ORIGINAL ARTICLE

SURGICAL SITE INFECTIONS PREVALENCE AFTER THE APPENDECTOMY OF COMPLICATED APPENDICITIS

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ABSTRACT

Introduction: Acute appendicitis, one of the most prevalent intra-abdominal illnesses expecting surgical intervention, and surgical site infection is the more prominent post-operative complication, affecting (5-10%) of all appendectomy patients. The optimal timing and schedule for prophylactic antibiotics, considering the risk of developing microbial resistance, has yet to be established. The aim of our study was to assess the prevalence of surgical site infections following surgical intervention in complicated cases of appendicitis.

Material & Methods: Descriptive study was conducted at Department of Surgery, Mardan Medical Complex, Mardan from June 2021 to January 2022. The study design was cross-sectional in which sample size was 292 patients, 5 percent of Surgical Site Infection having 2.5 proportion of error under WHO database software. For sample collection, a non-probability consecutive sampling technique was adopted.

Results: Per-operative observations in our analysis included adhesions, perforation, and peritonitis, whereas post-operative complications included port-site infection, bowel obstruction, and ileus. Most of the patients recovered within a week. The mean age was 30±7.1 years with (56%) patients were males and (44%) were females. Four percent of patients had perforated appendix while 13% patients had gangrenous appendix. Eight percent of patients had surgical site infection.

Conclusion: We determined that the Laparoscopic appendectomy (LA) procedure should be performed first choice, not only for the cosmetic reasons of deriving a tiny scar, but also for the increased chances of discovering additional pathologies (tumors, ovarian cysts, Meckel's diverticulum, etc.). The patient's early mobility and shorter post-operative hospital stay may also make it a better choice than routine appendectomies.

Key Words: Appendicitis, Antibiotics Therapy, Prevalence, Surgical Site Infections

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INTRODUCTION

Acute appendicitis is an acute bacterial inflammation of the appendix proven histologically by infiltration of muscularis propria layer by neutrophils, the most common acute surgical condition of the abdomen.[1] Approximately 5-10 percent of the population will have appendicitis in their life time, with a peak age between 15-25 years but affect all age groups.[2] Initial event of the disease is obstruction of the lumen of appendix commonly by faecolith followed by an acute inflammation. The continuously released

mucus secretions increase the intraluminal pressure which leads to obstruction of lymph drainage.[3] The inflammation of the mucosa is followed by transmigration of acute inflammatory cells across all the layers of appendix, and then to periappendicular tissue. Since the appendicular artery is an end artery, its thrombosis by inflammation leads to gangrene of the appendix. The appendix may perforate and cause generalized peritonitis or is walled off by the omentum and small gut loops resulting in a phlegmon the appendicular mass.[4] The classical presentation of the disease is a dull ache in the paraumblical region (visceral pain– T10) or epigastrium which then shifts to right iliac fossa (RIF) when parietal peritoneum is involved.[5] Tenderness, guarding, rigidity and rebound tenderness in RIF are classically described but the condition can simulate other inflammatory conditions or may be masked by variable positions of the organ.[6] Systemic symptoms like nausea, vomiting, anorexia, fever commences when inflammation becomes more severe. The inflammation may involve adjacent structures like ureter, urinary bladder, fallopian tubes and cause related symptoms. The clinical features of the appendicitis vary according to the location of appendix and the onset, progression and clinical features changes frequently.[7]

Surgical Site Infection (SSI) is a kind of infection that occurs after surgery in the body location where the procedure was performed. SSI is one of the most frequent surgical complications and the most prevalent healthcare-associated infection (HCAI).[8] It can eventually be superficial infections that just affect the skin. Certain SSIs are more severe, involving tissues beneath the skin, organs, or implanted objects.[9] It occurs in up to 40% of surgical procedures, prolonging recovery by a week on an average and frequently necessitating further surgical procedures. Every year, about 500,000 SSIs occur globally, with the United States accounting for (25%) of patients having inpatient surgery.[10] SSI is a leading cause of hospitalization, morbidity, and increased health-care expenses. When compared to patients without SSI, each SSI is associated with 7-10 extra postoperative days in the hospital and increased chance of mortality. SSI is directly responsible for 77 percent of mortality among individuals with SSI. It is anticipated that (5-10%) of patients enduring surgery may develop an SSI, resulting in an increased duration of stay and increased morbidity and death.[11]

Appendectomy is a surgical procedure used to treat appendicitis, an inflammation of the appendix that are among the most prevalent surgical emergencies, with a fatality rate of (12%) and (25%) for men and women, respectively.[12] Appendicitis is the most frequent emergency surgical operation practiced worldwide, accounting for nearly 1 million hospital days each year.[13] The complex appendectomy is the surgical intervention for complicated appendicitis (51%), which comprises perforated or gangrenous appendicitis with/without localized or diffused peritonitis. Empyema, abscess development, and fecal peritonitis are all indications of complex appendicitis.[14] The most prevalent sort complex appendicitis is perforation of an inflamed appendix, which has a high morbidity and death rate globally and affects people between the ages of 10 and 302.[15]

