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Surgical Treatment of Otitis Media with Effusion according to Eosinophilic Count and Radiological Grading of Adenoid Hypertrophy

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Abstract

Otitis media with effusion is one of the commonest chronic otological conditions of childhood. It is often a co-morbidity of allergic rhinitis. The higher incidence of OME in allergic children indicates the role of allergy in otitis media with effusion OME development and relapse. To detect the outcome of different management plans for treatment of otitis media with effusion OME according to Eosinophilic count in blood. Also to detect any correlation between increased Eosinophils in blood and in Adenoid tissue. This study includes 50 children age range 5-15 years with recurrent otitis media with effusion OME despite proper medical treatment for 3 months accompanied by Adenoid Hypertrophy, evaluated clinically for allergic symptoms and signs for categorization either allergic or non. Audiological and radiological assessment confirmed the diagnosis. Laboratory investigations including Eosinophilic count in CBC divided each category into two groups, Group A included cases with high blood Eosinophilia underwent Adenoidectomy+ Grommet tube insertion. Group B included cases with normal blood Eosinophilic count underwent Adenoidectomy+ Myringotomy only. Sensorily of middle ear fluid is noted intra-operatively either mucoid or serous. Endoscopic

examination of Adenoid intra-operative is done then removed and sent for histopathological examination to detect Eosinophilia in tissue to correlate blood & tissue Eosinophilia. Also. Follow up of each group was done with PTA and tympanometry up to 6 months. Post operative Adenoid tissue examination showed no Eosinophils in tissue of both groups. Recurrence of otitis media with effusion OME occurs in (32.14%) in Group A, all related to cases with +ve allergic signs & symptoms. Also in Group B, recurrence of effusion occurs in (31.94%) ears, (26.38%) related to cases with +ve allergic symptoms and signs and (5.5%) related to cases with -ve allergic symptoms and signs. No significant correlation has been found between blood and Adenoid tissue Eosinophilia. Also, there is no significant correlation between blood Eosinophilia and consistency of middle ear fluid in each group. The present study concluded that no correlation has been found between blood and tissue Eosinophilia as all Adenoid tissues from cases did not have atypical cells like Eosinophils. As regards outcome of surgical operation myringotomy operations are sufficient in patients with normal eosinophil and grommets tube are necessary for patients with high eosinophil in blood. No correlation has been found between type of middle ear effusion and level of eosinophils in blood

Keywords: Otitis media with effusion, Eosinophilia, Adenoid.

1. Introduction

Otitis media with effusion OME, is a disease defined by persistence of serious or mucous fluid in middle ear without signs of an acute infection [1]. It occurs due to cold, sore throat, upper respiratory tract infection or adenoid hypertrophy. Children on bottle and breast feeding in supine position are more susceptible to developing otitis media with effusion OME. This is because the eustachian tube in children is wider, more horizontal in position and patent most of the time which leads to accumulation of secretions in eustachian tube leading to tubal catarrh [2]. Otitis media with effusion OME is often a co-morbidity of allergic rhinitis. Eustachian tube functions can be affected directly by the mediators released in the nasal mucosa of patients with allergic rhinitis or indirectly by the resultant nasal obstruction. According to studies, neonates with allergy symptoms are five times more likely to develop (SOM). Allergy exposes the patients to sinonasal infections and creates a suitable condition for bacterial growth and early inflammation. The higher incidence of SOM in allergic children indicates the role of allergy in secretory otitis media development and relapse [4]. The diagnosis is essentially clinical and audiological. Clinical diagnosis is based on

