

Factors Associated with the Types of Chronic Suppurative Otitis Media

Nafilah Ramadhanti^{1*}, Abila Ghanie², Fiona Widyasari², Adeliem², Depi Jufri²

¹Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

²Department of ENT-HN, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

E-mail : fionawidyasari@fk.unsri.ac.id

Abstract

Chronic Suppurative Otitis Media (CSOM) is a common condition of the middle ear that may lead to serious complications if not properly managed. Several environmental and host-related factors are believed to influence the clinical presentation of CSOM. However, evidence examining their association with specific CSOM subtypes remains limited. This research was conducted to examine factors associated with different types of CSOM. A cross-sectional analytical approach was applied at Dr. Mohammad Hoesin General Hospital, Palembang, during July–September 2025, with a total of 68 CSOM patients participating in the study. Data on age, sex, cigarette smoke exposure, history of upper respiratory tract infections (URTIs), and allergic rhinitis were collected using structured interviews. The CSOM type was determined through otoscopic examination. The chi-square test was applied for bivariate analysis, and multivariable logistic regression analysis was performed to obtain adjusted odds ratios (aOR). Cigarette smoke exposure (aOR = 8.28; 95% CI: 1.85–37.01) and allergic rhinitis (aOR = 5.73; 95% CI: 1.31–24.99) were significantly associated with the atticointral type of CSOM, whereas recurrent URTIs showed a positive association that was not statistically significant after controlling for other variables. (aOR = 2.64; 95% CI: 0.59–11.80). The results of this study imply that cigarette smoke exposure and allergic rhinitis are significantly associated with the atticointral type of CSOM, while recurrent URTIs may act as a contributing factor.

Keywords: Allergic Rhinitis, Chronic Suppurative Otitis Media, Cigarette Smoke Exposure, Upper Respiratory Tract Infections

1. Introduction

Chronic Suppurative Otitis Media (CSOM) is a persistent inflammatory condition of the middle ear defined by perforation of the tympanic membrane and ongoing ear discharge lasting a minimum of 2–6 weeks, either continuously or intermittently.^{1–3} If untreated, CSOM can lead to extracranial and intracranial complications, particularly in cases accompanied by cholesteatoma.^{2,4} Globally, it affects an estimated 65–330 million individuals, with approximately 31 million new cases each year, approximately one-fifth of which occur in children under five years of age.^{3,5} In Indonesia, a national survey reported a prevalence of 3.9%.² In Palembang, hospital records documented 441 cases of CSOM.⁶

CSOM is classified into two types based on the anatomical site and associated complication risk. The tubotympanic type

(benign) is linked to central tympanic membrane perforation with limited middle ear involvement and generally poses a lower risk of complications.^{1,2} In contrast, the atticointral type (malignant) involves posterosuperior structures and is often associated with cholesteatoma, granulation tissue, osteitis, and attic or marginal perforations, carrying a substantially higher risk of complications.^{1,4,7}

Several risk factors are known to contribute to CSOM. Cigarette smoke exposure is a significant factor that causes chronic inflammation of the upper respiratory tract and impairs Eustachian tube function.^{3,8} Both active smokers and individuals exposed to secondhand smoke, particularly children, are more susceptible to recurrent otitis media that can progress to CSOM.^{8,9} Additional risk factors include a history of upper respiratory tract infections (URTIs), which promote

mucosal inflammation and disrupt mucociliary clearance and Eustachian tube ventilation.^{8,10} Allergic rhinitis also increases susceptibility through inflammatory and obstructive pathways, with studies reporting up to a twofold higher risk of CSOM among individuals with allergic rhinitis compared to those without.^{11–14}

Although these associations are well recognized, most previous studies have evaluated CSOM as a single clinical entity without distinguishing between the tubotympanic and atticoantral types. However, these subtypes differ substantially in anatomical involvement, pathogenesis, and risk of complications. Evidence examining whether environmental and host-related exposures are differentially associated with these clinical subtypes remains limited, especially within Indonesia. Accordingly, this research was undertaken to examine factors related to different types of CSOM among patients receiving care at a tertiary referral hospital in Palembang.

2. Methods

This study was carried out using an analytical cross-sectional design and was conducted at the Department of Otorhinolaryngology, Head and Neck Surgery, Dr. Mohammad Hoesin General Hospital in Palembang during July–September 2025. Ethical clearance was granted by the hospital's Health Research Ethics Committee (No. DP.04.03/D.XVIII.06.08/ETIK/143/2025). All participants were provided with comprehensive information regarding the study, and written informed consent was obtained to confirm their voluntary participation.

