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Frequency of Intra-Abdominal Abscess Formation in Perforated Appendix after Laparoscopic Appendectomy

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ABSTRACT

Objectives: To determine the frequency of post-operative intra-abdominal abscess (IAA) formation following laparoscopic appendectomy in cases of perforated appendicitis. **Study Settings:** The study was conducted in the Surgical Department of Allied Hospital Faisalabad and Faisalabad Medical University. **Duration of Study:** This descriptive study was carried out over six months following approval of the synopsis. **Data Collection:** A total of 160 patients aged 18–75 years, diagnosed with perforated appendicitis and managed with laparoscopic appendectomy, were included through non-probability consecutive sampling. Patients with prior abdominal surgery, uncontrolled diabetes, pregnancy, or malignancy were excluded. Post-operative IAAs were identified through clinical symptoms, laboratory findings, and ultrasonography within one week of surgery. Data were analyzed using SPSS version 25, with stratification for age, gender, and BMI. Chi-square tests were applied, and a p-value ≤ 0.05 was considered statistically significant. **Results:** The mean age of participants was 41.3 ± 13.7 years, with a majority (58.8%) aged 18–50 years. Male patients constituted 62.5% of the sample, and 65.6% had a BMI >25. The overall frequency of post-operative IAAs was 9.4%. Stratified analysis showed no significant differences in IAA rates based on age (p = 0.228), gender (p = 0.183), or BMI (p = 0.509). **Conclusion:** Laparoscopic appendectomy is associated with a low frequency of IAAs in cases of perforated appendicitis, regardless of age, gender, or BMI. These findings support its adoption as the standard of care in resource-limited settings like Pakistan, offering improved outcomes and reduced healthcare burden.

INTRODUCTION

Appendicitis is a global disease. In the 21st century,its incidence has increased in newly industrialized countries in Asia.[1] Acute appendicitis is the inflammation of appendix which can be complicated by gangrene, necrosis and perforation. A walled off perforation will result in appendicular abscess or mass formation while free perforation will lead to generalized peritonitis.[2] Delay in surgical treatment after diagnosis for more than 24 hrs is associated with increased risk of perforation.[3] Localized periumblical pain which later on migrate to whole abdomen along with nausea, vomiting and anorexia are the most common symptoms.Inflammatory markers like Leukocytosis of >10,000/ mm3 with polymorphonuclear predominance and ultrasonography are useful diagnostic investigations . [4]

Perforated appendicitis is associated with higher postoperative morbidity. Postoperative morbidity is associated with late admission, widespread peritonitis, conversion to open surgery, proximal perforation, and necrosis. [5] Intraabdominal abscess formation is the most feared post operative complication. It can be managed by minimally step up approach by using antibiotics only, CT guided percutaneous drainage or laparoscopic lavage according to size and number of collection.[6] Intraoperative drain placement doesn't have a positive outcome in post-operative abscess formation.[7]

Appendectomy is the recommended treatment by removal of appendix ,drainage of abscess, irrigation of the abdomen with saline, and insertion of peritoneal drain if indicated. [4] Laparoscopic appendectomy has advantage over open appendectomy due to reduced negative appendectomies,shorter length of hospital stay, surgical site infections, early return to normal activities.[8] Laparoscopic approach is a safe procedure in terms of decreased risk of postoperative intraabdominal abscess formation.[9] In a study conducted by Guy et al ,the incidence of post operative intraabdominal abscess was 9.1% in perforated appendicitis. [10]

Perforated appendicitis is associated with increased morbidity and mortality especially intraabdominal abscess formation resulting in longer hospital stay,late

recovery time and antibiotics use for longer duration. Laparoscopic appendectomy is safe approach.With this approach, we can reach all quadrants of peritoneal cavity for thorough lavage consequently there will be decreased risk of intra abdominal abscess formation resulting in early mobilization of patient, early return to oral diet, early recovery time, shorter hospital stay and antibiotics will not be needed for longer duration. Hence, Laparoscopic appendectomy is both safe and beneficial in terms of patients as well as health care system in terms of expenses. Our study will help in creating hospital protocols in many setups for treating perforated appendicitis with laparoscopic lavage to reduce the frequency of post-operative intraabdominal abscess formation.

METHODOLOGY

This study was conducted in the Surgical Department of Allied Hospital Faisalabad and Faisalabad Medical University from 20 August 2024 to 20 Feb 2025. The study was carried out over six months following approval of the synopsis. It was designed as a descriptive study. The sample size was calculated to be 160 patients using the WHO calculator, with a confidence level of 95%, a population proportion of 9.1%, and an absolute precision of 4.5%. Non-probability consecutive sampling was employed to recruit participants. Patients aged 18 to 75 years, of both genders, diagnosed with acute appendicitis and undergoing laparoscopic appendectomy with peritoneal lavage were included in the study. Exclusion criteria comprised patients with a prior history of abdominal surgery within one year of enrollment, uncontrolled diabetes, pregnancy, or malignancy.

