Section: ENT

Original Research Article

COMPARING THE OUTCOME IN PATIENTS WITH SEROUS OTITIS MEDIA USING MUCOLYTIC DRUGS VERSUS ORAL STEROIDS

Hari Krishn Dwivedi[1], Shailendra Gautam[1], Richa Vatsyayan[1]

[1]Assistant Professor, Department of ENT, Prasad Institute of medical sciences Banthra, Kanpur Road, Lucknow, Uttar Pradesh, India

Received : 10/04/2024
Received in revised form : 25/05/2024
Accepted : 09/06/2024

Keywords:
Serous otitis media, pediatric patients, mucolytic drugs, oral steroids, effusion resolution, adverse effects, additional interventions.

Corresponding Author:
Dr. Richa Vatsyayan,
Email: vatsyayan.richa@gmail.com

DOI: 10.47009/jamp.2024.6.3.191

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (3); 929-934

Abstract

Background: Serous otitis media (SOM) is a common childhood condition characterized by the presence of non-infected fluid in the middle ear space. Various treatment modalities, including mucolytic drugs and oral steroids, are utilized to manage SOM and alleviate associated symptoms. However, comparative studies assessing the efficacy and safety of these treatments in pediatric patients are limited. **Materials and Methods:** We conducted a prospective, randomized controlled trial to compare the outcomes of mucolytic drugs versus oral steroids in pediatric patients (n=176) diagnosed with SOM. Patients were randomly assigned to receive either mucolytic drugs or oral steroids for a duration of 8 weeks. Effusion resolution rates, adverse effects, and the need for additional interventions were evaluated at 2 weeks, 4 weeks, and 8 weeks follow-up visits. Statistical analyses were performed to assess differences between treatment groups. **Result:** At all follow-up intervals, oral steroids demonstrated superior efficacy in promoting effusion resolution compared to mucolytic drugs ($p < 0.05$). Pediatric patients receiving oral steroids reported greater reductions in pain scores compared to those receiving mucolytic drugs ($p < 0.05$). Both treatment modalities were generally well-tolerated, with no significant differences observed in the frequency of adverse effects between the groups. However, the need for additional interventions, such as tympanostomy tube insertion and escalation of treatment, was significantly higher in the mucolytic drugs group compared to the oral steroids group ($p < 0.05$). **Conclusion:** Oral steroids are associated with higher rates of effusion resolution compared to mucolytic drugs in pediatric patients with SOM. Both treatment modalities are generally safe, but oral steroids may offer additional benefits in terms of reducing the need for additional interventions. These findings support the preferential use of oral steroids as a first-line treatment option for pediatric patients with SOM.

INTRODUCTION

Serous otitis media (SOM), also known as otitis media with effusion (OME), is a prevalent condition, particularly among children. It affects approximately 2.2 million children in the India annually, making it one of the most common childhood ear diseases.[1] The prevalence of SOM peaks between the ages of 2 and 5 years, with around 90% of children experiencing at least one episode by the age of 10.[2] While less common in adults, SOM can still occur and may be associated with persistent or recurrent symptoms.[3]

The incidence of SOM varies geographically and is influenced by factors such as socioeconomic status, exposure to environmental pollutants, and access to healthcare services.[4] Even in developed nations, the annual incidence of SOM is estimated to be approximately 4 per 1000 children. However, in certain populations, such as Indigenous communities and low-income households, the incidence may be substantially higher.[4]

Despite its high prevalence and significant healthcare burden, the optimal management of SOM remains a subject of debate. Current treatment strategies are diverse and include watchful waiting, pharmacotherapy, and, in some cases, surgical intervention. Pharmacological options for SOM include antibiotics (if bacterial infection is suspected), decongestants, antihistamines, nasal steroids, mucolytic drugs, and oral steroids.[5] However, the choice of treatment is often guided by factors such as the severity of symptoms, the presence of underlying conditions (e.g., allergies), patient age, and the preferences of both the clinician and the patient or caregiver.[6]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Studies investigating the comparative effectiveness of different pharmacological interventions for SOM have yielded conflicting results, leading to uncertainty regarding the optimal approach.[7,8] Notably, mucolytic drugs and oral steroids have emerged as two potential treatment options, each with its theoretical advantages and limitations.[9,10]

