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Bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern ofisolates admitted in Neonatal Unit of Ashwini Sahakari Rugnalaya, Solapur

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I. Introduction

Neonatal sepsis is a clinical syndrome (sepsis neonatorum) resulting from the pathophysiologic effects of local or systemic infection .Bloodstream infections pose a major challenge to neonatal intensive care units worldwide . It affects newborns below 1 month of age and encompasses systemic infections including meningitis , pneumonia , arthritis , osteomyelitis and urinary tract infections [1, 2]. Neonates are immune- compromised and defend weakly to bacterial infections.

The bacterial agents associated with neonatal sepsis are Group B Streptococci , Escherichia coli, Listeria monocytogenes , coagulase -negative Staphylococci (CoNS),Staphylococcus aureus , Enterococci , Klebsiella spp ., Enterobacter spp ., Pseudomonas spp ., Salmonella spp .,H. influenzae, Neisseria meningitidis, and Streptococcus pneumoniae [3–5].

In developing countries , unsafe birthing practices have critical role to cause neonatal infections . Globally , the neonatal morbidity and mortality cases have been estimated to 2.5–3 million , annually [6].

Neonatal mortality rate (NMR) distribution disparities can be seen based on socioeconomic , educational and geographical parameters . In India , neonatal mortality has been found due to septicemia and emergence of drug resistant bacteria.

According to Nepal Demographic and Health Survey (2011), 85% of total death is accounted to neonatal sepsis which is higher than previous surveys, 70% in 2006 and 69% in 2001 [7].

NMR is higher in rural areas (34 deaths per 1000 live births) than in urban areas (23 deaths per 1000 live births). Currently , emergence of multidrug resistant bacteria imposes challenges in treatment of neonatal sepsis [8, 9].

Therefore, the knowledge of prevalence of local isolates and their antimicrobial sensitivity pattern is of utmost necessary for prompt antimicrobial therapy of neonatal sepsis. The most predisposing factors of infection in neonates are premature birth and low birth weight. Preterm neonates have 3 to tenfold higher incidence of infections than full term normal birth weight infants [6].

The causative organism varies due to geographical area. Neonates have high chance to acquire large proportion of vaginal Gram-negative bacteria [8].

Apart from prematurity, prolonged duration of parenteral alimentation with delayed enteral nutrition, intravascular catheterization, extended respiratory support on ventilators, gastrointestinal surgery, and use of broad spectrum antibiotics are recognized risk factors for neonatal infections [10].

Comparable decrease in the rates of LOS in preterm VLBW infants were noted in 669 North American Hospitals in the Vermont Oxford Network , with rates of LOS decreasing from 21% in 2000 to 15% by 2009 [11]. A similar analysis of LOS in pre- term infants born at <32 weeks gestation in 29 NICUs in the Canadian Neonatal Network showed that 15% of infants developed LOS, with 80% of these infection being gram-positive, chiefly CONS [12].

The most common NI in NICUs are bloodstream infections, often catheter -related (central line associated bloodstream infection, CLABSI), followed by Ventilator- Associated Pneumonias (VAP), surgical site infections and less frequently catheter associated urinary tract infections, and ventricular shunt infections. Skin and soft tissue infections may also be hospital acquired in newborn infants [13].

Bloodstream infections (BSI) pose a major challenge to neonatal intensive care units (NICU) worldwide.In high-income countries, BSI rates of up to 24% are reported among very low- birthweight infants(1500g).(14,15) Rates of BSI are poorly quantified in low-middle-income country NICU, with additional challenges of human and physical resource limitation and may be at least double that of high-income settings.[16]

Emergence of MDR organisms is a global phenomenon, but the implications are more serious for low–middle-income country neonatal units with limited access to newer classes of antibiotic.High rates of MDR gram-negative bacilli have been reported from a single neonatal and pediatric intensive care unit in
South Africa, with ESBL rates .50% for Klebsiella spp. and rates of Acinetobacter spp. resistant to piperacillin/tazobactam and carbapenems reported to be 53% and 57%, respectively.[17]

