,7</sup>. On the other hand, Laparoscopic appendectomy, as described by Semm in 1983, is associated with reduced infection rates (0% in LA vs 26.67% in OA)<sup>8</sup>, lesser post operative pain, early return to work, better cosmesis, but at the expense of longer duration of operation<sup>9</sup>. Surgical site infections (SSI) are a major problem in surgical wards and are estimated to account for at least 20% of all nosocomial infections. Over 5% of all patients admitted for any surgical procedure will

develop a SSI and of these two-third are superficial<sup>10</sup>. Wound infection is responsible for extended hospitalization time and increased overall cost of care as well as a substantial cause of morbidity and mortality<sup>11</sup>.

Although immense body of international literature already exists comparing frequency of wound infection following open and laparoscopic appendectomies, local data is still very scarce in this context.<sup>8,12,13</sup>

Apart from one study<sup>8</sup>, none of the local studies so far have succeeded in proving statistically significant difference in frequency of wound infection between the two groups (03% in LA vs 09% in OA)<sup>13</sup>. This might be due to inappropriate sample size (i.e., n=68 in each group)<sup>13</sup>. Keeping in mind this background, we designed this study with adequate sample size (i.e., n=300,150 in each group), to assess the reported superiority of laparoscopic appendectomy over open appendectomy in terms of decreased frequency of wound infection so that more and more patients could benefit from it with respect to decreased morbidity, reduced cost and shorter hospital stay.

## MATERIAL AND METHODS

Prospective Randomized controlled trial was conducted in the Department of Surgery, Mayo Hospital, Lahore from 01<sup>st</sup> July 2014 to 28<sup>th</sup> Feb. 2015 with a sample size of 300 cases (150 in each group), calculated with 80% power of test, 1% level of significance, and taking expected percentage of wound infection in both groups i.e., 0% in LA

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group vs 26.67% in OA group, in patients undergoing appendectomy. Non-probability purposive sampling was done. Patients with diagnosis of acute appendicitis undergoing appendectomy, aged above 13 yrs, both male and female patients were included in the study.

Patients with appendicular mass (history > 5days, palpable mass on physical examination, or found at Ultrasonography), associated pregnancy, those not fit for surgery, with chronic medical conditions like CLD, coagulation disorders, those incapable of providing informed consent were excluded. Consecutive 300 patients with diagnosis of acute appendicitis, fulfilling inclusion and exclusion criteria were registered from emergency department. Patients were explained about the nature of research and an informed written consent was obtained in all cases. Patients were randomized by pulling an envelope method into two equal groups i.e. those undergoing laparoscopic appendectomy (LA group) and those undergoing open appendectomy (OA group) on arrival in operating suite. There was no ethical issue associated with this study (certificate attached). Each group was prepared for surgery in the same manner. Patients in both groups were kept nil per oral for 6 hrs and were given standard antibiotic regime (single I/V dose of a 3<sup>rd</sup> generation cephalosporin & metronidazole preoperatively and two doses post-op at 8 hourly interval). All operations were performed by the same operating team experienced in laparoscopic and open surgical techniques. Post-operative pain was relieved by standard analgesic regime and additional analgesia was provided if needed. Post operative outcome in terms of wound infection was recorded for each group through a proforma. Patients were discharged once they were pain free, tolerating oral diet and fit to go home. They were followed up in OPD on weekly basis for 1-month post operatively.

The data collected was entered in SPSS Version 17 and analyzed accordingly. Mean and Standard deviation was used to measure numerical variables like age. Frequency and percentage was used to measure qualitative variables like gender and wound infection. Chi-Square test was used to test the significance of qualitative data (wound infection). p-value ≤ 0.05 was considered significant.

**RESULTS**

Total 300 patients with diagnosis of acute appendicitis, fulfilling inclusion and exclusion criteria were registered from emergency department. Patients were explained about the nature of research and an informed written consent was obtained in all cases. Patients were randomized by pulling an envelope method into two equal groups i.e. those undergoing laparoscopic appendectomy (LA group) and those undergoing open appendectomy (OA group) on arrival in operating suite.

Mean age of all 300 patients was 24.30±8.44 years. Mean age of patients in Group-OA and in Group-LA was 23.40±9.93 and 25.20±6.52 years respectively. Minimum age in both groups was 13 and 14 years. Whereas maximum age of patients in both groups was 55 and 42 years respectively (Table 1).

Gender distribution in both treatment groups is described in table-2. In Group-OA there were 80(53.3%) male and 70(46.7%) female patients. While in Group-LA there were 47(31.3%) male and 103(68.7%) female patients. In Group-OA male patients were greater in number as compared to female patients and in Group-LA female patients were greater in number as that of male patients. Overall female patients were greater as compared to male patients. (Table-2)

At 7<sup>th</sup> day 17(11.3%) patients had wound infection in OA- Group while in Group-LA at 7<sup>th</sup> day only 4(2.7%) patients had wound infection. Wound infection was higher in Group-OA patients as compared to Group-LA. The difference in wound infection was statistically significant p-value=0.3 (significant p-value<0.05) (Table-3). In both treatment groups none of the patients had wound infection at 30<sup>th</sup> day post operatively.

