

## Comparison of outcome between open and laparoscopic appendicectomy

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### Abstract

**Background:** Laparoscopic surgery is available for a long time but it is still not clear whether open appendicectomy (OA) or laparoscopic appendicectomy (LA) is the most appropriate surgical approach to acute appendicitis. The purpose of this study is to compare the surgical effects and safety of laparoscopic and open appendicectomy. **Methods:** Study was carried out in Jashore district in Bangladesh from January 2014 to June 2018. 605 cases of acute appendicitis included who underwent appendicectomy in Jashore Medical College Hospital and other private hospitals in Jashore town. Of them 317 patients underwent OA and 288 LA. Comparisons were carried out in terms of operating time, postoperative complications, postoperative hospital stay, return to normal activities and cost. **Results:** 21 cases were converted to open procedure and included in the laparoscopic group data. The mean operative time is a bit more in LA group (51.23±13.9 minutes) than OA group (47.12±10.64 minutes). The overall incidence of complications was lower in LA. Of them wound infection was significantly lower in LA group, but intra-abdominal abscess is a little bit more in LA group. The length of hospital stay was significantly shorter in LA group (2.6±0.5 days) than in OA group (4.7±2.6 days). Time of returning to their normal activities was significantly shorter in LA group (11.8±3.2 days) than OA (16.3±3.4 days). The mean total cost was 233 US dollar in LA and 208 US dollar in OA. **Conclusion:** LA was better than OA in respect with wound infection rate, postoperative complication, postoperative hospital stay and return to normal activities. The advantages of LA far outweigh the cost of surgery and duration of operation time.

**Key words:** Laparoscopic appendicectomy, Open appendicectomy, Complications, Operative time.

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### Introduction

Acute appendicitis is the most common cause of surgical abdomen in all age groups.<sup>1,2</sup> As a result, appendicectomy is one of the most frequently performed surgical procedures in emergency department. Approximately 7–10 % of the general population develops acute appendicitis with the maximal incidence being in the second and third decades of life.<sup>3</sup> The open approach to appendicectomy was originally described by McBurney in 1894.<sup>4</sup> In 1983, Semm introduced the use of laparoscopic techniques, with the first large study of laparoscopic appendectomies reported by Pier et al. in 1991.<sup>5,6</sup> Open appendicectomy 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.<sup>3,7,8</sup> Therefore, the widespread use of LA remains controversial, in contrast to laparoscopic cholecystectomy which is considered as a gold standard operation since its innovation. But 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.<sup>9,10</sup> Laparoscopic surgery is now thoroughly instituted and progressed approach of executing general surgical procedures. In certain teaching hospitals, every patient with right iliac fossa pain has to go through laparoscopy before continuing to appendicectomy.<sup>11,12</sup> Nowadays many surgeons recommend that laparoscopic appendicectomy should be the chosen management for acute appendicitis. Some surgeons have plenty of reports about this new technique. Both surgical techniques are safe and well established in clinical practice. This study compared open to laparoscopic appendicectomy in terms of operating time, postoperative complications, postoperative hospital stay, return to normal activities and cost.

### Methods

We performed a retrospective study of the patients who underwent appendicectomy in Jashore Medical College Hospital and other private

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hospitals in Jashore town between January 2014 and June 2018. The study included 605 patients and the diagnosis of acute appendicitis was made clinically with history (right lower abdominal pain, nausea/vomiting), physical examination (elevated body temperature, tenderness or guarding in right iliac fossa), some investigations (complete blood count, abdominal ultrasound). After taking informed consent, the patients were listed randomly to either a laparoscopic or open approach group. Patients in both groups were given third-generation cephalosporin and metronidazole preoperatively as protocol. Patients with severe systemic sign were given aminoglycoside (usually Amikacin.) OA was performed through Grid Iron incision. A standard 3-port technique was performed in laparoscopic group. Pneumoperitoneum was created by a continuous pressure of 12–14 mmHg of CO<sub>2</sub> via umbilical port, placed in infraumbilical site. The patient was placed in a Trendelenburg position, with a slight left rotation. The whole abdominal cavity was inspected to exclude other intra-abdominal pathology. After the mesoappendix was divided by bipolar forceps, the base of the appendix was ligated with one Meltzer's knot (Figure 1) and then appendix was dissected distal to loop.



