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Bacteraemia – a Sagamu perception

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Summary
In this study laboratory records of all positive blood cultures at Olabisi Onabanjo University Teaching Hospital between January 1993 and December 1998 were reviewed and analyzed. A total of 2057 samples of blood cultures were received in the laboratory during the period of study. 495 (24.1%) samples yielded significant growth of microorganisms. 87 (17.6%) of the positive cultures were from the out patients. Most of the positive blood cultures (99.6%) were mono-microbial. A total of 497 isolates were obtained. The predominant organisms isolated were *Klebsiella* species (30.8%), *Staphylococcus aureus* (30.8%), atypical coliforms (11.9%) and *Pseudomonas* species (7.5%). There were more gram- negative organisms 309 (62.2%) than gram -positive organisms 188 (37.8%). *Staphylococcus aureus* (30.8%) and *Staphylococcus epidermidis* (5.0%) were the predominant gram- positive organisms isolated. A large number (>50%) of the organisms isolated were resistant to Ampicillin and Gentamicin but were sensitive to third generation cephalosporins and quinolones. In conclusion, this study demonstrates the need for all hospitals to monitor the microorganisms causing septicemia so that the clinicians can be alerted to a suitable strategy for blind therapy.

Keywords: *Bacteraemia, OOUTH, Sagamu*

Résumé
Tous les cultures de sang enregistrés dans le laboratoire du Centre Universitaire hospitalier d'Onabanjo, Nigéria entre janvier 1993 a décembre 1998 était revues et analysés. Au total , 2,057 échantillons de culture de sang avaient été obtenu dans le laboratoire durant cette période ; 495 (24.1%) échantillons produisait un development des microrganismes significantive, 87(17.6) de culture positives étaient effective des patients de dehors. La majorité des échantillons de culture positive (99.6%) étaient mono microbienne avec un total de 4497 échantillons pure. Les espéces predominates isolées inclus : *Klebseille Sp* (30.0%), *staphylocoque aureus*(30.8%), *colifrme non typique* (11,9%) et *pseudomonas Sp.* (7.5%). Ils avaient plus des microorganismes de gramme négative (62.2%) que de gramme positive (37.8%). Les *staphylocoques Aureus* (30.8%) et S epidermis 5% étaient les grammes positives predominant. Un nombre elévé (>50%) d'organismes isolés etaient résistant à l'amplicilline et la gentamicine mais sensitive a la 3 ieme genération des cepholosporines et quinolones. En conclusion, cette étude démontre la necessité de controler les microorganismes causant la septicémie afin que les medécins soient alertes à faire des prescriptions effectives dans les hopitaux.

Introduction

Bacteraemia is the condition in which bacteria is present in the blood stream, often as a consequence of infection that involves the urinary or respiratory tract or the result of various invasive procedures [1]. While it may be transient in some cases, bacteraemia due to aerobic gram-negative bacilli can produce serious complications such as vascular collapse, respiratory insufficiency and renal failure [1,2].The presence of an organism in blood indicates that it is an invader of clinical significance. It indicates the urgent need for antibacterial therapy [3].

The initial chemotherapy for patients with septicemia is usually empirical. It is therefore essential that there should be good information on antibiotic sensitivity of isolates from blood for any hospital [4]. Empirical therapy may be guided by the result of conventional culture and sensitivity tests.

Definitive therapy of an individual case can only be affected after the results of routine culture and sensitivity tests are available. It is therefore important that the Clinical Microbiologist circulate locally collected summary data on bacteraemia. There are several reports from laboratories from various countries including Nigeria that provide valuable information on trends and antibiotic resistance in bacteraemia [2-21] This report reviewed laboratory records of bacteraemia at Olabisi Onabanjo University Teaching Hospital, Sagamu from January 1993 to December 1998.

Materials and methods

Laboratory records of all positive blood cultures received in the laboratory between 1993 and 1998 were reviewed. Data on isolates and antibiotic sensitivity pattern were analyzed.Blood was collected from patients under aseptic conditions and added to two bottles containing 20ml nutrient broth and thioglycollate broth. They were incubated at 37°C. Cultures were held for seven days. Bottles showing signs of growth were sub cultured unto Blood agar and MacConkey agar plates. All microorganisms isolated from blood were identified using standard biochemical tests [22]. Determination of antibiotic sensitivity pattern of the isolates was by the disc diffusion method [23]. Control organisms used were *Escherichia coli* ATCC 35218, *Staphylococcus aureus* ATCC 29213 and *Enterococcus faecalis* 29212.

