



## Neonatal Sepsis; Bacterial cause and their antibiotic susceptibility

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Neonatal Sepsis (NS) is the existence of microorganisms that cause hemodynamic changes and other clinical effects, as well as severe morbidity and mortality, it is caused by bacteria, viruses or fungi. Identification of microorganisms causing NS and their antibiotic susceptibility in neonates admitted to neonatal intensive care unit in King Faisal Medical Complex, Taif, Saudi Arabia. Prospective cross-sectional study was conducted to detect NS during period from January to August 2021. The blood samples were collected and submitted to different investigations include blood culture, CBC, and determination of inflammatory markers such as CRP. This study included 110 NS cases, EOS observed in 14 (12.7%), and LOS occurred in 96 (87.3%), the male were 62 (56.3%), female 40 (36.3%) and unknown gender 8 (7.2%), the blood culture technique showed that the most common detected microorganisms were CoNS 28 (25.5%) *E. coli*, 26 (23.6%), and *K. pneumoniae* 22 (20.0%), in addition the antibiotic susceptibility of isolated strains showed that the Trimethoprim-Sulfamethoxazole was found to be the highest sensitive antibiotic by (83.6%), while Ampicillin was the highest resistant antibiotic by (78.1%). NS is a public health problem so, it is recommend for health care organization to design a preventive program to prevent NS specially LOS.

**Keywords:** Neonatal Sepsis (NS), Early NS, Late NS, Bacterial microorganisms.

### Introduction

Neonatal Sepsis (NS) refers to the presence of microorganisms such as bacteria, viruses, or fungi that cause hemodynamic changes and significant morbidity and mortality. Depending on the age of onset and timing of sepsis episode, there are two types of NS, one of them is early-onset sepsis (EOS), and the other one is late-onset sepsis (LOS). EOS infections occur before or after childbirth and reflect vertical mother-to-infant transmission. LOS infections occur after delivery or between the ages of 3 and 7 days and are caused by organisms found in the hospital or in the environment (Shane et al. 2017).

In Saudi Arabia, prematurity is the most common cause of NS. The multiparty and caesarean section (CS) delivery is the key maternal risk factors for both EOS and LOS. Most commonly that GBS causing EOS among neonates, while the *Staphylococcus* spp. was the most common organism among LOS neonates. When compared to neonates with LOS, high mortality risk was found in neonates with EOS (Al-Matary et al. 2019).

The innate and acquired immune systems play a part in neonatal immunity. Innate immunity, which is mediated by phagocytes and the complement cascade, is the first line of defense against infection in newborns. It also controls self-tolerance and communicates with T and B cells from the acquired immune system to produce memory responses to antigens, the body has previously experienced. Acquired immunity is a slower but more directed immune response triggered by lymphocytes and antibodies passed down from mothers. Neonates have number of immune defects in both systems, rendering them more vulnerable to infection (Glaser et al. 2020).

NS signs and symptoms ranged from nonspecific or ambiguous symptoms to hemodynamic collapse. Irritability, lethargy, or poor feeding are early signs, besides poor perfusion and shock, respiratory distress, fever, hypothermia, or hypotension. Diagnosis based only on laboratory results that may reveal hyperglycemia or hypoglycemia, acidosis, or hyperbilirubinemia (Singh et al. 2020).

*Escherichia coli*, coagulase-negative *staphylococci*, and *Listeria monocytogenes* are among the most commonly isolated bacteria in NS. *Streptococci*, *Streptococcus pneumoniae*, *Streptococcus viridans*, *Haemophilus influenzae*, *Staphylococcus aureus*, and *Klebsiella* are more or less common bacteria. Group B *Streptococci* have been isolated and have now been identified as etiologic cause of NS. (Camacho-Gonzalez et al. 2013; Odabasi & Bulbul, 2020)

Many epidemiological studies on NS have confirmed the major shift from EOS to LOS, as well as a shift in the way bacterial blood culture isolates are treated. Globally, every year, more than a million neonates die in their first month of life as a result of sepsis or a severe infection. NS has a wide variety of incidences (from less than 1% to more than 35% of live births), depending on the gestational age and time of onset (EOS < 72 hours after birth or LOS > 72 hours after birth). Of all age groups, preterm neonates have the highest rates of sepsis and mortality (Wynn and Wong, 2016).

The aim of the present study is to identify the microorganism that are causing the NS in patients admitted to King Faisal Medical Complex, Taif, Saudi Arabia, in addition to screening of their antibiotic sensitivity and resistance.

#### Materials and methods

Prospective cross-section study was applied at NICU of King Faisal Medical Complex (KFMC) in Taif, Saudi Arabia. The study period was from January 2021 to August 2021. All neonates' cases with neonatal sepsis which suspected by clinical diagnosis and confirm by blood culture in the NICU were included in the study. a total of 110 neonates with a culture confirmed diagnosis of neonatal sepsis were included in this study.

#### Automated blood culture by using BACTEC FX:

Blood culture is used to confirm the diagnosis of neonatal sepsis is by isolating the causative agent, a minimum of 0.5–1 mL of blood was withdrawn aseptically, preferably from two different venipunctures from two separate sites. True pathogens are more likely to be present in both culture specimens. In the presence of a central venous catheter, blood cultures ideally would be obtained simultaneously, with one from a peripheral and one from a vascular catheter so that differential time to positivity can be assessed. This facilitates identification of peripheral bacteremia versus catheter-related bloodstream infections and has implications for clinical management. Automatic systems continuously monitor specimens and alert when positive signaling is detected, facilitating further processing for pathogen subculture on blood, MacConkey, and chocolate agar was identified and confirmed by BD Phoenix automated identification and susceptibility testing system.

Complete blood counts were performed and C-reactive protein as a marker of inflammation was estimated.

