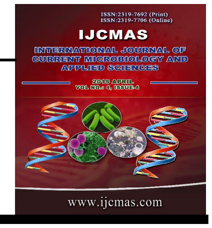

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Original Research Article

Comparative study on the sensitivity pattern between the Cephalosporins and Fluoroquinolones on wound infection isolates

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A B S T R A C T

Human skin acts as an excellent barrier to infections provided it is not breached. A wound is a type of injury in which the skin is torn, cut or punctured (open wound) or where blunt force trauma causes a contusion (closed wound).it is further classified as accidental, pathological or post -operative according to its nature. The cephalosporins and Fluoroquinolones have been the most commonly prescribed antibiotics for the treatment of resulting wound infections based on sensitivity result. Hence this study is to comparatively evaluate the sensitivity pattern of the cephalosporins and Fluoroquinolones on wound infection isolates. A total of 50 samples were collected from various wound sites and inoculated on blood agar, McConkey agar and chocolate agar using streaking method of inoculation. Out of a total of 50 samples collected 45(90%) showed positive growth while 5(10%) showed no significant growth. 5 different bacteria species were isolated, characterized and identified following some standard microbiological technique. The most frequent isolate was *Staphylococcus aureus* (52.2%) followed by *E. coli* (26.1%),*Pseudomonas aeruginosa* (10.6%), *Proteus spp (*10.5%), and *Klebsiella spp* (5.3%). In the antibiotic sensitivity testing the Fluoroquinolones showed more sensitivity in comparison to the cephalosporins (85.5%) with the ciprofloxacin (65.2%) and levofloxacin (42.3%) been the most effective antibiotic. the Fluoroquinolones have a better and broader spectrum of activity than the cephalosporins which explains why they are more effective in the treatment of wound infection.

Keywords

Cephalosporins, Fluoro quinolones, sensitivity pattern, and wound infection

Introduction

A wound is a breach in the skin and the exposure of subcutaneous tissue following loss of the skin integrity which provides a moist, warm and nutritive environment that is conductive to microbial colonization and proliferation (Shittu, *et. al.*, 2002. Nittin, *et. al.*, 2013). If the integrity and protective function of the skin is breached, large quantities of different cell types will enter the wound and initiate an inflammatory response. The current spread of multi-drug resistant bacteria pathogens has added a new dimension to the problem of wound infections (Sule and Olusanya, 2000). This is particularly worse in resource poor countries where sale of antibiotics is under poor control (Onile, 1997). A regular bacteriological review of infected wounds is therefore a necessity if affected patients must receive qualitative health care, particularly when blind treatment is a necessity, as in underdeveloped and developing nations (Fadeyi *et al.*, 2008). The cephalosporins and Fluoroquinolones have been the most commonly prescribed antibiotics for the treatment of resulting wound infections based on culture and sensitivity results (Sule and Olusanya, 2000).

Wounds are populated by microorganisms from two sources: exogenous (post-injury) and endogenous (normal flora of skin and mucous membranes) ((Bhatt and Lakhey, 2007).

Most wounds have polymicrobial population of aerobic and anaerobic bacteria, many with predictable primary pathogen e.g. of primary pathogens includes *staphylococcus aureus*, *Staphylococcus pyogenes* and *Pseudomonas aeruginosa* while primary anaerobic pathogens includes anaerobic cocci, bacteriodes, provotella, poriphyromonas, clostridium and environmental pathogens; here the source of wound will define the microbial population e.g. chronic wounds can be colonized by hospital flora e.g. MRSA (Methicillin resistant *Staphylococcus aureus*) e.t.c. (Cheesebrough, 2006)

It is now generally accepted that systemic antibiotics are essential for the management of clinically infected wounds, the choice of antibiotics to be used is not always apparent only after a comprehensive assessment process including considerations of patients characteristics, the results of microbiological investigations and the identification of both the nature and location of wound, can the most appropriate antibiotic be identified.

