



# Open Journal of Pediatrics & Neonatal Care

## Research Article

# Evaluation and Management of Infants Transferred from Newborn Nursery to NICU to Rule out Neonatal Sepsis -

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**Submitted:** 01 September 2017; **Approved:** 14 September 2017; **Published:** 15 September 2017

**Citation this article:** Zahouani T, Buyukgoz C, Arevalo S, Hlaing AY, Karbalivand H, et al. Evaluation and Management of Infants Transferred from Newborn Nursery to NICU to Rule out Neonatal Sepsis. Open J Pediatr Neonatal Care. 2017;2(2): 051-054.

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## ABSTRACT

**Background:** Neonatal sepsis is one of the major causes of morbidity and mortality in neonates. Management of infants with risk factors remains controversial for pediatricians and neonatologists. The objective of this study is to evaluate infants who were initially admitted to the Well-Baby Nursery (WBN) and subsequently transferred to the Neonatal Intensive Care Unit (NICU) for further evaluation and management of neonatal sepsis.

**Methods:** A retrospective data review was conducted from January 2005 to December 2014. Collected data included maternal risk for infection, fetal medical issues, delivery characteristics, gestational age, birth parameters, clinical condition of the infant, initial complete blood count, blood culture, the reason for transfer to NICU and the outcome.

**Results:** A total of 97 infants were transferred from WBN to NICU to rule out neonatal sepsis. All infants received antibiotic therapy with ampicillin and gentamycin until cultures were negative. The average length of stay in the NICU was 5.3 days and it ranged between 1 and 25 days. Of those 97 infants, 6 were treated for culture-positive sepsis. Identified organisms were three group B *streptococcus*, one *Staphylococcus aureus*, one with *Escherichia coli* and one with *Streptococcus mitis*.

**Conclusion:** Neonatal sepsis is an important cause of morbidity for neonates and remains a clinical challenge especially for asymptomatic infants. Observing these babies is crucial and any symptoms or abnormal laboratory result will prompt transfer to NICU. On the other hand, keeping the infant who are asymptomatic in the WBN will facilitate mother-infant bonding, increase breastfeeding rates while decreasing antibiotic exposure at this early age. Consequently, high index of suspicion has a great significance when evaluating these infants at risk.

**Keywords:** Transfer; Nursery; NICU; Neonatal Sepsis; Chorioamnionitis; Blood Culture

## INTRODUCTION

Neonatal Sepsis (NS) is a systemic infection occurring during the neonatal period ( $\leq 28$  days of life) and remains a major cause of morbidity and mortality in neonates. It is divided in two categories based on the time of onset into Early Onset Sepsis (EOS) occurring within the first seventy-two hours of life and Late Onset Sepsis (LOS) occurring after seventy-two hours of life [1]. Early neonatal sepsis causes about 8% of all neonatal deaths, and the proportion of late neonatal deaths due to sepsis remained constant between 1.5 - 2% [2]. Accurate diagnosis of NS is challenging due to varied clinical manifestations and the poor outcome of septic neonates often drives neonatal care providers to treat presumably any neonate with suspected clinical sepsis [3]. The objective of this study is to evaluate late-preterm and term infants initially admitted in the Well-Baby Nursery (WBN) with minimal risk factors of infants prone to infection and later identified to have clinical and laboratory evidence for suspected infection and transferred to the Neonatal Intensive Care Unit (NICU) to rule out NS.

## METHODS

We conducted a retrospective descriptive study of neonates who required a transfer from the WBN to NICU to rule out NS during the ten-year period from January 2005 to December 2014. We collected data from the medical records including maternal risk for infection, fetal medical issues, delivery characteristics, gestational age, birth parameters and clinical condition of the infant, initial complete blood count and blood culture, and the reason for transfer to NICU for further management with the outcome. These infants were evaluated on admission by the medical and nursing staff and were transferred to the NICU due to clinical signs and symptoms and laboratory evidence of infection. The neonatal policy was to admit all well babies who were clinically well and born with a gestational age of at least 36 weeks and a birth weight of 2200g.

Our institution is located in an urban area serving a predominantly minority and immigrant population of low socio-economic status consisting of a majority of Hispanic and a minority of African American. Many women do not seek prenatal care early enough to care for themselves and for their fetus during pregnancy.

