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BACTERIOLOGICAL PROFILE OF BLOOD CULTURE ISOLATES FROM PATIENTS OF A TERTIARY CARE HOSPITAL

Microbiology

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ABSTRACT

Background: Blood stream infections are a medical emergency and need to be addressed promptly to reduce morbidity and mortality. Bacteriological analysis of the causative agents and their antibiogram pattern is imperative to obtain a favourable clinical outcome.
Objectives: To isolate and identify blood bacterial pathogens, along with their antimicrobial sensitivity pattern.
Methods: A total of 1945 blood samples received in Hartley's Broth were subjected to bacterial culture analysis and antibiogram pattern of the isolates, according to standard laboratory procedures.
Results: Bacterial isolation rate from blood cultures was 11.1%. All positive cultures were monomicrobial. Gram Negative Bacilli were isolated in 74.2% cases. The predominant bacterial types were Acinetobacter baumannii (28.7%) and Pseudomonas aeruginosa (24.1%). Staphylococcus aureus was encountered in 10.2% cases, amongst which, MRSA was 63.6%. Antibiogram pattern showed 69.6% and 69.4% sensitivity to Piperacillin – Tazobactam and Colistin, respectively, among Gram Negative Bacteria and 100% sensitivity to Vancomycin among Gram Positive bacteria. Blood culture positive cases were in the older age group of above 61 years (23.6%) and the male : female ratio was 1.3 : 1. A large number of culture positive patients were admitted in Medicine wards (31.9%). Clinical analysis of culture positive subjects revealed a respiratory focus in 20.8% of the total.
Conclusion: Bacteremia and subsequent septicemia is a medical emergency and warrants timely detection, isolation and identification of pathogens and their antibiogram pattern. Knowledge of the bacteriological profile of blood pathogens in a locality is essential. This serves as a guide in emperical choice of antibiotics, before culture result is obtained, so that clinical outcome is favourable.

KEYWORDS

Blood pathogens, bacteremia, anti biogram pattern

INTRODUCTION

Bacteremia refers to the presence of bacteria in the blood. The organisms may find their way into the blood stream from an internal or external infective focus, often from the respiratory tract or abdomen.

It is a major cause of morbidity and mortality in hospitalised patients and may range from a mild to a life threatening situation.[1] Often, bacteremia may culminate into septicemia, wherein, the multiplying bacteria release toxins in the blood stream. This can lead to organ failure, shock and intravascular coagulation.

A wide range of bacterial pathogens have been associated with bacteremia. Prominent among these are Gram Negative organisms, such as Acinetobacter species, Pseudomonas aeruginosa and members of the Enterobacteriaceae family. Gram Positive bacteria that have been isolated from blood include Staphylococcus aureus, Coagulase negative Staphylococcus (CONS) and Enterococcus, among others. Variations have been observed in the predominant bacterial agent isolated from blood, across geographical locations.[2]

Management of bacteremia and septicemia have to be treated as medical emergencies. A positive blood culture is a specific indicator and needs to be undertaken in all suspected cases. Timely detection, isolation and identification of the causative agent, along with the antibiogram pattern of the organism will assist the clinician in the management of the patient, as early clinical signs are minimal and often, vague.

Routine blood culture techniques are associated with the drawback of an inherent delay of approximately seven days for a conclusive result. This often turns out to be detrimental to the patient, who may be requiring early administration of appropriate antimicrobials.

Periodic monitoring of the spectrum of bacterial agents of bacteremia along with their antibiogram pattern is important as it will serve as a reference to clinicians who may need to start antibiotics before the culture result.

The present study was therefore undertaken to isolate and identify blood bacterial pathogens and to determine their antibiogram pattern. An attempt was made to correlate with distribution of culture positive cases in various wards of the hospital and associated clinical conditions.

MATERIALS AND METHODS

A total of 1945 blood samples, collected in Hartley's digest Broth, were received for aerobic bacterial culture, in the Department of Microbiology, Goa Medical College and Hospital, from patients admitted in different wards / units, over a period of three months. Relevant details of the patients were recorded.