There are various types of antibiotics but in correlation to this work more emphasis will be layed on the sensitivity pattern between the Cephalosporin and Fluoroquinolones as a result of their extensive use in the treatment of wound infection.

Hence these work is to comparatively evaluate the sensitivity pattern between the cephalosporins and Fluoroquinolones on wound infection isolates.

Materials and Methods

Sample collection

Wound swabs/pus samples were collected with sterile disposable cotton swabs(Cheesebrough, 2006), from patients with suspected wound infection ranging from road traffic accidents, surgical incision site, and post -operative wounds .Moreso, relevant datas such as age, sex, aetiology of wound were obtained from patients. A total of 50 samples were collected out of which 27 were male and 23 were female patients falling between the age ranges of 14 – 42years.

Bacterial isolation

The samples were inoculated on the agar plates(blood, chocolate, and mcConkey agar) with the aid of a sterile wire loop by streak plate method and it was incubated at 37 °C for 24hours

The growth of microorganisms in the culture plates were examined for the various characteristics which includes shape, size, elevation, surface, edges,colony structure degree of growth and nature.

Identification and characterization of bacteria isolates

Bacteria isolates were characterized and identified using two step approach namely biochemical test and gram staining (Cheesebrough,2006). The characteristic features of the colonies observed were noted. The biochemical test carried out includes the following; catalase test, coagulase test, oxidase test and indole test.

Antibiotic sensitivity test

This is simply the susceptibility of bacteria isolates to antibiotics. It is carried out to determine which antibiotic will be most successful in treating a bacterial infection in vivo. Antibiotic sensitivity testing is often done by modified Kirby Bauer's disc diffusion method on MullerHinton agar. Small wafer containing antibiotics are impregnated onto the MullerHinton agar upon which the bacteria isolate was inoculated. If the bacteria are sensitive to the antibiotic, a clear ring or zone of inhibition is seen around the disc indicating poor growth (Cheesebrough, 2006). Presence of zone of inhibition is not automatically interpreted as susceptibility to the antibiotics; the zone width has to be measured and compared against a reference standard which contains measurement ranges and their equivalent categories of susceptible or resistant.

Method of data analysis

Data collected were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) Version 20 for frequencies and percentages to determine the abundance of bacteria species. Analysis of Variance (ANOVA) was used to test similarities and variations among the groups of antibiotics against the different bacteria isolates.

Result and Discussion

Out of 50 samples collected 45samples representing 90% yielded significant growth while 5 samples representing 10% yielded no significant growth. The gender distribution amongst the 45 sample that showed significant growth are as follows male 25(50%) and female 20(40%) as represented in Table 1.

The percentage distribution of isolates from different wound sites showed that surgical wound site 20(44.5%) were the most commonly infected. This was followed by post- operative wound 15(33.3%) and the least infected site was wound sepsis (road traffic accident) 10(22.2%) and this is depicted in Table 2.

Distribution of bacteria pathogen from surgical wound site showed that *E. coli* is the most prevalent organism accounting for 35% of the isolates, followed by *Staphylococcus aureus* 30%and the least prevalent was *Proteus spp* 5%. *Staphylococcus aureus* constituted the most common organism accounting for 46.7% from post-operative wound followed by *E.coli*33.3%,and the least prevalent were *Pseudomonas aeruginosa* 6.7%, *Proteus spp* 6.7% and *klebsiella spp* 6.7%.*Staphylococcus aureus* 80%is the most common isolate from wound sepsis site. Generally *Staphylococcus aureus* 52.2% was the most prevalent isolates from all wound sites followed by *E. coli* 26.1% and the least prevalent was *Proteus* spp 5.9% all of these are represented in Table 3.

