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Original Article

Is Laparoscopic Appendectomy Recommended in Perforated Appendicitis?

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ABSTRACT

Objective: To compare Open Appendectomy and Laparoscopic Appendectomy in the treatment of perforated Appendicitis.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Surgery, Combined Military Hospital, Abbottabad Pakistan, from Dec 2016 to Jan 2022.
Methodology: A total of 240 patients underwent either open (Group-A) or laparoscopic (Group-B) appendectomy. Patients of Perforated Appendicitis fulfilling inclusion criteria were included in the study after getting informed consent. Variables of operative time, hospital stays, surgical site infection and Intra-abdominal infection were recorded.
Results: Mean operating time for the Open Appendectomy-Group (49.7±6.10 minutes) was significantly shorter than the time of Laparoscopic Surgery-Group (58.93±5.41 minutes; p<0.001). The mean hospitalization time was shorter (2.57±0.77 days) in Laparoscopic Appendectomy than Open Surgery-Group (3.23±0.62 days, p=0.001). Two port sites (6.7%) in the Laparoscopic Group and nine surgical sites (30.0%) in the Open Surgery-Group got infected (p=0.021). Two patients (6.7%) in Open Appendectomy-Group and three patients (10.0%) in Laparoscopic Appendectomy-Group had postoperative complication of intra-abdominal abscess (p=1.00).
Conclusion: As compared to open approach, laparoscopic appendectomy had significantly lesser surgical site infections, shorter hospital stays and longer operating time. There was no statistically significant difference in the intra-abdominal infection in both techniques.

Key Words: Laparoscopic Appendectomy, Open Appendectomy, Perforated Appendicitis.

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INTRODUCTION

Worldwide, acute appendicitis is the most common abdominal emergency requiring surgery in all the age groups.[1,2] Male population has a lifetime risk of 8.6% and female population of 6.7% with 13-20% risk of appendicular perforation.[3,4]

Open appendectomy has been the procedure of choice since the time McBurney described it.[5] However after the introduction of laparoscopic appendectomy by Semm, it became favorite among Surgeons because it utilizes minimally invasive technique. There have been two schools of thought among surgeons about laparoscopic appendectomy.[6] Critics blame it for increased cost on disposable instruments, long operating time and increased incidence of intra-abdominal abscess in cases of perforated appendices.[7] The other school of thought prefers laparoscopic approach over open technique and claims that laparoscopic appendectomy is associated with a smaller surgical wound, less pain, early healing, shorter stay in the hospital and early return to work. Moreover, it helps in the diagnosis and provides an excellent view for a safe exploration. All these factors make it an attractive choice for both doctors and the patients.[8]

Research has established that laparoscopic appendectomy for non-perforated appendicitis should be preferred because it is associated with fewer complications and it can diagnose and treat simultaneously.[9] However, controversy in case of perforated appendicitis persists because of the increased incidence of intra-abdominal abscess reported by early studies.[10] Results of latest studies are shifting the trend towards Laparoscopic appendectomy by achieving comparable results with laparoscopy in perforated appendicitis. Dearth of similar studies for this very important issue form the rationale for our study.

METHODOLOGY

The quasi-experimental study was conducted at the Department of Surgery CMH Abbottabad Pakistan

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from December 2016 to January 2022 and approved by the Institutional Ethical Review Committee (letter no. CMHAtd-ETH-40-Surg-22). Sample size was calculated using WHO sample size calculator taking reported prevalence of perforated appendicitis 19.0%.[11]

Inclusion Criteria: Patients of either gender aged 15-50 years age, diagnosed with appendicitis, by history of more than 1 day of pain right iliac fossa with clinical evidence of abdominal tenderness, guarding, fever, tachycardia and leukocytosis (>10000) associated with free fluid in the lower abdomen or pelvis on abdominal ultrasound or CT scan were included.

Exclusion Criteria: Patients of uncomplicated appendicitis, past history of abdominal surgery, on preanesthetic assessment of ASA class three or above and those with any contraindication to laparoscopic surgery like cardiorespiratory illness, were excluded. Conversion from laparoscopic to open surgery for any reason was also excluded from the study.

Using non-probability consecutive sampling, we recruited patients after obtaining informed consent. 120 patients underwent open (Group-A) and 120 patients laparoscopic appendectomy (Group-B) (Figure-1). Outcome variables of procedure time, duration of hospitalization, surgical site infection and intra-abdominal infection were recorded. Duration of hospital stay was noted in days from date of admission to the date of discharge and time of procedure was recorded from skin incision to skin closure. Surgical site infection was noted by the presence of swelling, redness or discharge from the surgical site on the 4th and 7th postoperative day follow-up visit. Patients not passing flatus after 72 hours, having temperature after 48 hours of 100F0 or above and ultrasound/CT scan evidence of intra-abdominal collection of greater then 20ml were considered as intra-abdominal infection.