A recent article from South African NICU is about drug-resistant organisms, increasing gram- negative isolates and antibiotic therapy.[18]

Studies from other low–middle-income countries also report concern about ESBL-producers and MRSA in their NICU. Candida spp BSI rates (ranging from 4.4 to 6.8%) are lower than those reported from high-income countries.[19,20]

Infection rates are standard indicators of quality and safety in all healthcare settings all over the world [21]. The challenge of infection control policies and procedures is always to decrease the frequency of healthcare-associated infections (HAI). Consequently determining infection rates through a surveillance program is central step in both identifying problems and evaluating the implementation of any programme[22].

Healthcare-associated infections are associated with increased morbidity, mortality, and economic burden (either direct or indirect) [23].

The underdeveloped epidermis and frequent breeches in skin integrity due to intravenous catheters, blood draws and heel sticks place preterm neonates at risk of infection [24].

An increased incidence of S. aureus and A. baumannii infection and a decreased number of CoNS infections were observed. In another recent study, of blood stream infections, 59% were caused by CoNS[25].

On the other hand, Ho et al. [26]concluded that BSIs and skin/soft tissue infections caused by commensal species play important roles in healthcare-associated infections in the NICU.

Candida infections are a common cause Of late-onset sepsis in the NICU and a reassociated with significant mortality and neurodevelopmental impairment [27].

One of the most important reasons in managing candidial infection in our NICU is the use of prophylactic fluconazole in very-low-birth-weight infants to prevent invasive candidiasis. The rationale for this strategy is to prevent fungal colonization in high-risk infants and reduce the invasiveness of the disease (28].

Neonatal sepsis is a significant cause of morbidity and mortality among neonates worldwide [29,30].

World Health Organization has estimated that 1.6 million deaths occur globally every year due to neonatal infections and 40% of all neonatal deaths occur in developing countries [31].

The overall improvement in the neonatal survival due to newer drugs, better neonatal care and advanced life support facilities has led to a change in the spectrum of agents causing neonatal sepsis in developed countries [32].

However, there is a paucity of data on the recent trends of organisms causing neonatal sepsis in developing countries [33].

As delay in the treatment of neonatal sepsis is associated with increased mortality, empirical therapy is the corner- stone in the management of neonatal sepsis. A combination of ampicillin or third generation cephalosporins with an aminoglycoside (gentamicin) is the commonly used empirical regimen [30,34].
However, the appropriateness of this empirical therapy is being challenged in the present era of changing bacteriological profile and increasing antimicro- bial resistance. Knowledge of common organisms causing neonatal sepsis in a particular area and their antibiotic sensitivity pattern should be borne in mind before setting guidelines for empirical therapy.

What is a blood culture?
A blood culture is a laboratory test in which blood, taken from the patient, is inoculated into bottles containing culture media to determine whether infection-causing microorganisms (bacteria or fungi) are present in the patient's bloodstream.

Blood cultures are intended to:
- Confirm the presence of microorganisms in the bloodstream
- Identify the microbial etiology of the bloodstream infection
- Help determine the source of infection (e.g., endocarditis)
- Provide an organism for susceptibility testing and optimization of antimicrobial therapy

3 MAIN AIMS OF BLOOD CULTURE*:
- Confirm infectious etiology
- Identify the etiological agent
- Guide antimicrobial therapy

Why are blood cultures important?
Blood culture is the most widely used diagnostic tool for the detection of bacteremia and fungemia. It is the most important way to diagnose the etiology of bloodstream infections and sepsis and has major implications for the treatment of those patients.

