A survey of common pathogens in wound in patients at the University of Port Harcourt Teaching Hospital (U.P.T.H), Port Harcourt

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Summary

During a 30-month period, January 1996 to June 1998, a total of 2458 wound swab samples were collected, cultured and identified. In descending order of frequency, the organisms isolated include: *Staphylococcus aureus* (31.60%), *Escherichia coli* (25.97%), *Pseudomonas aeruginosa* (21.21%), *Klebsiella species* (10.82%), *Proteus species* (8.23%), *non-haemolytic streptococci* (1.29%), *Beta-haemolytic streptococcus* (0.43%) and *Candida albicans* (0.43%). The variation in frequency of the isolates according to sex, age and ward is reported. The antibiotic sensitivity pattern of these isolates is also presented.

Keywords: ***Wound, Pathogen, Survey***

Résumé

Pendant une période de trente moise, de janvier 1996 a juin 1998, un total de 2458 echantillom ronds out été receuillis, cultivés et identifies. Dans un ordre descendant de fréquence, l'organisms isolé comprend: *Staphylococcus aureus* (31.60%), *Escherichia coli* (25.97%), *Pseudomonas aeruginosa* (21.21%), *Klebsiella species* (10.82%), *Proteus species* (8.23%), non-*haemolytic streptococci* (1.29%), *Beta-haemolytic streptococcus* (0.43%) and *Candida albicans* (0.43%). La variation dans la fréquence des organismes isolés selon le sexe, l'âge et la salle de soin a été signalé. La structure de sensitivité de ces organismes a l'antibiotique a été également presenteé.

Introduction

Wound infections remain an important source of concern in hospitals the world over resulting from the associated morbidity and mortality. In recognition of this important problem, hospitals in the United States of America have stressed the importance of continued surveillance of all nosocomial infections as reported by Garner et al[1]. Here in Nigeria, a surveillance programme on hospital acquired wound infections was commenced at the premier University College Hospital at Ibadan, Nigeria in 1976 (Montefiore *et al*)[2]. The objectives in each case were to provide medical, nursing and other hospital staff with meaningful data on the prevalence and incidence of nosocomial infections in different areas of the hospital, so that adequate control measures could be formulated and constantly applied to help keep the incidence of such infections to a minimum. Various methods of data collection systems have been used by various investigators of this problem with varying results[3-11].

This paper reports on "A survey of common pathogens in wound in patients at the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Nigeria". It is hoped that the study will rekindle awareness in medical and hospital staff of this important problem so that the incidence of hospital acquired wound infections can be kept at a minimum. Secondly, the report intends to stress the importance of continued surveillance of wound infections. It is also hoped that the report will help in the formulation of comprehensive surveillance programme on hospital acquired wound infections in the hospital.

Materials and methods

Population

The University of Port Harcourt Teaching Hospital (UPTH) established in 1979 is a 250 bed institution with an average daily census of approximately 500 and a monthly admission rate of approximately 1,500 patients. The hospital serves the city of Port Harcourt, the Rivers State capital with a population of approximately 1.5 million and is a referral hospital for most of the other hospitals and clinics in the city and surrounding towns and villages.

Collection and isolation of organisms

A total of 2458 wound swabs were aseptically collected from patients in different wards of the hospital during a 30-month period – January 1996 to June 1998. The specimens were inoculated in triplicates immediately on collection on to chocolate agar, Blood agar, Nutrient agar, MacConkey agar and Robertson's cooked meat medium. The media were obtained from Oxoid Limited, Basingstoke, Hampshire, England. A set of the inoculated media was incubated aerobically at 37°C for 24-48 hours while the other set was incubated anaerobically under the same conditions of temperature and time. The chocolate and blood agar plate were incubated in an atmosphere enriched with carbon dioxide. Colonies developing after 24 hour incubation were picked aseptically with inoculating needle and purified by subculturing untill pure cultures of the individual organisms were obtained. Purity was ascertained by microscopy and Gram stained preparation of the isolates.

Identification of isolates

The isolates were identified by macroscopic examination of cultural and morphological characteristics, microscopic examination of Gram stain reaction of isolates, sugar fermentation tests, biochemical tests and germ tube test (Candida albicans) according to Bergey's Manual of Determinative Bacteriology[12].

Antibiotic sensitivity test

Drug susceptibility tests of the isolates were carried out for available antimicrobial agents using disc method with Biotec disc and sensitivity agar. Zones of inhibition of the drugs were interpreted as susceptible and resistant according to the guidelines recommended by the National Committee for Laboratory Standards[13]. Control organisms (*Escherichia coli* NCTC 10418 and *Staphylococcus aureus* NCTC 6571) were tested side by side to ascertain that the potency of the drugs contained in the antibiotic discs was still valid.

