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A Comparative Analysis of Laparoscopic Versus Open Appendectomy in Cases of Complicated Appendicitis

Lomesh Ashokkumar Prajapati, Jimitkumar H. Patel, Bhaumik Bipinchandra Patel and Tejas Bipinchandra Patel

Department of General Surgery, GMERS Medical College, Vadnagar, Gujarat, India

ABSTRACT

The utilization of laparoscopic appendectomy has demonstrated enhanced outcomes for cases of nonperforated appendicitis. This study endeavored to contrast the efficacy of laparoscopic appendectomy and open appendectomy in instances involving a perforated appendix based on parameters such as surgical site infection incidence, average operating duration and duration of hospitalization. Conducted within the Department of Surgery at a teaching Hospital in India, this study was designed as a prospective randomized investigation. The allocation of either laparoscopic or open appendectomy techniques to a cohort of 150 patients was executed through a random selection process, employing the lottery method. Patients harboring a perforated appendix were included in the study following their informed consent. The prevalence of wound site infections was notably elevated in cases of open appendectomy, as compared to instances of laparoscopic approach. While the mean duration of hospitalization was marginally prolonged in the laparoscopic cohort relative to open appendectomy, a statistically non-significant difference was observed. The mean operative time for laparoscopic appendectomy and open appendectomy was computed as 47.42±3.25 min and 51.73±2.99 min, respectively ($p<0.05$). Laparoscopic appendectomy was linked to a reduced incidence of surgical site infections, as well as a shorter mean operative duration. These results accentuate the potential advantages of laparoscopic techniques in managing perforated appendicitis.

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Key Words

Appendectomy, hospitalization appendicitis, laparoscopy, surgical wound infection

Corresponding Author

Tejas Bipinchandra Patel,
Department of General Surgery, GMERS Medical College, Godhra, Gujarat, India

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INTRODUCTION

Appendicitis denotes the inflammatory state of the vermiform appendix[1]. Acute appendicitis constitutes a prevailing abdominal emergency on a global scale, standing as the foremost contributor to abdominal surgical interventions across all age cohorts. The incidence of appendicitis translates to an overall lifetime risk of 8.6% for males and 6.7% for females[2,3]. Within the subset of patients afflicted with acute appendicitis, an estimated 13% to 20% exhibit the complication of a perforated appendix[4]. It is noteworthy that the susceptibility to appendix perforation is more pronounced in males (18%) compared to females (13%)[5]. Despite the marked probability of perforation manifesting within 24 hrs subsequent to the onset of appendicitis symptoms, this temporal trajectory can exhibit variation from case to case. Specifically, there exists a 20% likelihood of appendix perforation transpiring within the initial 24 hrs of symptom manifestation[6].

The landscape of surgical practice experienced a paradigm shift with the advent of laparoscopy[7]. The inception of laparoscopic appendectomy by Semm marked a transformative milestone in surgical methodology[2]. This technique garnered considerable favor among surgeons due to its minimally invasive approach, yet reservations remain regarding its substitution for open appendectomy[8]. Skeptics of laparoscopic appendectomy point to escalated operative expenses stemming from disposable instrument usage. Additional critiques encompass extended procedural duration and heightened incidence of intra-abdominal abscess formation, notably in cases featuring a perforated appendix[9,10].

Furthermore, the advantages of laparoscopy encompass reduced incision size, superior visualization of the peritoneal cavity and a secure exploration environment[11]. The utility and appropriateness of the laparoscopic approach in complex scenarios involving perforated appendices remains subject to dispute, attributed to the augmented occurrence of intra-abdominal collections. Nonetheless, several empirical studies have attested, statistically, to a lower incidence of postoperative complications linked to the laparoscopic technique[12]. However, the paucity of randomized prospective trials underscores a gap in the existing literature concerning a comprehensive evaluation of laparoscopy versus laparotomy in perforated appendix management. Notably, the preeminence of laparoscopic management has gained traction, given its dual capability to diagnose and extirpate the appendix concomitantly[13,14].

This study aspires to discern and compare the ramifications of employing laparoscopic and open modalities in addressing perforated appendicitis.

