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RESEARCH ARTICLE

INCIDENCE OF MICROORGANISMS CAUSING SEPTICAEMIA AND DETERMINATION OF ANTI MICROBIAL RESISTANCE IN ACHARYA VINOBA BHAVE RURAL HOSPITAL (AVBRH)

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ABSTRACT

Background: In developing countries there is a lack of data on estimation of incidence of sepsis. Global studies suggests that, it is required to address the magnitude of this problem with mortality rate ranging from 20-60%.
Aim and Objectives: to evaluate the incidence rate, microbial causative agent, drug susceptibility profile of causative bacteria and estimate the predisposing factors and patient outcome of the cases of septicaemia.
Method: Blood culture of inpatient admissions from a period of July 2013 to August 2014, suspected of septicaemia was processed and data analyzed.
Result: Out of 1714 blood culture specimen 490 were found to be positive.
Conclusion: The incidence rate of septicaemia in our hospital was found to be 7.4 per thousand per year. The incidence rate was highest in paediatric department. The most commonly isolated organisms were gram positive (46.7%), followed by gram negative (43.8%) and candida species (9.5%). The most effective antibiotic for Gram positive organism in this hospital was vancomycin and amikacin. While, effective antibiotic for Gram negative bacteria were colistin, netilmicin, meropenem and imipenem. The proportional mortality rate for patients with septicaemia was 14.4%.

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INTRODUCTION

Septicaemia is a blood stream infection associated with a spectrum of signs and symptoms. The term sepsis should be used when, an infectious aetiology is proven or strongly suspected and the response results in hypofunction of infected organs. (Betty A. Forbes *et al*., 2002; Robert S. Munford, 2015) There are many sequels associated with sepsis that can have a lifelong disabling effects. Elderly survivors of severe sepsis are three times likely to develop persistent cognitive and functional impairment. Acute infection may worsen pre-existing chronic disease or new chronic disease may emerge. The individuals with renal disease are at higher risk for severe infection leading to renal failure and eventually chronic dialysis. Similarly, infections with influenza is associated with increased risk of cardiovascular Disease. (Florian B Mayr *et al*., 2014) The rate of mortality ranges from 20% to 50 % depending on the severity of disease and the hospital setting. (Betty A. Forbes *et al*., 2002; Robert S. Munford, 2015) In developing countries very crude estimation of incidence of sepsis is available from reports due to lack of data. A study at global level indicates that it is urgently required to address this problem. (Issrah Jawad *et al*., 2012) The present study was carried out in a tertiary care rural hospital to evaluate the incidence rate, microbial causative agent, drug susceptibility profile of causative bacteria and estimate the predisposing factors and patient outcome of the cases of septicaemia. The study was designed to provide the data for control of septicaemia and research into distribution of septicaemia and efficacy of therapeutic drugs.

Study design: Prospective, Observational study.

MATERIAL AND METHODS

The study was approved by institutional medical ethics committee. Blood samples received for blood culture from AVBRH during July 2013 to August 2014 for a period of fourteen months, were studied in department of Microbiology, J.N. Medical College, Sawangi. Five-ten ml blood from adults and 2-5ml from children was collected by aseptic precautions and inoculated in brain-heart infusion broth was incubated at 37^0C and subculture was done on day 1, 2, 3 and 7 on MacConkey's agar and blood agar. The cultural characteristic of growth obtained was noted and identified by microscopy and biochemical tests by conventional methods and further tested for drug susceptibility profile by Kirby Bauer disc diffusion method and detection methods for Methicillin Resistant Staphylococcus aureus (MRSA) and Extended

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Spectrum β lactamases (ESBL) (Collee *et al*., 2008; Clinical and Laboratory Standards Institute, 2013).

Inclusion criteria

Cases suspected of septicaemia by clinicians were included in the study.

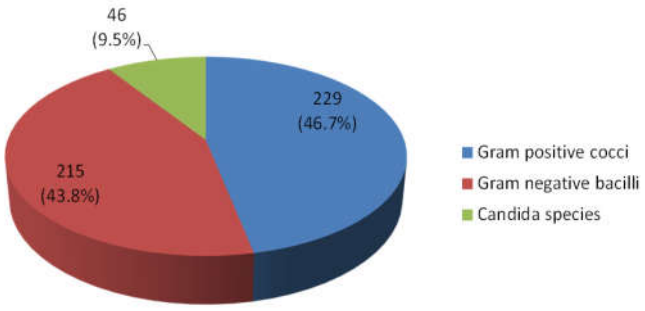
RESULTS

During a study period of fourteen months, from July 2013 to August 2014, the number of in patient admissions were 67,645 and a total number of 1714 blood culture specimens were received. The incidence rate (Table1) of septicaemia with bacteriological confirmation in AVBRH was found to be 7.24 per thousand admissions per year. The incidence in paediatric department was highest, 34.15 followed by CVTS 8.67 and medicine department 5.12 per thousand admissions per year.

