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The Role of Corticosteroids in Managing Hearing Loss in Children and its Risk Factors and Sociodemographic profile: A Hospital based study

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Abstract

Background: Paediatric hearing loss (HL) is influenced by sociodemographic and clinical risk factors. Corticosteroids are widely used, but their efficacy across different subgroups remains understudied. **Objective**: To assess (1) corticosteroid effectiveness in 54 children with HL, (2) sociodemographic (age, gender, socioeconomic status) and risk factor (otitis media, noise exposure, family history) associations, and (3) odds ratios (OR) for treatment success. **Methods**: Prospective observational study of 54 children (5–15 yrs) with HL in West Bengal. Hearing improvement (≥10 dB PTA gain) post-steroids (oral/intratympanic) was analysed. Sociodemographic and risk factors were collected via questionnaires. Statistical analysis included OR, chi-square, and logistic regression. **Results**: Hearing improvement: 68.5% (OR = 3.2, 95% CI: 1.4–7.1). Key risk factors: Otitis media (OR = 4.1, 95% CI: 1.8–9.3), urban residence (OR = 2.3, 95% CI: 1.1–4.9). Sociodemographic: Lower improvement in rural (OR = 0.4, 95% CI: 0.2–0.9) and low-income groups (OR = 0.5, 95% CI: 0.2–1.0). **Conclusion**: Corticosteroids are effective, but efficacy varies by sociodemographic and risk exposure.

KEYWORDS: *Hearing loss, corticosteroid, tympanic.*

INTRODUCTION

Hearing loss in children is a significant global health issue, with prevalence rates varying by age and location. In the United States, approximately 2 out of every 1,000 infants screened have detectable hearing loss, Globally, it's estimated that 34 million children have disabling hearing loss. Key Points: Prevalence: Hearing loss in children can range from mild to profound and affect one or both ears. Early detection is crucial:

Early intervention services are vital for children with hearing loss to develop language and communication skills. Causes: Hearing loss can be congenital (present at birth) or acquired (developing later in life)[1]. Consequences: Even mild hearing loss can impact a child's speech, language, and overall

development. Global burden: The World Health Organization estimates that over 5% of the world's population needs rehabilitation for disabling hearing loss, including 34 million children. Specific Statistics and Findings:
Neonatal hearing loss: In India, the prevalence of hearing loss among neonates is around 5 per 1000 births. Children: In India, the prevalence of hearing loss among children ranges from 6% to 16%. School-aged children: Studies on school-aged children have reported prevalence rates ranging from 1.75% to 14.9%. Unilateral hearing loss[2]:
Unilateral hearing loss (hearing loss in one ear) is also common in children, with prevalence rates between 3% and 6% in school-aged children. Impact on development:
Hearing loss, even at mild levels, can lead to delayed language development, academic difficulties, and social-emotional challenges

METHODS

The study was conducted in tertiary hospital. After obtaining institutional ethical committee approval It was a Observational prospective study conducted on 54 patients in the department of Otorhinolaryngology, at a tertiary care centre, from February2018–October2018. The institute Ethics Committee approval was obtained before starting the sample collection. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration. Detailed history of systemic diseases and its duration, medication were noted. Patients were subjected to General physical examination, and ocular examination.

Study Design

- **Participants:** 54 children with confirmed HL (conductive/sensorineural).
- **Intervention:**
  - **Group 1:** Oral prednisolone (1 mg/kg/day, 2 weeks).
  - **Group 2:** Intratympanic dexamethasone (4 mg/mL, weekly × 3).

Data Collected

1) **Sociodemographic:**
   - Age, gender, residence (urban/rural), income (low/middle/high).
2) **Risk Factors:**
   - Otitis media, noise exposure, family history, prematurity.

Statistical Analysis

- **Primary Outcome:** Hearing improvement (OR, 95% CI).
- **Secondary Analysis:**
  - Chi-square for sociodemographic/risk factor associations.
  - Multivariate logistic regression for adjusted ORs.

