

A Cross-Sectional Study on Prevalence of Traumatic Tympanic Membrane Perforation in Children at a Tertiary Care Centre of West Bengal.

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ABSTRACT

Background: Traumatic tympanic membrane perforation (TTMP) is one of the common yet underdiagnosed ENT conditions in the paediatric population. In developing countries like India, it is often caused by physical assault, accidental injury, or ear manipulation. Early identification and timely management can prevent long-term hearing impairment in children. **Objectives:** To estimate the prevalence of traumatic tympanic membrane perforation among children attending the ENT outpatient department and to assess associated sociodemographic and aetiological factors. **Methodology:** This cross-sectional observational study was conducted at a tertiary care centre in West Bengal over a period of six months. A total of 62 children aged 1–18 years were enrolled using a purposive sampling technique. Data were collected through structured interviews, clinical examination, and otoscopy. Sample size was calculated using the standard prevalence formula. **Results:** Out of 62 children examined, 38 (61.3%) were diagnosed with traumatic tympanic membrane perforation. The majority were males (63.2%) belonging to the 6–12 years age group (52.6%). Slap injury was the most common cause (44.7%), followed by ear

instrumentation (31.6%) and blast injury (13.2%). Right ear involvement was more frequent (57.9%). Most perforations were central in location (73.7%). **Conclusion:** The prevalence of TTMP in children at this tertiary centre is notably high. Physical assault (slapping) remains the single most important 790 preventable cause. Community awareness, parental education, and early ENT referral are critical steps to reduce morbidity in the paediatric age group.

Keywords: Tympanic membrane perforation, traumatic, children, paediatric, West Bengal, ENT, otoscopy, prevalence

1. INTRODUCTION

The tympanic membrane (TM), commonly known as the eardrum, is a delicate structure that plays a vital role in sound conduction and middle ear protection. Any breach in its integrity, whether due to infection or trauma, can result in conductive hearing loss, chronic otitis media, and significant impact on quality of life[1]. Traumatic tympanic membrane perforation (TTMP) refers specifically to a defect in the TM caused by mechanical, barotraumatic, or thermal injury, without an underlying infective aetiology[2].

In the paediatric population, this condition holds special clinical significance, as children are in a critical phase of language development and learning. Undetected or poorly managed hearing loss during these formative years can impede speech development, academic performance, and social interaction. In India, several studies have reported that children are disproportionately affected due to higher incidence of playground accidents, ear cleaning habits using cotton buds or sharp objects, and unfortunately, domestic physical violence[3].

West Bengal, as one of the most densely populated states in India, presents a unique epidemiological scenario. Tertiary care centres in this region cater to both urban and rural populations, and therefore serve as ideal settings for studying the true burden of ENT conditions in children. Despite this, there is a relative paucity of studies specifically examining TTMP in the paediatric age group in this geographical region.

This study was, therefore, undertaken to estimate the prevalence of TTMP in children attending the ENT outpatient department of a tertiary care centre in West Bengal, and to assess the associated sociodemographic factors, common aetiologies, and patterns of perforation. The findings from this study are expected to contribute meaningfully to the existing literature and help frame evidence-based preventive strategies[4].

2. OBJECTIVES

2.1 Primary Objective

To estimate the prevalence of traumatic tympanic membrane perforation among children (aged 1–18 ⁷⁹¹ years) attending the ENT outpatient department of a tertiary care centre in West Bengal.

2.2 Secondary Objectives

- (i) To assess the sociodemographic profile of children with TTMP in terms of age, sex, residence, and socioeconomic status.
- (ii) To identify the most common aetiological factors responsible for TTMP in this population.
- (iii) To describe the clinical pattern of perforation, including site, size, and laterality.
- (iv) To determine the association between sociodemographic factors and occurrence of TTMP.

3. METHODOLOGY

3.1 Study Design and Setting

This was a hospital-based, cross-sectional observational study conducted at the Department of Otorhinolaryngology (ENT) of a tertiary care centre in West Bengal. The study was carried out over a period of six months (January 2024 to June 2024). Institutional ethical clearance was obtained prior to data collection, and informed written consent was taken from parents or legal guardians of all participating children.

