

Full Length Research Paper

Retrospective incidence of wound infections and antibiotic sensitivity pattern: A study conducted at the Aminu Kano Teaching Hospital, Kano, Nigeria

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Infection continues to be a major complication of wounds with significant increase in costs, morbidity and potential mortality. Retrospective study of incidences of wound infection and antibiotic sensitivity pattern in patients that visited Aminu Kano Teaching Hospital, Kano, Nigeria, which involved the analysis of the medical records of 651 patients diagnosed from April, 2009 to September, 2010, was carried out. The medical records of the patients with wound infections showed that 77.9% of the wound sites were contaminated with various bacteria isolates, notably *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella* spp. in decreasing order of frequency. The most common infection site was surgical sites with amoxicillin, gentamicin and ceftriaxone, being the most commonly prescribed antibiotics for the treatment of resulting infections based on the culture and sensitivity results. The study shows that there is a high rate of wound infection in Kano, Nigeria.

Key words: Wound infections, retrospective studies, antibiotics.

INTRODUCTION

Human skin acts as an excellent barrier to infection, 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). Wounds can further be classified as accidental, pathological or post-operative according to its nature (Collier, 2003). Certain parasites (for example, Hookworm larvae) and bacteria (*Treponema pallidum*) can penetrate intact skin, but certain primary skin infections like impetigo is caused by *Streptococcus pyogenes* or *S. aureus*, or both gain access through abrasions, as minor trauma to skin is a part of everyday life (Bhatt and Lahkey, 2007).

Infection of a wound is the successful invasion and

proliferation by one or more species of microorganisms anywhere within the body's sterile tissues, sometimes resulting in pus formation (Calvin, 1998). Development of wound infection depends on the interplay of many factors. The breaking of the host protective layer, the skin, and thus disturbing the protective functions of the layer, will induce many cell types into the wound to initiate host response (Collier, 2003). Wound infections may occur following accidental trauma and injections, but post-operative wound infections in hospital are most common. Some infections are endogenous in which infection occurs from patient's own bacterial flora such as *S. aureus* from skin and anterior nares or coliforms. Many infections are exogenous; skin and anterior nares are important sources of *Staphylococci*, spread of organisms from hospital staff and visitors occur by direct and indirect airborne routes.

At present, more than 60% of hospital-acquired infections are due to gram-negative enteric bacilli and only in

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Table 1. Gender and age distributions of patients with wound Infections in Aminu Kano Teaching Hospital.

Gender (April 2009 -September 2010)	No and percentage of samples with bacteria isolates (%)	Age (April 2009 -September 2011)	No and percentage of samples with bacteria isolates (%)
Male (n=387)	308 (79.6)	Adult (n=475)	392 (82.5)
Female (n=264)	199 (75.4)	Child (n=176)	115 (65.3)
Total (n=651)	507 (77.9)	Total (n=651)	507 (77.9)

30% cases are gram-positive cocci responsible (Bhatt and Lahkey, 2007). Organisms commonly found in infected wounds include Gram positive cocci such as *S. aureus*, *Streptococcus* spp, Gram negative bacilli mostly *Acinetobacter*, *Enterobacter*, *E. coli*, *Proteus* spp, *Ps. aeruginosa* and anaerobic bacteria such as *Propionibacterium* spp. and *Klebsiella* spp. (Taiwo et al., 2002).

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).

This study aims at investigating the incidence of wound infection and the antibiotic sensitivity pattern at the Aminu Kano Teaching Hospital, Kano, Nigeria.

MATERIALS AND METHODS

Study area

This study was carried out at Aminu Kano Teaching Hospital, Kano in North West Nigeria. It is the largest Tertiary Health Institution in Kano State. It has a bed capacity of four hundred and twenty two.

Ethical considerations

Written Ethical approval for this study was obtained from the Medical Advisory Committee of the Teaching Hospital.