A positive blood culture either establishes or confirms that there is an infectious etiology for the patient's illness (35). A positive blood culture also provides the etiologic agent for antimicrobial susceptibility testing, enabling optimization of antibiotic therapy (35)

Sepsis is one of the most significant challenges in critical care, and early diagnosis is one of the most decisive factors in determining patient outcome. Early identification of pathogens in the blood can be a crucial step in assuring appropriate therapy, and beginning effective antibiotic therapy as early as possible can have a significant impact on the outcome of the disease. (36,37)

Providing adequate antibiotic therapy withinthe first 24-48 hours leads to:
- Decreased infection-related mortality (20-30%)
- Earlier recovery and shorter length of hospital stay
- Less risk of adverse effects
- Reduced risk of antimicrobial resistance
- Cost reduction (length of stay, therapy, diagnostic testing)

When should a blood culture be performed?
Blood cultures should always be requested when a bloodstream infection orsepsis is suspected.

Clinical symptoms in a patient which may lead to a suspicion of a bloodstream infection are:
- undetermined fever (≥38°C) or hypothermia (≤36°C)
- Shock,
- severe local infections (meningitis, endocarditis, pneumonia, pyelonephritis,intra-abdominal suppuration).
- abnormally raised heart rate
- low or raised blood pressure
- raised respiratory rate

Blood cultures should be collected:

- as soon as possible after the onset of clinical symptoms;
- ideally, prior to the administration of antimicrobial therapy(38).

If the patient is already on antimicrobial therapy, recovery of micro- organisms may be increased by collecting the blood sample immediately before administering the next dose and by inoculating the blood into bottles containing specialized antimicrobial neutralization media.

Healthcare-associated infections in the neonatal intensive care units (NICUs) are affected by many factors as endemic microbial flora, clinical techniques, and antibiotic stewardship policies. Consequently, neonatal infections became more than a challenge for pediatricians [39]. Blood stream infections (BSIs) caused by commensal species play important roles in nosocomial infections in the NICU, which poses difficulties in determining true pathogens from contaminants [40]. It also served as the single most important type of infection because of their high frequency(59%) and potential life-threatening consequences [41].

Monitoring neonatal infections is increasingly regarded as an important contributor to safe and high-quality health-care [42]. However, only few studies described BSIs in Indian NICUs. The objectives of this study were to determine the incidence and the pattern of BSIs in the NICU of Suez Canal University Hospital, Ismailia, Egypt, and to determine its impact on hospitalization, mortality, and morbidity among those critical age group patient

II. Methods

Study setting

Ashwini Sahakari Rugnalaya , Solapur provides tertiary medical services in Solapur district and is one of the well known neonates and children's hospital in Maharashtra. The NICU consists of 25 (combined medical and surgical) beds with an average occupancy rate in excess of 80%.

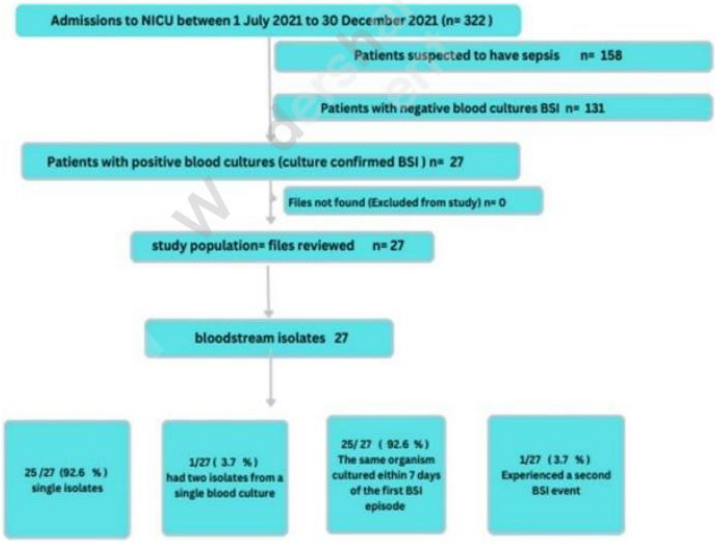
Respiratory support (including conventional and high-frequency oscillation ventilation, surfactant therapy and nitric oxide but not extracorporeal membrane oxygenation), together with intensive circulatory monitoring and parenteral nutrition are offered. Strict admission criterias are applied, with only the most critically ill patients being accepted for NICU admission.

