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Investigation of Predictors of Suppurative Otitis Media in Pediatric Practice

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Abstract: This study seeks to identify risk factors for otitis media, a prevalent pediatric ailment in developing nations, particularly Asia. The objective is to conduct well-planned epidemiological studies to reduce the incidence of hearing loss and deafness in infants. The study analyzed a population of preschool-aged children in a rural community, focusing on those with the highest prevalence of middle ear infection. The prevalence of middle ear infection among study participants was reported to be 8.6%. Otitis media with effusion (OME) was the most prevalent manifestation, followed by eustachian tubal block (ETB). Multiple risk factors, including persistent rhinorrhea, recurrent upper respiratory tract infections, snoring and mouth breathing, passive smoking, and seasonal rhinitis, were identified in the study. These variables substantially increased the likelihood of developing middle ear infection. In this rural population, however, sociodemographic factors such as age, gender, and socioeconomic status did not emerge as significant risk factors. The study emphasizes the significance of interventions including the treatment of enlarged adenoids, chronic sinusitis, and underlying nasal sensitivities, as well as the implementation of routine screening programs to identify and address risk factors. The negative effects of passive smoking on the respiratory and otological health of minors should also be highlighted in anti-smoking campaigns.

Key words: otitis media, childhood ailment, prevalence, hearing loss, risk factors..

Introduction

Otitis media is a prevalent childhood ailment in developing nations, particularly in Asia where it is the primary cause of hearing loss among children. Previous study conducted in 2007 revealed that out of 34 children aged 6-10 years diagnosed with hearing loss, 31 of them (91.2%) also had concurrent otitis media [1]. The prevalence of otitis media in this specific population was determined to be 17.6%. Other studies conducted on children in different regions of Asia reported otitis media prevalence ranging from 15.3% [2] to 20% [3]. Given the high prevalence of this condition among children and its impact on hearing, it is crucial to conduct well-planned epidemiological studies to identify risk factors and interventions aimed at reducing its occurrence. Surprisingly, no systematic study on risk factors for otitis media in children has been encountered to date. Studies from Western countries suggest that several intrinsic and extrinsic factors may contribute to a child's susceptibility to otitis media, including younger age [4], male gender [5,6], parental or sibling history of otitis media [5,7,8], early onset of otitis media [5], low socioeconomic status [5,6], shorter duration of breastfeeding [5,8-10], overcrowding [4,11], daycare attendance [4,6-8,11,12], recurrent upper respiratory infections [12], snoring [12], allergic rhinitis [13], and passive smoking [8,13]. In a few studies conducted in developing countries where otitis media prevalence is high, younger age [14], low socioeconomic status [14-17], large family size and overcrowding [18], exposure to household smoke [15,18], shorter duration of breastfeeding [15,19], snoring [14], recurrent upper respiratory infections [14,20], malnutrition [15], and low parental education [18] were identified as significant

risk factors. The variability of risk factors across different countries often reflects sociocultural differences among the studied populations [21]. This study aims to identify common risk factors for otitis media within a rural community where several sociodemographic indicators are similar among both affected and unaffected individuals. The preschool age group, which is widely recognized as being highly affected by this condition worldwide, was targeted for this investigation.

Materials and Methods

This study was conducted in ENT department of Samarkand State Medical University. The study was divided into two parts: a cross-sectional study to assess the prevalence of otitis media in the study population and a case-control study to identify risk factors for otitis media. Out of the 104 children in the study age group , 80 children were motivated to participate in the study and attend the screening camps. Informed consent was obtained from parents or guardians before the children underwent examination. The children's ages ranged from 11 months to 7 years, with a mean age of 3 years and 11 months. Of the total participants, 39 (51%) were girls, and 41 (49%) were boys. The mean weight of the children was 12.6 kg, ranging from 4.5 kg to 21 kg. hildren diagnosed with acute suppurative otitis media, otitis media with effusion, or chronic suppurative otitis media were considered cases. For each case, a control child who screened negative for otitis media was selected. Children with Down's syndrome, cleft palate, systemic diseases such as juvenile diabetes and nephrotic syndrome, and immunodeficiency were excluded from the study due to their higher risk of developing otitis media.

