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Original Article

Open Versus Laparoscopic Appendectomy for Perforated Appendicitis: A Randomized Prospective Study

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Abstract

Objective: To compare the mean hospital stay, mean operative time and frequency of port site infections in patients with early-perforated appendix managed laparoscopically versus open approach.
Study type, settings & duration: The randomized control trial was conducted at surgical unit-2, Holy Family Hospital, Rawalpindi, Pakistan from May 2015 to April 2016.
Methodology: All patients diagnosed on CT as perforated appendix presenting to emergency department were included and randomized by lottery method to open and laparoscopic appendectomy group. Open approach was by lower midline laparotomy. Abdomen was closed however skin was left open. Laparoscopic appendectomy was done by creating pnuemo-peritoneum by 3-port technique. Appendectomy and peritoneal lavage with normal saline was done in both groups. Appendix was retrieved through an endobag in laparoscopic group.
Results: Of the total 130 patients, Mean operative time was 46.98±2.99 minutes in laparoscopic surgery and 53.02±2.88 minutes in open surgery group with *p* value of 0.0001(showing a statistically significant difference), length of hospital stay was 4.38±1.09 day in laparoscopic surgery and 4.18±0.77 days in open surgery group (*p* value = 0.23, showing insignificant difference).Surgical site infection (port site infection and laparotomy access wound) was seven (10.77%) in Laparoscopic group and eighteen (27.69%) in open surgery group (*p* value = 0.01, showing significant difference)
Conclusion: Frequency of surgical site infection, mean hospital stay and mean operative time in the patients with perforated appendix managed laparoscopically are significantly lower when compared with open approach. However mean hospital stay in both groups was same showing non significant difference
Key words: Perforated appendix, laparoscopic surgery, open surgery, port site infection, hospital stay, mean operative time,

Introduction

With advancements in minimal invasive surgical techniques the ideal treatment of the acute appendicitis is Lap Appendectomy[1] and now many centers have transitioned towards this minimal access approach all over the world.[2]

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Authors Contribution

AN, MIA & MB conceptualized the project and did the literature search.AN, MB & MA did the data collection. Statistical analysis, drafting, revision & writing of manuscript was done by AN, MIA, MB & MA.

Managing complicated perforated appendix raise serious concerns about intra-abdominal and extra-abdominal wound infections.[3] Perforated appendix can be defined as acutely inflamed appendix with purulent peritoneal and pelvic collection, diagnosed on basis of CT scan.[4] Though safety of this minimal access approach in treatment of patients with acute uncomplicated perforated appendicitis is now established,[5] but in patients with perforated appendix expose a challenge. Surely minimal access approach has been associated with less hospital stay and significantly less post-operative pain[5] in perforated group. Nevertheless, the feasibility and validity of laparoscopic approach remains controversial as few earlier studies have documented increased incidence of Intra-abdominal collections,[6-8] while other trials confirmed statistically less postoperative complications including surgical site infections in laparoscopic approach.[5,9-11] Our study aimed at comparing three primary outcomes,

post-operative pain, hospital stay and surgical site infection in laparoscopic versus open appendectomies.

Methodology

This Randomized Control Trial was conducted at surgical floor 2 of Holy Family Hospital, Rawalpindi, Pakistan from May 2015 to April 2016. All patients between 15-50 years of age who presented to emergency department of the hospital with CT or Ultrasonographic evidence of perforation of appendix along with clinical correlation based on Alverado scoring were enrolled in study. Patients having simple appendicitis, those who underwent any previous abdominal surgery, anesthetically unfit patients (ASA Class 3 or above) or those with contraindication to minimal access approach like morbid obesity or pulmonary disorders or history of Koch's were excluded. After taking informed consent, the lottery method was employed for randomization prospectively to open and laparoscopic appendectomy group for perforated appendix. The pre & postoperative results were noted by house officers who also assessed the patients during postoperative period and, all this information were recorded on a pre-designed performa.

