

Original Article

Mapping of Bacterial Landscape of Neonatal Septicaemia, Tripoli-Libya

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ABSTRACT

Purpose: The objective of this study is to investigate the distribution and types of bacteria causing septicemia in newborns at Aljala Hospital in Tripoli, aiming to enhance understanding for better prevention and treatment of neonatal sepsis

Method: This retrospective study gathered data from newborns with sepsis at Aljala Hospital in Tripoli, Libya, from 2014 to 2023. It focused on various factors, including the type of delivery, the causes of sepsis, and the types of microorganisms involved in the infections.

Results The findings reveal a concerning predominance of Gram-negative bacteria, which constitute 63% of the identified pathogens, compared to 37% of Gram-positive bacteria. Notably, *Staphylococcus aureus* and *Escherichia coli* emerged as the most prevalent bacterial species associated with neonatal septicemia.

Conclusion:

This research underscores the urgent need for enhanced infection control measures and targeted therapeutic strategies to mitigate the impact of neonatal sepsis in such vulnerable populations.

Keywords: Newborn, Septicemia, Bacteria, Gram Negative, EOS, LOS and Libya

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INTRODUCTION:

Neonatal sepsis is a serious medical condition, characterized by systemic signs of infection and bacteremia in the first month of life⁽¹⁾. That arises from the bacterial, viral or fungal infections, associated with hemodynamic changes and clinical finding. Although, neonatal sepsis considered a momentous cause of mortality and morbidity at the neonatal intensive care unit, and an important cause of long hospitalization time, Although, Precise estimates of neonatal sepsis burden vary by setting. Differing estimates of disease burden have been reported from high-income countries equated with low-income and middle-income countries⁽²⁾. Nevertheless, according to the world health organization (WHO), 130 million neonates are born every year. Of those infants, about eight million do not survive till their first birthday, and more than ten million die before the age of five. Each year four million neonates die during the first month of life. Developing countries such as Egypt account for the majority of reported worldwide neonatal deaths. Neonatal infections are currently the reason for about 1.6 million deaths per year in the developing world, and the first cause of newborn mortality is infection^(3, 4). Despite major advances in neonatal care and increasing research, in developed countries, four of every ten infants with sepsis die or experience main disability including significant permanent neurodevelopmental impairment⁽⁵⁾. However, a newborn who has an infection and develops sepsis can have inflammation throughout their body. Although, this inflammation and blood clotting causes reduced blood flow to baby's limbs and vital organs. It can lead to multi-organs failure and even death. The clinical manifestations of newborn infections vary and include sub-clinical infection, mild to severe manifestations of focal or systemic infection, and, occasionally, congenital syndromes resulting from in utero infection. The timing of exposure, inoculum size, immune status, and virulence of the pathological agent could influence the expression of disease⁽⁶⁾. Healthcare providers classify neonatal

sepsis into two categories based on the age of onset [54], Early-onset neonatal sepsis (EOS) that develops within the first 72 hours of life and Late-onset neonatal sepsis, as sepsis develops after three days of life. 1.5.1.2 Late-onset sepsis (LOS): usually occurs via the transmission of pathogens from the surrounding environment after delivery, such as contact from healthcare workers or caregivers. A percentage of LOS may also be caused by a late manifestation of vertically transmitted infection. Infants requiring intravascular catheter insertion, or other invasive procedures that disrupt the mucosa, are at increased risk for developing LOS [63] Early neonatal sepsis (EOS) affects a significant number of newborns, and is associated with increasing morbidity and mortality rates in the first week of life. Around the world, it is estimated that the infection is responsible for 27.5% of neonatal deaths, Bacterial infections are the most common cause of sepsis in newborns. generally, identifies Group B *Streptococcus* (GBS) and *E. coli* as the dominant EOS pathogens and coagulase negative *staphylococci* (CONS) as the dominant LOS pathogen followed by GBS and *Staph aureus*. In developing countries, overall, Gram negative organisms are more common and are mainly represented by *Klebsiella*, *E. coli* and *Pseudomonas*. Of the Gram-positive organisms, *Staph aureus*, *Streptococcus pneumoniae*, and *Streptococcus pyogenes* are most commonly isolated. Agents that commonly cause nosocomial infection are coagulase negative *staphylococci*, gram-negative bacilli (*E. coli*, *Klebsiella pneumoniae*, *Salmonella*, *Enterobacter*, *Citrobacter*, *Pseudomonas aeruginosa*, *Serratia*), *Enterococci*, and *S. aureus*⁽⁷⁾. This study principally designed to study distribution of bacteria causing newborns septicemia in Tripoli at Aljala hospital and also to investigate the predominant types of bacteria causing sepsis which might improve the perceptiveness of health care providing in regards of preventions and treatment of such neonatal sepsis.

