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Research Paper

Microbiological and Epidemiological Study of Neonatal Septicaemia

Microbiology

KEYWORDS : Neonatal Septicaemia,Neonatal blood,Maternal genital tract,Health care personnel.

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ABSTRACT

INTRODUCTION

Bacterial sepsis in the neonates is a clinical syndrome characterised by systemic signs of infection and accompanied by bacteraemia in the first month of life. The source of infection is either nosocomial or community acquired or health care personnel.

AIMS

1.To identify the etiological agents in Neonatal Septicaemia.

2.To correlate the organisms isolated from neonatal blood with isolates from maternal vaginal tract and environment.

3.To determine the antibiotic sensitivity pattern of isolates.

MATERIALS AND METHODS

The present study has been carried out on 200 antenatal mothers admitted for normal vaginal delivery and their babies showing the signs and symptoms of neonatal sepsis. In this study bacterial isolates from maternal gential tract, umbilical vein blood, neonatal blood, environmental sources, health care personnel and their antibiotic suspectibility pattern were studied

RESULTS

Of 200 cases, 112 were with risk factors.88 babies were with no risk factors .84 were culture positive. The commonest isolates were Klebsiella pneumoniae, Escherichia coli,Staphylococcus aureus,Coagulase negative staphylococcus. Significant correlation was found between the isolates of neonatal blood and maternal genital tract, environment sources and health care personnel and with their antibiotic susceptibility pattern also.

CONCLUSION

Low birth weight and prematurity are the most important predisposing factors and these babies are more prone for neonatal sepsis.The sources of infection are maternal genital tract,environmental sources and health care personnel. Control of the infections in the mother and in hospital environment will reduce neonatal morbidity and mortality.

INTRODUCTION

Bacterial sepsis in the neonates is a clinical syndrome characterised by systemic signs of infection and accompanied by bacteraemia in the first month of life [1]. Early onset sepsis usually presents within 72 hours of life. The predisposing factors for early onset sepsis include low birth weight(<2500 gms), preterm babies[2]. The incidence of neonatal sepsis according to data from National Neonatal Perinatal Database (NNPD,2002-03) is 30 per 1000 live births[1].

Health care associated infections are an important problem in neonatal intensive care units in which environmental and host factors often contribute to higher rates of infections.

The early and efficient diagnosis of neonatal bacterial sepsis remains a difficult task. Blood culture is the gold standard for the diagnosis of septicaemia and should be done in all cases of suspected sepsis prior to starting of antibiotics[3].

Hence the present study was undertaken to determine the different predisposing factors, etiological agents and sources in neonatal septicaemia. This will help in measures to be taken by the antenatal mothers and control of the sources of infection.

AIMS AND OBJECTIVES

1. To identify the etiological agents in Neonatal Septicaemia.
2. To correlate the organisms isolated from neonatal blood with isolates from maternal vaginal tract and environment.
3. To determine the antibiotic sensitivity pattern of isolates.

METHODOLOGY [4,5,6]

The present study has been carried out on antenatal mothers admitted for normal vaginal delivery and their babies from March 2012 to March 2013.200 antenatal mothers& 200 live born babies delivered during this period showing signs and symptoms of Neonatal sepsis

EXCLUSION CRITERIA

Mothers: Malnourishment, Gential tract infections , Diabetes mellitus, TORCH infections, High risk pregnancy, Bad obstetric history, Urinary tract infection and Maternal fever

Neonates: Extreme prematurity (<30 weeks of gestational age), Gross congenital anomalies, Congenital infections,Neonates delivered outside and referred to NICU.

History was obtained from mother regarding antenatal care, treatment received in other hospital, history suggestive of intrauterine infection, quality of liquor, duration of labour, mode of delivery, APGAR score of babies and mode of resuscitation.

Vaginal swabs were collected from mothers during second stage of labour for culture and sensitivity after informed consent.

After the expulsion of placenta, 3-5ml blood was collected from umbilical vein and cultured using BHI broth according to standard methods.

2ml venous blood was collected from babies admitted in NICU showing signs and symptoms of sepsis and added aseptically to Brain heart infusion broth, incubated at 37°C under aerobic conditions for bacterial culture. Both the blood samples were subcultured on Mac Conkey agar and Blood agar plates on days 1, 2 and 4 and incubated aerobically at 37°C for 16-18 hours. The plates were examined for growth, if any growth was observed on plates it was processed according to standard methods. Antibiotic susceptibility of the isolates was performed by Kirby-Bauer disc diffusion method.

Swabs from Environmental sources and Health care personnel in NICU

Two sterile swabs were used for collection of the sample from each site of NICU. One swab was used for direct microscopy. The other swab was inoculated on Mac Conkey agar and Blood agar and incubated at 37°C for 16-18 hours. After taking consent, swabs from anterior nares, dorsum of hand, nail bed were collected from health care personnel**.** One swab was used for direct microscopy. The other swab was inoculated on Mac Conkey

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agar and Blood agar and incubated at 37°C for 16-18 hours. The plates were examined for growth, if any growth was observed on plates it was processed according to standard methods.

