



Bundle Care Approach for Prevention of Fungal Sepsis in NICU- A Before & After Study

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Introduction

Recent advances in newborn care in the form of multiple invasive modalities have increased the survival of extreme low birth weight and preterm neonates, but have turned out to be a curse by intensifying health care associated infections in the form of emergence of antimicrobial resistance and fungal sepsis. Fungal sepsis in Neonatal Intensive care unit is not uncommon, because of risk factors like extreme prematurity and low birth weight⁷, use of central lines, broad spectrum antibiotics and parenteral nutrition. Candida blood stream infection (BSI) is an important cause of neonatal sepsis and sepsis related mortality. Several species of Candida are implicated in causing fungal sepsis in newborn, like, *C.parapsilosis* *C. orthopsilosis* *C. glabrata* *C.Metapsilosis* *C.guilliermondii* *C.krusei* *C.lusitaniae*.

The clinical diagnosis of fungal septicemia resembles sepsis syndrome and is difficult to establish the diagnosis. The clinical features of fungal sepsis include frequent apnea, lethargy, GI symptoms, respiratory distress, increased oxygen requirement, thrombocytopenia, hyperglycemia, metabolic acidosis, hypotension and elevated leukocyte count.

Fungal sepsis entails greater mortality and morbidity in neonates. Systemic fungal infections can lead to end organ damage by involving the major organs like kidneys, brain, joints, eyes, lungs, spleen and bones⁸.

The objective of this study is to evaluate the effectiveness of NICU care bundle approach implemented in the prevention of neonatal fungal sepsis.

Methods

This retrospective cohort study was conducted in a Neonatal intensive care unit of tertiary care teaching hospital in Eastern India. As the use of antifungal drugs were high in the unit, care bundle approach (strict hand washing policy, avoiding use of third generation cephalosporin drugs, no use of H2 blockers like ranitidine, early initiation of feeding, antifungal prophylaxis was introduced from January 2017. All neonates admitted in neonatal intensive care unit from January 2015 to December 2019 were recruited in this study. Retrospective Chart review of all medical records (Jan 2015-Jan 2019) of NICU were thoroughly studied, with respect to gestational age, birth weight, mode of delivery, need of NICU admission, feeding, antibiotics use, H2 blocker administration, requirement of invasive mechanical ventilation & central catheterization. Data collected was compiled in MS Excel sheet and was analyzed by SPSS Software (version 21). Chi square test was used to calculate p value for categorical variables.

Results

Total number of admissions in NICU during Pre-intervention group (January 2015-December 2016) were 1943, out of which 550 were preterm neonates. It was noted that 56 were VLBW, 21 were ELBW babies were among them. 25 neonates received broad spectrum antibiotics, and 20 received H2 blockers like Ranitidine, 98 were on mechanical ventilator support, and 20 had central line (UVC, PICC lines). Total number of screen positive sepsis were 654, out of which 75 were culture positive.

During pre intervention period, 27 neonates developed fungal sepsis out of which 19 were preterm, Mean gestational age obtained was 33.5+/- 3.8 weeks. 13 were very low birth weight, 3 were ELBW. Mean birth weight was 1671.648gm. Male:Female ratio was 21:6. 21 of them received broad spectrum antibiotics (Meropenem, Cefotaxime), 11 received H2 blockers(Ranitidine), 11 had central line, 11 were on mechanical ventilation. Mortality was noted in 4 cases out of 27 cases.

Total number of admissions in NICU during Post-intervention group (January 2017-January 2019) were 1969, out of which 579 were preterm neonates. It was noted that 65 were VLBW, 30 were ELBW babies were among them. 13 neonates received broad spectrum antibiotics, and none received H2 blockers, 46 were on mechanical ventilator support, and 10 had central line (UVC, PICC lines). Total number of screen positive sepsis were 542, out of which 66 were culture positive.

During post intervention period, 6 neonates developed fungal sepsis, 5 were preterm, Mean gestational age obtained was 31.5+/-3.8 weeks. 4 were very low birth weight, 2 were ELBW. Mean birth weight was 1230.67gm. Male:Female ratio was 2:1. 2 of them received broad spectrum antibiotics (Meropenem, Cefotaxim), none received H2 blockers, 2 had central line, 1 were on mechanical ventilation. Mortality was noted in 1 out of 6 cases.

Category	Pre Intervention(Jan 2016- Dec 2016)	Post Intervention(Jan 2017-Jan 2019)
Total number of Admissions	1943	1969
Preterm Admissions	550(28.3%)	579(29.4%)
VLBW(<1.5kg)	56(2.88%)	65(3.30%)
ELBW<1kg)	21(1.08%)	30(1.5%)
Broad spectrum antibiotics(3rd generation cephalosporins, carbepenems)	25(1.28%)	13(0.6%)
H2 blocker	20(1.02%)	00

Mechanical Ventilation	98(5%)	46(2.336%)
Central Lines (UVC, PICC)	20(1.03%)	10(0.50%)
Total Number of Sepsis	654(33.6%)	542(27.5%)
Culture Positive Sepsis	75(3.86%)	66(3.35%)

Table 1: Risk factors for fungal septicemia in neonates

Analysis of the risk factors among the cases in Pre and Post Intervention group:

Birth Weight	Pre-Intervention		Post Intervention		P value
	Frequency(n)	Percentage (%)	Frequency(n)	Percentage (%)	
VLBW (1000-1500gm)	13	48.1	4	66	<0.001
ELBW(<1000gm)	3	11.1	2	33.3	0.637

Table 2: Birth Weight

Gestational age	Pre-Intervention		Post Intervention	
	Frequency(n)	Percentage (%)	Frequency(n)	Percentage (%)
<32wk	13	48.1	3	18
33-36wk	6	22.2	2	33.3
37-40wk	8	29.6	1	16.6
Mean Gestational age	33.5weeks		31.5weeks	