Data collection and sample size

Method of data collection was by Review of Records. A 17 months retrospective study of patients diagnosed with wound infections was carried out. A total of 651 patients were recorded over this period at the medical records department. Relevant data such as age, sex, aetiology of wound were obtained. Results of culture and sensitivity carried out by the microbiology department using standard biochemical tests were also obtained from the patient's medical records.

Statistical analysis

Medical records data was used for analysis. Data was organized in Microsoft excel and the general descriptive analysis and correlation coefficient was used to analyze occurrence and extent of factors and the statistical relationship using Microsoft excel and statistical package for social science (SPSS) windows 16.0 (Standard Version SPSS Inc., Chicago, IL, USA).

RESULTS

Out of the 651 wound samples received at the General Culture bench of the Microbiology Department of Aminu Kano Teaching Hospital from April, 2009 to September, 2010, 484 representing 74.35% yielded single organism, 23 (3.53%) yielded two organisms while 144 (22.12%) yielded no growth. The gender distribution amongst the 507 samples that showed growth, 308 (79.6%) were males, while 199 females also had almost equal proportion (75.4%) with the males. The age distribution of patients with wound infections in Aminu Kano Teaching Hospital with 392 (82.5%) being adults (from 13 years and above) and 115 (65.3%) being children (5 to 12 years) is shown in Table 1.

The percentage distribution of isolates from the different wound sites showed that the Surgical site wounds which amounted to 199 (39.9 %) of the isolates was found to be the most commonly infected. This was closely followed by wound sepsis 130 (26.1 %). All acute soft tissue infections such as road traffic accidents, lacerations, domestic violence and gunshot injuries were classified under wound sepsis and then burn sites. Infections at diabetic and non-diabetic ulcer sites were least frequent (Figure 1).

Distribution of bacteria pathogens isolated from wound sepsis site presented in Figure 2, showed that *S. aureus* is the most prevalent organism in this site, accounting for almost 60% of the isolates.

It was observed in Figure 3, that *S. aureus* constituted the most common isolate from burn sites with 63.5% frequency, followed by *E. coli* and *Ps. aeruginosa*, with 12.5 and 9.6%, respectively. *Klebsiella* spp., *Pr. mirabilis* and *Streptococcus* spp. were less frequently isolated. As depicted in Figure 4, *S. aureus* was also the most frequently isolated organism from non-diabetic ulcers,

