

A PROSPECTIVE STUDY ON LOCAL INCIDENCE OF HEARING IMPAIRMENT IN TERM NEONATES WITH PERINATAL ASPHYXIA AND TO IDENTIFY ASSOCIATED RISK FACTORS IN TERTIARY CARE CENTER

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Keywords:

HIE-Hypoxic ischemic encephalopathy
NVD-Normal vaginal delivery
LSCS-Lower segment cesarian section
LFT-Liver function tests, RFT-Renal function tests
OAE -Oto acoustic emission
BERA-Brain stem evoked response response

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Abstract

Background: As the first year of life is critical in the development of brain, absence of auditory experience in children at risk like perinatal asphyxia during this period significantly retards child's overall development. Aim: To study the local incidence of hearing impairment in term neonates with perinatal asphyxia delivered and admitted in niloufer hospital **Materials and Methods:** The study was conducted in the Department of Pediatrics, Niloufer hospital, affiliated to Osmania Medical Study Design: A Prospective observational study Study period: 18 months Study Population: Neonates delivered and admitted in SNCU, Niloufer hospital, Study Sample Size: 211. Term neonates delivered in Niloufer hospital, Hyderabad with perinatal asphyxia. Moderate perinatal asphyxia-slow or gasping breathing or an apgar score of 4-6 at 1 min. Severe perinatal asphyxia -no breathing or low apgar scores 0-3 at 1min of age. Parents/guardians of children with the above mentioned criteria who are willing to give informed consent. **Results:** Among the study population, 68.42% were further referred for further evaluation by BERA. Among the study population, 71.43% of the total population who were referred for BERA had hearing loss. Among the study population, 9.48% had hearing loss. Factors associated with hearing loss: Hyponatremia, hyperkalemia, deranged RFT and Assisted ventilation were significantly associated with hearing loss. **Conclusion:** Incidence of hearing loss was 9.48% Hyponatremia, Hyperkalemia, deranged RFT and assisted ventilation were significantly associated with hearing loss.

INTRODUCTION

Neonatal Hearing screening

In India, hearing disability has a higher prevalence in children aged 0-4 years (0.60%) and 5-9 years (0.28%) than all other disabilities (0.32%).^[1] Even though two-thirds of all persons with hearing deficits are from developing countries, newborn hearing screening (NHS) programs are not widely adopted. These countries are often burdened with other life-threatening public health concerns so that hearing loss has not received due attention.^[2]

Screening for Hearing loss in Asphyxiated neonates: Consequences of perinatal asphyxia range from death to various degrees of neuro-developmental sensory or motor deficits. One of its well-known sequelae is sensorineural hearing impairment. Adequate oxygenation and perfusion are essential for inner ear function and studies showed that neonatal asphyxia can cause inner ear degeneration, disappearance of the outer and inner hair cells, and

degeneration of the spiral and vestibular ganglion cells.^[15]

Congenital or early childhood onset of deafness or severe-to-profound hearing impairment, as reported by the World Health Organization (WHO), is encountered in approximately 0.5-5 per 1,000 neonates and infants [16]. United States Preventive Services Task Force reported that the prevalence of neonatal hearing loss in the Neonatal Intensive Care Unit (NICU) is 10-20 times greater than the prevalence of hearing loss in a population of normal neonates.^[17] Considering the infrastructure limitations in our country and as limited studies are available regarding hearing evaluation and birth asphyxia as a risk factor for hearing impairment including northern part of Karnataka, this study was undertaken to screen the possible burden of hearing impairment among the inborn neonates with birth asphyxia admitted to NICU Niloufer hospital Hyderabad by using OAE and BERA.

Aims & Objectives

Aim

- To study the local incidence of hearing impairment in term neonates with perinatal asphyxia delivered and admitted in Niloufer hospital.

Objectives

- To study the local incidence of hearing impairment in term neonates with perinatal asphyxia delivered and admitted in Niloufer hospital.
- To identify associated risk factors in perinatal asphyxia like hypoglycemia, renal and liver dysfunctions, dyselectrolytemias and newborn requiring assisted ventilation.

MATERIALS AND METHODS

Place of Study

The study was conducted in the Department of Pediatrics, Niloufer hospital, affiliated to Osmania Medical College. It is the largest tertiary care center in the state of Telangana, situated in the heart of Hyderabad.