After obtaining ethical approval, patients presenting with acute appendicitis and managed via laparoscopic appendectomy for perforated appendicitis were included. Informed consent was obtained from all participants after explaining the study's purpose. Demographic data were recorded at the time of enrollment. Patients were followed up in the outpatient clinic within one week of surgery. Those who presented with symptoms of fever, abdominal pain, or ileus underwent further investigations. Leukocyte counts were performed in the Pathology Department and interpreted by pathologists, while ultrasonography was performed in the Radiology Department and reported by radiologists. Post-operative intra-abdominal abscess was defined as patients presenting with fever, abdominal pain, or ileus accompanied by raised inflammatory markers such as leukocyte count. The diagnosis was confirmed by the presence of an intra-abdominal hypoechoic collection on ultrasonography, performed within one week of the post-operative period following laparoscopic appendectomy for perforated appendicitis. These findings were assessed using laboratory investigations and ultrasonography (USG). All data were collected while maintaining strict confidentiality and ensuring that patients had the autonomy to withdraw from the study at any time. The collected data were analyzed using SPSS software version 25. Quantitative variables such as age and BMI were summarized as means and standard deviations. Qualitative variables, including gender and post-operative intra-abdominal abscess, were reported as frequencies and percentages. Effect modifiers such as age, gender, and BMI were controlled through stratification. Post-stratification, the chi-square test was applied, and a p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The clinical and demographic characteristics of the 160 patients included in the study reveals that the majority of patients (58.8%) were aged between 18 and 50 years, while 41.3% of the participants were between 51 and 75 years. This indicates a slightly younger demographic predominantly represented in the study population, male patients constituted a significant proportion of the sample, accounting for 62.5%, whereas females made up the remaining 37.5%. This suggests a higher prevalence of males among the participants. Regarding BMI, the analysis revealed that 65.6% of the patients had a BMI greater than 25, indicating overweight or obesity, whereas 34.4% of the participants had a BMI up to 25, reflecting a normal or underweight category. This highlights a predominance of overweight individuals in the study. A notable finding is the low frequency of post-operative abscesses among the patients. Only 9.4% of the participants experienced this complication, while the majority (90.6%) did not, suggesting a favorable post-operative outcome for most of the study population. Overall, the study sample predominantly comprised younger males with a BMI over 25, and most patients did not develop post-operative abscesses. These findings provide valuable insight into the demographic and clinical profile of the studied group. (Table 1)

The frequency of post-operative abscesses based on different effect modifiers reveals that among patients aged 18-50 years, 11 (11.7%) developed post-operative abscesses, while the majority, 83 (88.3%), did not. In the older age group of 51-75 years, the prevalence of post-operative abscesses was slightly lower, with 4 (6.1%) patients affected and 62 (93.9%) unaffected. The difference in the frequency of post-operative abscesses between these age groups was not statistically significant (p = 0.228). Male patients showed a lower frequency of post-operative abscesses, with 7 (7.0%) affected, compared to 93 (93.0%) who remained free of the complication. Female patients had a slightly higher prevalence, with 8 (13.3%) experiencing post-operative abscesses and 52 (86.7%) unaffected. This difference, however, was not statistically significant (p = 0.183). Patients with a BMI up to 25 had a post-operative abscess frequency of 4 (7.3%), while 51 (92.7%) did not develop the complication. In patients with a BMI over 25, the frequency was higher, with 11 (10.5%) affected and 94 (89.5%) unaffected. The difference in post-operative abscess rates between the two BMI groups was also not statistically significant (p = 0.509).

Overall, the data indicate that the frequency of post-operative abscesses was not significantly influenced by age, gender, or BMI. These findings highlight a relatively low incidence of post-operative abscesses across all subgroups, suggesting that other factors may play a more critical role in the development of this complication. (Table 2)

Table 1
Clinical and demographic data of the patients(n=160)

Variable	Group	Frequency	Percent
Age	18-50	94	58.8
	51-75	66	41.3
Gender	Male	100	62.5
	Female	60	37.5
BMI	Up to 25	55	34.4
	>25	105	65.6
Post-operative Abscess	Yes	15	9.4
	No	145	90.6

Figure 1

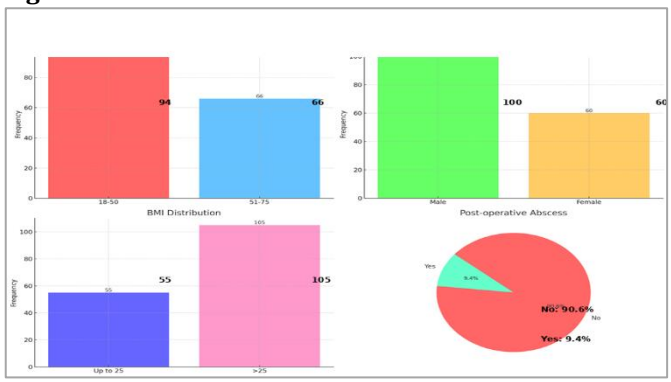

Table 2
Frequency of post-operative abscess according to different effect modifiers

