

Evaluation Of Risk Factor Of Middle Ear Diseases In Children Less Than 5 Years

Fazle Elahi Jonaed¹, Muntasir Mahbub², Ascif Al Mahady³,

S. M. Osman Gani⁴, Farhana Rahman⁵, Abidur Rahman⁶

Assistant Professor, Department Of Ent, Khwaja Yunus Ali Medical College & Hospital, Sirajganj, Bangladesh

Associate Professor And Head Of The Department, Department Of Ent, Khwaja Yunus Ali Medical College & Hospital, Sirajganj, Bangladesh

Assistant Professor, Department Of Ent, Enam Medical College, Dhaka, Bangladesh

Assistant Surgeon, Sadar Hospital, Gaibandha, Bangladesh

Assistant Registrar, Department Of Endocrinology, Khwaja Yunus Ali Medical College & Hospital, Sirajganj, Bangladesh

Intern, Sir Salimullah Medical College, Dhaka, Bangladesh

Abstract

Introduction: Middle ear diseases, such as acute otitis media (AOM), otitis media with effusion (OME), and chronic suppurative otitis media (CSOM), are common in children under five years old. These conditions can lead to significant morbidity, including hearing impairment and developmental delays. This study aimed to evaluate the risk factors and diagnostic distribution of middle ear diseases in children under five years, highlighting the role of upper respiratory tract infections (URTI), adenoid hypertrophy, feeding practices, deviated nasal septum (DNS), and trauma.

Methods: This cross-sectional study was conducted from 1st May, 2023 to 30 April, 2024 at Khwaja Yunus Ali Medical College & Hospital, Sirajganj, Bangladesh, retrospectively reviewing medical records of 88 children under five years diagnosed with middle ear diseases. Data were collected on demographic characteristics, breastfeeding status, history of upper respiratory tract infections, and other relevant factors. Descriptive and inferential statistics were used to analyze the data.

Result: The study population included 88 children, with 45.45% aged less than one year, 30.68% between one and three years, and 23.86% between three and five years. Males comprised 68.18% of the participants. The most common risk factors identified were URTI (54.54%), adenoid hypertrophy (26.13%), bottle feeding/breast feeding in lying position (5.68%), DNS (5.68%), and history of trauma (7.95%). Significant associations were found between these risk factors and the age groups. The most common diagnoses were bilateral OME (27.27%), right-sided chronic otitis media (12.50%), and left-sided chronic otitis media (13.63%).

Conclusion: This study underscores the multifactorial nature of middle ear diseases in children under five years. URITs, adenoid hypertrophy, improper feeding practices, DNS, and trauma are significant risk factors. Early detection and comprehensive management strategies are essential to reduce the burden of these diseases. Future research should focus on longitudinal studies to further elucidate causal relationships and evaluate preventive measures.

Keywords: Middle Ear Diseases, Acute Otitis Media, Effusion, Chronic Suppurative Otitis Media

Date of Submission: 03-06-2024

Date of Acceptance: 13-06-2024

I. Introduction

Middle ear diseases, including acute otitis media (AOM), otitis media with effusion (OME), and chronic suppurative otitis media (CSOM), are prevalent health issues affecting children under five years old worldwide [1-2]. These conditions not only cause discomfort and pain but can also lead to hearing impairment, speech and language delays, and academic difficulties, significantly impacting a child's overall development and quality of life [3]. The burden of middle ear diseases varies across geographic regions, with higher rates reported in low- and middle-income countries where access to healthcare services, vaccination coverage, and environmental conditions may be suboptimal [4,5]. Factors contributing to the development of middle ear diseases in young

children include anatomical factors such as eustachian tube dysfunction and craniofacial abnormalities, as well as environmental factors including exposure to tobacco smoke, crowded living conditions, and inadequate hygiene practices [6,7]. Acute otitis media presents with rapid onset symptoms such as ear pain, fever, and irritability, often accompanied by middle ear effusion and tympanic membrane inflammation [8]. Otitis media with effusion, commonly known as "glue ear," involves the presence of fluid in the middle ear without signs of acute infection, leading to conductive hearing loss and speech perception difficulties [9]. Chronic suppurative otitis media is characterized by persistent ear discharge and tympanic membrane perforation, associated with repeated episodes of acute otitis media and poor access to healthcare [10]. Diagnosing and managing middle ear diseases in children under five present several challenges, including the subjective nature of symptoms, limited access to healthcare facilities, and reliance on clinical assessment tools that may lack sensitivity and specificity [11,12]. Diagnostic modalities such as pneumatic otoscopy, tympanometry, and audiometry may be unavailable or underutilized in resource-limited settings, leading to underdiagnosis and undertreatment of middle ear diseases [13]. Preventive strategies aimed at reducing the burden of middle ear diseases in young children focus on vaccination against common pathogens such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*, which are frequently implicated in acute otitis media. Promotion of breastfeeding, avoidance of environmental tobacco smoke exposure, and implementation of good hygiene practices can also help reduce the risk of middle ear infections [14]. Understanding the risk factors associated with middle ear diseases in children under five years old is essential for developing targeted interventions and improving health outcomes in this vulnerable population. By identifying modifiable risk factors, healthcare providers can implement preventive measures and early interventions to reduce the incidence and severity of middle ear diseases, thereby minimizing the long-term consequences on child development and well-being. Aim of the study is to evaluation of risk factor of middle ear diseases in children less than 5 years.