Study Design A Prospective observational study

Study period 18 months

Study Population Neonates delivered and admitted in SNCU, Niloufer hospital,

Study Sample Size 211

Methodology

Neonates delivered and admitted in SNCU, Niloufer hospital, satisfying the inclusion criteria were enrolled into the study and admitted after getting informed consent from the parents/guardians.

Inclusion Criteria:

Neonates delivered and admitted in SNCU, Niloufer hospital, satisfying the inclusion criteria were enrolled into the study and admitted after getting informed consent from the parents/guardians.

- Term neonates delivered in Niloufer hospital, Hyderabad with perinatal asphyxia
- Moderate perinatal asphyxia-slow or gasping breathing or an apgar score of 4-6 at 1 min.
- Severe perinatal asphyxia -no breathing or low apgar scores 0-3 at 1min of age
- Parents/guardians of children with the above mentioned criteria who are willing to give informed consent.

Exclusion Criteria

The following infants and children were excluded from the study

- Neonates with major congenital anomalies
- Low birth weight and prematurity
- Neonates with torch infections
- Neonates with hyperbilirubinaemia requiring exchange transfusion
- Neonates with family history of hearing loss

- Parents or guardians those who are not willing to give informed consent.

Ethical Clearance

Ethical clearance was obtained from the Institutional Ethical Committee, Department of Paediatrics, Osmania Medical College, Koti, Hyderabad.

RESULTS

The study was conducted in the Department of Pediatrics, Niloufer hospital, affiliated to Osmania Medical College. It is the largest tertiary care center in the state of Telangana, situated in the heart of Hyderabad.

The results of the study are as follows.

Table 1: Table showing the age distribution (age at which baby was screened)

Age distribution	Frequency	Percentage
< or equal to 7 days	117	55.45
8-14 days	72	34.12
15-21 days	15	7.10
22-28 days	7	3.31
Total	211	100

In our study almost 90% of the study population are screened within 2 weeks, remaining population are screened after 2 weeks.

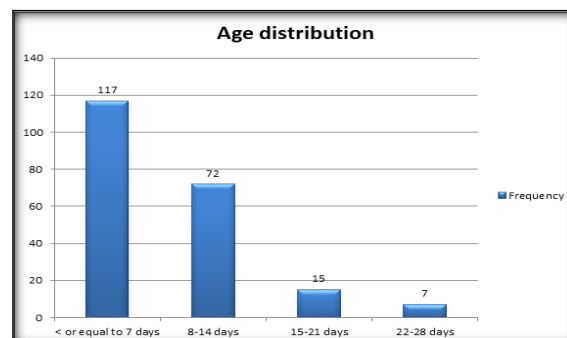


Figure 1: Showing the age distribution

Table 2: Showing the gender distribution

Gender	Frequency	Percentage
Female	77	36.49
Male	134	63.51
Grand Total	211	100.00

In the study population, males babies are affected more than female babies.

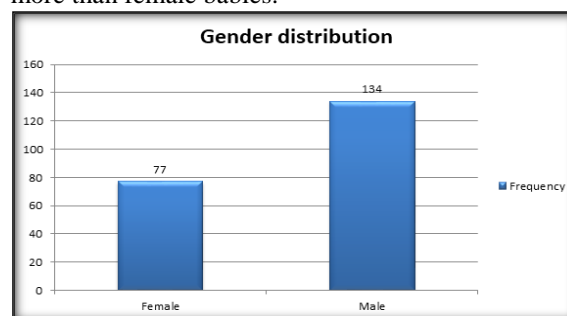


Figure 2: Showing the gender distribution

Table 3: Showing the mode of delivery

Mode of delivery	Frequency	Percentage
Assisted	49	23.22
LSCS	67	31.75
NVD	95	45.02
Grand Total	211	100.00

In the study population, most of the babies delivered by normal vaginal delivery followed by LSCS and assisted delivery.