3.2 Sample Size Calculation

The sample size was calculated using the standard formula for estimating prevalence in a cross-sectional study:

$$n = Z^2 \times p \times q / d^2 \text{ Where:}$$

n = Required sample size

Z = 1.96 (Z-value at 95% confidence level)

p = Expected prevalence = 0.55 (55%, based on a prior similar study)

q = 1 – p = 0.45 d = Allowable error = 0.12 (12%)

$$n = (1.96)^2 \times 0.55 \times 0.45 / (0.12)^2$$

$n = 3.8416 \times 0.2475 / 0.0144 \approx 66$, adjusted to 62 after accounting for incomplete records 792 Thus, a final sample of 62 children was included in the study.

3.3 Sampling Method

Purposive (consecutive) sampling was employed. All children aged 1 to 18 years presenting to the ENT OPD with ear complaints, within the study period, were screened. Those who met the inclusion criteria were enrolled consecutively until the desired sample size was achieved.

3.4 Inclusion and Exclusion Criteria

Inclusion criteria: Children aged 1–18 years presenting to the ENT OPD; those with history of ear trauma; ability of parent/guardian to provide consent.

Exclusion criteria: Children with pre-existing chronic otitis media or known congenital ear anomalies; those with incomplete clinical records; children who had undergone previous ear surgery.

3.5 Data Collection Tools

A pre-tested structured proforma was used to record sociodemographic details, presenting complaints, history of trauma, and otoscopic findings. Clinical examination was performed by a qualified ENT specialist using a standard auriscope and otoscope. Perforation size was graded as small (< 25%), moderate (25–50%), or large (> 50%) of the TM area. Data were entered in Microsoft Excel and analysed using SPSS version 23.

3.6 Statistical Analysis

Descriptive statistics including frequency, percentage, mean, and standard deviation were computed. Chisquare test was applied to determine association between categorical variables. A p-value of < 0.05 was considered statistically significant.

4. RESULTS

A total of 62 children were assessed during the study period. Of these, 38 children (61.3%) were diagnosed with traumatic tympanic membrane perforation. The remaining 24 children (38.7%) did not fulfil the diagnostic criteria for TTMP and were excluded from further analysis. All results presented hereafter pertain to the 38 affected children.

4.1 Sociodemographic Profile

Table 1 provides a detailed overview of the sociodemographic characteristics of the study participants with TTMP.

Table 1: Sociodemographic Profile of Children with Traumatic Tympanic Membrane Perforation (n = 38)

Sociodemographic Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	1 – 5 years	5	13.2
	6 – 12 years	20	52.6
	13 – 18 years	13	34.2
Sex	Male	24	63.2
	Female	14	36.8
Residence	Urban	22	57.9
	Rural	16	42.1
Socioeconomic Status	Lower class	18	47.4
	Middle class	15	39.5
	Upper class	5	13.1
Religion	Hindu	26	68.4
	Muslim	10	26.3
	Others	2	5.3
Family Type	Nuclear	23	60.5
	Joint/Extended	15	39.5

(Source: Primary data collected during the study period)

4.2 Aetiological Factors

The most common cause of TTMP was slap injury (blow to the ear), accounting for 44.7% (n = 17) of cases. This was followed by ear instrumentation with cotton buds or sharp objects in 31.6% (n = 12) of cases, blast injury in 13.2% (n = 5), foreign body insertion in 7.9% (n = 3), and accidental fall in 2.6% (n = 1) of cases.

4.3 Clinical Characteristics

In terms of laterality, the right ear was affected in 57.9% (n = 22) of cases, the left ear in 34.2% (n = 13), and bilateral perforation was observed in 7.9% (n = 3) of children. Central perforations were the most common type, noted in 73.7% (n = 28), followed by antero-inferior perforations in 18.4% (n = 7), and marginal perforations in 7.9% (n = 3). Regarding perforation size, 52.6% (n = 20) had small perforations (< 25%), 31.6% (n = 12) had moderate perforations (25–50%), and 15.8% (n = 6) had large perforations (> 50%).

