

## Evaluation of postoperative antibiotics after non-perforated appendectomy

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### Abstract

**Objective:** To evaluate the role of postoperative antibiotics in reducing surgical site infections after appendectomy for non-perforated appendicitis.

**Methods:** The randomised controlled trial was conducted at Khyber Teaching Hospital, Peshawar, Pakistan, from November 11, 2012, to May 30, 2014, and comprised patients of emergency appendectomy for non-perforated appendicitis who were divided into groups A and B. Group A received a single dose of cefuroxime sodium and metronidazole half-an-hour before induction, while Group B received one more dose of the same antibiotics postoperatively. Both groups were followed for 6 weeks. SPSS 20 was used for statistical analysis.

**Results:** Of the 390 patients in the study, 192(49.2%) were in Group A and 198(50.7%) in Group B. Number of surgical site infections was 15(7.8%) in Group A and 18(9.1%) in Group B ( $p=0.65$ ). Mean hospital stay of  $3.32\pm 0.4$  days and  $3.59\pm 0.46$  days was observed for Group A and B, respectively, ( $p<0.001$ ).

**Conclusion:** A single pre-operative dose of cefuroxime and metronidazole had the same efficacy in preventing surgical site infections in cases of non-perforated appendicitis as when the same regimen was repeated post-operatively.

**Keywords:** Acute, Appendicitis, Appendectomy, Antibiotics. (JPMA 65: 815; 2015)

### Introduction

Acute appendicitis is the most common emergency surgical condition.<sup>1</sup> It is the most frequent cause of acute abdominal pain with a lifetime risk of 7%.<sup>2</sup> Peak age is 15-25 years with a higher risk in males.<sup>3</sup> Emergency appendectomy is the usual treatment modality with more than 300,000 performed annually in the United States.<sup>4</sup> Surgical Site Infection (SSI) is still the most common post-op complication despite improved peri-operative care and antibiotics.<sup>5</sup> In non-perforated appendicitis, this rate is less than 10%.<sup>6</sup>

Contaminant wise, non-perforated appendicitis surgery is considered clean whereas contaminated and perforated appendicitis as contaminated. Pre-operative antibiotic regimes have been shown to be effective in reducing post-operative complications and SSIs.<sup>7,8</sup> These antibiotics are continued post-op with different courses and combinations according to each case. This seems logical and necessary for perforated cases due to peritoneal and wound contamination.<sup>9</sup> In non-perforated cases, however, their usage does not seem logical.<sup>7,10</sup>

Post-operative antibiotic treatment modalities for non-perforated appendectomy cases vary from centre to centre. Whether these are necessary or even required at all for reducing post-operative complications and SSIs in

these cases has not been elaborated in detail in medical literature. The current practice in our hospital for non-perforated appendectomies is continuation of antibiotics post-operatively. This is practised twice or until discharge of the patient if febrile. The current study was therefore carried out to determine the effectiveness of a single dose of antibiotics half-an-hour before induction compared with their repetition once more post-operatively in non-perforated appendectomies.

### Patients and Methods

The randomised control trial was carried out in the Surgical Unit of Khyber Teaching Hospital, Peshawar, Pakistan, from November 11, 2012, to May 30, 2014, after approval by the institutional ethics committees. Uniform guidelines of management were applied in all cases with standard operating technique for open appendectomy, grid iron incision and primary closure.

The study included all patients with acute appendicitis requiring appendectomy and written informed consent was taken in each case. Complicated appendicitis cases involving appendicular mass, gangrene, perforation and abscess were excluded. Comorbid cases e.g. immune-compromisation, diabetes and cases where there was a waiting period of more than 24 hours or who had received antibiotics within 72 hours of admission were also excluded. In addition, pregnant patients and cases lost to follow-up were not included. Patients with a Body Mass Index (BMI) greater than 25 were also excluded.

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Patients who met the inclusion criteria were randomised by simple parallel group randomisation into two groups; A and B. Both groups received a single pre-op dose of cefuroxime sodium and metronidazole half-an-hour pre-operatively i.e. before induction, but in Group B this was continued as an additional single dose of cefuroxime sodium and metronidazole 8 hours post-operatively.