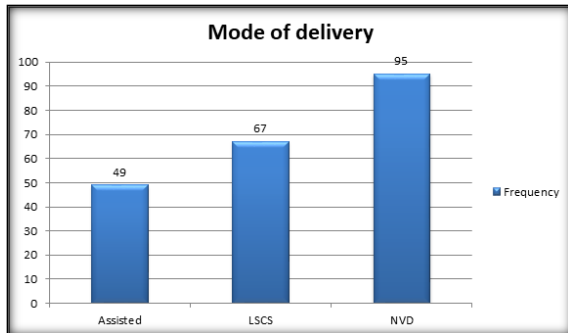


Figure 3: Showing the mode of delivery

Table 4: Showing the birth weight of the study population

Birth weight	Frequency	Percentage
2.5-3.0 kgs	165	78.67
3.1-3.5 kgs	35	16.59
>3.5 kgs	10	4.74
Total	211	100.00

In the study population, most of the babies belong to weight 2.5-3 kgs, followed by other weight groups.

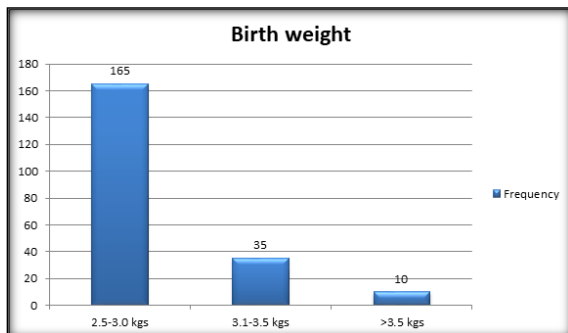


Figure 4: Showing the birth weight of the study population

Table 5: Showing the APGAR at 1 min

APGAR @ 1 min	Frequency	Percentage
< or equal to 3	45	21.32
4 - 6	166	78.67
Total	211	100

In the study population, moderate asphyxia cases are found to be more than severe asphyxia cases.

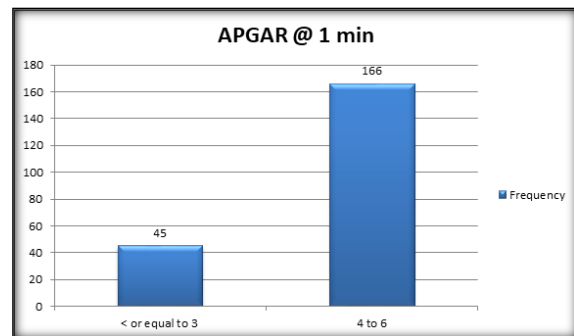


Figure 5: Showing the APGAR at 1 min

Table 6: Showing the APGAR at 5 min

APGAR @ 5 min	Frequency	Percentage
Less than or equal to 3	8	3.79
4-6	109	51.65
>6	94	45.54
Total	211	100

Among the study population, 3.79% had APGAR score of Less than or equal to 3, 51.65% had APGAR score of 4-6, 45.54% had APGAR score of >6 at 5 min

This indicates improved apgar scores at 5 mins due to effective resuscitation in our hospital.

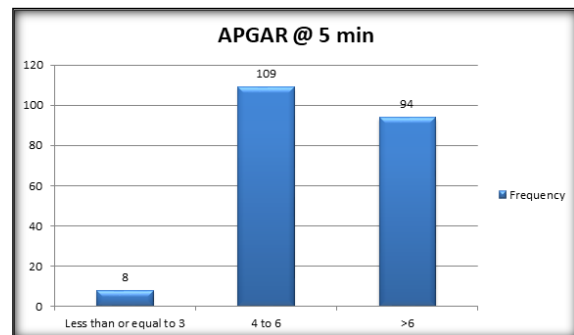


Figure 6: Showing the APGAR at 5 min.

Table 7: Showing the HIE stage

HIE	Frequency	Percentage
1	86	40.76
2	105	49.76
3	20	9.48
Grand Total	211	100.00

In the study population, HIE STAGE 2>STAGE 1>STAGE 3.

