One Year Study of Blood Culture in Adults Admitted in Intensive Respiratory Care Unit in a Tertiary Care Hospital

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Running Title: Sepsis in IRCU

Abstract: *Sepsis in Intensive Respiratory Care Unit (IRCU) is mainly due to gram negative bacteria, followed by gram positive bacteria.A retrospective study was undertaken for a period of one year to find out the bacterial etiology of sepsis in IRCU and their antimicrobial susceptibility pattern. Ten ml of blood was collected in 100 ml of tryptic soy broth from all adults admitted in IRCU with clinical suspicion of sepsis. Blood cultures were processed as per standard techniques and all organisms were identified by standard biochemical tests. Antibiotic susceptibility test was performed on Muller Hinton Agar by Kirby Bauer Disc Diffusion method, according to CLSI guidelines. Out of total 169 blood cultures received from IRCU, males compromised 74%. Pulmonary causes comprised 58.15%. Out of 169, 15.98% showed growth, of which Gram negative bacilli (GNB) predominated (77.78%). Amongst GNB, Acinetobacter species was commonest (76.2%). Acinetobacter species showed 93.75% and 100% susceptibility to tigecycline and colistin respectively. Multidrug resistant (MDR)-GNB encountered in this study was 71.4% and carbapenem resistance was 9.5%. All Methicillin Resistant Staphylococcus aureus were 100% susceptible to vancomycin and linezolid. Of the culture positive cases 96.3% were on mechanical ventilation and 7.69% developed Acute Respiratory Distress Syndrome. Mortality amongst culture positive cases was 37.04%. Incidence of MDR Acinetobacter species is increasingly being encountered in patients admitted with sepsis in IRCU. Therefore, prudent use of antibiotics and good infection control practices are advocated.*

Keywords: Sepsis, Gram negative bacilli, Antibiotic susceptibility pattern.

1. Introduction

Sepsis is defined as a systemic inflammatory response syndrome (SIRS) in response to infection, which when associated with acute organ dysfunction, may ultimately cause severe life-threatening complications[1,2]. Sepsis in Intensive Respiratory Care Unit (IRCU) is mainly due to gram negative bacteria, followed by gram positive bacteria with associated risk factors like mechanical ventilation, prolonged duration of stay in hospital, etc. Sepsis is defined as at least two of the following signs and symptoms that are both present and new to the patient with suspicion of new infection: Hyperthermia >38.3°C or Hypothermia <36°C; Tachycardia >90 bpm; Tachypnea >20 bpm; Leukocytosis (>11,000 µL/dl); Leukopenia (<4,000 µL/dl); or >10% bands[2,3]. Therefore, this study was undertaken to find out theincidence and risk factors of sepsis in IRCU in this tertiary care hospital, the etiology of sepsis along with their antibiotic susceptibility pattern.

2. Material and Methods

Ten ml of blood was collected in 100 ml of tryptic soy broth from all adults admitted in IRCU, with clinical suspicion of sepsis. Blood cultures were processed as per standard techniques and all organisms were identified by standard biochemical tests [4]. Antibiotic susceptibility test was performed on Muller Hinton Agar by Kirby Bauer Disc Diffusion method, according to CLSI guidelines.Antibiotic susceptibility testing was performed on Muller Hinton Agar by Kirby Bauer Disc Diffusion method, according to CLSI guidelines [5].

3. Results

A retrospective study was undertaken for a period of one year.Total blood cultures received from IRCU was 169, of which males compromised 74%. Male:Female ratio was 3.6:1. Out of 169, total number of samples showing growth was15.98% (27), contamination was 1.18% (02) and no growth was 82.84% (140). Gram negative bacilli (GNB) predominated (77.78%) and the remaining 22.22% was Gram positive cocci (GPC). Amongst GNB, *Acinetobacter* species was commonest (76.2%), followed by two *Escherichia coli*, one each of *Klebsiellapneumoniae*, *Enterobacter* species and *Pseudomonas aeruginosa*(Fig. 1). Fig.2 shows the antibiotic susceptibility pattern of *Acinetobacter* species. *P. aeruginosa*was susceptibile to amikacin, ciprofloxacin, ceftazidime, imipenem, netilmycin, piperacillin-tazobactam and cefepime. *Enterobacter* species was susceptible only to tigecycline and *K. pneumoniae* only to imipenem.Both the *E. coli* were susceptible to imipenem and tigecycline only. Multidrug resistant (MDR)-GNB encountered in this study was 71.4% and carbapenem resistance seen was 9.5%.

Amongst Gram positive cocci (GPC), Methicillin Resistant *Staphylococcus aureus*(MRSA) was commonest (66.67%),

followed by one each of Methicillin Sensitive *Staphylococcus aureus* (MSSA) and *Enterococcus* species. All MRSA were 100% susceptible to vancomycin and linezolid. One Vancomycin Resistant Enterococcus (VRE) susceptible to linezolid was isolated from an adult male diagnosed with tetanus.