Blood culture bottles were incubated aerobically at 37^{0}C and subcultures were done on Blood Agar and MacConkey Agar, on days 1, 2 and 7.

All inoculated media were incubated at 37^{o}C for 18-24 hours. Bacterial growth on the media after incubation was identified using standard microbiological techniques.[3] These included gram staining of the colonies, colony morphology and biochemical reactions.[3] Antimicrobial sensitivity testing was done on all isolates, by Kirby Bauer disc diffusion method, as per CLSI Guidelines.[4]

RESULTS

Out of a total of 1945 blood samples processed, bacterial culture positivity was obtained in 216 samples (11.1%). All culture positive cases were mono microbial.

Frequency of bacterial species isolated from blood bottles is depicted in Table No. 1. Gram Negative Bacilli were isolated in 74.2% cases. Among these bacterial species, Acinetobacter baumannii predominated (overall – 28.7%), followed by Pseudomonas aeruginosa (overall – 24.1%). Klebsiella pneumoniae and Escherichia coli accounted for 9.3% and 7.9% respectively, of the total (overall).

Gram Positive organisms were encountered in 24.5% of blood cultures. Overall, Staphylococcus aureus was isolated in 10.2% cases, while CONS was grown in 8.8% blood samples.

Antimicrobial sensitivity pattern can be observed in Tables 2 and 3. An overall low sensitivity was seen to Penicillin (28.7%) and Ampicillin (33.5%) among Gram Positive isolates. Cefoxitin resistance was seen in 14 out of 22 Staphylococcus aureus strains; MRSA occurrence being 63.6%. All these isolates were sensitive to Vancomycin.

Gram Negative isolates showed an overall low sensitivity of 23.0% to Cephalosporins.

Age and sex distribution of culture positive cases is seen in Table no 4. Blood culture positivity was seen in the older age groups ie. 23.6% in individuals above 61 years, 21.3% in the age group of 51-60 years and 18.1% in the age group of 41-50 years. Neonates and children below 10 years were 13.9%. The male : female ratio was 1.3:1.

A large number of blood culture positive patients were admitted in the Medicine wards (31.9%), Burns ward (17.6%) and ICU (17.6%) (Table No. 5).

Table No. 6 depicts the clinial diagnosis of patients, whose blood culture yielded bacterial growth. A respiratory focus was evident in 20.8% cases. Patients with burns and bacteremia were 16.2% of the total.

DISCUSSION

Bacteremia and subsequent septicemia is a medical emergency, contributing to mortality and morbidity in the patient and as well as a burden on health care. Blood culture remains the gold standard for assessment of bacteremia.

In the present study, bacterial culture positivity was 11.1%. This finding is comparable to the occurrence seen in other Indian studies; it being 13.9% in a study conducted by Sharma el al in 2015.[5] Similar findings were also obtained by Gupta et al[6] and Devi et al.[7] In contrast, a higher positivity of 33.9% was encountered by Sharma et al.[8]

Variation in blood culture positivity can be attributed to many factors. Lee et al opine that type of blood culture bottles used, volume of blood added to the bottles, time of sample collection and number of samples processed are some contributory factors.[9]

In the present study, a low bacterial isolation rate could be attributed to the fact that patients are referred to this Tertiary Care Centre after treatment is initiated and as well as rampant self medication.

The frequency of organisms isolated in the present study was predominantly Gram Negative organisms (74.2%). This finding is similar to that obtained in the study of Sahoo et al (69.2%).[2] Gram negative organisms are resilient to treatment and occur as nosocomial pathogens. However, Gohel et al encountered a predominance of Gram Positive organisms.[10]

Bacterial agents associated with bacteremia and septicemia vary with time and geographic location. Acinetobacter baumannii and Pseudomonas aeruginosa predominated in the present study (28.7% and 24.1% respectively), followed by Staphylococcus aureus (10.2%). The high occurrence of Acinetobacter species and Pseudomonas aeruginosa was also encounterd by Sharma et al.[5] These organisms are associated with multidrug resistance, have a fulminant course, are associated with high mortality and top the list of nosocomial pathogens. Occurrence of Staphylococcus is gaining importance in special units, such as Nephrology, as was encountered by Sahoo et al.[2]