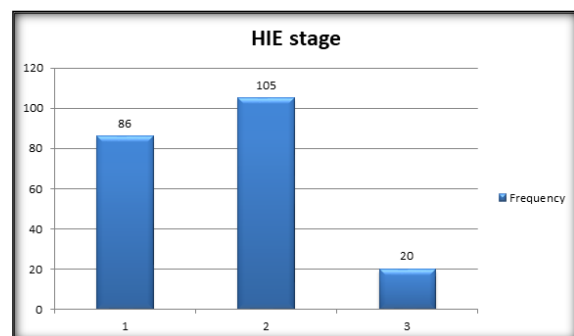


Figure 7: Showing the HIE stages

Out of 20 HIE 3 cases-4(20%) cases had hearing loss

Out of 105 HIE 2 cases -12(11%) cases had hearing loss

Out of 86 HIE 1 cases -4(4%) cases had hearing loss
Here in our study more HIE 3 cases are found to have hearing loss than HIE 2 and 1.

Table 8: Showing the OAE I results

OAE I	Frequency	Percentage
Pass	173	81.99
Refer	38	18.01
Total	211	100.00

Among the study population, out of total 211 cases screened OAE I results were normal in 81.99%, 18.01% were referred for OAE – II for further evaluation.

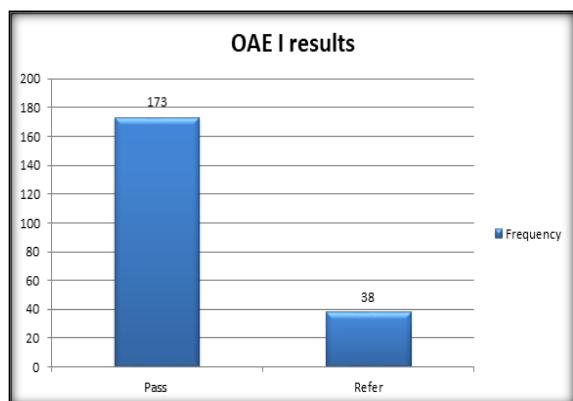


Figure 8: showing the OAE I results

Table 9: Showing OAE – II results

OAE II	Frequency	Percentage
Pass	10	26.32
Refer	26	68.42
TND[test not done]	2	5.26
Total	38	100.00

Out of 38 cases which were referred in OAE 1, 26 babies were referred ,10 cases were pass and 2 cases test not done.

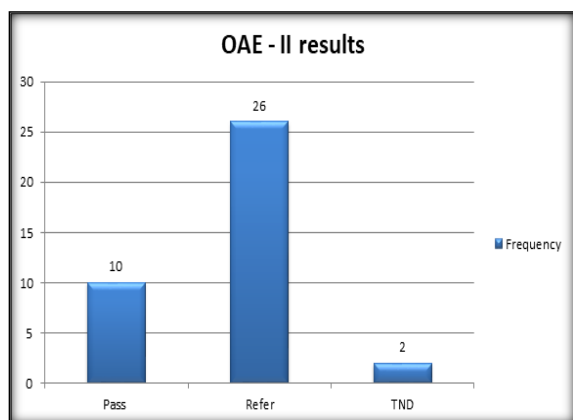


Figure 9: Showing OAE-II results

Table 10: showing BERA results

BERA	Frequency	Percentage
Pass	6	14.29
Fail	20	71.43

TND	2	14.29
Total	28	100.00

Among the study population, 71.43% of the total population who were fail for BERA had hearing loss.

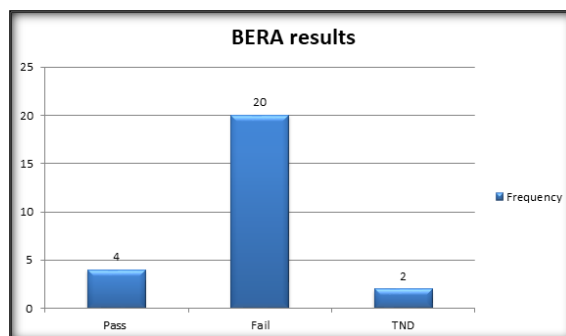


Figure 10: Showing the BERA results

Table 11: Showing the incidence of hearing loss

Hearing loss	Frequency	Percentage
Present	20	9.48
Absent	191	90.52
Total	211	100

Among the study population, 9.48% had hearing loss.

