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Outcome of Neonatal Sepsis in Neonatal Intensive Care Unit in Zagazig University Hospitals

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ABSTRACT

Background: Early and late onset sepsis is defined as presenting before and after the first 72 hours of birth. The general fatality rate of early-onset sepsis varies between 15-40%.

Objective: The aim of study is to detect outcome of neonatal sepsis in Neonatal Intensive Care Unit.

Patients and methods: This study consisted of 190 neonates at Neonatal Intensive Care Unit in Zagazig University Hospitals with (69.5%) of them were admitted to NICU in the 1st day, (27.9%) with gestational age more than 37 weeks, (40.0%) had weight from 1500- 2000 gram, males represented (52.2%) and (55.3%) were born by cesarean section. They were divided into 2 groups; positive and negative blood culture groups.

Results: Pregnancy age and birth weight were statistically significantly different between the groups, the septic and non-septic groups differed statistically in all manipulations except IV cannula. There was statistically significant difference between the septic and non-septic groups as premature labor, obstructed labor, mother RH -ve or +ve, premature rupture of membranes (PROM), chorioamnionitis, antepartum hemorrhage, respiratory distress, prematurity, CNS insult and perinatal asphyxia and congenital anomalies, ventilation modes, ventilation duration, hospital stay and causes of death. **Conclusion:** Prematurity, low body weight (BW), obstructed labor, PROM, chorioamnionitis, umbilical catheterization and mechanical ventilation are the most important risk factors. The commonest cause of admission to NICU was respiratory distress followed by prematurity and lastly hypoglycemia. Klebsiella pneumonia, Staphylococcus aureus and E-coli are the most common isolated organisms of blood cultures.

Keywords: Neonatal intensive care unit, Neonatal sepsis, Nosocomial infection.

INTRODUCTION

Neonatal sepsis it is still the leading cause of newborn mortality and morbidity despite recent improvements in health care facilities. A neonatal mortality rate of more than 40% results in the deaths of more than 3.1 million newborns every year [(1)]. In low- and middle-income countries, more than a million of these deaths are linked to infectious diseases like neonatal sepsis, meningitis, and pneumonia [(2)]. Neonatal sepsis/pneumonia alone is responsible for a quarter of the estimated four million neonatal deaths worldwide each year, representing a third of all severe infections [(3)].

When an infant is less than 28 days old and has systemic symptoms of infection and a bacterial pathogen in their bloodstream, they are considered to have neonatal sepsis, which is defined by this. [(4)]. A fully developed immune system, as well as structural components, are all missing in newborns, especially those who were born prematurely or were underweight [(5)]. Furthermore NICU admitted neonates are exposed to interventional therapeutics that may allow entry of pathogens as intubation, ventilation, central venous catheter, peripheral intravenous line, total parenteral nutrition (TPN), venipuncture and urinary catheter that may cause neonatal sepsis including blood stream infection, pneumonia, urinary tract infection, meningitis and skin infection. Conversely, neonatal sepsis survivors are still at risk for long-term and short-term neurodevelopmental morbidity [(6)].

Sepsis is still a significant contributor to mortality and morbidity among very-low-birthweight (VLBW, 1500 g) infants in Neonatal Intensive Care Units (NICUs) despite advances in neonatal care. As a result, the costs and length of hospitalization associated with neonatal sepsis remain high in both developed and developing countries [(7)].

Aim of this study is to detect outcome of neonatal sepsis in Neonatal Intensive Care Unit in Zagazig University Hospitals.

PATIENTS AND METHODS

From January 2018 to December 2018, Zagazig University Hospitals conducted a cross-sectional study in the Neonatal Intensive Care Unit.

Subjects:

The medical records of patients admitted to Zagazig University Hospital's Neonatal Intensive Care Unit (NICU) between January 2018 and December 2018 were screened for neonatal sepsis cases (190 cases).

Inclusion criteria:

All cases diagnosed with neonatal sepsis either acquired it before admission (early sepsis: acquired before or during delivery) or after admission (late and nosocomial sepsis) to Zagazig University Hospital NICU.

Exclusion criteria: Cases have multiple congenital anomalies incompatible with life, cases died before confirming the final diagnosis, and cases with deficient data about the outcome.