Discharge criteria included return of mobility, bowel activity, afebrile status, tolerance of normal diet and pain control on oral analgesics. Patients were advised to come on the 10th post-op day for suture removal and wound assessment, but to consult emergency any time if there was wound tenderness, fever or pus discharge. The last visit was planned at the end of 6 weeks.

Data was collected through a proforma. Statistical analysis was done using SPSS 20. Frequency, percentage, mean and standard deviation (SD) were calculated for variables. Comparison of categorical variables was done using chi-square. Tests for normality were applied between the groups for continuous variables. Data was found to be skewed on Shapiro-Wilk's test with a non-normal distribution. As a result, Mann-Whitney U test was used for comparison of continuous variables. For all statistical tests,  $p < 0.05$  was considered statistically significant.

## Results

Data was collected from 400 patients of whom 10(2.5%) were lost to follow-up. The remaining 390(97.5%) patients were divided into Group A 192(49.2%) and Group B 198(50.7%) (Table).

There was no significant difference between the groups regarding gender distribution ( $p=0.99$ ), mean age ( $p=0.439$ ), pre-operative duration of symptoms ( $p=0.169$ ), Total

Leukocyte Count (TLC) ( $p=0.33$ ) and the number of SSIs ( $p=0.65$ ). In Group-A, 15 (7.8%) cases and in Group-B 18(9.1%) developed SSIs ( $p=0.65$ ). None of the SSI cases was associated with any intra-abdominal collection and they were subsequently discharged. However, statistically significant differences were found between the groups regarding admission temperature ( $p=0.007$ ) and Surgery duration ( $p=0.046$ ). Mean hospital stay also differed between the two groups ( $3.32 \pm 0.4$  days in Group A versus  $3.59 \pm 0.46$  days in Group B;  $p < 0.001$ ). There was no mortality in our study.

## Discussion

Appendectomy is a routine surgical emergency procedure with approximately 400,000 done annually in Pakistan.<sup>11</sup> SSI in appendectomies therefore is alarming for attendants and the performing surgeons. Despite improved peri-operative care and antibiotics, this is still the most common post-operative complication.<sup>5</sup> Various studies have shown the rate of these post-appendectomy SSIs for non-perforated appendectomies to be 0-11%.<sup>7,10,12</sup> The factors involved include duration of pre-operative symptoms (hours), stage of the disease, choice and pre-operative use of antibiotics, and management practices of the hospital among others.<sup>10,12</sup> It is also influenced by factors relating to the individual patient.

Antibiotics heavily influence the rate of SSIs in non-perforated appendectomy cases. Their importance in the pre-operative setting has been well established.<sup>7,8,10</sup> Their use and role in the post-operative period has not been clearly established. In fact, there are studies that indicate their use in the post-operative period is without benefit and even controversial for non-perforated appendectomy cases.<sup>7,12</sup> A study in 1995 showed that non-perforated appendectomy patients treated pre-operatively with cefoxitin had a higher rate of SSIs (11%) compared to those treated with a single pre-operative dose of cefotetan (0%).<sup>13</sup> The type of antibiotic chosen therefore is important. In 2005 a study showed that a single pre-operative dose of antibiotics was sufficient to control post-operative SSIs in non-perforated appendectomies.<sup>14</sup> In 2009 a study showed that post-operative infection rates for non-perforated appendectomies were similar for patients whether they were given pre- and post-operative antibiotics (9%) or only post-operative antibiotics (10%,  $p=0.64$ ).<sup>15</sup> The 2005 study therefore showed that only a single pre-operative dose of antibiotics was sufficient to control post-operative infections in non-perforated appendectomy cases.<sup>14</sup> A 2012 study showed that SSI rates in non-perforated appendectomies were unchanged for patients treated with a single pre-operative dose of antibiotics 9(4.6%) or pre and post-operative antibiotics 8(4.3%), respectively ( $p=0.91$ ).<sup>7</sup> Our findings are somewhat similar with the difference that we compared the two groups between a single pre-operative