Aseptic measures were adopted in both groups to prevent infections. Both groups of patients undergoing surgery were given three doses of Inj. FLAGYL 400 mg and Inj. CEFTRIAXONE 1g. These drugs were administered intravenously during operation and continued up to fifth post-operative day. In open technique a lower midline laparotomy was performed, Meso-appendix and base of appendix tied with 2/0 Vicyl. After completion abdomen was washed thoroughly with copious amount of normal saline till the complete clearance from any visible contaminants. The abdomen was closed in single layer with Proline 1. Skin however was left open and pyodeine dressing applied. Wound was dressed daily with pyodeine. Laparoscopic appendectomy was performed by creating pnuemo peritoneum by 3 port technique, appendectomy done. Specimen bag developed from latex glove was used to minimize spillage during retrieval and abdomen washed thoroughly with copious amount of normal saline. Abdomen was irrigated and cleaned till complete gross clearance of obvious contaminants. Port sites were cleaned with pyodine and dressed without sutures. Both groups received three doses of inj TORADOL 30mg at eight hours interval for pain relief.

Data was entered into SPSS software (version 20.0) for analysis. Gender and other qualitative variables were measured as frequency and also as percentage. Age of patient, hospital stay, and operative time was measured and analyzed as mean±SD. To compare stay in hospital and time of surgery between two groups Independent sample t-test was used. Stratification was used as strategy to control effect modifiers like age, gender and ASA. After stratification, we used chi-square for qualitative variables and independent sample t test for quantitative variables. *p* value ≤0.05 was considered statistically significant.

Results

Total one hundred and thirty cases fulfilling the inclusion criteria were enrolled in both groups i.e. Sixty five in each group. Open appendectomies were performed in 65 patients and lap appendectomy in other 65 patients (LA group). Patients distribution according to age, showed that twenty nine (44.62%) in laparoscopic surgery and 27 (41.54%) in open surgery group, were between 15-30 years while thirty six (55.38%) in laparoscopic surgery and thirty eight (58.46%) in open surgery group were between 31-50 years. According to gender thirty three (50.77%) in laparoscopic surgery and thirty two (49.23%) in open surgery group were male while thirty two (49.23%) in laparoscopic group and thirty three (50.77%) in open surgery group were females.

There is statistically significant difference regarding age, gender and other demographic parameters in both groups (Table-1 & 2).

Table 1: Comparison of operative time with regard to age and gender. (n=130)

	Laparoscopic Surgery (n=65)	*Open Surgery (n=65)*
ASA 1	47.04 (SD 3.36)	53.25 (SD 2.49)
ASA 2	46.88 (SD 2.86)	53.02 (SD 2.88)

p value = 0.0001

Table 2: Comparison of operative time with regard ASA. (n=130)

	Laparoscopic Surgery (n=65)	*Open Surgery (n=65)*
Male	47.09 (SD 3.016)	53.13 (SD 2.89)
Female	46.88 (SD 2.88)	52.91 (SD 2.91)
Age 15-30 years	47.14 (SD 3.10)	53.19 (SD 2.99)
Age 31-50 years	46.86 (SD 2.94)	52.89 (SD 2.84)

p value = 0.0001

Mean operative time was compared in both groups and, it was found to be 46.98±2.99 minutes in laparoscopic surgery and 53.02±2.88 minutes in open surgery group, with a statistically significant *p* value of 0.0001 (Table-3).

Table 3: Comparison of mean operative time. (n=130)

	Laparoscopic Surgery (n=65)		*Open Surgery (n=65)*	
	Mean	*SD*	*Mean*	*SD*
Operative time (mins)	46.98	2.99	53.02	2.88

p value = 0.0001

Mean hospital stay was compared and found that in minimal access surgery group the stay was 4.38±1.09 days while it was 4.18±0.77 days after open surgery. The *p* value was statistically non-significant (*p* value 0.23) (Table-4).

Table 4: Comparison of mean hospital stay among enrolled patients. (n=130)

	Laparoscopic Surgery (n=65)		*Open Surgery (n=65)*	
	Mean	*SD*	*Mean*	*SD*
Hospital stay (days)	4.38	1.09	4.18	0.77

p value = 0.23

Frequency of surgical site infection (SSI) was seven (10.77%) in Laparoscopic group versus eighteen (27.69%) in open surgery group. The p value for SSI was 0.01 which is a significant difference (Table-5).