#### Statistical Methods

Data were analyzed using IBM® SPSS® Statistics version 26 (IBM® Corp., Armonk, NY). Categorical variables are presented counts and percentages. Ordinal data are compared using linear by linear association. Continuous numerical data are presented as mean and standard deviation and between-group differences are compared using the independent-samples t-test. P-values <0.05 are considered statistically significant.

#### Ethical Considerations

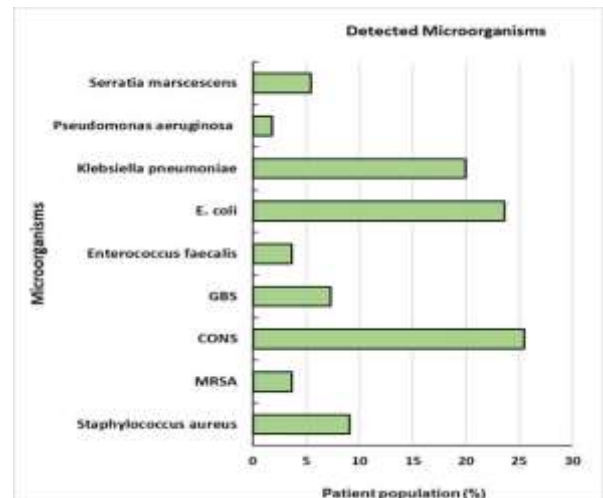
Ethical approval for this study was obtained from College of Applied Medical Sciences at Al-Taif University

#### Results

This study included 110 NS cases, EOS was observed in 14 (12.7%), and LOS occurred in 96 (87.3%), males were 62 (56.3%), females 40 (36.3%) and unknown gender 8 (7.2%).

#### Detection of microorganisms after blood culture

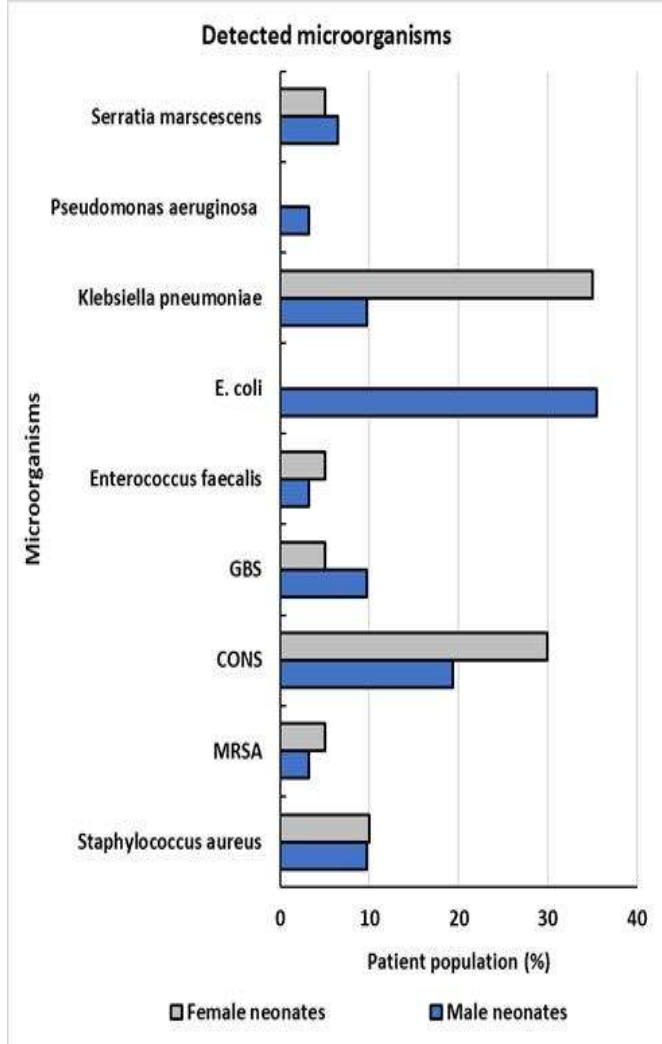
The blood culture technique was used to analyze the microbial species of all NS cases. The following figure 1 is representing all of the detected microorganisms in all cases, while figure 2 demonstrated the gender-distribution of the detected microorganisms. In overall NS cases, the most common detected microorganisms were Coagulase-negative *Staphylococci* (CoNS) (25.5%) *E. coli* ,(23.6%) , and *K. pneumoniae* (20%), while the least detected microorganism was *P. aeruginosa* (1.8%).



**Figure 1: The detected of microorganisms in all of the NS cases after blood culture (n=110). Data are presented as percentage of patients.**

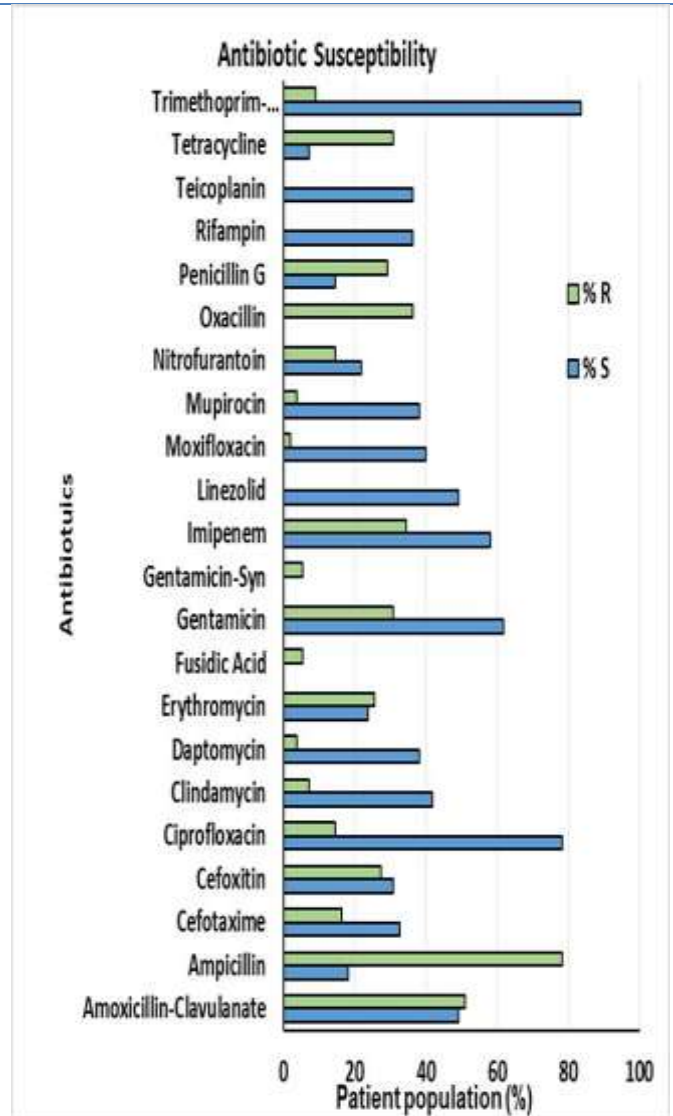
The gender-distribution of the detected microorganisms revealed that the most commonly detected microorganisms in male patients were *E and coli* .then CoNS, whereas in female patients that the most commonly