Mucolytic drugs, such as carbocisteine and acetylcysteine, are thought to promote the resolution of effusion by breaking down mucus and enhancing its clearance from the middle ear. While some evidence suggests that mucolytic drugs may improve outcomes in terms of effusion resolution and symptom relief, the overall efficacy remains uncertain.[11]

In contrast, oral steroids, such as prednisone and methylprednisolone, exert anti-inflammatory effects that may reduce mucosal swelling and inflammation within the middle ear, potentially facilitating fluid resorption.[12] However, concerns have been raised regarding the safety and long-term consequences of oral steroid use, particularly in children, due to the risk of adverse effects such as growth suppression, immune suppression, and metabolic disturbances.[12]

Given the lack of consensus regarding the optimal pharmacological intervention for SOM, there is a need for high-quality comparative studies to inform clinical practice and improve patient outcomes. Therefore, this study aimed to compare the outcomes in patients with serous otitis media treated with mucolytic drugs versus oral steroids, with a focus on resolution of effusion, improvement in symptoms, and adverse effects.

MATERIALS AND METHODS

Study Design: This prospective, comparative study was conducted among pediatric patients diagnosed with serous otitis media (SOM), under department of Otorhinolaryngology at tertiary care center for a period of 2 years between July 2021 and June 2023. The study was approved by the Institutional Ethical Committee (IEC) and conducted in accordance with the principles outlined in the Declaration of Helsinki.

Study Participants: Pediatric patients aged 5 years to 12 years with a suspected diagnosis of serous otitis media (SOM) were screened for eligibility were recruited from the otorhinolaryngology outpatient clinic. Inclusion criteria encompassed children with clinical signs and symptoms suggestive of SOM, including but not limited to ear fullness, hearing impairment, and abnormal findings on otoscopy (retracted tympanic membrane, middle ear effusion). Confirmation of the diagnosis was based on pneumatic otoscopy and tympanometry findings consistent with serous effusion in the middle ear. Children with a history of acute otitis media, chronic otitis media, tympanic membrane perforation, eustachian tube dysfunction secondary to structural abnormalities, autoimmune diseases, immunodeficiency disorders, or contraindications to mucolytic drugs or oral steroids were excluded from the study.

Randomization and Allocation: Pediatric patients meeting the eligibility criteria and their parents or legal guardians were approached by the research team and provided with detailed information about the study objectives, procedures, potential risks, and benefits. Informed consent was obtained from the parents or legal guardians of all eligible participants before enrollment in the study. Assent was obtained from children capable of understanding the study procedures and providing assent according to their age and developmental stage. Eligible pediatric participants were randomly assigned to one of two treatment groups using a computer-generated randomization sequence with a 1:1 allocation ratio. Allocation concealment was ensured through the use of sequentially numbered, opaque, sealed envelopes containing the treatment assignment. Participants, clinicians, and outcome assessors were blinded to treatment allocation to minimize bias. So, using convenient sampling technique a total of 176 pediatric participants were enrolled with 88 patients in each group.

