Pattern of hospital associated infections in a teaching hospital in Nigeria

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ABSTRACT

Objective: This study aimed at investigating the distribution and antibiogram of possible hospital associated pathogens, providing baseline information for the hospital. Methods: Patients with hospital associated infections in the various wards of OOUTH, Sagamu, between January 2007 and October 2010 were analyzed with respect to their age, sex, ward and duration of admission, site of infection, pathogens isolated and their antibiotic susceptibility pattern. Results: There were 12,109 discharges during the study period, out of which 217 had hospital associated infections giving an incidence rate of 1.8%. Surgical sites were the most infected (31.3%) while burns were the least infected (4.1%). Klebsiella pneumoniae was the most frequently isolated pathogen (37.3%) closely followed by Staphylococcus aureus (36.4%). Male surgical specialty and Neonatal wards had the highest hospital associated infections; each recorded 54 cases while the intensive care unit had only 4 cases during the period under study. Most of the isolates were sensitive to Ofloxacin and Ceftriazone while resistance was demonstrated against Azithromycin and Tetracycline by most isolates. Conclusion: The infection rate in this hospital is relatively low, however, regular surveillance remains a good control measure to either maintain the current infection rate or further reduce it.

1. Introduction

It has not been possible to create an environment that is absolutely free of microorganisms which have the potential for causing diseases in our health care facilities. This explains why some patients develop infections which were not previously present nor incubating in them at their time of being admitted. This type of infection is called Nosocomial or Hospital–associated infection.1,2 Nosocomial infections include infections acquired in the hospital but appearing after discharge and also occupational infections among staff of the facility.

Hospital–associated infection which has a world wide distribution remains a major cause of deaths among hospitalized patients. It has been estimated that over 1.4 million people worldwide suffer from infections complications acquired in the hospital.[3,4,5]

The prevalent rate of nosocomial infections in European and Western pacific regions were 7.7% and 9.0% respectively. In 1998, Ogunsola et al6 reported a monthly prevalence range of 0.11–8.1% among patients in Lagos University Teaching Hospital, while the prevalence rate was 4.2% at the University of Ilorin Teaching Hospital.[2,6,7] Some organisms can survive for a longer period of time in the hospital environment and can also survive disinfectant solutions thereby becoming potential pathogens for hospital infections.[1] These microorganisms could be bacteria, fungi, viruses or parasites.

Commonly isolated hospital associated pathogens are Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Escherichia coli, Bacillus cereus, Proteus sp, Legionella and Clostridium sp. Hepatitis B,C, D, HIV, Aspergillus sp., Candida albicans and Cryptosporidium
had also been incriminated as pathogens in nosocomial infections. [7,8,9]

Device-associated infection was reported to have been the major cause of morbidity and mortality of patients in intensive care unit of a Korean hospital. These device-associated infections include Catheter-associated urinary tract infection (CAUTI), central-line associated blood stream infection (CABSI) and ventilator-associated pneumonia (VAP). [10,11]

The most common sites of Nosocomial infections are surgical wounds, burns, urinary tract, respiratory system, skin, blood and the gastrointestinal tract. *Pseudomonas aeruginosa* is commonly associated with wound and burns infections while *Escherichia coli* is predominantly isolated in urinary tract infections. [12,13,14,15]

The role of a microbiology laboratory in the establishment of Nosocomial infection cannot be overemphasized. Gastmeier et al., [12] reported that there were remarkable differences in infection rates between hospitals with and those without an on-site Microbiology laboratory.

Many control measures which include setting up of infection control unit and use of checklist by infection control practitioners have been adopted in many health facilities, yet nosocomial infections still remain a burden. Since the establishment of the infection control unit in Olabisi Onabanjo University Teaching Hospital (OOUTH) Sagamu, Nigeria, there had not been any assessment of their activities nor making their achievements known to either the local or international communities. The publication of the contribution of this unit to reduction in hospital infections becomes imperative.

This study, therefore, aimed at investigating the rate, distribution and antibiogram of possible pathogens and establishing a reference which will be useful in monitoring the activity of the infection control unit of the hospital.

