OCCURRENCE OF SURGICAL SITE INFECTION AND ADHERENCE TO CHEMOPROPHYLAXIS PROTOCOL IN ORTHOPAEDICS AT UNIVERITY TEACHING HOSPITAL OF KIGALI, RWANDA

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ABSTRACT

Background: Surgical Site Infections (SSIs) are among preventable but devastating complications in trauma and orthopaedic surgery. This study was conducted to determine the prevalence of SSIs and assess adherence to antibiotic prophylaxis protocol in the Trauma and Orthopaedic Unit at the University Teaching Hospital of Kigali (CHUK).
Objective: To assess how the orthopaedic practice at University Teaching Hospital of Kigali (CHUK) adheres to the standard protocols of antibiotic prophylaxis and to what extent the orthopaedic SSI occurs at CHUK.
Design: This was a retrospective study.
Methods: Patients who underwent any major trauma or orthopaedic procedure from 1st October 2015 to 31st December 2015 were included. The patient's clinical records were reviewed to analyze the perioperative antibiotic use and track infectious complications within 90 days post-surgery. Percentages, means and ranges were used to describe the general characteristics and the outcome of interest.
Results: One hundred and thirty two patients with the mean age of 34.9 years were included in the study. Males accounted for 62.8% with a male to female ratio of 1.8/1. Emergencies and elective cases were accounting respectively for 90.1% and 9.8%. SSIs occurred in eight patients accounting for 6.06%. Ceftriaxone was predominantly used at 60.6% of all cases. The recommended chemoprophylaxis administration interval of 60 to 30 minutes prior to skin incision was respected in only 31.7% of cases. A single dose of chemoprophylaxis was given in 89.4% of cases.
Conclusion: The study noted significant deviations from internationally accepted standards of SSI chemoprophylaxis. Therefore, CHUK would be recommended to develop and implement evidence-based protocols for antibiotic prophylaxis in trauma and orthopaedics, to minimize SSI and ensure antibiotic stewardship.

Key words: Surgical site infection, Chemoprophylaxis, Prophylactic measures, Perioperative, Standard protocol

INTRODUCTION

The Surgical Site Infection (SSI) is an infection that occurs after surgery in the part of the body where surgery took place, within 30 days post-operation if no implanted material is used, and within 90 days in case implanted material is left in place (1). It can affect skin, subcutaneous tissues, organ and implanted materials. It is well known that effective prevention of the SSI requires a multifactorial approach including the use of antiseptic solutions to the skin, sterile gloves and drapes, use of antibiotic prophylaxis (2).

The SSI constitutes a significant global healthy concern. It accounts for the third most common cause of nosocomial infection and represents 31% of all hospital acquired infections (1). Even though the SSI seems to be less frequent in orthopaedic practice where it is reported to be as low as 1 to 5% (3), It becomes very devastating and difficult to treat when it occurs, and 70% of orthopaedic SSIs occur after discharge (4). The orthopaedic SSI's ability to prolong the hospital stay and to cause devastating infections impacts the economy negatively.

The orthopaedic SSIs are largely under reported especially in Low and Middle Income Countries (LMICs), and this scarcity of information prevents to have a real picture of the magnitude of the orthopaedic SSI problem. In a study done at

Muhimbili National Hospital in Tanzania, inpatients who underwent total hip arthroplasty, the incidence of SSI was estimated to be 1.5% (5). In Rwanda, the only study that documented SSIs was done at the University Teaching Hospital of Kigali (CHUK) and reported a prevalence of infection of 25.9% among patients who were admitted with open fractures (6).

Strategies for SSI prevention have been elaborated, and some of them have proven to be efficient when effectively used. The use of chemoprophylaxis, preoperative skin antiseptic use, MRSA screening and prophylaxis, are some of those strategies. However, despite the availability of robust clinical chemoprophylaxis guidelines (7) poor adherence to those guidelines have been consistently reported in many settings, and irrespective of the large amount of hospital consumed antibiotics used preoperatively for SSI prophylaxis (8), SSI remains a great contributor to the nosocomial infection burden (9).

This study was conducted to assess how the orthopaedic practice at CHUK adheres to the standard protocols of antibiotic prophylaxis, to what extent the orthopaedic SSI occurs at CHUK and to determine relationship if any, between the current practices about antibiotic prophylaxis and SSI occurrence in the orthopaedic patients. To our knowledge, there is no study conducted in Rwanda that described adherence to international guidelines on chemoprophylaxis for SSI prevention, and there are no specific clinical practice guidelines developed for this purpose.