**Table:** Group A and B Comparison.

	Group A (no post-op <sup>++</sup> antibiotics)	Group B (post-op antibiotics)	p-value <sup>#</sup>
No. of patients	192 (49.2%)	198 (50.8%)	
Males : Females	93(48.4%) : 99(51.6%)	96(48.5%) : 102(51.5%)	0.99
Male-female ratio	1 : 1.06	1 : 1.06	
Mean age (Years)	22.48 ± 8.35	22.7 ± 9.95	0.439
Symptom duration (hours)	28.73 ± 6.5	27.98 ± 6.45	0.169
Admission Temperature (°F)*	99.88 ± 0.8	99.67 ± 0.75	0.007
TLC <sup>+</sup> (x 10 <sup>9</sup> /Liter)	12.48 ± 1.34	12.43 ± 1.58	0.33
Surgery duration (minutes)	40.7 ± 4.23	39.55 ± 5.21	0.046
Hospital stay (days)	3.32 ± 0.40	3.59 ± 0.46	<0.001
Surgical site infection	15 (7.8%)	18 (9.1%)	0.65

Footnote: \*F: degree Fahrenheit. <sup>+</sup>TLC: Total Leukocyte Count. <sup>++</sup>op: operative. <sup>#</sup>all p-values are based on the Mann-Whitney U test.

TLC: Total leukocyte count.

antibiotic dose half-an-hour before induction and followed it up in group-B only with another dose post-operatively. Of the 192 Group A patients who were only given a single pre-operative dose of antibiotics, only 15(7.8%) developed SSI, while of the 198 Group B patients with both pre- and post-operative antibiotics, 18(9.1%) developed SSIs ( $p=0.65$ ).

In 2011, a study showed that in non-perforated appendectomy cases, the addition of post-operative antibiotics not only failed to add any benefit, but also worsened post-operative morbidity with prolonged hospital stay and increase in antibiotic-associated diarrhoea and treatment cost.<sup>12</sup> This is also shown by our present study where patients given post-operative antibiotics had a longer hospital stay  $3.59 \pm 0.46$  days compared to Group A patients who were only given a single pre-operative dose of antibiotics  $3.32 \pm 0.4$  days ( $p < 0.001$ ).

It is to be mentioned here that the local policy for discharge involved first assessment on the first post-operative day and a second one with early discharge on the second post-operative day in all cases of simple non-perforated appendectomy without any complications. Complications included persisting fever on assessment, generally unwell patient, absence of bowel sounds and gut motility, haemorrhage, wound site complications and atelectasis. Hence because of these, on average, Group B patients had their discharges at least a day later than Group A patients i.e. on the 3rd post-operative day. Regarding this difference between the groups, an earlier study, however, did not show any difference between the groups.<sup>7</sup>

Our study was carried out in a public-sector hospital and therefore to reduce confounders and complications and to elicit a clear role of antibiotics, we excluded immunocompromised and co-morbid patients. In our study the hospital stay was longer,  $3.32 \pm 0.4$  and  $3.59 \pm 0.46$  days for Group A and B respectively, compared to  $2.29 \pm 0.82$  and  $2.35 \pm 0.48$  days reported earlier.<sup>7</sup> Intra-abdominal collection is a rarity for non-perforated appendectomy, but in complicated appendectomies, it can be 2-3%.<sup>7</sup> However, there were no such cases in our study. Additionally, we chose to collect two-year data for the study instead of power-based statistical sample size calculation which can be a possible limitation.

The study showed that well-chosen and adequately-timed pre-operative antibiotics are adequate in preventing SSIs in cases of non-perforated appendectomy and post-operative antibiotics do not affect the SSI rates in such cases. The overuse and abuse of antibiotics is misplaced and causes increased morbidity and cost of healthcare.

## Conclusion

A single pre-operative dose of cefuroxime and metronidazole had the same efficacy in preventing SSIs in cases of non-perforated appendicitis as the same regimen repeated post-operatively. Therefore, according to evidence-based medicine, there is no need to repeat post-operative antibiotics for these cases.

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