Bacteriological Profile of Blood Cultures in a Tertiary Care Hospital, Kaski District, Western Region, Nepal

Shivananda P.G[a]., Jalan B.Y.[b], Dey S.[b], Easow J.M.[b], Guha S.[b], & Wilson G.[b]

Abstract

Introduction A retrospective analysis of reports from blood cultures was done to determine the spectrum of bacterial isolates and their antibiograms. Altogether 1050 blood cultures were performed in the clinical microbiology laboratory of the teaching hospital of Manipal Medical College of Medical Sciences during the period 1st Jan. 2002 to 31st Dec. 2002.

Objective To determine the spectrum of bacterial isolates from blood cultures and to study their antimicrobial susceptibility patterns.

Methods This study was carried out at the Department of Microbiology, Manipal Teaching Hospital, Pokhara, Nepal. A total of 1050 blood cultures were performed in the clinical microbiology laboratory during the isolates determined by standard microbiological methods. Antimicrobial susceptibility testing was performed by the Kirby-Bauer disc-diffusion method as per the recommendations of the NCCLS.

Results Of the blood cultures, 134 (12.8%) showed bacterial growth. Gram negative isolates accounted for 70.9% and Gram positive Cocci for 29.1%. Antimicrobial susceptibility testing revealed that the Gram positive isolates showed maximum resistance to penicillin and ampicillin. Gram negative isolates, including *Salmonella spp.*, also maximum resistance to ampicillin. The percentage of multidrug resistant *Salmonella typhi* strains was found to be 44.4%. The Gram negative isolates showed minimum resistance to the aminoglycoside amikacin.

Conclusion Due to the increasing antimicrobial resistance encountered in bacterial isolates, the importance of monitoring susceptibility patterns is of paramount importance from the viewpoint of both empirical therapy and prompt, effective treatment which could prove to be life-saving.

Key Words Bateremia, Bacteriological Profile, Antimicrobial Resistance

Introduction

The circulatory system is normally free of microbial organisms. Detection of bacteremia traditionally has been one of the most important functions of clinical microbiology laboratories. When blood cultures yield clinically important microorganisms, it is a sign that host defenses have failed to contain an infection at its primary site or that the clinician has failed to adequately eradicate the infectious process. A wide spectrum of microorganisms cause blood stream infections and this is subject to geographical variation[8]. Resistance to antimicrobial agents are increasing, making treatment difficult and with grave consequences. The present study was undertaken to describe the profile of blood culture isolates and their antibiograms.

Materials and Methods

Laboratory data on all blood samples that were received for culture in the microbiology department from 1st Jan. 2002 to 31st Dec. 2002 from patients admitted to various wards with suspected bacteremia/septicemia, were analysed retrospectively. A total of 1050 blood cultures were received.

[a] **Corresponding Author**: Dr. P.G. Shivananda, Prof. and head Department of Microbiology Manipal College of Medical Science, PO. Box No. 155, Deep Heights, Pokhara, Nepal

[b] Department of Microbiology, Manipal College of Medical Science, Pokhara

In adults, 10ml of blood was collected from a peripheral vein with aseptic precautions and inoculated immediately into a set of two blood culture bottles, one comprising 50ml of Brain Heart Infusion (BHI) biphasic medium and the other of MacConkey biphasic medium, maintaining a dilution of 1:10. In neonates, 2ml of blood was collected and inoculated into the same set of media with the expectation that the culture bottles contained 10ml of liquid broth so as to maintain a dilution of 1:10.

The blood cultures were incubated at 37° C for 7 days, and open subcultures performed after 24 hours, 48 hours and on the seventh day of incubation. Subcultures were done on 5% sheep blood agar, heated blood agar and MacConkey agar. In addition, culture bottles were examined daily and closed subculture was performed by titling the bottle so as to allow broth to flow over the slant, the slant was then reincubated in an upright position.

Bacterial isolates were identified by colony characteristics, biochemical reations and confirmed by slide agglutination tests wherever required[1]. Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method[2].

Results

A total of 1050 blood cultures were received, out of which 134 (12.8%) showed growth. Polymicrobial growth was not a feature in any of the positive cultures. Of the 134 isolates, 29.1% (39/134) were Gram positive and 70.9% (95/134) were Gram negative. Among the Gram positive isolates *Staphylococcus aureus* predominated (14.2%), followed by *Enterococcus spp.* (9%) and CONS (6%).

S.aureus showed maximum resistance to penicillin (63.2%) followed by ampicillin (52.6%), 5.3% of strains were methicillin-resistant *S. aureus* (MRSA). No vancomycin resistance was detected. Coagulase Negative Staphylococcal (CONS) strains on the other hand showed a higher degree of resistance with 75% of srains being resistant to penicillin and ampicillin. 50% of CONS were methicillin-resistant. Out of a total of 12 enterococcal isolates, 66.7% and 62.5% showed resistance to gentamicin and amikacin respectively. One strain was found to be resistant to vancomycin.