otoscopy and nasal endoscopy which is only indicated in cases of unilateral OME or when obstructive adenoid hypertrophy is suspected. Audiological diagnosis is based on Tympanometry and Pure tone Audiometry [5]. Tympanometry offers helpful quantitative data on ear canal volume, middle ear system mobility, and the existence of fluid in the middle ear. In the assessment of otitis media with effusion, its application has been advised in conjunction with more qualitative data (such as the history, otoscopic examination and the mobility of the tympanic membrane). OME is thought to be diagnosed with a type B tympanogram with a flat curve and normal canal volume [6]. Pure-tone audiometry is a subjective hearing test used to detect a person's hearing threshold levels which provides essential diagnostic information for diagnosing hearing loss and identifying its cause and severity. (Musiek et al., 2017) [7] Adenoid size is assessed using an Adenoid- nasopharyngeal ratio (ANR), the adenoid size is obtained by drawing a perpendicular line from the anterior margin of the basioociput to the maximum convexity of the adenoid and the nasopharynx size was obtained by drawing

a line between the posterosuperior edge of the hard palate and the anteroinferior edge of sphenobasiooccipital synchondrosis. By using the reference points and lines, adenoid size and nasopharyngeal size were measured separately, and adenoid nasopharyngeal ratio was calculated by the arithmetic, and the result has been documented in percentage. The ANR is categorized as grade 1 (0-25%), grade 2 (25-50%), grade 3 (50-75%), grade 4 (75-100%). To measure the degree of nasopharyngeal airway obstruction, which is obtained from x-ray nasopharynx lateral view with the child in an erect position with head fixed and positioned in horizontal plane [8]. Many different treatments have been used from oral or nasal steroids, antibiotics, antihistamines, decongestants or mucolytics to auto-inflation techniques. In some cases of persistent OME with failed medical treatment, surgery is needed as Adenoidectomy, Myringotomy and Tympanostomy tube insertion [9]. Adenoidectomy is performed for those with enlarged adenoid. Drainage of effusion through myringotomy with ventilation tube insertion represents rapid effective treatment.

2. Patients and Methods

This is a selected controlled clinical trial study that includes 50 children from both genders with age range 5-15 years with recurrent OME despite proper medical treatment for 3 months accompanied with Adenoid Hypertrophy selected from E.N.T outpatient clinic of Al Zahraa University Hospital and Ahmed Maher Teaching Hospital during the period from March 2022 to December 2023. This study was done after approval from institutional ethics committee of faculty of Medicine for girls Al-Azhar University. Signed written consent was obtained from parents of patients. Cases were evaluated for allergic manifestations by history & examination then audiological and radiological assessment (using plain X-ray nasopharynx in lateral view) were done in Al-Azhar

University Hospitals then laboratory investigations divided cases into two groups as regard to Eosinophilic count in CBC:

Group A included 14 cases (28 ears) with high blood Eosinophilia underwent bilateral Grommet tube insertion and Adenoidectomy +/- Tonsillectomy.

Group B included 36 cases (72 ears) with normal blood Eosinophilia underwent bilateral Myringotomy only and Adenoidectomy +/- Tonsillectomy. Endoscopic examination of Adenoid was done intra-operative before Adenoidectomy by curette to assess nasopharyngeal Adenoids and Eustachian tube end then Adenoid tissue was sent for histopathological examination in the histopathological laboratory in Al-Zahraa University Hospital. The children underwent six tympanometries, and three pure tone audio metries (AC & BC). A mild conductive HI was identified with PTA because of its narrow air- bone gap (10-25dB) and threshold for air conduction not to exceed 40 dB. While moderate CHL was identified by (>25 dB air-bone gap) and threshold for air conduction not to exceed 55 dB (KOSTIC et al.,2015). Patients undergoing tympanometry had clinical suspicion of OME. The probe tone used to acquire the tympanograms was 226 Hz. A curve was deemed flat when it showed no visible peak over the pressure range of +200 daPa to -400 daPa. A normal ear canal volume was defined as 0.3 - 1 mL.