METHODS

Medical records of cases admitted to Zagazig university hospital NICU in the period from January 2018 to December 2018 were searched for cases of neonatal sepsis according to the inclusion and exclusion criteria (Figure 1).

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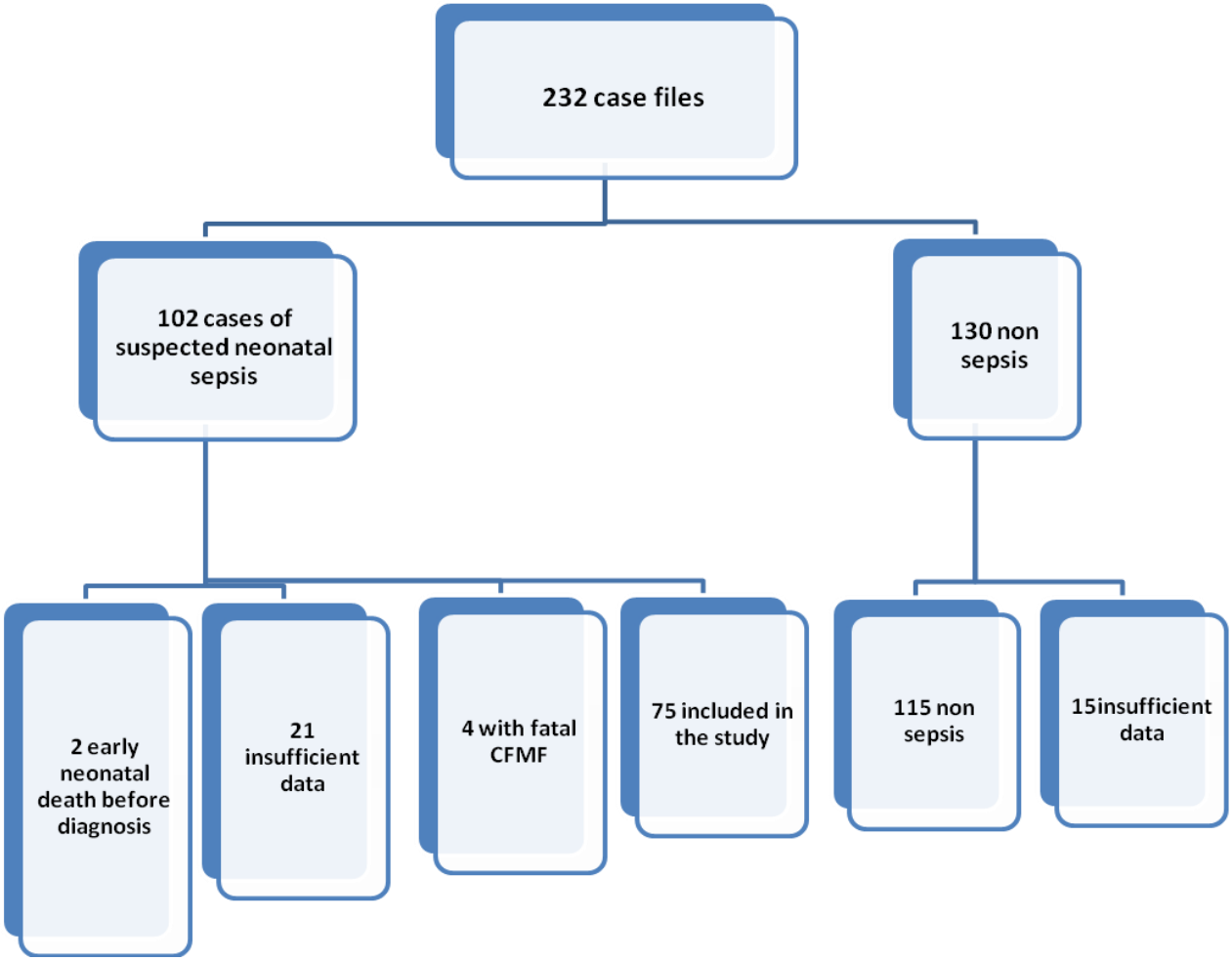

Figure (1): Flow chart of cases

All neonatal sepsis cases were searched for:
Personal history including:
Age at admission, gestational age at delivery, birth weight
Clinical picture:
Symptoms at admission; Vital data; pulse, temperature, blood pressure, respiratory rate and urinary output.
Investigation:

- For diagnosis: CBC and C-RP, Blood culture, sputum culture, urine culture and stool culture.
- To detect complications: (if available):

Management: Antibiotic regimens, manipulation (IV cannula, umbilical catheter, urinary catheter, central venous catheter (CVC), etc.) and total parenteral nutrition (TPN).
Final diagnosis: type of neonatal sepsis (early, late and very late) and complications.
Fate of the case: improved and discharged, discharged with sequelae or died.