RESULTS

Table No I : Neonatal Risk factors

Neonatal Risk factors	Total 200	Categories	No of cases	
PRESENCE	112	Mechanical Ventilation	6	Pre term & LBW 4
				Term & LBW 2
		Preterm	93	LBW 74
				NBW 19
		Low birth Weight	112	Preterm 74
				Term 38
		Birth Asphyxia	11	Pre term & LBW 8
				Term & LBW 3
No risk factor NBW	88			

LBW –Low birth weight; NBW-Normal birth weight

Of 200 cases, 112 were with risk factors. Of these 6 on mechanical ventilation and11 with Birth asphyxia showed neonatal sepsis. Of 93-premature babies 74 were with LBW and 19 were with NBW. All the 112 LBW showed signs of sepsis of which 38 were term and 74 were preterm babies .88 babies were with no risk factors and NBW.

Table No II: Type of sample showing culture positivity

Type of sample	Culture positive	culture negative	Total
Neonatal blood	84 (42%)	116 (58%)	200 (100%)
Umbilical vein blood	12 (6%)	188 (94%)	200 (100%)
Vaginal swab	118 (59%)	82 (41%)	200 (100%)

Chi-square (x^2) = 119.56; p <0.001

Significant difference (p<0.001) was observed in the number of isolates from different samples.

Table No III: Birth weight Vs Culture positivity

Birth Weight	Culture positive	Culture negative	Total	
Low birth weight (<2.5 Kg)	69 (61.6%)	43 (38.4%)	112 (100%)	Relative Risk RR=3.6
Normal birth weight (>=2.5 Kg)	15 (17%)	73 (83%)	88 (100%)	
Total	84 (42%)	116 (58%)	200 (100%)	

Chi-square (x^2) = 40.17; p <0.001

Low Birth weight babies were 112, of which 69(61.6%) were culture positive and of 88 Normal Birth weight only 15(17%) were culture positive. There was significant difference (p<0.001).

Table No IV: Gestational age Vs Culture Positivity

Gestational age	Culture positive	Culture negative	Total	
Preterm	48(51.6%)	45(48.4%)	93(100%)	Relative Risk RR =1.54
Term	36(33.7%)	71(66.3%)	107(100%)	
Total	84(42%)	116(58%)	200(100%)	

Chi-square (x^2) =6.59; p = 0.01

Pre-term were 93, of which 48(51.6%) were culture positive and of 107 Term were 107, 36(33.7%) were culture positive Significant difference (p=0.01) was observed.

Table NoV : Neonatal Risk factors Vs Culture

Neonatal Risk factors	Culture positive	Culture Negative	Total	
Presence	72(63.7%)	40(36.3%)	112(100%)	Relative Risk RR = 4.6
Absence	12(13.7%)	76(86.3%)	88(100%)	
Total	84(42%)	116(58%)	200(100%)	

Chi-square (x2) =50.29; p = 0.001

112 cases were with neonatal risk factors, of which 72(63.7%) were culture positive and 88 were without neonatal risk factors, of which 12(13.7%) were culture positive. Significant difference p<0.001

Table NoVI : Culture isolates from neonatal blood

Isolation of Organism	Neonatal Blood n=84
Klebsiella pneumoniae	28(33.5%)
Coagulase negative staphylococcus	24(28.5%)
Escherichia coli	12(14.3%)
Staphylococcus aureus	12(14.2%)
Acinetobacter species	8(9.5%)

Commonest isolate was Klebsiella pneumoniae followed by CoNS, Escherichia coli, Staphylococcus aureus and Acinetobacter species.

DISCUSSION

Table No VII : Comparison of isolates of Neonatal blood with Umbilical vein blood, Maternal genital tract, Environmental sources, Health care personnel

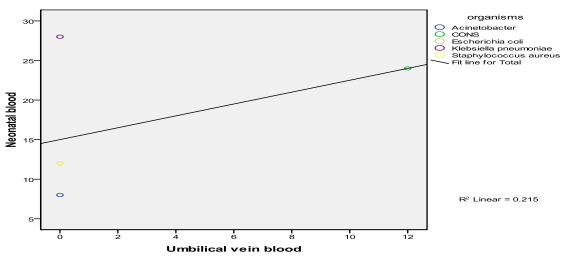
Isolation of Organism	Neonatal Blood n=84	Umbilical vein blood n=12	Maternal Genital tract(Vaginal swab) n=118	Environmental sources n=22	Health care personnel n=20
Escherichia coli	12 (14.3%)	0	42 (35.6%)	0	0
Klebsiella pneumoniae	28 (33.5%)	0	16 (13.6%)	22 (100%)	0
Acinetobacter species	8(9.5%)	0	2 (1.9%)	0	0
Citrobacter species	0	0	6 (5%)	0	0
Staphylococcus aureus	12 (14.2%)	0	14 (11.8%)	0	0