### 2. Materials and Methods

This retrospective study was carried out between January 2007 and October 2010 at the various wards/units of Olabisi Onabanjo University Teaching Hospital, Sagamu in Ogun state, Nigeria. Samples were taken from infected post operative wounds, umbilical cords and eye of neonates, burn sites, catheter tips, Steiman’s pin site and blood for culture. Information about the age, sex, ward and date of admission, site of infection and sample type were extracted from the patients’ laboratory forms.

The samples were streaked out on Blood agar and MacConkey agar. The plates were then incubated aerobically at 37°C for 24hrs. Presumptive identification of the colonies was done by observing their colonial morphology on the culture media. Further identification of purified isolates were done through biochemical tests which include, Catalase, Coagulase, Indole production, Citrate utilization, Urea agar and Sucrose Indole Motility (SIM) agar. Modified Kirby–Bauer’s [16] method was used for the susceptibility testing of the isolates. Meuller–Hinton agar and Abteky multiple antibiotic discs for both Gram positive and Gram negative isolates were used. Control strain, *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922) were tested along with Gram positive and Gram negative isolates respectively.

### 3. Results

A total of 217 patients had hospital associated infections during the 41 months of the study. During the same period 12,109 patients were discharged from the hospital putting the infection rate at 1.8%. Of the total hospital associated infection, 32.7% was for 2007 while the months of May, June,

**Table 1**

| Year | Jan | Feb | March | April | May | June | July | August | Sep. | Oct. | Nov. | Dec. | Total |
|------|-----|-----|-------|-------|-----|------|------|--------|------|------|------|------|-------|
| 2007 | 3   | 4   | 4     | 2     | 10  | 10   | 12   | 10     | –    | 2    | 9    | 5    | 71    |
| 2008 | 7   | 8   | 5     | 1     | 2   | 5    | 2    | 9      | 4    | 4    | 6    | 2    | 55    |
| 2009 | 4   | 5   | 8     | 16    | 4   | 4    | 3    | 1      | 4    | 4    | 8    | 5    | 66    |
| 2010 | 7   | 4   | 4     | 2     | 8   | –    | –    | –      | –    | –    | –    | –    | 25    |

**Table 2**

| Period | Number of pathogens isolated from infection sites. |
|--------|--------------------------------------------------|
| (Years) | Soft tissues | UTI | Surgical sites | Steiman’s pin sites | RTA wounds | Eyes | Cords | Burns | Blood | Total (%) |
| 2007   | 12           | 8   | 15             | 2                   | 8           | 4    | 5    | 5     | 1     | 60 (27.6) |
| 2008   | 2            | 10  | 14             | 4                   | 3           | 8    | 2    | 3     | 5     | 51 (23.5) |
| 2009   | 4            | 7   | 22             | 1                   | 10          | 5    | 4    | –     | 7     | 62(28.6)  |
| 2010   | 1            | 7   | 17             | 3                   | 10          | 4    | –    | 1     | 1     | 44 (20.3) |
| Total (%) | 19 (8.8) | 34 (15.7) | 68 (31.3) | 10 (4.6) | 31 (14.3) | 21 (9.7) | 11 (5.1) | 9 (4.1) | 14 (6.4) | 217 (100) |

Legend:

UTI– Urinary Tract Infections
RTA– Road Traffic Accidents
July and August of the same year recorded an average of 10.5 infections as shown in Table 1. The month of April, 2009 recorded the highest number of infections. Table 2 showed that there were 127 (58.5%) males and 85 (41.5%) females, giving a male to female ratio of 1.5:1. 31.3% of infections were from surgical wounds, 15.7% were from urinary tracts while burns contributed 4.1%.

| Years | MSS | PSW | MSG | GYN | NNW | ICU | MMW | FMW | FSW | Total |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| 2007  | 28  | 9   | 10  | 2   | 4   | 4   | 13  | 66  |     |       |
| 2008  | 15  | 2   | 13  | 9   | 14  | 2   | 5   | 60  |     |       |
| 2009  | 4   | 4   | 30  | 24  | 4   | 1   | 6   | 66  |     |       |
| 2010  | 7   | 3   | 16  | 33  | 2   | 6   | 25  |     |     |       |
| Total | 54  | 15  | 41  | 4   | 4   | 11  | 15  |     |     |       |

Legend:
MSS—male surgical specialty; PSW—paediatrics surgical ward; MSG—male surgical general; GYN—gynaecology ward; NNW—neonatal ward; ICU—intensive care unit; MMW—male Medical ward; FMW—female medical ward; FSF—female surgical ward.