II. Methods

In this cross-sectional study, we aimed to evaluate the risk factors associated with middle ear diseases in children under the age of 5. The data for this study were collected retrospectively from 1st May, 2023 to 30 April, 2024 at Khwaja Yunus Ali Medical College & Hospital, Sirajganj, Bangladesh. The inclusion criteria encompassed children aged less than 5 years who had been diagnosed with middle ear diseases, such as otitis media. Exclusion criteria involved children with congenital abnormalities of the ear, previous ear surgery, or incomplete medical records. Data collection involved reviewing the medical records of eligible participants and extracting relevant information including demographic details, breastfeeding status, and history of upper respiratory tract infections. Data analysis was performed using SPSS version 26. Descriptive statistics were used to summarize the demographic characteristics of the participants, while inferential statistics, such as chi-square tests or logistic regression analysis, were employed to assess the association between potential risk factors and the occurrence of middle ear diseases. Continuous variables were presented as means with standard deviations, and categorical variables as frequencies and percentages. A p-value of less than 0.05 was considered statistically significant. Ethical considerations were adhered to throughout the study, ensuring the confidentiality and anonymity of participants' information. This study aimed to provide valuable insights into the risk factors contributing to middle ear diseases in young children, aiding in the development of targeted preventive strategies and interventions.

III. Results

The study included a total of 88 children under the age of 5, with a distribution of baseline characteristics as follows: 45.45% of the participants were less than 1-year-old, 30.68% were between 1 and 3 years old, and 23.86% were between 3 and 5 years old. In terms of gender distribution, 68.18% of the participants were male, and 31.81% were female.

Table 1: Distribution of study population based on baseline characteristics (N=88)

Baseline characteristics	(n, %)
Age	
< 1year	40,45.45%
1-3 Years	27,30.68%
3-5 years	21,23.86%
Gender	
Male	60, 68.18%
Female	28, 31.81%

Bilateral earache was reported by 26.13% of the children, while unilateral earache was a complaint in only 1.13% of cases. Bilateral ear blockage was the most common complaint, affecting 34.09% of the participants. Bilateral ear discharge was noted in 32.95% of the children, with unilateral ear discharge reported by 1.13%. Bilateral hearing loss was observed in 6.82% of the children, and unilateral hearing loss was seen in 1.13%. Additionally, tinnitus was reported by 1.13% of the participants.

Table 2: distribution of study population based on chief complaints of study population (N=88)

Chief complaints	(n,%)
Bilateral earache	23,26.13%
Unilateral earache	1,1.13%
Bilateral ear blockage	30,34.09%
Bilateral ear discharge	29,32.95%
Unilateral ear discharge	1, 1.13%
Bilateral hearing loss	6, 1.13%
Unilateral hearing loss	1, 1.13%
Tinnitus	1, 1.13%

Regarding the diagnoses, 27.27% of the children were diagnosed with bilateral otitis media with effusion (OME), while 5.68% had bilateral acute otitis media (AOM). Bilateral chronic otitis media (COM) was diagnosed in 7.95% of the participants. Right-sided AOM and left-sided AOM were diagnosed in 11.36% and 10.22% of the children, respectively. Right OME and left OME were each diagnosed in 4.54% of the participants. Right-sided COM was found in 12.50%, and left-sided COM in 13.63%. Additionally, 2.27% of the children had a traumatic rupture of the tympanic membrane.

Table 3: Distribution of study population based on diagnosis (N=88)

Diagnosis	(n,%)
Bilateral OME	24,27.27%
Bilateral AOM	5,5.68%
Bilateral COM	7,7.95%
Right AOM	10,11.36%
Left AOM	9,10.22%
Right OME	4,4.54%
Left OME	4,4.54%
Right COM	11,12.50%
Left COM	12,13.63%
Traumatic rupture of tympanic membrane	2,2.27%,

The study also identified several etiologies and risk factors associated with middle ear diseases. Upper respiratory tract infections (URTI) were the most common risk factor, present in 54.54% of the cases. Adenoid hypertrophy was noted in 26.13% of the participants. Bottle feeding/breast feeding in lying position was identified as a risk factor in 5.68% of the cases, as was deviated nasal septum (DNS). A history of trauma was reported in 7.95% of the children.

