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Prevalence Of Pseudomonas In Burn Wounds At The University Of Benin Teaching Hospital. Benin City, Nigeria.

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ABSTRACT

The studies of the prevalence of *Pseudomonas aeruginosa* in burn wounds and the etiologic factors that contribute to burn contamination in the ward were carried out. Out of the 104 isolates from freshly admitted burn wounds patients; the isolates predominated in second-degree burns 45 (43.3%), followed by first-degree 38(36.5%) and third- degree 21(20.2%). From long term inmates the isolates dominated in third degree burns 33(53.2%) and second- degree 29(46.8%). The result of cultured samples taken from different parts of the ward showed that sink-traps 15(53.6%) had the highest prevalence followed by bath-tubs 7(25%), instrument 4(14.3%) and air 2(7.1%). While from staff nurses *Pseudomonas aeruginosa* predominated in the nostrils18 (50%), mouths 11(30.6%) and hands 7(19.4%). The organisms were further tested for their antibiotic sensitivity pattern. The quinolones, cefuroxime and gentamicin were the most effective on isolates from newly admitted patients and to a lesser extend on isolates from long-term inmate patients, environment and from staff nurses. Generally, there was a significant different between ($p < 0.05$) the antibiotic sensitivity pattern from freshly admitted patients and prolong hospitalized patients and also between freshly admitted and the environment and staff nurses ($p < 0.05$). No significant difference ($p > 0.05$) between the environmental isolates and staff nurses isolates.

Key Word: -*Pseudomonas aeruginosa* in Burns, Environment and Sensitivity.

Strains of *P. aeruginosa* resistant to antimicrobial agents including the quinolones are endemic already in numerous hospitals and chronic burn unit institutions (Alice, *et al.*, 1999 and Goldmann, *et al.*, 1996). Patients with burns infected with *P.aeruginosa* suffer from a significant prolonged stay, disability, deformation, cost of the in-patient treatment and death (Enabulele, *et al.*, 1993 and Steer, *et al.*, 1996). The incidence is really at large but unfortunately burn infections associated with *P. aeruginosa* are not yet notifiable diseases and hence no proper records or statistical data are available in most third world countries. As a matter of fact this is the greatest handicap and should be of great concern for those who treat and rehabilitate burn wounds patients. The increasingly morbidity and mortality due to burn injury resulting from antibiotic resistant *P. aeruginosa* is on the increase and particular having bearing on the socio-economic status on the population (Naghesha, *et al.*, 1996).

The prevalent of *P. aeruginosa* in burn wounds and the usual approach to the prevention of wound infection that include aseptic techniques, disinfecting procedures and well planned systemic antimicrobial therapy has fail because several strains of *P. aeruginosa* can now grow and degrade most of these agents (Prescott, *et al.*, 2001) It is now hoped that with increasing resistant to antimicrobial agents, chemotherapy will be replaced by immunization of those at risk against typical *P. aeruginosa* burn wound infections.

MATERIALS AND METHODS.

A total of 104 swabs of burn wounds were obtained from freshly admitted patients and from 62 patients of the same cause who stayed for more than four months at the University of Benin Teaching Hospital (UBTH), Benin City, Edo State of Nigeria, from January to September 2001.Burns were regarded as infected when purulent drainage occurred or the wound fail to heal within the healing period depending on the degree of the burn (Crew, 1967). All the specimens were immediately taken to the University of Benin Teaching Hospital (UBTH), Medical Microbiology Laboratory for processing.

Bacteriology.

Samples were inoculated aerobically on sterile glucose broth, nutrient agar, blood agar, MacConkey agar, Cystine lactose electrolyte deficient agar (CLED), and chocolate agar (Cheesbrough, 2000) at 37^{0}c for 24 hours to 48 hours. The colonies of each representative isolates were then characterized using standard bacteriological methods

(morphologically and biochemically) as described by Cowan and Steel, (1974). Such tests included gram stain, catalase, coagulase, oxidase, citrate test, bile solubility test, hemolysin production, and pigment production, growth at 42°c, distinctive smell, and sugar fermentation. They were further sub-cultured and stored on nutrient agar slants at 4°c for further analysis.

