

# Prolonged use of antibiotics in complicated appendicitis: Does it prevent post-appendicectomy complications?

P Ward, C Smith, I Shaikh, S Yalamarathi

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## Abstract

**Introduction:** The main objective of the study was to determine if the duration of antibiotic use had an effect on the incidence of postoperative complications in acute appendicitis. **Methods:** The use of antibiotics with its duration along with its relation to the operation, and the incidence and types of post-operative complications were recorded in 3 patient groups (normal appendix, simple appendicitis and severe appendicitis). **Results:** This study included 135 patients for a year's time with severe appendicitis (69 patients, 51.1%); 95% of patients received antibiotics including 41.4% for >48 hours. The overall complication rate was 9.6%, with the highest rate in the severe group (7.4%) and the most common complication being wound infection (7/13 - 53.9%). All patients developing wound infection received at least 48 hours of antibiotics. **Conclusion:** The incidence of complications is higher in patients with severe appendicitis, and our observational study has shown that prolongation of antibiotics beyond 48 hours does not necessarily reduce the risk of complications. This gives a basis for conducting a future prospective randomized trial.

## INTRODUCTION

Appendicitis is a common general surgical emergency admission with the mainstay of treatment being appendicectomy, which is performed either by an open technique or laparoscopically<sup>1,2</sup>. Antibiotics are used during the course of the operation, either pre-operatively or at induction of anaesthesia to reduce the incidence of post-operative complications, especially wound infections. However, the duration of antibiotic usage remains a contentious issue and there are no clear recommendations regarding this.

The Scottish Intercollegiate Guidelines Network (SIGN) publication<sup>3</sup> on antibiotic prophylaxis states that this is recommended in appendicectomy to reduce incidence of wound infection but gives no guidelines regarding the duration of its use. A Cochrane systematic review<sup>4</sup> found that antibiotic prescription in patients undergoing appendicectomy was superior to placebo in prevention of wound infection and intra-abdominal abscess but concluded that no recommendations can be made regarding the length of antibiotic treatment and the efficacy of individual regimens (although the reviewers state that single doses may be as effective as multiple doses in patients where pus is present at operation). At the same time, it is widely recognized that comprehensive antibiotic treatment should

be continued in patients with perforated or other severe forms of appendicitis because of the heavy intraperitoneal and wound microbial contamination and consequently higher incidence of postoperative infective complications compared with simpler forms of appendicitis<sup>5</sup>. This study was hence carried out to determine if the duration of antibiotics had any influence on the complication rates after an appendicectomy.

## MATERIALS AND METHODS

This retrospective observational study was carried out in the general surgical department, between October 2005 and September 2006. All patients who underwent either an open or laparoscopic appendicectomy for acute appendicitis were identified from Fife surgical procedure coding records. Information regarding the pathological state of appendix at the time of operation, complications, time of administration and duration of antibiotics were retrieved from the clinical case records. Additional information like the histopathological analysis of appendix specimens was obtained from the pathology reports. All these relevant information was entered onto a pro-forma sheet. Routine practise is to wash the peritoneal cavity thoroughly with saline; however, due to inconsistency of recording operative notes, it was impossible to determine variables such as amount and type of fluid used to wash. Surgeries were performed by surgical trainees or consultants or both.

The patients were divided into three main groups based on the intra-operative state of the appendix. Patients who had simple (catarrhal/inflamed) appendicitis were categorised as Group 1. Similarly, those who had a gangrenous, purulent, necrotic or perforated appendix or appendicular abscess were placed into Group 2 as 'severe' appendicitis. Patients with a normal appendix at operation were included in a separate group (group 3). The state of the appendix and presence/absence of perforation at the time of operation was discerned from the surgeon's operation note and from the pathology report of the appendix specimen. If there was a discrepancy between the surgeons' findings and the pathology report, the state of appendix documented in the pathology report was used in data analysis.

Post-operative complications were divided into local, intra-abdominal and systemic. These complications were identified from the case notes and discharge summaries. The incidence of complications in each cohort were identified, and related to the antibiotic prescription, in order to identify whether the duration of antibiotic prescription had an influence on the post-operative complications.

