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Original Research Article

Combating Neonatal Infections in Libya: Common Bacteria and Treatment Strategies

H. Abushwereb[1*], R. Ibrahim[2], F. Ennafathi[3]

[1]Faculty of Pharmacy-University of Tripoli, Libya
[2]Al-Jalaa Pediatric Hospital, Libya
[3]Tripoli Medical Centre

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Abstract: Neonatal infections represent a prevalent issue impacting newborns during their initial days, resulting in escalated mortality rates, particularly evident in less developed nations. Two studies examined the microbes responsible for the beginning of infections in newborns and compared different treatment modalities. Predominant infectious manifestations included septicemia, meningitis, septic arthritis, and pneumonia. Gram-negative Klebsiella and Staphylococcus emerged as the prevalent bacterial strains responsible for neonatal infections. The antibiotic regimens commonly employed in medical facilities in Libya comprised of ampicillin, gentamicin, cefotaxime, vancomycin, amoxicillin, meropenem, amikacin, tazocin, and cloxacillin. Gender disparities were observed in the incidence rates of septicemia and meningitis, with the former being more recurrent in females. The collective fatality rate stood at 5–10% among the entire neonatal cohort.

Keywords: Neonatal infection, antibiotics, bacteria, mortality rate, treatment, resistance.

INTRODUCTION

Neonatal mortality, defined as the death of an infant within the first 28 days of life, remains a pressing issue worldwide [1]. The leading cause of neonatal deaths is often linked to infectious diseases, particularly sepsis and pneumonia [2, 3]. Hospitals, unfortunately, serve as a potential source of infections, contributing to the problem of nosocomial infections [4-6]. Several factors contribute to this issue [7], including overcrowding, staff shortages, closure of specialized communicable disease hospitals, an increase in complex surgical procedures, indiscriminate and prolonged use of broad-spectrum antibiotics, a false sense of security leading to neglect of aseptic techniques, and the use of immunosuppressing agents [8]. Consequently, once-harmless bacteria have gained prominence, causing over 60% of all hospital-acquired infections [9, 10].

Significant progress has been made in reducing infant mortality rates worldwide over the past three decades [11–15]. Achieving high coverage of quality antenatal care, skilled attendance at birth, and postnatal care for both the mother and baby, along with proper care for small and sick newborns, could further enhance survival rates and eliminate preventable deaths [14, 15].

While the healthcare services provided in neonatal intensive care units play an essential role in improving survival rates, the risk of neonatal mortality still persists [16]. Therefore, it becomes crucial to prioritize the well-being of newborns immediately after birth, accurately diagnose symptoms, promptly treat emerging diseases, and ensure the use of appropriate treatments to guarantee their safety [17]. The primary treatment focus lies in tackling serious and far-reaching problems associated with the increasing incidence of bacteremia and deaths caused by organisms such as Staphylococci, Escherichia coli, Enterobacter spp., Pseudomonas spp., and Proteus spp. [17]. With these concerns in mind, a study was conducted on newborns to examine the incidence of mortality within different time periods at the same hospitals. The study aimed to evaluate and compare the antibiotic treatment policies implemented in neonatal intensive care units across Libyan hospitals while also considering the presence of various microorganisms over multiple years.

The aim of this study is to investigate and analyze various aspects related to neonatal infections, including the incidence of deaths among newborns at different times in the same hospitals, the policy of antibiotics used for treatment in neonatal intensive care

***Corresponding Author:** H. Abushwereb
Faculty of Pharmacy-University of Tripoli, Libya

rooms in Libyan hospitals, and a comparison of the types of microbes present during different years. By comparing the data from 2003 and 2013, the study aimed to examine potential changes in bacterial patterns and treatment approaches over the course of the study period. The study seeks to shed light on the factors contributing to neonatal mortality and the effectiveness of treatment approaches, ultimately aiming to improve the care and outcomes for newborns.

METHODOLOGY

Population and Samples

A total of 112 patients (61 males and 51 females) in 2003 and 120 patients (65 males and 55 females) in 2013, all aged between one day and twenty-eight days, were selected from the neonatal intensive care units of two separate hospitals, Tripoli Medical Centre (TMC) **and** Al-Jalaa Paediatric Hospital, Tripoli, Libya. Both hospitals act as the highest referral hospitals and provide standardised services in accordance with the Ministry of Health of Libya. Data were collected from January to June in both years (2003 and 2013).