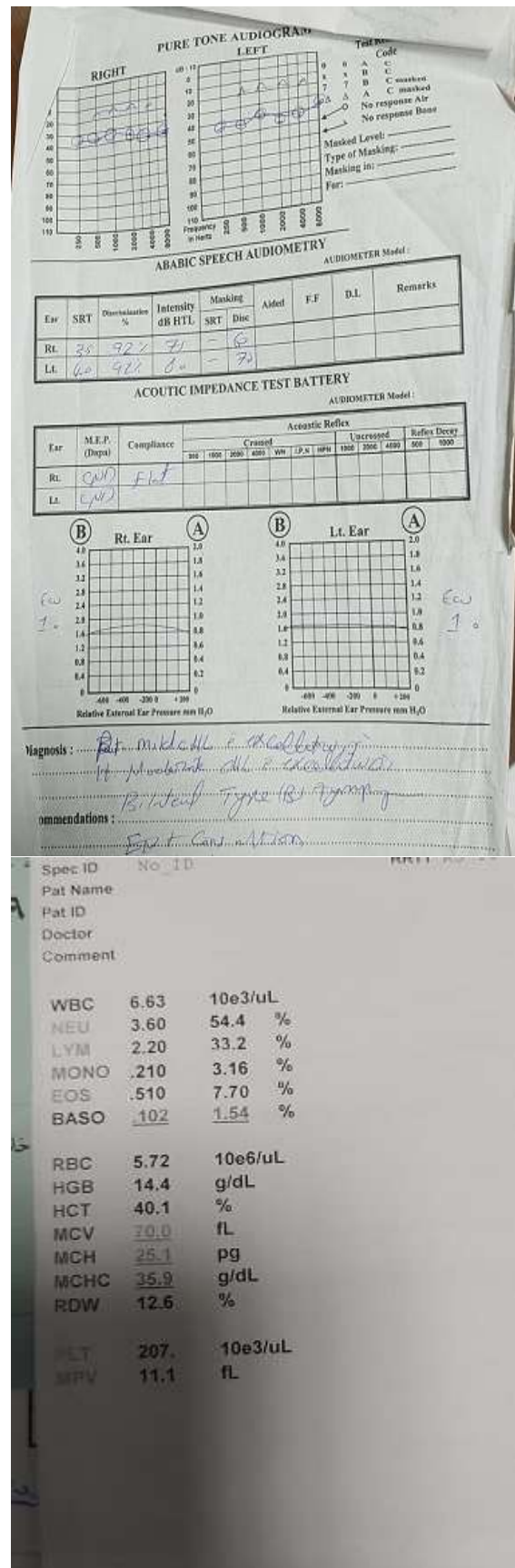


Figure 1: 8-year old boy with bilateral SOM and Adenoid hypertrophy grade 4, bilateral type B in tympanogram and bilateral CHL in PTA, CBC shows high blood Eosinophilia, included in Group A.

