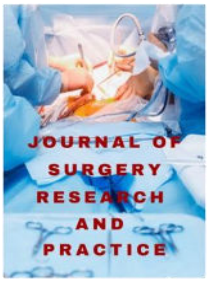

e-ISSN: 3068-3742
Journal of Surgery Research and Practice

ATHENAEUM SCIENTIFIC PUBLISHERS

Short Communication

Optimal Management of Perforated Appendicitis: Review of Articles and Observational Study

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Citation: Khoury ME, et al. Optimal Management of Perforated Appendicitis: Review of Articles and Observational Study. J Surg Res Prac. 2023;4(3):1-4.

https://doi.org/10.46889/JSRP.2023.4308

Received Date: 01-11-2023

Accepted Date: 21-11-2023

Published Date: 29-11-2023

Abstract

Complicated appendicitis is defined as an acute episode of appendicitis, accompanied by a perforation of the appendix or the formation of an intra-abdominal abscess, with or without peritonitis. Laparoscopic appendectomies have been performed since the 1980s. However, the debate has still been ongoing on whether the laparoscopic approach is preferred over open appendectomies for complicated appendicitis, with most scholars focusing on the post-operative complications as an indicator to investigate the above.

Keywords: Appendicitis; Laparoscopic Appendectomy; Intra-Abdominal Abscesses

Introduction

Complicated appendicitis is defined as an acute episode of appendicitis, accompanied by a perforation of the appendix or the formation of an intra-abdominal abscess, with or without peritonitis [1]. Laparoscopic appendectomies have been performed since the 1980s and surgeons have reached a generalized consensus on the superiority of this technique over an open appendectomy for uncomplicated appendicitis. However, the debate has still been ongoing on whether the laparoscopic approach is preferred over open appendectomies for complicated appendicitis, with most scholars focusing on the post-operative complications as an indicator to investigate the above.

Some scholars have studied the above research question by comparing the incidence of post-operative complications for laparoscopic appendectomies conducted in patients presenting with complicated versus uncomplicated appendicitis. In a study conducted by Ball, et al., on 304 patients, the results showed no significant difference in the total length of stay in the hospital or return to daily activities between the two groups [1]. Furthermore, complication rates were equivalent between the two groups after undergoing laparoscopic surgery, revealing 5% in the uncomplicated group and 6% in the complicated one, with abdominal abscesses occurring in only three patients of the complicated group, as opposed to four patients presenting with uncomplicated appendicitis. Furthermore, another variable they studied is analgesia requirements, which also showed no significant differences. On the other hand, other researchers have investigated and compared the outcomes of laparoscopic appendectomies as compared to open appendectomies for complicated appendicitis. Ball, et al., have argued that many series covering a wide variety of patients have concluded that the risks for post-operative abscess and fistula formation or any other intra-abdominal complication, have been similar for both laparoscopic and open appendectomies in cases of patients presenting with acute appendicitis [1]. However, in their own study, the scholars concluded that there exists a significant difference in hospital stays between patients undergoing open surgery, with a higher rate of complications (22%) for patients presenting with complicated appendicitis, while the laparoscopic appendectomy had an average of 2.2 days stay at the hospital and 6% complication rate. Another study conducted by Horvath, et al., also showed statistically significant differences between the open and laparoscopic

approaches for complicated appendicitis [2]. There was no difference in prevalence of postoperative ileus or appendiceal stump insufficiencies between the two groups. Nevertheless, surgical time was significantly lower in the open approach, showing a longer duration by around five minutes and the median length of stay was significantly shorter for the laparoscopic approach. Furthermore, surgical site infections occurred in 38 out of the 926 patients undergoing an open appendectomy (4.1%), as compared to no patients out of the 590 who underwent a laparoscopic appendectomy (0%). Another statistically significant difference in favor of the open approach is the incidence of intraabdominal abscess, which is higher in the laparoscopic approach (2 patients in the open appendectomy versus 10 patients in the laparoscopic appendectomy). However, they explain that the risk of intraabdominal abscesses can be greatly reduced through local irrigation in supine position, making laparoscopic appendectomies safe and possible ways to treat complicated appendicitis [2]. In accordance with the above, Katsuno, et al., found that wound infections were significantly increased in patients presenting with complicated appendicitis, undergoing open appendectomy, with a higher overall risk of postoperative complications (32.1%), as opposed to 18% for laparoscopic appendectomies [3]. However, intra-abdominal abscesses were still greater in the laparoscopic appendectomy group (7.1%) as compared to the open appendectomy group (4.8%) [3].

Furthermore, Wei, et al., conducted a meta-analysis on several previous randomized clinical trials and argued that the significantly greater operative time for laparoscopic appendectomies is correlated with the increased instrumentation and preparation required for such a delicate surgery and that this lengthier operative time is not disadvantageous in the face of the shorter hospital stay, easier healing process and lower risk of complications of laparoscopic appendectomies for complicated appendicitis [4]. In this meta-analysis, not only is the overall rate of post-operative complications less in the laparoscopic appendectomy group, but the incidence of intra-abdominal abscesses is also significantly lower, although there were some discrepancies. These scholars tried to explain the above findings by claiming that the minimally invasive approach decreases rates of wound infections through extraction with a trocar, but limits a thorough removal of inflammatory exudation from the peritoneal cavity due to decreased visualization, thereby increasing the risk for intra-abdominal abscesses in some studies [4].