The study population included patients diagnosed with Chronic Suppurative Otitis Media (CSOM) living in Palembang and nearby areas. The accessible population consisted of patients who attended the hospital during the

study period. Patients were included if they had a confirmed clinical diagnosis of CSOM. Patients were excluded if they had other ear diseases or congenital ear malformations that might interfere with the classification of CSOM type.

Data were collected through structured interviews conducted during patient anamnesis at the Otology Division. The dependent variable was the type of CSOM, classified as tubotympanic or atticoantral based on clinical otoscopic examination performed by an otorhinolaryngologist.

The classification of CSOM type was determined through otoscopic examination performed by an otorhinolaryngologist. When necessary, microscopic examination was used to confirm the presence of attic retraction, marginal perforation, granulation tissue, or cholesteatoma suggestive of the atticoantral type. Tubotympanic CSOM was defined as a disease involving the pars tensa with a central perforation of the tympanic membrane, whereas atticoantral CSOM refers to a disease affecting the pars flaccida or attic area, typically characterized by marginal perforation, retraction of the attic, or the presence of cholesteatoma.

A structured data collection form was used to record demographic characteristics and potential exposures using structured yes/no questions during clinical anamnesis conducted by the researcher while the patient was being evaluated by an otorhinolaryngologist. The form components were developed based on previously published epidemiological studies on CSOM and were reviewed by two otorhinolaryngologists to ensure content validity. To ensure accuracy and consistency, interviews were conducted directly by the researcher during patient anamnesis under the supervision of an attending otorhinolaryngologist.

The independent variables included age, sex, cigarette smoke exposure, recurrent upper respiratory tract infections (URTIs), and allergic rhinitis. Cigarette smoke exposure was categorized as active smoking, former smoking, or passive exposure to tobacco smoke from the surrounding environment.¹⁵ Recurrent upper respiratory tract infections (URTIs) were operationally defined as episodes occurring more than six times within a year or at a frequency exceeding once per month.^{16,17} Allergic rhinitis was identified either through a prior medical diagnosis made by a physician or based on a history of typical clinical manifestations, including repetitive sneezing, nasal blockage, rhinorrhea, and nasal itching triggered by allergen exposure.¹⁶

The determination of the minimum sample size was performed using a two-proportion formula, which indicated that a minimum of 61 subjects was required. All data obtained were systematically recorded and processed using IBM SPSS Statistics version 30. Data analysis began with descriptive statistics to present the distribution of variables in terms of frequencies and percentages. Furthermore, the association between factors and the types of CSOM was evaluated through bivariate analysis using the chi-square test. The initial assessment of association strength was performed using crude odds ratios (ORs) and their corresponding 95% confidence intervals (CIs). Variables identified with p-values below 0.25 during the bivariate stage were further analyzed using multivariable logistic regression to account for confounding variables and to derive adjusted odds ratios (aORs). Results were regarded as statistically significant when the p-value was below 0.05.

3. Results

The baseline profile of the study participants is summarized in Table 1. The majority of subjects were within the

adolescent to young adult age range, with the largest proportion found in the 11–20 year group (27.9%), followed by those aged 21–30 years (22.1%). Female participants (57.4%) were slightly more prevalent than males (42.6%). Based on disease classification, most cases were identified as the atticointral type of CSOM (67.6%). Regarding potential risk factors, exposure to cigarette smoke was reported by a substantial proportion of participants (76.5%), as was a history of upper respiratory tract infections (79.4%), while nearly half of the patients (48.5%) had allergic rhinitis.

The results of the bivariate analysis indicated that several risk factors were significantly related to the type of CSOM (Table 2). Exposure to cigarette smoke was notably higher in patients with the atticointral type (87.0%) compared to those with the tubotympanic type (54.5%), with a statistically significant difference ($p = 0.003$). Likewise, recurrent URTIs were more frequently reported among atticointral cases (89.1%) than tubotympanic cases (59.1%) ($p = 0.004$). In addition, allergic rhinitis was observed more often in the atticointral group (60.9%) compared to the tubotympanic group (22.7%), which was also statistically significant ($p = 0.003$).

As shown in the multivariable logistic regression analysis (Table 3), cigarette smoke exposure and allergic rhinitis remained significantly associated with atticointral CSOM. Patients with cigarette smoke exposure had an approximately eightfold higher likelihood of developing the atticointral type (AOR = 8.282; 95% CI: 1.853–37.011; $p = 0.006$). Allergic rhinitis was also independently associated with atticointral CSOM (AOR = 5.726; 95% CI: 1.312–24.989; $p = 0.020$). However, following adjustment, recurrent URTIs were not significantly associated with CSOM type (AOR = 2.638; 95% CI: 0.589–11.804; $p = 0.205$).