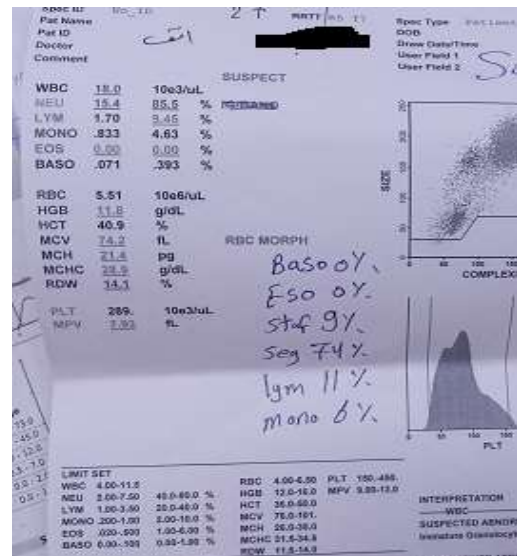
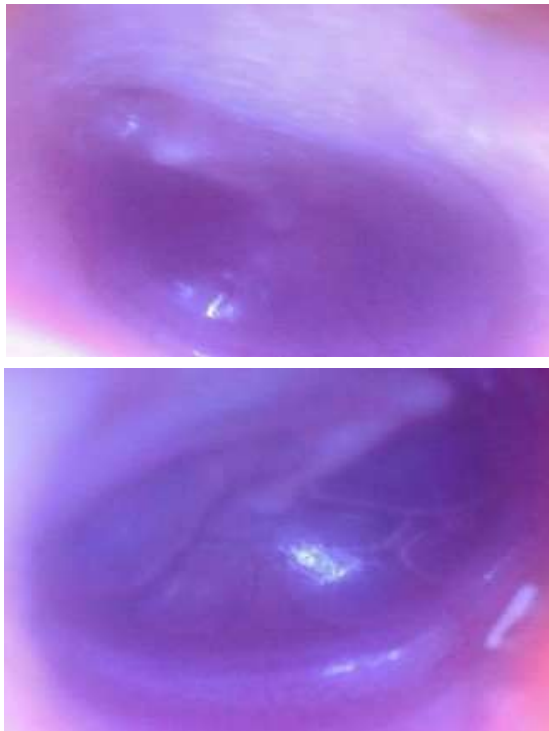
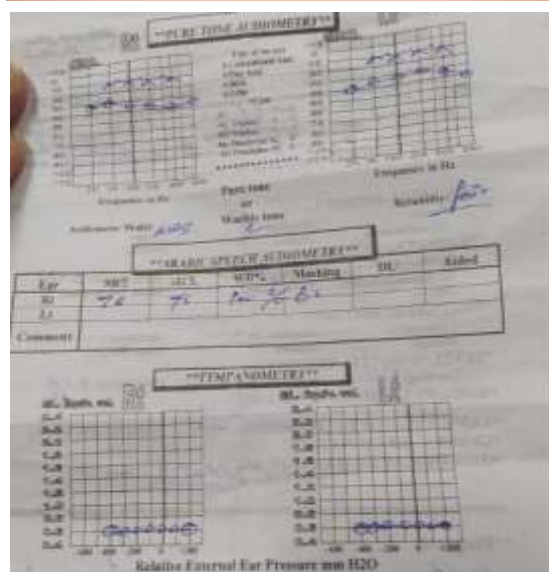


Figure 2: 7-year-old boy with bilateral SOM and adenoid hypertrophy grade 2, bilateral type B in Tympanogram, bilateral CHL in PTA, CBC shows normal Eosinophilia, included in Group B.



3. Statistical analysis

Shapiro Wilk test was used to evaluate normal distribution of numerical data. Numerical variables are expressed as mean and Standard Deviation. Categorical variables are expressed as frequencies and percentages. Student t test is used to compare numerical variables between two study groups. Paired t-test is used to assess the statistical significance of the difference between two means measured twice for the same study group. A significant level of $P < 0.05$ was used in all tests. All statistical procedures were carried out using SPSS version 25 for Windows (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

4. Results

The present study included children aged 5-15 years. The mean age was 7.06 ± 2.51 years old. There was a male predominance when compared to females (62% vs. 38%, respectively). Two groups were established after clinical, audiological and radiological assessment based on blood Eosinophilia in CBC. Eosinophilic group (Group A) includes 14 cases, 9 (64.2%) of them are

+ve for symptoms and signs for allergy by clinical examination while 5 (35.7%) of them are -ve. Eosinophils were detected in 14 cases of blood (100%) but not in their Adenoid tissues (0%). Majority of Adenoid tissue hypertrophy were grade 2 (57.1%), but though, no Eosinophils were detected (0%). Non-Eosinophilic group (Group B) includes 36 cases, 16 (44.4%) of them are +ve for symptoms and signs for allergy by clinical examination while 20 (55.6%) of them are -ve. Eosinophils were not detected in blood of 36 cases (0%) nor in their Adenoid tissues (0%). Majority of Adenoid hypertrophy were Grade 3 (38.9%) and Grade 2 (33.3%), but though, no Eosinophils were detected (0%). 9 cases from Group A and 16 cases from Group B have +ve symptoms and signs of allergy by clinical examination (25 cases). 18 ears (64.2%) of cases from group A with +ve allergy, all give thick mucoid effusion during incision. Also, 8 ears (28.5%) of cases from the same group but with -ve allergy give thick mucoid effusion. Prevalence of mucoid effusion among ears in Group A is high (92.7%). 26 ears (36.1%) of case from group B with +ve allergy give thick mucoid effusion. Also 12 ears (16.6%) of cases from the same group but with -ve allergy give thick mucoid effusion. Prevalence of thick mucoid effusion among ears in Group B is (52.7%) higher than serous effusion. As shown in table 1, there