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Results

Out of a total of 2458 swab samples (1426 or 58% from males and 1032 (42%) from females) collected and examined, growth was obtained from 2310 (94%) samples while 148 (6%) samples showed no growth. One thousand, nine hundred and ten swab samples (77.7%) had predominantly single infection while 548 (22.3%) of the swab samples had multiple infections.

Table 1 shows in descending order of frequency the organisms isolated in this study. *Staphylococcus aureus* was the most frequently isolated and accounted for 730 (31.60%). This was followed by *Escherichia coli* 600 (25.97%), *Pseudomonas species* 490 (21.21%), *Klebsiella species* 250 (10.82%), *Proteus species* 190 (8.23%), *Non-haemolytic streptococci* 30 (1.29%), *Beta-haemolytic streptococci* 10 (0.4%) and *Candida albicans* 10 (0.43%).

Table 1 Types and frequency of isolates from infected wounds

Organism	Number of times isolated
Staphylococcus aureus	730 (31.60%)
Escherichia coli	600 (25.97%)
Pseudomonas spp.	490 (21.21%)
Klebsiella spp.	250 (10.82%)
Proteus spp.	190 (8.2%)
Streptococcus (non haemolytic)	30 (1.29%)
Streptococcus (beta-haemolytic)	10 (0.43%)
Candida albicans	10 (0.43%)
Total	2310(100.00%)

Table 2 represents the frequency of the isolates according to the wards. Surgical and orthopaedic wards recorded the highest frequency of 570 (24.68%) respectively while Antenatal ward recorded the lowest frequency of 10 (0.43%). There was also variation in the frequency of isolates according to the age of patients. One thousand, nine hundred and twenty (83.12%) of the isolates were recovered from patients 18 years and above while 30 (1.29%) of the isolates were recovered from the age group 0–1 year (Table 3). Table 3 also dipicts that 1180 (51.08%) of the isolates were recovered from males compared to 1130 (48.92%) of the isolates recovered from females. The result of the antibiotic sensitivity test on the isolates is as shown in Table 4. The sensitivity pattern of the isolates in descending order is as follows: isolates were sensitive to Ciprofloxacin (100%), Tarivid (100%), Zinnat (86%), Fortum (57%), Gentamicin (57%), Augmentin (43%), Penicillin (29%), Chloramphenicol (14%) and Erythromycin (14%). The isolates were resistant to Ampicillin, Streptomycin and Tetracycline.

Table 2 Wound isolates from wards (Departments)

Wards	Organisms								
(Department)	Staphylococcus aureus	Escherichia coli	Pseudomonas species	Klebsiella species	Proteus species	Streptococcus (non haemolytic)	Streptococcus (B-haemolytic)	Candida albicans	Total
Surgical	170 (29.82%)	170 (29.82%)	110 (19.30%)	50 (8.77%)	50 (8.77%)	20 (3.50%)	–	–	570 (24.68%)
Medical	50 (41.67%)	30 (25.00%)	10 (8.33%)	10 (8.33%)	–	–	10 (8.33%)	10 (8.33%)	120 (5.19%)
Casualty	10 (11.11%)	20 (22.22%)	40 (44.44%)	–	20 (22.22%)	–	–	–	90 (3.90%)
Out-patient	230 (56.10%)	80 (19.51%)	60 (14.46%)	20 (4.88%)	20 (4.88%)	–	–	–	410 (17.75%)
Isolation	20 (33.33%)	20 (33.33%)	–	20 (33.33%)	–	–	–	–	60 (2.59%)
Post-Natal	30 (20.00%)	40 (26.67%)	10 (6.66%)	40 (26.67%)	30 (20.00%)	–	–	–	150 (6.49%)
Obstetrics & Gynaecology	10 (20.00%)	40 80.00%)	–	–	–	–	–	–	50 (2.16%)
Intensive care	30 (27.27%)	–	60 (54.55%)	–	10 (9.09%)	10 (9.09%)	–	–	110 (4.76%)
Children Emergency	30 (25.00%)	20 (16.67%)	60 (50.00%)	10 (8.33%)	–	–	–	–	120 (5.19%)
E.N.T. (Ear, Nose, Throat)	–	–	30 (100%)	–	–	–	–	–	30 (1.30%)
Special Care Baby Unit	10 (50.00%)	10 (50.0%)	–	–	–	–	–	–	20 (0.90%)
Ante Natal	10 (100%)	–	–	–	–	–	–	–	10 (0.43%)
Orthopaedic	130 (22.81%)	170 (28.82%)	110 (19.30%)	100 (17.54%)	60 (10.53%)	–	–	–	570 (24.68%)
Total	**730 (31.60%)**	**600 (25.97%)**	**490 (21.21%)**	**250 (10.82%)**	**190 (8.23%)**	**30 (1.29%)**	**10 (0.43%)**	**10 (0.43%)**	**2310 (100%)**