Ethical consent:
An approval of the study was obtained from Zagazig University Academic and Ethical Committee. Every care giver of a patient signed an informed written consent for acceptance of participation in the study.

This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis
The collected data were coded, processed and analyzed using the SPSS (Statistical Package for the Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Wilk test. Qualitative data were represented as frequencies and relative percentages and were compared by chi square test (χ^2). Quantitative data were expressed as mean ± SD (Standard deviation) and were compared by independent samples t-test if normally distributed variables (parametric data) or by Mann-Whitney test if non-parametric. P value < 0.05 was considered significant.

RESULTS
Table (1) shows that pregnant women in the positive group had significantly lower birth weights than those in the negative group. Positive and negative groups were not significantly different when it comes to sex and delivery mode.

Table (1): General characteristics as risk factors related to occurrence of positive blood culture among hospitalized neonates (n= 190)

Variables	Category	Positive blood culture (n= 75)	Negative blood culture (n=115)	P value
		n (%)	n (%)	
Gender:	- Male (n= 99)	44 (58.7)	55 (47.8)	0.7
	-Female (n=91)	31 (41.3)	60 (52.2)	
Gestational age (weeks):	- < 37 weeks (n= 137)	92 (67.2)	45 (26.8)	**<0.001***
	- > 37 weeks (n= 53)	17 (32.5)	36 (67.5)	
Mode of delivery:	- C.S (n= 105)	43 (75.3)	62 (53.9)	0.7
	- V.D (n= 85)	32 (24.7)	53 (46.1)	
Birth weight(gm):	-< 1000 (n=4) - 1000-1500 (n=32) - 1500- 2500 (n=108) - > 2500 (n=46)	3 (4.0) 24 (32.0) 31 (41.3) 17 (22.7)	1 (0.8) 8 (6.9) 77 (66.9) 29 (25.2)	**<0.001****

n= Number, *= Significant, **= Highly significant

Table (2) showed that all manipulations except IV cannula were statistically significantly different between the positive and negative groups.

Table (2): Manipulations as risk factors related to occurrence of sepsis among the hospitalized neonates

Manipulations	sepsis (n=75) n (%)	Non sepsis (n=115) n (%)	p-value
Umbilical catheterization:			
- No (136)	13 (9.5)	123 (90.5)	**<0.001****
- Yes (54)	48 (88.8)	6 (11.2)	
Surgery:			
- No (180)	66 (88.0)	114 (99.1)	**<0.001****
- Yes (10)	9 (12.0)	1 (0.9)	
IV cannula:			
- No (6)	1 (1.4)	5 4.(4)	0.245
- Yes (184)	74 (9.8)	110.0 (95.6)	
CVC:			
- No (163)	54 (72.0)	109 (94.7)	**<0.001****
- Yes (27)	21 (28.0)	6 (5.3)	
TPN:			
- No (152)	122 (80.0	111 (96.5)	**0.008***
- Yes (38)	15 (20.0)	4 (3.5)	
Urine catheter: - No (136) - Yes (54)	 38 (50.7) 37 (49.3)	 98 (85.3) 17 (14.7)	**0.001****
Chest tube: - No (175) - Yes (15)	 64 (85.3) 11 (14.7)	 111 (96.5) 4 (3.5)	**0.005***
Endotracheal tube (EET): - No (110) - Yes (80)	 23 (30.6) 52 (69)	 87 (75.6) 28 (24.4)	**<0.001****

n= Number, *= Significant, **= Highly significant

Table (3) shows that early labour, obstructed labour, eclampsia and preeclampsia, RH -ve or +ve, PROM and chorionitis and antepartum hemorrhage were all statistically significantly different between the positive and negative groups.