In the present study, Gram Positive isolates showed a low sensitivity to Ampicillin (33.5%). The occurrence of MRSA was 63.6%. Fortunately, all these isolates were sensitive to Vancomycin. The occurrence of MRSA in the study of Sharma et al was 32%.[5] Gram negative organisms showed an overall low sensitivity to Cephalosporins (23.0%). Effective antibiotics against Gram Negative organisms were Meropenem / Imipenem (68.1%), Amikacin (68.1%), Colistin (69.4%) and Piperacillin– Tazobactam (69.6%). Resistance to antibiotics is probably related to their irrational, inappropriate and inadequate use, often available off the counter.

A total of 31.9% patients with positive blood culture were admitted in the Medicine wards, while 17.6% each, in the Burns ward and ICU. Similar findings were also observed by Gupta et al, in their study (28.36% - admitted in Medicine wards).[6] It is often seen that bacteremia and septicemia cases are in Medicine wards, ICU and Burns ward. This is probably related to the fact that these patients have underlying conditions, are immunocompromised and undergo procedures, predisposing the bacteria to enter the blood stream.

A respiratory focus and burns was seen in 20.8% and 16.2% patients respectively with bacteremia in the present study. Bacterial route of entry into the blood is often from the respiratory tract, breach in skin surface, urinary, biliary and abdominal tract.

CONCLUSION

A regular analysis of the bacteriological profile of blood culture isolates is essential, in a hospital setting and geographic location, in order to know the trend of common bacteria causing bacteremia and septicemia. A knowledge and update of the antimicrobial pattern of the etiological agents will help the treating doctor to select the most appropriate antibiotic even before the culture result is available.

Table 1: Frequency Of Bacterial Species Isolated From Blood Cultures

Organisms	Total No. isolated	Percentage
Staphylococcus aureus	22	10.2
CONS	19	8.8
Enterococcus Species	11	5.1
Streptococcus viridans	1	0.4
Acinetobacter baumannii	62	28.7
Pseudomonas aeruginosa	52	24.1
Klebsiella pneumoniae	20	9.3
Escherichia coli	17	7.9
Citrobacter species	5	2.3
Enterobacter species	4	1.9
Candida albicans	1	0.4
Non albicans Candida species	2	0.9
Total	216	100

Table 2: Antimicrobial Sensitivity Pattern Of Gram Positive Cocci (percentage)

Antibiotic	S. aureus	CONS	Enterococcus
Penicillin	27.3	31.6	27.3
Ampicillin	36.4	36.8	27.3
Amoxycillin	45.4	47.4	-
Azithromycin	45.5	47.4	-
Trimethoprim + Sulphamethoxazole	72.7	78.9	-
Chloramphenicol	68.2	68.4	-
Ciprofloxacin	68.2	68.4	81.8
Levofloxacin	68.2	68.4	81.8
Gentamicin	54.5	52.6	54.5
Doxycycline	72.7	68.4	54.5
Tetracycline	-	-	81.8
Clindamycin	72.7	78.9	-
Linezolid	90.9	89.4	81.8
Cefoxitin	36.4	68.4	-
Vancomycin	100	100	100

Table 3: Antimicrobial Sensitivity Pattern Of Gram Negative Bacilli (percentage)

Antibiotic	Enterobacteriaceae	Pseudomonas aeruginosa	Acinetobacter baumannii
Ampicillin	17.4	-	-
Cefazolin	30.4	-	-
Gentamicin	54.3	61.5	19.4
Amikacin	76.1	65.4	62.9
Tobramycin	54.3	61.5	19.4
Amoxycillin + Clavulanate	30.4	-	-
Ampicillin + Sulbactam	30.4	-	19.4
Piperacillin + Tazobactam	65.2	80.8	62.9
Cefuroxime	30.4	-	-
Cefepime	30.4	19.2	19.4
Ceftriaxone	30.4	-	19.4
Ceftazidime	30.4	19.2	19.4
Ciprofloxacin	65.2	65.4	40.3
Levofloxacin	-	65.4	-
Imipenem	76.1	65.4	62.9
Meropenem	76.1	65.4	62.9
Trimethoprim + Sulphamethoxazole	54.3	-	40.3
Aztreonam	65.2	61.5	-
Colistin	76.1	69.2	62.9
Chloramphenicol	65.2	-	-
Doxycycline	-	-	19.4
Netilmycin	-	61.5	-