Routinely, hygiene was undertaken. Infants who presented with clinical manifestations of neonatal sepsis—others like feeding difficulties, abnormal heart rate, hypoxia, temperature abnormality, and signs of respiratory distress—were included in this study according to the NICE guidelines [18]. The main focus of the two studies was to analyse the patterns of bacterial types and the corresponding antibiotic treatments across both time periods. This analysis included considerations such as patient age, sensitivity tests, the specific microorganisms involved in each disease, and the clinical manifestations resulting from the administration of antibiotics. Also included are gender, onset of sepsis, birth weight, and gestational age.

Inclusion Criteria

The inclusion criteria for this study were neonates treated in neonatal intensive care units whose blood was taken for culture examination and diagnosed with sepsis. Others whose blood cultures were negative were excluded from the study.

Data Analysis

A descriptive analysis was performed with SPSS version 23 (SPSS Inc., Chicago, IL). Descriptive analysis was performed by finding the frequency distributions of the patient's characteristics and the isolated microorganism growth from the blood culture.

RESULTS

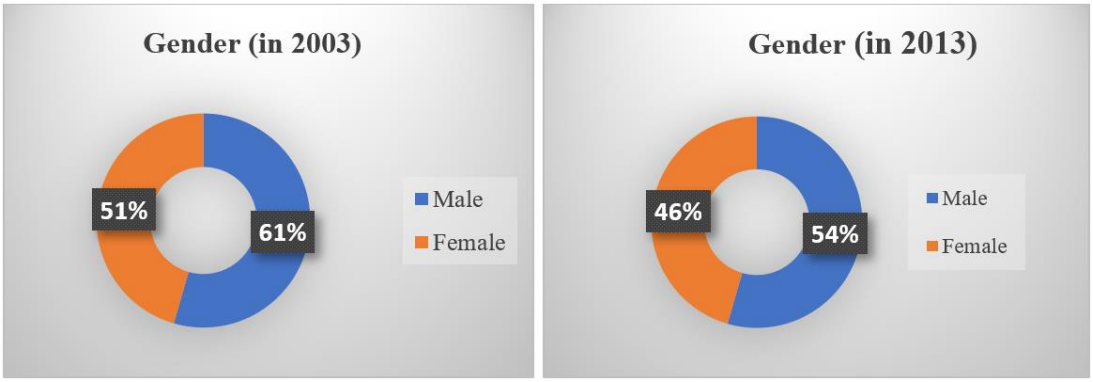

Fig 1: Shows gender in 2003 (n= 112 cases) and in 2013 (n=120 cases)

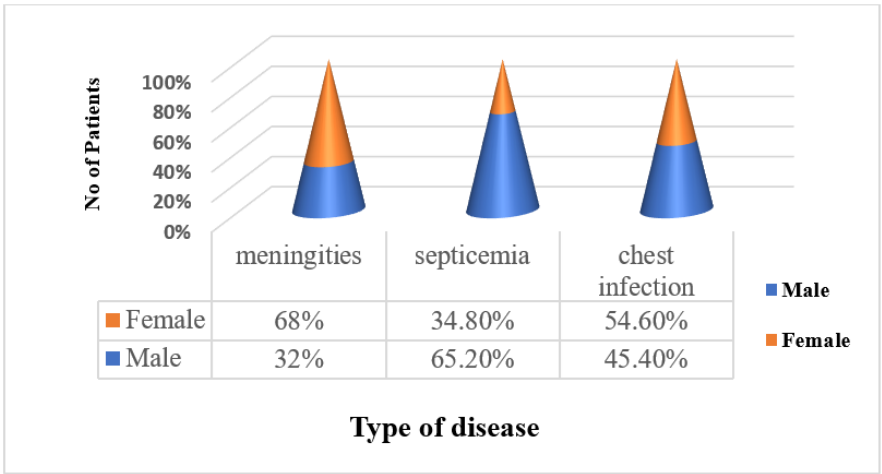

Fig. 2: The comparison between types of disease and sex of neonates (2013)

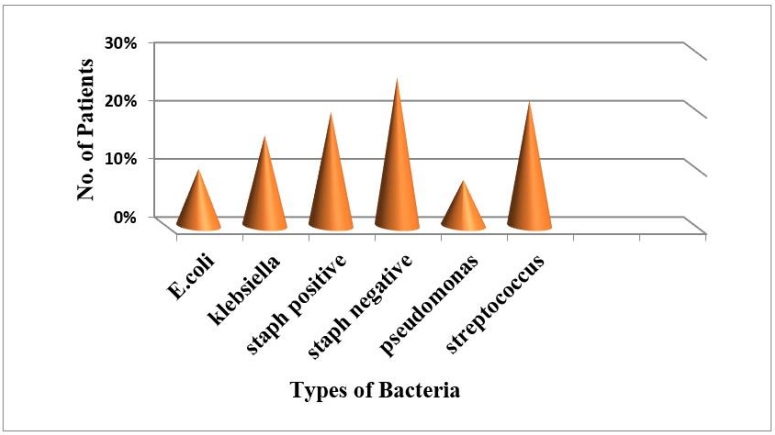

Fig. 3: Types of bacteria in cases of septicemia (2013)