Coagulase negative staphylococcus	24 (28.5%)	12 (100%)	20 (16.9%)	0	20 (100%)

The source of isolates in neonatal blood

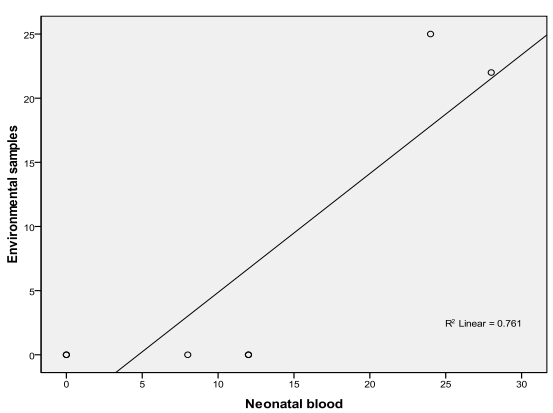
Escherichia coli --may be from Maternal genital tract, Klebsiella pneumoniae--probably from Environmental sources mainly from mucous sucker and also from Maternal genital tract. Staphylococcus aureus--could be from Maternal genital tract, Coagulase negative staphylococcus-- might be from Maternal genital tract and Health care personnel. By tracing out the sources certain preventive measures can be followed to control the infections in mothers during their antenatal period and infection control measures in the hospital environment.

Fig:I Correlation of isolates of Neonatal blood with Umbilical vein blood



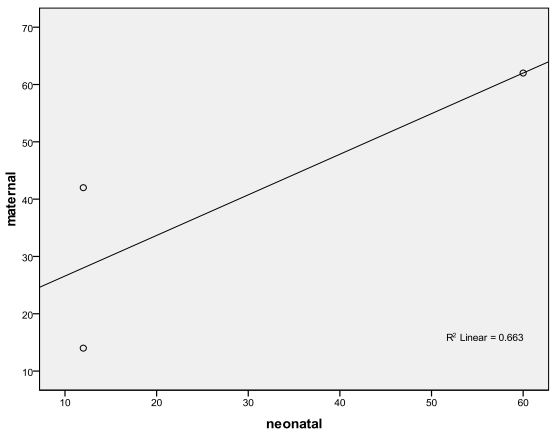
The only organism isolated from umbilical vein blood was Coagulase negative staphylococcus and other organisms were from only neonatal blood. There was no correlation between the isolates of neonatal blood and umbilical vein blood. So umbilical vein blood may not be helpful in the diagnosis of neonatal sepsis. Correlation Co efficient =0.463(p>0.005)

Fig:2 Correlation of Environmental samples and Health care personnel in NICU with neonatal blood



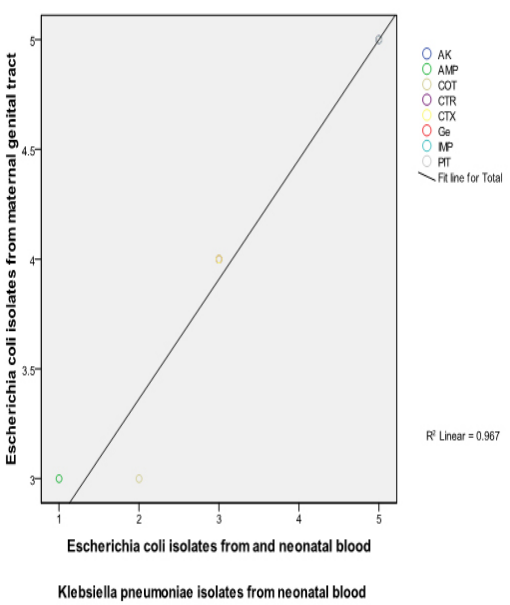
There was a highly significant (p=0.01) correlation between the isolates of environmental samples with that of neonatal blood. Source of Klebsiella pneumoniae and Coagulase negative staphylococcus were from environment and health personnel. Correlation Co efficient =0.872(p=0.01)

Fig3: Correlation between Escherichia coli & Staphylococcus aureus isolated from maternal genital tract & neonatal blood:



There was highly significant correlation between Escherichia coli & Staphylococcus aureus isolated from maternal genital tract & neonatal blood, thus tracing their source to mother. Correlation Co efficient =0.814(p=0.01)

Fig 4: Correlation of Antibiotic Sensitivity pattern of Klebsiella pneumoniae and Escherichia coli isolates from Maternal genital tract and neonatal blood



Correlation coefficient(r) = 0.983 (p=0.01) Correlation coefficient(r) = 0.942 (p=0.01)

There was significant correlation in Antibiotic Sensitivity pattern among common Gram negative bacterial isolates from maternal genital tract and neonatal blood. This also confirms the source.