Variable	Group	Post-operative Abscess (Yes)	Post-operative Abscess (No)	Total	P value
Age	18-50	11 (11.7%)	83 (88.3%)	94 (100%)	0.228
	51-75	4 (6.1%)	62 (93.9%)	66 (100%)	
Gender	Male	7 (7.0%)	93 (93.0%)	100 (100%)	0.183
	Female	8 (13.3%)	52 (86.7%)	60 (100%)	
BMI	Up to 25	4 (7.3%)	51 (92.7%)	55 (100%)	0.509
	>25	11 (10.5%)	94 (89.5%)	105 (100%)	

DISCUSSION

This study aimed to determine the frequency of post-operative intra-abdominal abscess (IAA) formation following laparoscopic appendectomy in cases of perforated appendicitis. The findings revealed a relatively low incidence of IAAs (9.4%), which underscores the safety and efficacy of laparoscopic appendectomy as a surgical approach for managing complicated appendicitis. This result is particularly significant in the context of our country, where late presentation of appendicitis often leads to more advanced disease and an increased risk of complications.

IAAs are a well-recognized complication of appendectomy, particularly in cases of perforated appendicitis. Globally, the reported incidence of IAAs ranges from 3% to 25%, depending on patient demographics, surgical techniques, and healthcare resources. The frequency observed in this study is consistent with findings by Guy et al[10] who reported a rate of 9.1% for IAAs in perforated appendicitis. Similarly, Son et al[11] documented a 10.9% incidence in pediatric patients, although they identified additional risk factors such as prolonged symptom duration and elevated C-reactive protein (CRP) levels. Our study did not specifically evaluate these risk factors but provides evidence that laparoscopic appendectomy can achieve low complication rates, even in resource-limited settings.

The low frequency of IAAs in this study can be attributed to several factors. First, the laparoscopic approach provides superior visualization and access to the peritoneal cavity, enabling thorough lavage and effective removal of infectious material. This aligns with evidence from Mulita et al[12] who emphasized the advantages of laparoscopy, including reduced hospital stays and faster recovery, despite finding no significant difference in IAA rates between laparoscopic and open appendectomy. Second, consistent surgical protocols, including the avoidance of routine drain placement, likely contributed to favorable outcomes. Miranda-Rosales et al[13] and Burini et al[14] both demonstrated that drains do not reduce the incidence of IAAs and may even increase post-operative complications like fever and residual collections. Third, structured post-operative follow-up ensured early detection and management of complications, potentially preventing the progression of small collections into clinically significant abscesses.

Stratified analysis in this study revealed no statistically significant differences in the frequency of IAAs based on age, gender, or body mass index (BMI). Among patients aged 18–50 years, the incidence of IAAs was slightly higher (11.7%) compared to those aged 51–75 years (6.1%), but this difference was not statistically significant (p = 0.228). This is consistent with findings from Nikolovski et al[15] who reported that younger patients might present with more advanced disease due to delays in diagnosis and treatment, potentially influencing outcomes.

Gender stratification showed that males had a lower frequency of IAAs (7.0%) compared to females (13.3%), although this difference was not statistically significant (p = 0.183). These findings align with studies like Khan et al[16] which reported no significant gender-based differences in post-operative complications, including IAAs. The slightly higher rate among females may warrant further investigation into potential anatomical or hormonal influences on inflammatory responses.

BMI stratification revealed that patients with a BMI over 25 had a higher incidence of IAAs (10.5%) compared to those with a BMI of 25 or lower (7.3%), but the difference was not statistically significant (p = 0.509). Obesity is often associated with increased surgical complexity and altered immune responses, which can predispose patients to complications. However, the lack of significant association in this study suggests that the surgical approach and perioperative care were effective in mitigating these risks.

The findings of this study have important implications for clinical practice, particularly in the context of Pakistan. Laparoscopic appendectomy appears to be a safe and effective approach for managing perforated appendicitis, with a low incidence of post-operative complications like IAAs. Given the challenges of late presentation and limited resources in developing countries, the adoption of laparoscopic techniques could improve surgical outcomes, reduce hospital stays, and minimize healthcare costs.

The lack of significant differences in IAA rates across stratified groups further highlights the robustness of laparoscopic appendectomy as a surgical technique. By standardizing protocols and focusing on optimal perioperative care, healthcare providers can achieve consistent outcomes across diverse patient populations. This study also supports the broader integration of laparoscopic appendectomy into treatment protocols for perforated appendicitis, reducing the need for open surgery and its associated complications.

Although this study provides valuable insights, it also highlights areas for future research. Investigating additional risk factors, such as disease severity, preoperative inflammatory markers (e.g., CRP and leukocyte counts), and surgical technique variations, could provide a more comprehensive understanding of IAA formation. Moreover, multicenter studies with larger sample sizes would help validate these findings and explore the impact of healthcare resource disparities on surgical outcomes.

CONCLUSION

This study demonstrates that laparoscopic appendectomy is associated with a low incidence of post-operative IAAs, with no significant influence from age, gender, or BMI. These findings underscore the safety and efficacy of laparoscopic techniques in managing perforated appendicitis and offer valuable guidance for improving surgical care in Pakistan. By adopting laparoscopic appendectomy as the standard of care, healthcare providers can achieve better outcomes for patients while reducing the burden on healthcare systems.

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