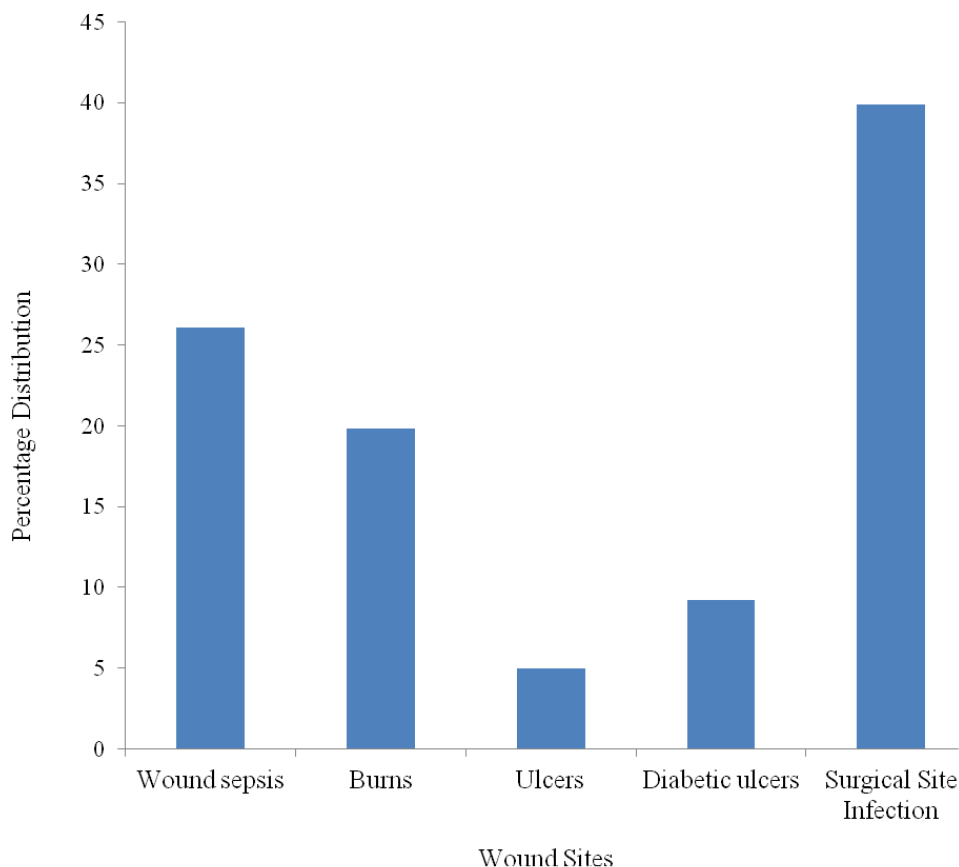


Figure 1. Percentage distribution of isolates from different wound sites of patients attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010.

accounting for 50%, followed distantly by *E. coli* and *Ps. aeruginosa*.

The most frequently isolated organisms from diabetic ulcer sites were *S. aureus* (36.8%), *Pr. mirabilis* (26.3%), *E. coli* (19.3%) and *Ps. aeruginosa* (12.3%).

Less frequently isolated from this site were *Klebsiella* spp and *Streptococcus* spp. (Figure 5). *S. aureus* continued to be the predominant organism from the surgical wound sites, constituting about 40% of the isolates. The Enterobacteriaceae such as *E. coli* and *Pr. mirabilis* were the next most frequent, followed distantly by *Ps. aeruginosa*. Only one isolate of *Streptococcus* spp. was obtained from this site (Figure 6).

Data presented in Table 2 showed that the most commonly used antibiotics in the treatment of wound infections based on the culture and sensitivity results in the hospital were β -lactam antibiotics (Penicillins and Cephalosporins) and the aminoglycosides, followed closely by the quinolones. Tetracyclines and anti-metabolites such as sulphonamides were less prescribed; only used in infections caused by *S. aureus*.

DISCUSSION

Generally, inadequate antimicrobial treatment defined as ineffective treatment of infection is an important factor in emergence of antibiotic resistant bacteria. Factors that contribute to inadequate antimicrobial treatment of hospitalized patients include: the prior use of antibiotic, broad spectrum antibiotics, prolonged hospital stay and the presence of invasive medical devices. The relatively high percentage of wound samples with infection in the retrospective studies indicated that there is high prevalence of wound infection within the study environment. Although, the number of samples from male patients with wound infections were much higher than those from female patients (308 males compared to 199 females), the differences in the proportions with infection in each gender class were much less (79.59% males and 75.38% females). There was negligible correlation ($r = 0.12$) between gender and contracting wound infection. A similar result was also reported in India, the slight difference in the number of males to females with wound

