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Original Research Article

Clinical Efficacy and Safety Assessment of Laparoscopic vs. Open Appendectomy Techniques

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Abstract:

Background: The normal treatment based on acute appendicitis is appendectomy. Traditional appendectomy procedures have been open appendectomy (OA), but laparoscopic appendectomy (LA) has the benefits of minimally invasive surgery.

Aim: To compare laparoscopic and open appendectomy in the treatment of acute appendicitis in patients about safety and efficacy.

Methodology: A comparative observational study was conducted involving 80 patients (40 with local anesthesia and 40 with overall anesthesia) in the Department of General Surgery at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. Included in the patients were those over 10 years who were diagnosed with acute appendicitis. The variables analyzed included operative time, postoperative recovery, complications, hospital stay and return to normal activity.

Results: OA had a shorter operating time (31.4 vs. 54.9 min, $p<0.0001$). LA patients experienced earlier bowel movements and diet tolerance (92.5% vs. 70% and 85% vs. 62.5%; $p<0.001$), lower analgesic requirements, shorter hospital stays (1.4 vs. 2.7 days; $p=0.015$), and faster return to normal activity (11.5 vs. 16.1 days; $p<0.001$). Wound-related complications were significantly lower in LA (infection: 10% vs. 82.5%; dehiscence: 0% vs. 32.5%; $p<0.001$). Major intra-abdominal complications were comparable.

Conclusion: Laparoscopic appendectomy, despite longer operative time, offers superior postoperative recovery, fewer wound complications, and earlier return to normal activities, making it the preferred approach for uncomplicated acute appendicitis when feasible.

Keywords: Acute Appendicitis, Laparoscopic Appendectomy, Open Appendectomy, Postoperative Recovery, Surgical Outcomes.

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Introduction

Appendicitis is a very common form of surgical emergency in the world and the only way out of this is appendectomy to avoid complications that include perforation, abscess or generalized peritonitis. Conventionally, the accepted method of removing the inflamed appendix, using a right lower quadrant incision, has been open appendectomy. This method worked very well, was comparatively simple and very common in the urban and rural operating rooms over the decades [1]. Minimally invasive surgery has led to the introduction of laparoscopic appendectomy as an alternative method that has continued to gain popularity among surgeons through laparoscopic advancement of minimally invasive surgery.

Laparoscopic appendectomy uses small abdominal incisions whereby a camera and other specialized tools are passed. This procedure enables the surgeon to see inside the abdomen more clearly and exercise the appendix with the least damage of the surrounding tissues. Some of the possible advantages have been linked to laparoscopic approach and they are less postoperative pain, less admission in hospital, quicker healing, and superior cosmetics. Such benefits are especially attractive to younger patients, working people and people who would like to get back to normal routine faster, which is why laparoscopic surgery is the best choice [2].

Although laparoscopic appendectomy has advantages, it can be questioned whether it lacks

limitations. The process tends to be more complicated with more sophisticated equipment, training and could have extended durations of operation particularly to surgeons in their early years of learning. Also, the cost of laparoscopic instruments and resources availability in low-income or resource-restricted health facilities may be mentioned as a concern [3]. In certain patients, like those with inflammation that is severe, dense adhesions, or complicated appendicitis, laparoscopic procedure may also pose some technical problems, which might affect the surgical outcomes.

In its turn, open appendectomy is also a reliable and easily available procedure, especially in the case of emergency or in the place where laparoscopic equipment is not always at hand. The technique can be easily and quick to perform even in complex situations by surgeons who are trained in open procedures. Nonetheless, open appendectomy is usually accompanied by a larger incision, thereby exposing the patient to a higher probability of postoperative pain, prolonged healing periods, and wound-related complications, including infections as well as hernias [4].

Considering these opposite benefits and drawbacks, the comparison of the safety and effectiveness of laparoscopic and open appendectomy is required to inform the clinical decision-making process. Durability of the operative period, the level of pain following the operation, the length of stay at the hospital, instances of complications, the recovery of the patient, and patient satisfaction are the key considerations that ought to be made when making such comparisons [5]. The understanding of these aspects is particularly useful in the optimization of the surgical plan to the requirements of the individual patients, the clinical picture and the opportunities of the healthcare system.