Table 3 Organisms isolated according to sex and age

Organisms	Number of isolates	Isolates from males	Isolates from females	Ages (in years) 0 – 1	2 – 12	13 – 18	Above 18
Staphylococcus aureus	730	450	280	20 (2.74%)	80 (10.96%)	40 (5.48%)	590 (80.82%)
Escherichia coli	600	290	310	10 (1.67%)	40 (6.67%)	30 (5.00%)	520 (86.67%)
Pseudomonas species	490	230	260	0 (0.00%)	80 (16.33%)	20 (4.08%)	390 (79.59%)
Klebsiella species	250	60	190	0 (0.00%)	10 (4.00%)	10 (4.00%)	230 (92.00%)
Proteus species	190	120	70	0 (0.00%)	40 (21.05%)	0 (0.00%)	150 (78.95%)
Streptococcus species (non haemolytic)	30	10	20	0 (0.00%)	10 (33.33%)	0 (0.00%)	20 (66.6%)
Streptococcus species (B-haemolytic)	10	10	0	0 (0.00%)	0 (0.00%)	0 (0.00%)	10 (100.00%)
Candida albicans	10	10	0	0 (0.00%)	0 (0.00%)	0 (0.00%)	10 (100.00%)
Total	**2310**	**1180 (51.08%)**	**1130 (48.92%)**	**30 (1.29%)**	**250 (10.82%)**	**100 (4.33%)**	**1920 (83.12%)**

Table 4 Antibiotic sensitivity of isolate organism

Code and sensitivity zone (mm)		Staphylococcus aureus	Escherichia coli	Pseudomonas species	Klebsiella species	Proteus species	Streptococcus species (non haemolytic)	Streptococcus species (B-haemolytic)
Ampicillin (10)	Amp - 10 ≥ 14	R	R	R	R	R	R	R
Augmentin (10)	Aug - 10 ≥ 18	S	S	R	R	S	I	R
Ciprofloxacin (5)	Cip - 5 ≥ 21	S	S	S	S	S	S	S
Chloramphenicol (30)	Chl - 30 ≥ 18	R	R	R	S	R	R	R
Erythromycin (15)	Ery - 15 ≥ 18	R	R	R	R	R	S	R
Fortum (10)	For - 10 ≥ 18	S	S	R	S	R	S	R
Gentamicin (10)	Gen- 10≥ 15	R	S	R	S	S	S	S
Penicillin (10)	Pen-10 ≥ 19	R	R	R	R	S	R	S
Streptomycin (10)	Str - 10 ≥ 15	R	R	R	R	R	R	R
Tarivid (10)	Tar – 10 ≥ 15	S	S	S	S	S	S	S
Tetracycline (30)	Tet –30 ≥ 19	R	R	R	R	R	R	R
Zinnat (15)	Zin - 15 ≥ 18	S	S	S	S	S	S	R

Key: S = Susceptible, R = Resistant, I = Intermediate.

Discussion

This survey indicate that *Staphylococcus aureus* (31.60%) was the most predominantly isolated pathogen from all sources. Most of the *staphylococcal* wound sepsis occurred in medical (41.67%) and surgical (29.82%) wards. *Staphylococcal* wound sepsis accounted for 22.81% and 20.00% in Orthopaedic and Obsteric/Gynaecology wards respectively. *Escherichia coli* (25.97%) which ranked second in frequency of isolation in this survey was mostly isolated from Obstetric and Gynaecology Ward (80.00%), Surgical wards (29.82%) and Orthopaedic ward (29.82%). Pseudomonas species which was isolated (21.21%) from all sources occurred mostly in the surgical and Orthopaedic wards, each of which recorded 19.30%.

In a previous study on the bacteriology of wound infection in the surgical wards of this institution, Otukunefor and Datubo-Brown[14] observed that *Staphylococcus* and *Pseudomonas species* were the predominant organisms isolated from all sources and accounted for 37.50% and 35.20% respectively. They also reported the isolation of *Klebsiella species* (6.80%), *Proteus species* (6.80%) and *E.Coli* (6.80%). They observed that *Staphylococcus* and *Pseudomonas species* contributed equally (43.30%) to the infections of burns, while *staphylococcus species* was predominant in surgical wounds.