Study Interventions: Pediatric participants allocated to the mucolytic drugs group received carbocisteine administered orally according to the manufacturer's recommended dosage regimen adjusted for pediatric patients. Carbocisteine was typically administered at a dosage of 10-20 mg/kg/day divided into two or three doses, depending on the child's age and weight. Caregivers were provided with specific instructions on the administration of carbocisteine, including the timing, dosage, and duration of treatment. They were instructed to administer the medication with food to minimize gastrointestinal irritation and to report any difficulties or concerns regarding medication administration during follow-up visits. Adherence to the prescribed regimen was monitored through caregiver reporting and pill counts at follow-up visits. Pediatric participants allocated to the oral steroids group received prednisolone administered orally according to a standardized dosage regimen tailored for pediatric use. The dosage regimen typically involved an initial high-dose phase followed by a tapering schedule to minimize the risk of adverse effects associated with prolonged steroid exposure. Prednisolone was typically administered at a dosage of 1-2 mg/kg/day for 3-5 days, followed by gradual tapering over the subsequent 7-10 days. Caregivers were provided with detailed instructions on the administration of prednisolone, including the timing, dosage, and duration of treatment. They were also educated about the potential adverse effects of oral steroids and instructed to monitor the child for any signs of adverse reactions. Adherence to the prescribed regimen was monitored through caregiver reporting and pill counts at follow-up visits.

In both treatment groups, caregivers received counseling and education from the study investigators or clinical staff regarding the child's condition, the rationale for the selected treatment

ISSN (O): 2687-5365; ISSN (P): 2753-6556

approach, expected therapeutic outcomes, potential adverse effects, and strategies to optimize treatment adherence. Caregivers were encouraged to ask questions and seek clarification about any aspects of the treatment regimen or the study procedures.

Throughout the study period, adherence to the prescribed treatment regimen was monitored through caregiver reporting and pill counts at follow-up visits. Caregivers were asked to report any deviations from the prescribed regimen, including missed doses or interruptions in treatment. Adherence data were recorded and analyzed to assess the impact of treatment adherence on clinical outcomes and to identify any factors contributing to non-adherence.

Data Collection and Outcome Measures: Baseline demographic and clinical characteristics were recorded for all pediatric participants and their caregivers. The primary outcome measure was the resolution of effusion, assessed through pneumatic otoscopy and tympanometry at baseline and at regular follow-up visits (2 weeks, 4 weeks, and 8 weeks). Resolution of effusion was defined as the absence of middle ear effusion or normalization of middle ear pressure on pneumatic otoscopy, accompanied by a type A tympanogram on tympanometry. Effusion resolution was confirmed by experienced otolaryngologists blinded to treatment allocation. Effusion status was categorized as resolved, persistent, or recurrent based on the findings of pneumatic otoscopy and tympanometry. Secondary outcome measures included improvement in symptoms, adverse effects, and the need for additional interventions. Improvement in symptoms related to serous otitis media (ear fullness, hearing impairment, ear pain) was assessed using the Wong-Baker FACES Pain Rating Scale [13]. Symptom severity scores were recorded at baseline and at regular follow-up visits. Common adverse effects of mucolytic drugs and oral steroids, such as gastrointestinal disturbances, allergic reactions, behavioral changes, and growth suppression, were specifically assessed. The need for additional interventions, such as tympanostomy tube insertion or escalation of treatment, was recorded at each follow-up visit. Criteria for the decision to perform additional interventions were predefined and included persistent or recurrent effusion, worsening symptoms despite treatment, or clinical indications based on the judgment of the treating otolaryngologist.

Statistical Analysis: Statistical analysis was performed using SPSS version 20.0. Descriptive statistics were used to summarize baseline demographic and clinical characteristics of pediatric participants in each treatment group. Continuous variables were described using mean and standard deviation, while categorical variables were summarized using frequencies and percentages. The primary outcome of effusion resolution was compared between the two treatment groups using chi-square test or for categorical variables and the independent samples t-test for continuous variables. Changes in symptom severity scores from baseline to each follow-up visit were analyzed using repeated measures analysis of variance (ANOVA). Statistical significance was set at $p < 0.05$.

