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A randomized control trial to determine the need for postoperative antibiotics after laparoscopic appendicectomy in nonperforated appendicitis

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ABSTRACT

Background: Acute Appendicitis is the most common cause of acute pain in the abdomen. Appropriate use of prophylactic antibiotics prevents the risk of postoperative surgical site infections (SSIs). However, there is no conclusive guideline concerning the duration of antibiotic usage. A single preoperative prophylactic dose has been recommended by many randomized control trials. Hence, the study aimed to determine the need for postoperative antibiotics after laparoscopic appendicectomy for nonperforated appendicitis.

Methods: A total of 100 patients with nonperforated appendicitis undergoing laparoscopic appendicectomy divided into two groups. Group A (n=50) patients received single dose of preoperative antibiotic and group B (n=50) patients received preoperative dose, as well as three postoperative doses of antibiotics. Routine investigations including complete blood count, blood urea, serum creatinine; other investigations such as ultrasound of abdomen were also performed. Following laparoscopic appendicectomy, surgical wound was inspected after 48 h, 72 h, and on day 7 to look for any signs of postoperative SSI.

Results: The mean age in group A was 30.74 ± 10.69 years compared to 30.72 ± 9.56 years (p=0.757) in group B. All the patients in study presented with right iliac fossa pain. Three patients in group A (6%) and two patients in group B (4%) had grade III SSIs, which were managed conservatively. The difference between both the groups for incidence of SSIs was statistically insignificant (p=1.000).

Conclusions: Prophylactic postoperative doses of antibiotics confer no additional benefit over a single preoperative dose in preventing the postoperative SSIs after laparoscopic appendicectomy.

Keywords: Laparoscopic appendicectomy, Nonperforated appendicitis, Prophylactic antibiotics, Surgical site infections

INTRODUCTION

Appendicitis, the inflammation of appendix, is the common cause of surgical intervention. Initially appendicectomy was considered as a gold standard treatment modality for acute appendicitis. Later, laparoscopic appendicectomy is the most frequently

performed surgical intervention. The early surgical intervention following acute appendicitis improves the outcome

It was assessed that risk of acute appendicitis is 6.7% for women and 8.6% for men, with a peak incidence between 10 and 30 years in both the sexes.²

Pathological state of vermiform appendix is an important contributing factor of postoperative surgical site infection (SSI's) following appendicectomy.^{3,4} Patients with perforated or gangrenous appendicitis are at higher incidence of SSI's than those with nonperforated appendicitis.⁵ SSI's are the major cause of postoperative morbidities including pain, anxiety, inconvenience, increased hospital stay, and financial cost.⁶ Along with medicine, major and continuous efforts have been made by the surgeons to prevent sepsis. Despite all, postoperative wound infection is still a major limiting factor in surgery.

SSI's occurs mostly along the surgical tract involving superficial tissues, deeper tissues, organ, or an intraabdominal space. Superficial incisional infections, account for 60%-80% of all SSIs, have a better prognosis than organ or space-related SSIs.5 The appropriate use of antibiotics reduces risk of postoperative SSI by 40%-60%.⁷ Prospective clinical trials have established guidelines for choice of prophylactic antibiotics, route of administration, and its timing following emergency appendicectomy. However, there are no definitive guidelines regarding duration of antibiotic usage.^{8,9}

The antibiotics given preoperatively at the time of maximum bacterial contamination, that is during the course of surgery, achieve adequate serum and tissue levels and play an imperative role in prevention of SSIs.¹⁰ However, the role of postoperative antibiotics in reducing the SSI's in nonperforated cases is still conflicting. 11 A single-dose antibiotic prophylaxis has been recommended for majority of the elective general surgical procedures; however, in reality, this practice is not followed and multiple-dose regimens are still in use at many centers.^{4,12} Hence, this study was conducted to determine the need for postoperative antibiotics in reducing SSI after laparoscopic appendicectomy for nonperforated appendicitis.

METHODS

The present 1-year open label randomized control trial (RCT) was conducted at the Department of General Surgery from January 2015 to December 2015. A total of 100 patients admitted with nonperforated appendicitis at the hospital were studied.