detected microorganisms **K. pneumoniae**(figure 2).



**Figure 2: The gender-distribution of the detected microorganisms of the NS cases after blood culture (males n=62; females n=40). Data are presented as percentages of patients. Detection of antibiotic susceptibility of isolated strains**

The antibiotic susceptibility of isolated strains from all of NS patients were investigated. As shown in figure 3, Trimethoprim-Sulfamethoxazole was found to be the highest sensitive antibiotic by 83.6%, while Gentamicin-Syn was the lowest sensitivity by 0%. On the other hand, Ampicillin was the highest resistant antibiotic by 78.1% and linezolid was the lowest resistant by 0%.



**Figure 3: Detection of antibiotic susceptibility of blood specimens in all of the NS cases after blood culture (n=110). Data are presented as percentage of patients. S: Sensitive and R: Resistant.**

Gender-effect on the antibiotic susceptibility is demonstrated in figure 4 and revealed that ciprofloxacin was the highest sensitive antibiotic in male, while tetracycline is the lowest. Whereas ampicillin was the highest resistant antibiotic in male, mupirocin, daptomycin and ciprofloxacin were equally the lowest.

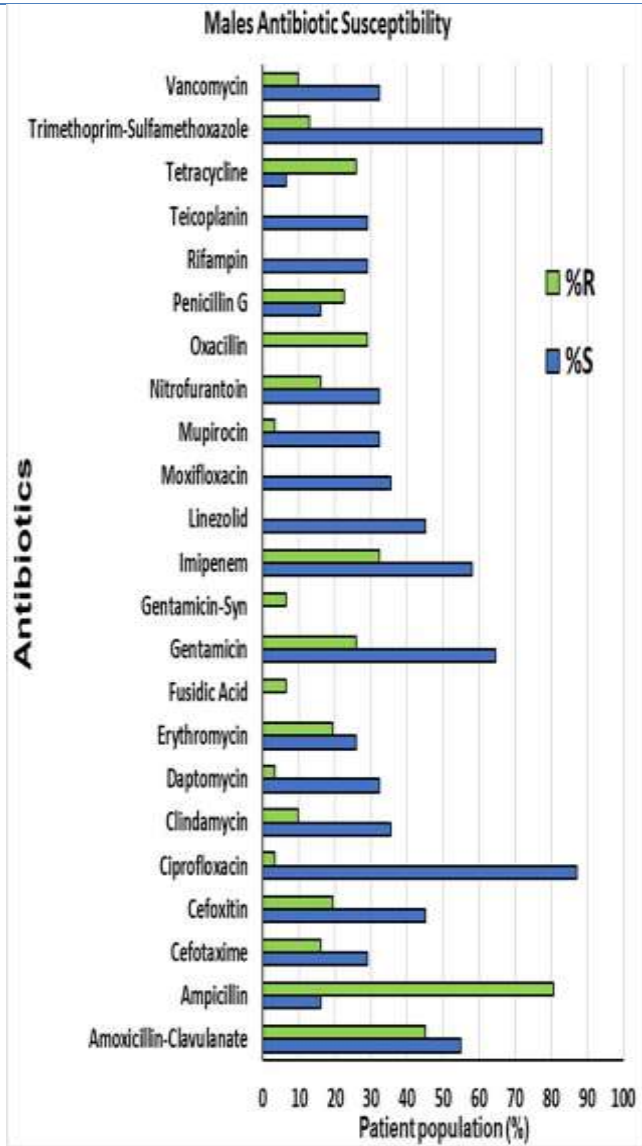


Figure 4: The gender-distribution effect on the antibiotic susceptibility of blood specimens in male NS cases after blood culture (n=62). Data are presented as percentage of patients. S: Sensitive and R: Resistant.

Trimethoprim-sulfamethoxazole is the highest sensitive antibiotic in female while cefoxitin is the lowest. In figure 5, it is clear that ampicillin was the highest resistant antibiotic in females, while trimethoprim-sulfamethoxazole, moxifloxacin, gentamicin- Sy, fusidic acid, clindamycin, daptomycin and mupirocin were equally the lowest.

