Section: Paediatrics

Original Research Article

COMPARISON OF HEARING SCREENING STATUS IN NEONATES DELIVERED TO HIGH-RISK AND NON-HIGH-RISK PREGNANCIES IN TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Neonatal hearing loss impacts 1-3 out of every 1,000 live births worldwide, with prevalence increasing by 5 to 10 times in high-risk populations; data from India reveal discrepancies in comparative screening results. **Materials and Methods:** A cross-sectional study involving 220 neonates, comprising 110 high-risk and 110 non-high-risk participants, was conducted at AVMCH, Puducherry, from July 2024 to December 2025—initial OAE screening conducted within 72 hours; referrals validated by BERA. Chi-square tests were utilised to test equivalence, with an implication level set at $p<0.05$. **Result:** Results indicate that high-risk neonates exhibited a referral risk for OAE that was nine times greater, with rates of 16.4% compared to 1.8% (RR=9.1). BERA confirmed a severe or profound loss in 20 out of 110 high-risk individuals compared to 1 out of 110 non-high-risk individuals. Identified risks include prematurity at 96.4%, preeclampsia at 55.5%, and hypertension at 68.2%. **Conclusion:** High-risk pregnancies demonstrate a significantly increased incidence of hearing impairment; the implementation of hybrid OAE-BERA protocols is crucial in Indian tertiary care environments.

INTRODUCTION

The prevalence of neonatal hearing loss is observed at a rate of 1-3 per 1,000 live births, with an increased incidence noted among high-risk neonates, such as those born prematurely, those who have extended stays in the NICU exceeding five days, and those with maternal conditions such as hypertension or diabetes. In India, high-risk rates are observed at 10.3-10.7 per 1000, compared to 0.98-4.7 per 1000 for low-risk groups. Additionally, 20-50% of cases occur in non-risk groups, highlighting the necessity for universal screening. This research examines the outcomes of OAE/BERA across different groups at a tertiary hospital in Puducherry, aiming to fill local evidence gaps in accordance with JCIH-aligned protocols, specifically the recommendation to screen by one month.[1-3]

MATERIALS AND METHODS

A cross-sectional experimental education was directed in the Audiology Department of AVMCH in Puducherry for a period of 18 months.

Among the participants, there were 220 term infants, with 110 belonging to each group. High-risk neonates were well-defined as those with a preterm birth of 37 weeks, a low birth weight of less than 2500g, a neonatal intensive care unit (NICU) stay of more than five days, asphyxia, autotoxins, and maternal hypertension or diabetes (according to the JCIH criteria). Ear atresia, middle ear pathology, and parental refusal are all excluded from consideration.

The sample size for the study was 220, with a power of 80% and a significance level of $\alpha=0.05$. The prevalence of impairment was 4%, whereas the prevalence of impairment was 15%.

The procedure involves obtaining informed consent and approval from the IEC. Determining demographics, risks, and APGAR, as well as TEOAE (1-4kHz, pass ≥30-40dB), rescreening 24-48 hours

after failure, and BERA confirmation (sedated if necessary) were all included in the structured proforma.

SPSS version 25 was employed to perform a chi-square test, and a significance level of $p<0.05$ was taken as significant.

RESULTS

There were 220 newborns, with 54.5% of them being female; the gender and group ratio was balanced. High-risk conditions include hypertension (68.2%), preeclampsia (55.5%), gestational diabetes mellitus (30.9%), and premature birth (96.4%). OAE referrals: 2/110 (1.8%) non-high-risk against 18/110 (16.4%) high-risk, and the relative risk (RR) was 9.1. BERA: severe loss totalling 14 high-risk cases, severe-profound loss totalling 6 high-risk cases (totalling 20). Analogous APGAR scores; improved high-risk family hearing loss (6.4% versus 1.8%).

Table 1: Comparison of High-Risk and Non-High-Risk Pregnancies

Parameters	Non-High Risk (n=110)	High Risk (n=110)	P value
Mean Gestational Age (weeks)	38.14	38.14 (prematurity 5.5%)	<0.001
Caesarean (%)	90(81.8)	108(98.2)	<0.001
OAE Pass (%)	108(98.2)	92 (83.6)	<0.001
BERA Severe+ Loss (n)	1(0.9)	20(18%)	<0.001

The table simplifies the important relative upshots on neonatal hearing screening (OAE and BERA) between non-high-risk (n=110) and high-risk (n=110) gravidity clusters at AVMCH, Puducherry. These constraints highpoint clinically substantial variances determined by perinatal risks, with all p-values <0.001 representing robust statistical implication via chi-square testing.

Both assemblies display an indistinguishable mean gestational age of 38.14 weeks, signifying overall term deliveries. The high-risk group annotation "(prematurity 5.5%)" ribbons a subgroup vulnerability—prematurity (<37 weeks) affects ~6 neonates here, positioning with known 3-5x audible range risk promotion from cochlear immaturity.