A total of 525 infants were born at Ashwini Sahakari Rugnalaya and Shobha Nursing Home , Solapur, with a high rate (59 %) of low birthweight (LBW, ,2500 g) infants.

Study design and selection of study population

A retrospective study was undertaken which included any patient admitted to the NICU of with a positive blood culture at any stage during NICU admission. Microbiological data were extracted from the National Health Laboratory Services (NHLS) database and clinical data were retrieved from hospital records. The names and hospital numbers of all patients recorded in the NICU admission log book were used to search the laboratory database. All bacterial and/or fungal cultures requested during the study period were included. Hospital records of patients with a positive blood culture during their NICU stay were reviewed using a standardized data-capture sheet. Basic demographics, possible risk factors for BSI, clinical data relating to the event(s), blood culture results, susceptibility patterns, antibiotic usage before the event, and morbidity and mortality data were collected.

FIG 1 Study design flow chart:



Study definitions

Bloodstream infection*:* Any fungal or bacterial isolate from a blood culture specimen collected on admission to or at any point during NICU admission. An additional BSI event was defined as a different pathogen cultured at a secondary time point during NICU admission or isolation of the same pathogen on a blood culture taken more than 7 days after the original sample.

Minimum Inhibitory Concentration (MIC)
The MIC is defined as the lowest drug concentration that inhibits visible growth of a micro-organism after a certain incubation period.

Inborn
Inborn refers to those newborns delivered at Ashwini Sahakari Rugnalaya and ShobhaNursing Home , Solapur.

Outborn
Outborn refers to those patients which are not delivered at Ashwini Sahakari Rugnalaya and Shobha Nursing Home , Solapur , and referred here for further management.

Laboratory Methods

For each neonate, two blood samples per patient (1 mL each) were drawn under sterile conditions at least 30 min apart from each other. All blood cultures were processed by the Microbiology Laboratory, Ashwini Sahakari Rugnalaya , Solapur .

Culture Method
Blood is collected aseptically in Pediatric bottle, labeled. Immediately after receiving ,the bottle is entered into the BACT/ALERT system after giving the lab ID (Refer work instruction of BACTALERT).
If a bottle flags positive pull out the positive bottle. Smear is taken and informed to the concerned doctor and preliminary report sent. If the smear shows Gram negative Bacilli, then subcultured on blood Agar, Mac Conkey Agar and Chocolate Agar. If the smear shows Gram positive cocci in clusters subcultured, on blood Agar and Mac Conkey Agar .If the smear shows Gram positive cocci in chains or Gram positive Bacilli subcultured on blood Agar and Mac Conkey Agar . If the smear shows budding yeast cells subcultured on blood Agar and saboraud's dextrose Agar.If it is false positive,bottle is kept back into the incubator within 3 hours on the same slot. If the bottle is negative on 4th day , the preliminary negative report, sent
.If negative on the 7th day, the final negative repor is sentt. For patients with endocarditis give 14 days protocol. If the bottle is negative on the 4th day send the preliminary negative report and the final after 14 days. Reportable interval of examination results. Preliminary negative report on 4th day. Final negative report on 7th day, for Infective Endocarditis patients after 14 days.For culture positive samples final report, 48-72hrs after the bottle flags positive.
Interpretation of result based on growth and gram smear report. If growth is noted, proceed with Identification

and sensitivity.

Susceptibility Testing

The antibiotic susceptibility for isolated pathogens was determined on Muller Hinton (oxoid) by Kirby-Bauer disk diffusion method and interpreted according to the National Committee for Clinical Laboratory Standards breakpoint values..

Ethical approval

Approval for the study was obtained from the Human Research Ethics Committee of Ashwini Rural Medical College, Solapur . Waiver of informed consent was granted.