Figure 1, 2 and 3 shows the inhibition zone diameter of the antibiotics against the bacteria isolates.As observed from the histogram, among the Fluoroquinolones *E. coli* from surgical wound site (20.17mm), post- operative site (19.93mm) and wound sepsis site (19.93mm) were the most susceptible organism while *Proteus spp* from surgical wound site (15.57mm), post-operative site (16.67mm) and wound sepsis site (15.67mm) were the least susceptible. Among the cephalosporins *Proteus spp* from surgical wound site (11.57mm), post-operative wound site (12.37mm), and wound sepsis site (11.60mm) were the least susceptible. In general the Fluoroquinolones shows more activity against the isolates.

In this work a total of 50 samples from various wound sites were included out of which male patients were 25(50%) and female patients were 20(40%). The most common isolate was *Staphylococcus aureus*(52.2%), *E. coli* (26.1%), *Pseudomonas aeruginosa* (10.6%) and the least isolates was *Proteus spp* which was (5.9%). A similar study conducted in Tribhuvan university teaching hospital by Singh *et al*, (2006) reported that 82.50% showed bacterial growth and 10 different bacterial species were isolated including predominantly *Staphylococcus aureus* 57.70% followed by *E. coli*. No significant growth from some of the samples in these study may be due to delay in transportation of samples to laboratory from site of collection.

Another reason is the collection of samples from patients taking antibiotics. Another similar study was also conducted by Kansakar *et al*, (2003) on bacteriology of wound infection and the antibiotic sensitivity pattern of the isolates reported that 60% of the samples collected were found to be positive growth and 17 different bacteria species was isolated. Most common isolate was *Staphylococcus aureus* (50%) followed by *E. coli* (11.9%), *Pseudomonas aeruginosa* (8.3%), *Kebsiella species* (8.3%) and *Proteus species* (5%) (Bhatt and Lakhey, 2007).

Antibiotic sensitivity testing of this study showed that the Fluoroquinolones were more sensitive in the treatment of wound infection in comparison to the Cephalosporins. *E. coli* from surgical wound site (20.17mm), post- operative site (19.93mm) and wound sepsis site (19.93mm) were the most susceptible organism when tested, *Proteus spp* from surgical wound site (15.57mm), post-operative site (16.67mm) and wound sepsis site (15.67mm) were the least susceptible. These results are reinforced by the study conducted in the United States where 70-80% isolates were susceptible to ciprofloxacin (Karlowsty *et al*, 2003). Basically, the Fluoroquinolones have a better and broader spectrum of activity than the Cephalosporins (Desarro *et al.*, 2001) which explains why they are more effective in the treatment of wound infection.

The most common isolate in wound infection was *Staphylococcus aureus* (52.2%), followed by *E. coli* (26.1%), *Pseudomonas aeruginosa* (10.6%) and the least prevalent isolate were *Proteus spp* and *Klebsiella spp* with the frequencies of (5.9%) and (5%) respectively.

The antibiotic sensitivity testing showed that the ciprofloxacin and levofloxacin (65.2%), (42.3%) respectively was the most effective antibiotic. Indiscriminate use of antibiotic has led to the development of antibiotic strains for commonly used drugs such as Fluoroquinolones and Cephalosporins,it is therefore suggested that a detailed study with proper antibiotic usage, susceptibility testing irrespective of the organism isolated from wound swabs/pus samples is carried out to find out their resistance pattern so that modified antibiotics can be developed to completely tackle wound infection.

Table.1 Gender distribution of significant growth

Gender	Number examined	Number with significant growth	Number without significant growth	Percentage (%) With significant growth
Male	27	25	2	50
Female	23	20	3	40
Total	50	45	5	90

Table.2 Percentage distribution of isolates from different wound sites

Wound sites	No cultured	No. and percentage of samples with isolates
Surgical	22	20 (44.5)
Post-operative	16	15 (33.3)
Wound sepsis	12	10 (22.2)
Total	50	45 (90)