Selection criteria

All patients aged between 18 and 50 years of either sex presenting with uncomplicated appendicitis were considered eligible for the study. Patients with complicated appendicitis (gangrenous or perforated), additional comorbidities including diabetes, immunosuppression, cardiac, renal or liver failure, allergic to cephalosporins, refuse to give written consent and who has taken antibiotics outside before participating in the study were excluded from the study. A written and informed consent was taken from each patient enrolled in

the study after briefing them about nature of surgery, required investigations, proposed interventions, and possible untoward outcomes

Data collection

The data related to the demography, history of illness, and details of the clinical examination of the patients were recorded on a predesigned proforma. Routine investigations including complete blood count, blood urea, serum creatinine, and other investigations such as ultrasound of abdomen were also performed.

Randomization of the groups was done by opaque envelope method. A total of 100 opaque envelopes containing a card inside were made. Fifty of these envelopes contained a card mentioning group A (study group) and the remaining fifty had a card mentioning group B (control group). Patients were asked to pick up an envelope randomly and depending on the group mentioned in the envelope, they were allocated into either one of the two groups.

Intervention

Patients in both the groups underwent laparoscopic appendicectomy as per the standard procedures. Similar instruments and suture materials were used in both the groups. Basic principles of surgery including adequate hemostasis and no undue traction on the tissues were followed in both the groups. Both the groups received a single preoperative injection of 1gm cefotaxime and 100ml metronidazole intravenously at the time of induction of anesthesia; however, in group B, additionally three more doses of same antibiotics were administered postoperatively at 8, 16, and 24 h from the time of index surgery whereas for group A no postoperative antibiotics were given.

Intravenous fluids, analgesics, and other supportive treatments were also given as per the surgeon's advice. Surgical wound was inspected after 48, 72 h, and on day 7 to look for any signs of postoperative wound infection. The scores at each dressing were charted in a preformed table to assess wound infection as per the Southampton scoring system (Grade 0-5). Wound healing was taken as normal for grades 0, 1, and 2. Infection of wound was categorized as minimal for grade 3 and as major for grades 4 and 5.

Statistical analysis

SPSS 20 (SPSS Inc, Chicago, IL) was used to analyze the pooled data. The demographic characteristics were compared using chi-square test, infection rates were compared using Fisher's exact test, and the mean duration of hospital stay was compared using unpaired t-test. $P \le 0.05$ at 95% confidence interval was considered as statistically significant.

RESULTS

The demographics, detailed history, and clinical characteristics of the study patients is showed (Table 1). No significant difference was observed between the two groups regarding mean age, gender distribution, pain, fever, nausea/vomiting, McBurney's tenderness, bowel sounds, total leukocyte count, ultrasonography, diagnosis, and histopathology report (p>0.05). Southampton scoring system of SSI's after 7, 48 h, and day 7 is summarized

(Table 2). None of the patients in present study had grade 4 or 5 SSIs. Wound healing was taken as normal for grades 0, 1 and 2 whereas the patients with grade 3 were considered as having wound infection. Only 3 (6%) patients in group A and 2 (4%) in group B had grade 3 SSIs at 72 h and they were managed conservatively with daily cleaning and dressing. The mean duration of hospital stay for group B was higher than group A; however, there was no statistically significant difference $(3.14\pm0.45 \text{ days vs. } 3.08\pm0.34 \text{ days; p} = 0.455)$.

Table 1: Demographic, detailed history and clinical characteristics of the study population.

Findings	Group A, n=50	Group B, n=50	P value	
Mean age	30.74±10.69	30.72±9.56	0.757	
Pain	50 (100%)	50 (100%)	1	
Fever	13 (26%)	16 (32%)	0.509	
Nausea/vomiting	31 (62%)	34 (68%)	0.529	
Bowel sounds	50 (100%)	50 (100%)	1	
Total leukocyte count				
6,000-11,000	24 (48%)	22 (44%)	0.600	
>11,000	26 (52%)	28 (56%)	0.688	
Ultrasonography, inflamed appendix, probe tenderness	8 (16%)	12 (24%)	0.317	
Diagnosis				
Acute appendicitis	40 (80%)	42 (84%)		
Chronic appendicitis	6 (12%)	2 (4%)	0.204	
Recurrent appendicitis	3 (6%)	4 (8%)	- 0.294 -	
Sub-acute appendicitis	1 (2%)	2 (4%)		
Histopathology report				
Acute appendicitis	41 (82%)	44 (88%)	0.401	
Chronic appendicitis	9 (18 5)	6 (12%)		

Table 2: Summary of Southampton scoring.