Table (3): Comparing maternal history between positive and negative blood cultures groups in the studied neonates

maternal history	Positive blood culture (n= 75) n (%)	Negative blood culture (n=115) n (%)	p-value
No maternal history (98)	28 (28.5)	70 (71.5)	0.9
Obstructed labor (17)	8 (47.1)	9 (52.9)	**0.03***
Eclampsia, preeclampsia (15)	12 (80.0)	3 (20.0)	**0.04***
Antepartum hge, anemia (24)	8 (33.3)	16 (66.7)	**0.002***
Mother age <19, >40 (4)	2 (50.0)	2 (50.0)	0.7
Mother RH -ve or O+ve (5)	0 (0.00)	5 (100.0)	**0.03***
Antenatal sonar abnormality (2)	2 (100.0)	0 (0.00)	0.6
IVF, infertility (2)	1 (50.0)	1 (50.0)	0.6
Diabetic mother (11)	4.0 (36.4)	7 (63.6)	0.7
Premature labor (12)	10 (83.3)	2 (16.7)	**0.001****
PROM (7)	5 (71.4)	2 (28.6)	**0.04***
Chorioamnionitis (7)	5 (71.4)	2 (28.6)	**0.04***

n= Number, *= Significant, **= Highly significant

Table (4) shows that statistically significant differences in ventilation modes were found between positive and negative groups.

Table (4): Comparing ventilation mode between positive and negative blood cultures groups in the studied neonates

Ventilation mode	Positive blood culture (n= 75) n (%)	Negative blood culture (n=115) n (%)	p-value
Free oxygen (25)	00 (0.00)	25 (21.7)	**0.03***
Nasal prong (44)	7 (9.4)	37 (32.2)	**0.002***
CPAP (58)	25 (33.3)	33 (28.7)	**0.003***
Mechanical ventilation (63)	43 (57.3)	20 (17.4)	**<0.001****

n= Number, **= Highly significant

Table (5) shows that ventilation and hospital stay were statistically different between the positive and negative blood culture groups, with the positive group requiring a longer hospital stay and more ventilation.

Table (5): Comparing ventilation duration and hospital stay between positive and negative blood cultures groups in the studied neonates

Variable	Positive blood culture (n= 75)	Negative blood culture (n=115)	P
	mean ± SD	mean ± SD	
Ventilation duration	3.9 ± 0.7	1.9 ± 0.8	**0.001****
	n (%)	**n (%)**	**p**
Hospital stay(days) 0-5 6-11 12-16 >16	00 (0.00) 16 (21.3) 20 (26.7) 39 (52.0)	45 (39.1) 39 (33.9) 21 (18.3) 10 (8.7)	**<0.001****

n= Number, **= Highly significant

Table (6) shows that there was statistically significant difference between the positive and negative blood culture groups in causes of death with all deaths in positive group were due to sepsis.

Table (6): Comparing death cause between positive and negative blood cultures in the studied neonates

Death cause	Positive blood culture (n= 25 n (%)	Negative blood culture (n=7) n (%)	p-value
Sepsis (23)	23 (92.0)	0.0 (0.00)	**0.001****
Other cause (9)	2 (8.00)	7 (100.0)	

n= Number, **= Highly significant

Table (7) shows that there was statistically significant difference between the positive and negative blood culture groups in Hb (anemia), CRP, platelets (thrombocytopenia) initially and on follow up but regarding other elements of CBC, there was no statistically significant difference between the positive and negative blood culture groups.

Table (7): Comparing CBC between positive and negative blood culture groups in the studied neonates

Variable	Positive blood culture (n= 75)	Negative blood culture (n=115)	P
	Mean ± SD	Mean ± SD	
HB{g/dl} (initial)	12.3 ± 2.7	15.6 ± 3.3	**0.03***
HB{g/dl} (follow up)	10.1 ± 2.6	14.4 ± 2.1	**0.02***
Hematocrit (initial)	46.8 ± 11.7	43.2 ± 1.6	0.1
Hematocrit (follow up)	39.4 ± 9.6	40.2 ± 6.9	0.4
Platelets {10^9/l} (initial)	223.7 ± 50.6	237.8 ± 55.9	**0.03***
platelets{10^9/l} (follow up)	150.5 ± 19.9	223.9 ± 6.1	**0.001****
TLC{10^9/l} (initial)	31.2 ±1.1	10.8 ± 1.3	**0.002***
TLC{10^9/l} (follow up)	11.7 ±1.4	14.2 ± 1.2	0.3
CRP **{**mg/L**}**	48 ± 2.1	10.5 ±0.2	**0.002***
IT ratio	0.4 ±0.1	0.18 ±0.005	0.6

n= Number, *= Significant, **= Highly significant.