Table.3 Wound sites, number and percentage distribution of bacteria pathogen

	Bacteria isolates No (%)				
Wound site	***Staphylococcus aureus***	***Pseudomonas aeruginosa***	***E. coli***	***Klebsiella Spp.***	***Proteus Spp.***
Surgical	6 (30)	3 (15)	7 (35)	3 (15)	1 (5)
Post-operative	7 (46.7)	1 (6.7)	5 (33.3)	1 (6.7)	1 (6.7)
Wound sepsis	8 (80)	1 (10.0)	1 (10)	-	-

Total	21 (52.2)	5 (10.6)	13 (26.1)	4 (10.9)	2 (5.9)

Fig.1 Inhibition zone diameter (mm) of antibiotics against the bacteria isolates on surgical wound sites

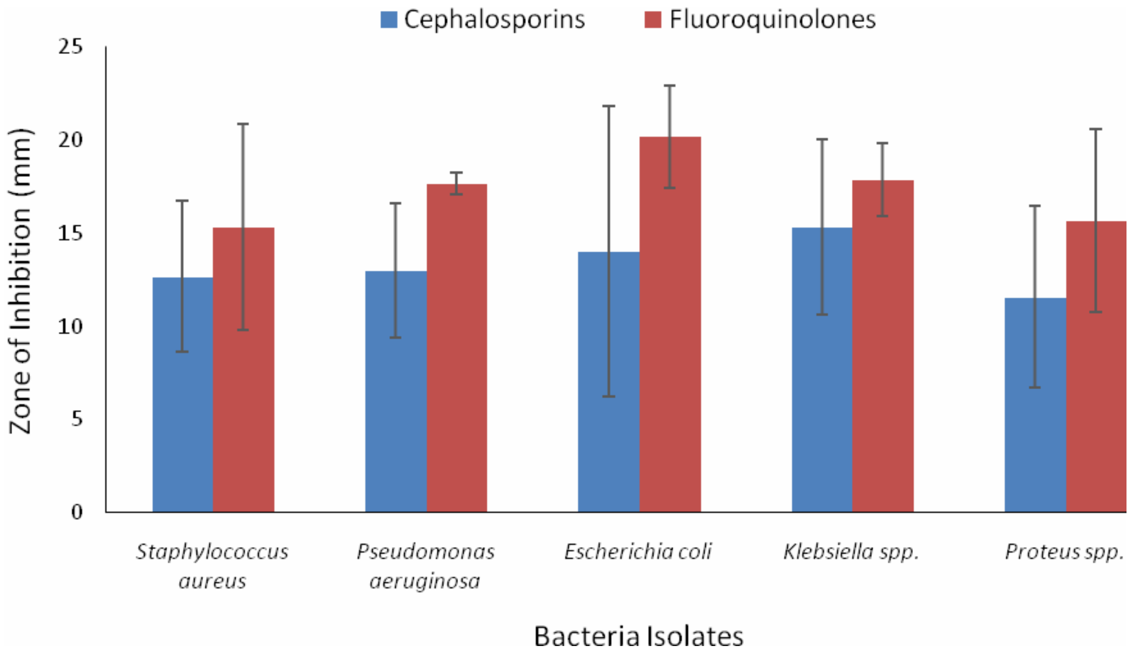


Fig.2 Inhibition zone diameter (mm) of antibiotics against the bacteria isolates on post-operative wound sites