Table 4: Distribution of study population based on Etiology/risk factors (N=88)

Etiology/risk factors	(n,%)
URTI	48,54.54%
Adenoid	23,26.13%
Bottle feeding/Breast feeding in lying position	5,5.68%
DNS	5,5.68%
H/O Trauma	7,7.95%

When examining the distribution of risk factors by age, URTI was most prevalent in children under 1-year-old (41.66%) and those aged 1-3 years (43.75%), with statistical significance ($p = 0.002$ and $p = 0.005$, respectively). Adenoid hypertrophy was more common in children aged 3-5 years (56.52%) with a significant p -value (0.009). Bottle feeding/breast feeding in lying position was exclusively observed in children under 1-year-old (100%), which was statistically significant ($p = 0.03$). The occurrence of DNS and a history of trauma did not show significant variation across the different age groups.

Table 5: Distribution of study population according to age and etiology/risk factors (N=88)

Risk factors Age	URTI (n=48) (n, %); p-value	Adenoid (n=23) (n, %); p-value	Bottle/Breast feeding (n=5) (n, %); p-value	DNS (n=5) (n, %); p-value	H/O Trauma (n=7) (n, %); p-value
<1yrs	20,41.66%; 0.002	0,0.00% (not applicable)	5,100.00%;0.03	1,20.00%;0.67	1,14.28%;0.11
1-3yrs	21,43.75%;0.005	10,43.47%; 0.80	0,0.00%(not applicable)	1,20.00%;0.93	4,57.14%;0.45
>3-5yrs	7,14.58%;0.06	13,56.52%;0.009	0,0.00%(not applicable)	3,60.00%;0.60	2,28.57%;0.72

IV. Discussion

The current study aimed to evaluate the risk factors and diagnostic distribution of middle ear diseases in children under five years. The findings indicate a significant prevalence of middle ear diseases within this age group, with a notable distribution in diagnoses and associated risk factors. In our cohort of 88 children, the majority were male (68.18%), and the highest prevalence of middle ear diseases was observed in children less than one-year-old. This gender disparity aligns with findings from Bennett and Haggard, who reported a higher incidence of middle ear diseases in males due to potential anatomical and immunological differences between genders [15]. Our study identified upper respiratory tract infections (URTI) as the most common risk factor, present in 54.54% of the cases. This is consistent with the findings of Alexandrino et al., who highlighted URTIs as a significant risk factor for otitis media, particularly in children attending day care centers [16]. The high prevalence of URTI in our study, particularly among children under one-year-old, underscores the vulnerability of this age group to respiratory infections and subsequent middle ear diseases. Additionally, the Pacific Islands Families Study corroborates these findings by associating frequent respiratory infections with increased risk for otitis media with effusion (OME) [17]. Adenoid hypertrophy was another significant risk factor identified in our study, present in 26.13% of the children. The role of adenoid hypertrophy in predisposing children to middle ear diseases has been well-documented. Uluyol and Erdem demonstrated that adenoid hypertrophy can disrupt normal nasopharyngeal flora, leading to recurrent sinonasal and middle ear infections [18]. Our findings of a higher prevalence of adenoid hypertrophy in children aged 3-5 years, with statistical significance, align with their conclusions. The study also highlighted bottle feeding/ breast feeding in lying position as a risk factor, present in 5.68% of the cases. Kraemer et al. found that improper feeding positions could contribute to Eustachian tube dysfunction, thereby increasing the risk of persistent middle ear effusions [19]. Our data showed a significant association of this risk factor with children under one-year-old, suggesting the need for better parental education on feeding practices to prevent otitis media. Deviated nasal septum (DNS) was identified in 5.68% of our participants. Swain's review on DNS in children indicates that this condition can lead to chronic nasal congestion and Eustachian tube dysfunction, further predisposing children to otitis media [20]. Although the prevalence of DNS in our study was lower compared to other risk factors, its impact on the development of middle ear diseases cannot be overlooked. A history of trauma was reported in 7.95% of the children, highlighting another potential risk factor for middle ear diseases. Trauma to the ear or head can disrupt the normal anatomical structures and function, leading to conditions like chronic otitis media with effusion (COME) [21]. The significant association of trauma with middle ear diseases in our study population aligns with these findings, emphasizing the need for preventive measures and early intervention in cases of trauma. The diagnostic distribution in our study revealed that bilateral OME was the most common diagnosis (27.27%), followed by right-sided chronic otitis media (12.50%) and left-sided chronic otitis media (13.63%). These findings are in line with the Pacific Islands Families Study, which reported similar diagnostic patterns and emphasized the role of environmental and respiratory factors in the prevalence of OME [17]. Additionally, the prevalence of acute otitis media (AOM) and chronic suppurative otitis media (CSOM) in our study is comparable to the patterns observed in the studies by Kumari et al. and Bruneau et al., who highlighted the significant burden of these conditions in children [22,23]. In conclusion, the current study underscores the multifactorial nature of middle ear diseases in children under five years, highlighting the significant role of URTIs, adenoid hypertrophy, feeding practices, DNS, and trauma. Our findings are consistent with existing literature and emphasize the need for comprehensive preventive strategies,