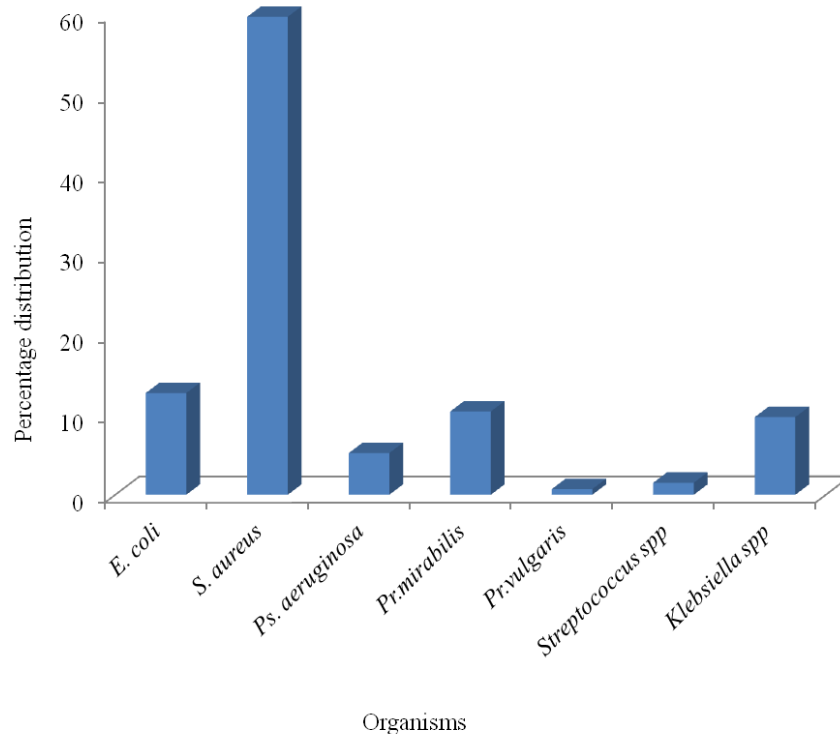


Figure 2. Percentage distribution of bacteria isolates from wound sepsis sites of patients attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010.

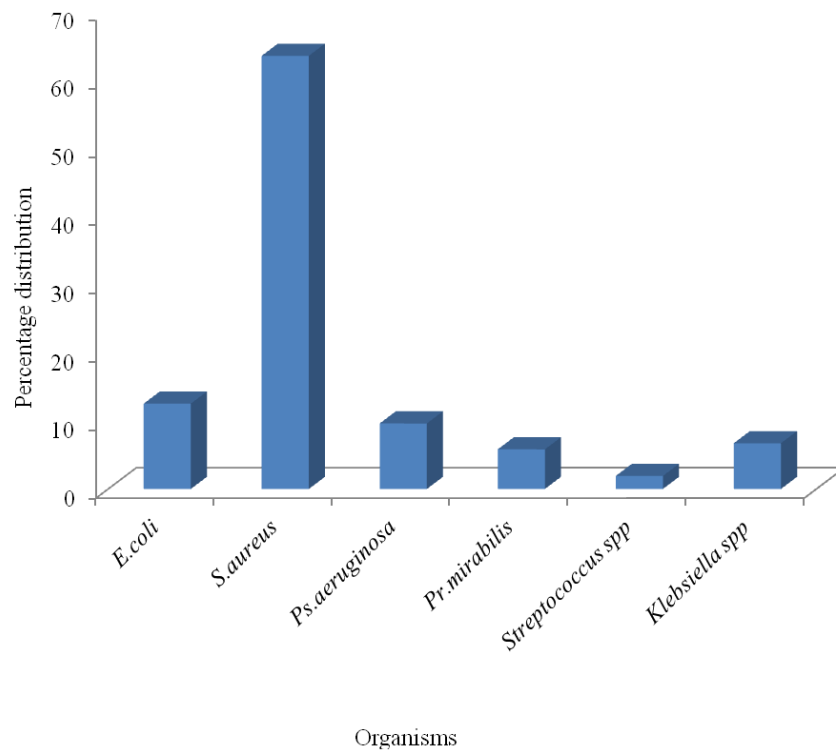


Figure 3. Percentage distribution of bacteria isolates from burn sites of patients attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010.