Pulmonary causes comprised 58.15% and the remaining 41.85% were extra pulmonary causes. Table 1 shows the associated risk factors in sepsis in culture positive cases in IRCU. Mortality amongst culture positive cases was 37.04% (10). Amongst the 10 deceased patients, death due to *Acinetobacter* species was commonest (70%), followed by 20% due to MRSA and 10% due to *Pseudomonas aeruginosa*.

Discussion

This study was undertaken as data on cases of sepsis in patients admitted in IRCU in Indian scenario is lacking. In the present study, Gram negative bacilli predominated (77.78%), amongst which *Acinetobacter* species was the commonest (76.2%) (Fig. 1). Gram positive cocci (MRSA, MSSA, *Enterococcus* species) were found in 22.22% of the cases. Mortality in the culture positive cases was 37.04%. In the study conducted by Fernando Zanonet al[6] in 2008, the most frequent pathogens were also Gram negative bacilli (*Escherichia coli, Pseudomonas aeruginosa, Enterobacter* species and *Acinetobacter* species) in 53.2% of the cases, and Gram positive cocci (Coagulase-negative *Staphylococcus* and *Staphylococcus aureus*) in the remaining. Overall ICU mortality rate was 31.1%. The findings of both these studies are in concordance.

In the study conducted by Vincentet al[7] in microbiological culture positive cases, 62% of the positive isolates were Gram negative organisms, 47% were Gram positive and 19% were fungi. However, we did not recover any fungi in the present study. In patients with positive isolates, the most common Gram positive organism was *Staphylococcus aureus* (20%); the commonest Gram negative organisms were *Pseudomonas* species (20%) and *Escherichia coli* (16%). Infected patients in ICU had 25.3% mortality rate. These findings are in accordance with the present study. Mechanical ventilation, central line insertion and longer duration of ICU stay (> 14 days) turned out to be significant risk factors in the present study (Table 1). Mechanical ventilation and longer duration of ICU stay were also the risk factors in the study by Vincent et al[7].

In the study conducted by Todiet al[8], amongst the culture positive patients, the lung was the predominant source of sepsis (57.45%). Gram negative organisms were responsible for 72.45% of cases and Gram positive organisms for 13.13%. Their findings are almost similar to the present study.

In the study conducted by Radji et al[9] in Indonesia, the most common locations for infection were respiratory tract (78.7%), followed by urinary tract(7.6%), surgical site (7.5%), blood (3.8%) and peritoneal fluid (2. 4%).The most predominant isolate was *Pseudomonas aeruginosa*(26.5%), followed by *Klebsiellapneumoniae* (15.3%)and

Staphylococcus epidermidis(14.9%), whereas *Acinetobacterbaumanni* was only 0.4%. This is in contrast with the present study, where *Acinetobacter species* was predominant.

In a study conducted by Wattal et al[10] in New Delhi, Gram negative bacilli (GNB), Grampositivecocci(GPC) and fungi were isolated in 49%, 33%, and 18% cases, respectively. Among GNB, *Klebsiella spp.* was the commonest, followed by *Acinetobacter spp*. High penicillin resistance in Gram positive isolates suggest vancomycin, linezolidandtige cycline as the options for empiric therapy, whereas tigecycline and colistin are the only options remaining for highly resistant Gram negative isolates. Similar to the present study, GNB predominaned in their study and *Acinetobacter spp.* was the second most common microorganism. Antibiotic susceptibility pattern was also in concordance with the present study.

In a study conducted by Rajeevan et al[11] in 2011, among the total Gram positive isolates recovered, *Staphylococcus aureus* was 67%, followed by Coagulase Negative *Staphylococcus spp.* as28%, *Streptococcus pneumoniae, Streptococcus viridians* and *Enterococcus species* 1.6% each. Among *S. aureus*,32.5% were MRSA and 88.2% were MRCONS. All MRSA and MRCONS exhibited 0% resistance to linezolid, teicoplanin and vancomycin. This pattern was similar to the present study. The *Streptococcus pneumoniae* and *Enterococcus species* in their study were sensitive to all antibiotics. In the present study, one VRE was isolated. In their study, among the antibiotics used for Gram negative bacteria, 0% resistance was seen against imipenem and meropenem and *Salmonella Typhi* isolated were sensitive to all antibiotics. In the present study,*S. Typhi* was not isolated.

In the study conducted by Ghadiri et al[12], 8.5% of microorganisms which were isolated from nosocomial BSI patients were *Acinetobacter spp*. The *Acinetobacter spp.* isolates showed highest resistance to cephalothin (81.8%), followed by cotrimoxazole and gentamicin (63.6% each). However, in the present study, the highest resistance rate was to cefepime (100%), followed by ciprofloxacin, piperacillin, cefotaxime and piperacillin tazobactum (93.75% each).