In contrast, other researchers have used the same method to investigate the above research question, by comparing outcomes of laparoscopic and open appendectomies for complicated appendicitis, but have yielded different results, showing no significant differences between the two groups. In a study conducted by Fujishiro, et al., researchers found that the incidence of postoperative complications, such as organ-space surgical site infection, deep wound SSIs and superficial wound SSIs, had an odds ratio of 1.21 and the length of stay in the hospital was 4 days for both groups, patients presenting with acute appendicitis who underwent open or laparoscopic appendectomies [5]. Therefore, in the pediatric population, patients presenting with acute appendicitis had post-operative complications and length of stay similar in both types of surgeries [5]. Furthermore, Khalil, et al., showed that although laparoscopic appendectomies take longer surgical times and shorter hospital stays, no differences were statistically significant for the rate of intra-abdominal abscesses in both groups, with around 1.6% in the open appendectomy group, as compared to 1% in the laparoscopic approach group [6]. These scholars also denounced the theory that gas insufflation increases the risk of intra-abdominal abscesses in patients undergoing a laparoscopic appendectomy for acute appendicitis. This is because there was no significant difference between the two groups and because the abscesses were primarily situated in the right lower quadrant and pelvis and cultures for open and laparoscopic appendectomies yielded mixed GI flora and not only anaerobes [6]. In addition, Yei, et al., argue that the only advantage that laparoscopic appendectomies have over open appendectomies is found in the case of elderly patients, those with comorbidities or patients presenting with acute appendicitis, in terms of cost and hospital stay duration only [7].

Other scholars have opted to compare the open and laparoscopic approaches for patients presenting with both, complicated and uncomplicated appendicitis. Tiwari, et al., have found that a laparoscopic approach is preferred over the open approach no matter the initial presentation [8]. Of course, complicated appendicitis had worse outcomes than the uncomplicated presentation; however, for complicated appendicitis presentations, although the mortality was negligible for either approach, morbidity proved to be significantly decreased with a laparoscopic appendectomy, ranging between 5 and 18.5%, as compared to 8-17% with open approaches. In addition, in their research, the risk of intra-abdominal abscesses were also lower with laparoscopic approaches, ranging between 12.8 and 39.5%, as compared to the open approach, ranging between 26 and 37% [8].

In order to tackle the most common morbidity associated with complicated appendicitis, intra-abdominal abscess formation, other scholars have researched ways and techniques of doing so. According to Katkhouda, et al., there are three important things

to avoid intra-abdominal abscesses, which include proper preoperative resuscitation, proper perioperative antibiotics and a good surgical method and they found that applying the correct minimally invasive procedures would minimize the risk of intra-abdominal abscesses to near 0 [9]. Allemann, et al., found that adopting prophylactic drainage after laparoscopic appendectomy did not contribute positively to complication risks [10]. Patients who were without a drain had a statistically significant lower risk of total complications (7.7%) as compared to patients who were with a drain (18.5%), while speeding recovery time and decreasing the stay at the hospital [10]. However, another discrepancy in the literature occurs because other scholars have advocated for drainage in the case of presentations of acute appendicitis. Pakula, et al., have found that usage of a closed suction drain significantly decreases the risk of intra-abdominal abscess formation (6%), as compared to patients without drain placement (20%) [11]. With all the above literature kept in mind, the "European Association for Endoscopic Surgery and other interventional techniques" has claimed that the laparoscopic approach can be used to treat cases of acute appendicitis if "the proper expertise is available," thereby showing that any surgeon, who lacks the expertise of performing a laparoscopy, can end up with a higher rate of complications and conversions thereon to an open approach [1].

Nevertheless, despite the escalating belief in the superiority of non-invasive laparoscopic methods of surgery in a variety of fields and especially in cases of appendicitis, research has been inconsistent concerning the complications and sequelae of laparoscopic appendectomies for complicated appendicitis. There persists a discrepancy concerning the rate of intra-abdominal abscesses, aside from other complications for laparoscopic appendectomies and especially for complicated appendicitis. While most have reported an increase in the risk, others have reported decreased or equivalent risks and even others have advocated for different techniques to prevent the above. Further research will be portrayed in this research paper to add to the body of knowledge concerning the topic at hand to investigate whether the risk of post-operative complications is even less than what is found in previous papers.

In our study that was conducted between 2012 and 2022 comparing laparoscopic vs open approach in the management of perforated appendicitis, we have seen significant difference favoring the laparoscopic approach, with less incidence of recurrent abscesses, which was seen in one patient of the 100-patient operated with the laparoscopic approach.

Our analysis confirm that the best result of laparoscopic approach is due to the followings:

1. The massive lavage that we do, with at least 10 liters of normal saline
2. The exploration of all quadrants of the abdominal cavity thoroughly, searching for any residual purulent fluid
3. Patient position changing during exploration
4. The time consumption for the lavage was at least one hour
5. The surgery was done by the attending physician and not by the residents
6. Good drainage that was kept sometimes even after the patient discharge
7. Appropriate antibiotherapy

We think that the most important factor that led to the decrease in the incidence of the recurrence of abscesses was the massive lavage and thorough exploration of the abdominal cavity. These two factors cannot be done similarly during classical open approach.

Conflict of Interest

The authors have no conflict of interest to declare.

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