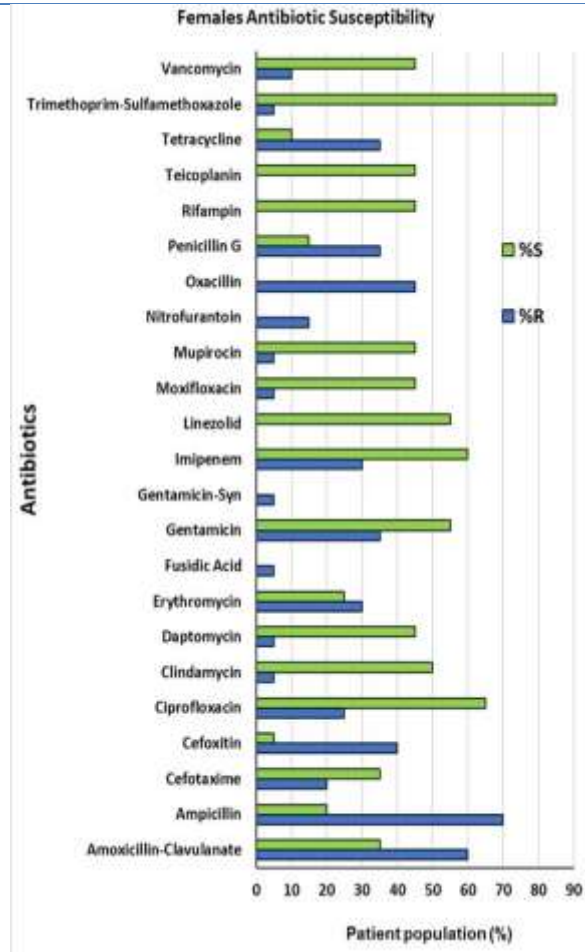


Figure 5: The gender-distribution effect on the antibiotic susceptibility of blood specimens in female NS cases after blood culture (n=40). Data are presented as percentage of patients. S: Sensitive and R: Resistant.

**Microorganism susceptibility to different antibiotics**

Tables 1 and 2 show antimicrobial resistance pattern of organisms isolated from blood culture. The antibiotics with the highest susceptibility to MRSA are linezolid and moxifloxacin (100%) and trimethoprim-sulfamethoxazole (80%) respectively. Cefotaxime and Ciprofloxacin have the highest CONS susceptibility rates among antibiotics (93%). These tests confirmed that CONS were sensitive to vancomycin, linezolid, rifampin, trimethoprim/sulfamethoxazole, clindamycin, and gentamicin.

Trimethoprim/sulfamethoxazole and gentamicin were all effective against 80% of isolates. Penicillin sensitivity was seen in GBS and Enterococcus faecalis.

**Table 1: Antibiotic susceptibility pattern of Gram-positive bacteria isolates of neonatal sepsis. Data are presented as percentage of antibiotic sensitivity.**

Antibiotic S	StaphAureus (9.09)%	MRSA (3.64)%	CONS (25.45)%	GBS(7.27)%	Enterococcus faecalis (3.64)%
Amx	60	0	21	100	100
Amp	0	0	21	25	50
Ctx	0	0	93	100	NA
Cxt	0	NA	NA	NA	0
Cip	40	0	93	NA	100
Cp	60	50	93	100	NA
DAP	60	0	93	NA	NA
Ery	60	0	14	100	NA
Ge	80	0	14	NA	100
Imp	40	0	14	NA	100
Lzd	60	100	93	100	NA
Mxf	40	100	93	93	NA
Mup	60	0	93	NA	NA
Nft	0	NA	NA	NA	NA
Ox	0	0	0	NA	NA
Pg	60	0	0	100	NA
Rmp	60	100	93	NA	NA
Te	60	100	93	NA	NA
Te	60	NA	0	NA	NA
Sxt	80	0	86	NA	100
Vanco	60	0	93	NA	0

**Note:** (% = n/total), n = number of sensitive isolates

**Abbreviations:** Amp, ampicillin; Amx, amoxicillin;; Cip, ciprofloxacin; Cn, gentamicin; Sxt, trimethoprim-sulfamethoxazole; Cxt, cefoxitin; Pg, penicillin, Vanco, vancomycin, CTX, Cefotaxime. CIP,Ciprofloxacin DAP,Daptomycin, ERY, Erythromycin,IMP, Imipenem,LZD, Linezolid,MXF, Moxifloxacin, MUP, Mupirocin,NFT, Nitrofurantoin, OX,Oxacillin,RMP, Rifampin,TE, Teicoplanin. NA: not applied

**Table 2: Antibiotic susceptibility pattern of Gram-negative bacteria isolates of neonatal sepsis. Data are presented as percentage of antibiotic sensitivity.**

ANTIBIOTICS	E. coli (23.64)%	Klebsiella pneumoniae (20)%	Pseudomonas aeruginosa (1.82)%	Serratia marscescens (5.45)%
Amx	85	18	0	67
Amp	8	18	0	33
Ctx	NA	NA	NA	0
Cxt	92	9	0	100
Cip	85	82	100	100
Cp	NA	NA	NA	0
DAP	NA	NA	NA	100
Ery	NA	NA	NA	100
Ge	85	91	100	100
Imp	92	91	100	NA
Lzd	NA	NA	NA	100
Mxf	NA	NA	NA	100
Mup	NA	NA	NA	100
Nft	92	NA	0	100
Ox	NA	NA	NA	NA
Pg	NA	NA	NA	NA
Rmp	NA	NA	NA	NA
Te	NA	NA	NA	NA
Te	NA	NA	NA	0
Sxt	92	100	100	100
Vanco	NA	NA	NA	100