Discussion:

Invading organisms or their byproducts can spread throughout the bloodstream or into other tissues of the body, leading to sepsis, a toxic condition. As a medical term, the term "septicemia" is also used. The term "sepsis" now encompasses more than just an infection. Septic shock is now associated with a variety of symptoms, including those of systemic inflammatory response syndrome (SIRS). Sepsis can be caused by a virus, fungus, bacteria, or parasite [(8)].

Severe neonatal sepsis has a high mortality and morbidity rate for infants because of its distinct symptoms, diagnosis, and treatment. However, some late-onset neonatal sepsis has been documented within the first 90 days of life, particularly when prematurity has been a factor [(9)]. Sepsis in neonates is a leading cause of death and serious illness for those who are born prematurely or in hospitals. One-fifth of all neonatal deaths are caused by sepsis. Sepsis remains the seventh leading cause of neonatal death in the United States [(10)].

Every 1,000 births, one to eight babies will develop early-onset sepsis. Sepsis with late onset occurs in newborns over the course of the first 72 hours of life. Late-onset sepsis can be caused by a wide range of infections, the majority of which are acquired in the hospital [(9)]. It is essential to prevent late-onset sepsis. It is possible to prevent the development of late-onset necrotizing fasciitis by adhering to infection-control policies and practices such as hand hygiene and the use of chlorhexidine [(11)].

The aim of this study is to detect the outcome of neonatal sepsis in Neonatal Intensive Care Unit in Zagazig University Hospitals.

This study consisted of 190 neonates with (69.5%) of them were admitted to NICU in the 1st day, where (27.9%) were term, males represented (52.2%), (75.8%) with body weight less than 2500 grams, preterm represented (72.1%) and (55.3%) were born by cesarean section (C.S). These results were comparable to study by **Ingale *et al.* [(12)],** where data of 393 neonates were analyzed (24.9%) of them were term, males represented (56.7%), body weight less than 2500 grams (87.7%), preterm (75%) neonates but in contrast to our study only (18%) were born by cesarean section. Similar male predominance of infections has been reported in another study. Males constituted 42 (58%). X-linked immune regulatory genes may be to blame for the higher incidence of male-specific infections in newborns with neonatal septicemia [(13)].

In contrast to our study, which showed that (55.3%) of neonates were born by cesarean section**, Ingale *et al.*[(12)]** reported that majority of infected neonates were born vaginally (81.9%), and **Mehar *et al.*[(13)]** found that spontaneous vaginal delivery was reported to be the case (62 percent). As a tertiary referral hospital for both obstetrics and pediatrics, our hospital sees many late referral cases with adverse intrapartum and neonatal risk factors that necessitate interference with emergency caesarean section. This indicates vertical transmission from the maternal genital tract.

The current study showed that (51.6%) of the studied group had no maternal history of any problems, (8.9%) were born to mothers had obstructed labor and (7.8%) were born to mothers had pregnancy induced hypertension and eclampsia, (3.8%) represented cases with PROMs and the same percentages with chorioamnionitis. In a study by **Ingale *et al.*[12];** mothers are at increased risk because of high blood pressure during pregnancy (13,4 percent), PROMs (10,1 percent), and amniotic fluid tainted with meconium (also 10,1 percent)

Maternal risk factors were found to be consistent across study of **West and Tabansi[14]**, with higher rate of prolonged rupture of fetal membranes greater than 24 hours represented (17.8%) while peripartum pyrexia represented (7.1%) and chorioamnionitis (7.1%)**.**

The current study found that the commonest cause of admission to NICU was respiratory distress (63.2%) followed by prematurity (36.8%) and lastly hypoglycemia (2.6%). These results are comparable to results from **Mehar *et al.* [13],** where the commonest cause of admission to NICU was respiratory distress (including hyaline membrane diseases, meconium aspiration syndrome and perinatal asphyxia) (63.4%) followed by congenital heart disease (9.5%) and lastly hypoglycemia (4.8%).