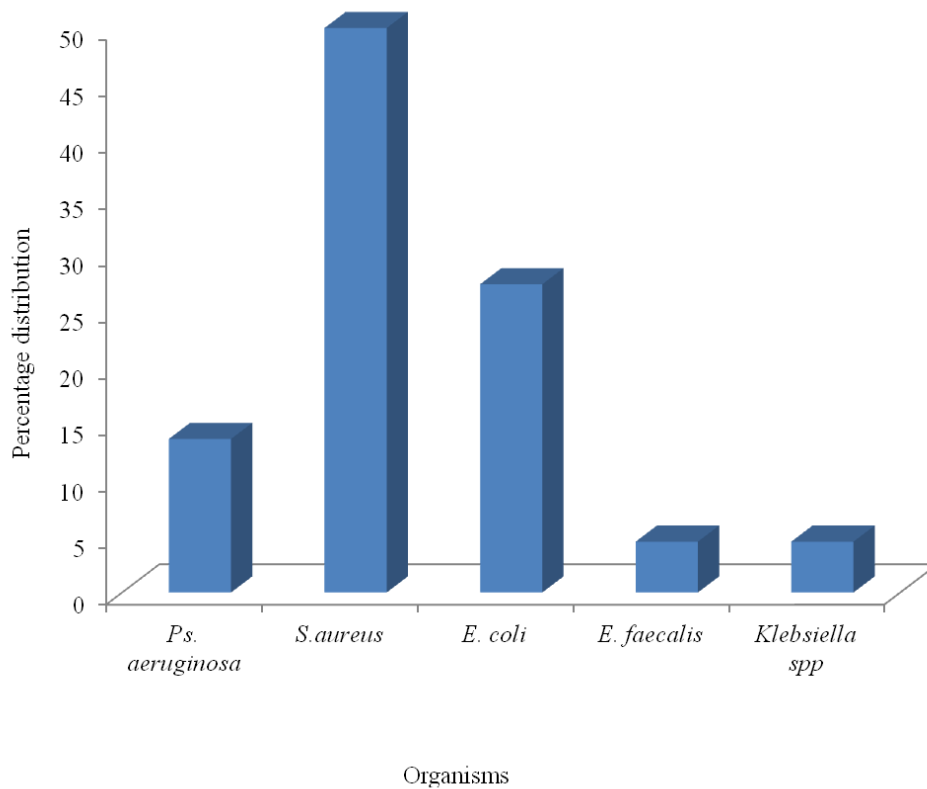


Figure 4. Percentage Distribution of Bacteria Isolates from Ulcer Sites of Patients Attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010

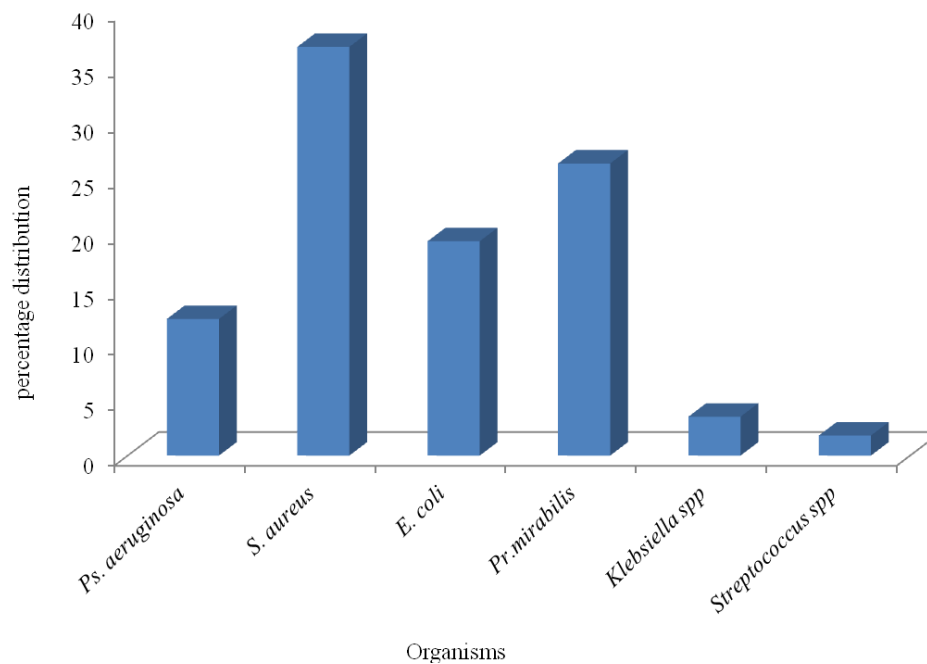


Figure 5. Percentage distribution of bacteria isolates from diabetic ulcer sites of patients attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010.

