Bacteriological study of blood stream infection (BSI) in ICU patients

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Abstract

Introduction: Blood stream infection is a most common health care associated infection causes significant disease and death worldwide. Patients are admitted to ICUs carry higher risk of nosocomial BSI than those who are admitted in other type of units. Early Identification of causative agents & their antibiotic sensitivity pattern are useful to reduce mortality & improve clinical outcome of the patients.

Materials and Methods: A prospective study conducted in tertiary care hospital. During study all the patients monitor for nosocomial blood stream \ infection. Blood sample collected from suspected patient of blood stream infection for detection causative organism & antimicrobial susceptibility pattern.

Result: A Total 620 samples were tested out of these 173 (27.90%) were positive growth in culture. Maximum number of blood stream infections were from paediatric ICU (69.62%), followed by Medical ICU (18.35%) and from surgical ICU (12.02%). In present study incidence of length of stay is more after five day of admission in ICU (68.35%). The incidence of blood stream infection due to gram positive organism was (51.28%). Among them *Staphylococcus aureus* 72 (45.56%) was most common organism. Gram negative organism were quite low (48.73%) among them *Klebsiella spp.* (16.45%) was most common. The antimicrobial susceptibility pattern of isolated organisms showed high resistance to routinely used antimicrobial agents.

Conclusion: The systemic approach by studying the culture of organisms from the foci and blood culture and the antibiotic profile may help the clinician to select appropriate empirical antimicrobial agents.

Keywords: Antimicrobial sensitivity, Causative organisms, Intensive care Units, Nosocomial blood stream infection.

Introduction

The importance of ICU is inevitable in the control of infection and treatment of the most variable and severe illness of the human body.[1] Critically ill patients in ICU are at high risk of getting the hospital Acquired infections, as evidence by several studies. The risk of acquiring Nosocomial infections are increase up to 5 to 10 times in ICU patients where it is compared to patient from general ward.[2]

Nosocomial infections become evident clinically after 48hrs of hospitalization and it is not originate from patient's original admitting diagnosis. These types of infections cause significant morbidity, mortality and have a considerable impact on health care associated costs.[3]

The rate of Nosocomial infections in the ICU is increase worldwide mainly due to use of invasive procedures performed in the ICU. The therapeutic interventions are related with infectious complications such as sophisticated life support, intravenous fluid therapy, prosthetic devices, indwelling catheters, immunosuppressive therapy, changes in the population at high risk and the use of broad spectrum antimicrobial agents leading to multidrug resistance organisms, they contributed to the evolution of the Nosocomial infections.[4]

Out of all types of Nosocomial infections blood stream infection is a serious health problem in all over the world.[3] Blood stream infection (BSI) is an important event which is responsible for longest hospital stay. Two types BSIs can be occur. It may be healthcare associated or community-associated infection. Health-care associated blood stream infection is a frequently occurring in hospitalised patients. Blood stream infections continue can be severe & always life-threatening condition. Emerging advanced life-support facilities and development of newer antimicrobial agents are associated with high BSIs mortality rate ranging 25-50%.[5]

Gram-negative organisms are the leading cause of blood stream infections.[5] Approximately 75% of primary Bloodstream infections is caused by gram-negative bacilli due to the development of resistance against β-lactam agents like ESBL (Extended Spectrum Beta Lactamase). *Klebsiella pneumonia*, *Escherichia coli, Proteus spp, Pseudomonas spp., Enterobacter spp., Citrobacter spp., and Acinetobacter spp.*. are the common.

Materials and Methods

This is a prospective study in tertiary care hospital. Samples are collected from different ICUs (Paediatric ICUs, medical and surgical ICU) at Tertiary care Hospital, patient having at least one of the following criteria: Patient has a recognized pathogen cultured from one or more blood cultures and the organism

cultured from blood is not related to an infection at another site or Patient has at least one signs or symptoms like raise respiratory rate, abnormally rise heart rate, low or high blood pressure, fever (> 38°C) or hypothermia, rigors, chills, severe local infections (pneumonia, endocarditis, intra-abdominal suppuration, pyelonephritis, meningitis, etc…) or At least one of the Common skin contaminant (e.g, *Bacillus sp., micrococci, Coagulase-negative staphylococci or Diphtheroids*) is isolated from two or more blood cultures collection on separate occasions.