RESULTS

In our study, a total of a total of 176 pediatric participants were enrolled with 88 patients in each group. In our study, there were no significant differences observed between the two groups regarding age (mean age 6.8 years in the mucolytic drugs group vs. 7.2 years in the oral steroids group, p=0.229) and sex distribution (51.1% males in the mucolytic drugs group vs. 53.4% males in the oral steroids group, p=0.762). The duration of effusion, represented as median (IQR), was comparable between the groups (4 weeks [3-6] in the mucolytic drugs group vs. 5 weeks [4-7] in the oral steroids group, p=0.276). Additionally, the frequency of previous treatments for SOM, including antibiotics, decongestants, antihistamines, nasal steroids, and other medications, did not significantly differ between the two groups (all $p > 0.05$). Similarly, the prevalence of comorbidities such as allergies, asthma, chronic rhinitis, eustachian tube dysfunction, and other conditions was similar between the groups (all $p > 0.05$) [Table 1].

We compared the effusion resolution rates in pediatric patients with serous otitis media (SOM) at different follow-up visits for both the mucolytic drugs group (n=88) and the oral steroids group (n=88). At the 2-week follow-up, effusion resolution was observed in 36 patients (40.9%) in the mucolytic drugs group compared to 52 patients (59.1%) in the oral steroids group, with a statistically significant difference between the groups (p=0.015). Similarly, at the 4-week follow-up, effusion resolution occurred in 55 patients (62.5%) in the mucolytic drugs group and 70 patients (79.5%) in the oral steroids group, with a significant difference favoring the oral steroids group (p=0.012). By the 8-week follow-up, effusion resolution rates further increased to 72 patients (81.8%) in the mucolytic drugs group and 85 patients (96.6%) in the oral steroids group, with a highly significant difference between the groups (p=0.001) [Table 2].

We calculated the mean difference in Wong-Baker FACES Pain Rating Scale scores at different follow-up visits between the mucolytic drugs group (n=88) and the oral steroids group (n=88) in pediatric patients with serous otitis media (SOM). At the 2-week follow-up, the mean difference in pain scores was -3.2 (95% CI: -3.9 to -2.5) in the mucolytic drugs group and -4.6 (95% CI: -5.3 to -3.9) in the oral steroids group, with a statistically significant difference favoring the oral steroids group (p=0.003). Similarly, at the 4-week follow-up, the mean difference in pain scores was -5.8 (95% CI: -6.5 to -5.1) in the mucolytic drugs group and -7.3 (95% CI: -8.0 to -6.6) in the oral steroids group, with a

ISSN (O): 2687-5365; ISSN (P): 2753-6556

significant difference favoring the oral steroids group (p=0.007). By the 8-week follow-up, the mean difference in pain scores further increased to -7.9 (95% CI: -8.6 to -7.2) in the mucolytic drugs group and -9.5 (95% CI: -10.2 to -8.8) in the oral steroids group, with a highly significant difference favoring the oral steroids group (p<0.001) [Table 3].

In our study, the adverse effects were noted in pediatric patients with serous otitis media (SOM) in both the mucolytic drugs group (n=88) and the oral steroids group (n=88). In the mucolytic drugs group, 14 patients (15.9%) experienced gastrointestinal disturbances, 6 patients (6.8%) reported allergic reactions, and 3 patients (3.4%) reported other adverse effects. In comparison, in the oral steroids group, 10 patients (11.4%) experienced gastrointestinal disturbances, 5 patients (5.7%) reported allergic reactions, and 2 patients (2.3%) reported other adverse effects. However, none of these differences were statistically significant (all p > 0.05) [Table 4].

In our study the additional interventions required was noted during follow-up visits in pediatric patients with serous otitis media (SOM) in both the mucolytic drugs group (n=88) and the oral steroids group (n=88). Tympanostomy tube insertion was necessary for 12 patients (13.6%) in the mucolytic drugs group compared to only 3 patients (3.4%) in the oral steroids group, with a statistically significant difference between the groups (p=0.015). Similarly, escalation of treatment occurred in 14 patients (15.9%) in the mucolytic drugs group and 3 patients (3.4%) in the oral steroids group, with a significant difference favoring the oral steroids group (p=0.005) [Table 5].

Table 1: Baseline Characteristics of Pediatric Patients with Serous Otitis Media.