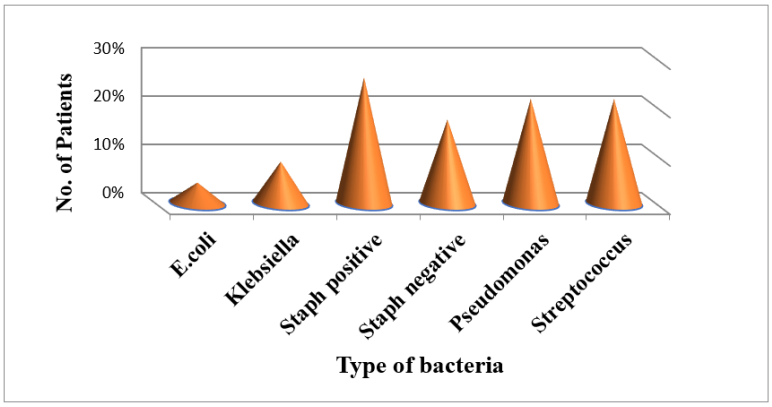

Fig. 4: Types of bacteria in cases of meningitis (2013)

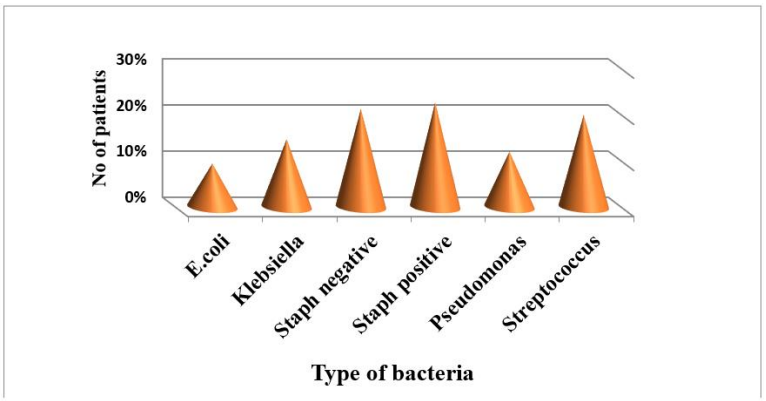

Fig. 5: Types of bacteria in this study (2013)