Antibiotic usage, type of antibiotic, its use in relation to the operation (i.e., pre-operative; intra- & post-operative; both pre- and post-operative) and the total duration of its use were determined from the drug prescription and the anaesthetic charts. The antibiotics used were mainly third generation cephalosporins directed against gram-negative organisms and metronidazole-covering anaerobes. Patients received either of the antibiotics as a single agent or in combination according to local policy or surgeon's preference.

## RESULTS

One hundred and forty-eight patients underwent either an open or laparoscopic appendicectomy during this study period, but it was only possible to obtain all the relevant data for 135 patients. These patients ranged in age from 12 years to 83 years (mean age 28.35 years), with 83 males and 52 females.

The number of patients in each group, according to the state of the appendix at operation is shown in Table 1. The majority of the patients had severe appendicitis (51.1% - Group 2) and this was followed by patients with simple appendicitis (46.7% - Group 1). The incidence of negative appendicectomy was very small in this series (2.2% - Group 3). Patients belonging to Group 3 were excluded from some of the analyses as there were no post-operative

complications amongst them.

**Figure 1**

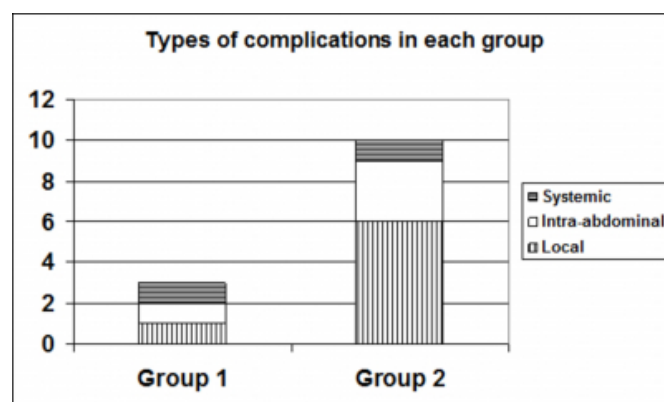
Table 1: Breakdown of patients into groups according to the state of the appendix and overall complication rate

Group	State of the appendix at operation	Numbers (%)	Complication rates (%)
1	Catarrhal / Inflamed	63 (46.7%)	3 (2.2%)
2	Gangrenous / Necrotic / Purulent / Perforated / Abscess	69 (51.1%)	10 (7.4%)
3	Normal	03 (2.2%)	0
		135 (100%)	13 (9.6%)

The overall complication rate was 9.6% (13/135 patients) and the rates according to the various groups are listed in Table 1. The majority of complications were in Group 2 (7.4%) and the remaining ones occurred in Group 1. The breakdown of the complications according to whether they were local, intra-abdominal or systemic is shown in Figure 1. The majority of them were wound-related complications (7/13 patients - 53.9%) with 4 patients having intra-abdominal complications (30.7%) and 2 with systemic complications (15.4%). The wound-related complications were mainly minor cellulitis or infection. Intra-abdominal complications were prolonged post-operative ileus in 3 patients and a pelvic abscess in the fourth patient. Systemic complications included severe sepsis and chest infection in one patient each.

**Figure 2**

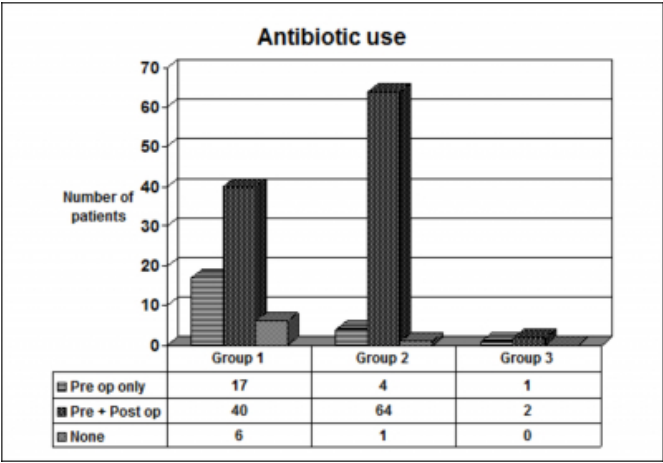
Figure 1: Breakdown of complications in each group. Group 1 - Inflamed appendix, Group 2 - Gangrenous, perforated appendix