early diagnosis, and appropriate management to reduce the burden of middle ear diseases in this vulnerable population. Future research should focus on longitudinal studies to further elucidate the causal relationships and effectiveness of intervention strategies in diverse populations.

This study underscores the multifactorial nature of middle ear diseases in children under five years. Our findings highlight that upper respiratory tract infections, adenoid hypertrophy, improper feeding practices, deviated nasal septum, and trauma are significant risk factors. The high incidence of bilateral otitis media with effusion among our study population emphasizes the critical need for early detection and comprehensive management strategies. Our data show that upper respiratory tract infections are the most common risk factor, particularly prevalent among children under one-year-old, underscoring the vulnerability of this age group. Adenoid hypertrophy, improper feeding practices, and trauma also emerged as significant contributors, reinforcing the importance of parental education and timely medical intervention. Effective strategies to reduce the burden of middle ear diseases in young children should focus on early diagnosis, preventive healthcare measures, and addressing modifiable risk factors. Future research should aim at longitudinal studies to better understand the causal relationships and evaluate preventive measures. By adopting a multifaceted approach to prevention and management, healthcare providers can improve the health outcomes and quality of life for this vulnerable pediatric population.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

V. Conclusion

In conclusion, this study highlights the significant prevalence and diverse etiologies of middle ear diseases in children under five years of age. The diagnostic distribution within our cohort, particularly the high incidence of bilateral otitis media with effusion, emphasizes the need for early detection and comprehensive management strategies. These results are consistent with existing literature and underscore the importance of multifactorial prevention approaches, including parental education on proper feeding practices, reducing exposure to tobacco smoke, and addressing anatomical abnormalities through timely medical interventions. Future research should focus on longitudinal studies to further elucidate the causal relationships and evaluate the effectiveness of targeted preventive measures in diverse populations.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