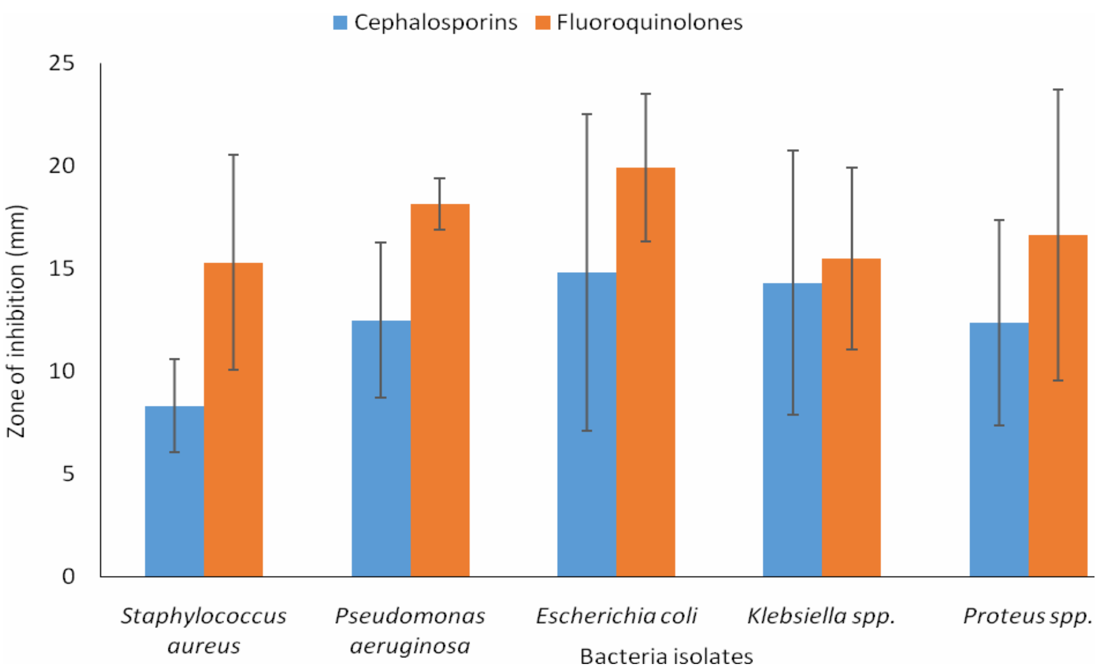
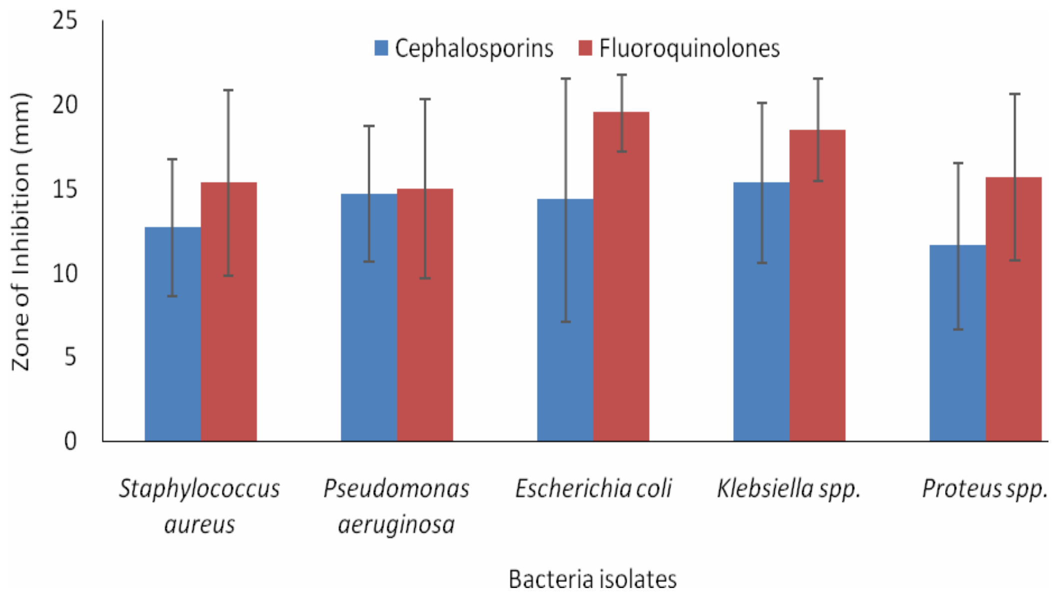


Fig.3 Inhibition zone diameter (mm) of antibiotics against the bacteria isolates on wound sepsis sites



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