Antibiotics were used in 95% of the patients (128/135). The use of antibiotics amongst the different groups is shown in Figure 2; 82.8% of the patients received both pre- and post-operative antibiotics (106/128) and 22 patients (17.2%) received antibiotics in the pre-operative period only.

**Figure 3**

Figure 2: Use of antibiotics amongst the various groups

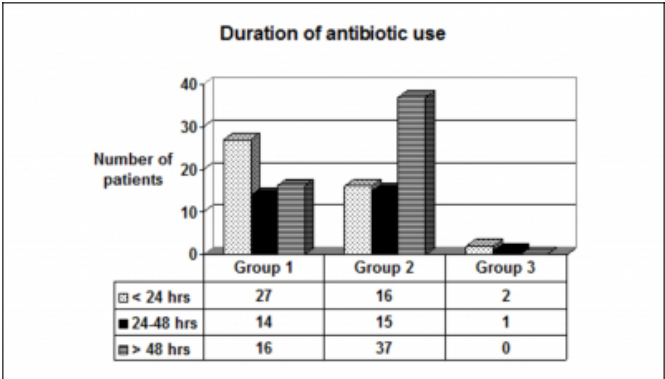


The duration of antibiotic use in different groups is shown in Figure 3a. Overall, the majority of patients received antibiotics for more than 48 hours (41.4% - 53/128 patients); furthermore, for 35.2% (45/128) and 23.4% (30/128) of patients antibiotics were prescribed for <24 hours and 24-48 hours, respectively. When the same information was looked for in the individual groups, most Group I patients received antibiotics for less than 24 hours (27/57 patients - 47.4%), with 24.5% (14/57 patients) and 28.1% (16/57 patients) receiving antibiotics for 24-48 hours and >48 hours, respectively. The usage in the more severe group was as follows: <24 hours - 23.4% (16/68 patients); 24-48 hours - 22.1% (15/68 patients) and >48 hours - 54.4% (37/68 patients).

The number of complications in the groups depending upon the duration of the antibiotics is shown in Figure 3. Overall, the highest complications were noted in patients who had antibiotics for more than 48 hours (9/13 - 69.2%); with the rest of complications occurring in those who had antibiotics for 24-48 hours (3/13- 23%) and for <24 hours 1/13- 7.8%).

**Figure 4**

Figure 3: Duration of antibiotic use in the different groups

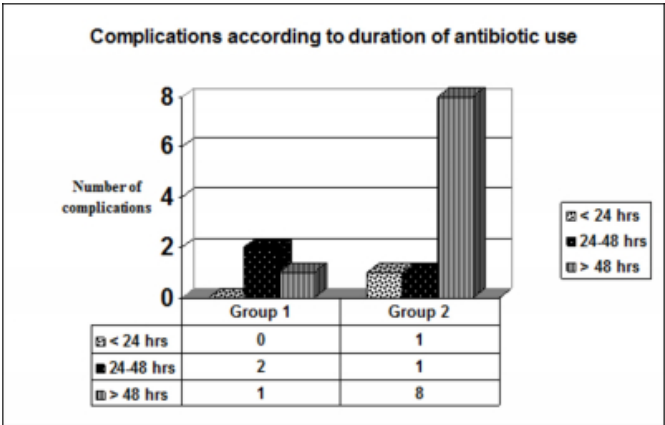


The complication rate for patients receiving antibiotics for less than 24 hours was zero in group 1 and 6.3% (1/16 patients) in group 2. The complication rates for groups 1 and 2 in patients who received antibiotics for 24-48 hours were 14.3% (2/14 patients) and 6.7% (1/15 patients), respectively. Similarly, the complication rates for patients who received antibiotics for a duration of longer than 48 hours were 6.2% (1/16 patients) and 21.7% (8/37 patients), respectively (Figure 4).