References

- [1] Monasta L, Ronfani L, Marchetti F, Montico M, Vecchi Brumatti L, Bavcar A, Et Al. Burden Of Disease Caused By Otitis Media: Systematic Review And Global Estimates. *Plos One*. 2012;7(4):E36226.
- [2] Morris Ps, Leach Aj, Silberberg P, Mellon G, Wilson C, Hamilton E, Et Al. Otitis Media In Young Aboriginal Children From Remote Communities In Northern And Central Australia: A Cross-Sectional Survey. *Bmc Pediatr*. 2005;5:27.
- [3] Rosenfeld Rm, Shin Jj, Schwartz Sr, Coggins R, Gagnon L, Hackell Jm. Clinical Practice Guideline: Otitis Media With Effusion (Update). *Otolaryngol Head Neck Surg*. 2016;154(1 Suppl):S1-S41.
- [4] Teele Dw, Klein Jo, Rosner B, Greater Boston Otitis Media Study Group. Epidemiology Of Otitis Media During The First Seven Years Of Life In Children In Greater Boston: A Prospective, Cohort Study. *J Infect Dis*. 1989;160(1):83-94.
- [5] Marchisio P, Cantarutti L, Sturkenboom M, Giroto S, Picelli G, Dona D, Et Al. Burden Of Acute Otitis Media In Primary Care Pediatrics In Italy: A Secondary Data Analysis From The Pedianet Database. *Bmc Pediatr*. 2012;12:185.
- [6] Morris Ps, Gadil G, Mccallum Gb, Wilson Ca, Smith-Vaughan Hc, Torzillo Pj, Et Al. Single-Dose Azithromycin Versus Seven Days Of Amoxicillin In The Treatment Of Acute Otitis Media In Aboriginal Children (Aataac): A Double Blind, Randomised Controlled Trial. *Med J Aust*. 2010;192(1):24-29.
- [7] Leach Aj, Morris Ps. The Burden And Outcome Of Respiratory Tract Infection In Australian And Aboriginal Children. *Pediatr Infect Dis J*. 2007;26(10 Suppl):S4-7.
- [8] Pukander J. The Frequency Of Acute Otitis Media Among Children Attending Day-Care Centers--Effects Of A National Vaccination Program Against Haemophilus Influenzae Type B In Finland. *Acta Otolaryngol*. 1995;115(2):220-222.
- [9] Marom T, Tan A, Wilkinson Gs, Pierson Ks, Freeman Jj, Chonmaitree T. Trends In Otitis Media-Related Health Care Use In The United States, 2001-2011. *Jama Pediatr*. 2014;168(1):68-75.
- [10] Leach Aj, Morris Ps, Mathews Jd. Compared To Placebo, Long-Term Antibiotics Resolve Otitis Media With Effusion (Ome) And Prevent Acute Otitis Media With Perforation (Aomwip) In A High-Risk Population: A Randomized Controlled Trial. *Bmc Pediatr*. 2008;8:23.
- [11] Cohen R, Martin E, De La Rocque F, Thollot F, Pecquet S, Werner A, Et Al. Procalcitonin To Reduce The Number Of Unnecessary Antibiotic Prescriptions In Acute Otitis Media: The Panther Randomized Controlled Trial. *Pediatr Infect Dis J*. 2017;36(9):854-859.
- [12] Garbutt Jm, Conlon B, Sterkel R, Baty J, Stein J, Sterkel B, Et Al. The Comparative Effectiveness Of A Multimodal Intervention To Prevent The Second And Third Episodes Of Otitis Media In Children With A History Of Recurrent Acute Otitis Media. *Arch Pediatr Adolesc Med*. 2011;165(3):243-249.

- [13] Homøe P, Christensen Rb, Bretlau P. Acute Mastoiditis In Children: A 10-Year Retrospective And Validated Multicenter Study. *Pediatr Infect Dis J.* 2012;31(3):272-275.
- [14] Rovers Mm, Glasziou P, Appelman Cl, Burke P, McCormick Dp, Damoiseaux Ra, Et Al. Antibiotics For Acute Otitis Media: A Meta-Analysis With Individual Patient Data. *Lancet.* 2006;368(9545):1429-1435.
- [15] Bennett Ke, Haggard Ml. Accumulation Of Factors Influencing Children's Middle Ear Disease: Risk Factor Modelling On A Large Population Cohort. *J Epidemiol Community Health.* 1998;52(12):786-793.
- [16] Alexandrino As, Santos R, Melo C, Bastos J. Risk Factors For Respiratory Infections Among Children Attending Day Care Centres. *Fam Pract.* 2016;33(2):161-166
- [17] Paterson J, Carter S, Wallace J, Ahmad Z, Garrett N, Silva P. Pacific Islands Families Study: Risk Factors Associated With Otitis Media With Effusion Among Pacific 2-Year-Old Children. *Int J Pediatr Otorhinolaryngol.* 2007;71(7):1047-1054.
- [18] Uluyol S, Erdem M. The Long-Term Effects Of Adenoidectomy On Nasal Bacterial Flora In Children. *Iraq Med J.* 2017;24:91-93.
- [19] Kraemer Mj, Richardson M, Weiss N, Furukawa Ct, Shapiro G, Pierson W, Et Al. Risk Factors For Persistent Middle-Ear Effusions: Otitis Media, Catarrh, Cigarette Smoke Exposure, And Atopy. *Jama.* 1983;249(8):1022-1025.
- [20] Swain Sk. Deviated Nasal Septum In Children: A Review. *Int J Contemp Pediatr.* 2022 Mar;9(3):308-13.
- [21] Kraemer Mj, Marshall S, Richardson M. Etiologic Factors In The Development Of Chronic Middle Ear Effusions. *Clin Rev Allergy.*
- [22] Kumari Ms, Madhavi J, Krishna Nb, Meghanadh Kr, Jyothy A. Prevalence And Associated Risk Factors Of Otitis Media And Its Subtypes In South Indian Population. *Egypt J Ear Nose Throat Allied Sci.* 2016.
- [23] Bruneau S, Ayukawa H, Proulx Jf, Baxter Jd, Kost K. Longitudinal Observations (1987-1997) On The Prevalence Of Middle Ear Disease And Associated Risk Factors Among Inuit Children Of Inukjuak, Nunavik, Quebec, Canada. *International Journal Of Circumpolar Health.* 2001 Nov 30;60(4):632-9.