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Open Appendectomy versus Laparoscopic Appendectomy in Complicated Appendicitis: A Comparative Study

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Original Research Article

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Abstract: ***Introduction:*** Appendectomy is the most common surgical procedure performed in emergency surgery. Because of lack of consensus about the most appropriate technique, appendectomy is still being performed by both open (OA) and laparoscopic (LA) methods. ***Material and Methods:*** This is prospective, comparative, single centre and descriptive study conducted in the Department of General Surgery, a tertiary care teaching hospital among 60 patients over a period of 6 months. Patients with appendicitis were included in the study. The diagnosis of appendicitis was made on the following criteria: History of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting, fever of more than 38°C and/or leukocytosis above 10,000 cells per mL, right lower quadrant guarding, and tenderness on physical examination. ***Results:*** Maximum number of patients were male 38 (63.3%) and female 22 (36.6%) in Laparoscopic appendectomy. In Open appendectomy group, maximum number of patients were male 39 (65.0%) and female 21 (35.0%) in Laparoscopic appendectomy. Duration of the operation time ranged from 31-94 min in Laparoscopic appendectomy (Mean±SD 49.4±4.2) and 25 to 62 min (Mean±SD: 29.3±3.9) in Open appendectomy. Mean duration of post-operative pain was 21.01±3.9 hours in Laparoscopic appendectomy and 29.34±3.64 hours in Open appendectomy ($p<0.001$). The mean duration of hospital was 1.98±0.09 days in Laparoscopic appendectomy and 6.01±1.86 days in Open appendectomy ($p<0.05$). ***Conclusion:*** Our results showed the advantages of the laparoscopic approach over open appendectomy including shorter hospital stay, decreased need for postoperative analgesia, earlier return to work, lower rate of wound infection, against only marginally higher hospital costs. In the future, laparoscopic appendectomy could represent the standard treatment for patients with appendicitis and undiagnosed abdominal pain.
Keywords: Appendicitis, Open Appendectomy, Laparoscopic Appendectomy.

INTRODUCTION

Appendicitis is the most common cause of surgical abdomen in all age groups [1]. Approximately 7–10 % of the general population develops acute appendicitis with the maximal incidence being in the second and third decades of life [2]. Open appendectomy has been the gold standard for treating patients with acute appendicitis for more than a century, but the efficiency and superiority of laparoscopic approach compared to the open technique is the subject of much debate nowadays [3]. There is evidence that minimal surgical trauma through laparoscopic approach resulted in significant shorter hospital stay, less postoperative pain, faster return to daily activities in several settings related with gastrointestinal surgery [4].

However, several retrospective studies [5], several randomized trials [6] and meta-analyses [7] comparing laparoscopic with open appendectomy have provided conflicting results. Some of these studies have demonstrated better clinical outcomes with the laparoscopic approach [8], while other studies have shown marginal or no clinical benefits [9] and higher surgical costs [10]. Bearing in mind that laparoscopic appendectomy, unlike other laparoscopic procedures [11], has not been found superior to open surgery for acute appendicitis.

We designed the present study to determine any possible benefits of the laparoscopic approach. The aim of this study was to compare the clinical outcomes (hospital stay, operating time, postoperative complications, analgesia requirement, and time to oral intake and to resume normal activity) and the hospital costs between open appendectomy and laparoscopic appendectomy.

MATERIAL AND METHODS

This is prospective, comparative, single centre and descriptive study conducted in the Department of General Surgery, a tertiary care teaching hospital among 60 patients over a period of 6 months.

Patients with appendicitis were included in the study. The diagnosis of appendicitis was made on the following criteria: History of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting, fever of more than 38°C and/or leukocytosis above 10,000 cells per mL, right lower quadrant guarding, and tenderness on physical examination.

Inclusion Criteria

All patients included above 18 years of age and either gender with appendicitis was included in the study. Patient willing to give informed written consent.

Exclusion Criteria

Patients were excluded if the diagnosis of appendicitis was not clinically established and if they had a history of symptoms for more than 5 days and/or a palpable mass in the right lower quadrant, suggesting an appendiceal abscess treated with antibiotics and possible percutaneous drainage. Patients with the following conditions were also excluded: history of cirrhosis and coagulation disorders, generalized peritonitis, shock on admission, absolute contraindication to laparoscopic surgery (large ventral hernia, history of laparotomies for small bowel obstruction, ascites with abdominal distension), contraindication to general anesthesia (severe cardiac and/or pulmonary disease), inability to give informed consent due to mental disability, and pregnancy.

RESULTS

In our study, the most of the patients the age group of 21-40 years i.e., 44 out of 60 (73.3%), followed by 41-60 years, i.e., 25 out of 60 (25.0%) in Laparoscopic appendectomy. In Open appendectomy group the most of the patients the age group of 21-40 years i.e., 45 out of 60 (75.0%), followed by 41-60 years, i.e., 13 out of 60 (21.6%).

Table-1: Distribution of different age groups between two groups

Age in years	Laparoscopic appendectomy	Open appendectomy
18-40	44 (73.3%)	45 (75.0%)
41-60	15 (25.0%)	13 (21.6%)
>61	1 (1.6%)	2 (3.3%)
Total	60 (100%)	60 (100%)

Table-2: Distribution of gender between two groups

Gender	Laparoscopic appendectomy	Open appendectomy
Male	38 (63.3%)	39 (65.0%)
Female	22 (36.6%)	21 (35.0%)
Total	60 (100%)	45 (100%)

In table 2, maximum number of patients were male 38 (63.3%) and female 22 (36.6%) in Laparoscopic appendectomy. In Open appendectomy group, maximum number of patients were male 39 (65.0%) and female 21 (35.0%) in Laparoscopic appendectomy.