**Note:** (% = n/total), n = number of sensitive isolates

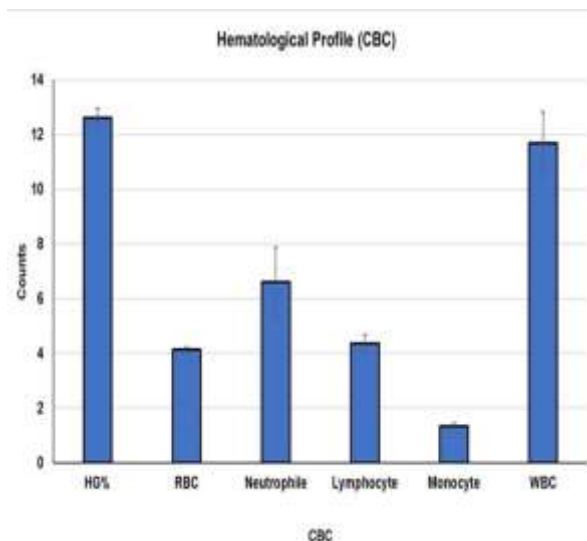


**Abbreviations:** Amp, ampicillin; Amx, amoxicillin;; Cip, ciprofloxacin; Cn, gentamicin; Sxt, trimethoprim-sulfamethoxazole; Cxt, cefoxitin; Pg, penicillin, Vanco, vancomycin, CTX, Cefotaxime. CIP, Ciprofloxacin DAP, Daptomycin, ERY, Erythromycin, IMP, Imipenem, LZD, Linezolid, MXF, Moxifloxacin, MUP, Mupirocin, NFT, Nitrofurantoin, OX, Oxacillin, RMP, Rifampin, TE, Teicoplanin. NA: not applied

All Gram-negative bacilli isolates were susceptible to gentamicin, amikacin, and colistin whereas 90% were susceptible to cefepime and ciprofloxacin, and 85% to ceftazidime. All the Gram-negative isolates except one *Pseudomonas* isolate were susceptible to carbapenems (meropenem and imipenem).

### Hematological profile of all patients

The complete blood count was carried out automatically for the blood specimens of NS patients. The analysis of hematological profile of all patients in figure 6 showed the mean  $\pm$ SE of Hemoglobin concentration was  $12.61 \pm 2.51$ , RBC count was  $4.13 \pm 0.69$ , Neutrophil was  $6.621 \pm 3.29$ , Lymphocyte was  $4.35 \pm 2.425$ , monocyte was  $1.33 \pm 1.027$  and WBC was  $11.69 \pm 8.47$ .

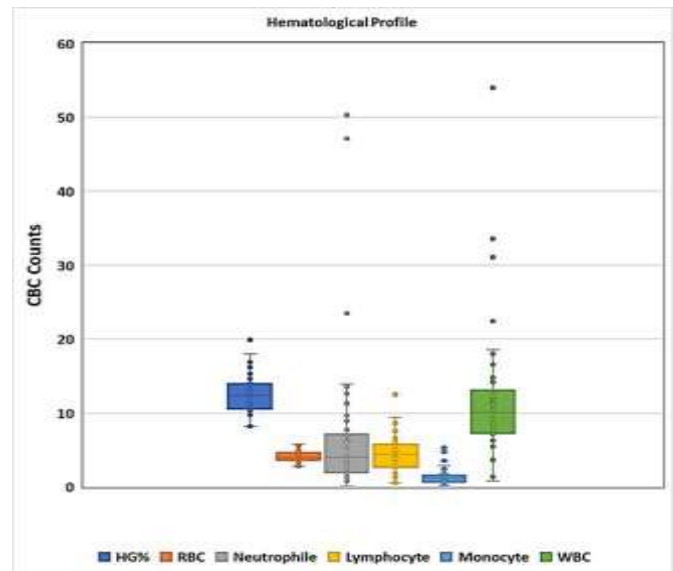


**Figure 6: Evaluation of CBC of blood specimens in all of the NS cases after blood culture (n=110). Data are presented as mean  $\pm$  standard error. Where the CBC parameters units were; HG%: Hemoglobin percentage; RBC: Red blood cells (M/uL); WBC: White blood cells (K/uL); neutrophiles, lymphocytes, and monocytes (K/uL).**

### Box-and-whisker plot analysis for Hematological profile of all patients

Due to the presence of outliers in the hematological results, the results were submitted to the box-and-whisker plot analysis, lines in the boxes signify the median values; the upper/lower border-lines of the boxes denote the 25th and 75th percentiles, respectively; and the upper/lower bars outside the boxes represent the 90th and 10th percentiles, respectively. Figure 7 indicated that there were a high number of outliers and 75th percentiles cases in neutrophil and WBCs, which may affect their mean values

that are presented in figure 7.



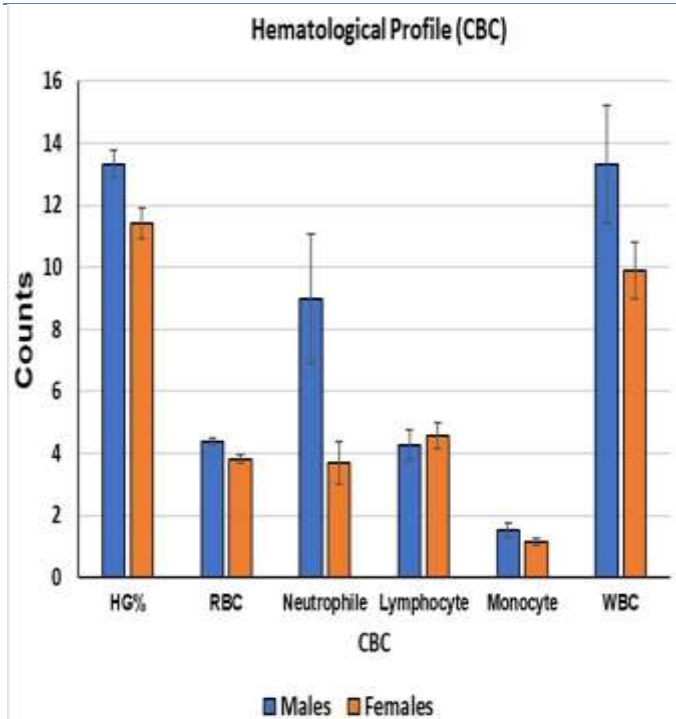
**Figure 7: Box-and-whisker plot analysis for Hematological profile of all patients of blood specimens in all of the NS cases after blood culture (n=110). Where the CBC parameters units were HG%: Hemoglobin percentage; RBC: Red blood cells (M/uL); WBC: White blood cells (M/uL); neutrophiles, lymphocytes, and monocytes (K/uL).**