Table 3: Gestational Age

Use of broad-spectrum antibiotics	Pre-Intervention		Post Intervention		P value
	Frequency(n)	Percentage (%)	Frequency(n)	Percentage (%)	
3 rd generation Cephalosporins and Carbapenams	21	77.7	2	33.3	<0.01

Table 4: Use of broad spectrum antibiotic use

Use of H2 Blockers:	Pre-Intervention		Post Intervention		P value
Ranitidine	Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)	-----
	11	40.7	00	00	

Table 5: Use of H2 Blockers

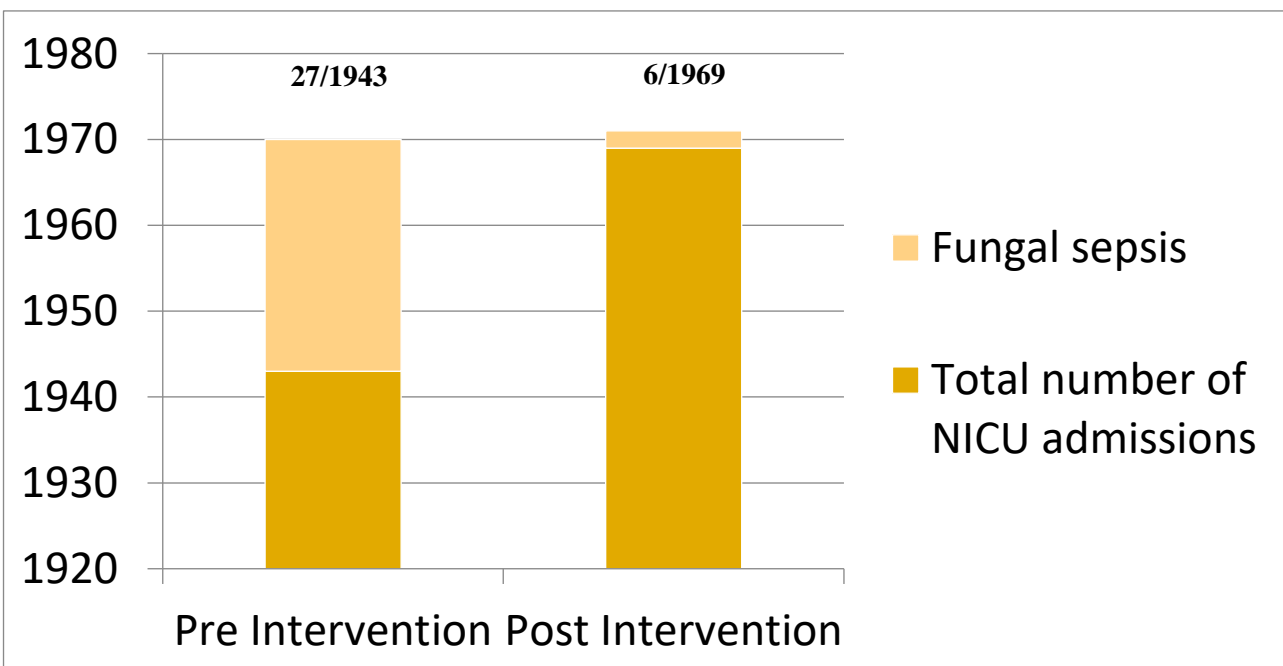
Central line	Pre Intervention		Post Intervention		P value
UVC, PICC lines	Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)	0.623
	11	40.7	2	33.3	

Table 6: Central Line Catheterization

Mechanical Ventilation:	Pre Intervention		Post Intervention		P value
	Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)	0.104
	11	40.7	1	16.6	

Table 7: Mechanical Ventilator support

Incidence of fungal sepsis in NICU between pre-intervention group and post intervention group were statistically compared using Chi Square test, bundle care approach significantly reduced fungal sepsis in NICU (p value <0.001).



Discussion

Fungal sepsis in Neonatal Intensive care unit is a commonly encountered entity, because of risk factors like extreme prematurity, use of central lines & broad spectrum antibiotics. It accounts for significant mortality and morbidity in critically sick newborns.

In the present study, total number of preterm babies accounted for 72.7% of the total cases, thus emphasizing the fact that prematurity is a risk factor for development of fungal sepsis.[2]

51.5% of the cases were VLBW and 15.15% were ELBW babies. Similar observation was also noted in Ananthiah et al, in which it was concluded that Candida sepsis was more common among preterm and low-birth-weight neonates[2].

An attempt to prevent fungal sepsis in our NICU setting was done by following strict policy of hand hygiene, usage of broad spectrum antibiotics, H2 blockers, invasive methods such as central line insertion, mechanical ventilation[6].

It was noted that 77.7% of the cases belonging to pre intervention group received broad spectrum antibiotics. Number of cases of post intervention who received broad spectrum antibiotics were 33.3%. p value was found to be significant. Usage of broad spectrum antibiotics is a well known risk factor associated with fungal sepsis. Similar conclusion was drawn from several studies like Saiman et al [3].

40.7% of the cases in pre intervention group received H2 blockers .H2 blockers were not used during the post intervention study period in NICU.

Invasive procedures like mechanical ventilation, Central line insertion increase the risk of fungal sepsis [4,5]. In pre intervention group cases, 40.2% had a central line and 33.3% cases had central line. 40.7% and 16.6% of the cases in pre intervention and post category cases were on mechanical ventilator [9] respectively.

Conclusions

Use of strict infection control strategies like hand hygiene, restrictive use of broad spectrum antibiotics, preventive approach like antifungal prophylaxis had significantly reduced fungal sepsis in NICU.

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