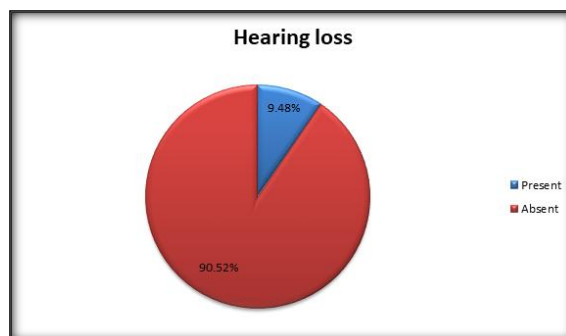


Figure 11: Showing the incidence of hearing loss

Table 12: Showing the association between hyponatremia and hearing loss

Hyponatremia	Hearing loss		Total
	Present	Absent	
Yes	3	6	9
No	17	185	202
Total	20	191	211

P=0.02

In the study population, hyponatremia and hearing loss were significantly associated with P value of 0.02 using chi square test.

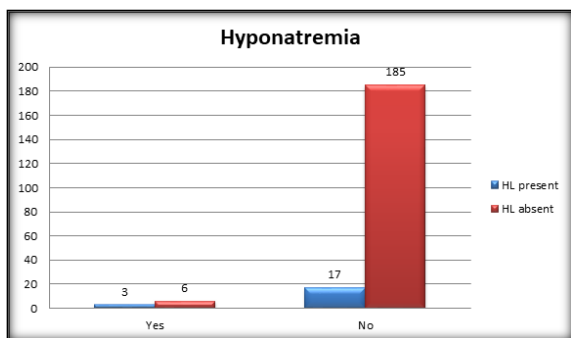


Figure 12: Showing the association between hyponatremia and hearing loss

HL: hearing loss

Table 13: Showing the association between hypernatremia and hearing loss

Hypernatremia	Hearing loss		Total
	Present	Absent	
Yes	1	3	4
No	19	188	207
Total	20	191	211

P=0.1882

In the study population, hypernatremia and hearing loss were not significantly associated with P value of 0.1882 using chi square test.

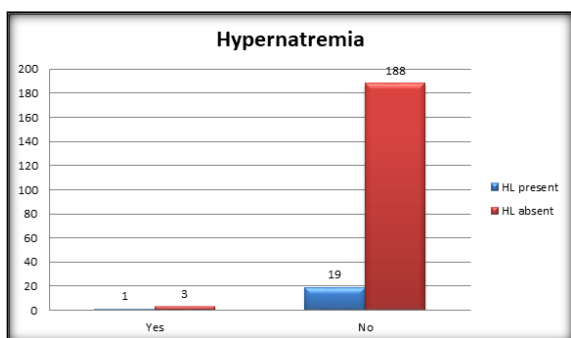


Figure 13: Showing the association between hypernatremia and hearing loss

HL: hearing loss

Table 14: Showing the association between hyperkalemia and hearing loss

Hyperkalemia	Hearing loss		Total
	Present	Absent	
Yes	4	8	12
No	16	183	199
Total	20	191	211

P=0.04

Among the study population, hyperkalemia and hearing loss were significantly associated with P value of 0.04.

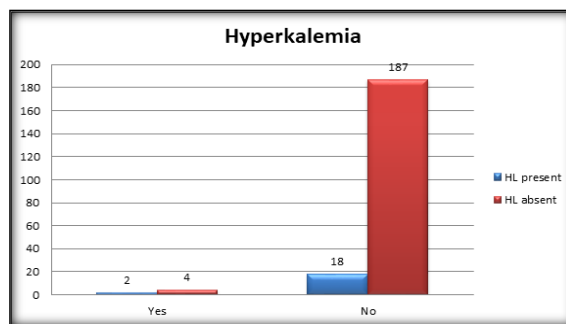


Figure 14: Showing the association between hyperkalemia and hearing loss

HL: hearing loss

Table 15: Showing the association between hypokalemia and hearing loss

Hypokalemia	Hearing loss		Total
	Present	Absent	
Yes	1	3	4
No	19	188	207
Total	20	191	211

P=0.1882

Among the study population, hypokalemia and hearing loss were not significantly associated with P value of 0.1882.