Results

A total of 2057 samples of blood cultures were received in the laboratory during the study period 1993-1998. 495 (24.1%) samples yielded growth of microorganisms (Table 1) A total of 497 isolates were obtained. (Table 2) 87 (17.6%) of the positive cultures were from the out-patients (general and children's emergency room). These were community- acquired infections. In most of the positive blood cultures (99.6 %) only one organism was isolated. However, two bottles yielded poly-microbial growth. Two organisms were each isolated in both poly-microbial cultures.

The predominant organisms isolated were *Klebsiella* species (30.8%), *Staphylococcus aureus* (30.8%), other coliforms (11.9%) and *Pseudomonas* species (7.5%).There were

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Table 1: Yearly distribution of positive blood cultures at OOUTH (1993-1998)

Year	No. of cultures	No of positive cultures (%)
1993	226	55 (24.3)
1994	297	73 (24.6)
1995	416	128 (30.8)
1996	348	87 (25)
1997	389	75 (19.3)
1998	381	77 (20.2)
Total	2057	495 (24.1)

more gram- negative organisms 309 (62.2%) than gram -positive organisms 188 (37.8%). *Klebsiella* species, other coliforms, and *Pseudomonas* species were the predominant gram-negative bacilli. *Staphylococcus aureus* (30.8%) and *Staphylococcus epidermidis* (5.0%) were the predominant gram- positive organisms.(Table 2)

Table 2: Microorganisms causing bacteraemia at OOUTH 1993-1998

Micro-organisms	Number of Isolates	Percentage
Klebsiella species	153	30.8
Esherichia coli	28	5.6
Proteus species	19	3.8
Other coliforms	59	11.9
Pseudomonas species	37	7.5
Salmonella species	13	2.6
Staphylococcus aureus	153	30.8
S. epidermidis	25	5.0
Enterococcus faecalis	7	1.4
Streptococcus pyogenes	3	0.6
	497	100

Most of the positive cultures 358 (72.3%) were collected from pediatric patients with the largest number 201 (40.6%) from the neonatal wards. (Table 3)

Table 3: Ward distribution of positive blood cultures at OOU TH

Ward	No. of positive cultures	Percentage of positive cultures
Neonatal	201	40.6
Paediatric	83	16.8
Child's emergency	74	15
Medical	56	11.3
Surgery	44	8.9
Obst & Gyane	15	3.0
Gen. outpatient's	13	2.6
Intensive care	9	1.8
Total	495	100

A large number of gram- negative bacilli (>50%) were resistant to Ampicillin and Gentamicin.(Table 4)

Table 4: Anti-microbial susceptibility pattern (%) of isolates from blood cultures at OOUTH (1993-1998)

Isolate	No. tested	AMP	GEN	STR	COT	ERY	CEFT	CRO	OEX
Gram posotove cocci									
S. aureus	153	15.7	86.2	NT	NT	94.6	NT	80.4	100
S epidermidis	25	63.6	53.8	NT	NT	72.7	NT	84.6	100
S. faecalis	7	25	42.9	NT	NT	85.7	NT	33.3	100
S. pneumonia	1	100	0	NT	NT	100	NT	100	100
S pyogenes	2	66.6	100	NT	NT	100	NT	100	100
Gram-negative bacilli									
E. coli	28	26.1	66.6	8	15.4	NT	75	78.6	100
K. pneumniae	153	6.5	52.1	27.0	25.2	NT	87.1	73.4	100
Proteus sp.	19	26.3	73.3	50	45	NT	80	42.9	88.9
Pseudomonas sp.	37	0	59.2	26.9	9.1	NT	94.4	45.2	100
Salmonella sp.	13	16.6	100	72.3	76.9	NT	100	100	100
Other coliforms	59	25	68.2	43.8	60	NT	100	67.4	100

Key:
AMP - Ampicillin; GEN - Gentamicin; ERY - Eruthromycin; STR - Streptomycin; COT - Cotrimoxazole; CEFT - Ceftazidime; CRO - Ceftriazone; OFX - Ofloxacin; NT - Not tested.

Susceptibility to third generation cephalosporins and quinolones (Ofloxacin) tested varied between 42-100%.
Klebsiella pneumoniae isolated was susceptible to Ceftriazone, Ceftazidime and Ofloxacin. *E.coli* and *Proteus* species were susceptible to Gentamicin.Susceptibility of *S.aureus* and *S. epidermidis* to Ampicillin was quite low while 80% of *S. aureus* was sensitive to Gentamicin. Susceptibility to third generation cephalosporins and quinolones varied between 84- 100% and to Erythromycin between 72-94%.