### Hematological profile according to gender

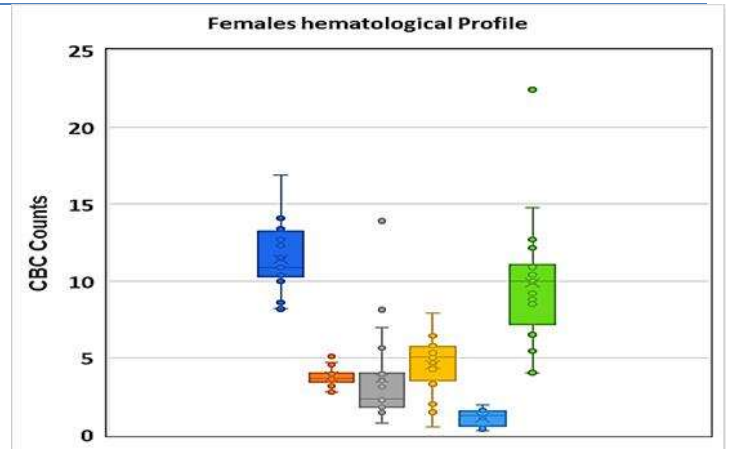
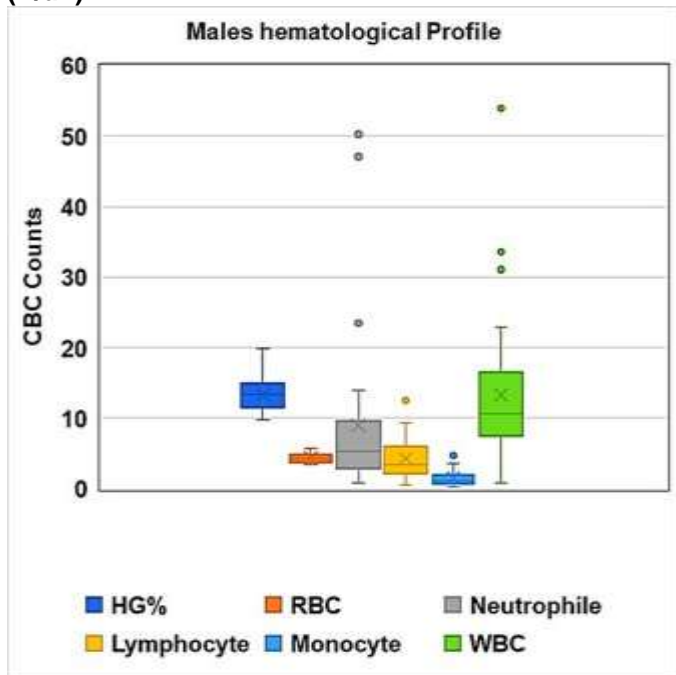
The analysis of hematological profile in NS patients in a gender basis indicated that the mean  $\pm$ SE of HG% were ( $13.32 \pm 2.46$ ;  $11.42 \pm 2.19$ ), RBC count were ( $4.37 \pm 0.67$ ;  $3.8 \pm 0.60$ ), neutrophils were ( $8.99 \pm 11.64$ ;  $3.67 \pm 3.07$ ), lymphocyte were ( $4.26 \pm 2.79$ ;  $4.57 \pm 1.92$ ), monocyte were ( $1.52 \pm 1.27$ ;  $1.13 \pm 0.49$ ) and WBC were ( $13.32 \pm 5.56$ ;  $9.88 \pm 4.05$ ) for males and females, respectively. There was a significant increase in WBC and neutrophils in males versus females' neonates;  $p=0.04$  and  $p=0.03$ , respectively.

Box-and-whisker plot analysis for deference CBC count between males and females of NS patients

The analysis indicated that, in male patients (Figure 9a) there were a high number of outliers in neutrophile and WBCs, which may affect their mean values that are presented in figure 9 and that the female results (Figure 9b) are more homogenous and the mean values in figure 8 represents the real findings.



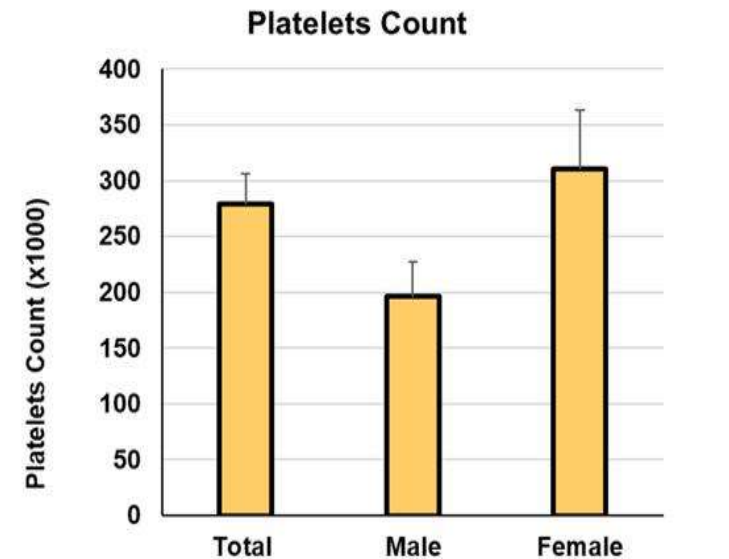
**Figure 8: Evaluation of CBC of blood specimens in all of the NS cases after blood culture (n=110). Data are presented as mean ± standard error. Where the CBC parameters units were; HG%: Hemoglobin percentage; RBC: Red blood cells (M/uL); WBC: White blood cells (K/uL); neutrophils, lymphocytes, and monocytes (K/uL).**



**Figure 9: a. Box-and-whisker plot analysis for hematological profile males (n=62). b. Box-and-whisker plot analysis for hematological profile females (n=40).**

**Platelets count**

The complete blood count was carried out automatically in all of the blood specimens of NS patients. Figure 10 showed non-significant enhancement in platelet count value with a p value 0.209. The mean ±SE value in female was 310.3 ±235.6 and in male the mean ±SE was 260.58 ±196.64. Totally, the mean ±SE was 278.81 ±205.24. The analysis of platelets counts of all patients indicated that the mean platelets count was lower in males than females. Box-and-whisker plot analysis revealed the absence of outliers.