Table 5: Comparison of surgical site infection in both groups. (n=130)

Infection	*Laparoscopic Surgery (n=65)*		*Open Surgery (n=65)*	
	No. of patients	*%*	*No. of patients*	*%*
Yes	7	10.77	18	27.69
No	58	89.23	47	72.31
Total	65	100	65	100

p value = 0.01

Stratification controlled the effect modifiers like gender, age and ASA. Chi-square was applied for statistical analysis of qualitative variables while independent sample t test for analysis of quantitative variables. We selected *p* value ≤0.05 as significant.

Discussion

In this study the operative time was compared between Open Appendectomies and Lap Appendectomy. it was found that operative time was 46.98±2.99 minutes in laparoscopic surgery and 53.02±2.88 minutes in patients having open surgery with *p* value of 0.0001 which is statistically significant. These findings are not in line with a previous study done by Fukami et al[9] that revealed that the operative time in Laparoscopic and open approach were almost the same. Probably more time was used for closure of abdomen with single layer suturing in open technique and could be attributed to extended time in open group.

Similarly when post operative length of hospital stay was compared it was found that in case of laproscopic surgery it was 4.38±1.09 days while in case of open surgery length of hospital stay was 4.18±0.77 days, with a non significant p value of 0.23 hence we find trivial difference between the two groups. This finding is in line with other studies performed by Wotherspoon HA et al[8] which also concluded statistically insignificant difference in hospital stay among both groups. However in a most recent study conducted by Lin et al.[5] showed less duration of post operative hospital stay in laparoscopic group. This can be attributed to relatively lesser requirement of dressing of large surgical wounds in open approach and thorough abdominal wash in laparoscopic surgery.

Comparison of surgical site infection showing that seven (10.77%) wounds got infected in the Laparoscopic group and eighteen (27.69%) wounds in open surgery group were infected. while no wound infection occurred in fifty eight (89.23%) laparoscopic surgery patients and forty seven (72.31%) wounds remained healthy in open surgery group (*p* value = 0.01). Our wound infection rate was 8.3% in laparoscopic as compared to 24.4% with open appendectomy. These values have shown a marked difference which is in favor of laparoscopic group. Finding of such a high frequency of wound infection in open approach is similar to findings of a Korean study done by Suh Y et al[12] which showed relatively higher surgical site infection rates. Similar findings of high surgical site infection in group of patients being operated by open approach is also reported by a local study conducted by M. Ashraf et al.[13] These trends of higher infections rate can be explained by large wounds created in laparotomy which obviously get contaminated and higher chances of infection in perforated appendicitis. while in laparoscopy, the peritoneum acts as a natural barrier to infection.[12]

Sleem R et al[14] conducted another study to determine whether open or laparoscopic approach have better outcomes. The 27.9% patients developed perforation among 885 total patients. Total of 16% patients had to be converted from laparoscopic to open approach due to surgical difficulties. Also length of stay in hospital was significantly lower in the laparoscopic group (*p* <.05).Both groups had similar incidence of post-operative abscesses. However, wound infection and

use of antibiotics were much less in minimal access group (p <.05).Similarly Andersson at al who also concluded that appendicitis managed laparoscopically has better and improved outcomes;[15] however, for perforated appendicitis owing to its higher morbidity compared with open procedures, laparoscopy was controversal.[3,16]

On basis of the study findings we may conclude that perforated appendix can be managed effectively by laparoscopic appendectomy. The outcomes of minimal access are better than the open approach in perforated appendicitis.

The results of this study clarify the hypothesis that *"Laparoscopic approach is better and advantageous than open approach in terms of reduced infection rate and has less operative time."*

We may wrap up our discussion with the remarks that laparoscopy is a safe, effective and more diagnostic modality for managing perforated appendix as compared to open conventional approach. Furthermore Laparoscopic approach should be first choice for management of all perforated appendices unless there is some contraindication.

Conflict of interest: None declared.

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