Table 1: Descriptive statistics for age in treatment groups

|                | Group-OA | Group-LA | Total |
|----------------|----------|----------|-------|
| N              | 150      | 150      | 300   |
| Mean           | 23.40    | 25.20    | 24.30 |
| Std. Deviation | 9.93     | 6.52     | 8.44  |
| Range          | 42       | 28       | 42    |
| Minimum        | 13       | 14       | 13    |
| Maximum        | 55       | 42       | 55    |

Group-OA= Open appendectomy

Group-LA= Laparoscopic appendectomy

Table 2: Gender distribution of patients in treatment groups

| Gender | Group-OA  | Group-LA   | Total      |
|--------|-----------|------------|------------|
| Male   | 80(53.3%) | 47(31.3%)  | 127(42.3%) |
| Female | 70(46.7%) | 103(68.7%) | 173(57.7%) |
| Total  | 150(100%) | 150(100%)  | 300(%)     |

Table 3: Wound infection at 7<sup>th</sup> day post operatively in both treatment groups

| Wound infection at 7 <sup>th</sup> day | Group-OA   | Group-LA   | Total    |
|--|------------|------------|----------|
| Yes                                    | 17(11.3%)  | 4(2.7%)    | 21(7%)   |
| No                                     | 133(88.7%) | 146(97.3%) | 279(93%) |
| Total                                  | 150(100%)  | 150(100%)  | 300(%)   |

P value= 0.03 (Significant: p-value<0.05)

**DISCUSSION**

McBurney in 1894, introduced appendectomy and since then it has been the treatment of choice for acute appendicitis. Appendicitis is the most frequent intra-abdominal condition requiring immediate surgery, with a lifetime risk of 6%. For more than a century, open appendectomy remained the gold standard treatment for acute appendicitis. It is difficult and challenging to diagnose acute appendicitis. An accepted negative appendectomy rate for presumed appendicitis ranges from 15% to 20%, even higher in women of childbearing age (20% to 30%)<sup>17,18</sup>.

Before the era of laparoscopic surgery single umbilical port diagnostic laparoscopy enabled to diagnose appendicitis as high as in 50% cases. The beginning of endoscopic surgery led to the idea of performing laparoscopic appendectomy (LA)<sup>14</sup>.

In 1983 Semm, a German Gynecologist performed the first LA. More than 2 decades later, the benefits of LA

are still controversial. Despite numerous case series and randomized clinical trials comparing LA versus OA, a consensus concerning the relative advantages of each procedure has not yet been reached<sup>15,19,20</sup>.

According to the results reported by Ali from Bangladesh showed that the wound infection rate was higher in open group as compared to laparoscopic group. (OA= 13.79%, LA= 6.45%). Age of patients in OA and LA group was 31.05±6.15 and 29.83±5.2 years. Gender distribution showed that female patients were greater in number as compared to male patients who were treated for appendicitis. i.e., (Male=51, Female=69)<sup>21</sup>.

Another study from Pakistan conducted in Peshawar showed the comparison of OA and LA. Results from this study showed the gender distribution that 86 male and 34 females were operated for acute appendicitis. Mean age of patients in LA group was 23.6±14.2 and in OA group mean age of patients was 20.8±1.0 years respectively. Wound infection in LA group in this study was 1.6% and in open group 8.3%<sup>22</sup>.

According to the results of an Indian study wound infection rate in LA and in OA group was 7.89% and 11.6%. There were no statistically significant differences in the wound infection rates in both the groups<sup>23</sup>.

Results reported by Katkhouda et al. showed that wound infection in LA and in OA group was 6.2% and 6.7% respectively. There was no significant difference in wound infection in both groups<sup>16</sup>.

Khan et al. in his study reported (1.2%) superficial wound infection in the laparoscopic group and 9.2% in the open group showing a significant association for LA regarding wound infection. (p-value≤0.05).<sup>25</sup>

Results of a study conducted in Karachi compared the open with laparoscopic appendectomy in terms of postoperative pain, rate of wound infection and hospital stay showed that none of patients who were operated with Laproscopic technique had wound infection whereas patients who were treated with open surgery 26.67% of the patients had wound infection after 1-week post operatively.<sup>8</sup>

Another study from Peshawar published in 2011 showed that wound infection in LA and OA was 4.1% and 10.6%, apparently wound infection is less in LA but statistically this difference was not significant<sup>26</sup>

Results of 2 local studies one from Lahore and one from Multan reported incidence of wound infection in LA was 0-2% and in OA the infection rate ranges from 5-6% respectively<sup>27,28</sup>.

Results of a prospective randomized trial reported incidence of wound infection was more common after OA (13%) than after LA (0%) (p-value≤0.05).<sup>29</sup>

In this study incidence of wound infection in LA group was 2.7% and in OA wound infection was 11.3%. This range is comparable to other national and international studies reported for wound infection for both treatment modalities. Few studies had reported that incidence of wound infection was same for LA and OA. But many other studies had also reported 0% wound infection in LA showing its significant aspect. Although due to variation in sample size the results were equal regarding wound infection for both techniques. But as this study is a large randomized comparative trial, reported results are comparable and in accordance to the wound infection

range reported by other studies. In short, LA is safer in many aspects and it had very low incidence of wound infection post operatively.

Low incidence of wound infection in LA is one the most important point in favor of LA. In LA, if appendix is always removed in canula sheath or endo-bag, there is no question of contamination of wound. But in OA whatever may be the level of care always there is chance of wound contamination. The laparoscopic technique provides an opportunity to detect concomitant pathology in the lower abdomen easily without any extra effort and thereby reduces real negative appendectomy rate. This study confirmed the benefits of laparoscopic appendectomy over open operation. So it is concluded that laparoscopic appendectomy should be the procedure of choice.

## CONCLUSION

Laparoscopic appendectomy is associated with a statistically significant lower rate of wound infection as compared to open appendectomy. Although laparoscopic appendectomy is relatively expensive, but it is a safe and effective procedure for the removal of appendix over open appendectomy

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