Table 4: Age And Sex Distribution Of Culture Positive Cases

Age in years	Male		Female		Total	
	No.	%	No.	%	No.	%
0-10	19	66.3	11	36.7	30	13.9
11-20	5	55.6	4	44.4	9	4.2
21-30	10	62.5	6	37.5	16	7.4
31-40	14	56	11	44	25	11.5
41-50	23	58.9	16	41.1	39	18.1
51-60	25	54.3	21	45.7	46	21.3
> 61	28	54.9	23	45.1	51	23.6
Total	124	57.4	92	42.6	216	100

Table 5: Ward / Unit Wise Distribution Of Culture Positive Cases

Ward / Unit	Number	Percentage
Neonatal ward	17	7.9
Paediatric wards	13	6.1
ICU	38	17.6
Medicine wards	69	31.9
Pulmonary Medicine wards	11	5.1
Surgical wards	15	6.9
Burns Unit	38	17.6
Orthopaedic wards	5	2.3
Gyaenecology wards	10	4.6
Total	216	100

Table 6: Clinical Diagnosis Of Patients Yielding Positive Blood Culture

Clinical Condition	Number	Percentage
Neonatal septicemia	17	7.9
Endocarditis	10	4.6
Respiratory focus	45	20.8
Abdominal surgery undertaken	12	5.6
Wound infection	12	5.6
Burns	35	16.2
Urinary Tract Infection	14	6.4
Meningitis	16	7.5
Bone infection	5	2.3
Pelvic related focus	10	4.6
No known focus	40	18.5
Total	216	100

REFERENCES

1. Laupland KB. Defining the epidemiology of bloodstream infections: The "gold standard" of population based assessment. Epidemiol Infect. 2012; 141(10):2149-2157.
2. Sahoo D, Mohanty L, Panda SS, Mishra SN. Bacteriological analysis of Blood Culture Isolates in Patients with Sepsis in a Tertiary Care Hospital of Eastern India. International Journal of Contemporary Medical Research. 2016; 3(12):3448-3450.
3. Collee JG, Fraser AG, Marmion BP, Simmons A. Tests for identification of bacteria. In: Mackie and McCartney's Practical Medical Microbiology. 14th Edn, London Churchill Livingstone; 1999. p 131-149.
4. Performance standards for Antimicrobial susceptibility testing. Clinical and Laboratory Standards Institute, M100, 28th Edition, January 2018, Wayne, PA, 19087, USA.
5. Sharma R, Sharma R, Gupta S. Bacteriological analysis of blood culture isolates with their antibiogram from a Tertiary care hospital. IJPSR. 2015; 6(11):4847-4851.
6. Gupta S, Kashyap B. Bacteriological profile and antibiogram of blood culture isolates from a tertiary care hospital of North India. Trop J Med Res. 2016; 19:94-9.
7. Devi V, Sahoo B, Damrolien S, Praveen S, Lungran P, Devi M. A study on the bacterial profile of bloodstream infections in RIMS Hospital. J Dent Med Sci. 2015; 14:18-23.
8. Sharma M, Goel N, Chaudhary U, Aggarwal R, Arora DR. Bacteremia in children. Indian J Pediatr. 2002; 69:1029-32.
9. Lee A, Mirrett S, Reller LB, Weinstein MP. Detection of bloodstream infections in adults: How many blood cultures are needed? J Clin Microbiol. 2007; 45:3546-8.
10. Gohel K, Jojera A, Soni S, Gang S, Sabnis R, Desai M. Bacteriological Profile and Drug Resistance Patterns of Blood Culture Isolates in a Tertiary Care Nephrourology Teaching Institute. BioMed Research International. 2014; Artcle ID 153747.