It is noteworthy that the findings in the present survey are similar to the observations of Otukunefor and Datubo-Brown[14] with regards to *staphylococcus species* being the predominant organism isolated from all sources and in the type of

organisms isolated. In contrast to their observations however, we found that *E.coli* (25.97%) was more predominantly isolated that *Pseudomonas species* (21.21%) from all sources. In this study, we also found that Pseudomonas species (45.45%) was more predominantly isolated in burns than staphylococcus species (27.27%). We also isolated streptococcus species and *Candida albicans* which were not observed in the previous study. The antibiotic sensitivity pattern in this study is similar to that observed by Otukunefor and Datubo-Brown[14] except for the added resistance to streptomycin. The unrestricted use of antimicrobial agents by the populace may be responsible for the development of more resistant strains of the pathogens to available antimicrobial agents.

Our finding on staphylococcus species being the most common single cause of post-operative wound infection is also similar to those of Johnson[15], Montefiore *et al*[2] and Scott-Emuakpor[16]. Johnson[15] reported 45.00% and 31.00% respectively in studies carried out in Britain and United States of America (U.S.A), Montefiore *et al*[2] and Scott-Emuakpor[16] from studies conducted at the University College Hospital, Ibadan, Nigeria recorded frequencies of 38.00% and 27.00% respectively of staphylococcus species isolated. However, Montefiore et al[2] found that most of the staphylococcal infections occurred in Gynaecology and Surgical wards with 54.60% of all wound sepsis in the Obstetrics and Gynaecology being due to Staphylococcus species. Our findings are also similar to that of Montefiore et al[2] on the Enterobacteria *E.coli, Klebsiella species and Proteus species).* While Montefiore *et al*[2] reported that the enterobacteria accounted for over 50.00% of their isolates, the Enterobacteria represents 45.00% of our isolation in this survey.

The isolates from our Orthopaedic ward are also similar to those obtained by Oguachuba[17] from the Orthopaedic-traumatological Department of Jos University Teaching Hospital, Nigeria. However, while Oguachuba[17] reported the predominance of Proteus spp (41.86%), *Staphylococcus aureus (25.58%) and Coliforms (13.95%),* we observed that the predominating organisms in this ward at UPTH are *E.coli* (29.82%), *S. aureus (22.81%)* and *Pseudomonas species* (19.30%).

Data obtained in this study also indicate that wounds of patients 18 years and over were most infected (83.12%), and that wounds of males were slightly more frequently infected than females (51.08%) as against 48.92%). It is probable that this age group may be most frequently exposed to injury in their daily activities and hence more prone to injuries resulting in wounds or that they are more likely to present with health conditions that may require surgery. It is also possible that these patients are ignorant of proper personal and general hygiene which may lead to the contamination of their wounds by their own microflora or habit. The relatively high incidence of *E-coli* observed in Obstetric and Gynaecology ward in particular and the Enterobacteria from all sources may be indicative of contamination of faecal origin and a reflection of poor hygiene. Sources of infection encountered in hospitals including carriers among medical staff, students, patients, patient's visitors, improperly sterilised equipment, patient's bedding and dressing and non-adherence to strict aseptic procedures in the various departments present insurmountable problems to the elimination of wound infection in hospitals. However, a good measure of control can be established and incidence of infection reduced to a minimum. Such measures which need to be regularly re-emphasised include the reduction of traffic in the operating rooms, detection and isolation of carriers and patients with active infections, proper aseptic techniques and the exclusion of surgeons and attendants with septic lesions in operating rooms.

This survey confirms the continuing importance of S.aureu in particular and other pathogens in wound infection. S.aureus was isolated from all departments (wards) investigated in highest numbers compared with other pathogens. The differences in the isolation rates from the various studies mentioned in this report may be due to differences in methods used by the investigators and in the sample sizes examined. The survey also confirms and emphasises the importance of a more regular surveillance in hospitals as basic to wound infection control. It is only through such regular surveillance that the changing patterns of wound pathogens and their susceptibility to available antimicrobial agents can be detected and adequate and realistic control measure formulated and applied. This will not only be of direct benefit to the patients but also help reduce economic loss due to prolonged hospitalisation.

It is hoped that this study will draw attention to the need for development of regular surveillance programmes in the new and expanding hospitals so that morbidity and mortality associated with wound infections can be reduced to the barest minimum.

Acknowledgement

We are grateful to Dr. D.P. Ekpo of the Department of Foreign Languages and Literatures, University of Port Harcourt, Port Harcourt for the French translation of the summary.

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