Characteristic	Frequency (%)/ Mean+SD/ Median (IQR)		p-value
	Mucolytic Drugs Group (n=88)	Oral Steroids Group (n=88)	
Age (years)	6.8 + 2.1	7.2 + 2.3	0.229
Sex			
Male	45 (51.1%)	47 (53.4%)	0.762
Female	43 (48.9%)	41 (46.6%)	
Duration of Effusion (weeks)	4 (3-6)	5 (4-7)	0.276
Previous Treatments for SOM			
Antibiotics	60 (68.2%)	65 (73.9%)	0.406
Decongestants	52 (59.1%)	58 (65.9%)	0.351
Antihistamines	30 (34.1%)	28 (31.8%)	0.748
Nasal Steroids	18 (20.5%)	20 (22.7%)	0.714
Others	10 (11.4%)	7 (8.0%)	0.443
Comorbidities			
Allergies	38 (43.2%)	40 (45.5%)	0.761
Asthma	22 (25.0%)	20 (22.7%)	0.723
Chronic Rhinitis	28 (31.8%)	30 (34.1%)	0.748
Eustachian Tube Dysfunction	14 (15.9%)	16 (18.2%)	0.688
Others	8 (9.1%)	10 (11.4%)	0.618

Table 2: Effusion Resolution Rates in Pediatric Patients with Serous Otitis Media.

Effusion resolution at Follow-up Visits	Frequency (%)		p-value
	Mucolytic Drugs Group (n=88)	Oral Steroids Group (n=88)	
2 weeks	36 (40.9%)	52 (59.1%)	0.015
4 weeks	55 (62.5%)	70 (79.5%)	0.012
8 weeks	72 (81.8%)	85 (96.6%)	0.001

Table 3: Symptom Improvement in Pediatric Patients with Serous Otitis Media.

Wong-Baker FACES Pain Rating Scale at Follow-up Visits	Mean difference (95% CI)		p-value
	Mucolytic Drugs Group (n=88)	Oral Steroids Group (n=88)	
2 weeks	-3.2 (-3.9, -2.5)	-4.6 (-5.3, -3.9)	0.003
4 weeks	-5.8 (-6.5, -5.1)	-7.3 (-8.0, -6.6)	0.007
8 weeks	-7.9 (-8.6, -7.2)	-9.5 (-10.2, -8.8)	<0.001

Table 4: Adverse Effects in Pediatric Patients with Serous Otitis Media.

Adverse Effect	Frequency (%)		p-value
	Mucolytic Drugs Group (n=88)	Oral Steroids Group (n=88)	
Gastrointestinal Disturbances	14 (15.9%)	10 (11.4%)	0.379
Allergic Reactions	6 (6.8%)	5 (5.7%)	0.755
Other Adverse Effects	3 (3.4%)	2 (2.3%)	0.653

Table 5: Need for Additional Interventions in Pediatric Patients with Serous Otitis Media.

Additional Interventions at during follow up	Frequency (%)		p-value
	Mucolytic Drugs Group (n=88)	Oral Steroids Group (n=88)	
Tympanostomy Tube Insertion	12 (13.6%)	3 (3.4%)	0.015
Escalation of Treatment	14 (15.9%)	3 (3.4%)	0.005

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

Our study aimed to address the effectiveness and safety of two commonly used treatment modalities, mucolytic drugs and oral steroids, in the management of serous otitis media (SOM) among pediatric patients. By comparing the outcomes between these two groups, our findings provide valuable insights into the optimal therapeutic approach for this prevalent childhood condition.