was a highly significant improvement in the Tympanometry after 1 month, 3 months and 6 months among patients underwent Grommet tube surgery (P value<0.001). Type B decreased from 28 ears (100%) pre operation to 9 ears (32.1%) in the 6th month post operation. 14 ears were recorded Type A, and 5 ears were Type C in the 6th month follow up. As shown in table 2, 20 ears (71.4%) of Group A were detected as mild conductive hearing loss while 7 ears (25%) were moderate conductive hearing loss. With follow up to the 6th month, 20 ears (71.4%) were improved in hearing and only 8 ears (28.6%) recorded as mild CHL. As shown in table 3 there was a highly statistically significant improvement in the Tympanometry after 1 month, 3 months and 6 months among patients underwent Myringotomy only. (P value<0.001). Type B decreased from 72 ears (100%) pre operation to 23 ears (31.9%) in the 6th month post operation. 34 ears were recorded Type A, and 15 ears were Type C in the 6th month follow up. As shown in Table .4 sixty ears (83.3%) of Group B were detected as mild conductive hearing loss while 7 ears (9.7%) were moderate conductive hearing loss. With follow up to the 6th month, 58 ears (80.6%) were improved in hearing and only 14 ears (19.4%) recorded as mild CHL.

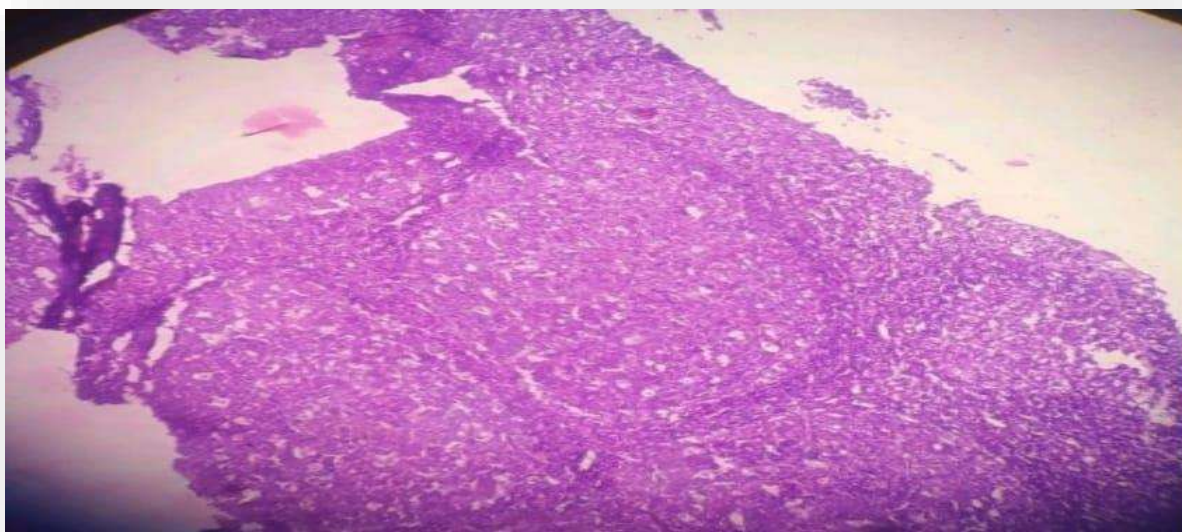


Figure 3: Adenoid tissue under 100x magnification microscopic examination from a case in group A, report shows reactive lymphoid hyperplasia with no atypical cells.