Antibiotic therapy in cases of perforated appendicitis to cover both aerobes and anaerobes is necessary. Traditional intra-operative abdominal culture can be abandoned and antibiotic therapy should begin without any abdominal culture reports.[16] In children, there is therapeutic similarity between extended intravenous therapy and intravenous therapy followed by conversion to oral antibiotic therapy. When enteral intake is tolerated after appendectomy for perforated appendicitis, the patient can be safely discharged on oral antibiotics, irrespective of fever or leukocytosis.[17]

The current descriptive study aims to evaluate current prevalence of surgical site infections following appendectomy of complicated appendicitis in our local community. Pre-operative, intra-operative, and post-operative precautions can be performed to lower the chance of acquiring an SSI. These post-operative infections place a considerable strain on both the patient and the health-care system, and they can cause psychological and physical stress in patients.[18] Knowing the local facts and figure on these SSI rates will allow us to develop a good surgical strategy for the prompt diagnosis and treatments of patients who develops with infections following surgical interventions.

MATERIAL AND METHODS

The current descriptive cross-sectional study was conducted from June 2021 to January 2022

in the Department of Surgery, Mardan Medical Complex, Mardan. The sample size was 292 with a 5 percentage of Surgical Site Infection and a margin of error of 2.5 percent using WHO software.

2.1 Sample Selection

Inclusion criteria:

•Patients currently passed through laparoscopic appendectomy

•14-60 years and both genders

Exclusion criteria:

•Patients who underwent an appendectomy for uncomplicated appendicitis.

•Patients who underwent interval appendectomy for appendicitis.

•Patients who obtained SSIs as a result of surgery other than an appendectomy.

The conditions indicated above operate as confounders, and if fulfilled, would induce bias into the study results.

2.2 Data Collection Procedure

This study was performed with the approval of the Mardan Medical Complex's (MMC) ethics board and research committee (CPSP/REU/SGR-2012-028-5963). The study included all hospitalized patients and the patients from other departments who met the inclusion criteria. The study objectives and its benefits were described to the patients, and signed informed consent was acquired.

After obtaining a detailed history, a thorough clinical examination was performed, and a full set of standard investigations was conducted. All of the procedures were performed under general anesthesia by the same surgeon with more than five years of expertise, using standardized techniques and aseptic protocols.

The wound examination was used to confirm SSI diagnosis, and the wound was assessed clinically. Postoperative pain assessment was done and surgical site was inspected on daily basis during hospital stay as well as in outpatient department for SSI.

A study Proforma was designed to collect information for each subject. The proforma had all of the above-mentioned information, including name, age, gender, address, SSIs, and so on. To control confounders and bias in research outcomes, strict exclusion criteria were being employed.

2.3 Data Analysis Procedure

SPSS v. 26 was used to analyze acquired data from patients using proformas. For continuous variables such as age, the mean SD was calculated. For categorical variables such as gender, complex appendicitis, and SSI, frequencies and percentages were determined. The Chi-Square test was used, and a P value of 0.05 was considered significant. Surgical Site Infection was stratified by age, gender, and complex appendicitis to examine how the impact changed (Figure 2 and Table 2).

2.4 Surgical Site Infection Criteria

The interpretation of clinical and laboratory results is required for the identification of SSI, and it is critical that a surveillance program employ definitions that are consistent and standardized; otherwise, erroneous or un-interpretable, the rate of SSIs will be measured and documented. The CDC's National Nosocomial Infections Surveillance (NNIS) system has created standardized surveillance criteria for defining SSIs.[19] SSIs are characterized as incisional or organ/space based on these characteristics. Incisional SSIs are further classified as those affecting just skin and subcutaneous tissue (superficial incisional SSI) and those involving deeper soft tissues of the incision (deep incisional SSI). Organ/space SSIs involve any area of the anatomy (e.g., organ or space) that was opened or manipulated during an operation other than incised body wall layers (Figure 1). For example, if a patient had an appendectomy and then developed an intra-abdominal abscess that did not drain through the incision, the infection would be classified as an organ/space SSI at the intra-abdominal location.

RESULTS

In this study the total of 292 patients data was collected in which 164 (56%) patients were males and 128 (44%) were females (Table 1). Status of complicated appendicitis among 292 patients was analyzed as 12 (4%) patients had perforated appendicitis while 38 (13%) patients had gangrenous appendicitis as shown in Table 2. The observed frequency of surgical site infection was 23 (8%) patients had surgical site infection while 269 (92%) patients had no sign for it as presented in Figure 2.

