



## Antibiotic use in open tibial fractures of children - An audit

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### ABSTRACT

Antibiotic therapy is a recognised standard of care in open fractures. The purpose of this study was to look into the consistency of pattern of antibiotic prescribing practice in the management of open fractures. Eighty children presenting with open tibial fractures between 1989 and 2009 were taken into this retrospective audit. The relevant information was collected from the case records. Patients were grouped into two groups, those who were treated before and those after the guidelines. Seventy-eight patients with complete records were included in this audit. 37 patients had Gustilo and Anderson Grade I, 24 had grade II and 17 had Grade III open fractures. First dose intravenous antibiotic was given in A&E department in 55 patients. Sixty four patients had cephalosporins and 24 patients had penicillins. In 7 patients additional metronidazole was given. Only intravenous therapy was given in 29 patients and intravenous therapy followed by oral antibiotics in 49 patients. Average duration of intravenous therapy for patients treated before 1997, was 2.9 days. Whereas those treated after 1997, had average intravenous therapy for 2.8 days.

There is lack of consistency in use of prophylactic antibiotics in open fractures. This audit has prompted us a reevaluation of antibiotic therapy in open fractures to find a consistent regimen

### INTRODUCTION

Open tibial fractures are high-energy injuries and are associated with significant morbidity. Deep infection is one of the most significant complications. Various studies in the past have shown that there has been a great reduction in the incidence of infection with the use of antibiotics in addition to surgical management. At present, antibiotic therapy is a recognised standard of care in open fractures and its role in the prevention of infection has widespread acceptance [1, 4].

The British Orthopaedic Association and British Association of Plastic Surgeons (BOA/BAPS) in 1997 have issued joint guidelines for the management of open tibial fractures. These guidelines recommend a 3-dose regimen of appropriate antibiotic in conjunction with standard wound care and fracture management [1]. Some authors recommended antibiotics for 3 days in type I and II open fractures and for 5 days in type III open fractures. The choice of antibiotics is to be determined by the treating surgeon [2, 3]

The purpose of this study was to look into the consistency of pattern of antibiotic prescribing practice in the management of

open fractures and also to investigate whether the publication of guidelines by joint British Orthopaedic Association and British Association of Plastic Surgeons (1997) has altered the antibiotic prescribing practice.

### MATERIALS AND METHODS

Eighty children presenting with open fractures of tibia treated between 1989 and 2009 were taken into this retrospective audit. The relevant information was collected from the case records. Information collected on each patient consisted of age of the patient, type of injury, severity and type of open fracture, timing of first dose of antibiotic, type and duration of antibiotics, route of antibiotic administration; was also recorded. Patients were grouped into two groups, those who were treated before the guidelines and those who were treated after the guidelines. Average day of antibiotic therapy before and after joint BOA/BAPS guidelines was noted.

The number of infections including both superficial and deep was also noted. The total cost of antibiotics used with present day cost was calculated and compared with the cost for 3 doses for each patient as per guidelines.

**TABLE 1**

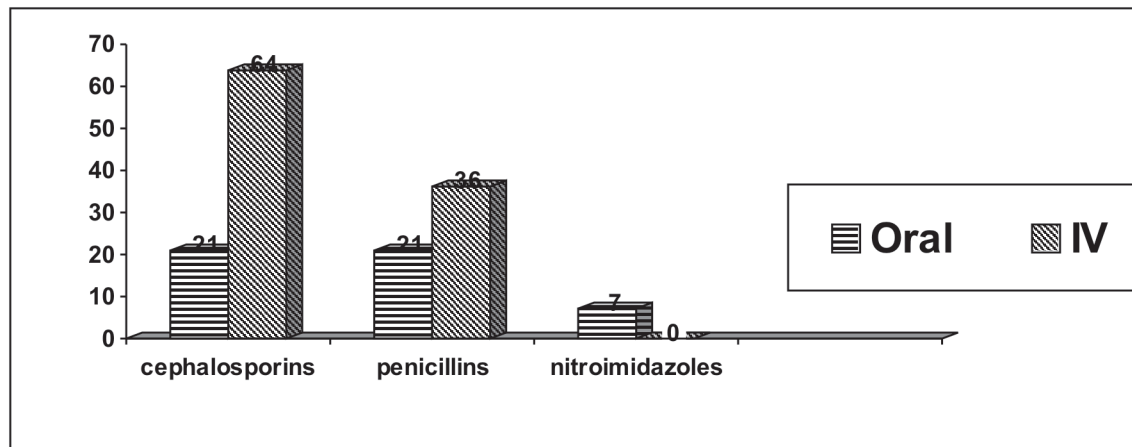
Type of open fracture	Number of patients
• Grade I	37
• Grade II	24
• Grade III A	9
• Grade IIIB	5
• Grade IIIC	3

series was approximately 2,500 pounds compared to the actual cost 620 pounds by using 3 doses of cephalosporins as per joint guidelines.