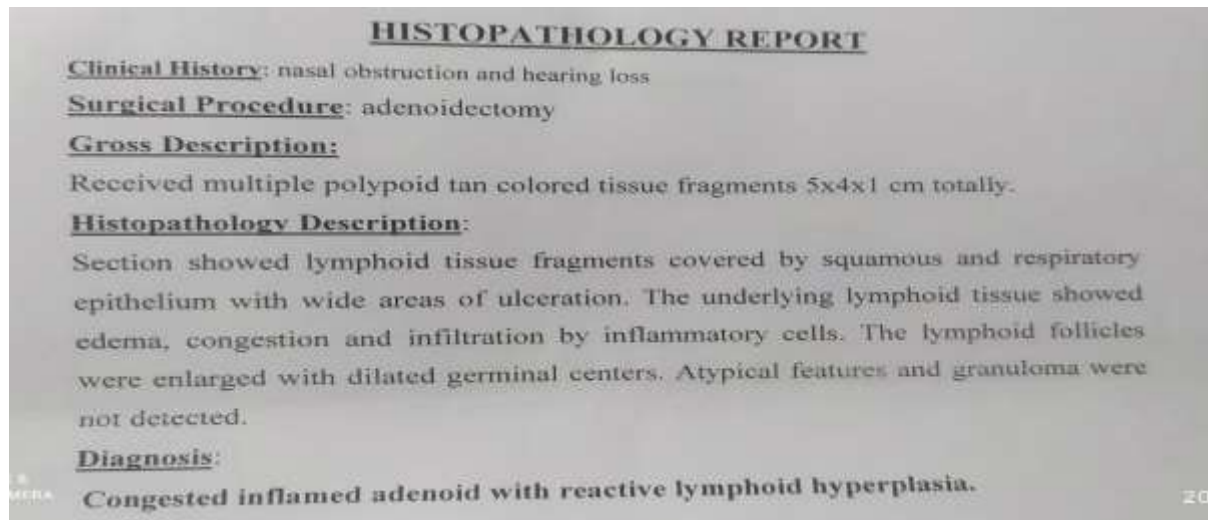


Figure 4: Histopathology report of the above slide of a case from group A

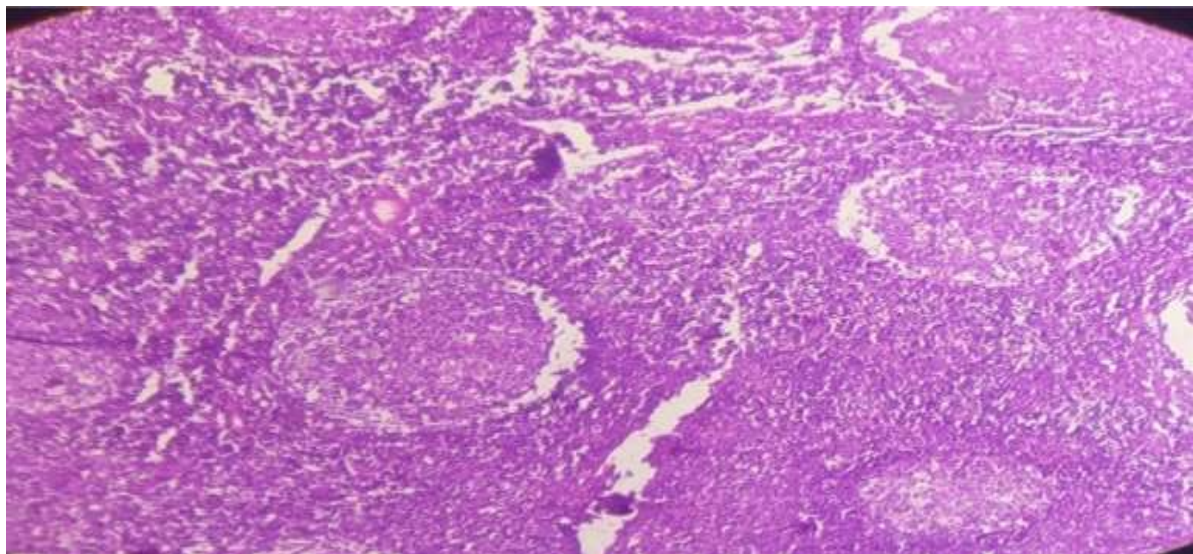


Figure 5: Adenoid tissue under 100x magnification microscopic examination from a case in group B, report shows reactive lymphoid hyperplasia with no atypical cells.