Statistics and analysis of data

Data is put in excel sheet then mean, median and association is analysed by SPSS version 20. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and SD. MS Excel and MS word was used to obtain various types of graphs such as bar diagram. P value (Probability that the result is true) of P value <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 analyse data. Sample size is calculated by N master statistical software

RESULTS

Corticosteroids offer a potential advantage in treating sudden sensorineural hearing loss (SSNHL) by reducing inflammation and oedema in the inner ear, which can improve hearing outcomes if treatment is initiated early. Intratympanic injections offer a targeted approach, potentially reducing systemic side effects. Elaboration:

Corticosteroids, like prednisolone and dexamethasone, are commonly used to treat hearing loss due to their anti-inflammatory and immunosuppressive properties. These medications are particularly helpful in cases of sudden sensorineural hearing loss (SSNHL), where inflammation and fluid buildup in the inner ear can damage the delicate structures responsible for hearing. Advantages of Corticosteroid Reduced Inflammation: Corticosteroids help to reduce inflammation in the inner ear, which can be a major contributor to SSNHL .
In this study intratympanic steroid have better response as compare to oral steroid in hearing loss.(Table1)

1. Treatment Efficacy (n = 54)

Outcome	**Oral Steroids (n=27)**	**Intratympanic (n=27)**	**OR (95% CI)**
Hearing Improved	55.6% (n=15)	81.5% (n=22)	**3.2 (1.4–7.1)**

Sociodemographic factors like age, time since onset of hearing loss, and the presence of other health conditions can influence the effectiveness of corticosteroid treatment for hearing loss. Specifically, younger individuals, those with hearing loss onset within the past few days, and those without other significant health issues tend to show better responses to corticosteroids. Elaboration: Age: Studies have shown that younger individuals with sudden sensorineural hearing loss (SSNHL) may experience better hearing recovery with corticosteroid treatment compared to older individuals. Time Since Onset: The time elapsed between the onset of hearing loss and the start of corticosteroid treatment is a crucial factor. Early intervention (within a few days) generally yields better results.
Other Factors: Factors like the type of hearing loss (e.g., low-frequency vs. overall), the presence of vertigo, and even certain biomarkers like SOD levels have been investigated in relation to corticosteroid response, though the results are not always consistent**.**
In this study we found that sociodemographic factors play important role in hearing loss treatment and management. urban person better response as compare to rural in case corticosteroid response in hearing loss treatment (Table 2)

2. Sociodemographic Influence

Factor	**Improved HL (%)**	**OR (95% CI)**	**p-value**
Urban residence	75.0%	2.3 (1.1–4.9)	0.03
Rural residence	50.0%	0.4 (0.2–0.9)	0.02
Income ≥$300/month	78.6%	2.1 (1.0–4.4)	0.04

General Health Conditions: Pre-existing conditions like diabetes, hypertension, or cardiovascular disease can affect the overall response to corticosteroids and potentially impact hearing recovery. Severity of Hearing Loss: The degree of hearing loss at the time of diagnosis can also play a role. More severe hearing loss may be associated with a poorer response to corticosteroid treatment.

3. Risk Factor Analysis

Risk Factor	**Adjusted OR (95% CI)**	**p-value**
Otitis media	4.1 (1.8–9.3)	0.001
Noise exposure	1.8 (0.8–4.1)	0.15
Family history	2.5 (1.1–5.7)	0.03

Family history is important risk factors in hearing loss of children (Table 2).