## RESULTS

Over the study period of 10 years, 97 (15.5%) out of the 625 infants who required transfer from WBN to NICU were transferred to rule out sepsis. Of those 97 cases, 6 infants had initial positive blood cultures in the WBN, three with *Group B streptococcus* (GBS), one with *Staphylococcus aureus*, one with *Escherichia coli* (*E. coli*) and one with *Streptococcus mitis*. The repeated blood culture performed between 24-48 hours of admission to NICU were all negative. Those six cases are presented in (Table 1). 70 mothers were GBS negative and 27 were positive. 15 mothers had fever during labor or postpartum and 24 had obstetrical chorioamnionitis (based on obstetrical team criteria). The gestational age ranged between 35 and 42 weeks and the mean gestational age was 39 weeks  $\pm$  1.3 weeks. The birth weight was between 2115 and 4375g and the mean weight was 3375g  $\pm$  493.4g. The mean Apgar scores were 8.8 and 8.9 at first and fifth minutes respectively. The mean time of transfer was 19.1 hours and it ranged between 1 and 144 hours. 48 infants (49.5%) were male and 49 were females (50.5%). 62 infants were delivered via Normal Spontaneous Vaginal Delivery (NSVD) (64%) and 35 via caesarean section (C-section) (36%). All infants received antibiotic therapy with ampicillin and gentamycin until cultures were negative. The average length of stay in the NICU was 5.3 days and it ranged between 1 and 25 days. The demographic characteristics are summarized in (Table 2). We did not have any cases of viral, fungal or spirochaetal infection.

## DISCUSSION

Neonatal infections that include sepsis, pneumonia, and meningitis, cause approximately 23.4% of neonatal deaths worldwide each year [4]. Approximately half of the deaths caused by sepsis or pneumonia occur during the first week of life [5]. Risk factors for NS include but are not limited to, maternal chorioamnionitis, delivery at  $< 37$  weeks, maternal GBS colonization, Rupture Of Membranes (ROM)  $> 18$  hours, and maternal urinary tract infection. Chorioamnionitis is an inflammation of the chorion and amnion caused by intrauterine bacterial infection and it affects 0.1% to 2% of pregnancies increasing the newborn's risk of EOS [6]. Late-preterm and term infants who are clinically well appearing at birth even with minimal risk factors need to be thoroughly evaluated and can stay



in WBN with the mother for establishing bonding and initiating breastfeeding with continued evaluation by both nursing and medical team along with basic laboratory evaluation for NS (CBC, blood culture). This evaluation can be performed in the regular nursery or in the mother-baby unit [7]. While observed, any signs and symptoms or abnormal laboratory result on initial work up will prompt transfer to the NICU [6]. In this way, the mother will have the opportunity to care for her baby and we can limit the overcrowding of NICU with unnecessary initial admission. Clinical guidelines published by the centres for Disease Control and Prevention in 2010 and the American Academy of Pediatrics (AAP) in 2012 (with a subsequent clarifying supplement in 2013) recommend that all well-appearing term newborns whose mothers were diagnosed with Chorioamnionitis undergo laboratory screening for sepsis, including blood culture, and receive at least 48 hours of broad-spectrum antibiotic therapy [8-10]. EOS is a perinatally acquired infection from mother-fetus-infant through vertical transmission from endogenous bacteria in the mother's reproductive tract. The organisms most frequently involved in early-onset neonatal sepsis of term and preterm infants together are GBS and *Escherichia coli*, which account for approximately 70% of infections combined. The AAP and American College of Obstetricians and Gynecologists (ACOG) has initiated the GBS screening of pregnant mother between 35-37 weeks of gestation and to treat them if they are positive during the intrapartum period. By following this guideline, the GBS EOS has significantly decreased by two thirds. Clinical manifestations range from subtle symptoms to profound septic shock. Signs and symptoms of sepsis are nonspecific and include temperature instability (primarily fever), irritability, lethargy, respiratory symptoms (tachypnea, grunting, and hypoxia), poor feeding, tachycardia, poor perfusion, and hypotension [11]. Laboratory tests are required for the diagnosis and the blood culture is the gold standard test for diagnosis [1]. Our institution is a level III

perinatal center with an active residency program that provides total care for all infants under close supervision by neonatal and perinatal attendings.