The Signs and symptoms of nosocomial infection appear after 48 hours of hospital admission, and there are no any signs and symptoms of infection at the time of admission confirm by history and clinical examination of patient. Blood was collected from clinically suspected cases blood stream infection following strict aseptic precautions. Withdraw 5 ml of an adult or about 2ml from a young child Blood was inoculated aseptically into 50ml(for adult) & 20ml (for paediatric) Glucose broth (1:10 ratio). After that culture bottles were incubated at 37°C aerobically in incubator and periodic subcultures done in solid media like, MacConkey agar media, blood agar media and chocolate agar media after overnight incubation on day 1, day 3, for isolation. The growth obtained was identified by conventional biochemical test.[6] And isolated organism's Antibiotic Susceptibility Testing was done by Kirby-Bauer disk diffusion method by using Mueller Hinton agar plate. The turbidity of broth containing test organism compare with 0.5 McFarland standard and it inoculate a Lawn culture on a Muller Hinton agar plate The inoculated plated was allowed to dry for few minutes in room temperature with lid closed and then the appropriate antibiotic discs were placed on the agar surface with the sterile forceps and pressed gently to make sure that the disc was in even contact with the medium. The discs were placed in such a way that they were 15mm away from the edge of the plate and the distance between each disc was not less than 25mm. Only 6 discs were placed per petri plate then plates were incubated at 37°C aerobically overnight. Interpretation of result measured as susceptible, Intermediate or resistant identified by measuring diameter of the zones as per as per CLSI guidelines. Utilisation of drug are An–amikacin, g – gentamycin, ba/ct - co-trimoxazole, cip / rc – ciprofloxacin, ctx – ceftriaxone, cf – cefotaxime, nr – norfloxacin, slb/as - ampicillin/sulbactam, pc – piperacillin, ch – chloramphenicol, ci – ceftizoxime, zn – ofloxacine, pr – cephalexin, az – azithromycin, lz –linezoid, cx – cloxacillin, te - tetracycline

Result

Total 620 samples were collected from suspected blood stream infection from different ICUs in Tertiary care Hospital. Out of 620 samples were obtained from these 173 (27.90%) were positive growth in culture, while 447 (72.09%) samples recommended as no growth in culture. sex wise distribution of positive samples in that 94 (54.33%) patients were male, while 79 (45.66%) were female. age wise distribution of cases shows 1 month-15 years children were 123 (71.09%), 16-30 years patients were 13 (7.51%), 31-45 years patients were 24 (13.87%), 46-60 years were 08 (4.62%) and above 60 years were 05 (2.89%). ward wise distribution of cases shows in medical ICU cases were 29 (16.76%) and surgical ICU cases were 21 (12.13%) while maximum cases observed in paediatric ICU were 123 (71.09%). Incidence of length of stay in< 5 days were 56 (32.36%) while in ≥ 5days rate were 117 (67.63%) in present study showing nosocomial blood stream infection were 96 (55.49%) by Gram positive organisms while 77 (44.50%) by Gram negative organisms. Fig. 1 shows isolated gram positive organism & Fig. 2 shows isolated gram negative organisms in present study. In Fig. 3 shows Antibiotic sensitivity of gram positive organisms & Fig. 4 shows Antibiotic sensitivity of gram negative organisms.

Discussion

Bacteria are champions of evolution, and a few microbes have adapted to a point where they pose serious clinical challenges for humans. In present study rate of blood stream infection is 27.90% comparable with different study of 22.68% in Jan Muhammad Shaikh et al. 2008,[7] 27% in Rizvi M et al. 20078, 29.2% in Stephane Hugonnet et al.20049, 34.7% in Jordi valles et al. 2011.[10] In present study, the sex-wise prevalence of BSI are more in male 94 (54.33%) than female 79 (45.66%). This is comparable with study of Jan Muhammad Shaikh et al[7] (M-52.6% & F-47.4%), Christine Bonnal et al.[11] (M-60% & F-39.70%), Prowle et al.[12] (M-65.2% & F-34.84%). In present study, the age-wise prevalence of BSI are more in paediatric patient 123 (71.09%) which was comparable with Shahla latif et al.[13] (76%), while adult patient it was more common in age group of 31 to 45yrs (13.92%) which was comparable with the study of Olgica Gajović et al[14] (mean age 40yrs) and in Dr. Venu Gopal et al.[15] (mean age 47), in present study, maximum BSI diagnosed patients were from Paediatric ICUs 123 (71.09%), where paediatric ICUs comparable with study of Shahla Latif et al.[13] (76%). In present study, incidence of length of stay was higher in ≥5days (67.63%), which was comparable with study of Stéphane Hugonnet et al[9] (mean day-5 day) Ambanaa Gowda Durgad et al (mean day-6.42). In present study 55.49% rate of gram positive organisms were comparable with the (50%) rate in study of Eric A.J. Hoste et al[16] while 44.50% rate of gram negative organisms comparable with the (39.7%) rate in study of Eric A.J. Hoste et al[16] and Jordi Vallés et al[10] (42.2%). Table 1 shows rate of isolated gram positive organisms comparable with different studies table 2 shows rate of isolated gram negative organisms comparable with

