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Original research article

CLINICAL AND MICROBIOLOGICAL PROFILE OF NEONATES ASSOCIATED WITH PICC LINE INSERTION

[1]Dr. Shivaleela, [2]Dr. Guruprasad B, [3]Dr. Raghavendra H Desai, [4]Dr. Jayaraj Harsoor

[1]Specialist, Department of Pediatrics, GIMS, Gadag, Karnataka, India

[2]Senior Resident, Department of Pediatrics, KVG Medical College, Sullia, Karnataka, India

[3]Associate Professor, Department of Pediatrics, KIMS, Hubli, Karnataka, India

[4]Specialist, Department of Pediatrics, GIMS, Kalaburgi, Karnataka, India

Corresponding Author:

Dr. Jayaraj Harsoor

Abstract

It is estimated that nosocomial and other health-care associated infections affect >2 million patients and contribute to 88,000 deaths in U.S. hospitals annually. The fact that 25-50% or more of nosocomial infections are due to the combined effect of the patient's own flora and invasive devices, highlights the importance of improvements in the use and design of such devices. Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Continuous data was represented as mean and standard deviation. In our study the mean insertion day of life was 2.44 days, neonates in whom PICC line was inserted between 1-3days of life (11) 14.29% had CLABSI, (4)13.33% of neonates had CLABSI in whom PICC line was inserted between 3-7 days, (1) 33.33% of neonates had CLABSI in whom PICC line was inserted between 7-12 days of life.

Keywords: PICC line, local and systemic infections, clinical profile

Introduction

CLABSI is a Surveillance definition used by the CDC and defined as recovery of a pathogen from a blood culture(a single blood culture for organism not commonly present on the skin, and two or more blood cultures for organism commonly present on the skin and the clinical signs of sepsis like apnoea, hypothermia, bradycardia ,poor perfusion) in a patient who had central line at the time of infection or within 48 hours before development of infection .The infection cannot be related to any other infection the patient might have and must not have been present or incubating when the patient was admitted to the facility.

Blood stream infections related to central venous catheterization constitute one of the major nosocomial device associated infections. Such type of device associated infections occur as sporadic, as well as in clusters caused by the same organism. They are the main source of bacteremia and septicemia in hospitalized patients [1].

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For intravascular catheter related bacteremia to occur, microorganisms must gain access to the extraluminal or intraluminal surface of the device. Microbial adherence and incorporation into biofilms then occurs, resulting first in infection and then, in some instances, in haematogenous dissemination [2].

It is estimated that nosocomial and other health-care associated infections affect >2 million patients and contribute to 88,000 deaths in U.S. hospitals annually. The fact that 25-50% or more of nosocomial infections are due to the combined effect of the patient's own flora and invasive devices, highlights the importance of improvements in the use and design of such devices. It is especially noteworthy that turnover or shortages of trained personnel jeopardize safe and effective patient care and have been associated with increased infection rates [3].

Intravascular devices are common causes of local site infection and cause up to 50% of nosocomial infections, central vascular catheters (CVCs) account for 80-90% of these infection. CRBSIs, most of which are associated with central venous catheters, account for 11% of all HAIs [4].

National estimates indicate that as many as 200,000 BSI associated with CVCs occur each year in the United States, with an attributable mortality of 12-25%. One-third to one-half of these episodes occur in ICUs, with increasing care of seriously ill patients in the community, vascular catheter–associated bloodstream infections acquired in outpatient settings may become as frequent as those acquired in hospitals. This possibility emphasizes the need to broaden surveillance activities. Agencies such as the National Healthcare Safety Network (NHSN; formerly the National Nosocomial Infections Surveillance System) of the CDC were formed in response to the growing awareness that HAIs are urgent public health and patient safety issues. The recent action plan proposed by the Department of Health and Human Services identified CRBSIs as a priority area for prevention [5].

Vascular catheters are important source of bacteremias, they are increasing from 3% in the mid-1970s to 19% in the early 1990s. As early as 1977, Makki suggested that more than 25,000 patients develop device-related bacteremia in the U.S each year. Rates of bacteremia associated with the use of intravascular devices increased significantly into the early 2000s [6].

Methodology

Source of data

Data was collected from all neonates including PNC cases with PICC inserted in NICU.

Type of study

It is a Hospital based Prospective Observational Study.

Place of study

This study was conducted at NICU, Department of Paediatrics.