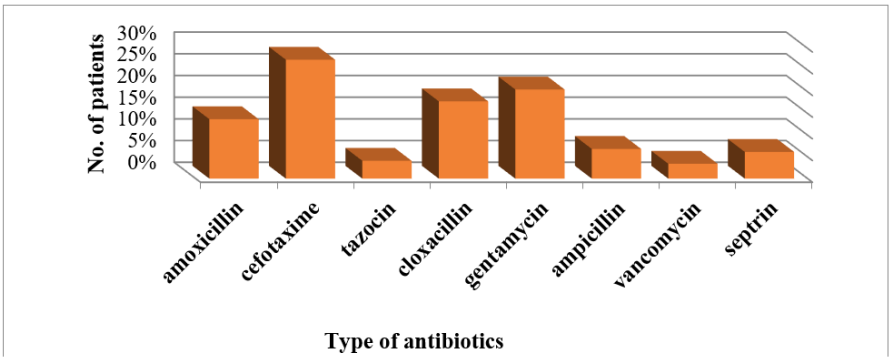

Fig. 6: Sensitivity of bacteria to antibiotics

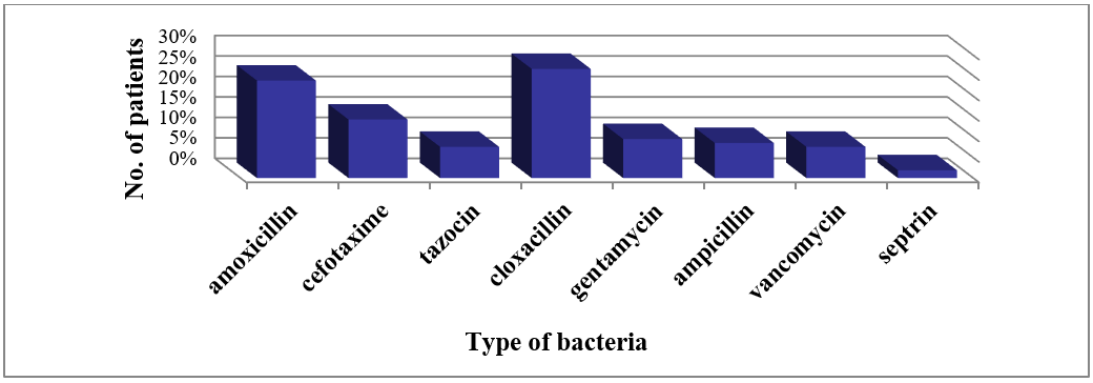

Fig. 7: Resistance of bacteria to antibiotics

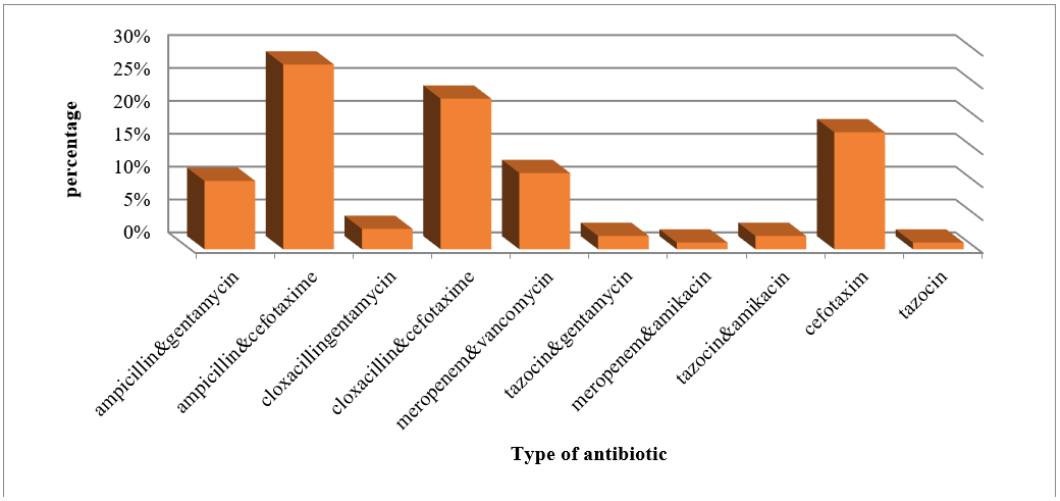

Fig. 8: Types of antibiotics used in treatment of neonatal infection

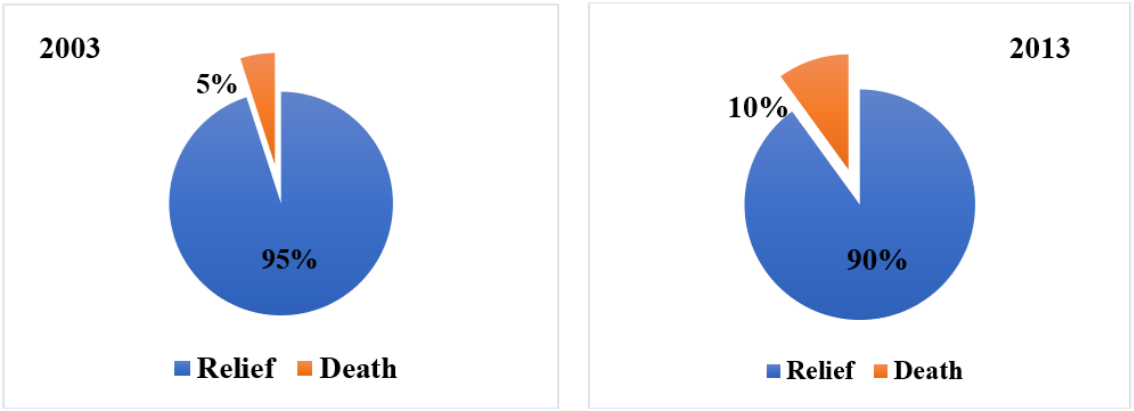

Fig. 9: The post treatment result (2003 and 2013)

In cases of septicemia, the prevalence of infected males was 65.2%, while in females it was 34.8%. On the other hand, in cases of meningitis, males accounted for 32% of all cases, which was lower compared to females, who represented 68%. Chest infections were more prevalent in females, with 54.6% of cases, while males accounted for 45.4% [see Fig. 1]. The symptoms commonly associated with septicemia are fever and respiratory distress, which account for 18.6% of cases. The most frequently identified bacteria in septicemia cases were Staph-negative at 25.5%, followed by Streptococcus at 21.6% [see Fig. 2]. For meningitis cases, the predominant symptoms were fever and poor feeding. The most common bacteria found in meningitis cases were Staph-positive, accounting for 26.15% [see Fig. 3]. The study indicates the types of bacteria discovered, their sensitivity, and resistance to treatment, as presented in Figs. 4, 5, 6, and 7. Regarding the treatment of neonatal bacterial infections, the preferred combination therapy of antibiotics was ampicillin with cefotaxime, accounting for 28.1% of cases. The second most frequently used combination was cloxacillin with cefotaxime, representing 22.9% of treatments, followed by ampicillin with gentamicin at 10.4% [see Fig. 8].