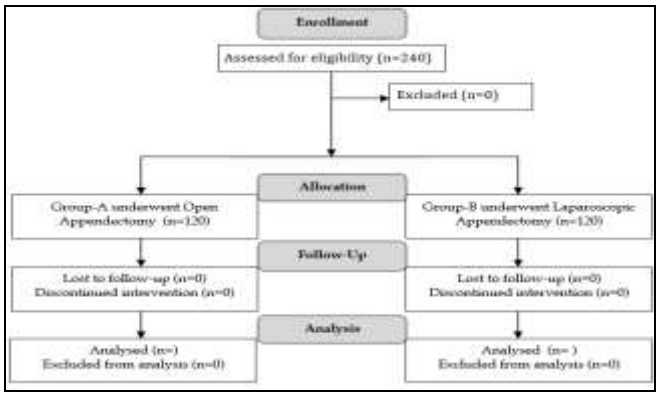

Figure-1: Patient Flow Diagram (n= 240)

Preoperative and five days post-operative antibiotic cover was administered to all patients with intravenous Metronidazole 500mg q8H and Cefuroxime 1.5gm q8H. Open appendectomy was performed by a lower midline incision. After thorough peritoneal lavage with Normal Saline abdomen was closed and drain placed in the pelvis. Laparoscopic appendectomy was done via three-port technique after creating pneumoperitoneum through supraumbilical port. Appendices retrieved along with the port after bringing inside the port. The abdomen was cleaned by suction and copious irrigation with Normal Saline and drain was placed in the pelvis. Postoperative analgesia was provided to all patients with intravenous Tramadol 50mg q6H for 48 hours.

Data was analyzed by using Statistical Package for the Social Sciences (SPSS) version 23. Mean±SD was calculated for continuous variables. Frequency and percentage were calculated for categorical variables. Chi-square test was used for categorical variables and Independent samples t-test was used for continuous variables. The *p*-value of ≤0.05 was considered significant.

RESULTS

A total of two hundred and forty patients (120 each group) were included in the study. There were 151 male patients (62.9%) and 89 female patients (37.1%). Mean age was 27.30±10.30 Years. The time of operating was more in laparoscopic appendectomy group (58.93±5.41 minutes) as compared to open appendectomy (49.70±6.10 Minutes) as *p*-value<0. 001. However, length of hospitalization was shorter in laparoscopic appendectomy group (2.57±0.77 days) as compared to open appendectomy (3.23±0.63 days) as *p*-value<0.001 shown in Table-I.

Table-I: Comparison of Operating Time and Length of Hospitalization in Laparoscopic and Open Appendectomy (n=240)

Outcomes	Group-A (n=120)	Group-B (n=120)	*p*-value
Operating time (Minutes)	49.70±6.10	58.93±5.41	<0.001
Length of hospitalization (Days)	3.23±0.63	2.57±0.77	<0.001

Furthermore, 8(6.7%) patients had surgical site infection in laparoscopic appendectomy group and 21(17.5%) patients had in open appendectomy (*p*-value=0.010). Intra-abdominal infection was noted in 7 patients (5.8%) in open appendectomy and 12 patients (10.0%) in laparoscopic appendectomy, however the

difference was not statistically significant as *p*-value=0.231 (Table-II). Perforated appendix with surrounding pus was shown in Figure-2.

Table-II: Comparison of Infection Between Laparoscopic and open Appendectomy (n=240)

Infection	Group-A (n=120)	Group-B (n=120)	*p*-value
Surgical Site infection	21(17.5%)	8(6.7%)	0.010
Intra-Abdominal Infection	7(5.8%)	12(10.0%)	0.231

