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Research Article

Effect of blood culture reports on antibiotics use by physicians in septic patients of intensive care unit

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ABSTRACT

Background: To limit the emergence and spread of antibiotic resistance, adjustments in the antibiotic regimen should be done according to the results of blood cultures as soon as they are available. This study was planned to determine the effect of blood culture and sensitivity tests on the antibiotics use in ICU patients of a tertiary care teaching hospital.
Methods: This chart review retrospective study was carried out in ICU patients of a tertiary care teaching hospital. The data was collected from patients' medical record file in a case record form which included patient's demographic details, provisional diagnosis/or diagnosis, blood culture reports, and antimicrobial treatment (both the empiric treatment as well as the change made after the release of the blood culture results). The effect of blood culture results on antibiotic treatment was analysed.
Results: A total of 245 patients were subjected to blood culture during the period of 6 months with an average of 40.8/month. 86 (35.1%) patients showed positive blood culture results, while 159 (64.9%) patients showed negative blood culture results. 55 patients discharged after the release of blood culture and sensitivity results. Antibiotic regimens were modified or changed in 26 (47.27%), and in 29 (52.72%) there was no modification. Most commonly used antibiotic after blood culture reports were meropenem (34.62%) followed by 11.54% of each teicoplanin, piperacillin+ tazobactum and tigecyclin.
Conclusions: Blood culture reports help in management of critically ill patients if bacteria are resistant to previously used antibiotic, but do not help in narrowing the therapy in ICU patients.

Keywords: Blood culture, Septic patients, Antibiotic resistance, Critical

INTRODUCTION

Treatment of bloodstream infections in Intensive Care Unit (ICU) patients is very much challenging for physicians.[1] Mortality as a result of increase in frequency of bacteremia has been reported to be as high as 35% to 50%. Risk factors for a fatal outcome include compromised status of the host, age, type of organism, and shock. Hence, knowledge of the most common organism involved in a particular bacteremia, therefore, is of paramount importance because it facilitates the physicians' selection of appropriate antibiotic therapy.[2] Blood cultures are routinely included in the evaluation of febrile patients, but owing to a high mortality in bacteremia, empirical broad spectrum antibiotic therapy is often started to cover potentially dangerous pathogenic

bacteria even before culture results become available. To limit the emergence and spread of antibiotic resistance, adjustments in the antibiotic regimen should be done according to the results of blood cultures as soon as they are available. But the results of blood cultures are often ignored because the patients are doing well on empirical therapy. However, there is a lack of information on how the blood cultures and sensitivity results influence the attending physicians in the treatment of bacteremia. One study concluded that there was no consistent logical approach to the use of bacteriologic results, as change was made in only 20.9% of positive cultures.[3] Another study found that blood cultures have a limited effect on antibiotic choices as they observed that there was underutilization of the blood culture and sensitivity results.[4] There is, however no available data on how blood culture reports are utilized by physicians who request for these tests in our hospital. So this study was planned to determine the effect of blood culture and sensitivity tests on the antibiotics use in ICU patients of a tertiary care teaching hospital.

METHODS

This chart review retrospective study was carried out in ICU patients of a tertiary care teaching hospital. This hospital satisfies the health care needs of thousands of patients of Udaipur city and patients coming from nearby areas. The data was collected from medical records of ICU patients of all age and from either sex, who were admitted to ICU. Approval from the institutional ethics committee was taken before starting the study. The data was collected from patients' medical record file in a case record form which included patient's demographic details, ICU registration number, provisional diagnosis/or diagnosis, blood culture reports, and antimicrobial treatment (both the empiric treatment, as well as, the change made after the release of the blood culture results).

Patients who died before the release of the blood culture reports, patients who were discharged per request or against medical advice as indicated in the chart, postoperative patients whose antibiotic regimen were changed immediately after surgery based on the intraoperative findings, patients with presumed polymicrobial sepsis (e.g. those from DM foot) where broad spectrum antibiotics are justifiable, and patients with contaminated blood cultures were excluded.

All the data collected was analyzed using appropriate statistical tests.

RESULTS

A total of 245 patients were subjected to blood culture during the period of 6 months with an average of 40.8/month from January 2015 to June 2015. Out of 245 patients, 145 (59.2%) were men and 100 (40.8%) were women. The median age was 50.81 years (age ranges from 14-88). Out of 245 blood cultures were sent, 35.1% or 86 patients showed positive blood culture results, while 64.9% or 159 patients showed negative blood culture results.

Of the 86 patients with positive growths, 6 were having fungal growth, 1 was deemed contaminants and 24 either died or went home against advice. Remaining 55 charts were reviewed for the antibiotic appropriateness.

Table 1 shows the distribution of pathogens of positive blood culture reports. 54.43% were caused by Gram +ve organisms, most common of which was Staphylococcus hominis, which accounted for 17.72% of all pathogens followed by S. heaemolyticus and S. epidermidis 8.86% each. 45.57% were caused by Gram -ve organism, the most common of which was E coli, which accounted for 20.25% of all pathogens followed by Klebsiella pneumonia (10.13%) and Acinetobacter baumannii (6.33%).

Table 1: Distribution of pathogens of positive blood culture reports (N=79).