Duration	Group N	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4 and 5	P value
48 h	Group A	42 (84%)	6 (12%)	2 (4%)	0	0	0.108
	Group B	48 (96%)	1 (2%)	1 (2%)	0	0	
72 h	Group A	42 (84%)	1 (2%)	4 (8%)	3 (6%)	0	1.000
	Group B	43 (86%)	2 (4%)	3 (6%)	2 (4%)	0	
7 th day	Group A	49 (98%)	1 (2%)	0	0	0	1.000
	Group B	49 (98%)	1 (2%)	0	0	0	

DISCUSSION

SSI following surgical intervention is an alarming impediment, which is never sought by a patient as well as surgeon. SSIs account for approximately 15% of all nosocomial infections, usually develop when endogenous flora are translocated to a normally sterile site. Factors influencing development of SSIs include perioperative care, host defences, bacterial inoculum and virulence, and intraoperative management.

In addition, SSIs have a high impact on financial burden. A prospective study conducted by Davey et al, also

reported an increase in hospital expenditures on a patient when a surgical site becomes infected. 16

A systematic review by Daskalakis et al, concluded that all patients with nonperforated appendicitis, preoperative treatment is sufficient whereas the use of postoperative antibiotic treatment is not recommended. Whereas, in case of perforated appendicitis, postoperative broadspectrum antibiotics are recommended. Similarly, a systematic review by Andersen et al, have shown that the use of antibiotics in patients with uncomplicated appendicitis is superior to placebo in reducing postoperative complications; however, concluded that no

specific recommendations can be made regarding the duration of antibiotic use. ¹⁸ However, for patients with complicated appendicitis, comprehensive antibiotic regime is to be continued, as they have quite high risk of infective complications. Altogether, only a very few studies have demonstrated the clinical benefits and disadvantages of giving postoperative antibiotics along with adequate preoperative antibiotics prophylaxis. ¹⁹ The main aim of these prophylactic antibiotics is to lessen the occurrence of postoperative SSIs. ²⁰ Redundant use and continuation of broad-spectrum antibiotics beyond the suggested time period may consequence in inappropriate prophylaxis. These practices may augment the risk of adverse effects and promote the emergence of resistant strains that consequence in higher morbidity and mortality. ²¹

Most of the patients in both the groups were aged between 21 to 30 years. The mean age was high in group A compared to group B (30.74±10.69 years vs. 30.72 ± 9.56 ; p = 0.757). These findings were consonance with literature showing that the appendicitis is seen more frequently in patients in their second through fourth decades of life with mean age of 31.3 years. Similar studies conducted by Luckmann et al, and Anderson et al, reported that in contrast to perforated appendicitis, nonperforated appendicitis was related to age. 22,23 On examination, all patients in both the groups had tenderness in right iliac fossa (McBurney's tenderness) on the abdominal examination, as provided in literature it is the most important sign that suggests appendicitis.²⁴ leukocytosis. ranges from 10,000 18,000cells/mm³ is mostly seen in patients with acute uncomplicated appendicitis; however, the white blood cell counts are variable.²⁵ Likewise, in present study leucocytosis was seen in 52% of patients in group A and 56% of patients in group B; however, the difference was not statistically insignificant (p=0.688) between the groups.

The results of the study indicated that prophylactic postoperative doses of antibiotics had no additional benefit over a single preoperative dose of antibiotic and it had no any significant effect on risk of developing SSIs However, the following appendicectomy. parameters such as maintenance of asepsis, good surgical technique, and a good postoperative care also plays a substantial role in reducing the risk of postoperative SSIs and thereby reducing the morbidity. Correspondingly, a RCT conducted by Mui et al, concluded that the single dose of perioperative antibiotic is adequate for prevention of infective wound complications in patients undergoing surgery for uncomplicated appendicitis.26 They also concluded that the prolonged antibiotic administration cost-ineffective and leads to unnecessary complications. Few other studies in the literature also reported that that single dose of prophylactic antibiotic is enough to prevent infective complications following appendicectomy for nonperforated appendicitis.²⁷⁻³⁰

CONCLUSION

Overall, the results of this study suggest that the use of single preoperative dose of prophylactic antibiotics cefotaxime and metronidazole at the time of induction is sufficient to reduce the risk of postoperative SSIs and additional postoperative doses have no statistically significant benefits. However, these findings are limited to a single procedure-laparoscopic appendicectomy. Further studies on a larger scale with various other abdominal surgeries are required to determine the actual need for postoperative prophylactic antibiotics to reduce the SSIs.

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Institutional Ethics Committee

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