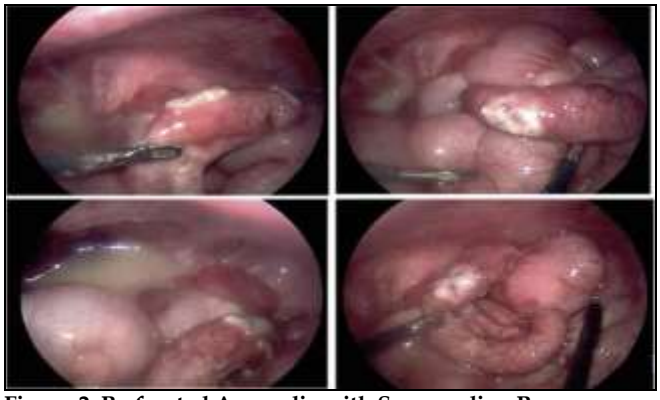

Figure-2: Perforated Appendix with Surrounding Pus

DISCUSSION

Laparoscopic surgery was avoided for complicated appendicitis in the past because of anticipated difficulty in surgery and fear of increased postoperative complications.[12] The challenge was, however, accepted as skills and experience in the field of laparoscopic surgery advanced. Laparoscopic appendectomy was performed for perforated appendicitis and evaluated by different Surgeons. Different researchers came out with variable results in their studies. The major difference in these studies is the number of patients and their follow up, different practices of antibiotics use, technique of appendicular stump closure. peritoneal lavage, drain placement and experience of operating surgeon.[13]

Laparoscopic appendectomy has significant benefits over open appendectomy in complicated appendicitis as demonstrated in the meta-analysis by Athanasiou *et al*.[13] which showed that laparoscopic appendectomy had significantly less surgical site infections, with shorter time to start oral intake, and shorter hospitalization time. There was no significant difference in intra-abdominal abscess rates.

Our study reveals shorter mean operating time for open (49.70±6.09 minutes) as compared to Laparoscopic group (58.93±5.41minutes). Seqsaqa *et al*. recorded significantly longer operative time with laparoscopic approach. They recorded mean operating time of 17±27.0 minutes with open appendectomy and 61.33±20.08 minutes with laparoscopic approach.[14]

Longer mean operating time seen in these studies for laparoscopic Appendectomy contradicts with studies by Nazir *et al*. They recoded 46.98±2.99 minutes for laparoscopic and 53.02±2.88 minutes for open appendectomy.[15] Experience with laparoscopic techniques in different centers can be an explanation for these variations in the operating time cited by different researchers.

Nazir *et al*. recorded mean hospital stay slightly longer in the laparoscopic approach (4.38±1.09 days) than in open appendectomy (4.18±0.77 days'=0.23).[15] In contrast, significant difference in duration of hospital stay between the laparoscopic appendectomy group (2.57±0.77 days) and the open appendectomy group (3.23±1.09 days) was noted in our study (*p*=0.001). Rasuli *et al.* also had significantly lower mean hospital stay with laparoscopic appendectomy than open appendectomy.[16]

Our Surgical site infection was 30% in open appendectomy and 6.7% in laparoscopic appendectomy (*p*=0.02). These findings coincide with study by Nazir *et al*. which shows 27.69% surgical site infection in Open and 10.7% in Laparoscopic group.[15] Talha *et al*. also reported higher rate of surgical site infection in open appendectomy than laparoscopic technique.[17]

A major concern in earlier studies about using Laparoscopic appendectomy for perforated appendicitis was the increased occurrence of intraabdominal abscess. The occurrence of intraabdominal abscess leads to prolonged antibiotic usage, increased rate of readmission, and increased medical costs.[17]

Over the last decade the evidence for intra-abdominal abscesses in the treatment of perforated appendicitis by open or laparoscopic technique changed and was demonstrated by cumulative meta-analysis by Ukai *et al*. Out of 51 trials for intra-abdominal abscess, studies up to 2001 showed statistical significance in favor of open appendectomy. However, studies done after 2001 showed insignificant results when two techniques were compared for intraabdominal abscess while treating perforated appendicitis.[18]

In our study, three patients of laparoscopic appendectomy (6.7%) and two patients of open appendectomy (10%) had intra-abdominal abscess. The difference in the rate of intra-abdominal infection between the two groups was, however, not statistically significant (p=1.00). Results of a study by Talha *et al*. reveal higher but statistically insignificant rate of intra-abdominal abscess in laparoscopic technique as compared to open appendectomy. Masoomi *et al*. in their study recorded lower rate of intra-abdominal infection in laparoscopic than in open appendectomy (1.65 vs 3.57%).[19]

These differences in the rate of intraabdominal infection can be attributed to patient related factors like extremes of age, Diabetes, degree of inflammation and its extent. Surgery related factors include variations of individual practices including appendicular stump closure techniques, peritoneal lavage, insertion of drains, use of antibiotics, experience, skill and techniques of different operating surgeons.

CONCLUSIONS

As compared to open technique, laparoscopic appendectomy in perforated appendicitis has significantly lesser rate of surgical site infection, shorter hospital stays and longer operating time. There is no statistically significant difference in the intra-abdominal infection in both techniques. laparoscopic appendectomy is therefore recommended as a safe option in cases of perforated appendicitis in properly trained, skilled and experienced hands.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

YA & IR: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MYA & RAH: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AR & MNBT: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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