different studies. In gram positive organism *S.aureus* were more sensitive to Linezoid & Ampicilin/Sulbactam followed by Cloxacillin then Co-Trimoxazole & Tetracycline, Cephalexin Which are comparable with similar study of R.B. Patwardhan et al,[17] Yahiya A. Abass et al,[18] Easow JM et al,[5] Sunit Singhi et al,[19] while isolated *Enterococci* most sensitive to Tetracycline (100%), Linezoid, Amikacin, Gentamycin (66.66%), Ciprofloxacin, Co-Trimoxazole, Ampicilin/Sulbactam, Cephalexin, Azithromycin, Cloxacillin (33.33%) while resistance to Cefotaxime & isolated *Streptococcus spp*. most sensitive to Linezoid(100%), Tetracycline, followed by Ampicilin/Sulbactam & Cefotaxime & Cephalexin, Ciprofloxacin, Gentamycin, Co-Trimoxazole, Gentamycin, Cloxacillin (50%) Amikacin, Azithromycin (16.66%) sensitivity pattern of all gram positive organism are comparable with similar study of R.B. Patwardhan et al,[17] Yahiya A. Abass et al,[18] Easow JM et al,.[5] In present study, *Klebsiella* were most sensitive to Amikacin, Ciprofloxacin, Gentamycin followed by Chloramphenicol, Tetracycline, Ofloxacine Isolated Pseudomonas were highly sensitive to Co-Trimoxazole followed by Ciprofloxacin, Cefotaxime & Ofloxacine. *Acinatobacter spp*. were sensitive to Ofloxacine & Amikacin followed by Gentamycin, Co-Trimoxazole & Tetracycline. E.coli were most sensitive to Amikacin, Gentamycin, Co-Trimoxazole, Ampicillin/Sulbactam. *Proteous spp. & Providencia spp* were sensitive to all drugs. Sensitivity pattern of all gram negative organism, R.B. Patwardhan et al,[17] S sager Faiz et al.[21] US Kamat et al,[22] Olgica Gajović et al.[14]

Table 1: Common gram positive organism found in different studies

Various studies	**Organism isolated%**			
	S.aureus	**Enterococci**	**Streptococus spp.**	**CONS**
Shaaban H. Ahmed et al[3] 2009	29.2%	7.4%	2.3%	-
Rosineide M et al [23]2007	49.5%	7.1%	-	-
N Nigatu Endaiafer et al[20]. 2008	37.5%	-	12.4%	-
Chen R et al[24]2012	28.0%	-	-	-
Hilmer Wisplinghoff et al[25]2004	10.3%	9.4%	-	-
Outi Lyytikäinen et al [26]2004	-	-	5%	-
David K. Warren et al[27] 2001	8%	21%	3%	-
Silvia Natoli et al[28] 2009	-	-	-	13%
M.Mer[29] 2005	-	-	-	11%
Easow JM et al[5] 2010	-	2.1%	-	-
Present study	41.61%	1.73%	3.46%	8.67%

Table 2: Common gram negative organism found in different studies

Various studies	**Organism isolated%**					
	Klebsiella	**Acinatobacter spp.**	**Pseudomonas aeruginosa**	**Escherichia coli**	**Proteus Spp.**	**Providentia Spp.**
Dr. Venu Gopal L. [15]2008	13.15%	2.23%	15.78%	31.57%	2.63%	-
Stijn Blot et. al.[30] 2002	15.9%	-	18.8%	30.8%	-	-
Svenja J et al.[31] 2006	24.3%	-	14.8%	19.9%	-	-
Olgica Gajović et al[14], 2011	23.3%	12.3%	30.3%	15.8%	16.9%	1.9%
Didier Pittet et al[32]1997	6.2%	-	5.1%	7.9%	-	-
Blot S et al[33] 2003	-	7.8%	-	-	-	-
Easow JM et al[5]2010	15.62%	4.2%	8.3%	10.4%	-	-
Present study	15.02%	9.82%	9.82%	8.09%	1.15%	0.57%