DISCUSSION

Surgical site infections are a leading factor of postoperative infection, accounting for around one-quarter of all nosocomial infections. They are the second or third most prevalent form of hospital acquired infection, behind urinary tract infections, pneumonia, and blood acquired infections. National investigations have identified the people who are more vulnerable to infection in general and in several specific

surgical procedures. Antibiotic prophylaxis before surgery has evolved tremendously during the previous 20 years. Improvements in the timing of first administration, the rational selection of antibiotic drugs, and shorter administration durations have defined the efficacy of this strategy in preventing postoperative wound infections more precisely.[20]

In another study conducted by Waqar et al.[21] at Lady Reading Hospital Peshawar, the per-operative diagnosis observed, 6 (10%) patients had common appendicitis, 45 (75%) patients had acute, and 9 (15%) patients had complicated appendicitis, which included perforated 2 (3.3%) and gangrenous in 7 (11.6%) patients. These observations were almost parallel to the results of two international studies that is study by A. Bangnall NM et al.[22] in which normal appendix were observed in (20%) patients, acute were in (56.2%), gangrenous were in (5.3%), while the patients having perforated appendicitis were in 7.7%. In another series by Haridas et al.[23] patients with normal appendix were in (12%), acute were in (53%), gangrenous were in (12%) patients.

According to Anderson et al.[24] the most prevalent causes for conversion include dense adhesion secondary to inflammation, localized perforation, and spreading peritonitis. Furthermore, the surgeon's previous expertise is a clinical predictor of conversion. In our series of sixty patients, the dense adhesions related to inflammation were in 4 (6.6%) cases, localized perforation in 2 (3.3%), diffused peritonitis in 2 (3.3%), and bleeding during operation were observed and 6 (10%) patients compelled switching to open appendectomy. We redden adhesions related to inflammation in 2 (3.3%), localized perforation in 2 (3.3%), diffuse peritonitis in 1 (1.6%) patient, and bleeding during operation in 1 (1.6%) patient. We had trouble dealing with adhesions and bleeding since we lacked Harmonic scalpels and Liga-Sure. Our study's total conversion rate of (10%) is consistent with another published research. Although the conversion rate has been reported as high as (22%) in some published studies, others have found a lower rate of (1.8%).[23] Postoperative complications appeared in 5 (8.3%) of the cases, with 2 (3.3%) developing port site infection, 1 (1.6%) developing postoperative ileus, 1 (1.6%) developing partial bowel obstruction, and 1 (1.7%) presenting with right iliac fossa abscess. Furthermore, according to Anderson et al.[24] the risk of port-site infection was (11%) cases, while (6.5%) were developed post-operative ileus, (15%) intra-abdominal abscess, and (4.3%) developed partial bowel obstruction.

The low prevalence of wound infection and intra-abdominal abscess in our study might be attributed to our antibiotic regimen, as antimicrobial prophylaxis perioperatively decreases the risk of postoperative infections substantially.[25] When compared to open appendectomy, certain studies using LA reveal a much greater intra-abdominal abscess rate and a reduced wound infection rate. In contrast, Santacroce et al.[26] discovered (2.8%) less postoperative intra-abdominal abscesses in comparison to the greater risk for open appendectomy. Yet, Dian et al.[27] determined that laparoscopic appendectomy resulted in fewer infectious post-complications than OA in a study of 85 patients of perforated appendicitis. As a result, the concern of developing deep abscesses after laparoscopic appendectomy cannot be adopted as a general rule.

The surgery time from skin incision to skin closure in our research ranged from 45 to 110 minutes, with a mean of 77.5 minutes. Other studies have reported a wide range of operative times, ranging from 31.5 minutes to 110 minutes, with no trend toward a shorter operative time in LA over the last decade. According to published local and international studies, the average hospital stay in patients with no abnormalities was 1.5 days21.[23] Bangnall et al.[22] shown that LA is safe and beneficial for selected individuals even in a day care scenario.

Minimally invasive procedures surgery is evolving to produce optimal outcomes with a small incision, and the current period implies that laparoscopy will be widely used in general surgery, particularly in the emergency scenario. Recent breakthroughs in Natural Orifice Transluminal Endoscopic Surgery (NOTES) have documented incision-less operations such as trans-gastric appendectomy, which need time to evolve before it can be used in practice.[27,28]

Laparoscopic appendectomy allowed for a more proper diagnosis and more extensive abdominal examination, as well as the detection and treatment of concomitant pathologies. There are less postoperative problems, fewer

adhesions, less postoperative discomfort, reduced hospital stays, and patients are able to return to work sooner.[22,23]

Other studies, however, indicated longer operating times and greater costs for laparoscopy, or did not uncover enough benefits to support the superiority of the laparoscopic technique. In 1995, the Consensus Conference of the European Association of Endoscopic Surgery (EAES) acknowledged the safety profile of laparoscopic appendectomy, but warned physicians of possible hazards and major risk factors.[21]

Controlled trials have demonstrated benefits for patients, particularly in terms of more accurate diagnosis, less wound infection, and quicker return to work. Although promising, laparoscopic appendectomy is still not the gold standard for acute appendicitis.