Table 1. CSOM Patients' Characteristics (N = 68)

Variable	Total respondents (%)
Age (years)	
≤ 10	2 (2.9)
11-20	19 (27.9)
21-30	15 (22.1)
31-40	12 (17.6)
41-50	11 (16.2)
51-60	6 (8.8)
>60	3 (4.4)
Sex	
Male	29 (42.6)
Female	39 (57.4)
CSOM Type	
Atticoantral	46 (67.6)
Tubotympanic	22 (32.4)
Cigarette Smoke Exposure	
Yes	52 (76.5)
No	16 (23.5)
History of URTIs	
Yes	54 (79.4)
No	14 (20.6)
Allergic Rhinitis	
Yes	33 (48.5)
No	35 (51.5)

Table 2. Bivariate Analysis of Factors Associated with the Type of CSOM

Variable	CSOM Type (N = 68)		Unadjusted OR	95% CI	p-value
	Atticoantral (n = 46)	Tubotympanic (n = 22)			
Cigarette Smoke Exposure					
Yes	40 (87.0)	12 (54.5)	5.56	1.67 – 18.45	0.003
No	6 (13.0)	10 (45.5)	Reference		
History of Recurrent URTIs					
Yes	41 (89.1)	13 (59.1)	5.68	1.61 – 19.99	0.004
No	5 (10.9)	9 (40.9)	Reference		
Allergic Rhinitis					
Yes	28 (60.9)	5 (22.7)	5.29	1.66 – 16.87	0.003
No	18 (39.1)	17 (77.3)	Reference		

Table 3. Multivariable Logistic Regression Analysis of Factors Associated with CSOM Type

Variable	Adjusted OR	95% CI	p-value
Cigarette Smoke Exposure	8.282	1.853 – 37.011	0.006
History of URTIs	2.638	0.589 – 11.804	0.205
Allergic Rhinitis	5.726	1.312 – 24.989	0.020

4. Discussion

This study identified significant associations between the type of chronic suppurative otitis media (CSOM) and three major risk factors: cigarette smoke exposure, recurrent upper respiratory tract infections (URTIs), and allergic rhinitis. Patients with the

atticoantral type of CSOM, which is commonly correlated with the presence of cholesteatoma, structural bone damage, and a higher risk of complications, were more frequently exposed to these risk factors compared with patients with the tubotympanic type. These findings suggest

that chronic inflammatory conditions affecting the upper airway may contribute not only to the development of CSOM but also to the severity and pathological subtype of the disease.

This study found that cigarette smoke exposure was significantly linked to the atticointral form of CSOM. Cigarette smoke exposure was reported in 87.0% of patients with atticointral CSOM compared with 54.5% of those with the tubotympanic type. Multivariable logistic regression analysis showed that cigarette smoke exposure increased the likelihood of developing atticointral CSOM more than eightfold (adjusted odds ratio 8.282, 95% confidence interval 1.853–37.011).

Zhang et al. reported that passive smokers had a 1.39-fold higher risk of developing CSOM, while Wang et al. found that cigarette smoke exposure increased the risk of otitis media by 7.11-fold and the risk of CSOM by 2.31-fold.^{8,10} Tarhun et al. also observed a significantly higher incidence of serous otitis media among children living in smoking households, suggesting that early smoke exposure disrupts mucociliary defense and impairs Eustachian tube function, thereby increasing susceptibility to middle ear infections.⁹

Cigarette smoke is composed of multiple toxic components, such as nicotine and carbon monoxide, which can injure the respiratory epithelium and interfere with mucociliary function.^{9,10} This condition may promote chronic inflammatory changes in the Eustachian tube mucosa, ultimately causing dysfunction of the tube and impaired aeration of the middle ear.^{9,18} Inflammatory signaling pathways such as NF- κ B may also be activated, increasing the production of proinflammatory cytokines, including TNF- α , and promoting mucosal edema, mucus hypersecretion, and persistent infection within the middle ear.^{8,9,18}

Recurrent URTIs were also more frequently observed among patients with atticointral CSOM. In this study, 89.1% of patients with atticointral CSOM had a history of recurrent URTIs compared with 59.1% of patients with the tubotympanic type. The unadjusted results showed that recurrent URTIs increased the odds of atticointral CSOM (OR 5.68; 95% CI 1.61–19.99). However, after adjusting for other variables, this effect was not statistically significant. (adjusted OR 2.638; 95% CI 0.589–11.804), suggesting that URTIs may function as a contributing factor rather than an independent determinant.