4. Conclusion

Incidence of MDR *Acinetobacter* species is increasingly being encountered in patients admitted in IRCU with sepsis. Therefore, prudent use of antibiotics and good infection control practices are advocated in the IRCU.Regular surveillance of antibiotic susceptibility patterns is very important inpreparing and implementing specific antibiotic usage strategies such ascombination therapy, antibiotic restriction and adherence tostandard antibiotic susceptibility testingto prevent emergence and spread of drug resistance. Such strategies help the clinicians in choosing empirical ordirected therapy of infected patients.

6. Conflict of Interest

None declared.

References

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Table 1: Associated risk factors in sepsis in culture positive cases in IRCU

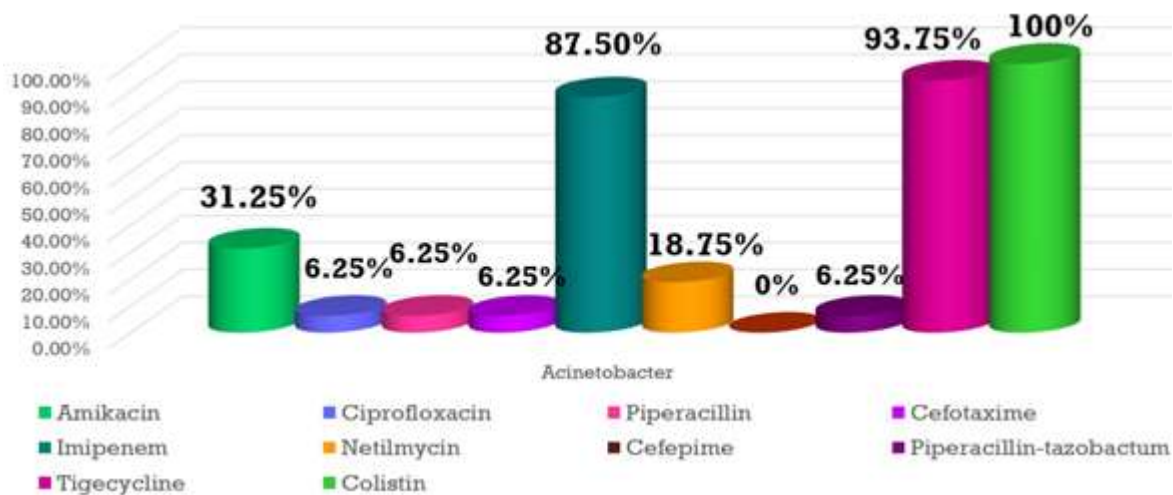| Associated Risk Factors	Number	Percentage
Mechanical ventilation	26 (Two developed ARDS)	96.30
Central line insertion	27	100.00
Duration of hospital stay < 14 days >14 days	00 27	00.00 100.00
Tracheostomy tube	05	18.52
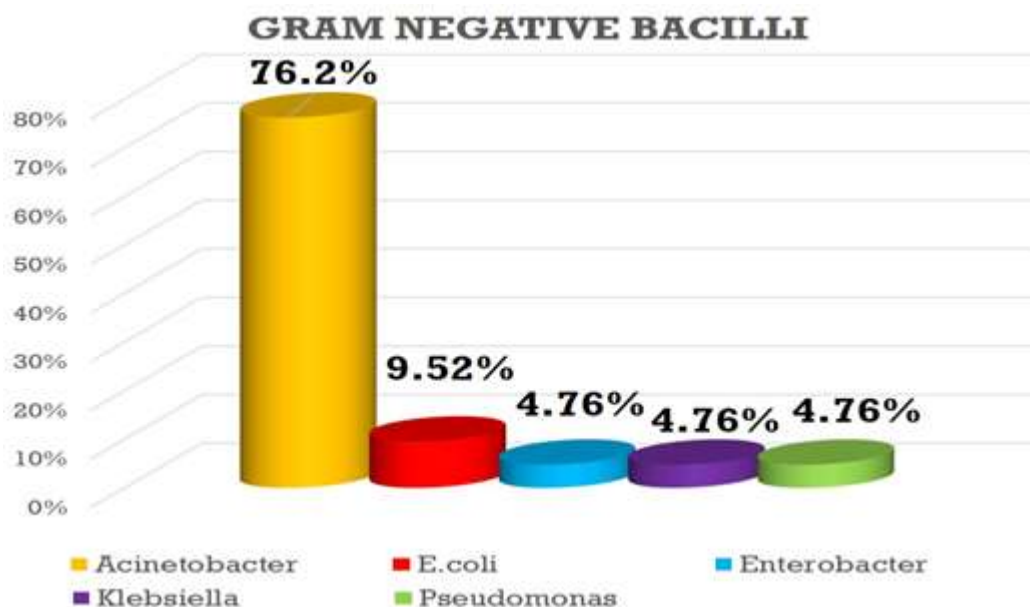
Figure 1: Growth distribution of GNB

Figure 2: Antibiotic susceptibility pattern of Acinetobacter species