MATERIALS AND METHODS

Conducted within the Department of Surgery at a teaching Hospital in India, this study was designed as a prospective randomized investigation. In this study, a total of 150 patients were enrolled, with equal distribution of 75 patients in each of the study groups. The inclusion criteria involved individuals aged 15-50 years, who presented with a perforated appendix and ultrasonographic evidence indicating the presence of free fluid within the abdominal cavity. Specifically, patients were identified as having a perforated appendix if they exhibited persistent right iliac fossa pain for a duration of one to two days, suggestive of appendix perforation. Clinical indicators such as lower abdominal tenderness, tachycardia and fever (>99°F) further supported this diagnosis. Furthermore, participants with a total leukocyte count of 10,000 or higher, as well as those displaying ultrasonographic evidence of free fluid within the lower abdominal region or pelvis, were included in the study. On the contrary, exclusion criteria encompassed individuals with a history of prior abdominal surgery, uncomplicated appendicitis, anesthetic ineligibility corresponding to ASA class three or higher, as well as general contraindications to laparoscopic surgery, including respiratory insufficiency, morbid obesity, or a tuberculosis history.

Inclusion of eligible participants was contingent upon the successful acquisition of informed consent. Employing a prospective lottery-based method, the assignment of cases to either the open or laparoscopic appendectomy groups was executed randomly. Following the interventions, a comprehensive evaluation of perioperative and postoperative outcomes was undertaken, with meticulous data recording accomplished through the utilization of a predefined proforma. Notably, the primary outcome metrics comprised the length of hospitalization, the incidence of port site infections and the mean operative duration. The criterion for diagnosing port site infection involved the identification of signs of inflammation, such as erythema and discharge, during the fourth-day postoperative assessment conducted at the outpatient department.

The technique employed for open appendectomy necessitated a lower midline laparotomy, facilitating the appendectomy procedure followed by abdominal irrigation utilizing normal saline. The closure of the abdominal cavity was performed, while intentionally leaving the skin open. Conversely, the approach to laparoscopic appendectomy was accomplished utilizing the three-port technique, thereby creating a pneumoperitoneum. Subsequently, the appendectomy procedure was carried out, with the excised appendix securely enclosed within a meticulously designed

glove-made specimen bag to minimize the risk of spillage. Subsequent to the completion of the surgical steps, the abdominal cavity underwent lavage utilizing normal saline.

RESULTS

Table 1 presents a comprehensive juxtaposition of outcome variables between the two studied groups. Notably, laparoscopic surgery group exhibited a significantly reduced operation time in comparison to the Open Surgery Group. Furthermore, the Laparoscopic Surgery Group demonstrated a lower incidence of port site infections. Importantly, no statistically significant disparity was observed in the duration of hospital stay between the two groups.

The influence of effect modifiers such as age, gender and ASA grades was mitigated through a process of stratification. The ensuing outcomes of poststratification chi-square tests, employed for qualitative variables and independent samples t-tests, utilized for quantitative variables, are meticulously delineated in Table 2-4.

DISCUSSIONS

Laparoscopic appendectomy has historically been regarded with caution for complicated appendicitis due to the perceived higher risk of postoperative complications[15,16]. However, this paradigm has been challenged by multiple investigations that have explored the outcomes of laparoscopic appendectomy in cases of complicated appendicitis[17,18].

A study conducted by Mohamed and Mahran[11] shares similarities with our own, reporting a mean age of 32±14 years in the laparoscopic appendectomy group and 34±13 years in the open appendectomy group. This alignment in age distribution can be attributed to the predilection of appendicitis within the younger age range, a trend substantiated by findings from Hui *et al*.[19]. Lunca *et al*.[20] emphasized the highest incidence of appendicitis among individuals aged 11-20 years, although an uptick in occurrence among older individuals might be linked to increased life expectancies.

Diverging from Mohamed and Mahran[11] results, our study notably identified a significantly shorter mean operating time in the laparoscopic group as compared to the open group. In contrast, Lin *et al*.[14] reported extended completion times for laparoscopic appendectomy in comparison to open appendectomy. Similarly, other studies have suggested longer operating times for laparoscopic procedures[21,22]. However, our findings are consistent with studies by Tiwari *et al*.[12] and Yau *et al*.[23], which revealed shorter mean operating times for laparoscopic appendectomy. Variations in reported mean operating times can be attributed to differences in skill levels and familiarity with laparoscopic techniques across different institutions.

