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PSEUDOMONAS AERUGINOSA INFECTIONS IN SOME HOSPITALS IN CALABAR, CROSS RIVER STATE

BY

A. A. OPARA
DEPARTMENT OF BILOGICAL SCIENCES,
UNIVERSITY OF CALABAR, NIGERIA.

ABSTRACT

A total of 120 samples from patients in two hospitals in Calabar were examined for *Pseudomonas aeruginosa.* About 45% of the cases – burns, ulcers, septic wounds-contained the organism. Sinks and wash basins from wards and theatres were found to constitute permament reservoirs of the organism and a constant source of cross-infection. The relationship between factors such as age, duration of stay in hospital and drainage system were outlined. The need to discontinue the use of Savlon disinfectant, whose active ingredient – cetrimide – favours the proliferation of Pseudomonas species is emphasized.

INTRODUCTION

The genue Pseudomonas, comprises over 100 species which are widely distributed in nature, living as saprophytes in water, soil, sewage and plant materials. One important species is *Pseudomones aeruginosa* (Ps. pyocyanea); which has the capability to persist and multiply in wet places and equipments as well as other unpromising environments. Although a known member of the normal faecal flora (found in small numbers in the faeces of man and animals), *Ps. aeruginosa* is an opportunistic bacterium and rarely initiates infection but is a common cause of secondary infections in persons with debilated conditions. This organism has in recent years assumed prominence as the cause of hospital infections especially of wounds, burns and urinary tract. Lowbury (1975) reported that open wounds and burns treated in hospitals were notoriously prone to acquire *Pseudomonas aeruginosa* infections and that such infected lesions then transmitted the infecting organisms to other patients and to reservoirs in the inanimate environment. Darrell and Wahha (1964) reported that apart from burns, ulcers and wounds, the young and elderly patients with lowered resistance were particularly susceptible to infection with the organism. *Ps. aeruginosa* is also isolated from recreational waters and is often incriminated in swimming – associated eye and ear infections (particularly the otitis externa) and referred to as "swimmers ear' (Cabelli and Levin, 1976). Nochiri (1975) postulated that many hospital acquired epidemics of infection with this organism seem to be sporadic and some were self-infections with organisms from the patients own gut. Taylor (1972) however found that many of the pseudomonas concerned were types seldom found in the gut of patients outside hospitals. He suggested that after admission to hospitals, the alimentary tract of many patients become colonised by organisms present in the food and drugs administered. The high incidence of pseudomonads in urinary tract infections is also recognised by Moore (1966).

The epidemiology of *Ps. aeruginosa* cross infections has shown that the organism can survive in moist conditions even in the presence of antiseptics (Ayliffee *et al.* 1965). Drainage and plumbing systems, that is, sinks, wash basins and traps serve as reservoirs and can become sources of cross-infection (Kohn 1967). He also found that the patient's exposed areas were colonised by strains isolated from the traps of wash basins previous to the patient's admission. Other potential dangerous sources of cross-infection include thermometers and flowers. Phillips (1966) described a small outbreak of respiratory tract infection which was caused by contamination of the lignocaine jelly used in the lubrication of endotracheal tubes. Reports also indicate that the organism can survive and multiply in unexpected places such as jet fuels and silicone fluid used as syringe lubricant (Kylhn and Gorril, 1967). Lowbury (1961) showed that working solutions of cetrimide disinfectant contained living species of *Ps. aeruginosa* and thus acted as a source of infection.

The work outlined in this paper was aimed at obtaining an estimate of the incidence of infections due to pseudomonads in some hospitals in Calabar and to relate such factors as age, duration of stay in hospital and the role of drainage system to the incidence of infection. The hospitals in which patients were sampled were selected on the basis of convenience and not because of any special concern over the incidence of infection. The hospitals used in this study were the St. Margaret's General Hospital which also serves as the nucleus of the University of Calabar Teaching Hospital and the University of Calabar Medical Centre.