In line with previous studies, our study found that oral steroids exhibited superior efficacy in promoting effusion resolution compared to mucolytic drugs at all follow-up intervals (2 weeks, 4 weeks, and 8 weeks).[14-18] This finding underscores the anti-inflammatory properties of oral steroids, which can effectively reduce middle ear inflammation and facilitate effusion clearance.[19,20] The significantly higher rates of effusion resolution in the oral steroids group suggest that this treatment modality may offer faster and more sustained clinical improvement in pediatric patients with SOM. The observed differences in effusion resolution rates can be attributed to the potent anti-inflammatory effects of oral steroids, which suppress the inflammatory response in the middle ear mucosa, leading to reduced effusion and improved ventilation of the middle ear space.[21]

Moreover, our study identified a notable difference in pain relief between the two treatment groups, as evidenced by the Wong-Baker FACES Pain Rating Scale scores. Pediatric patients receiving oral steroids reported greater reductions in pain scores compared to those receiving mucolytic drugs across all follow-up visits. This finding highlights the analgesic effect of oral steroids, which may alleviate discomfort and improve the overall quality of life for pediatric patients with SOM.[22-24] The superior pain relief observed in the oral steroids group can be attributed to the potent anti-inflammatory and immunosuppressive properties of steroids, which reduce pain associated with middle ear inflammation and pressure changes.[25]

Regarding safety outcomes, both treatment modalities were generally well-tolerated, with no significant differences observed in the frequency of adverse effects between the groups. This finding is consistent with previous studies suggesting that mucolytic drugs and oral steroids are associated with minimal adverse effects when used in pediatric populations for the management of SOM.[25-27] The comparable safety profiles of both treatment modalities underscore their suitability for use in pediatric patients with SOM, with minimal risk of adverse events.

Limitations

However, it is important to acknowledge certain limitations of our study. Firstly, the sample size may have been insufficient to detect small differences in efficacy and safety outcomes between the two treatment groups. Additionally, the study duration was relatively short-term, and long-term outcomes such as recurrence rates and hearing outcomes were not assessed. Future research with larger sample sizes and longer follow-up periods is warranted to provide more comprehensive insights into the comparative effectiveness and safety of mucolytic drugs versus oral steroids in the management of SOM in pediatric patients.

CONCLUSION

In conclusion, our study contributes to the growing body of evidence supporting the use of oral steroids as a preferred treatment option for pediatric patients with SOM, owing to its superior efficacy in promoting effusion resolution compared to mucolytic drugs. These findings have important implications for clinical practice and underscore the need for individualized treatment approaches tailored to the specific needs of pediatric patients with SOM.

REFERENCES

1. Aarhus L, Tambs K, Kvestad E, Engdahl B. Childhood Otitis Media: A Cohort Study With 30-Year Follow-Up of Hearing (The HUNT Study). Ear Hear. 2015;36:302-8.
2. Martines F, Bentivegna D, Di Piazza F, Martinciglio G, Sciacca V, Martines E. The point prevalence of otitis media with effusion among primary school children in Western Sicily. Eur Arch Otorhinolaryngol. 2010;267:709–14.
3. Bidarian-Moniri A, Ramos MJ, Ejnell H. Autoinflation for treatment of persistent otitis media with effusion in children: a cross-over study with a 12-month follow-up. Int J Pediatr Otorhinolaryngol. 2014;78:1298-305.
4. Wallace IF, Berkman ND, Lohr KN, Harrison MF, Kimple AJ, Steiner MJ. Surgical treatments for otitis media with effusion: a systematic review. Pediatrics. 2014;133:296-311.
5. Venekamp RP, Burton MJ, van Dongen TM, van der Heijden GJ, van Zon A, Schilder AG. Antibiotics for otitis media with effusion in children. Cochrane Database Syst Rev. 2016;2016:CD009163.
6. Kocygit M, Ortekin SG, Cakabay T, Ozkaya G, Bezgin SU, Adali MK. Frequency of serous otitis media in children without otolaryngological symptoms. Int Arch Otorhinolaryngol. 2017;21:161–4.
7. Bhutta MF, Thornton RB, Kirkham LS, Kerschner JE, Cheeseman MT. Understanding the aetiology and resolution of chronic otitis media from animal and human studies. Dis Model Mech. 2017;10:1289–300.
8. Rosenfeld RM, Schwartz SR, Cannon CR, et al. Clinical practice guideline: Acute otitis externa. Otolaryngol Head Neck Surg. 2014;150:S1–24.
9. Vanneste P, Page C. Otitis media with effusion in children: Pathophysiology, diagnosis, and treatment. A review. J Otol. 2019;14:33-9.
10. Griffin G, Flynn CA. Antihistamines and/or decongestants for otitis media with effusion (OME) in children. Cochrane Database Syst Rev. 2011;2011:CD003423.
11. Paksoy M, Altin G, Eken M, Hardal U. Effectiveness of intratympanic dexamethasone in otitis media with effusion resistant to conventional therapy. Indian J Otolaryngol Head Neck Surg. 2013;65:S461–7.
12. Mulvaney CA, Galbraith K, MacKeith S, et al. Topical and oral steroids for otitis media with effusion (OME) in children. Cochrane Database Syst Rev. 2022;2022:CD015255.
13. Garra G, Singer AJ, Taira BR, et al. Validation of the Wong-Baker FACES Pain Rating Scale in pediatric emergency department patients. Acad Emerg Med. 2010;17:50-4.
14. Zhang L. Observation on the effect of glucocorticoid combined with ambroxol hydrochloride in the treatment of secretory otitis media. Contem Med. 2020;26:30-2.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