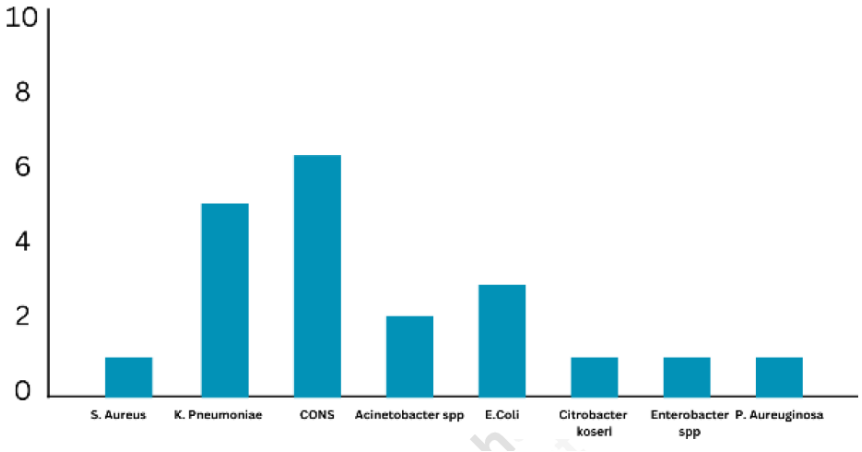
Statistical analysis

Data were entered onto an Excel spreadsheet and summarized using descriptive data analyses with SPSS , version 20.0 . Categorical and continuous variables and frequency tables were obtained
.

III. Results

A total of 322 infants were admitted to the NICU in period of July 2021 to Dec 2021. Blood cultures were obtained on admission or during the NICU stay in 158 (49 %) patients. Culture-confirmed BSI was diagnosed in 27 (17 %)patients and medical records were available for all 27 infants (100 %) infants.

Fig 2 Bacteriological profile of neonatal sepsis from suspected cases



Out of 158 blood samples, 27 samples showed growth of organism and 131 samples did not show any microbial growth. The incidence of neonatal sepsis was 17.08 % among 158 blood samples enrolled in this study. Among positive cases, the bacteriological profile showed 10 (37%) were Gram-positive cocci and 13 (48 %) were Gram-negative bacilli and fungal isolates were 4 (14.8 %) . The highest bacterial strains isolated were CONS 6(22.2 %) followed by K. pneumoniae 5 (18.5%) ,E. Coli 3 (11.11%) Acinetobacter spp.

2 (7.4 %), Enterobacter spp. 1 (3.7 %), P. aeruginosa 1 (3.7 %), and Citrobacter spp.1 (3.7 %), (Fig. 2). The highest prevalence (52.3%) of positive blood culture was found in the male neonates. . In relation to diferent neonatal risk factors, positive blood culture showed the highest prevalence of bacterial growth in neonatal cases with 3 or above 3 days age (71.2%); low birth weight (62.7%); preterm gestational age (31.4%); and caesarean mode of delivery (63.3%).

Table 1

Organism	No of isolates (%
Gran-negative isolates	**13 (48 %)**
Acinetobacter baumannii	2 (7.4 %)

Klebsiella pneumoniae	5 (18.5 %)
Escherichia coli	3 (11.11 %)
Pseudomonas aeruginosa	1 (3.7 %)
Enterobacter cloacae	1 (3.7%)
Citrobacter Koseri	1 (3.7 %)
Gram-positive isolates	**10 (37 %)**
CoNS	6 (22.2 %)
MRSA	1 (3.7 %)
Staphylococcus saprophyticus	1 (3.7 %)
Staphylococcus epidermidis	1 (3.7 %)
Streptococcus pneumoniae	0
Enterococcus faecalis	1 (3.7 %)
Fungal isolates	**4 (14.8 %)**
Candida albicans	1 (3.7 %)
Candida tropicalis	2 (7.4 %)
Candida utilis	1 (3.7 %)