All the 7 patients who developed wound infections had antibiotics continued for >48 hours with 5 of these patients receiving them up to or longer than 5 days.

**Figure 5**

Figure 4: Number of complications in relation to the duration of antibiotic use



**DISCUSSION**

Appendicitis presents itself in various forms ranging from minor inflammation to the severest forms like a gangrenous state with or without perforation. Due to the known differences in the pattern of their post-operative behaviour and based on the pathological state of the appendix <sup>6</sup>,

patients were categorised into different groups so that we could separate the “mild” from the “severe” forms of appendicitis.

One would expect that the post-operative complications would be higher in patients with the severe form of appendicitis and this aspect is confirmed in our study with most complications (7.4%) occurring in this group compared to the milder forms (2.2%). The overall complication rate of 9.6% is comparable to other series<sup>2,6-8</sup>.

Antibiotics are recommended for reducing the incidence of wound infections post-operatively<sup>3</sup>. The optimum duration of antibiotic prescription is currently a topic under review. The Cochrane review<sup>4</sup> of antibiotic prescription in appendectomy has suggested that single doses may be as effective in reduction of post-operative complications as multiple doses. A randomised controlled trial by Mui et al.<sup>7</sup> looked at the impact of the duration of antibiotics on the incidence of complications in patients undergoing open appendectomy for non-perforated appendicitis. They failed to demonstrate any significant difference between a single dose, 3-doses and a 5-day course of antibiotics. Interestingly, they noted a higher antibiotic-related complication rate in the group who had the 5-day course of antibiotics.

In this study, 41.4% of the patients received antibiotics for more than 48 hours and 56.2% received them both in the pre- and postoperative period. These were group 2 patients and antibiotics were continued with the assumption that the longer course would be beneficial in reducing the risk of infective complications. Fortunately, none of our patients developed any antibiotic-related complications, but this is to be carefully thought of as there is an increased incidence of potentially life-threatening complications like clostridium-difficile-associated diarrhoea (pseudomembranous colitis) in patients with prolonged course of antibiotics<sup>9</sup> and no antibiotic is immune.

This study demonstrated no change in complication rates depending on the duration of antibiotics, as 69.2% of the complications were noted in patients receiving antibiotics for more than 48 hours and in the subgroup analysis the highest complications were in the group with severe appendicitis with prolonged course of antibiotics. It was also shown that all the patients who developed wound-related infective complications had antibiotics continued for >48 hours with 5 of these patients receiving antibiotics for up to or more than 5 days. Prescribing antibiotics for longer duration does not

seem to give additional protection, which was corroborated by other studies<sup>10-11</sup>. These findings raise the question: Are there other variables which are more important than the type and duration of antibiotics? This may include the clinical condition of the patient at presentation including age, co-morbidities, technical aspects of the operations like use of peritoneal wash-out<sup>12-13</sup>, open versus laparoscopic procedure surgical technique<sup>1,2</sup>, duration of symptoms and delay in surgery after diagnosis. Unfortunately, as this has been a retrospective study, all these issues could not be addressed, but the findings from this study do open up the prospect for a fully randomised trial, taking into consideration all these potential variables.

**Conclusions:** The observations from our study are that the prolongation of antibiotic treatment beyond 48 hours does not necessarily reduce the risk of complications. However, this needs to be proven by a future prospective randomized trial.

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**Author Information**

**P. A. Ward, MB, ChB**

Department of General and Colorectal Surgery, Queen Margaret Hospital

**C. A. Smith, MB, ChB**

Department of General and Colorectal Surgery, Queen Margaret Hospital

**I. A. Shaikh, MRCS, MD**

Specialist Registrar, Department of General and Colorectal Surgery, Queen Margaret Hospital

**S. Yalamarthy, FRCS**

Consultant Surgeon, Department of General and Colorectal Surgery, Queen Margaret Hospital