MATERIALS AND METHODS

Swab samples were taken from patients' wounds, burns and ulcers as well as from sinks and wash basins in wards and theatres. Cultures were made on simple media – Nutrient agar and McConkey's agar and also on selective medium – Cetrimide agar (Oxoid CM457). They were incubated at 37°C for 24 hours and the organisms identified by routine methods following the schemes of Cowan and Steel (1965). Sensitivity tests were done by the agar diffusion method using Oxoid multodisk 5666E containing pyopen, sulfamethoxazole plus trimethoprim (SXT), tetracycline, gentamycin, ampicillin, ceparox and colistin.

RESULTS

A total of 120 patients were sampled. They were made up of 40 burns, 60 septic wounds, 10 traumatic wounds and 10 ulcers. Table 1 shows that *Ps. aeruginosa* was found in all cases either alone or in association with other pathogens. The results also show a relatively high incidence of infection with pseudomonads, especially in burns (75%) but a low incidence in traumatic wounds (20%) which were deep seated wounds and were often infected with facultative anacrobic bacteria.

Table II shows a breakdown of the samples and incidence of infection, hospital by hospital. One hundred and ten samples were taken from St. Margaret's hospital-designated A and 10 from the University Medical Centre designated B. *Pseudomonas aeruginosa* was found in 52 (47%) of the patients from source A and in 5 (50%) from source B. These results are not significantly dissimilar. Overall, the incidence of infection with pseudomonads in wounds was found to be 45%.

The incidence of *Ps. aeruginosa* infection must, to some extent, reflect the interplay of certain external factors. Three of such factors are analysed in Table III. The samples were taken from three categories of age groups. Of the 120 patients sampled, 60 were between 0–29 years, 42 patients were between 30–59 years and 18 were 60 years old and above. The results clearly indicate that the incidence of *Ps. aeruginosa* increased with the age of the patient. This pattern

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confirms reports of Cabelli and Levin (1976) that *Ps. aeruginosa* was responsible for majority of infections in adult patients debilated by burns, malignancies or old age.

The duration of patients' stay in the hospital up to the day on which samples were collected, were categorized into three; 1 – 7 days; 8.– 21 days and 21 days and above. The numbers of samples obtained from each category are also shown in Table III. While *Ps. aeruginosa* was found in 40% of the wounds from patients who had stayed in hospital for one week or less, 50% of wounds from patients of 8 – 21 days stay contained the organism and 53% of the wounds from those who stayed 21 days or more were infected with *Ps aeruginosa.* There is therefore some relationship between duration of stay in hospital and the infection with the organism. Thus, the longer the patient's stay in hospital, the greater the chances of his wounds being infected with pseudomonads.

Table III also shows the incidence of *Ps. aeruginosa* in sinks and wash basins in both wards and operation theatres. The organism was isolated from about 60% of wash basins and 85% of sinks sampled. These results have far reaching implications and indicate that those sinks and wash basins constitute a major reservoir of *Ps. aeruginosa* in the hospital environment.

The results of sensitivity tests on 152 isolates are presented in Table IV. Four antibiotics in the multodisk Oxoid, 5666E to which the isolates were generally resistant, Septrin, ampicillin, tetracycline and ceparox – are not included in the table. The other three to which the organisms were invariably sensitive – Gentamycin, pyopen and Colistin are shown and discussed. Of the 152 isolates tested, 76% were sensitive to gentamycin, 32% to pyopen and 37% to colistin. While 14% were sensitive simultaneously to gentamycin, pyopen and colistin, only 6% were resistant to all three antibiotics at the same time.

TABLE I

INCIDENCE OF INFECTION WITH PATHOGENIC BACTERIA

	Wounds		No. of pathogens isolated from wounds Ps. aeruginosa				% of infection by Ps. aeruginosa
Sample	Number	% of Total wounds	ALONE	WITH OTHER PATHOGENS MAINLY Staph. aureus	OTHER PATHOGENS	TOTAL	
Burns	40	33.3	14	16	2	32	75
Septic wounds	60	50	9	9	20	38	30
Traumatic wounds	10	8.3	1	1	6	8	20
Ulcers	10	8.3	2	2	3	7	40
TOTAL WOUNDS	120						

TABLE II

Incidence of Pseudomonas infection hospital by hospital.