Antibiotic Susceptibility

The antibiotic susceptibility of freshly admitted and prolong hospitalized patients were determined by agar diffusion as recommended by National Committee on Clinical Laboratory Standard (NCCLS) using Oxoid-Mueller-Hinton Agar. These antimicrobial agents included; erythromycin10μg, cefuroxime 30μg, penicillin10IU (International Unit), streptomycin 10μg, ofloxacin 5μg, pefloxacin 10μg, ampicillin 10μg, tetracycline 10μg, cloxacillin10μg and gentamicin 10μg. They were then placed on the agar plates uniformly and incubated with the test organisms at 37° c for 24 hours. Zones of inhibition were then measured and the results recorded as sensitive (s) or resistant (r) base on World Health Organization drug Information and National Committee of Clinical Laboratory Standards (NCCLS)

Data Analysis

The results were analyzed using analysis of variance (ANOVA). The calculated values where then compared with the critical values at appropriate degree of freedoms at the significant level of P= 0.05 (Alika, 1997)

RESULT

The *P. aeruginosa* isolated from burn wounds on freshly admitted, prolong hospitalized patients and from the hospital environment (environment and staff nurses) are shown in tables (1) and (2). From freshly admitted patients, the isolate predominated in second-degree burns 45(43.3%), followed by first degree 38 (36.5%) and third degree 21(20.2%). From prolong hospitalized inmates, the prevalence was high in third degree 33(53.2%) burn wound cases, followed by second degree 29(46.8%) and no first-degree cases. Also from the hospital environment, the organism predominated in sink-traps15 (53.6%), bath-tubs 7(25%), instrument 4(14.3%) and air 2(7.1%). In staff nurses, the nostrils had the highest prevalence 18(50%), mouths 11(30.6%) and the hands the least 7(19.4%) as shown in table (2). The antibiotic (oxoid multi-discs) susceptibility patterns are shown in tables (3) and (4), where the isolates were more susceptible to the quinolones, followed by the aminoglycosides and the penicillins the least. The prolonged hospitalization of patients resulted into high emergence of resistant strains of *P. aeruginosa.*

Table 1: Prevalence of P. Aeruginosa from various degree of burn wounds from freshly admitted and from long-term inmates after 16 weeks of hospitalization.

		Degree of Burn		
Samples	No. of Isolates	1°	2°	3°
Freshly admitted Patients	104	38 (36.5%)	45 (43.3%)	21(20.2%)
Long Term Inmates	62	_	29(46.8%)	33(53.2%)
Total	166 (100%)	38 (22.9%)	74 (44.6%)	54 (32.5%)

Table 2: Prevalence of P. aeruginosa from Hospital Environment and from Staff Nurses.

Source of sample	No. of isolates	Sink-trap	Air	Instruments	Bath-tubs
Environment	28	15 (53.6%)	2 (7.1%)	4 (14.3%)	7 (25%)
Staff Nurses	36	Mouths	Nostrils	Hands	
		7 (19.4%)	18 (50%)	11 (30.6%)	

Table 3: Antibiotic susceptibility pattern of P. Aeruginosa from freshly admitted and from long-term inmates.

Source of samples	No of isolates	OB	PN	PEN	CN	TE	E	S	CXM	OFX	CIP	PET
Fresh Admission	104	1.9%	48.1%	24%	58.7%	34.6%	50%	47.1%	55.8%	67.3%	86.5%	76.9%
Prolong Admission	62	0.0%	0.0%	0.0%	37.1%	24.2%	22.6%	25.8%	19.4%	54.8%	51.6%	46.7%

Table 4: Antibiotic susceptibility pattern of P. aeruginosa from Environment and from Staff Nurses

Source of samples	No of isolates	OB	PN	PEN	CN	TE	E	S	CXM	OFX	CIP	PET
Sink-trap	15	0.0%	0.0%	0.0%	6.6%	0.0%	0.0%	0.0%	6.6%	26.7%	6.6%	13.3%
Air	2	0.0%	0.0%	0.0%	0.0%	0.0%	50%	0.0%	0.0%	0.0%	50%	0.0%
Instrument	4	0.0%	0.0%	0.0%	25%	0.0%	0.0%	0.0%	50%	25%	0.0%	25%
Bath-tub	7	0.0%	14.3%	0.0%	0.0%	0.0%	26.6%	0.0%	14.3%	26.6%	42.9%	14.3%
Mouth	11	0.0%	0.0%	0.0%	9.1%	0.0%	0.0%	18.2%	0.0%	27.3%	11.1%	45.5%
Nostrils	18	0.0%	0.0%	0.0%	11.1%	5.6%	0.0%	0.0%	11.1%	22.2%	27.3%	33.3%
Hands	7	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	26.6%	14.3%	14.3%	0.0%	42.9%