## DISCUSSION

One of the important goals of treatment of open fractures is prevention of infection. Effective antibiotic therapy is a major factor in the prevention of infection apart from surgical management[1].

Since 1969, studies of open fractures, revealed that at least 70% of open fractures were contaminated with bacteria at the time of injury. The risk of infection at the site of open fracture depends greatly on the severity of soft tissue injury[2,3, 4 ]. The value of antibiotic therapy is now universally accepted and it has



**Figure 1:** Range of antibiotics used and total number of administered doses in the whole group.

## RESULTS

Seventy-eight patients with complete records were included in this audit. Average age of the patient was 7.4 years. 37 patients had Gustilo and Anderson (1976) types I, 24 had type II and 17 had type III (Type A -9, Type B -5 and Type C -3) open fractures. There were no farm yard injuries (Table 1).

First dose intravenous antibiotic was given in A&E department in 55 patients. The average time to first dose of antibiotic administration was 4.9 hours (range 1 to 24 hours). The type of intravenous antibiotic used was mostly cephalosporins and penicillins. 64 patients had cephalosporins and 24 patients had penicillins. Cephalosporins were used intravenously in 64 patients (425 doses). 21 patients were given oral cephalosporins after the initial intravenous therapy. 22 patients were given combination of cephalosporins and penicillins. Additional metronidazole was administered in 7 patients (graph 1).

Only intravenous therapy was given in 29 patients and intravenous therapy followed by oral antibiotics in 49 patients. Average duration of intravenous therapy for patients treated before 1997, was 2.9 days (range 1 dose to 15 days) and oral therapy was 4.2 days (range 1 dose to 22 days). Whereas those treated after 1997, had average intravenous therapy for 2.8 days (range 1 dose to 10 days) and average oral therapy for 4.6 days (range from 1 dose to 21 days). There were 4 cases with superficial infection and none had deep infections. There was no change in the practice of antibiotic prescription after the joint guidelines. The total cost of antibiotics used for the patients in this

been well documented. In a prospective double blind, randomised study by Patzakis et al (1983) the rate of infection was 13.9% in a group of patients who received only placebos compared with 2.3% in a group that was treated with cephalothin[5]. Experimental studies have also demonstrated the efficiency of antibiotics in preventing infection when they are administered just before or shortly after bacterial contamination[4].

Wilkins and Patzakis (1991) recommended 3 days of antibiotic therapy after the initial debridement in type I and II open fractures and for 5 days after debridement in type III open fractures[6]. The type of antibiotic is to be determined by the surgeon[5,6,7.] Olson (1997) suggested the use of cefazolin 1 gram 8 hourly for gram positive organisms and aminoglycosides for gram negative organisms. Aerobic organisms are to be covered with penicillin [3]

The British Orthopaedic Association and British Association for Plastic Surgeons guidelines (1997) for the management of open tibial fractures suggested the use of three doses of broad spectrum antibiotics for type I, II, IIIA open fractures. Type IIIB open fractures should be covered in addition with penicillin. The surgeon may choose to increase the course of antibiotics for type IIIB fractures. The choice of antibiotic to be used decided by the treating surgeons in consultation with the microbiologists[1].

From this audit it was evident that there was lack of consistency in the use of antibiotics in children's open fractures. However there were no deep infections in this series. There is a problem of antibiotic overuse and cost implications are obvious.

Also there was no change in the practice of antibiotic therapy in terms of type and duration, after the joint BOA/BAPS guidelines. The publication of joint BOA/ BAPS guidelines has not altered the antibiotic prescribing practice.

### CONCLUSION

From this study it was evident that there was lack of consistency in the use of antibiotics in children's open fractures. Present practice is most likely based on treating surgeon's training and experience. The evidence base for the BOA/BAPS guideline is unclear.

Whether or not antibiotics should be administered is based on level I evidence. The dosage and antibiotic of choice, however, appear to be based on level IV evidence at best. This audit has prompted us reevaluation of antibiotic use in open fractures in children to find a consistent regimen. A re-audit will show if the change in practice has had any effect.

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