MATERIALS AND METHODS

The study was carried out in the Orthopaedic Unit at the University Teaching Hospital of Kigali also known as Centre Hospitalier Universitaire de Kigali (CHUK), located in Kigali City, Nyarugenge District. CHUK is one of the national referral hospitals and it is also a teaching hospital. The hospital is essentially an acute hospital and receives mostly trauma and other acute surgical conditions. The research proposal was approved by the CHUK's Institutional Review Board prior to data collection. The study was a retrospective review and analysis of patient records for the period from October 1st, 2015 to December 31st, 2015.

Inclusion criteria

All patients who underwent any orthopaedic open surgery under general or loco-regional anaesthesia within the study period were considered for the study. Their records were reviewed to study perioperative antibiotic prophylaxis use, and follow up records of up to 90 days were consulted to track infectious complications.

Exclusion criteria

(i) Patients whose indication for surgery was an established orthopaedic infection.
(ii) Patients with open fractures.
(iii) Patients who didn't receive chemoprophylaxis.
(iv) Patients planned for reoperation due to established or suspected surgical site infection.

Data collection: Data were collected by the principal investigator, by looking into complete files of patients operated in orthopaedic surgery at CHUK within the period of October 1st, 2015 to December 31st, 2015. Variables studied were: age, sex, indication of surgery, operation done, antibiotic given (type, dose, dose intervals, timing, duration, route of administration), preoperative vital signs (Toc, HR, BP, RR, Sao2), SSI signs (pain or tenderness, local swelling, redness, hotness, purulent discharge at the incision site and fever) in addition, transfusion (in case it was done). OPD follow up records were also reviewed to track infectious complications.

Data analysis and results interpretation: Obtained data were analyzed using SPSS version 16.0 and Microsoft Excel; results were presented using tables.

Ethical consideration: The research proposal was approved by the KUTH's research and ethics committee before proceeding to data collection and further parts of the research project.

RESULTS

A total of 264 patient's files were reviewed, 132 patient's records who didn't meet the inclusion criteria were excluded, and 132 patient's records were retained to the study. Tables 1 to 3 represent the demographic and clinical characteristics of the patients, where the majority were male at 62.8% and the mean age of the study population was

Table 1
Patients demographics

Gender	Male	83 (62.8%)	
	Female	49 (37.1%)	
Age	Minimum	3	34.9 was the mean age
	Maximum	87	

Table 2
Indications of surgery and their frequencies

Indication of surgery	Frequency	(%)
Emergency cases*	119	90.1
Elective cases*	13	9.8

*Open fractures excluded

Table 3
Location of fractures and other conditions and their frequencies

Location of fractures or other conditions		Frequency	(%)
Lower limb	Hip bone fracture	2	1.5
	Femur fracture	53	40.2
	Patella fracture	2	1.5
	Tibia and fibular fracture	11	8.3
	Neglected hip dislocation	4	3
	Femur nonunion	1	0.8
Total		73	55.3
Upper limb	Clavicle fracture	1	0.8
	Humerus fracture	36	27.3
	Radius and ulnar fracture	14	10.6
	Neglected elbow dislocation	6	4.5
	Humerus nonunion	1	0.8
	Radius nonunion	1	0.8
Total		59	44.7
Overall number*		132	

34.9 years, at 55.3% the injury was located on the lower limb among all cases.

Among the 132 patients, eight patients were identified with clinical evidence of SSIs, therefore the prevalence of SSI was 6.06%. The evidences of SSIs were considered according to the standard definition of SSIs, the findings are summarized in Table 4.

Table 4
Prevalence of SSIs in orthopaedic surgery at CHUK

Evidence* of SSIs	No. of patients	Prevalence (%)
Yes	8	6.06
No	124	93.9

* Evidences of SSIs are pain or tenderness, local swelling, redness, hotness, purulent discharge at the incision site and fever

Table 5 represents the antibiotics given perioperatively and their frequencies of use whereby ceftriaxone at 60.6% was the frequently used antibiotics followed by cloxacillin at 22.7%.

Table 5

Types of perioperative chemoprophylaxis used at CHUK in orthopaedics

Type of antibiotics	Frequency	(%)
Ceftriaxone	80	60.6
Cloxacillin	30	22.7
Cefotaxime	15	11.4
Chloramphenicol	7	5.3

The minimum time prior to skin incision was 6 minutes, whereas the maximum time was 60 minutes, the mean time was 30.51 minutes. Table 6 shows that at 68.3% antibiotics were administered in 30 minutes prior to skin incision.