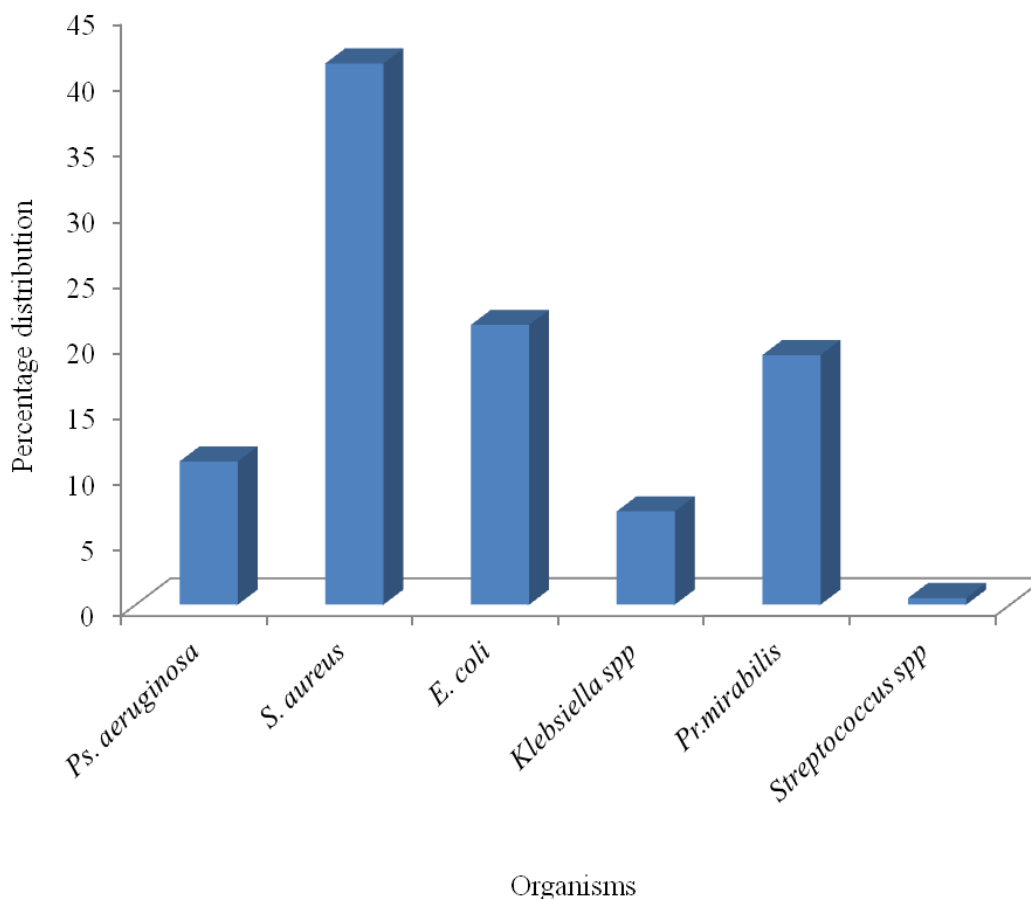


Figure 6. Percentage distribution of Bacteria Isolates from surgical wound sites of patients attending Aminu Kano Teaching Hospital from April, 2009 to September, 2010.

Table 2. Percentage distribution of antibiotic prescription pattern on wound infections in Aminu Kano Teaching Hospital.