Table 1: Resistance Patterns of Gram Positive Isolates

Organism	P	A	Ac	Cp	Ox	Va	G	Ak	Cf	Pc
Staphylococcus aureus (N=19)	12 (63.2)	10 (52.6)	5 (26.3)	1 (5.3)	1 (5.3)	0 (0)	1 (5.3)			
Cons (n=18)	6 (75)	6 (75)	3 (37.5)	4 (50)	4 (50)	0 (0)	1 (12.5)			
Enterococcus spp. (n=12)	6 (50)	4 (33.3)				1 (8.3)	8 (66.7)	5 (62.5)	4 (33.3)	4 (33.3)

N = Number of isolates

CONS = Coagulated Negative staphylococci

Figures shown are number of the resistant isolates

Figures in the parentheses are the percentage of their respective numbers

P =Penicillin; **A** = Ampicillin; **Ac** = Amoxycillin-Clavulanic acid;
Cp =Cephalexin; **Ox** = Oxacillin; **Va** = Vancomycin;
Ak =Amikacin; **Cf** = Ciprofloxacin; **Pc** = Piperacillin;**G**= Genatmicin

Among the Gram negative bacteria, *Salmonella spp.* accounted for a major proportion (40.3%) of all bacterial isolated. This was followed by *Escherichia coli* (8.2), *Enterobacter spp.* (6.7), *Klebsiella spp.* (6%) and *Pseudomonas aeruginosa* (5.2%). Other less frequent isolates were *Alcaligenes faecalis* and *Morganella morganii* (2.98%). A total of 27 *Salmonella typhi* strains were isolated out of which 44.4%, 29.6% and 33.3% were resistant to ampicillin, co-trimoxazole and chloramphenicol respectively. Multidrug resistance was detected in 44.4% of the isolates. None of the strains were resistant to ciprofloxacin. Of the 27 *Salmonella paratyphi* A strains isolated 11.1% were found to be resistant to cotrimoxazole, 7.4% were resistant to ampicillin and ciprofloxacin and 3.7% were resistant to chloramphenicol.

The other Gram negative bacteria that were isolated showed maximum resistance to ampicillin and least resistance to amikacin (Table 2). Of the 7 *Pseudomonas aeruginosa* strains 42.8% were resistant to ceftriaxone, and 28.5% were resistant to ceftazidime, piperacillin and carbenicillin. None of the isolates were reistant to gentamicin, amikacin, ciprofloxacin and chloramphenicol.

Discussion

The varying profile of organisms isolated from blood cultures in patients having bacteemia warrants the continuous monitoring of these isolates along with their antibiograms. Studies carried out in China have shown that there is a rise in the proportion of CONS as compared to *S. aureus* and *E. Coli*[3]. In our study we found that the number of

Gram negative isolates exceeded that of Gram positive isolates, the percentage ratio being 70.9/20.1, this was more or less similar with other studies conducted in Karachi and Kuwait[4,5]. The most frequent isolates in our study were *S. typhi* and *S. paratyphi A* (40.3%), followed by *S. aereus* (14.2%), *Entrococcus* spp. (9%) and *E. coli* (8.2%). The percentage of *Salmonella* resistant to ampicillin, chloramphenicol and co-trimoxazole has been reported to vary between 39-46% (India)[6] and 48-51% (China)[7]. In our study 29.6-44.4% of strains were resistant to the above-mentioned drugs.

Table 2: Resistance Patterns of Gram Negative Isolates

Organism	A	Co	G	Ak	Cf	Ci	Ce*	C	Pc	Cb
Salmonella typhi (N=27)	12 (44.4)	8 (29.6)	0 (0)		0 (0)	0 (0)	9 (33.3)			
S. paratyphi A (n=27)	2 (7.4)	3 (11.1)	1 (3.7)		2 (7.4)	0 (0)	0 (0)	1 (3.7)		
Escherichia coli (n=11)	6 (54.5)	3 (27.3)	1 (9.1)	0 (0)	4 (36.4)	4 (36.4)	2 (18.2)	1 (9.1)		
Enterobacter spp (n=9)	6 (66.7)	1 (11.1)	3 (33.3)	1 (11.1)	1 (11.1)	5 (55.5)	5 (55.5)	5 (55.5)		
Klebsiella spp. (n=8)	6 (75)	4 (50)	5 (62.5)	0 (0)	4 (50)	5 (62.5)	5 (62.5)	3 (37.5)		
Pseudomonas aerugionsa (n=7)			0 (0)	0 (0)	0 (0)	3 (42.8)	2 (28.5)	0 (0)	2 (28.5)	2 (28.5)

Figures shown in the table are number of resistant isolates

Figures shown in parentheses indicated % of resistant isolates

* Cefotaxime was replaced by Ceftazidime while testing Pseudomonas spp

A	= Ampicillin;	**Co**	= Co-trimoxazole;	**G**	=Gentamicin;
Ak	= Amikacin;	**Cf**	= Ciprofloxacin;	**Ci**	= Ceftriaxone;
Ce	= Cefotaxime;	**Ca**	=Ceftazidime;	**C**	= Chloramphenicol;
Pc	= Piperacillin	**Cb**	= Carvenicillin		

In a study conducted in China, the incidence of methicillin reistance was reported to be 10% and 60% in *S. aureus* and CONS respectively[3]. In our study the incidence was lower at 5% and 50% in *S. aureus* and CONS respectively. No vancomicin reisitant *S. aureus* were detected in our study and this finding is consistent with other studis carried out in this region [3,8]. A substantial number of *enterococcal* isolates were found to be resistant to aminoglycosides (Table 1), this could be due to the fact that they possess low-level intrinsic resistance to these agents.

The coliforms viz. *E. coli*, *Klebsiella* spp. and *Enterobacter spp.* Showed maximum resistance to ampicillin, however the number of resistant strains were much lower than those mentioned in other studies[8].

Antimicrobial susceptibility testing and proper documentation of the results is an important task performed by the clinical microbiology laboratory. Baseline data, on bacteriological spectrum of isolates and antimicrobial resistance patterns in a particular area, is of importance as it provides a guideline for empirical therapy whenever required. It also prevents the erratic use of antimicrobial agents.

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