Inclusion criteria

All neonates including PNC cases with PICC inserted for any cause.

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Exclusion criteria

This study excludes

1. Patients with previously diagnosed bacteremia and septicemia
2. PICCs terminated within 48 hours of insertion.

Sample size

Based on the previous studies observed that incidence rate of PICC line associated infection was 19% (throughout the observation period) To estimate the true incidence of PICC line associated infections with 8% error and 95% confidence interval, sample size estimated is minimum of 93.

$$n = \frac{z^2 pq}{d^2} = 93$$

z = 1- 96 at 95% confidence interval d = Margin of error = 8%
p = Incidence of CLABSI = 19%

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Continuous data was represented as mean and standard deviation.

Statistical analysis

Graphical representation of data: M S Excel and MS word was used to obtain various types of graphs such as diagram, bar diagram.

P value (probability that the result is true) of < 0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical Software: MS Excel, SPSS version 22(IBM SPSS Statistics, Somers NY, USA (was used to analyze data.

Results

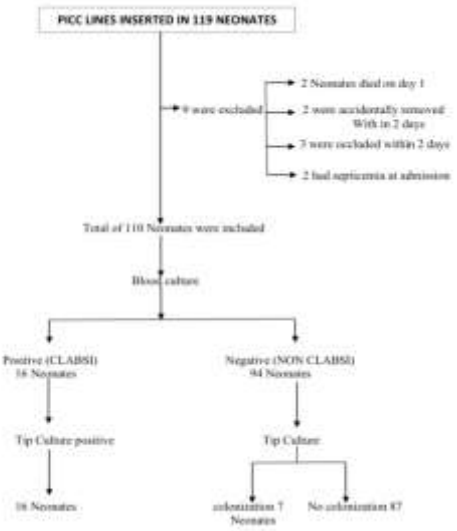

Fig 1: Flow Chart

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Table 1: Association between sex and status of CLABSI of neonates

Sex	Without CLABSI	%	With CLABSI	%	Total	%
Male	42	79.25	11	20.75	53	48.18
Female	52	91.23	5	8.77	57	51.82
Total	94	85.45	16	14.55	110	100.00
Chi-square with Yates's correction = 2.2820 P = 0.1310						

Among male children 20.75% developed CLABSI, while among females 8.77% developed CLABSI

Table 2: Association between Birth weight and status of CLABSI of neonates

Birth weight	Without CLABSI	%	With CLABSI	%	Total	%
<1.5 kg	30	81.08	7	18.91	37	33.6
1.5 kg -2.5 kg	32	84.21	6	15.57	38	34.5
>2.5 kg	32	91.42	3	8.57	35	31.81
Total	94	85.45	16	14.55	110	100.00
Over all, Chi-square= 0.7400 P = 0.8640, NS						
Between <1.5 kg vs. 1.5 kg -2.5kg, Chi-square= 0.1280 P = 0.7200,NS						
Between <1.5 kg vs. >2.5 kg, Chi-square with Yates's correction = 0.8610 P = 0.3530,NS						
Between 1.5 kg -2.5kg vs. >2.5 kg, Chi-square with Yates's correction = 0.337 P = 0.561, NS						

In our study the median birth weight was 1.9 kg, In neonates whose birth weight was less than 1.5 kg, (7) 18.91% developed CLABSI, neonates with birth weight of 1.5-2.5 kg (6) 15.57% developed CLABSI, in neonates with birth weight of more than 2.5 kg 8.57% (3) developed CLABSI.

Table 3: Association between Gestational age and status of CLABSI of neonates

Gestational age	Without CLABSI	%	With CLABSI	%	Total	%
28-32 weeks	25	86.21	4	13.79	29	26.36
32-34 weeks	17	77.27	5	22.73	22	20.00
34-37 weeks	12	80.00	3	20.00	15	13.64
>37 weeks	40	90.91	4	9.09	44	40.00
Total	94	85.45	16	14.55	110	100.00
Over all Chi-square= 2.6100 P = 0.4560, NS						
Between 28-32 weeks vs. 32-34 weeks, Chi-square with Yates's correction = 0.210 P = 0.647, NS						
Between 28-32 weeks vs. 34-37 weeks, Chi-square with Yates's correction = 0.0100 P = 0.9210, NS						
Between 28-32 weeks vs. >37 weeks, Chi-square with Yates's correction =0.061 P = 0.805,						