4.4 Symptom Profile

The most frequently reported symptoms were ear pain (otalgia) in 84.2% (n = 32), decreased hearing in 68.4% (n = 26), ear discharge in 44.7% (n = 17), tinnitus in 26.3% (n = 10), and dizziness or vertigo in 10.5% (n = 4) of children. A statistically significant association was found between socioeconomic status and severity of perforation ($p < 0.05$), suggesting that children from lower socioeconomic backgrounds presented with larger perforations and delayed treatment.

5. DISCUSSION

This cross-sectional study was conducted at a tertiary care centre in West Bengal with the specific aim of assessing the prevalence of TTMP in the paediatric age group. The overall prevalence of 61.3% observed in this study is notably high and is consistent with findings reported from other tertiary institutions across India. Varghese et al. (2019) reported a prevalence of 58.2% in a similar hospital-based study from Kerala, while Datta et al. (2021) observed a prevalence of 63.0% in a study conducted in eastern India, both of which are closely aligned with the present findings[5].

The predominance of TTMP in the 6–12 years age group (52.6%) is consistent with existing literature, which identifies school-going children as the most vulnerable population. This age group is characterised by active participation in physical activities and play, making them more susceptible to accidental and intentional physical trauma[6]. Additionally, a male preponderance (63.2%) was observed in this study, which is in agreement with studies by Kumar et al. (2020), where male children accounted for approximately 60–65% of TTMP cases. This male predominance may be attributed to greater outdoor activity, risk-taking behaviour, and possibly higher exposure to physical altercations in this demographic. Slap injury was identified as the most common aetiology in this study (44.7%), highlighting the distressing reality of physical violence as a significant contributor to paediatric ear injuries. This finding mirrors

observations from studies across South Asia, where slapping to the ear or ‘cuffing’ is an unfortunately common form of corporal punishment at home and school. The raised hydrostatic pressure generated by a palm strike to the ear canal is sufficient to rupture the tympanic membrane and can sometimes cause ossicular chain disruption[7]. Ear instrumentation with cotton buds or sharp objects was the second most common cause (31.6%), which reflects a widespread cultural habit of ear cleaning with non-medical

objects. Sustained health education campaigns targeting parents and caregivers about the dangers of ear instrumentation are, therefore, urgently warranted.

The clinical pattern observed in this study, with a predominance of central perforations (73.7%), is in agreement with several published studies. Central perforations tend to heal spontaneously with conservative management in a significant proportion of cases, particularly when small in size. However, larger perforations and those associated with infection carry a higher risk of chronicity and require myringoplasty[8]. The greater frequency of right ear involvement (57.9%) in this study may reflect the right-handedness of perpetrators in physical assault cases, as a right-handed slap to a facing person predominantly impacts the left side of the victim’s face, though this association requires further investigation[9].

The association between lower socioeconomic status and larger perforation size ($p < 0.05$) observed in this study is an important finding. Children from lower socioeconomic backgrounds may have limited access to healthcare services, resulting in delayed presentation and thus greater severity at the time of diagnosis. This underscores the need for targeted outreach programmes and affordable ENT services in underserved communities.

This study has certain limitations. Being hospital-based, it may not fully represent the community-level prevalence of TTMP. Purposive sampling, while practical, may introduce selection bias. Additionally, audiometric assessment was not performed for all children, which limits the assessment of functional hearing outcomes. Future studies with a larger sample size, community-based design, and audiometric follow-up are recommended[10].

6. CONCLUSION

Traumatic tympanic membrane perforation is a prevalent and clinically significant condition in the paediatric population of West Bengal. The overall prevalence of 61.3% recorded in this tertiary care-based

study underscores the significant burden of this condition. Slap injury and ear instrumentation are the most common preventable causes, and the highest burden falls on school-going children from lower socioeconomic backgrounds.

Preventive strategies must focus on community awareness, parental education regarding harmful earcleaning practices, strict prohibition of corporal punishment, and early referral to ENT specialists. 796 Training of primary care physicians and school health workers in recognising early signs of TTMP can significantly reduce the risk of long-term complications, including chronic otitis media and hearing impairment, in this vulnerable population.

7. Declaration

Conflict of Interest: The authors declare no conflict of interest.

Source of Funding: The study received no external funding. It was conducted as a departmental academic research project.

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