Our study found that the rate of neonatal sepsis in Zagazig University Hospitals was (n=75) (39.5%). This agrees with study by **Ingale *et al.* [12];** with clinical signs and symptoms suggestive of infections in 393 (32.4%) of the neonates. In the study of **Shah and Desai[15];** infection rates in NICUs in India have been reported at 21.22 percent and 50.9 percent, respectively. In the US, NICU infections occur at a rate of 6–25%, while in Europe, infections occur at a rate of 8–10%[16]. These discrepancies may be due to the fact that each population has its own unique characteristics and risk factors.

In our study (31.6%) of the study group had nosocomial sepsis and (7.9%) had early neonatal sepsis, where (53.3%) of the early neonatal sepsis group presented by not doing well baby and (20.0%) had poor suckling, lethargic (13.3%), hypothermia(6.7%) and molting (6.7%). This agrees with **Ingale *et al.*[12]**. A similar proportion (65.7 percent) of septicemia cases in this study had a late onset, as reported by **Gosalia *et al.* [17].**

In contrast to this study, **Swarnkar and Swarnkar[18]** reported that among the 3574 live birth the incidence being 52.88/1000 live birth, which had an incidence of 20.15/1000 live births in 72 neonates, accounting for 38 percent of all neonatal sepsis. . In study of **West and Tabansi[14]**, the commonest clinical features of septicemia were respiratory distress (30.2%), fever (26.6%), poor suckling (22.5%) and jaundice (14.2%).

About (17.3%) of the blood culture had no growth, Klebsiella was the commonest organism (22.7%) followed by Staph aureus (17.3%) then E. coli (12.0%) and (97.8%) of the study group had negative other cultures (stool, urine and sputum). This agrees with **Ingale *et al.*[12]** regarding early onset septicemia, Klebsiella pneumoniae was the most common pathogen (40 percent), with the study of **Premlatha *et al.*[19]** where K. pneumoniae has been identified as the most common cause of early-onset septicemia (EOS) in India. Candida parapsilosis and coagulase-negative staphylococci (CoNS) were the most common pathogens responsible for late-onset septicemia (45.8%, 20.8% each). CoNS and Candida spp. have a similar prevalence, in late-onset septicemia (LOS) as was reported by **Ahmed *et al.*[20]. Desai and Malek[21]** as well as cited predominant Gram negative bacteria in neonatal septicemia. However, **Ballot *et al.*[22]** have reported Gram positive bacteria as predominant cause of neonatal septicemia.

Neonatal septicemia's microbiome is constantly evolving due to improvements in the diagnosis and treatment of the condition. In pre-antibiotic times, Gram positive cocci like Streptococcus pyogenes and Pneumococci were the leading causes of septicemia. When antimicrobial agents were introduced in the NICU, Gram-negative bacteria like E. coli, Pseudomonas, and Klebsiella became a major threat to sick or fragile newborns [23].

In the current study most common complication of neonatal sepsis in studied group was necrotizing enterocolitis (22.6%), then pneumonia (20%), DIC (12%) and no complications in (33.4%). In study of **Swarnkar and Swarnkar[18],** the most common comorbidity of neonatal sepsis in studied group was pneumonia in (68%), necrotizing enterocolitis in (15.3)% and meningitis in(8.3%).

In our study as regard maternal and fetal risk factors, the current study showed statistically significant differences between sepsis and non-sepsis group as regard: preterm labor (gestational age), birth weight, obstructed labor, eclampsia and preeclampsia, PROMs, chorioamnionitis, antepartum hemorrhage, respiratory distress and perinatanl asphyxia; yet no significant differences were found as regard sex, mode of delivery, congenital heart disease, inborn error of metabolism or being infant of diabetic mother.

As regard risk factors for neonatal sepsis, this study showed statically significant differences between sepsis and non-sepsis groups as regard: umbilical catheter insertion (88.8% Vs 11.2%) respectively, TPN (20% Vs 3.5%) respectively, central venous catheter insertion (28% Vs 5.3%), undergoing surgery (12% Vs 0.9%), urinary catheter insertion (49.3% Vs 14.7%), and chest tube insertion (14.7% Vs 3.5%) , and not only mechanical ventilation (Endotracheal tube (EET) insertion) (69% VS 24.9) but also ventilation duration and hospital stay with more values in sepsis group. Only IV cannula insertion as manipulation didn't show statistically significant difference between both groups, interestingly it was the most common manipulation done in NICU.