In our study, a comparison of mean hospital stay between the two groups demonstrated an insignificant disparity, aligning with findings by Mohamed and Mahran[11]. In contrast, Tiwari *et al*.[12] reported a

Table 1: Comparison of outcome variables in both the groups

Outcome variables	Laparoscopic surgery group (n = 75)	Open surgery group (n = 75)	p-value
Operation time in minutes (mean±SD)	47.42±3.25	51.73±2.99	<0.05
Days of hospital stay (mean±SD)	4.25±1.12	4.31±0.82	0.29
Port site infection n (%)	9 (12%)	16 (21.33%)	<0.05

Table 2: Stratified comparison of Operation time in minutes (mean±SD) in both the groups

Independent variable	Variable subgroup	Laparoscopic surgery group (n = 75)	Open surgery group (n = 75)	p-value
Age group (years)	15-30	47.28±3.06	53.04±3.12	<0.05
	31-50	46.75±2.98	52.78±2.91	<0.05
Gender	Male	47.15±3.20	53.20±2.95	<0.05
	Female	46.93±2.85	52.87±2.98	<0.05
ASA class	I	47.01±3.31	53.32±2.55	<0.05
	II	46.79±2.81	53.10±2.92	<0.05

Table 3: Stratified comparison of days of hospital stay (mean±SD) in both the groups

Independent variables	Variable subgroup	Laparoscopic surgery group (n = 75)	Open surgery group (n = 75)	p-value
Age group (years)	15-30	4.57±1.18	4.18±0.79	0.34
	31-50	4.28±1.05	4.09±0.83	<0.05
Gender	Male	4.30±1.20	4.06±0.75	0.29
	Female	4.51±1.12	4.29±0.81	0.51
ASA class	I	4.38±1.08	4.23±0.80	0.71
	II	4.47±1.22	4.11±0.77	0.18

Table 4: Stratified comparison of rate of port site infection in both the groups

		Laparoscopic surgery group (n = 75)		Open surgery group (n = 75)		
Independent variables	Variable subgroup	No.	Percentage	No.	Percentage	p-value
Age group (years)	15-30	3/33	9.09	7/31	22.58	0.21
	31-50	5/42	11.90	14/44	31.82	<0.05
Gender	Male	5/38	13.16	9/37	24.32	0.19
	Female	3/37	8.11	12/38	31.58	<0.05
ASA class	I	6/47	12.77	10/46	21.74	0.23
	II	2/28	7.14	10/29	34.48	<0.05

significant distinction in hospital stay between the groups[12]. Lin *et al*.[14] also observed a significantly shorter hospital stay for laparoscopic appendectomy. The similarity in port site infection rates between our findings and those of Mohamed Mohamed and Mahran[11] is noteworthy, as well as the correlation between lower infection rates and laparoscopic appendectomy identified by Mohamed and Mahran[11] and Lin *et al*.[4]. The reduced risk of infections in laparoscopic appendectomy can be attributed to the diminished manipulation of the gastrointestinal tract, coupled with the appendix being explored in situ, thereby limiting contact with incisions in the anterior abdominal wall layers.

Post-stratification chi-square tests illuminated significant differences in operating time between the laparoscopic and open appendectomy techniques across different subgroups, including age, gender and ASA classes. Additionally, our study revealed statistically significant distinctions in the length of hospital stay and infection rates based on these parameters. Factors such as age, gender and ASA class might contribute to variations in immunity, subsequently affecting infection rates and influencing the surgical outcomes within these groups.

CONCLUSION

Laparoscopic appendectomy exhibited superiority over open appendectomy concerning wound site infections and operating time. The duration of the surgical procedure is contingent upon the proficiency of the surgeon and the extent of the ailment. In relation to the duration of hospitalization, no notable distinction was discernible between the two methodologies. Consequently, it can be concluded that the adoption of laparoscopic appendectomy for the excision of perforated appendices is a safe and viable approach.

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