FIG 3

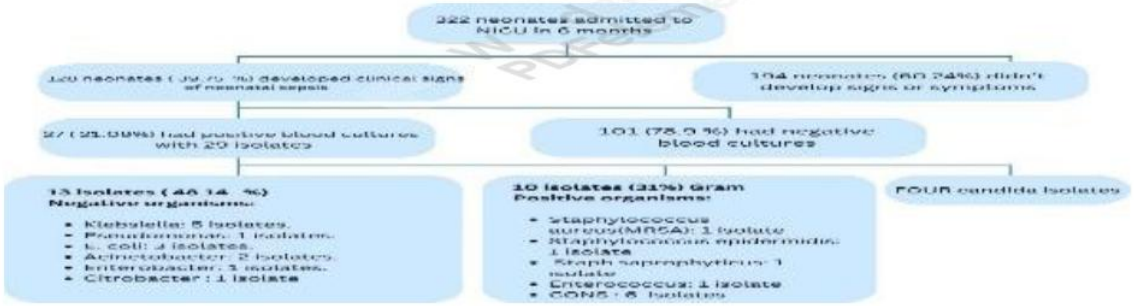


Table 2

Single BSI event blood sample	Second BSI event	Two or more isolates from a single
25 (92.6 %)	1 (3.7 %)	1 (3.7 %)

Table 2 describes the characteristics of the study population (n 27). Among the 27 infants with BSI episodes, a total of 29 isolates were obtained: 25/27 (92.6%) were single isolates, 1/27 (3.7%) had two organisms isolated from a single blood culture, 1/27 (3.7 %) had a second organism cultured within a week of the first BSI episode and a third BSI event is not observed (0%) Of the 27 isolates, 66 (84.6%) represent blood cultures obtained more than 48 hours after birth or hospitalization.

Table 3
Antimicrobial susceptibility for all isolates

Gram-negative isolates	n 27	Penicillin S/R	Piperacillin - tazobactam S/R	Gentamicin S/R	Amikacin S/R	Ceftriaxone S/R	Carbapenem S/R	Colistin S/R	Vancomycin S/R	Fluconazole S/R
Gran-negative isolates										
Acinetobacter baumannii	2	0/2	1/1	2/0	2/0	1/1	2/0	2/0	2/0	-
Klebsiella pneumoniae	5	1/4	4/1	1/4	4/1	2/3	5/0	5/0	2/3	-
Escherichia coli	3	0/3	3/0	3/0	3/0	2/1	3/0	3/0	3/0	-
Pseudomonas aeruginosa	1	0/1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	-
Enterobacter cloacae	1	0/1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	-
Citrobacter Koseri	1	1/0								
Gram-positive isolates 6/0										
CoNS	6	2/4	5/1	6/0	6/0	4/2	5/1	6/0	1/0	-
MRSA	1	0/1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	-
Staph Epidermidis	1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	-
Staph saprophyticus	1	0/1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	-
Enterococcus faecalis	1	0/1	1/0	0/1	1/0	1/0	1/0	1/0	1/0	-
Fungal isolates										
Candida albicans	1									1/0
Candida tropicalis	1									1/0
Candida utilis	2									2/0

Table 3 provides a summary of the BSI isolates and their drug susceptibility patterns. Therewere only 3

(11.11 %) Escherichia coli isolates, both susceptible to first-line antibiotics. Of the 5 Klebsiella pneumoniae isolates, 3 (60%) were ESBL-producers. All the MRSA isolates were vancomycin- susceptible and all Candida spp isolated were fluconazole-susceptible.

TABLE-4

Characteristics	Number (%)
Gender	
Male	16 (59.25 %)
Female	11 (40.74 %)
Birth weight	
<1000 gm.	3 (11.11 %)
1000 gm–<1500 gm	6 (22.22 %)
1500–2500 gm	12 (44.44 %)
>2500 gm	6 (22.22 %)
Discharge status	
Alive	22 (81.4 %)
Died	5 (18.5 %)

It is observed that male newborns are more susceptible to sepsis.Also low birth weight, VLBW, ELBW babies have been found more prone to infection. VLBW and ELBW babies who had culture positive sepsis, have higher mortality rates than those of normal weight babies