Sample Size Calculation

The sample size was determined to investigate whether persistent rhinorrhea is a risk factor for otitis media. Based on a study it was found that approximately 22% of children in the age group of 1-6 years (children in day care centers) had a history of persistent rhinorrhea. It was anticipated that the odds for a history of persistent rhinorrhea among children diagnosed with otitis media would be three times that of controls. A sample size of 70 cases and 70 controls was estimated to have 80% power to detect a difference between two proportions using a two-group continuity corrected chi-square or Fisher's Exact test, with a two-sided significance level of 0.05. Sample size calculations were performed using PS-Power and sample size calculation software. Previous studies have indicated that the prevalence of chronic suppurative otitis media in children is approximately 6-7%. Hence, a sample size of 100 children was calculated for the prevalence study, taking into account the estimation that around 6-7% of children would have otitis media, allowing for the diagnosis of approximately 70 children with otitis media for the case-control study.

Ethics Committee Approval.

The study design and protocols were approved by the Institutional Review Board and Ethics Committee.

Diagnostic Criteria The following diagnostic criteria were used:

1. Acute suppurative otitis media (ASOM): Diagnosed in a child with an acutely (<2 weeks) perforated, congested eardrum with pulsatile discharge or a bulging, congested eardrum with a B curve on tympanometry.
2. Chronic suppurative otitis media (CSOM): Diagnosed in a child with a history of ear discharge from a central perforation of the tympanic membrane lasting more than 2 weeks.
3. Otitis media with effusion (OME): Diagnosed in a child with an intact, pale, dull, retracted tympanic membrane and a B curve on tympanometry.
4. Eustachian tubal block (ETB): Diagnosed in a patient with a retracted tympanic membrane and a C curve.
5. Impacted wax: Diagnosed in a child with hard wax that completely obscures the tympanic membrane and cannot be removed in a single session of instillation of ear drops followed by ear syringing or suction clearance.

Clinical and Audiological Examination

All 80 children underwent examinations for weight, height, mid-arm circumference, and the presence of any congenital anomalies. An ear, nose, and throat (ENT) examination was conducted for all children. Children with cerumen in the ear canal were reassessed after wax removal. Otoscopy was performed to identify patients with acute suppurative otitis media (ASOM), chronic suppurative otitis media (CSOM), otitis media with effusion (OME), or eustachian tubal block (ETB).

Tympanometry was subsequently performed using a portable tympanometer, except for children with impacted wax or ear discharge or those with a perforated tympanic membrane. Tympanogram curves were interpreted as follows: A curve (normal), B curve (OME), C curve (ETB). Children above 2 years of age underwent screening audiometry, while children under 2 years of age underwent free field testing with calibrated noise

Risk Factors Studied The following risk factors:

Age (<3 years, 3 years and above) and sex (males, females).

Socioeconomic status (SES) based on the type of residence. Lower SES was assigned to those living in temporary shelters or huts without a proper foundation (kutcha houses), while higher SES was assigned to those living in cement and brick houses.

Malnutrition, determined based on weight below 2 standard deviations (SD) below the reference median using the nutrition anthropometry program of CDC/Epiinfo statistical package (2000).

Duration of breastfeeding (≤6 months, >6 months).

Passive smoking (present, absent).

Exposure to household smoke (firewood) (yes, no).

Positive throat swab for Streptococcus pneumoniae or Haemophilus influenzae.

Persistent rhinorrhea (present, absent). Diagnosed in children with an upper respiratory tract infection causing rhinorrhea lasting longer than 2 weeks or those with an episode of upper respiratory infection occurring every month.

Results.

In the cross-sectional study involving a total of 80 patients, the demographic characteristics of the population were analyzed. The distribution of sociodemographic features was similar between those diagnosed with otitis media and those without. The age distribution was representative, with 31.4% of children being under 3 years old. Boys outnumbered girls in the population. The majority of the population was literate and employed, and more than 80% of households had at least one member educated up to middle school or above. Approximately 63% of the population belonged to a higher socioeconomic status.

The otological findings of the 80 children screened are summarized. The most common abnormality observed during otoscopic examination was wax, which was found in 28.5% of the children. Among them, 70 children (8.8%) had hard and impacted wax. Eighteen children (2.3%) failed the screening audiometry test.

Among the study participants, 69 children were diagnosed with otitis media, resulting in an overall prevalence rate of 8.6%. Two patients had acute suppurative otitis media (ASOM) or chronic suppurative otitis media (CSOM) in one ear and otitis media with effusion (OME) in the other ear. OME was the most common manifestation of otitis media, with 48 cases (6%) diagnosed with this condition in either one or both ears. Among the OME cases, 30 patients (3.8%) had bilateral disease. Bilateral involvement was also observed in 3 out of 12 cases of ASOM and 6 out of 11 cases of CSOM. No cases of aural cholesteatoma or adhesive otitis media were identified. Eustachian tubal block (ETB) was diagnosed in 36 cases (4.5%). Tympanometry results showed A, B, and C curves in the left ears of 493, 40, and 31 patients, respectively, and in the right ears of 499, 48, and 33 patients, respectively. Tympanometry proved helpful in distinguishing between patients with OME and those with ETB, particularly when the clinical findings were indistinguishable.