Bacteria isolates	Pen	Ceph	Aminog	Quinol	Mac	Tet	Sulph
<i>E. coli</i> (n = 92)	36.9	25.4	21.9	13.7	2.1	0	0
<i>Ps. aeruginosa</i> (n = 49)	16.2	57.3	16.2	10.3	0	0	0
<i>S. aureus</i> (n = 267)	38.2	21.2	20.0	17.2	2.8	0.2	0.4
<i>Pr. mirabilis</i> (n = 7)	30.4	21.5	20.7	24.5	2.9	0	0
<i>Pr. vulgaris</i> (n = 1)	100	0	0	0	0	0	0
<i>E. faecalis</i> (n = 1)	100	0	0	0	0	0	0
<i>Streptococcus spp</i> (n = 6)	36.4	27.1	27.4	9.1	0	0	0
<i>Klebsiella spp</i> (n = 37)	29.1	28.9	23.7	18.3	0	0	0

Pen = penicillins, Ceph = cephalosporins, Aminog = aminoglycosides, Quinol = quinolones, Mac = macrolides, Tet = tetracyclines, Sulph = sulphonamides.

infection is due to the social behavior where males are given superiority to the females, and if contacted disease are brought immediately to hospitals in comparison to female for treatment (Aizza et al., 2007). The proportion

of adults with wound infection was much higher than children, and there was a moderate correlation ($r = 0.43$) between age and contracting wound infection. This could be due to the fact that more adults are likely to undergo a

surgical operation which is the site that is mostly infected.

It is not surprising that the three microorganisms most frequently isolated from the wound samples in the retrospective study were *S. aureus*, *E. coli* and *Ps. aeruginosa*. The frequent occurrence of *S. aureus* and the Gram negative organisms has also been reported (Olayinka et al., 2004; Sani et al., 2012). The preponderance of *S. aureus* (58%) in the retrospective data is in conformity with findings from other studies (Taiwo et al., 2002).

It was observed that Surgical site infection ranked highest among wound infections. This report is in agreement with the result of Taiwo et al. (2002). This is attributable to the fact that patients are likely to undergo surgical operations and more likely to have breaks in their local defence system. Wound sepsis which includes acute soft tissue infections follows surgical site infection in prevalence. Similar findings have also been reported (Aizza et al., 2007). In wound sepsis, *S. aureus* was also the most prevalent infectious organism caused by incision or fluid collection under the skin surface. This finding is similar to that obtained by Akinjogunla et al. (2009). The susceptibility of burn wound to opportunistic colonization by bacteria and fungi results from several factors, including the presence of coagulated proteins, the absence of blood-borne immune factors, and the avascularity of the burn wound (Jefferson and João, 2005).

Further analysis of the retrospective studies also showed that *S. aureus*, *Ps. aeruginosa*, *E. coli* and *Pr. mirabilis* are associated with surgical site infections. This finding is similar to that reported by (Nwachukwu et al., 2009) who found that 41.2, 21.3, 19 and 10.9% were *S. aureus*, *E. coli*, *Pr. mirabilis* and *Ps. aeruginosa*, respectively. The relatively high number of Enterobacteriaceae isolated in this study points to the fact that the presence of enteric organisms in the wounds at operation probably resulted to subsequent sepsis. This finding, therefore, infers that enteric organisms are important determinants of healing in surgical wounds. The incidence of the enteric bacteria also confirms the observation that most wound infections arising from abdominal procedures are presently acquired from the patient's own faecal flora (Jonathan et al., 2008).

Although, several antibiotics were in use, based largely on the organisms isolated from the wound sites; it has been suggested that treatment should be based on the patient as a whole and not the infection alone, and that management strategies must be based on data derived from a holistic assessment of the needs of the individual (Collier, 2003).

Conclusion

Bacteria isolates associated with wound infections in the retrospective study, which were mostly *S. aureus*, enteric bacteria and *Ps. aeruginosa* are consistent with reports of similar studies conducted globally and in various parts of the country. The most commonly prescribed antibiotics in the facility were the penicillins, cephalosporins, aminoglycosides and quinolones. The correct choice of antibiotics should be made only after antibiotic sensitivity testing.

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