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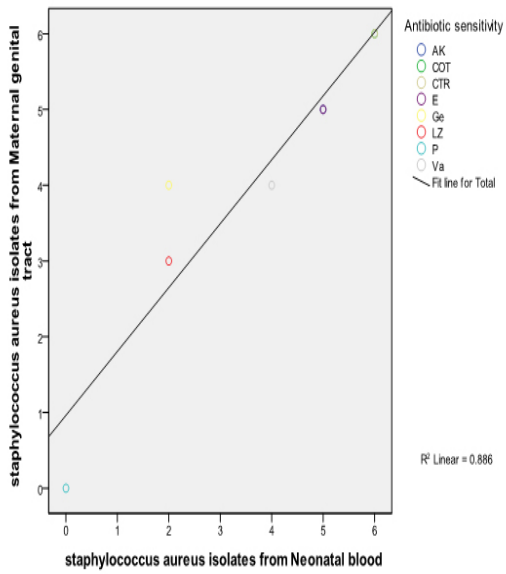
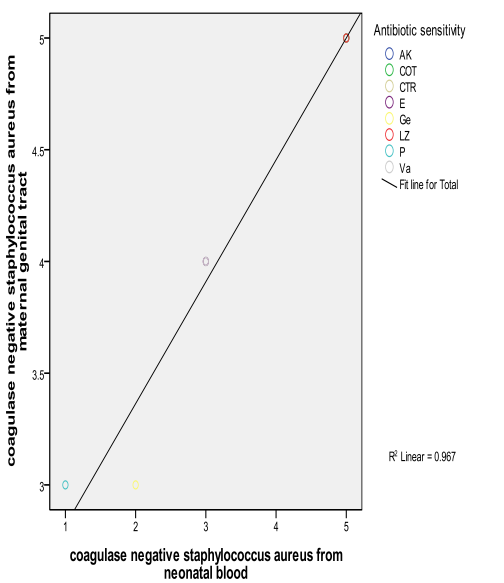
Fig : **5 Correlation of Antibiotic Sensitivity pattern of Staphylococcus aureus and Coagulase negative staphylococcus isolates from Maternal genital tract and neonatal blood**





Correlation coefficient(r) = 0.944 (p=0.01)
Correlation coefficient(r) = 0.948 (p=0.01)

There was significant correlation in Antibiotic Sensitivity pattern among common Gram positive bacterial isolates from maternal genital tract and neonatal blood, thus confirming the source of infection.

Comparison of Culture Positivity in Various Studies

The present study yields a culture positivity (42%) among the clinically suspected cases of neonatal sepsis correlating with NNPD (National Neonatal Perinatal Database 2006) 50 – 60 % , Shashikala S.Thallur et al [7], 64.8%, Zakariya et al [8]41.6%,Chacko A et al [9]43.1% and differing with Kerur Basavaraju et al [10]20%,Mathur.M.Shah et al [11]24.8%,Bhat R et al [12]18%.

Commonest Isolates in different studies

The present study in which the common isolate Klebsiella pneumoniae was comparable with studies of Shashikala S.Thallur et al[7]., Mathur.S.Shah et al[11]. Escherichia coli was the commonest isolate in a study done by Kerur Basavaraj et al[10] and K.A.Kuruvilla et al[13]. Staphylococcus was the commonest pathogen followed by coliforms in Martin.M.Meremikwu et al [14]study.

Comparative studies of Culture positive and Low birth weight

Culture positive in low birth weight was 69(82%) correlating with studies done by Begum S et al[15] 63(97%), Aletayeb SMH et al[16] 112(73.2%), Raghavan M et al [17]30(60%) and differing with Kayange N et al[18] 53(35.6%).Low birth weight is the most important predisposing factor and more prone for neonatal sepsis.

Comparative studies of Culture positivity & Gestational Age

Culture positivity in preterm babies is 48(57.1%) ,correlating with Hasfa A et al [19]54(51.9%), Hasan MS et al [20]36(72.7%) and differing with ShresthaNJ et al [21]25(24.5%) and Bhat R et al [12]93(40.6%) . Hence Prematurity is another important predisposing factor for neonatal sepsis.

CONCLUSION

Neonatal septicaemia is a very broad term and treating it is a difficult task. The present study shows that many etiological factors encompass in its causation like low birth weight, prematurity, maternal factors, environmental sources and health care personnel with significant correlation .So certain precautions, preventive measures, proper antenatal care, sterile procedures help in reducing the sepsis. Early diagnosis and prompt treatment are the key words in the management of neonatal sepsis.

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