Table-3: Comparison of operation time between two groups

Operation	Operation time (minutes)	Mean±SD operation time (minutes)
Laparoscopic appendectomy	31-94	49.4±4.2
Open appendectomy	26-62	29.3±3.9

Duration of the operation time ranged from 31-94 min in Laparoscopic appendectomy (Mean±SD 49.4±4.2) and 25 to 62 min (Mean±SD: 29.3±3.9) in Open appendectomy.

Table-4: Comparison of outcome variables between the two groups

Outcome variables	Laparoscopic appendectomy (Mean±SD)	Open appendectomy (Mean±SD)	p-value
Post- op pain (hours)	21.01±3.9	29.34±3.64	<0.001
Duration of hospital stay (days)	1.98±0.09	6.01±1.86	<0.05
Return to work (days)	2.97±0.29	6.95±1.56	<0.05

Mean duration of post-operative pain was 21.01±3.9 hours in Laparoscopic appendectomy and 29.34±3.64 hours in Open appendectomy ($p<0.001$). The mean duration of hospital was 1.98±0.09 days in Laparoscopic appendectomy and 6.01±1.86 days in Open appendectomy ($p<0.05$).

Table-5: Complications in open and laparoscopic surgery in present study

Complications during hospital stay	Laparoscopic cholecystectomy	Open cholecystectomy

Wound infection	4	10
Vomiting	3	6
Postoperative ileus	1	2
Wound dehiscence	2	5
Intra-abdominal abscess	4	1

DISCUSSION

Acute appendicitis is a very common pathology encountered in adult patient populations, with a lifetime risk of 7-8% [12]. There have been much recent research and debate over the best operative modality for an appendectomy, despite the laparoscopic approach gaining popularity among general surgeons. The rate of LA between 1998 and 2008 increased from 20.6% to 70.8%, becoming the prevalent approach to treat acute appendicitis since 2005 [13]. In the subset of obese patients, the benefits of laparoscopy are generally more striking, associated with lower risk of intraoperative complications, fewer surgical site infections, and shortened hospital stays [14].

Although the infection of the surgical wound is not a life-threatening condition, it worsens the quality of life in the early postoperative period and prolongs the recovery time. The reduction of wound infection rate is a significant advantage of LA [15]. The extraction of specimen with a bag and through a trocar port rather than directly through the surgical wound as in open procedures can explain this reduction in incidence. Moreover, the smaller size of the laparoscopic incisions reduces the probability of infection, especially in obese patients. Although the number of surgical site infections in MIA group was higher than in LA group, the difference was not significant.

One of the most known advantages of laparoscopic approach is short lengths of hospital stay. In the present study, the difference was not significant between two groups, possibly due to the smaller sizes of incision and selected patients with lower body mass index and complicated appendicitis. The other known advantage of laparoscopy is good cosmetic results. Patient satisfaction was asked for wound healing and scar tissue in the present study. Although it was not a subjective method to evaluate the cosmetic results of the patients on telephone and only by classifying the scar as bad, moderate, good, and excellent, the difference between two groups was not statistically significant. General anaesthesia is mandatory for laparoscopic procedures, but mini-incision appendectomy provides the option of regional anaesthesia. The use of regional anaesthesia instead of general anaesthesia for mini-incision appendectomy can be recognized as an advantage of MIA.

This study compared the postoperative outcomes and total hospital costs of laparoscopic and mini-incision approaches in the management of complicated appendicitis. We hypothesized that the increase in resources and equipment needed for laparoscopy would result in an overall increase in the cost of hospitalization when LA was used for appendectomy. Wei *et al*. [16] in their meta-analysis including 8 randomized controlled trials performed an analysis of the costs across different countries and age groups using the hospital cost ratio to compare the total cost of laparoscopic and open appendectomy (OA). The total hospital costs for LA were higher by 11% when compared to OA, but the difference was found to be not statistically significant. According to a Cochrane review published by Sauerland *et al*. [17], laparoscopy does not show relevant advantages compared to open appendectomy; therefore, indication should be limited to young women and obese patients. Nakhamiyayev *et al*. [18] and Varela *et al*. [19] reported that the total hospital costs were comparable between the two procedures or were even lower for the laparoscopic group when the subgroup of obese patients was analyzed.

The main limitations of the present study were those inherent to a retrospective analysis, including lack of prospective validation. Validated prospective collection of patient satisfaction, quality of life, and pain scores also are needed to highlight any improvements in patient-centered outcomes. It should be better to address the comparison of postoperative pain scores between two groups. Thus, further prospective well-designed studies are needed.

Laparoscopic approach presents obvious advantages in some of patient groups such as obese patients, young women patients having a suspect of other diagnoses with or without acute appendicitis, and patients with perforated appendicitis. But in developing countries, total hospital costs are still a serious problem. In conclusion with respect to the results of the present study, mini-incision appendectomy seems to be an alternative for selected patients with complicated appendicitis.

CONCLUSION

Our results showed the advantages of the laparoscopic approach over open appendectomy including shorter hospital stay, decreased need for postoperative analgesia, earlier return to work, lower rate of wound infection, against only marginally higher hospital costs. Furthermore, we found a considerable preference (during the collection of consent) of patients and a high satisfaction after the surgery in the laparoscopic group. Provided that surgical experience and equipment are available, laparoscopy could be considered safe and equally efficient compared to open technique and should be undertaken as the initial

procedure of choice for most case of suspected appendicitis. However, since there is no consensus to the best approach, both procedures (open and laparoscopic appendectomy) are still being practiced actively deferring the choice to the preference of surgeon and patients. In the future, laparoscopic appendectomy could represent the standard treatment for patients with appendicitis and undiagnosed abdominal pain.

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