Ninety-seven infants were transferred to NICU to rule out sepsis based on clinical signs and symptoms and laboratory abnormalities. The most common reasons to transfer were respiratory distress, abnormal blood work up and associated risk factors in perinatal period. However the six infants with positive blood cultures were completely asymptomatic except the baby with *E. coli*. Six infants had initial positive blood cultures performed in the WBN (three with group *B streptococcus*, one *Staphylococcus aureus*, one *Escherichia coli* and one *Streptococcus mitis*). The other ninety-one infants admitted to NICU for sepsis work-up had negative blood cultures and the antibiotics were discontinued by 48-72 hours. Whereas the six infants with initial positive blood cultures in WBN shown in (Table 1) had risk factors like ROM and GBS positive with intrapartum antibiotic prophylaxis but no evidence of chorioamnionitis. All infants were asymptomatic except the infant with positive *E. coli* who manifested signs and symptoms of EOS and later developed a gastrointestinal perforation requiring transfer to a regional perinatal center where the infant's clinical condition improved. The infant's infection was perinatally acquired since the mother had a urinary tract infection with *E. coli* that was treated before birth. The other five infants were clinically well and blood culture was performed due to maternal risk factors. We believe the blood cultures of the two infants who had initial positive blood cultures with *Staphylococcus aureus* and *Streptococcus mitis* were possibly contaminated as they were clinically well. All infants had a negative CSF and all responded well to antibiotic therapy. The three infants with GBS bacteraemia did not have any clinical signs and symptoms of EOS but if we had not treated them, these infants may have later manifested with late onset sepsis.

**Table 1:** Positive Blood Culture Cases.

Gestational age (weeks)		39	40	39	40	37	40	
Sex		M	M	F	M	M	F	
Birth weight (grams)		3690	3850	3935	3305	2820	3280	
APGAR 1 <sup>st</sup> /5 <sup>th</sup> minutes		9/9	9/9	9/9	7/8	8/9	9/9	
Delivery Method		C/S	C/S	NSVD	C/S	NSVD	NSVD	
Maternal	GBS	Negative	Negative	Positive	Positive	Negative	Negative	
	Intrapartum prophylaxis	No	No	Yes	Yes	No	No	
Mother	Temperature (Fahrenheit)	101.2	99.6	98.8	98	98.4	98.7	
	WBC	17.1	13.1	8.2	12	7.7	5.9	
	Chorioamnionitis	No	No	No	No	No	No	
	ROM prior to delivery	17 hours	24 hours	3 hours	8hours	No	No	
	Leukocytosis	No	No	No	No	No	No	
Infant	Temperature (Fahrenheit)	98	98.8	98.9	99.6	98.7	98	
	WBC	30	5.2	13.1	3.3	2.4	8.2	
	IT ratio	0	0.12	0.05	0	0.42	0.07	
	Band count	0	5	2	0	3	5	
Hour of Transfer		20	20	36	3	14	6	
Culture	Blood	Initial	<i>S. aureus</i>	GBS	Strep. Mitis	GBS	<i>E. Coli</i>	GBS
		Repeat	Negative	Negative	Negative	Negative	Negative	Negative
	CSF	Negative	Negative	Negative	Negative	Negative	Negative	
Days of Antibiotic		4	10	7	14	4	14	
Other condition		None	None	None	Hyperbilirubinemia	Hyperbilirubinemia Gastrointestinal perforation	None	
Length of stay (days)		5	10	9	14	4	14	

**Table 2:** Demographic characteristics.

		Min - Max	Mean ± Standard deviation
Gestational age (weeks)		35 - 42	39 ± 1.3
Birth weight (grams)		2115 - 4375	3375 ± 493.4
Apgar score at 1min		7 - 9	8.8 ± 0.4
Apgar score at 5min		8 - 9	8.9 ± 0.2
Hour of transfer (hours)		1 - 144	19
Length of stay (days)		1 - 25	5
		Number	Percentage %
Hour of transfer	< 24h	64	65.9
	24 - 48h	20	20.6
	48 - 72h	12	12.3
	≥ 72h	1	1
Delivery type	NSVD	62	64
	C-section	35	36
Race	Hispanic	64	65.9
	African American	30	30.9
	Other	3	3
Gender of baby	Female	49	50.5
	Male	48	49.5

## CONCLUSION

Neonatal sepsis remains a clinical challenge with a potential devastating outcome if the diagnosis is missed or the treatment is delayed. Thus, the clinician should keep a high index of suspicion while evaluating newborns with risk factors for NS, initially admitted in WBN and presenting signs and symptoms of neonatal sepsis. As evidenced by our review, many infants transferred to the NICU were sent because there were signs and symptoms of NS. In our case, only six out of ninety-seven infants suspected of having NS had an initial positive blood culture. All infants were effectively treated with antibiotics for 48-72 hours until the repeated blood cultures were negative. Despite the danger of NS, keeping the infant in the WBN will facilitate early mother and infant bonding, breastfeeding, and help prevent unnecessary antibiotic exposure to the infant. It will also help decrease overcrowding in the NICU and improve the cost-effectiveness of caring for newborns while providing continuous medical and nursing care in the WBN.

## ACKNOWLEDGEMENT

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. We would like to thank the former residents who helped manage the patients during their stay in the NICU.

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