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Correlation of Empiric Antibiotic Use with Susceptibility Pattern of Blood Isolates in Septicemia Patients in an Intensive Care Unit

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Abstract

Introduction: Blood stream infection causes a significant morbidity and mortality rate worldwide. SIRS (Systemic Inflammatory Response syndrome) criteria are negative, it is very unlikely the person have sepsis; if it is positive and there is just a moderate probability that the person have sepsis. Sepsis is defined as SIRS in response to an infectious process. Severe sepsis is an infectious disease state associated with Multiple Organ Dysfunction Syndromes (MODS).

Objectives: The objective of the study was to identify the rational empirical usage of antibiotics through blood culture for septicemia patient in ICUs and to find out the morbidity and mortality percentage for empirical and switch antibiotic therapy in septicemic patient.

Materials and Method: It’s a prospective observational study carried out for 6 month in Intensive care units (ICU’S). Patients admitted in ICU’S who are diagnosed with septicemia and prescribed with empirical antibiotics were included. Outpatients and Patient not willing to give informed consent was excluded. The data were analysed with IBM.SPSS statistics software23.0 version.

Results: Totally 142 patients were followed up in 3 different ICUs In tertiary care teaching hospital, Pseudomonas species, Staphylococcus aureus and E. coli were most observed organism in the study. Penicillin and cephalosporin groups were mostly found to be resistance and Lincomycin, Fluroquinolones was found to be more susceptible in the study. Patients who receive empirical antibiotic continued therapy showed increased mortality rate than Switch antibiotic therapy.

Keywords*:* Empirical, Antibiotics, Sirs, Sensitivity, Resistance, Septicemia.

Introduction

Bloodstream infection causes a significant morbidity and mortality rate worldwide. Rapid and reliable detection of bacterial pathogens and rational use of antimicrobial are required for proper management, empiric antibiotic administration is required in majority of ICU patients, but extensive use of broad and narrow spectrum antibiotics may lead to development of resistance strain of bacteria and other pathogens. The extensive and irrational use of antibiotics has also been reported to increase the risk of toxicity and drug interactions [1].

The study was aimed to determine the rational use of empirical antibiotic therapy in ICU patients and its impact on clinical outcomes. SIRS (Systemic Inflammatory Response syndrome) [2]. Criteria had been used to define sepsis if the SIRS criteria are negative, it is very unlikely the person has sepsis; if it is positive and there is just a moderate probability that the person has sepsis. According to SIRS, there were different levels of sepsis: sepsis, severe sepsis, and septic shock [3]. SIRS is the presence of two or more of the following: abnormal body temperature, heart rate, respiratory rate, or blood gas, and white blood cell count. With the increased emphasis placed on earlier detection of sepsis, several clinical scores have been proposed to help further predict which patients are septic and which patients will ultimately have a worse outcome [4]. Antimicrobial drug therapy is strongly recommended to be started as soon as possible after the diagnosis of severe sepsis, or septic shock has been made. Delays in initiating antibiotic therapy have been associated with increased mortality. There has been no correlation between the timing of a blood culture draw and detecting significant bacteraemia. Recommendations from the Infectious Disease Society of America (IDSA) emphasize drawing them in a sterile manner from at least two different locations, with the volume of the blood cultured being emphasized rather than timing [5]. The initial management of infection requires forming a probable diagnosis, obtaining cultures and initiating appropriate and timely empirical anti-microbial therapy and source control. The management, because of its complexities has been grouped into 2 bundles of care, a 3 and 6-hour acute sepsis bundle, and a 24-hour sepsis management bundle [6]. The objective of the study is to identify and correlate the rational use of empirical antibiotics in septicemic patients through blood culture, To identify the rational empirical usage of antibiotics for empirical antibiotics through blood culture for septicemic patient and to find out the morbidity and mortality percentage for empirical and switch antibiotic therapy in ICUs setting

Materials And Method

It is a Prospective observational study conducted for the period of six month in ICUs in a tertiary care teaching hospital. Patients admitted in ICUs who are diagnosed with septicemia and prescribed with empirical antibiotics and with culture Susceptibility were included. Outpatients and those who are not willing to give informed consent were excluded. The collected data were analysed with IBM.SPSS statistics software23.0 version. To describe about the data descriptive statistics frequency analysis, percentage analysis was used.

Results

A prospective study was conducted for a period of 6 months. The study population comprised of 83 (58.45%) male patients and 59 (41.54%) female patients. Totally 142 patients were followed up in 3 different ICUs in a tertiary care teaching hospital. The study population comprised of 83 (58.45%) male patients and 59 (41.54%) female patients. Various organisms growth were observed in 142 patients during the study period in that Pseudomonas species was found in 10 female (7.04%) and 13 male (9.15%), E.coli was found in 7 female (4.9%) and 13 male (9.15%), Enterobacter was found in 4 female (2.81%) and 6 male (4.22%), Streptococcus species was found in 8 female (5.63%) and 10 male (7.04%), Staphylococcus aureus was found in 15 female (10.56%) and 23 male (16.19%), Acinetobacter species was found in 5 female (3.52%) and 6 male (4.22%) and other species was found in 9 female (6.33%)and 13 male (9.15%). Various organisms identified in the blood culture, Staphylococcus aureus (27%) was found to be more in distribution when compared to other microorganism. The susceptibility and resistance pattern of E. coli towards higher end antibiotics were Piperacillin and tazobactum shows a greater number of resistances were as Imipenam and cefaperazone/sulbactum shows a greater number of susceptibilities to E.coli. For staphylococcus Erythromycin showed a greater number of resistances and gentamycin shows a greater number of susceptibilities, In Pseudomonas Piperacillin/tazobactum and cefaperazone /sulbactum shows a greater number of susceptibilities and Imipenam shows a lesser number of resistances. The correlation between empirical antibiotics and switch antibiotics for various microorganisms isolated from blood culture shown in Table I.The Morbidity and Mortality rate of septicemic patient were observed in 142 patients in that 69 patients were continued with empirical therapy and 73 patients were Switch to different antibiotic therapy according to culture report. Patients who receive empirical antibiotic continued therapy showed increased Mortality rate than Switch antibiotic therapy. The percentage of Morbidity and Mortality rate of empiric and switch antibiotic therapy were shown in Table II.