Key to tables 3 and 4

OB = Cloxacillin
PN = Ampicillin
PEN = Penicillin
CXM = Cefuroxime
CN = Gentamicin
TE = Tetracycline
E = Erythromycin
S = Streptomycin
OFX = Ofloxacin
CIP = Ciprofloxacin
PET = Pefloxacin

DISCUSSION

The results indicated that *P. aeruginosa* could be implicated in various degrees of burn wounds as shown in the present study and other reports (Naghesha, *et al., 1996*; Bassak, *et al.,* 1992 and Steer, *et al.,* 1996.). The isolates implicated in freshly hospitalized patients are shown in table 1 were *P. aeruginosa* predominated, as reported in other findings (Naghesha, *et al., 1996).* This is due to the fact that *P. aeruginosa* is an ubiquitous; hospital base opportunistic organism hence can easily gain access into the tissues when the integrity of skin is destroyed (Roitt, 1988 and Weinstein, 1991). Damage to the skin exposes the tissues to organisms of low virulence due to the impairment of the host immune response s (Crew, 1967 and Roitt, 1988).

According to our studies and other reports, hospital staffs are carriers of *P.aeruginosa* and also are clothing, bed linens and other formites in human environment (Prescott, *et al.*, 2001; Pittet, *et al.*, 1999; Vindene, *et al.*, 1996 and Stevens, *et al.*, 1994). This corroborated with the studies of Pittet, *et al*, (1994) that *P.aeruginosa* was the leading nosocomial pathogen in Swiss University. Also when Nagesha, (1996) subjected various degree of burns to bacteriological and clinical examination the commonest organisms on admission were *P.aeruginosa* and *S. aureus* and were very high in patients with deep burn wounds. *P.aeruginosa* also was found very prevalence in sinks, water bath and water taps (Jawetz, *et al.,* 2001 and Atlas, 1997) as reflected in the studies as well. This could easily be transmitted to patients when they are on the hospital facilities. Similar findings showed that the abundant and extensive/abusive use of antimicrobial agents particularly in hospitalized patients had led to the suppression of drug susceptible organisms in burns and favours the persistent growth of drug resistant bacteria. Also the close environment of hospitals favours the transmission of such resistant organisms through formites as well as direct contact (Larry, *et al.,* 1996; Itokazu, *et al.,* 1996 and Weinstein, 1991) and from dressing rooms.

Additional institutional factors that may increase the likelihood of person to person transmission include resident interaction in two or fourbeded rooms and communal activities such as meals and various types of therapy, high patient-to-staff ratios facilitate cross infection (Goldman, *et al.,* 1996). Findings have also suggested that person to person spread is through direct contact especially that between a resident and the transient colonial hands of a health care worker, is thought to be the principal mode of transmission (Weinstein, 1991). Isolation of resistant pathogens from hands of health care workers and observations on timing of new cases have provided some evidence for methicillin resistance *Staphylococcus aureus* (MRSA), resistant gram-

negative *P. aeruginosa* and *uropathogens E. coli* (Weinstein, 1991; Weinstein, 2001 and Larry, *et al., 1996*).

One of the essential features that enhance the infectious processes included the colonization and invasion of the burns by *P. aeruginosa* using it's virulent enzymes such as elastase, hyaluronidase, collagenase, and lipases (Enabulele *et al.*, 1993; Prescott, *et al.*, 2001 and Atlas, 1997. This could highly influence the rate of death in severe burn patients on prolonged hospitalization.

As seen in tables 3 and 4, there was a change in the antibiotic susceptibility patterns of the isolates from freshly admitted, long-term inmates, environment and from staff nurses. The antibiotics that were effective on isolates from freshly admitted became ineffective on isolates from prolonged hospitalization. This was comparable to those of the environment and staff nurses as well. The result indicated that the patients were able to acquire resistant to *P.aeruginosa* when they were on the facility (Larry, *et al.*, 1996). These antibiotic susceptibility disparities are shown in tables 3 and 4, although the quinolones (CIP, OFX and PET) showed some effectiveness, this was subject to the fact that they are new generation antibiotics, which are expensive and have not been exposed to extensive abuse in our environment. The gentamicin showed such considerable susceptibility above all common less expensive and old antibiotics, due to it mode of administration, which is primarily by injection.

The prolonged hospitalization of patients resulted in high emergence of resistant strains of *P. aeruginosa*. It is now hope that with increasing resistant to antimicrobial agents, chemotherapy will be replace by immunization of those at risk against typical *P. aeruginosa* burn wound infections.

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