Discussion

In this study, 2057 blood cultures were received in the laboratory over a 6-year period. Among them only 495(24.1%) cultures were positive. This is comparable with reports from studies in Jos and Ibadan [3,4]. It was not possible to determine the clinical significance of these isolates since in almost all patients' only one blood culture sample was submitted.

There were more gram- negative than gram-positive organisms obtained from the positive cultures. This was also observed in other studies in Africa [5,6,15], Pakistan [8,9,12] and Australia [3] in which gram- negative organisms were the commonest cause of bacteraemia [4,6,7,8,9,11,12] but is in contrast to reports from Kuwait, England and Denmark [18,19,20,21] where the predominant organisms causing bacteraemia are gram- positive organisms. However a report from India [17] gave a ratio of gram- positive to gram- negative bacteraemia of 1:1.

The high frequency of gram- negative bacteraemia in this study may be due to instrumentation, intravenous cannulas and the frequent administration of broad-spectrum antibiotics. The isolation of *Klebsiella* specie as the commonest gram- negative bacteria from blood is of great significance. *Klebsiella* bacteraemia is associated with high rates of morbidity and mortality. *Klebsiella* species are an important cause of hospital - acquired infections. They are also a leading cause of gram- negative bacteraemia [9,11,12,14]. Previous studies show that *Kleb-*

siella is a primary pathogen and that its isolation from blood cultures should be regarded as clinically relevant in all cases [14].

The predominance of *Klebsiella* species and *S. aureus* is in contrast to other studies where *E.coli* and *S. aureus* were the most common microorganisms isolated from blood [3,5,9, 16,.18,19,20]. It was not possible to differentiate community acquired bacteremia from those that were hospital acquired since the study was based in the laboratory. However, cultures received from the general outpatient's department and the children's emergency room were considered as community acquired.

In this study it appears as if nosocomial bacteraemia was more common than community acquired bacteraemia (17.6%). This is supported by the predominance of Klebsiella bacteraemia, which have been described as being typically nosocomial in origin [14]. However, majority of the positive cultures, were mono-microbial. Poly-microbial infection of the blood has been reported as mostly being hospital acquired.

Continuous surveillance of infection in the hospital might help to clarify this. In this study, many of the microorganisms were resistant to commonly used antibiotics but sensitive to the third generation cephalosporins and quinolones. This is comparable to the report from Jos on isolates from blood cultures [5] and the review on antibiotic resistance in Nigeria [26]. In England and Wales it was also reported that microorganisms causing bacteraemia showed increased resistance to important antibiotics, thus suggesting that bacterial resistance to antibiotics is a world wide phenomenom [16].

Many of the gram-negative bacilli are multiple antibiotics resistant. This may give rise to therapeutic problems within the hospital. It appears as if Ampicillin and Gentamicin combination may no longer be useful for treating infections due to gram- negative bacilli. This is comparable to a study in Karachi [13] where more than 80% of gram- negative bacilli were resistant to Ampicillin but is in contrast to reports from Denmark where resistance to aminoglycosides was quite low (less than 1%) and the recommended regimen for empirical antibiotic treatment (a combination of Penicillin G and ampicillin) still provides coverage for bacteremia [20,21].

S. aureus was sensitive to Gentamicin, Erythromycin, Ceftriazone and Ofloxacin. The high level of antibiotic resistance will limit the number of antibiotics that physicians can use to treat infections. They would have to use the more expensive drugs such as cephalosporins and quinolones. Furthermore the infections caused by these resistant organisms may be difficult or impossible to treat, hence morbidity and mortality rates, length of hospital stay and costs to the patient will all increase.There is an unequivocal link between antibiotic use and the development of resistance [24]. Studies in Denmark also revealed that previous antibiotic prescriptions predicted antibiotic resistance and that this should be taken into account when selecting empirical antibiotic therapy of severe infections [25].

Judicious use of antibiotics, which avoids over-prescribing and unnecessary use of broad-spectrum agents, should therefore reduce the rates of gram- negative infection and colonization and also limit the spread of resistant strains [24].

Given the frequency with which *Klebsiella* species were isolated from the blood and the fact that most of the positive cultures were from children, it is of utmost concern to determine what could be responsible for this as *Klebsiella* bacteraemia has been associated with high rates of morbidity and mortality.

In conclusion, this study demonstrates the need for all hospitals to monitor the microorganisms causing septicemia so that the clinicians can be alerted to a suitable strategy for blind therapy. It appears that even though the rate of positive cultures was low (24.1%), it is still useful as a guide for antibiotic therapy. This study highlights the need for infection control procedures and antibiotic control policy in the hospital [23,25]. There is also a need for a prospective study to review the relationship between underlying conditions and outcome of septicemia in the hospital.

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