Fig. 1: Graph shows isolated gram positive organism isolated

Fig. 2: Graph shows isolated gram negative organism isolated

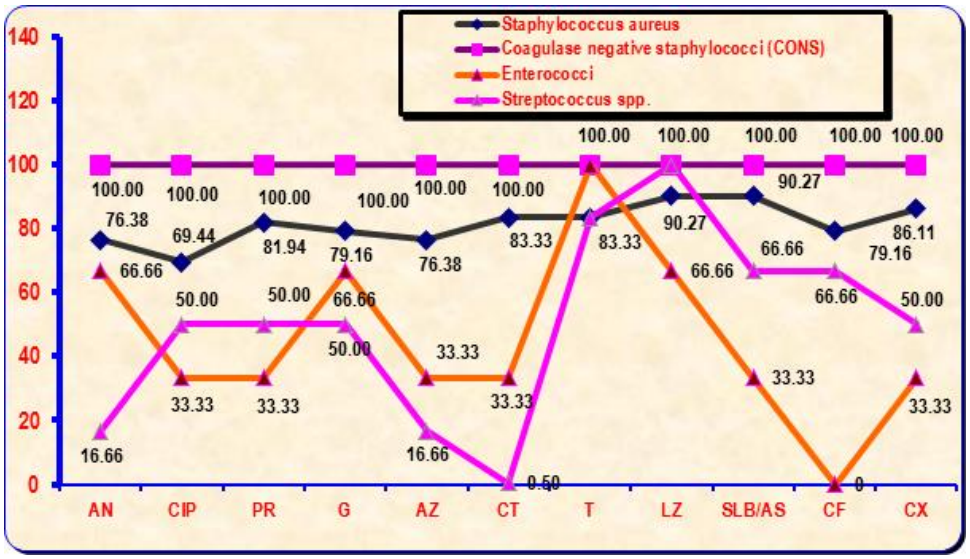

Fig. 3

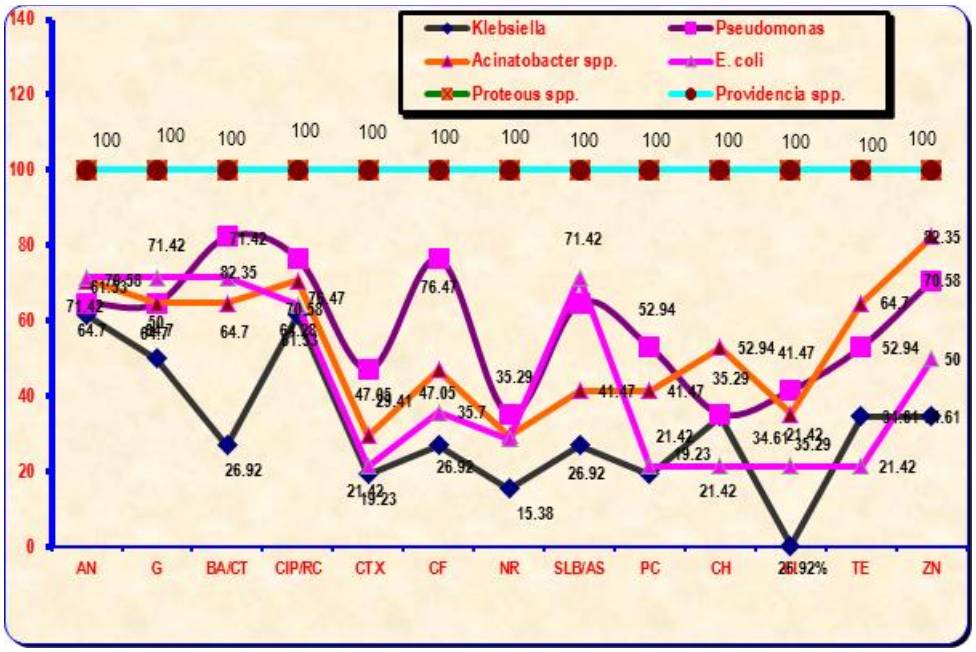

Fig. 1

Conclusion

Paediatric patient are more prone to hospital acquired infections & it cause of morbidity and mortality due to various risk factors. The epidemiology of gram-positive bacteraemia is changing and requires appropriate management and treatment strategies to maximize patient outcome. The systemic approach by studying the culture of organisms from the foci and blood culture and the antibiotic profile may help the clinician to select appropriate empirical antibiotic. Moreover stringent hospital infection control measures and a good antibiotic policy for the hospital is the need of the hour.

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