There have been several research and clinical trials conducted on the differences between the two surgical methods over the past decades. The advantages of laparoscopic appendectomy are provided by many, and the feasibility and dependability of open methods in particular clinical cases is highlighted by some [6]. However, the patients, experience of surgeons, healthcare infrastructure, and severity of the cases are different and thus outcomes are not always universal. Consequently, additional comparative analyses can be useful to verify best practices and make surgical decisions.

The aim of the proposed comparative study would be to make a comparison of laparoscopic and open appendectomy in terms of safety and effectiveness. This paper will raise evidence-based data that may assist surgeons and other health care practitioners in deciding on the kind of surgical intervention to apply based on clinical outcomes and post-operative recovery trends. Lastly, the process of decision-making in appendectomy can be enhanced to enhance the patient outcomes by reducing health care burden and making such resource utilization more efficient.

Methodology

Study Design: This research will be comparative observational research to compare the safety and efficacy of laparoscopic appendectomy against open appendectomy.

Study Area: The study was conducted at the Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India for one year.

Study Participants

Inclusion Criteria

- Patients of all genders are diagnosed clinically and/or radiologically with acute appendicitis.
- Patients undergo either laparoscopic appendectomy or open appendectomy.
- Patients aged 10 years and above.
- Patients who provided informed consent for treatment and data use.

Exclusion Criteria

- Pregnant women.
- Patients with severe systemic illness require intensive perioperative care (e.g., hemodynamic instability, severe cardiopulmonary disease, cirrhosis, coagulation disorders).
- Patients with generalized peritonitis requiring emergency exploratory laparotomy.
- Recurrent appendicitis requiring interval appendectomy.

Sample Size: A total sample size of 80 patients was included in the study, with 40 patients undergoing laparoscopic appendectomy and 40 patients undergoing open appendectomy

Procedure: Patients who are presented with symptoms of acute appendicitis were evaluated clinically through history and physical examination, supported by laboratory investigations. In cases where the diagnosis was uncertain, abdominal ultrasound or CT scan was performed. Based on the surgeon's preference and assessment of the patient's condition, either laparoscopic or open appendectomy was undertaken. All patients were administered a typical preoperative prophylactic dosage of a third-generation cephalosporin combined with metronidazole at the onset of anesthesia.

Open appendectomy was done with a typical McBurney incision, after which the appendix was identified, ligated and exercised. The laparoscopy appendectomy was done through three-port technique holding pneumoperitoneum at 12-14 mmHg and the appendix was displaced through endobag.

Oral intake was initiated as soon as bowel movements were restored post-operative and transitioned to soft diet done as tolerated. Patients were discharged as afebrile, diet tolerant, and with sufficient pain management. The time of operation, the length of postoperative recovery, complications, and other factors were documented to be compared.

Statistical Analysis: The statistical data will be assembled and analyzed with the help of statistical software (SPSS version 27). The quantitative variables (operative time, hospital stay) will be presented in the form of mean standard deviation, and they will be compared with the help of t-test created by Student. Where there is the possibility of Chi-square or Fisher exact test to compare the categorical variables (e.g. postoperative complications). The p-value of less than 0.05 will be taken as statistically significant.

Result

Table 1 presents demographic and preoperative clinical data of 80 patients receiving open (n=40) or laparoscopic appendectomy (n=40). The gender distribution was also very different, as there were more males in open group (60%), and more females in laparoscopic group (57.5) (P < 0.001). The average age did not differ between groups (=28-30 years, P = 0.57). Preoperative WBC counts were significantly higher in the open appendectomy group (14,903 vs. 13,346/mm³, P = 0.0002), suggesting greater inflammatory response. The prevalence of co-morbidities such as CAD, hypertension, COPD, and diabetes was low and comparable between groups (P = 0.244).