Table 1. Department wise Incidence rate of septicemia in AVBRH

Department	Admissions	Positive culture	Incidence rate
AVBRH	67645	490	7.24
Pediatrics	9837	336	34.15
Medicine	18918	97	5.12
Surgery	9236	34	3.68
CVTS	346	3	8.67
Orthopedics	5262	7	1.33
Gynecology	6803	4	0.58
TBC	2161	5	2.31
Dermatology	1879	1	0.53
Ophthalmology	7827	-	-
ENT	3755	3	0.79
Psychiatry	1621	-	-

Out of 1714 blood culture specimen 490 were found to be positive. The proportion of Gram positive bacteria were (46.7%) almost equal to Gram negative bacteria (43.8%) while Candida was isolated in 9.5% of blood cultures (Graph1). The polymicrobial isolation rate was 5.5%.



Graph 1. Organisms causing septicaemia

The most commonly isolated (Table 2) Gram positive bacteria was staphylococci *aureus* (38.8%) and less frequently isolated were, enterococci (4.1%), coagulase negative staphylococci (3.7%) and streptococci (0.2%).

Table 2. Gram positive organisms causing septicemia

	Staphylococci	CONS	Streptococci	Enterococci	Total
AVBRH	190	18	1	20	229
Pediatrics	133	14	1	10	158
Medicine	43	3	-	6	52
Surgery	6	1	-	3	10
CVTS	-	-	-	-	-
Orthopedics	5	-	-	-	5
Gynecology	-	-	-	1	1
TBC	2	-	-	-	2
Dermatology	-	-	-	-	-
Ophthalmology	-	-	-	-	-
ENT	1	-	-	-	1
Psychiatry	-	-	-	-	-

The commonly isolated Gram negative bacteria (Table 3,4) was Pseudomonas species (18.7%), Klebsiella *pneumoniae* (11.4%) and less frequently isolated were Acinetobacter (4.4%), Escherichia *coli* (3.3%) and Citrobacter (3.1%).

Table 3. Gram negative organisms (Enterobacteriacea) causing septicemia

	E.coli	Klebsiella	Enterobacter	Citrobacter	Salmonella	Proteus	Total
AVBRH	16	56	3	15	2	1	93
Pediatrics	8	29	3	11	-	-	51
Medicine	4	17	-	1	2	-	24
Surgery	2	7	-	3	-	1	13
CVTS	-	1	-	-	-	-	1
Orthopedics	-	-	-	-	-	-	-
Gynecology	2	-	-	-	-	-	2
TBC	-	-	-	-	-	-	-
Dermatology	-	1	-	-	-	-	1
Ophthalmology	-	-	-	-	-	-	-
ENT	-	1	-	-	-	-	1
Psychiatry	-	-	-	-	-	-	-

Table 4. Gram negative organisms (Non fermenter) causing septicemia

	Pseudomonas	Acinetobacter	Non fermenter	Total
AVBRH	92	22	8	122
Pediatrics	67	15	4	86
Medicine	12	4	2	18
Surgery	9	2	-	11
CVTS	-	-	-	-
Orthopedics	1	-	1	2
Gynecology	1	-	-	1
TBC	2	-	1	3
Dermatology	-	-	-	-
Ophthalmology	-	-	-	-
ENT	-	1	-	1
Psychiatry	-	-	-	-

Table 5. Resistance pattern of GPC

	AK	CF	CO	E	P	VA
Staphylococci (N=190)	18	55	21	111	159	-
CONS (N=18)	2	2	1	13	17	-
Enterococci (N=20)	14	13	2	12	11	-
Streptococci (N=1)	-	-	1	1	1	-
Total (N=229)	34 (14.8%)	70 (30.6%)	25 (10.9%)	137 (59.8%)	188 (82.1%)	-

AK= Amikacin (30µg) E= Erythromycin (15µg) CF= Ciprofloxacin (5 µg) P= Penicillin (10 units) CO= Trimethoprim-sulfamethoxazole (1.25-23.75 µg) VA= Vancomycin (30µg)

Table 6. Resistance pattern of GNB

	AK	CF	CA	CO	I	MR	PB	AO	CL	PI
E.coli(N=16)	5	9	11	8	1	2	-	2	1	-
Klebsiella(N=56)	28	28	53	47	9	6	-	10	-	-
Enterobacter(N=3)	-	-	3	2	-	-	-	-	-	-
Citrobacter (N=16)	6	6	12	11	-	-	-	-	-	-
Salmonella(N=2)	-	-	1	-	-	-	-	-	-	-
Proteus (N=1)	-	-	-	1	-	-	-	-	-	-
Pseudomonas(N=93)	66	7	51	10	4	-	2	2	3	34
Acinetobacter(N=22)	12	9	17	10	6	2	-	4	1	3
Nonfermenter(N=80)	3	1	5	4	-	-	-	-	-	-
Total (N=215)	120 (55.8)	60 (27.9)	153 (71.2)	93 (43.3)	20 (9.3)	10 (4.6)	2 (0.9)	18 (8.4)	5 (2.3)	37 (17.2)