Table 5

Risk factor	No of isolates	Percentage (%)
Maternal		
Pre eclampsia/ PIH	5	18.5 %
Maternal diabetes	1	3.7 %
PROM	1	3.7 %
Maternal feto Rh incompatibility	1	3.7 %
Multiple PV examinations	6	22.22 %
Meconeun Stained Liquor	4	14.81 %
Neonatal		
Low birth weight	8	29.6 %
Prematurity	13	48.14 %
Maternal + Neonatal	19	79.16 %
Iatrogenic		
Invasive procedures	12	44.44 %
Presence of foreign material ET tube/catheter	5	18.5 %
Maternal+Neonatal+Iatrogenic	24	88.8 %
No any risk factor	3	11.11 %

Multiple PV examinations , previous abortions history and meconium stained liquor are found to be be potential maternal factors to develop sepsis in newborns .Low birth weight and prematurity contributes to neonatal factors for sepsis.Neonate who underwent Intubation, PICC line insertion, Ventilation with bipap or ventilator, are found to be more prone for sepsis
.Maternal and neonatal risk factors collectively contributes to 79% of all neonatal sepsis at our hospital.

IV. Discussion

This study aims to report BSI prevalence, the spectrum of pathogens and antimicrobial resistance patterns in an NICU in the Ashwini Sahakari Rugnalaya , Solapur. LBW is a known risk factor for neonatal infection and, in our setting. BSI prevalence rate reported from our NICU (8.3 %) is not unexpected. In addition, given the low yield of neonatal blood cultures, the true prevalence of BSI in our NICU is likely to be much higher.Gram-negative organisms were the predominant group of pathogens responsible for significant BSI events. Although CoNS were the most commonly cultured bacteria overall, they were seldom responsible for significant BSI episodes, and it is more likely that they represented blood culture contamination and/or skincolonization.The degree of antibiotic resistance of BSI isolates in the NICU is concerning. All S. aureus isolates inour study group were methicillin-resistant. The high rate of ESBL-producing

K. pneumoniae and multi-resistant Acinetobacter baumannii isolates high-lights the need for continuous antibiotic stewardship and intensified infection prevention and control (IPC) interventions. Antibiotic stewardship should focus on encouraging selection of appropriate agents, timely discontinuation of therapy where possible and prompt de-escalation of antibiotic therapy. De-escalation implies the changing of empiric, broad-spectrum antibiotics to a narrower spectrum antibiotic (guided by isolate sensitivity) in order to reduce emergence of antibiotic resistance. The success of such interventions needs to be assessed continuously, with findings and recommendations regularly communicated to the NICU clinicians. The overwhelming majority of BSI isolates reflect healthcare-associated infections (HAI), which indicates the need for critical review of the IPC measures implemented and compliance with these strategies in the NICU. Regular feedback from the hospital's unit for IPC as well as support of the NICU clinicians by the Department of Microbiology will be important in achieving reduction of HAI rates in the NICU. It was reassuring that a large proportion of events were not preceded by any antibiotic use. Almost 55 % of BSI events were preceded by empiric prescription of first-line therapy with penicillin G and gentamicin. Overuse of cephalosporins is an often-quoted risk factor for development of ESBL-producing gram-negative BSI. However, in our NICU, a minority of patients received a cephalosporin before developing BSI, mostly infants transferred from primary and secondary hospitals. Measures to expand access to alternative antibiotic classes in such settings, together with antimicrobial stewardship interventions, might help to reduce the emergence of resistant bacteria. The use of fluconazole prophylaxis in NICU patients remains controversial and many clinicians believe that this practice may lead to

emergence of resistant strains, although this phenomenon has not been proven. In our NICU (which does not routinely use fluconazole prophylaxis), all Candida spp cultured were susceptibleto fluconazole.