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NS
Between 32-34 weeks vs. 34-37 weeks, Chi-square with Yates's correction = 0.0001 P = 1.0000, NS
Between 32-34 weeks vs. >37 weeks, Chi-square with Yates's correction =1.3030 P = 0.2540, NS
Between 34-37 weeks vs. >37 weeks, Chi-square with Yates's correction =0.444 P = 0.505, NS

In our study the median gestational age was 35 wks. In neonates whose gestational age was between 28-32 wks. 13.79% (4) developed CLABSI, while 22.73% (5) of neonates between gestational age 32-34weeks developed CLABSI, 20% (3) of neonates between 34-37 weeks developed CLABSI, 9.09% (4) of neonates more than 37 weeks had developed CLABSI.

Table 4: Association between Age (IDL) and status of CLABSI of neonates

Age (IDL)	Without CLABSI	%	With CLABSI	%	Total	%
1-3 days	66	85.71	11	14.29	77	70.00
3-7 days	26	86.67	4	13.33	30	27.27
7-12 days	2	66.67	1	33.33	3	2.73
Total	94	85.45	16	14.55	110	100.00
Over all, Chi-square= 0.8920 P = 0.6400						
Between 1-3days vs. 3-7days, Chi-square with Yates's correction = 0.0001 P = 1.000,NS						
Between 1-3days vs. 7-12days, Chi-square with Yates's correction = 0.0070 P = 0.934,NS						
Between 3-7days vs. 7-12days, Chi-square with Yates's correction = 0.0060 P = 0.9390,NS						

In our study the mean insertion day of life was 2.44 days, neonates in whom PICC line was inserted between 1-3days of life (11) 14.29% had CLABSI, (4)13.33% of neonates had CLABSI in whom PICC line was inserted between 3-7 days, (1) 33.33% of neonates had CLABSI in whom PICC line was inserted between 7-12 days of life.

Table 5: Association between site of insertion and status of CLABSI of neonates

Site of insertion	Without CLABSI	%	With CLABSI	%	Total	%
LL	90	84.91	16	15.09	106	96.36
UL	4	100.00	0	0.00	4	3.64
Total	94	85.45	16	14.55	110	100.00
Chi-square with Yates's correction = 0.0140 P = 0.9060						

In neonates where the site of insertion was lowerlimb15.09% developed CLABSI, in

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neonates in whom PICC line was inserted in upper limb none of them developed CLABSI.

Table 6: Association between Dwell time and status of CLABSI of neonates

Dwell time	Without CLABSI	%	With CLABSI	%	Total	%
>2 d-<4 d	10	100.00	0	0.00	10	9.09
4-7 d	30	81.08	7	18.92	37	33.64
7-10 d	44	86.27	7	13.73	51	46.36
10-15 d	9	81.82	2	18.18	11	10.00
>15 d	1	100.00	0	0.00	1	0.91
Total	94	85.45	16	14.55	110	100.00
Overall, Chi-square= 2.5860 P = 0.6290,NS						
Between >2 d-<4 d vs. 4-7 d, Chi-square with Yates's correction = 0.981 P = 0.322,NS						
Between 4-7 d vs. 7-10 d, Chi-square = 0.432 P = 0.5110,NS						
Between 4-7 d vs. 10-15 d, Chi-square= with Yates's correction = 0.000 P = 1.000,NS						
Between 7-10 d vs. 10-15 d, Chi-square with Yates's correction = 0.000 P = 1.000,NS						

In our study the median dwell time was 9.7 days, in neonates whose dwell time 4-7 days 18.92%(7) developed CLABSI, 13.73% (7) of neonates developed CLABSI whose dwell time between 7-10 days, 18.18% (2) of neonates developed CLABSI whose dwell time between 10-15 days, none of them developed CLABSI in neonates with dwell time >2to<4days and more than 15 days.

Table 7: Association between indication (clinical condition) and status of CLABSI of neonates

Diagnosis	Without CLABSI	%	With CLABSI	%	Total	%
RDS	10	10.64	0	0.00	10	9.09
MAS	8	8.51	2	12.50	10	9.09
HIE	16	17.02	1	6.25	17	15.45
Difficult IV access	57	83.82	11	16.17	68	61.81
NEC	0	0.00	1	6.25	1	0.91
AKI	3	3.19	1	6.25	4	3.64
Total	94	85.45	16	14.55	110	100.00

Among neonates 16.17% (11) of difficult iv access cases develops CLABSI, 12.5% (2) of MAS had CLABSI, 6.25% of cases had CLABSI in HIE, NEC and AKI each.