AK= Amikacin (30µg) I= Imipenem (10µg) CF= Ciprofloxacin (5 µg) MR= Meropenem (10µg) CA= Ceftazidime (30µg) PB= Polymyxin B (300 unit) CO= Trimethoprim-sulfamethoxazole (1.25-23.75 µg) AO= Aztreonam (30µg) CL= Colistin (10µg)

Gram positive cocci had shown following pattern of resistance (Table 5): There was highest amount (60-80%) of resistance to Penicillin, erythromycin followed by lower resistance (10-30%) to ciprofloxacin, amikacin and cotrimoxazole. Methicillin resistant staphylococci aureus (MRSA) was detected in 29.2% and Methicillin resistant coagulase negative staphylococci (MRCONS) in 2.6% cases. Gram negative bacilli had shown following pattern of resistance (Table 6): Highest resistance (30-70%) was observed for ceftazidime, amikacin, cotrimoxazole, tetracyclin. Lower resistance (1-25%) was observed for ciprofloxacin, netilmicin, piperacillin, imipenem, aztreonam, meropenem, colistin and polymixin B. Extended spectrum beta lactamase (ESBL) were detected in 19.2% cases. The most common predisposing factor for septicaemia was found to be infections, Pyrexia of unknown origin, Immunosuppressive conditions, post operative, burns and unspecified. The proportional mortality rate either by signs and symptoms or bacteriological confirmation was 14.2%. The proportional mortality rate was highest in paediatric age group 22.9%.

DISCUSSION

We found no studies from India about incidence rate of septicaemia. From developed countries it has been reported as, 30.64 in Brazil by Silva *et al* (2001-2002), 20.4 in Vietnam by Hao *et al* (1993-1994). Reports with lower incidence rate are 3 per thousand by Angus *et al* USA (1995), 1.49 per thousand by Flatter *et al* Norway (1991), 0.91 per thousand by Braun *et al* USA (1995-1999), 0.77 per thousand by Finfer *et al* (1999-2000) and Watson *et al* 0.37 to 5.16 in USA (1995). The incidence rate in present study is found to be 7.24 per thousand admissions per year. The rate of blood culture positive was: 47.5 % in study by Roy *et al* (2002), 20.02% in study by Usha Arora and Puspa Devi (2007), 10.49 % in a study at Nepal by Chaudhary *et al*. (2012), 31.4% in a study at Nigeria by Komolafe and Adeyoke (2008) and 38% in a study by Yunes Panahi, Tehran. (Yunes Panahi *et al*., 2008) It is 20.58% in present study (2014) similar to study by Usha Arora and Puspa Devi. Most of the studies reports Gram positive organisms as more common causative of septicaemia. Septicaemia due gram positive was reported 52.67% by Usha Arora, 46.73 % in present study and 53.9% in Nigeria. Gram negative organisms were predominant causative agents, as reported by I. Roy (Lukhnow) and Chaudhary *et al* al from Nepal. The interval between onset of hypotension and administration of appropriate antimicrobial therapy was the major determinant of outcome, a delay of as little as one hour was associated with lower survival rates. It is very important to initiate empirical antimicrobial therapy that is effective against both gram positive and gram negative bacteria. (Betty A. Forbes *et al*., 2002) Drugs with lower amount of resistance according to the hospital settings can be preferred for patients with severe sepsis or septic shock which also promotes judicial use of antibiotics and lower emergence of drug resistance.

Conclusion

The incidence rate of septicaemia was found to be7.24 per thousand of admission per year. We hereby conclude that incidence of septicaemia in our hospital are more common than developed countries. The most common Gram positive organism was staphylococci *aureus* showing highest sensitivity to vancomycin and amikacin. The most common gram negative organism was Pseudomonas species showing highest sensitivity to piperacillin, Imipenem, aztreonam, meropenem, colistin and polymixin B. MRSA was detected in 29.2% cases and ESBL's were detected in 19.2% cases. The most common predisposing factor was found to be infections, Pyrexia of unknown origin, Immunosuppressive conditions, post operative, burns and unspecified. The proportional mortality rate for septicaemia is found to be 14.4%. Early detection in departments with high incidence rate and patients with predisposing factors, prompt treatment with effective antibiotics according to the hospital setting and strict implementation of infection control measures such as hand hygiene, antibiotic stewardship is needed to reduce the incidence and mortality rate of septicaemia cases in hospitalised patients.

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