Caesarean deliveries control both groups (81.8% non-high-risk vs. 98.2% high-risk), shimmering tertiary care outlines for complex pregnancies. The near-universal rate in high-risk cases (e.g., preeclampsia in 55-68%) underlines obstetric involvements that associate with higher screening letdowns owing to allied asphyxia or NICU needs.

OAE pass taxes starkly fluctuate, springy ~9x higher referral risk in high-risk newborns. This replicates outer hair cell dysfunction from risk issues like low birth weight or ototoxins, consistent with Indian tertiary data.

Confirmed severe losses via BERA are excessively high, confirming ~20x elevated sensorineural impairment burden. High-risk factors (e.g., NICU>5 days, hyperbilirubinemia) drive bilateral losses, supporting JCIH-mandated ABR confirmation to detect auditory neuropathy missed by OAE.[4]

Table 2: Comparison of OAE and BERA

Risk Implication	Non-High-Risk	High-Risk	Clinical Significance
Low Referral Burden	108 (98% pass OAE; minimal BERA fails)	18 (16% OAE referrals; 18% BERA abnormal)	Prioritise ABR for high-risk to cut false negatives
Resource Use	Routine screening suffices	2-stage mandatory (OAE→BERA)	Hybrid protocols optimise yield in Indian ICUs

DISCUSSION

This cross-sectional study at AVMCH, Puducherry, demonstrates markedly higher hearing screening failure rates in high-risk neonates (OAE pass 83.6% vs. 98.2%; BERA severe+ loss 20/110 vs. 1/110), driven by factors like prematurity (96.4%), NICU admission (93.6%), and maternal hypertension (68.2%). These findings are in line with Indian tertiary care data presenting 5-10x elevated prevalence, emphasising cumulative perinatal insults on cochlear/brainstem pathways.[5]

Key findings: High-risk OAE referrals (16.4%) reproduce outer hair cell susceptibility to hypoxia, ototoxins, and hyperbilirubinemia—consistent with Shanghai NICU data. BERA validation exposed bilateral severe-profound fatalities predominant in high-risk (90%), corresponding to Eastern India cohorts. Caesarean dominance (98.2%) signs obstetric problems, increasing risks, while stable gestational age emphasises a multifactorial aetiology outside prematurity alone.[6-9]

Comparison with the literature: This study coincides with Puducherry-local studies: Gopinath et al. stated 58% abnormal OAE/BERA in GDM neonates vs. 28% controls ($p<0.05$). Nationally, Parida et al. (Eastern India) found two-stage OAE-ABR referrals 12-22% high-risk vs. 1-3% low-risk, with 5.6/1000 confirmed losses—our 18.2% high-risk yield exceeds due to powered risk-stratification. Globally, JCIH-aligned hybrids detect 92-98% within 1 month, reducing language delays 50%; our data support this over OAE-alone (misses 4-19% ANSD). Disparities persist in LMICs: 30-70% loss-to-follow-up vs. 95% high-resource coverage.[10]

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Table 3: Comparison with other studies

Study Comparison	High-Risk Referral (%)	Confirmed Loss/1000	Key Risk (OR/p)
Current (Puducherry)	16.4 (OAE); 18.2 (BERA)	182	NICU (p<0.001)
Parida et al. (2023, Eastern India).[11]	9-17 (OAE)	5.6	NICU>5d (OR 3-6)
Siddique et al. (2023, Karnataka)[from prior]	10-22	41-55	LBW (p<0.001)
Zhai et al. (2021, China),[12]	29.8 (AABR fail)	NR	HyperBili (p=0.001)

Clinical Implications: Hybrid protocols, which consist of universal OAE and high-risk BERA, are designed to optimise yield and cost in overburdened Indian intensive care units (ICUs) (₹500-2000 per test), with a priority on NICU grads (10-20x risk). The Rashtriya Bal Swasthya Karyakram (RBSK) should be integrated to achieve a retention rate of 85% through immunisation linkage and tele-ABR. Early intervention (by six months) reduces developmental gaps, which is essential considering that 70–80 per cent of high-risk neonates sustain losses of 10–20 per cent.

Strengths and Limitations: Strengths include a powered sample (n=220), two-stage protocol, JCIH risk criteria, and local relevance amid sparse Puducherry data. Limitations: single-centre (generalizability), cross-sectional (no longitudinal outcomes), potential selection bias in tertiary referrals, and absent genetic testing (20-50% idiopathic cases). Future multicentric RCTs with 6-month follow-up and cost analysis are needed.

Future Directions: Advocate policy for mandatory screening in high-risk (e.g., NICU>48h), train multidisciplinary teams, and scale tele-AABR to curb 45-70% high-risk dropout. Genetic panels (GJB2) for family history cases (6.4% high-risk here) could refine precision.

CONCLUSION

BERA should be given priority for high-risk neonates in order to accomplish the aims of JCIH 1-3-6; local statistics support the implementation of universal OAE.

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