The ward distribution of hospital associated infections as shown in Table 3 had 54 infection cases in male surgical specialty (MSS) and neonatal wards (NNW) while only four cases were reported in intensive care unit (ICU) of the hospital during the study period. *Staphylococcus aureus* (36.4%) and *Klebsiella pneumoniae* (37.3%) were the most frequently isolated bacteria. However, *Serratia marsences* was isolated in two cases (0.9%) in 2009 as shown in Table 4. The ratio of Gram—positive to Gram—negative stood at 1:3. The susceptibility of the isolates was highest with Ofloxacin. Tetracycline and Nalidixic acids performance were poor. *Staphylococcus aureus* was sensitive to a greater number of antibiotics while the atypical coliforms were resistant to many of the antibiotic used in this study as demonstrated in Table 5.

### 4.Discussion

Hospital associated infections remain the major cause of death among hospitalised patients worldwide. The infection rate of 1.8% in this study is relatively low when compared with other reports from different parts of the same country (Nigeria) namely Ilorin (4.2%), Ife (2.7%), Lagos (3.8%) and other nations of the world like Germany (3.5%), Senegal (11%), Norway (7.3%), Korea (7.5%) and Ankara (2.4%).[17,18,20]

The most likely reasons for this low infection rate might be associated with the type of cases received during the study period, the types of interventions employed and the zeal of the infection-control nurses in the despatch of their duty and the willingness on the part of the care givers to embrace the then new programme in controlling hospital associated infections.

The infection rate of 28.9% recorded in the neonatal unit and surgical ward were of great concern when compared with total infection rate of 1.8%. Though, similar pattern was observed in Lagos (15.1%), Korea (20%) and other centres. [17,18,21] The contribution of the immature immune system of these neonates might be a major factor together with the stress of delivery processes especially in prolonged labour cases since these are cases often referred to tertiary health
facilities as last result. Many factors can really contribute to the high rate of infection (31.3%) in post operative wound infections which could include the surgical procedures employed, fitness of the patient before surgery, post operative nursing care and the ward environment. But not likely from the operating theatre since the air of the operating theatre of this hospital has been studied and found to contain no potential pathogen for Nosocomial infection.

Though critical cases are managed in the Intensive Care Unit (ICU) of the Hospital, the very low infection rate (1.8%) might be due to the consciousness of the health care givers; holistic cleaning arrangements regularly employed in this units and restriction of movements to and fro this unit, which is not observed in many other wards of the hospital. However, an average device–associated infection rate of 6.8% has been reported by the International Nosocomial Infection Control Consortium (INICC) in 36 countries of the world, [14,25].

In a German hospital, Urinary Tract Infection (UTI) was responsible for 42.1% of nosocomial infections, in Lagos 22% but 15.7% in this study. This is relatively comparable to observation from Lagos hospital but lower than the study in Germany. In– dwelling catheter, types of ailments (e.g diabetes and AIDS), patients toilet hygiene and duration of stay in the hospital are known to predispose a patient to hospital associated UTI.[12,21,26] The most frequently isolated Gram negative bacterium is Klebsiella pneumoniae (37.3%). This agrees with the work of Odimayo et al.[7] and Edinc et al.[22]Klebsiella pneumoniae is a non–motile capsulated bacterium that can survive adverse conditions. It is often associated with infections such as bronchopneumonia, wound sepsis, bacteremia, meningitis and urinary tract infections.[13,27,28] Hence, its isolation is of clinical importance. Staphylococcus aureus (36.4%) was the most frequently isolated Gram–positive bacterium. This has also been reported by other researchers. Staphylococcus aureus is equally hardy and can survive in adverse environment for a very long period. It has been isolated from skin and nasal samples of hospital personnel, hospital formites and air.[1,9]

This explains why Staphylococcus aureus is readily isolated in the hospital environment.[8,9,23,29] Proteus sp., Coagulase–negative Staphylococcus; Escherichia coli, Pseudomonas sp., which were isolated in this study has equally been reported in other related works.[6,7,10,13]

Ofloxacin has the best activity across all the isolates and this is closely followed by Ceftriazon which were isolated in this study has equally been reported in other related works.[6,7,10,13]

Conflicts of interest statement

We declare that we have no conflict of interest.

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