Organism	Number (%)
Gram +ve bacteria	**43 (54.43%)**
Staphylococcus hominis	14 (17.72%)
Staphylococcus haemolyticus	07 (8.86%)
Staphylococcus epidermidis	07 (8.86%)
Staphylococcus aureus	07 (8.86%)
Staphylococcus cohnii urealyticums	03 (3.80%)
Staphylococcus pseudintermedius	01 (1.27%)
Streptococcus pneumoniae	01 (1.27%)
Staphylococcus lugdunensis	01 (1.27%)
Staphylococcus capitis	01 (1.27%)
Enterococcus faecium	01 (1.27%)
Gram -ve bacteria	**36 (45.57%)**
E. coli	16 (20.25%)
Klebsiella pneumoniae	08 (10.13%)
Acinetobacter baumannii	05 (6.33%)
Burkholderia cepacia	03 (3.80%)
Enterobacter claocae	02 (2.53%)
Salmonella paratyphi A	01 (1.27%)
Sphingomonas paucimobilis	01 (1.27%)

Total 121 antibiotics were given to 79 patients who have shown positive blood culture reports. Most commonly used antibiotic before blood culture report was piperacillin + tazobactum (21.49%) followed by meropenem and ceftriaxone 13.22% each (Table 2).

55 patients discharged after the release of blood culture and sensitivity results, antibiotic regimens were modified or changed in 26 (47.27%), and in 29 (52.72%) there was no modification. 26 consultant modified their empiric treatment according the results of blood culture and sensitivity reports. Most commonly used antibiotic after blood culture reports were meropenem (34.62%)

followed by 11.54% of each teicoplanin, piperacillin + tazobactum combination and tigecyclin (Table 3).

Of the 29 non-modifications, 22 patients were already being given appropriate antibiotic coverage and pathogen was sensitive to the antibiotic given, while in 7 patients clinical improvement was seen at the time of blood culture reports.

Table 2: Most commonly used antibiotic before blood culture report (total n=121 antibiotics given to N=79 patients which shows positive blood culture reports).

Antibiotics	Number (n=121)
Piperacillin + Tazobactum	26 (21.49%)
Meropenem	16 (13.22%)
Ceftriaxone	16 (13.22%)
Clindamycin	14 (11.57%)
Levofloxacin	11 (9.09%)
Vancomycin	06 (4.96%)
Cefoperazone + Sulbactum	05 (4.13%)

Table 3: Antibiotic used after blood culture report (N=26 patients in which antibiotic changed).

Antibiotics	Number (N=26)
Meropenem	09 (34.62%)
Teicoplanin	03 (11.54%)
Piperacillin + Tazobactum	03 (11.54%)
Tigecycline	03 (11.54%)
Amikacin	03 (11.54%)
Linezolid	02 (7.69%)
Imipenem	01 (3.85%)
Vancomycin	01 (3.85%)
Colistin	01 (3.85%)

DISCUSSION

Early diagnosis and prompt administration of appropriate antibiotics are essential for septic patients, because of the morbidity and mortality associated with this condition. Despite recommendations clinical practices pertaining to blood culture reports are often inappropriate and the usefulness of blood cultures has been questioned,[5-7] but in present scenario unnecessary use of antibiotics should be avoided to decrease incidence of resistance as well as cost to the patients.

In our study most of the organism isolated after blood cultures were Gram +ve as compared to Gram -ve bacteria. Similar findings were also shown by other studies.[8,9] Other studies have shown Gram -ve bacteria as predominant organism.[4,10,11] The reason of difference between different studies could be because of prevalence of different bacteria in different geographical areas. Another reason could be because of increased incidence of Gram +ve nosocomial infections in ICU.[12,13] Most prevalent organism in our study was E coli which is Gram -ve bacteria inspite of being more prevalence of Gram +ve bacteria. Similar results were found in others studies too.[14] Our hospital is a tertiary care teaching hospital in which most of the patients are referred cases in ICU so chances of hospital acquired infection is more which could be due to E. coli.

In our study in 47.27% patients antibiotic therapy was modified or changed according to the blood culture and sensitivity reports. Study conducted by Panaligan et al. has shown that modification of therapy was in 7.2% patients only and another study has shown modification in 27% patients.[4,2] This could be because physicians were more inclined to start on newer broad spectrum antibiotics and those were sensitive to organisms. Berild et al study has shown modification of therapy in 64.60% patients.[14] High proportion of antibiotic adjusted in this study according to the blood culture findings could be because of use of aminoglycosides and metronidazole as empirical combination therapy which were the antibiotics most frequently discontinue. As our study was conducted in patients of ICU of a tertiary hospital where most of the patients come as referred cases from primary and secondary hospital and already being resistant due to inappropriate use of antibiotics, so broad spectrum newer antibiotics were started by most of the physician. Although in our study change was made in 47.27% of cases but it was not leading to narrowing of antibiotic therapy. After modification most commonly used antibiotic was meropenem followed by teicoplanin and piperacillin + tazobactum which are broad spectrum newer antibiotics used for resistant cases. And before blood culture reports most commonly used antibiotic was piperacillin + tazobactum followed by meropenem. In ICU possibility to narrow therapy was ignored due to admission of critically ill patients. To treat those patients, physician start newer broad spectrum antibiotics and after the blood culture and sensitivity reports if physician finds antibiotic being used sensitive to that bacteria then he/she continue with that antibiotic otherwise they alter the regimen with newer broad spectrum antibiotic which is sensitive to that organism. In settings with a higher level of antibiotic resistance physicians are forced to use the newer and expensive broad-spectrum antibiotics for empirical treatment.[14]

CONCLUSION

In ICU set up it looks that blood culture reports do not help in narrowing the therapy or decreasing the cost of therapy. But certainly these blood culture reports help in management of critically ill patients if bacteria are resistant to previously used antibiotic.

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