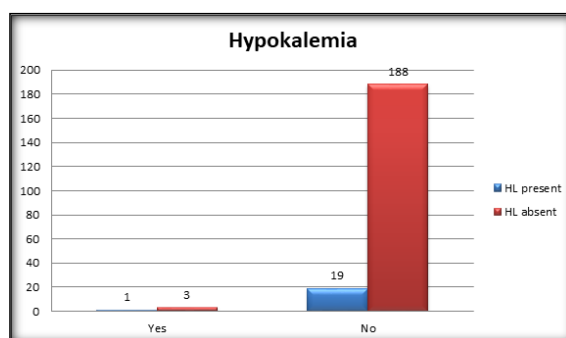


Figure 15: Showing the association between hypokalemia and hearing loss

HL: hearing loss

Table 16: Showing the association between hypocalcemia and hearing loss

Hypocalcemia	Hearing loss		Total
	Present	Absent	
Yes	1	3	4
No	19	188	207
Total	20	191	211

P=0.1882

Among the study population, hypocalcemia and hearing loss were not significantly associated with P value of 0.1882.

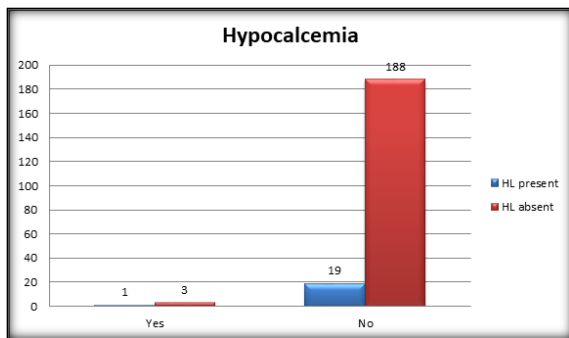


Figure 16: Showing the association between hypocalcemia and hearing loss

HL: hearing loss

Table 17: Showing the association between deranged RFT and hearing loss

Deranged RFT	Hearing loss		Total
	Present	Absent	
Yes	5	11	16
No	15	180	195
Total	20	191	211

P=0.005

Among the study population, deranged RFT and hearing loss were significantly associated with P value of 0.005.

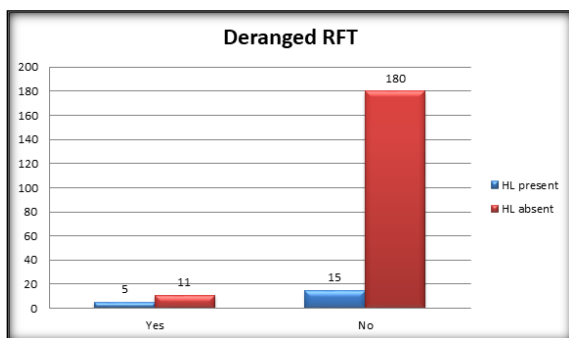


Figure 17: Showing the association between deranged RFT and hearing loss

HL: hearingloss

Table 18: Showing the association between assisted ventilation and hearing loss

Assisted ventilation	Hearing loss		Total
	Present	Absent	
Yes	4	8	12
No	16	183	199
Total	20	191	211

P=0.001

Among the study population, assisted ventilation and hearing loss were significantly associated with P value of 0.001.

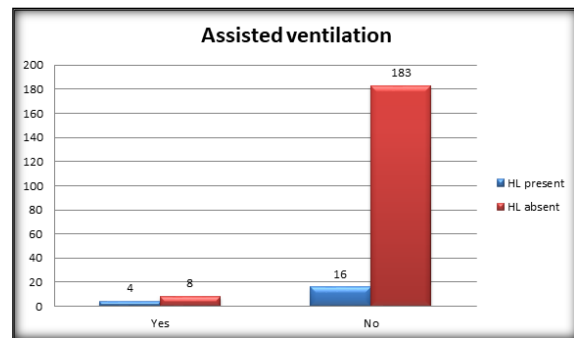


Figure 18: Showing the association between assisted ventilation and hearing loss

HL: hearingloss

Table 19: Showing the deranged liver enzymes, seizure activity and hypoglycemia among the hearing loss cases

Parameter	Frequency	Percentage
Deranged liver enzymes	0	0
Seizure activity	0	0
Hypoglycemia	0	0

Among the study population, there were no cases of deranged liver enzymes, seizure activity, hypoglycemia.