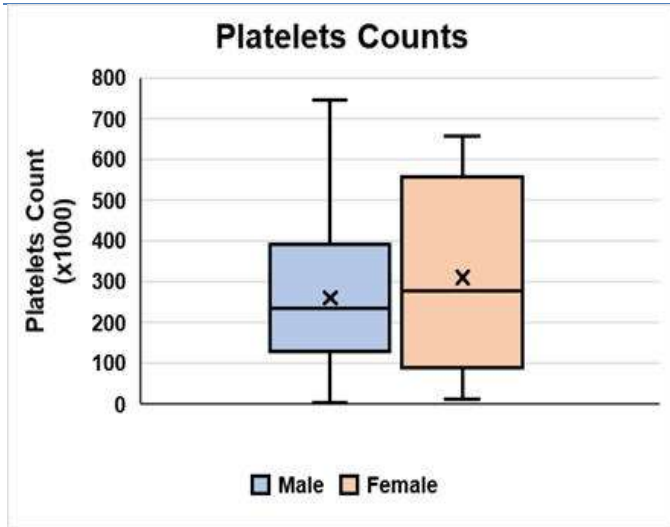


Figure 10: a. Platelets count in NS patients (n=110). b. Box-and-whisker plot analysis for platelets count in males (n=62) and females (n=40).

**Inflammatory marker CRP**

a. CRP is an important inflammatory marker was found in all of the NS patients. The results in figure 11 demonstrated that: the mean value of CRP for total was  $4.00 \pm 2.30$

1. and there was increased difference in CRP profile, where it showed a higher mean  $\pm$ SE ( $6.55 \pm 3.7$ ) in males than in females ( $3.68 \pm 1.2$ ) but non-significant ( $p=0.24$ ).

b. Box-and-whisker plot analysis revealed the presence of outliers in both of males and females' groups, a finding that may affect the mean values.

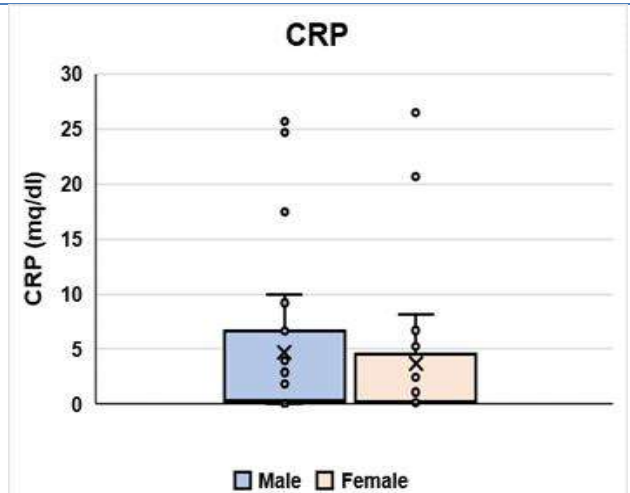
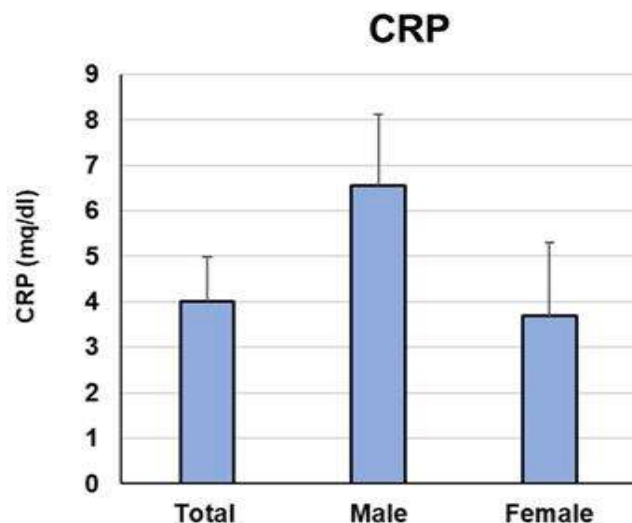


Figure 11: a. CRP (mg/dl) in NS patients (n=55). b. Box-and-whisker plot analysis for platelets count in males (n=62) and females (n=40).

**DISCUSSION**

Neonatal sepsis is a phrase used to describe the presence of microorganisms that induce significant morbidity and mortality, hemodynamic abnormalities, and other clinical consequences. It can be brought on by bacteria, viruses, or fungi.

In the newborn intensive care unit of the King Faisal Medical Complex in Taif city, this study was done to examine the hematological, chemical, and bacteriological profiles of NS. 110 NS patients were included in this investigation, of whom 14 (12.7%) had EOS and 96 (87.3%) had LOS. Males made up 62 (56.3%), females 40 (36.3%), and 8 (7.2%) were of an unspecified gender.

In this study, the blood culture technique was used to analyze the microbial species of all NS cases, which showed in figures 1,2 that the most common detected microorganisms were CoNS 28 (25.5%), *E. coli* 26 (23.6%), and *k. pneumoniae* 22 (20.0%), while the least detected microorganism was *P. aeruginosa* 2 (1.8%).