Meanwhile, overall treatments showed a 95% infection cure rate in 2003 and a 90% cure rate in 2013 [Fig. 9].

DISCUSSION

Neonatal sepsis continues to have significant morbidity and mortality. Due to its high incidence, especially in developed countries, neonatal sepsis is considered a burden on the country [19]. The findings of this study shed light on the prevalence, symptoms, bacterial aetiology, and treatment patterns of neonatal bacterial infections, including septicemia, meningitis, and chest infections [19]. The results highlight notable gender disparities in infection prevalence, with differences observed in the distribution of cases among males and females [20]. Septicemia, characterized by fever and respiratory distress, showed a higher prevalence among males, with Staph negative and Streptococcus being the predominant bacterial pathogens [20]. Conversely, meningitis exhibited a higher incidence among females, with Staph-positive being the most commonly identified bacterium [21]. Chest infections, predominantly affecting females, also presented with distinct symptomatologies. The most common infections found in both studies were septicemia, meningitis, septic arthritis (in 2003 and 2013), and pneumonia (in 2013). These infections typically presented with multiple symptoms and were usually treated with a combination of antibiotics, following the British guidelines for neonatal antibiotic usage, which were determined empirically based on the age of the infant and the expected type of microorganism acquired from the mother or through nosocomial infection [22]. Gram-negative Klebsiella (in 2003 figures not shown) and both positive and negative Staphylococcus (in 2013) were identified as the most prevalent bacterial types causing neonatal infections. The predominance of gram-negative bacteria can be attributed to a lack of standard infection control practices. Inadequate hand hygiene and a lack of essential equipment and supplies have been identified as major contributors to nosocomial infections caused by gram-negative bacteria [23, 24]. Septicemia was observed more frequently than other diseases, and meningitis appeared to be more prevalent in females compared to males. The common antibiotics used to treat neonatal infections in Libyan hospitals included ampicillin, gentamicin, cefotaxime, vancomycin, amoxicillin, meropenem, amikacin, tazocin, and cloxacillin. The sensitivity tests indicated that cefotaxime and gentamicin were effective, while cloxacillin exhibited the highest resistance, followed by amoxicillin. Overall, death was in 5–10% of the total children.

The study underscores the importance of appropriate antibiotic therapy in the management of neonatal bacterial infections [24, 25]. Combination therapy, particularly ampicillin with cefotaxime, emerged as the preferred treatment regimen, emphasizing the significance of broad-spectrum coverage against common pathogens [26]. Even though the number of neonatal deaths worldwide has significantly decreased—from 5 million in 1990 to 2.4 million in 2019—babies are still most susceptible during their first 28 days of life [27–30]. Approximately 33% of infants die on the day of delivery, and over 75% pass away in the first week of life (WHO). Greater care and treatment control in the future are still needed to lower the death rate (WHO). In this study, the policy of treatment followed controlled 90–95% of patients, as the data recorded only 5–10% of deaths, and this percentage still represents a high percentage. There is hope in the future for more therapeutic control to reduce the death rate. Enhancing the survival and well-being of newborns and preventing avoidable stillbirths can be achieved through widespread access to high-quality antenatal care, skilled attendance at birth, postnatal care for both mother and infant, and specialized care for small and sick newborns [28, 29]. Hospitals have responded to the risk of infections by offering neonatal intensive care unit services to minimize the spread of infections [31, 32]. Additionally, a prudent approach to antibiotic use, coupled with targeted treatment strategies, is employed for all infants admitted to the intensive care unit [32].

CONCLUSION

In conclusion, these findings contribute valuable insights into the epidemiology and management of neonatal bacterial infections, providing a basis for optimizing clinical strategies and enhancing patient outcomes in neonatal care settings. Further research and surveillance efforts are warranted to address evolving bacterial resistance patterns and refine therapeutic approaches in this vulnerable population.

Limitation

The calculation of sample size was not performed. Various challenges were encountered during the data collection process.

Conflict of interest statement: The Authors declare no conflict of interest.

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