Previous studies have reported similar findings. Findings from Zhang et al. indicated that individuals with prior URTI experienced a 6.59-fold higher likelihood of developing CSOM, whereas Wang et al. likewise demonstrated a significant link between URTIs and middle ear infections.^{8,10}

Histologically, the Eustachian tube, nasal cavity, and paranasal sinuses are lined with pseudostratified ciliated epithelium with goblet cells forming a mucociliary clearance system.¹⁹ Recurrent or persistent URTIs may cause mucosal inflammation and swelling of lymphoreticular tissue near the Eustachian tube ostium, resulting in congestion and partial obstruction. This process impairs mucociliary clearance and disrupts Eustachian tube ventilation, interfering with normal aeration and drainage of the middle ear.²⁰

Persistent inflammation can lead to persistent negative pressure in the middle ear, which may induce tympanic membrane retraction and structural changes that predispose to the development of cholesteatoma. Consequently, recurrent or inadequately managed URTIs may sustain middle ear inflammation and contribute to the progression of CSOM, particularly the atticointral type, which is associated with

greater tissue destruction and a higher risk of complications.^{8,19,20}

Allergic rhinitis was another factor significantly associated with the type of CSOM. Approximately 60.9% of patients with the atticointral type reported a history of allergic rhinitis, compared with only 22.7% of those with the tubotympanic type. Diana et al. demonstrated that patients with allergic rhinitis had up to a 92.9% higher risk of developing CSOM, while Afriana et al. reported that the risk was nearly doubled compared with individuals without allergic disease.^{21,22}

Allergic rhinitis refers to a long-standing inflammation of the nasal mucosa involving immunoglobulin E and a T helper 2–dominant immune mechanism.¹¹ This inflammatory process may lead to mucosal edema and increased nasal secretions, which can extend to the Eustachian tube orifice and interfere with middle ear ventilation.²¹ Immunological findings have revealed higher levels of inflammatory markers, including IL-4, IL-5, eosinophil cationic protein (ECP), and IgE, in the middle ear fluid of individuals with otitis media with effusion, which is recognized as a precursor to CSOM.^{12,14,23}

Another factor that should be considered when interpreting these findings is potential referral bias. Since the study took place in a tertiary referral hospital, the patient population is likely to consist predominantly of individuals with more advanced or complicated disease. Consequently, the proportion of atticointral CSOM observed in this study may be higher than that in community-based populations.

These findings highlight the importance of addressing modifiable environmental exposures, such as tobacco smoke, and managing upper airway inflammatory conditions to reduce the risk of severe CSOM.

Several limitations should be noted in the interpretation of this study. In particular,

the cross-sectional design hinders the ability to identify temporal relationships between exposures and CSOM types, thus limiting causal interpretation. Second, the relatively limited sample size may have affected the statistical power and contributed to the wide confidence intervals observed in the multivariable analysis. Third, certain exposure variables, such as cigarette smoke exposure and history of URTIs, were based on patient self-reports and are therefore susceptible to recall bias. Lastly, as the study was conducted in a tertiary referral hospital, the proportion of atticointral CSOM cases may be higher than in community-based populations, which could reduce the generalizability of the findings.

5. Conclusion

This study concludes that cigarette smoke exposure and allergic rhinitis were significantly associated with the atticointral type of CSOM, while recurrent URTIs showed a positive but non-significant association after adjustment. These findings suggest that chronic inflammatory conditions affecting the upper airway may be linked to more severe forms of CSOM.

6. Acknowledgement

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References

1. PERHATI-KL PP. [*Panduan Praktik Klinis Prosedur Tindakan Clinical Pathways di Bidang Telinga, Hidung, Tenggorokan, Kepala, dan Leher*](#). Jakarta: Perhimpunan Dokter Spesialis Telinga Hidung Tenggorok Bedah Kepala Leher Indonesia 2013–2016, April 11, 2020.
2. RI KK. [*Pedoman Nasional Pelayanan Kedokteran Tata laksana Otitis Media Supuratif Kronis*](#). Kementerian Kesehatan RI, <https://perhati-kl.or.id/download/pnpk-omsk/> (April 9,