DISCUSSION

Corticosteroids offer a potential advantage in treating sudden sensorineural hearing loss (SSNHL) by reducing inflammation and oedema in the inner ear, which can improve hearing outcomes if treatment is initiated

early. Intratympanic injections offer a targeted approach, potentially reducing systemic side effects. Elaboration: Corticosteroids, like prednisolone and dexamethasone, are commonly used to treat hearing loss due to their anti-inflammatory and immunosuppressive properties. These medications are particularly helpful in cases of sudden sensorineural hearing loss (SSNHL), where inflammation and fluid buildup in the inner ear can damage the delicate structures responsible for hearing. Advantages of Corticosteroid Treatment: Reduced Inflammation: Corticosteroids help to reduce inflammation in the inner ear, which can be a major contributor to SSNHL[3]. Improved Hearing: By reducing inflammation and oedema, corticosteroids can improve hearing outcomes, especially when treatment is started promptly after the onset of symptoms. Intratympanic Injections[4]:

Intratympanic (IT) injections, where corticosteroids are injected directly into the middle ear, offer a targeted approach with potentially fewer systemic side effects compared to oral corticosteroids. Effective for Various Conditions: Corticosteroids are also used in other conditions where inflammation is a factor, such as Meniere's disease and autoimmune inner ear disease[5]. The effectiveness of corticosteroid treatment is often dependent on the timing of initiation. Starting treatment within two weeks of the onset of SSNHL is generally recommended to maximize the chance of hearing recovery. Potential Side Effects:

While IT injections offer a targeted approach, both oral and injected corticosteroids can have side effects, including increased blood sugar, mood changes, and potential for infection. Individualized Treatment: The best approach for corticosteroid treatment (oral vs. intratympanic) and the specific dosage should be determined by a healthcare professional based on the individual's specific circumstances and medical history[6].

In our study we found that intratympanic steroid have more efficacy as compare to oral steroid Intratympanic steroids outperformed oral steroids (OR = 3.2), aligning with prior studies. In this study we found that Urban children take better responds as compare to rural Urban and higher-income children responded better, likely due to earlier diagnosis and treatment access[7].

Otitis media was the strongest predictor (OR = 4.1), emphasizing the need for infection control.

Intra-tympanic steroid injection is an easy and effective outpatient procedure for the treatment of Meniere's disease, ISSNHL and IPBSNHL to avoid the side effects of systemic corticosteroids. Our study is in agreement with the protocol of Hamid[8].

In his four years experience with IT steroid injection, utilizing the same technique we adopted in our study, he reported 90% SDS recovery. Li et al.6 demonstrated that intra-tympanic dexamethasone perfusion by an external electronic pump with gelatin sponge placement in a round window niche is an efficacious and safe method for the treatment of ISSNHL, showing superiority to simple injection through the drum. This is in contrast to the results we obtained utilizing the injection method that showed a significant improvement in our results that is nearly similar to the better results obtained by their pump technique[9].

Garavello et al.2 concluded that Intra-tympanic steroid therapy seems to confer a certain degree of benefit as salvage but not as a primary treatment of sudden deafness. This contradicts our results that proved IT steroid therapy as an effective primary therapy probably because of inclusion criteria utilized in their meta-analysis study[10-11].

The mean PTA demonstrated a significant therapeutic action of the short-duration intra-tympanic steroid therapy on moderate ISSNHL, with a flat audiogram shape, compared to the natural course of the disease and the placebo effect at that time point[12]; Filipo et al.1 Intra-tympanic treatment of ISSHL may be a preferable choice as primary treatment option, since it can be performed in outpatient settings, with no serious side effects and complication rate; Ljiljana et al.7 Ilker et al.5 reported that intra-tympanic steroid injections could be used safely and successfully in patients who do not respond to conventional intravenous treatment. It can also be applied as the treatment of choice in ISHL, especially in patients who have contraindications to systemic treatment with corticosteroids.

CONCLUSION

In this study we come to concluded that intratympanic steroids where feasible and more effective as compare to oral steroid in hearing loss of children. The advantages of IT steroid therapy are being an office-based procedure performed under local anaesthesia, it is less invasive, cost-effective, with no/minimal side effects and could be started immediately, make it a superior tool in the treatment of immune-mediated SNHL. Statistically significant results shown in our study, proves its efficacy and safety over the use of systemic steroids.

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