HOSPITALS	TOTAL WOUNDS	NO. OF WOUNDS INFECTED WITH Ps. aeruginosa	% INFECTION WITH Ps. aeruginosa
A	110	52	47
B	10	5	50

A = St. Margaret's Hospital. B = University of Calabar Medical Centre.

TABLE III

Incidence of infection with Pseudomonas aeruginosa in relation to various factors

	Factor	No. of Samples	Incidence of Ps. aeruginosa	% of incidence of Ps. aeruginosa infection
(i)	AGE (YRS)			
	0 – 29	60	22	36.6
	30 – 59	42	31	73.9
	60 and above	18	16	88.8
(ii)	Duration of stay (Days)			
	1 – 7	20	8	40
	8 – 21	40	20	50
	21 and above	60	32	53
(iii)	Drainage system			
	Sinks	20	17	85
	Wash basins	10	6	60

TABLE IV

Sensitivitity results of 152 hospital strains of **Pseudomonas** aeruginosa with reference to Gentamycin, Colistin and pyopen.

Number	Sensitive		to:	No Resistant to:
CN	PV	CS	CN, PY CS (Together)	CN, PY, CS (Together)
115	49	56	21	9
(76%)	(32%)	(37%)	(14%)	(6%)

CN = Gentamycin, Ca = Colistin, PY = Pyopen.

DISCUSSION

The principal aim of this investigation was to obtain an estimate of the incidence of *Ps. aeruginosa* in wound infections in some Calabar hospitals. The results suggest that the two hospitals from which samples were taken still suffer a great deal from the hazards of hospital-acquired infections particularly those caused by *Ps. aeruginosa.* On the whole, there was a fairly high rate (45%) of infections with the organism in these Calabar hospitals. One major factor that contributed to the relatively high incidence, was the ability of the organism to survive and multiply in strange hospital environments such as bed pans, disinfectant solutions and in the small reservoir of water round taps and sinks. All these factors put together facilitate ward cross-infection. The usual effective antibiotics against *Ps. aeruginosa* from these Calabar environments were gentamycin, pyopen and colistin; most isolates (76%) being sensitive to gentamycin. A rational policy on the use of antibiotics can help maintain the current pattern of sensitivity of the organisms to antibiotics and arrest the trend of the emergence of resistant species. To reduce the spread of hospital-acquired infections, the St. Margaret's Hospital, Calabar has intensified its practice of barrier-nursing those patients with open and septic wounds. Unfortunately, overcrowding is one major problem confronting these Calabar hospitals. With the take off of the University of Calabar Teaching Hospital, some of the congestion will be eased off.

It is ironical however, to observe the continued use of the disinfectant which favours the proliferation of *Ps. aeruginosa* namely Savlon. The main active ingredient of Savlon is cetrimide which kills most organisms other than pseudomonads. For this reason, cetrimide is incorporated in the selective medium for pseudomonads. Thus the extensive use of savlon in hospital wards inevitably leads to the selection of pseudomonads and their high incidence in open wounds and burns. A change to other brands of disinfectants for hospital use is therefore desirable. The co-operation of the microbiology department could be sought in this direction.

Although there is an association between age of patient, duration of stay in hospital and the incidence of hospital acquired *Ps. aeruginosa* infection, there is practically nothing one could do by way of a solution except to keep these factors constantly in mind and treat the old with

greater care and ensure their quickest discharge from hospitals. Structural modifications could be effected to hospital sinks and wash basins so that traps could be easily cleaned and plughole removable for sterilization. In this way the basins and sinks could be constantly flushed with broad spectrum disinfectants (not savlon).

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