Discussion

A prospective study was conducted for a period of 6 months to evaluate “The study of correlation of empiric antibiotic use with susceptible pattern of blood isolates in septicemic patients in an intensive care unit”.

The study population comprised of 142 patients prescribed with antibiotics in septicemia patients with positive blood culture in ICUs. Similar study was conducted by S. Annamallaei *et al* [7]. “The study of correlation of empiric antibiotic use with susceptible pattern of blood isolates in septicemic patients in an intensive care unit”.

In this study out of 142 patients 58.45% were male and 41.54% were female patients showed contrast result in study conducted by Mohanty.L *et al* reported that out of 100 patients 48% were male and 52% were female patients [8].

Gram positive organism 46% shows more resistance than gram negative 37%. Similar observations were seen in the Eiman M Mokkaddas *et al* that the gram-positive organism accounted for 54% and gram-negative organism were 39% [9].

Among various organism isolated in this study, staphylococcus species was found to be susceptible to ciprofloxacin 28.2% in our study. This is in concordance with the study conducted by D Radha rani *et al* recorded that staphylococcus showed susceptible to ciprofloxacin by 52.80% [10].

A study conducted by Hussien El-shiekh *et al* reported that high end antibiotic Imipenem 36.8% showed high susceptibility towards gram-negative organism which was similar in this study, that the Imipenem 27.7% showed high susceptibility towards gram-negative organism [11]. Antibiotics such as Erythromycin 23.3%, Piperacillin with tazobactum 22.5%, Gentamycin 13.3% showed more resistance against all organisms which is in contrast with study conducted by Shahrokh HagiSaghati *et al* where Ampicillin 35.4%, Amikacin 30.6% and penicillin 17.3% showed more resistance [12].

The most prevalent pathogens in the study was Staphylococcus aureus 26.79% showed high susceptibility to amikacin 73.6% which is not in concordance with a study conducted by Lydia Mudzikati *et al.* the most prevalent pathogen was klebsiella pneumonia 29.4% species shows high susceptibility to amikacin (86%) [13]. In this study gram-positive organism 46% were the predominant cause of blood stream infections which is in contrast to study done by Dharmraj Bhatta *et al* “Bacteriological profile of Blood stream infections among febrile patients attending a tertiary care center of western, Nepal” reveals that gram-negative 36.8% bacteria were the predominant cause of Blood Stream Infections [14].

In this study, out of 142 patients, 69 patients continued with empirical antibiotics without culture report, in that Cephalosporin class of antibiotics 55.26% were prescribed more frequently whereas 73 patients were switched to another antibiotic by culture report in that Fluroquinolones class of antibiotics 36.8% were prescribed in the patients. The mortality rate for empirically continued therapy was found to be 10.1% whereas patient switched with culture proven susceptibility antibiotics, the mortality rate was found to be decreased 6.8%. Similar study conducted by Annamallei.S *et al* the mortality rate for switch over therapy was found to be decreased 12.2% than empirically therapy (27.3%) [7].

Conclusion

Antibiotic resistance is a global problem of increasing significance that takes a costly toll on lives and healthcare economy around the world. Majority Gram positive isolates shows more drug resistance than gram negative isolates in this study. Thus, the treatment by recognizing current knowledge of antibiotics, proper evaluation and monitoring is needed by health care professional to select appropriate antibiotics and to promote rational use. Adhering well-designed hospital guidelines and selecting antibiotics based on susceptibility pattern is needed.

Ethical clearance: A prior approval was obtained from the institutional ethical committee

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Legends Tables

Table 1: Empirical antibiotics vs Switch antibiotics for various microorganisms isolated in blood culture

Organism Observed	No. of. Patients (N=142)	Empirical Antibiotics									Switch antibiotics								
		p	*c*	*ca*	*a*	*fl*	*ox*	*gl*	*li*	*mc*	*p*	*c*	*ca*	*a*	*fl*	*ox*	*gl*	*li*	*mc*
Pseudomonas sp	23	6	13	-	-	2	-	-	-	2	10	2	1	-	8	-	2	-	0
E. coli	20	-	14	-	-	-	4	-	-	2	7	4	3	3	-	2	-	-	1
Enterobacter sp	10	2	4	-	-	3	-	-	-	1	1	4	-	-	5	-	-	-	-
Streptococcus sp	18	5	13	-	-	-	-	-	-	-	6	6	-	-	-	-	3	-	3
Staphylococcus sp	38	12	21	1	2	1	-	1	-	-	4	13	-	-	14	-	1	4	2
Acinetobacter sp	11	4	6	-	1	-	-	-	-	-	0	4	-	3	4	-	-	-	-

P= Penicillin, *c*= Cephalosporin, *ca*= Carbapenem, *a*= Amino glycoside, *fl*= Fluroquinolones, *ox*= oxazolidinones, *gl*= Glycopeptides, *li*= Lincomycin, *mc*= Macrolides

Table 2: Percentage of Morbidity and Mortality rate of empiric and switch antibiotic therapy

S. No	Empirical to Empirical Therapy (N=69)		Empirical to Switch Therapy (N=73)	
	Live	Dead	Live	Dead
1.	52 (75.3%)	07 (10.1%)	68 (93.1%)	05(6.8%)