In our study there was statistically significant difference between the sepsis and non-sepsis groups in ventilation modes. Cases with sepsis received more free oxygen, more nasal prong, more continuous positive airway pressure (CPAP) and more mechanical ventilation. In contrast to these results, **Ingale *et al.*[(12)]** found no statistically significant differences between sepsis and non-sepsis group as regard mechanical ventilation and preterm labour; yet as comparable to our results there were statistically significant differences between both groups as regard PROMs, birth asphyxia and pregnancy induced hypertension. Similar risk factors were observed by **West and Tabansi[(14)]**.

In contrast to current study, **Swarnkar and Swarnkar[(18)]** had reported that in preterm, small for gestational age (SGA) and meconium staining of liquor, the incidence of sepsis was negligible if maternal risk factor were absent. On the other hand in comparable to the current study the mentioned study found that PROM, and foul smelling liquor (as maternal risk factors) were significant risk factor associated with sepsis and there was no significant association between maternal diabetes with EOS, and they concluded that in the absence of maternal risk factors, even if the infant is at high risk for sepsis due to prematurity, very low birth weight, small for gestational age or birth asphyxia; the incidence of EOS is negligible. Other neonatal risk factors reported are umbilical catheterization, and formula feeding.

Our study showed that only (10.5%) of the study group had positive C reactive protein (CRP) as screening parameter at admission agreeing with rate of early neonatal sepsis in the study (7.9%), (42.1%) in the 2nd time, this indicates recruitment of cases developed nosocomial neonatal sepsis (31.6%) and (8.9%) had positive CRP in the 3rd time follow up. In contrast to **Swarnkar and Swarnkar[(18)],** where 87.5% of neonates had positive CRP from whom only 45.8% had blood culture positive.

As regard the definitive outcome of our study (77.8%) of the study group were discharged and (22.2%) of them had died where sepsis was responsible for 71.8% of all deaths. This is comparable to results by **Ingale *et al.*[(12)]** where (79.2%) of the study neonates were cured and (20.7%) died where the case fatality rate was higher in late onset infection (22.7%) as compared to early onset infection (17.1%), in contrast to results from **Ballot *et al.*[(22)]**, which have similar mortality rate 18.6% yet the case fatality rate of EOS and LOS were not significantly different, 1/16 (6.3%) as compared to 45/230 (19.6%) (P = 0. 319).

As regard the relation between the commonest organism (Klebsiella) and general characteristics of the sampled neonates; most of Klebsiella cases were males, VLBW, C.S borne and with early gestational age. As regard the relation between the commonest organism (Klebsiella) and manipulations in the sampled neonates; Klebsiella was commonly associated with ETT, chest tube, urine catheter, TPN, CVC and (100%) in IV cannula of the study group. Our study shows that Klebsiella was present in (64.7%) of respiratory distress (RD) cases and (29.4%) of prematurity in the study group.

As regard antibiotic profile of the main causative organism Klebsiella pneumoniae, the best antibiotic were amikacine and imipenem, and the highest resistance was found for third generation cephalosporins and amoxicilline/clavulanic acid. This is comparable to the study of **Ingale *et al.*[(12)]**, which found the highest levels of resistance to third-generation cephalosporins (Ceftazidime (81.1 percent) and Cefotaxime (60.3 percent)) in Gram-negative bacteria. Polymyxin B and colistin were found to be active against all Gram-negative bacteria.

Conclusion:

Neonatal sepsis represents a big problem in our NICU in Zagazig University Hospitals. It was diagnosed in about 39.5% of neonates. Prematurity, low BW, obstructed labor, PROM, chorioamnionitis, umbilical catheterization and mechanical ventilation are the most important risk factors. The commonest cause of admission to NICU was respiratory distress (63.2%) followed by prematurity (36.8%) and lastly hypoglycemia (2.6%).

Klebsiella pneumonia (22.7%), *Staphylococcus aureus* (17.3) and *E-coli* (12%) are the most common isolated organisms of blood cultures. All isolated organisms were most sensitive to imipenem and most resistant to cefotaxime. In our study (77.8%) of the study group were discharged and (22.2%) of them had died and (71.8%) of the deaths were due to sepsis.

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