Table 6

Timing of chemoprophylaxis administration in range of minutes

Time in range (minutes)	Frequency in percentage
0-30	68.3
31-60	31.7

In orthopaedic surgery at CHUK, as shown in Table 7 the duration of perioperative antibiotics use varied from single dose to 11 days depending on the type of antibiotics used and the indication of surgery. Table 7a shows that at 94% of the study population the antibiotic use was chemoprophylaxis while Table 7b show the number of patients whom their perioperative use of antibiotics was therapeutic and they presented evidence of SSIs which were 8 in total.

Table 7a

Duration of chemoprophylaxis administration

Duration	Frequency	(%)*
Single dose	118	89.4
1 day	5	3.8
2 days	1	0.8
Total	124	93.9

Table 7b

Duration of perioperative antibiotic therapy

Duration (Days)	No.	(%)
3	1	0.8
4	2	1.5
5	2	1.5
6	1	0.8
9	1	0.8
11	1	0.8
Total	8	6.06
Overall number	132	100

*Percentages were calculated referring to the study population (132 patients)

The dose of chemoprophylaxis administered was dependent on type of antibiotics given, by the fact that their therapeutic doses are different. The frequently used doses were 2 grams and 1 gram of ceftriaxone respectively at 39.4% and 17.4%. In paediatric population ceftriaxone and cefotaxime were given as 1 gram while chlorampenicol was used as 0.25 gram.

DISCUSSION

The overall prevalence of SSIs was 6.0% in our study, and this is closer to the findings of AlBuhairan *et al* (3) reporting it to range between 1-5%. However there are other studies that had different findings where the rate of SSIs was found to be as high as 12 to 12.4% respectively (10,11), this difference may be attributed to the differences in the study population and characteristics.

Moreover there was a study conducted previously at CHUK on open fractures where the occurrence of SSIs was 25.9%, (6) where not all the participants have undergone surgery, and even those ones operated on most of them were operated more than 24 hours from the time of injury.

Regarding antibiotics used in the current study, the mostly recommended prophylactic antibiotic, a first generation cephalosporin (cefazolin), was not used at all. Instead, a third generation cephalosporin (ceftriaxone) was used in 60.6% of cases followed by cloxacillin at 22.7%. Cloxacillin was found to have been used mostly in one particular period probably due to the stock out. However it is recommended by ASHP (American Society of Health-system Pharmacy) report (graded as level 1 of evidence) that cefazolin is the first line to be used as chemoprophylaxis, while clindamycin and vancomycin are considered as valid alternative options (7).

In this study, the minimum time of chemoprophylaxis administration prior to skin incision was 6 minutes, whereas the maximum was 60 minutes, the mean time was 30.51 minutes. The orthopaedics practice at CHUK was partial compliant with the standard protocol recommending administration of preoperative chemoprophylaxis in the interval from the 60th up to the 30th minute prior to skin incision (7), in our study at 68.3% antibiotics were given in 30 minutes prior to incision and at 31.7% the antibiotics were given in the interval from the 60th minute to 30th minute.

In the present study, 118 patients were given single dose of antibiotics which is equivalent to 89.4% of the cases. This predominance use of single dose is attributed to the fact that ceftriaxone was the mostly used antibiotics, and its half-life is longer than 5 hours and not many orthopaedic operations done at CHUK last longer than the half-life of ceftriaxone, therefore the orthopaedics practice at CHUK is obeying to the standard protocol at 93.2% (single and 1 day of use), the standard protocol recommend to use chemoprophylaxis not longer than 24 hours irrespective of the used antibiotics (7). In this study, the mostly used doses were 2 grams and 1 gram of ceftriaxone respectively at 39.4% and 17.4%, therefore it is clear that the orthopaedics practice at CHUK didn't obey to the standard guideline recommending to use cefazolin 2 grams for patients <120 kg; 3 grams for patient ≥120 kg (30 mg/kg for paediatrics) and the re-dosing interval to be 4 hours in case the operation is not yet finished (7).

CONCLUSION

The current study reported the rate of SSI in orthopaedic unit at CHUK to be 6.06% and we noted poor adherence to the standard protocol in terms of choice of chemoprophylaxis and partial compliance in timing of antibiotic administration.

RECOMMENDATIONS

(i) The hospital management should ensure availability and use of recommended antibiotics for prophylaxis.
(ii) The orthopaedic unit at CHUK should develop and adhere to clinical practice guidelines focusing on the antibiotic chemoprophylaxis to prevent SSIs and clearly indicating;
- The choices of antibiotics
- The dosage of antibiotics
- The timing for administration and cessation of selected antibiotics.

Conflict of interest statement: Authors declare no conflict of interest in regard to this study.

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