Antimicrobial resistance of bacterial pathogens in a Neonatal Intensive Care Unit

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Introduction

With the improvement of health care facilities and development of public awareness, neonatal mortality rate decreased significantly in Bangladesh from 36.8/1,000 live birth in year 2004 to 20/1,000 live birth in year 2015.\(^1\)

However, neonatal sepsis is, still, responsible for 30-50% of total neonatal deaths each year.\(^2\) Globally, around 20% of neonates suffer from sepsis.\(^3\) Since the aim of empirical therapy is to target the infectious microorganism(s), it is essential for every neonatal unit to survey the profile of causative microorganism and their susceptibility in order to ensure effective antimicrobial treatment.\(^3, 4\)

The pathogens causing neonatal sepsis varies overtime and places.\(^3, 4\) Group B Streptococcus and E. coli still contribute to 70-75% of cases of neonatal septicemia in the North America and Europe.\(^4, 5\) Whereas, Gram negative microorganisms remain the major cause of neonatal sepsis, particularly early onset sepsis in most of the developing countries.\(^4, 10\)

Due to inappropriate use of antibiotics which is often seen in some developing countries, resistant microorganisms can grow in the community.\(^11, 12\) So, periodic surveillances are essential to identify antibiotic sensitivity pattern of the common pathogens.\(^15\)

Abstract

The aim of this study was to identify the antimicrobial susceptibility pattern and relevant treatment options in a neonatal intensive care unit from January 2012 and June 2016. Out of the total 78 culture positive samples, Gram positive and Gram negative micro-organisms were 26% and 74% respectively. **Acinetobacter** remained the predominant isolate (32.1%) followed by **Klebsiella** species (18.0%). Most of the Gram positive isolates exhibited higher resistance to penicillin, cephalosporin, macrolides, gentamycin and quinolones. Gram positive isolates had sensitivity of 100% to linezolid, vancomycin, chloramphenicol followed by rifampicin (84%). In comparison to other commonly used antibiotics, sensitivity to these four medicines was statistically significant (p<0.05). Similarly, most of the Gram negative bacteria showed resistance to cephaplorcin, aminoglycosides. About two-third cases showed resistant to meropenum, quinolones and combination preparation of piperacillin and tazobactam. Overall sensitivity among the Gram negative isolates was to polymixin B (100%) and minocycline (97%), followed by colistin (83%). In comparison to other commonly used antibiotics, sensitivity to these three medicines was statistically significant (p<0.05).

Materials and Methods

The study was conducted retrospectively from January 2012 and June 2016. All the cases of positive cultures (n=78) were included in the study and skin commensals, contaminates and fungal pathogens were excluded.

After collection of the sample (2-3 mL of blood for culture, culture of tip of endotrachial tube, culture of aspirate from endotrachial tube) with all aseptic precaution, culture bottles were transported immediately to the Microbiology Laboratory and were processed as per standard microbiological techniques and the isolates were identified.

All positive culture reports were checked, verified and analyzed. The sensitivity and resistance pattern of the various antibiotics against the isolated pathogens were also noted.

The obtained data were statistically analyzed using Fisher’s exact test using an \(r \times c\) exact contingency table. We also used Statistical Package for Social Sciences (SPSS) version 16 for data analysis.
Results

Out of these 78 bacterial isolates, 74% were Gram negative microorganisms, 26% were Gram positive microorganisms. Table I shows overall sensitivity pattern of Gram positive microorganisms. Most of the Gram positive isolates exhibited higher resistance to penicillin, cephalosporin, macrolides, gentamicin and quinolones. Susceptibility to commonly used was found to vancomycin (100%), chloramphenicol (100%), rifampicin (84%) and linezolid (100%). In comparison to other commonly used antibiotics, sensitivity to these four medicines was statistically significant (p<0.05).

Table II showing overall sensitivity pattern of Gram negative organism, Acinetobacter spp. (32.1%) are the commonest microorganisms responsible for infection in neonate followed by Klebsiella species (n=14, 18.0%). Most of the Gram negative bacteria showed resistance to cephalosporin, aminoglycosides; about two-third showed resistant to meropenem, quinolones and combination preparation of piperacillin and tazobactam. Best overall sensitivity among Gram negative isolates was to polymixin B (100%) and minocycline (97%), followed by colistin (83%). In comparison to other commonly used antibiotics, sensitivity to these three medicines was statistically significant (p<0.05).

Surprisingly, sensitivity pattern for Acinetobacter spp. have not been changed significantly over the last four and half years (Figure 1).

Discussion

In the present study, Gram negative organisms were responsible for majority cases of neonatal sepsis about 74% and only 26% septic cases were by...
Gram positive organisms. A recent study conducted by Muley et al. (2015) in India reported 70.8% neonatal septicemia cases caused by Gram negative isolates. Almost similar results were reported by Pooja et al. (2015) where Gram negative and Gram positive organisms were isolated in 79.9% and 18.2% cases respectively. Karlowicz et al. (2000) reported that Gram positive organisms caused 73% of bacterial sepsis but highest mortality rate was observed in Gram negative septic cases. Geographical variations are observed among the pathogens causing neonatal sepsis. Recently, Gram negative organisms like Acinetobacter, Klebsiella, Escherichia coli and Pseudomonas are commonly isolated. Of the Gram positive organisms, Staphylococcus aureus, coagulase negative Staphylococcus, Streptococcus pneumonia and S. pyogenes are most commonly isolated. In this study, we found Acinetobacter remained the predominant isolate (32.1%) followed by Klebsiella species (18.0%) implicated in neonatal sepsis. Sharma et al. (2013) and Shah et al. (2012) reported coagulase negative Staphylococcus as mainly responsible for neonatal sepsis and were sensitive to vancomycin only. We found coagulase negative Staphylococcus were 100% sensitive to linezolid, vancomycin and chloramphenicol.

The present study shows that most of the Gram negative organisms were resistant to commonly used antibiotics like aminoglycosides and cephalosporin. About two-third cases showed resistant to meropenem, quinolones and combination preparation of piperacillin and tazobactam. Similar association had also been found in many other studies. According to Pitout et al. (1998), Gram negative organisms can produce extended spectrum beta-lactamases which is responsible for this multidrug resistance pattern.

In this study, among the Gram negative isolates, maximum sensitivity was observed to polymyxin B (100%) and minocycline (97%), followed by colistin (83%). In comparison to other commonly used antibiotics, sensitivity to these three medicines was statistically significant (p<0.05). Mustafa and Ahmed (2014) reported higher sensitivity to imipenem and linezolid which were statistically significant (p<0.05), but they recommended not to use these medicines indiscriminately to prevent resistance to these drugs may develop. Although multidrug resistance is a burning issue now-a-day and its severity is increasing day by day. Surprisingly, in this study it was found that antibiotic sensitivity pattern for Acinetobacter spp. have not been changed significantly over the last four and half years.

**Conclusion**

Gram negative organisms specially Acinetobacter and Klebsiella were commonly responsible for the neonatal sepsis. Organisms were resistant to most of the commonly used antibiotics. Gram negative organisms were commonly sensitive to polymyxin B, minocycline and colistin. Gram positive organisms were commonly sensitive to vancomycin, chloramphenicol, rifampicin and linezolid.

**Ethical Issue**

Approval for the study was taken from the ethical committee of the hospital.

**References**