- 2025).
3. Organization WHO. [Chronic suppurative otitis media: Burden of Illness and Management Options. Geneva, Switzerland: World Health Organization.](#)
4. Dhingra PL, Dhingra S. [Diseases of the Ear. In: Diseases of Ear, Nose, and Throat.](#) New Delhi: Elsevier India, pp. 1–83.
5. Khairkar M, Deshmukh P, Maity H, et al. [Chronic Suppurative Otitis Media: A Comprehensive Review of Epidemiology, Pathogenesis, Microbiology, and Complications. Cureus.](#) Epub ahead of print April 3, 2023.
6. Dania HR. [Hubungan Tipe Otitis Media Supuratif Kronis Dengan Derajat dan Jenis Gangguan Pendengaran Di KSM/Bagian THT-KL RSUP Dr. Mohammad Hosein Tahun 2025.](#) Sriwijaya, 2024.
7. Soepardi EA, Iskandar N. [Gangguan Pendengaran dan Kelainan Telinga. In: BUKU AJAR ILMU KESEHATAN: Telinga, Hidung, Tenggorokan, Kepala dan Leher.](#) Jakarta: Balai Penerbit FKUI, 2007, pp. 69–74.
8. Zhang Y, Xu M, Zhang J, et al. [Risk Factors for Chronic and Recurrent Otitis Media—A Meta-Analysis.](#) *PLoS ONE* 2014; 9: e86397.
9. Tarhun YM. [The Effect of Passive Smoking on the Etiology of Serous Otitis Media in Children.](#) *American Journal of Otolaryngology* 2020; 41: 102398.
10. Wang J, Chen B, Xu M, et al. [Etiological Factors Associated with Chronic Suppurative Otitis Media in a Population of Han Adults in China.](#) *Acta Otolaryngologica* 2016; 136: 1024–1028.
11. Sahin-Yilmaz A, Naclerio RM. [Rhinitis Allergica. In: Ballenger's Otorhinolaryngology 18 Head and Neck Surgery.](#) People's Medical Publishing House, 2018, pp. 595–616.
12. Zernotti ME, Pawankar R, Ansotegui I, et al. [Otitis Media with Effusion and Atopy: Is There a Causal Relationship? The World Allergy Organization journal](#) 2017; 10: 37.
13. Juszcak HM, Loftus PA. [Role of Allergy in Eustachian Tube Dysfunction.](#) *Current Allergy and Asthma Reports* 2020; 20: 54.
14. Wang F, Yu C, Liu R. [Causal Relationship Between Allergic Rhinitis and Otitis Media: A Mendelian Randomization Study.](#) *Medicine* 2024; 103: e39671.
15. Organization WHO. [Tobacco Questions for Surveys: A Subset of Key Questions from the Global Adult Tobacco Survey.](#) World Health Organization; 2011.
16. Dhingra PL, Dhingra S. [Diseases of Nose and Paranasal Sinuses. In: Diseases of Ear, Nose and Throat.](#) New Delhi: Elsevier India, 2017, pp. 147–240.
17. RI K. [Pedoman Pengendalian Infeksi Saluran Pernafasan Akut.](#) 1st ed. Jakarta, 2011.
18. Rahman U, Gopal B. [Effect of Household Smoking on the Development of Acute Otitis Media in Children Between the Ages of 6 to 10 Years in Rural South India.](#) *Int J Acad Med Pharm* 2025; 7: 911–914.
19. Mohankumar V, Veerasigamani N. [A Study on the Influence of Sinusitis in a Case of Persistent Chronic Suppurative Otitis Media of Tubotympanic Type.](#) *Journal of Evidence Based Medicine and Healthcare* 2017; 4: 3643–3647.
20. Hassooni HR, Fadhil SF, Hameed RM, et al. [Upper Respiratory Infection and Otitis Media Are Clinically and Microbiologically Associated.](#) *Journal of Ideas in Health* 2018; 1: 29–33.
21. Afriana A, Syabriansyah S, Dita DAA. [Profile of Allergic Rhinitis and its Association with Chronic Suppurative](#)

[Otitis Media](#). *Muhammadiyah Medical Journal* 2023; 4: 64.

22. Diana F, Haryuna TSH. [Hubungan Rinitis Alergi dengan Kejadian Otitis Media Supuratif Kronik](#). *Majalah Kedokteran Bandung* 2017; 49: 79–85.
23. Suryani L, Widuri A. [Chronic Suppurative Otitis Media Characteristic in Secondary Hospital in Yogyakarta](#). *Open Access Macedonian Journal of Medical Sciences* 2022; 10: 152–156.