METHODS AND MATERIA:

This study is a retrospective study designed to collect data from newborns patients’ files who had have sepsis at Aljala hospital, Tripoli-Libya. from 2014 to 2023, the patient record contains (Year of the file, age, Gender, Pathological conditions of the mother, Type of delivery, causes of sepsis, types of micro-organisms, onset of sepsis, duration of treatment in hospital, overall course of treatment and complications). Statistics All outputs were produced using EXCEL. All variables were described by number and/or percentage.

RESULTS:

Out of a total of 350 cases involved in this study, 185 (52%) cases were male and 192, (48%) cases were female, however, this study revealing that 75 (22%) of the study participants had culture-proven neonatal sepsis. Regarding the onset of sepsis based on the neonatal age at the time of infections, this study has shown that significant numbers of cases have had Early-onset sepsis EOS (89%), where Late-onset sepsis LOS (11%) such type of sepsis usually arises after delivery through contaminated nearby milieu. Nevertheless, the bacterial profiling of neonatal sepsis cases of this study shown higher percentage of Gram negative (63%) bacteria compared to (37%) of Gram positive of total cases (table 1)

Table 1. Type of bacteria of neonatal septicemia.

Gram positive	Gram negative
<i>Staphylococcus aureus</i> (25)33 %	<i>KLEBSIELLA SPECIES</i> (16) 22%
Group B <i>Streptococcal</i> (GBS) Disease (7)12%	<i>NEISSERIA MENINGITIDIS</i> (9)%
	<i>ESCHERICHIA COLI</i> (25)33 %

The mode of delivery, whether vaginal or via cesarean section (C-section), significantly impacts the incidence of neonatal sepsis, particularly Early-Onset Neonatal Sepsis (EONS). This study reveals that 60% of births occur through vaginal delivery, while 40% are performed via C-section. This distribution is critical as it relates to the exposure of neonates to maternal microorganisms during the parturition for EONS predominantly originate from the maternal genital tract or the surrounding delivery area. This suggests that the method of delivery can influence the likelihood of a newborn being exposed to potentially harmful pathogens

Therefore, this might suggest the greater risk of bacterial transmission during vaginal delivery compared to C-section and therefor increase risk of neonatal exposure to vaginal and GIT flora which could include pathogenic bacteria responsible for neonatal sepsis.

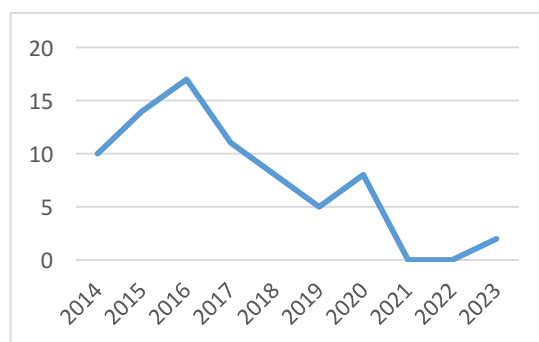


Figure 1. Numbers of infections per year

Regarding the causes of neonatal sepsis this study revealing that out of a total of 75 case the most cases are caused by U.T.I (33 case) 16 case caused lung infection, 12 by meningitis, 12 by skin infection, 2 Jaundice, 2 Premature rupture of membranes,1 Necrotizing enterocolitis and 1 Multiple congenital anomaly (figure 2).

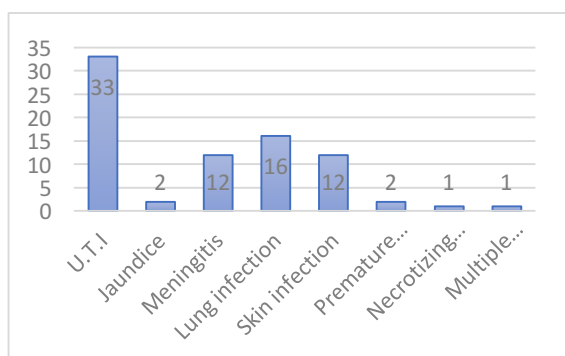


Figure 2. primary causes of neonatal septicemia, as the UTI account for 33 of total cases followed by lung infection 16 cases were meningitis and skin infection 12 cases for each.