**Figure 1: Meltzer knot, 2:3:2 (Two hitches, Three winds, Two half locking hitches)**

The specimen was placed in the trocar or endobag (it was only used when the placement of the appendix in the trocar was not possible or the appendix was gangrenous or there was chance of contamination) and was retrieved through the infraumbilical port. When the patients were fully recovered from anesthesia and their bowel sounds returned, clear fluids were started. Soft diet was introduced when the patients tolerated the liquid diet. Patients were discharged when they were able to take regular diet, there was no fever and their pain was well controlled. The operative time (minutes) for both groups was calculated from the starting of skin incision to the last skin stitch given. The duration of hospital stay (days) was counted as the number of nights spent at the hospital postoperatively. Wound infection was defined as redness or serous or purulent or seropurulent discharge from the incision site. Intra-abdominal

abscess was defined as collection of pus or infected fluid that is surrounded by inflamed tissue in the abdominal cavity. The total hospital costs were determined as a mean for each group. Depending on the intra-operative evaluation, the cases of acute appendicitis were divided into uncomplicated if only the appendix was found inflamed or complicated if the inflamed appendix was associated with peri-appendiceal abscess, gangrene, or perforation, which were noted during per-operative period. Cases which were converted from laparoscopic to open appendectomy were included in the LA group.

#### Inclusion criteria

- The patients of both sexes within the age group of 15-60 years presented with acute appendicitis.
- Both emergency and elective cases were included.

#### Exclusion criteria

- Patients with appendicular lump due to delayed presentation.
- Patients who were not willing to participate in the study.

#### Statistical analysis by SPSS

#### Results

A total of 605 cases of appendectomy were reviewed. OA was performed in 317 patients, LA in 288. Twenty one cases were converted to open procedure and included in the laparoscopic group data.

Mean operative time ( $51.23 \pm 13.9$  min) for the LA group was a bit longer than the mean operative time for open appendectomy ( $47.12 \pm 10.64$  min).

We have seen a greater overall incidence of complications in open surgery than in laparoscopic surgery. A total of 8 complications occurred in the laparoscopic group, while 33 complications occurred in the open appendectomy group. Of them we found that wound infection rate was significantly lower in LA group (in LA group: 4 cases, in OA group: 32 cases;  $P < 0.001$ ), but intra-abdominal abscess is a little bit more in LA group, which is not significant (in LA group: 4 cases, in OA group: 1 case;  $P = 0.147$ ).

In this study the length of hospital stay was significantly shorter in LA group ( $2.6 \pm 0.5$  days) than in OA group ( $4.7 \pm 2.6$  days);  $P = 0.015$ .

Highly significant difference was found between these 2 groups in case of time of returning to their normal activities. It was less in the laparoscopic group ( $11.8 \pm 3.2$  days) compared with the open appendectomy group ( $16.3 \pm 3.4$  days);  $P < 0.001$ .

**Table I: Operative and postoperative clinical data**

	OA (n = 317)	LA (n = 288)	P-value
Mean operative time	47.12 ± 10.64 min	51.23 ± 13.9 min	
Complications			
Wound infection	33 cases	8 cases	P < 0.001
Intra-abdominal abscess	32 cases	4 cases	P = 0.147
Length of hospital stay	1 cases	4 cases	
Time of returning to their normal activities	4.7 ± 2.6 days	2.6 ± 0.5 days	P = 0.015
Mean total cost	16.3 ± 3.4 days	11.8 ± 3.2 days	P < 0.001
	\$ 208	\$ 233	

It is known that in operation theatre, laparoscopic surgery is more expensive than open approach (that uses few and cheaper equipment) due to use of costly instruments, longer operative and anaesthesiological time. But, the shorter hospital stay in the laparoscopic group kept the ward cost low in comparison to the open group. So, the total hospital cost for each patient of the LA group (233 US dollar) was only 25 US dollar higher compared to those in the OA group (208 US dollar).