The study had several limitations. Retrospective, laboratory-based surveillance targeting only culture-confirmed episodes of BSI was undertaken. Prospective clinical surveillance achieves far superior detection of HAI, but was not feasible for the purposes of this study. Accurate identification of the final cause of death among patients with BSI was also complicated by the retrospective study design. In addition, the sample size was small and patients who received a blood culture before admission to the NICU were not included in the study, selecting for possible bias. Prior antibiotic use and the lack of obtaining a good volume for blood culture specimens might have contributed to a lower positive yield. Faulty collection techniques might have contributed to the high proportion of gram-positive organisms that were associated with clinically non-significant BSI events. All these factors may explain the relatively low rate of significant BSIs that was seen compared with other low-middle income countries. Since all infants with suspected sepsis are routinely cultured prior to initiation of antibiotic treatment, the disease profile should be representative of the true disease spectrum encountered. The small sample size also made comparative analysis very difficult. The study tried to distinguish significant pathogens from colonizing pathogens, though delineating these was Problematic.

The high mortality rate in patients with BSI (although often associated with prematurity, VLBW, and other comorbid conditions is of concern. The high mortality rate is also partly because of the large drainage area for NICU referrals (with delayed transfer of ill infants) and the limited availability of NICU beds (which restricts admission to only the most critically ill patients). NICUs, to produce data on unique isolate profiles, resistance patterns and the risk factors whichneed to be addressed. Without this institution-specific information it will be difficult to formulate appropriate antibiotic protocols, antibiotic stewardship interventions and IPC measures and to move away from outbreak-reporting to development of continuous surveillance programmes.

The antibiotic susceptibility pattern of bacterial isolates from blood culture showed the maximum susceptibility towards amikacin, gentamicin, ciprofloxacin, and ofloxacin. However, the isolates showed the higher resistivity pattern towards ampicillin and amoxycillin. The most effective antibiotics against predominant isolates S. aureus and other CoNS isolates were amikacin, gentamicin.. For K. pneumoniae and other Gram-negative strains, meropenem, imipenem, amikacin, gentamicin, ciprofoxacin, and ofoxacin were drug of choice for treatment of neonatal sepsis. The antibiotic sensitivity test of bacterial strains isolated from this study provides insight for selection of appropriate drugs for further control of neonatal mortality rate. Ampicillin and amoxycillin which have been revealed as inefective drugs might be due to emergence of antimicrobial genes in bacteria and inappropriate use of antibiotics prior to hospitalization of neonatal cases [8].

V. Conclusions

The blood culture positivity rate was 8.38 %. This study showed the high prevalence of CONS as Gram-positive bacteria and K. pneumoniae as Gram-negative bacteria among suspected neonatal cases. Overall isolates showed maximum sensitivity towards aminoglycosides and quinolones whereas minimum sensitivity towards penicillin. In India, emergence of antibiotic resistance among bacterial isolates from neonatal sepsis is a major cause for treatment failure, higher morbidity and mortality . Proper antibiotic guidelines and its effective implementation could be milestones for revolution in the field of antibiotic resistance control . The epidemiology of neonatal sepsis , causative risk factors and antibiotic resistance pattern of pathogens may be used to develop guidelines for management of neonatal sepsis.

CONS was the commonest agent causing both early-onset and late-onset sepsis followed by Klebsiella pneumonae . Adequate care of the low birth weight babies is of utmost importance to prevent infection by Klebsiella pneumoniae .Amikacin should be used along with third-generation cephalosporins for empirical treatment of gram-negative neonatal sepsis. This empirical regimen should be modified later based on the antibiogram of the isolates.

Nosocomial or hospital acquired infections threaten the survival and neurodevelopmental outcomes of infants admitted to the neonatal intensive care unit , and increase cost of care . Premature infants are particularly vulnerable since they often undergo invasive procedures and are dependent on central catheters to deliver nutrition and on ventilators for respiratory support . Prevention of nosocomial infection is a critical patient safety imperative, and invariably requires a multidisciplinary approach . Hand hygiene before and after patient contact is the most important measure, and yet, compliance with this simple measure can be unsatisfactory. Alcohol based hand sanitizer is effective against many microorganisms and is efficient, compared to plain or antiseptic containing soaps.

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