DISCUSSION:

The findings from the study conducted in Tripoli provide critical insights into the bacterial landscape associated with neonatal sepsis. Although, the identification of *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Escherichia coli* as the predominant pathogens underscores the need for a focused approach in managing neonatal infections. However, *Klebsiella pneumoniae* accounted for 28.3% of the identified pathogens, such bacterium is notorious for its ability to cause severe infections, particularly in immunocompromised populations such as neonates. On the other hands, the high prevalence of *Klebsiella* in this cohort raises concerns regarding antibiotic resistance, as this pathogen is known to exhibit multidrug resistance, complicating treatment options⁽⁸⁾. The implications of this finding necessitate ongoing surveillance and the development of targeted antibiotic stewardship programs to mitigate resistance patterns and improve clinical outcomes⁽⁹⁾. With a prevalence of 20.0%, *Staphylococcus aureus* remains a significant contributor to neonatal sepsis. This pathogen is often associated with skin and soft tissue infections but can lead to systemic infections, The identification of *Escherichia coli* in 10.0% of cases aligns with its established role in neonatal infections, particularly those arising from urinary tract infections and gastrointestinal sources. The

presence of *E. coli* highlights the need for clinicians to consider the potential for polymicrobial infections and the importance of comprehensive diagnostic approaches to guide effective treatment.

Compering to the results obtained from this study were *Staphylococcus aureus* and *Escherichia coli* represent the highest bacteria among newborn septicemic patients by 33% for each, followed by *Klebsiella pneumoniae* 22% and GBS 12%. Other study Study in Addis Ababa and Ethiopia (2023) have concluding that the predominant bacteria were *Klebsiella spp* (44%), *E. coli* (21.6%), and Coagulase-negative *Staphylococci* (15.47%)⁽¹⁰⁾. Nevertheless, Global Study on Neonatal Sepsis (2023) there Key Findings as following, *E. coli* was the most common Gram-negative bacteria. However⁽¹¹⁾. However other study has been conducted in China during 2019 and revealed that Gram-negative bacteria dominated over Gram-positive bacteria in NS in additions the distribution of *Klebsiella pneumoniae* (21.9%), and *Escherichia coli* (21.9%), compared to group B *Streptococcus* (13.2%), and *Staphylococcus aureus* (6.8%)⁽¹²⁾. This study aligns with other research, highlighting *Staphylococcus aureus*, *E. coli*, and *Klebsiella species* as significant pathogens in NS⁽¹³⁾.

Regarding gender distribution among affected neonatal the slight male predominance in this study is also observed in other different studies, suggesting a potential biological or environmental factor influencing male susceptibility⁽¹⁴⁻¹⁶⁾.

On the other hands the obtained results of this study had have showed that the normal vaginal delivery 60% compere to C-section 40 %, this might be due to a greater risk of bacterial transmission during vaginal delivery compared to C-section, while C-sections are often performed to reduce the risk of infection, they are not utterly riskless. "The 40% association indicates that other factors are also involved such as hospital-acquired infections, might play a role^(17, 18).

Although, this research indicates that Early Onset Sepsis (EOS) is more prevalent than Late Onset Sepsis (LOS) in cases of neonatal septicemia. This finding is consistent with studies conducted in Nigeria and Uganda, which similarly reported higher rates of EOS^(19, 20). The conclusion underscores the critical importance of early detection and the implementation of targeted antibiotic therapy for the effective management of neonatal septicemia. However, the present research identifies urinary tract infections (UTIs) as the predominant source of neonatal septicemia, followed closely by pulmonary infections and meningitis. This finding is corroborated by studies conducted in Uganda and India⁽²¹⁻²³⁾. Although, the number of infected cases has decreases over time, with a maximum of 17 cases of neonatal sepsis in 2016 and a minimum of 0 cases in 2021 and 2022 this might reflect the progress of health system in Libya and the improvement of the level of sterilization and the effectiveness of infectious disease control programs (figure 1).

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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CONCLUSION:

The study highlights a high incidence of neonatal sepsis, with a significant proportion of cases attributed to Gram-negative bacteria. The bacterial profiling revealed that the most common pathogens causing neonatal sepsis were *Staphylococcus aureus* and *Escherichia coli*. Additionally, early-onset sepsis (EOS) was found to be more prevalent than late-onset sepsis (LOS). The study also indicated that normal vaginal delivery (NVD) increases the risk of bacterial exposure compared to cesarean section (CS).

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project. their support, this work never be able to

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