More or less in agreement with our findings, studies by Nasr et al. (2013) and Mahmoud et al. (2022) revealed that *S. aureus* was the most prevalent bacterium associated with NS. In contrast to our study, Arain et al. 2015 demonstrated that the *Streptococcus agalactiae* or GBS was the major cause of bacterial infections in the perinatal period, including sepsis which is accordance to Zamzami et al. 2011 study, that showed the GBS EOS-infection was the main cause of neonatal sepsis. The study of Al-Mazroea, 2017 showed that the gram-positive bacteria such as CoNS and *Staph aureus* were the most common culture isolates among sepsis patients, which agrees with our results, gram-negative bacteria were *klebsiella Pneumonia*, *E coli*, *Acenobacter* and *Pseudomonas*.

The keys to effective therapy include immediate supportive care and appropriate antibiotic delivery (Ershad et al. 2019). According to this study, Gentamicin-Syn had



the lowest sensitivity, with Trimethoprim-Sulfamethoxazole having the maximum sensitivity by 83.6%.

In contrast, Ampicillin was the most resistant antibiotic by 78.1%, and linezolid was the least resistant by 0%, as shown in figures 3-5. Tables 2 also revealed that the antibiotics with the highest susceptibility to MRSA are linezolid and moxifloxacin (100%) and trimethoprim-sulfamethoxazole (80%) respectively. Cefotaxime and Ciprofloxacin have the highest CONS susceptibility rates among antibiotics (93%) These tests confirmed that CONS were sensitive to vancomycin, linezolid, rifampin, trimethoprim/sulfamethoxazole, clindamycin, and gentamycin. Al Mouqdad et al., 2018.'s research also supported this. Vancomycin, linezolid, rifampin, and clindamycin were all effective treatments for *S. aureus* isolates. Trimethoprim/sulfamethoxazole and gentamicin were all effective against 80% of isolates. Penicillin sensitivity was seen in GBS and *Enterococcus faecalis*.

All Gram-negative bacilli isolates were susceptible to gentamicin, amikacin, and colistin whereas 90% were susceptible to cefepime and ciprofloxacin, and 85% to ceftazidime. All the Gram-negative isolates except one *Pseudomonas* isolate were susceptible to carbapenems (meropenem and imipenem). A study carried out by Al Matary et al. 2019 go more or less with the present study who showed *Streptococci* sensitive to Trimethoprim-Sulfamethoxazole (Bactriam). All Gram-negative bacteria were sensitive to Amikacin. *P. aeruginosa* and *Acinetobacter* (Gram-negative non-fermenting bacteria,) were sensitive to amikacin and gentamycin. All Gram-positive bacteria were sensitive to gentamycin.

In neonatology, CBC was the accepted protocol for infants with a suspicion of sepsis. In our investigation, CBC was automatically carried out on individuals with NS. A shift in the HG%, RBCs, Neutrophil, Lymphocyte, Monocyte, WBCs, and platelets was seen in the hematological profile. The mean of WBCs  $\pm$ SE was  $11.69 \pm 8.47$ , Neutrophile was  $6.621 \pm 3.29$ , Lymphocyte was  $4.35 \pm 2.425$ , and Monocyte was  $1.33 \pm 1.027$ , all of which are considerably increased.

The results of platelets showed that females have substantially higher values than males ( $p = 0.209$ ). The mean  $\pm$ SE for females was  $310.3 \pm 235.6$  and for males it was  $260.58 \pm 196.64$ . The total mean was  $278.81 \pm 205.24$  as shown in figures 6-10. Contrasting with the complete blood count results in our study, another study showed in a retrospective cross-sectional study ( $n = 67, 623$ ) evaluating the CBC. Although there were lower mean values in some of the components of the CBC, immature neutrophils were higher in neonates with infection, with no difference in platelet counts (Bhandari, 2014). Other study showed that males with sepsis have a higher mortality rate, indicating that sex-related factors can play a role in host susceptibility. Hematological results such as Hb%, WBC and PLT have been reported, and the latest research found that neonates with anemia, thrombocytopenia, leukopenia, and

neutropenia have a higher mortality risk (Jumah and Hassan, 2007). Late preterm males had a higher risk of composite extreme neonatal morbidity, NICU admission for >3 days, hypothermia, and feeding difficulty as compared to females. Gender variations in late preterm neonatal outcomes may be attributed to unmeasured biologic factors or placental metabolic differences requiring further research (Battarbee et al. 2018).

The acute inflammatory protein CRP raises in infected or inflamed areas to 1000-fold (Sproston and Ashworth, 2018). Our results showed in figure 11 that the total mean value of CRP were 4 mg/dL (Normal value is 0.3 to 1.0 mg/dL), CRP was higher in male than female patients. In male patients, the mean value of CRP is 6.5 mg/dL and this due to the presence of microorganisms in high percentage in male cases which are *E. coli* 35.48% and CoNS 19.35%, using the blood culture technique, while in female patients the most common microorganism was *K. pneumonia* 35% resulting in elevation of the inflammatory marker CRP and the mean value is around 3.85 mg/dL

With 168 neonates altogether, only 102 of whom had sepsis in the previous prospective case-control study, the CRP mean in this one was  $24.97 \pm 15.58$  mg/dL. (Rashwan et al. 2019). The total CRP was  $2.2 \pm 0.959$  mg/dL in another prospective cross-sectional trial with 75 newborns, although only 9 had sepsis (Charles et al. 2018).

## CONCLUSION

The most prevalent bacteria in all NS cases were CoNS (predominantly in females), *E. coli* (only in men), and *K. pneumoniae* (mainly in females). The most sensitive antibiotic was Trimethoprim-Sulfamethoxazole, while the least sensitive was Gentamicin-Syn. Linezolid had the lowest resistance level while ampicillin had the highest. The most effective antibiotics against CoNS were Cefotaxime and Ciprofloxacin, Trimethoprim-Sulfamethoxazole against *K. pneumoniae*, and Cefoxitin & Imipenem against *E. coli*. Males had considerably higher levels of WBCs, neutrophils, and CRP than females, which may be related to the higher prevalence of (*E. coli* and CoNS) in males..

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

## AUTHOR CONTRIBUTIONS

All authors read and approved the final version.

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