DISCUSSION

211 babies with birth asphyxia admitted in SNCU are screened in our audiology department

The results of the study are as follows

Age distribution (age at hearing screening)

In the present study, Among the study population, 55.45% belonged to the age group of less than or equal to 7 days, 34.12% belonged to age group of 8-14 days, 7.10% belonged to the age group of 15-21 days and 3.31% belonged to age group of 22-28 days.

So around 90 % of the babies are screened in the first 2 weeks of life

Gender distribution:

In the present study, Among the study population, 36.49% were females, 63.51% were males.so male babies are more involved than female babies which is comparable to other studies

Mode of delivery

In the present study,31.75% were born through LSCS, 45.02% were born through Normal vaginal delivery. 23.22% were assisted deliveries.

APGAR Score at 1 min

In the present study,21.32% had severe asphyxia, 78.67% had moderate asphyxia

In the present study, 3.79% had APGAR score of Less than or equal to 3, 51.65% had APGAR score of 4-6, 45.54% had APGAR score of >6 at 5 min

HIE

In the present study, Among the study population, 49.76% belonged to HIE stage II, 40.76% were in HIE stage I, 9.48% were in HIE stage III.

Out of 20 HIE 3 cases- 4(20%) cases had hearing loss

Out of 105 HIE 2 cases -12(11%) cases had hearing loss

Out of 86 HIE 1 cases -4(4%) cases had hearing loss
Here in our study more HIE 3 cases are found to have hearing loss than HIE 2 and 1

OAE – I result

In the present study, Among the study population, OAE I results were normal in 81.99%, 18.01% were referred for OAE – II for further evaluation.

OAE – II results

In the present study, Among the study population, 68.42% were further referred for further evaluation by BERA.

BERA results

In the present study, Among the study population, 71.43% of the total population who were referred for BERA had hearing loss.

So out of 38 cases which was referred in OAE 1-20 cases (55%) only are diagnosed to have hearing loss by BERA

Incidence of Hearing loss

In the present study, Among the study population, 9.48% had hearing loss.

Factors associated with hearing loss

Factors associated with hearing loss: Hyponatremia, hyperkalemia, deranged RFT and Assisted ventilation were significantly associated with hearing loss.

Summary of 211 Neonates

- Around 90 % of the babies were screened in the first 2 weeks rest of the babies next 2 weeks depending on their clinical condition
- 36.49% were females, 63.51% were males.
- 31.75% were born through LSCS, 45.02% were born through Normal vaginal delivery. 23.22% were assisted deliveries.
- 78.67% had birth weight between 2.5-3.0 kgs. 16.59% had their birth weight between 3.1-3.5 kgs, 4.74% had their birth weight >3.5 kgs.
- Among the study population, 21.32% had APGAR score of < or equal to 3(severe asphyxia) 78.67% had APGAR score of 4-6(moderate asphyxia)
- Among the study population, 3.79% had APGAR score of Less than or equal to 3, 51.65% had APGAR score of 4-6, 45.54% had APGAR score of >6 at 5 min
- Among the study population, 49.76% belonged to HIE stage II, 40.76% were in HIE stage I, 9.48% were in HIE stage III.
- In our study more HIE 3 cases are found to have hearing loss than HIE 2 and 1
- Among the study population, OAE I results were normal in 81.99%, 18.01% were referred for OAE – II for further evaluation.
- Among the study population, 68.42% were further referred for further evaluation by BERA.

- Among the study population, 71.43% of the total population who were referred for BERA had hearing loss.
- Among the study population, 9.48% had hearing loss.
- Factors associated with hearing loss: Hyponatremia, hyperkalemia, deranged RFT and Assisted ventilation were significantly associated with hearing loss.

CONCLUSION

- The study was conducted in the Department of Pediatrics, Niloufer hospital, affiliated to Osmania Medical College. It is the largest tertiary care center in the state of Telangana, situated in the heart of Hyderabad.
- Incidence of hearing loss was 9.48%
- Hyponatremia, Hyperkalemia, deranged RFT and assisted ventilation were significantly associated with hearing loss.

Limitations

- Only 211 cases has been taken in this study so the study population is less
- Loss to followup are 4 cases among 38 cases which are referred in OAE Iso test not done in these cases
- Incidence of hearing impairment among normal babies not done in this study.

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