Table 1: Preoperative clinical and demographic data (n=80)

Variable	Laparoscopic Appendectomy (n=40)	Open Appendectomy (n=40)	P value
Gender			<0.001
Male	17 (42.5%)	24 (60.0%)	
Female	23 (57.5%)	16 (40.0%)	
Mean age (years)	27.75 ± 14.24	29.66 ± 15.13	0.57
WBC count (/mm³)	13,346 ± 5,450	14,903 ± 4,686	0.0002
Co-morbidities			0.244
CAD	1 (2.5%)	1 (2.5%)	
Hypertension	1 (2.5%)	2 (5.0%)	
COPD	1 (2.5%)	1 (2.5%)	
DM	1 (2.5%)	2 (5.0%)	

Table 2 compares operative and postoperative outcomes between open and laparoscopic appendectomy in 80 patients. While open appendectomy had a shorter operative time (31.4 vs. 54.9 minutes, p<0.0001), laparoscopic appendectomy was associated with faster recovery: more patients had bowel movements and tolerated diet on the first postoperative day (92.5% vs. 70.0% and 85.0% vs. 62.5%, respectively; p<0.001), required fewer analgesics, had shorter hospital stays (1.4 vs. 2.7 days, p=0.015), and returned to normal activity sooner (11.5 vs. 16.1 days, p<0.001). Overall, laparoscopic appendectomy offered improved postoperative recovery despite longer surgery time.

Table 2: Surgical and postoperative clinical data (n=80)

Parameter	Laparoscopic Appendectomy (n=40)	Open Appendectomy (n=40)	P-value
Operative time (min)	54.9 ± 14.7	31.36 ± 11.43	<0.0001
Bowel movements (1st POD)	37 (92.5%)	28 (70.0%)	<0.001
Time until diet (1st POD)	34 (85.0%)	25 (62.5%)	<0.001
Parenteral analgesics (doses/day)	1.0 ± 0.5	1.5 ± 0.6	0.001
Oral analgesics (doses/day)	1.86 ± 1.14	2.00 ± 2.26	<0.0001
Hospital stays (day)	1.4 ± 0.6	2.7 ± 2.5	0.015
Return to normal activities (day)	11.5 ± 3.1	16.1 ± 3.3	<0.001

Table 3 shows that laparoscopic appendectomy is associated with significantly fewer wound-related complications compared to open appendectomy. While minor complications like vomiting and paralytic ileus were slightly lower in the laparoscopic group, these differences were not statistically significant. Wound infection and major wound dehiscence were significantly more common after open appendectomy (P < 0.001, 82.5% vs. 10% and 32.5% vs. 0%). No significant differences were observed between the groups for other important sequelae, such as intra-abdominal abscess and hemoperitoneum. Overall, laparoscopic appendectomy demonstrates a clear advantage in reducing wound complications.

Table 3: Postoperative minor and major complications following laparoscopic and open appendectomy (n=80)			
Postoperative Complications	**Laparoscopic Appendectomy (n = 40)**	**Open Appendectomy (n = 40)**	**P-value**
Minor			
Wound infection	4 (10.0%)	33 (82.5%)	<0.001
Vomiting	13 (32.5%)	17 (42.5%)	0.621
Paralytic ileus	8 (20.0%)	11 (27.5%)	0.618
Major			
Intra-abdominal abscess	4 (10.0%)	1 (2.5%)	0.147
Wound dehiscence	0 (0.0%)	13 (32.5%)	<0.001
Hemoperitoneum	0 (0.0%)	1 (2.5%)	0.339

Discussion

The present study was an outcome study comparing the open and laparoscopic appendectomy in 80 patients based on demographic, preoperative, operative, and postoperative outcome. There was a significant gender gap between the groups, with more men in the open appendectomy group and more women in the laparoscopic group, despite the groups being similar in age (around 28 to 30 years). This difference could be because of preference by a surgeon or a patient and not based on clinical need since there was no significant difference between the two groups about age and comorbidity, i.e. CAD, hypertension, COPD, and diabetes. Findings on the preoperative WBC were also significantly higher in open appendectomy group which suggests that such patients may have had greater inflammatory response and it could be a contributory factor to the surgical decision or outcome. According to Manto et al., (2015) [7], the operative time of Laparoscopic Appendectomy was lower (mean 41.4210.32 minutes) than that of Open Appendectomy (mean 46.2518.84 minutes) and justified this by the fact that their team was sufficiently experienced with Laparoscopic Appendectomy.