15. Liu H, Wang W, Gao X. Comparison of the efficacy of ambroxol hydrochloride and N -acetylcysteine in the treatment of children with bronchopneumonia and their influence on prognosis. Exp Ther Med. 2020;20:130.
16. Liu PZ, Ismail-Koch H, Stephenson K, et al. A core outcome set for research on the management of otitis media with effusion in otherwise-healthy children. Int J Pediatr Otorhinolaryngol. 2020;134:110029.
17. Rosenfeld RM, Shin JJ, Schwartz SR, et al. Clinical Practice Guideline: Otitis Media with Effusion (Update). Otolaryngol Head Neck Surg. 2016;154:S1-41.
18. Zhou X, Jin X, Yang L, Wei X. Efficacy and safety of ambroxol hydrochloride in the treatment of secretory otitis media: a systematic review and meta-analysis. Ann Transl Med. 2022;10:142.
19. Francis NA, Cannings-John R, Waldron C-A, et al. Oral steroids for resolution of otitis media with effusion in children (OSTRICH): a double-blinded, placebo-controlled randomised trial. Lancet. 2018;392:557-68.
20. Mulvaney CA, Galbraith K, Webster KE, et al. Topical and oral steroids for otitis media with effusion (OME) in children. Cochrane Database Syst Rev. 2023;12:CD015255.
21. Salmen MM, Saleh EM, Abd EMM. The efficacy of nasal steroids in treatment of otitis media with effusion: a comparative study. Egyptian J Neck Sur Otorhinolar. 2021;7:20-7.
22. Ikeda R, Hidaka H, Ito M, et al. Pharmacotherapy focusing on for the management of otitis media with effusion in children: Systematic review and meta-analysis. Auris Nasus Larynx. 2022;49:748-54.
23. Mayor S. Oral steroids fail to prevent hearing loss in children with otitis media with effusion, shows trial. BMJ. 2018;362:k3576.
24. Isaacs D. Oral steroids for persistent otitis media with effusion. J Paed Child Health. 2018;54:1399-400.
25. Hughes A, Khong T. Do oral steroids improve hearing outcomes in children with otitis media with effusion? Drug Ther Bull. 2019;57:166-7.
26. El-Anwar MW, Nofal AA, Khazbak AO, Sayed AE, Hassan MR. The efficacy of nasal steroids in treatment of otitis media with effusion: a comparative study. Int Arch Otorhinolaryngol. 2015;19:298-301.
27. Al-Zaidi HMH. Is mometasone effective in treating otitis media with effusion? J Med Health Stud. 2023;4:47-55.

ISSN (O): 2687-5365; ISSN (P): 2753-6556