### Discussion

The possibility of appendicitis must be considered in any patient presenting with an acute abdomen, and a certain preoperative diagnosis is still a challenge.<sup>13,14</sup> Although more than 20 years have elapsed since the introduction of laparoscopic appendectomy (performed in 1983 by Semm, a gynaecologist), open appendectomy is still the conventional technique. Some authors consider emergency laparoscopy as a promising tool for the treatment of abdominal emergencies able to decrease costs and invasiveness and maximize outcomes and patients' comfort.<sup>15,16</sup> Several studies<sup>7,17-19</sup> have shown that laparoscopic appendectomy is safe and results in a faster return to normal activities with fewer wound complications. These findings have been challenged by other authors who observed no significant difference in the outcome between the two procedures.<sup>3,18,20,21</sup> Another advantage of the laparoscopic approach is that it allows a full exploration of the peritoneal cavity, thus representing an important diagnostic tool in case there is only suspicion of acute appendicitis. Several diseases such as pelvic inflammatory disease, endometriosis, ovarian cysts, ectopic pregnancy, cholecystitis and colonic perforation may mimic appendicitis.<sup>22</sup> In young fertile women 50% of the surgical procedures performed for

suspected acute appendicitis turn out not to be acute appendicitis, unless proper imaging was performed.<sup>23</sup> A definite diagnosis is obtained in 96% of patients undergoing LA compared with 72% of those undergoing open procedures.<sup>24</sup> Laparoscopic procedures had rarer postoperative respiratory complications compared to open surgery.<sup>25,26</sup> Advantages of laparoscopic appendectomy are its better visualization of organs, shorter hospital stay, fewer wound infection, less post-operative pain and rapid coming back to work.<sup>27</sup> Our study showed that laparoscopic surgery gave rise to significantly less post-operative pain, less wound infection which lead to shorter hospital stay and quick recovery. The operating room time, in most of the previous studies was longer for the LA group, despite the subjective perception that it can be an easier operation.<sup>28-30</sup> This may be due to the inclusion of additional steps for set up, insufflation, trocar entry under direct vision, and diagnostic laparoscopy. Initially in this study the operative time was little more in case of LA due to lack of expertise of the surgeon. But in time this difficulty was overcome with skill and experience. Overall complication rates were similar in both groups in most of the studies. Infectious complications like wound infection and intra abdominal abscesses are two variables by which the techniques have been traditionally compared. However most studies demonstrated reduced wound infection rate for LA. On the other hand, Klingler et al<sup>31</sup> and Katkhouda et al<sup>32</sup> found that infectious complications were similar in both groups. The lower rate of wound infection in laparoscopic group may be due to placement of the detached appendix into trocar before its removal from the abdominal cavity, reducing contact with the abdominal wall and minimizing contamination.

Conversely, intra-abdominal abscess is a serious and life-threatening complication. Several hypotheses have been suggested to find possible explanations: mechanical spread of bacteria in the peritoneal cavity promoted by carbon dioxide insufflation, especially in case of ruptured appendix,<sup>33,34</sup> inadequate learning curve,<sup>35</sup> the meticulous irrigation, instead of simple suctioning, of the infected area in severe peritonitis, that leads to contamination of the entire abdominal cavity, which is difficult to aspirate latter.<sup>36</sup> In our study the management of intrabdominal abscesses included conservative management, percutaneous drainage and surgical procedures. Wound infections were dealt conservatively. Length of hospital stay is a very important factor that directly influences the economy and the well-being of the patient particularly those in active age group. The literature provides contradictory results. Although some recent retrospective cohort studies or chart reviews found LA associated with significantly shorter hospital stay.<sup>37,38</sup> The higher cost of laparoscopic instruments compared to the traditional open technique represents a major bar to its greater use. However, due to the shorter hospital stay, the total cost for laparoscopic appendectomy was slightly more than that of open appendectomy. In addition, Moore and al. demonstrated an economic benefit of laparoscopic appendectomy from a social perspective, since earlier return to daily activities is crucial, especially for patients who are young and lead a productive life.<sup>39</sup> Limitations of our study included the lack of evaluation of laparoscopic surgery in obese, children. Moreover the follow up period was only limited to 2 weeks after hospital discharge.

### Conclusion

Laparoscopic appendectomy is an effective and safe option and the procedure of choice for the most patients. It was better than OA in respect with wound infection rate, postoperative complication, postoperative hospital stay and return to normal activities. The advantages of LA far outweigh the cost of surgery and duration of operation time. Therefore, laparoscopic appendectomy can be recommended as preferred approach for treatment of acute appendicitis.

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