A notable difference in length of surgery was observed depending on the outcomes of the operations. The process of open appendectomy took a lot less time and the period of conducting the operation was 31.4 on average compared to 54.9 in laparoscopic appendectomy. This laparoscopic surgery was notwithstanding and was associated with its benefits that were achieved in the postoperative period. Patients who had laparoscopic appendectomy had previous bowel movements, early toleration to food, reduced analgesic requirements, reduced time spent in hospital and normalization of activities were faster. These findings were in line with the previous studies that reported that despite the duration of the surgery being prolonged, minimal invasion surgery leads to faster recovery. Yang et al., (2017) [8] conducted the average operative time in the Laparoscopic Appendectomy (80min) was significantly longer in comparison to the Open Appendectomy (65min) with p= -1.

Postoperative complications were also preferred in laparoscopic appendectomy. Laparoscopic group had some minor complications such as vomiting and paralytic ileus, but they were not significant. Better still, laparoscopy surgery experienced a tremendous reduction in wound complications. Only 10 percent of laparoscopic cases were found to be affected by wound infection against 82.5 percent of the open cases and wound dehiscence was absent in the laparoscopic group. These differences point to the reduced tissue trauma and improved wound healing in comparison with the utilization of minimally invasive surgeries. Liu et al., (2020) [9] discovered that the pain severity score in the laparoscopic group was considerably reduced throughout the 2-26 days postprocedure compared to the open appendectomy group (p=0.04).

Despite the undeniable benefits of laparoscopic appendectomy in the recovery process and the wound, some key complications like intra-abdominal abscess and hemoperitoneum were no different in the groups. This indicates that laparoscopic surgery is better than the other in enhancing superficial and early postoperative recovery, but both methods are similar in the prevention of severe intra-abdominal complications which are rather associated with the severity of the disease and not necessarily the nature of the surgical procedure. Talha et al., (2020) [10] demonstrated the meantime to resume normal work was found to be 15.3±3.4 days in laparoscopic procedure and 22.3±3.7 days in open procedure signifying that laparoscopic group resumed normal work early than open.

All in all, this paper contributes to the accumulating list that laparoscopic appendectomy has better postoperative results than its counterpart, open appendectomy, even though it requires a longer operative period. Rapid healing decreased the analgesic needs, hospital stay and wound complications emphasize the clinical benefits of laparoscopic surgery. The surgical method adopted must be based on the patient factors, skills of the surgeon and resources at hand, however, the evidence is that minimally invasive methods should be followed where possible. According to Shirazi et al. (2010) [11] found that the overall complication rate following Laparoscopic

Appendectomy ($p < 0.0001$, 15) was significantly reduced compared to the Open Appendectomy group (31.8).

To summarize, even though open appendectomy is a safe and still effective technique, particularly when the available laparoscopic facilities are insufficient, laparoscopic appendectomy shows apparent advantages in terms of postoperative recovery and wound outcomes. These results support the present trends in surgery of the preference of simple acute appendicitis to minimally invasive appendectomy.

Conclusion

In conclusion, laparoscopic appendectomy has more benefits compared to open appendectomy as it relates to postoperative and wound related outcomes. Open appendectomy had shorter surgical periods, but patients who had laparoscopic surgery had an earlier bowel recovery, dietary tolerance, needed less analgesic, reduced hospitalization, and normal activities went back to normal faster. Further, laparoscopic appendectomy has been linked to significantly reduced wound infections and none of wound dehiscence, which indicates its advantage compared to the traditional approach in reducing tissue trauma and supporting healing. The two methods were similar in the way they helped to keep the major intra-abdominal complications at bay. In general, laparoscopic appendectomy is a safe, effective, and patient-friendly method and should therefore be the first choice when dealing with uncomplicated acute appendicitis in case of available resources and expertise

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