CONCLUSION

In the current study, the pre-operative observations encompassed adhesions, perforation, and peritonitis, whereas post-operative complications included port-site infection, ileus, and bowel obstruction. The majority of people recovered within a week. The findings will be disseminated to numerous health-care organizations in order to improve the surgical method and promote better treatment. According to our findings, the LA procedure should be considered as a first choice, not only for cosmetic reasons of producing a small scar, but also because it increases the chances of finding other pathologies (tumors, ovarian cysts, Meckel's diverticulum, etc.) that may not be easily found in open appendectomies using grid iron incision. Additionally, the patient's early mobility and brief post-operative stay in the hospital may make it a better choice than standard appendectomies. This will aid in the careful use of appendectomy for complex appendicitis, allowing for improved patient management and minimizing morbidity and mortality.

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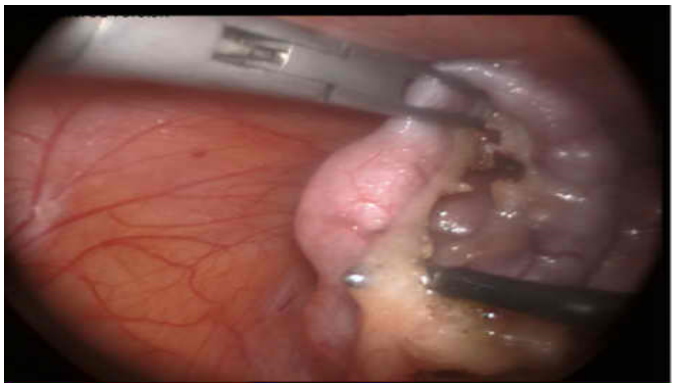

Figure 1: Clinical Presentation of Laparoscopic appendectomy (LA)

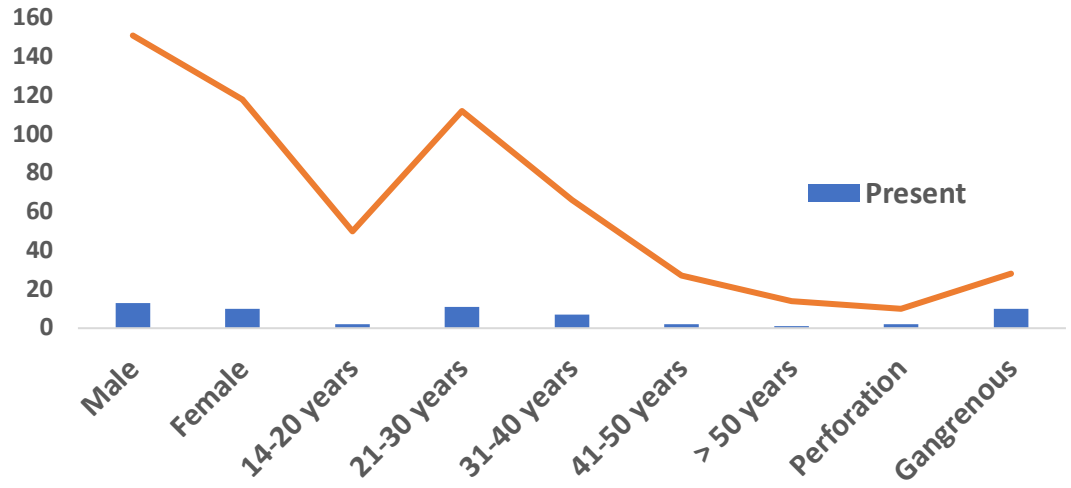

Figure 2: Impact of Prophylactic Antibiotics in the Prevalence of Surgical Site Infection

Table 1: Patient Characteristics

		Frequency	Percentage
Gender	Male	164	56%
	Female	128	44%
Age	14-20 years	52	18%
	21-30 years	123	42%
	31-40 years	73	25%
	41-50 years	29	10%
	> 50 years	15	5%
Appendicitis (Comp.)	Perforation	12	4%
	Gangrenous	38	13%

Table 2: Surgical site infection (SSI) prevalence in the study population

		Present	Absent	*P* value*
Surgical Site Infection	Frequency	23	269	
Gender-wise-SSI	Male	13	151	0.001
	Female	10	118	
Age-wise-SSI	14-20 years	2	50	0.002
	21-30 years	11	112	
	31-40 years	7	66	
	41-50 years	2	27	
	> 50 years	1	14	
Appendicitis (Comp.)	Perforation	2	10	0.004
	Gangrenous	10	28	

* Chi Square