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Table 8: Complications wise distribution of neonates

Complications	No of neonates	% of neonates
Redness	3	2.73
Swelling	1	0.91
Phlebitis	0	0.00
Oozing	2	1.82
Mal position	0	0.00
Cath break	0	0.00
Occlusion	15	13.64
CLABSI	16	14.55

Among the non CLABSI 13.64% (15) had occlusion, 2.73% had redness, 1.82% had oozing, none of them had phlebitis, catheter break and mal position, 14.55% had CLABSI.

Table 9: Culture Profile Of Blood Sample And Catheter Tip

		Number	Percentage
Blood	Positive	16	14.54
	Negative	94	88.45
Catheter	Positive	16	14.54
	Colonization	07	6.36
	Negative	87	79.09

Among the 110 neonates , 14.55% of the blood culture was positive,14.55% of the catheter tip culture positive and catheter tip colonization only present in 6.36%.

Discussion

Out of 110 cases 48.18% (53) were males and 51.82% (57) were females with M:F ratio 1:1.1, which was similar to the study conducted by Jayashree Purkayashtha *et al*. [7] where percentage of males were 45.5% and females were 54.5%. Another study by Arnab Sengupta *et al*. [8] at Baltimore found that 61.9% of males had CLABSI. Among male children 20.75% developed CLABSI, while among females 8.77% developed CLABSI. It is well documented that females have probably stronger innate and humoral response than males and are less susceptible to many bacterial, viral and fungal infections. Lymphocytes provides mechanistic evidence for enhanced female immunity to infectious diseases and the involvement of X-linked genes and XCI. There was no statistical significance between sex and status of CLABSI of neonates. Which was similar to the study conducted by Sarala Ks *et al*. [9], where there was male predominance in the occurrence of CLABSI.

The median birth weight was 1.9 kg (800 gm -3kg). In the multicenter cohort study conducted by Aaron M *et al*. 10, the median birth weight was 2 kg which was similar to

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our study. In another study conducted by p. Brian Smith MD MS *et al*. [11] median birth weight was 1.749. In neonates whose birth weight of Less than 1.5 kg, 18.91% (7) were developed CLABSI, in neonates with birth weight of 1.5-2.5 kg 15.57% (6) developed CLABSI, and 8.57% (3) of neonates with birth weight more than 2.5 kgs developed CLABSI. The incidence of CLABSI in our study more in VLBW followed by LBW. Shubani MT *et al*. [12] postulated that higher infection rate in VLBW neonates could reflect functional immaturity of the immune system.

The median gestational age in our study was 35 weeks (28-40 weeks). Which was similar to study conducted by Alessandra *et al*. [13] where the median gestational age was 35 weeks. In the study conducted by Jayashree Pukayastha *et al*. [7] from manipal, median gestational age was 30 wks. (25-40 wks.). In another study done by Jie wen MD *et al*. [14] median gestational age was 31 wks. (27-37 wks.). In neonates whose gestational age was between 28-32 wks., 13.79% (4) developed CLABSI, while 22.73% (5) of neonates between gestational AGE 32-34 weeks developed CLABSI, 20% (3) of neonates between 34-37weeks developed CLABSI, 9.09% (4) of neonates more than 37 weeks had developed CLABSI. Neonates with lower gestational age has more CLABSI.

The mean insertion day of life was 2.44 days (IQR 1.50). Which is similar to Jayashree *et al*., [7] where it was 3 days. In the study conducted by Aaron M *et al*., [10] the mean insertion day of life was 5 days. In another study conducted by Arnab Sengupta *et al*., [8] the mean insertion day of life was 5 days. Neonates in whom PICC line was inserted between 1-3 days of life, 14.29% had CLABSI, 13.33% of neonates had CLABSI in whom PICC line was inserted between 3-7 days, 33.33% of neonates had CLABSI in whom PICC line was inserted between 7-12 days of life.

Conclusion

- The median birth weight was 1.9 kg.
- The median gestational age in our study was 35 weeks.
- The mean insertion day of life was 2.44 days.
- The most common indication for picc line insertion was difficult IV access (61.81%).

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