In the analysis of 80 preschool children residing in rural areas, the odds of developing otitis media were 7.6 times higher for those with a history of persistent rhinorrhoea ($p < 0.01$, OR = 7.56, 95% CI 2.73–20.92). Symptoms such as snoring and mouth breathing, which are commonly observed during episodes of persistent rhinorrhoea, were also significantly associated with the disease ($p = 0.01$, OR = 4.89, 95% CI 1.32–18.17). Additionally, seasonal rhinitis and passive smoking were identified as important risk factors. A comparison between cases and controls revealed that seasonal rhinitis ($p = 0.02$, OR = 5.93, 95% CI = 1.33–26.5) and passive smoking ($p = 0.04$, OR = 3.29, 95% CI 1.05–10.33) predisposed children to otitis media (table 1).

Table 1: Risk Factors Associated with Otitis Media in Preschool, Rural Children

Risk Factors	p-value	Odds Ratio	95% Confidence Interval
History of Persistent Rhinorrhoea	<0.01	7.56	2.73-20.92
Snoring and Mouth Breathing	0.01	4.89	1.32-18.17
Seasonal Rhinitis	0.02	5.93	1.33-26.5
Passive Smoking	0.04	3.29	1.05-10.33

Discussion.

This epidemiological study on preschool rural children in a specific region demonstrates that certain risk factors are significantly associated with otitis media. Persistent rhinorrhoea, which was observed in 10.6% of the children, emerged as a crucial risk factor for the disease ($p < 0.01$, OR = 7.56, 95% CI 2.73–20.92). Similar findings have been reported in previous studies conducted in different regions [20]. The high prevalence of persistent rhinorrhoea in this population contributes to the elevated prevalence of otitis media.

Recurrent upper respiratory tract infections, a symptom commonly associated with persistent rhinorrhoea, also emerged as an important risk factor for otitis media in this study ($p < 0.01$, OR = 4.89, 95% CI 1.32–18.17). The association between persistent rhinorrhoea and otitis media can be explained by the fact that retained secretions in the nasal cavity and nasopharynx create an environment conducive to bacterial growth, which can then spread to the middle ear via the Eustachian tube. Snoring and mouth breathing, often observed in children with persistent rhinorrhoea, were also found to be significantly associated with otitis media ($p = 0.01$, OR = 4.89, 95% CI 1.32–18.17). Evaluation and treatment of enlarged adenoids and tonsils, which can cause snoring, could help reduce the risk of otitis media in affected children. Passive smoking was identified as another significant risk factor for otitis media in this study ($p = 0.04$, OR = 3.29, 95% CI 1.05–10.33). Exposure to cigarette smoke can paralyze cilia and damage respiratory epithelium, making it more susceptible to bacterial infections. However, it is worth noting that the awareness of the adverse effects of passive smoking on respiratory and otological health of children is currently insufficient at a national level.Seasonal rhinitis, particularly during winter, was also found to be a noteworthy risk factor for otitis media ($p = 0.02$, OR = 5.93, 95% CI = 1.33–26.51). Many of the children with seasonal rhinitis in this study had concurrent passive smoking, highlighting the potential interaction between these risk factors. Sociodemographic factors such as age, sex, nutritional status, balwadi attendance, parental education status, and socioeconomic status did not emerge as significant risk factors in this particular community. However, it is important to acknowledge that this study focused on a specific rural population, and the results may not be generalizable to other regions or populations.

There are some limitations to consider, including potential recall bias as data was collected retrospectively. Additionally, tympanometry, used for diagnosing otitis media, has its limitations in screening studies of this nature.

Conclusions.

To address the issue of otitis media, interventions should include the treatment of enlarged adenoids, chronic sinusitis, and underlying nasal allergies. Regular screening programs and school visits to identify persistent rhinorrhoea, obstructed breathing, and otitis media should be incorporated into a designated national health program for ear care. Furthermore, the adverse effects of passive smoking on children's respiratory and otological health should be emphasized in anti-tobacco campaigns.

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