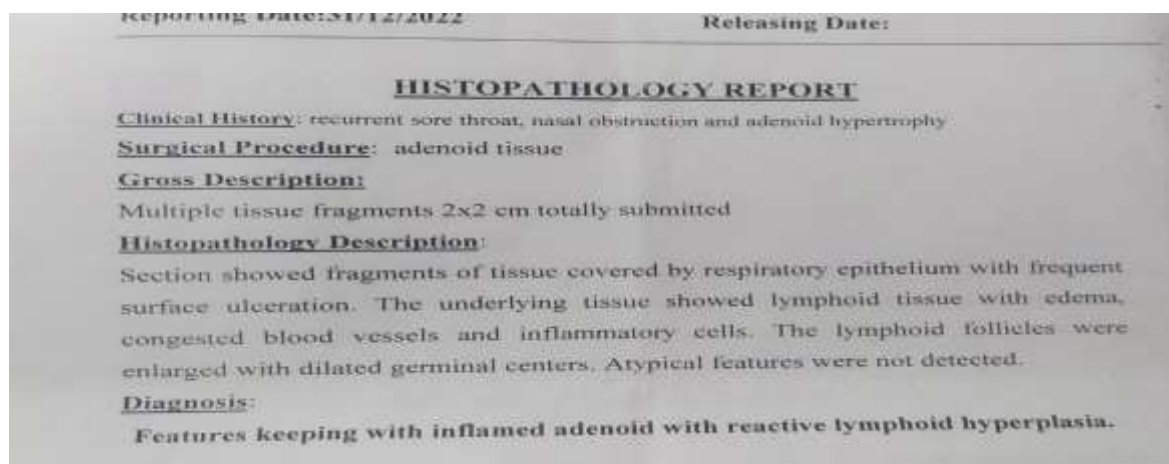


Figure 6: Histopathology report of the above slide of a case from group B.

Table 1: Follow up of Group A with Tympanometry:

Tympanometry	Group A (28 ears)				Test value	P-value	Sig.
	Pre-operative	Post-op (1 month)	(3 months)	(6 months)			
Type A	0 (0.0%)	7 (25.0%)	10 (35.7%)	14(50.0%)	33.407*	<0.001	HS
Type B	28 (100.0%)	21 (75.0%)	15 (53.6%)	9 (32.1%)			
Type C	0 (0.0%)	0 (0.0%)	3 (10.7%)	5 (17.9%)			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant *: Chi-square test

Table 2: Follow up of Group A with PTA:

PTA	Group A (28 ears)		
	Pre-operative	Post-op (3 month)	(6 months)
Normal (0-10 dB air-bone gap)	1 (3.6%)	24 (85.7%)	20 (71.4%)
Mild (10-25 dB air-bone gap)	20 (71.4%)	4 (14.3%)	8 (28.6%)
Moderate (>25 dB air-bone gap)	7 (25%)	0 (0.0%)	0 (0.0%)

Table 3: Follow up in Group B with Tympanometry:

Tympanometry	Group B (72 ears)				Test value	P-value	Sig.
	Pre-operative	Post-op (1 month)	(3 months)	(6 month)			
Type A	0 (0.0%)	15 (20.8%)	31 (43.1%)	34(47.2%)	91.235*	0.000	HS
Type B	72 (100.0%)	46 (63.9%)	30 (41.7%)	23(31.9%)			
Type C	0 (0.0%)	11 (15.3%)	11 (15.3%)	15(20.8%)			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

*: Chi-square test

Table 4: Follow up of Group B with PTA.

PTA	Group A (72 ears)		
	Pre-operative	Post-op (3 month)	(6 months)
Normal (0-10 dB air-bone gap)	5 (6.9%)	57 (79.2%)	58 (80.6%)
Mild (10-25 dB air-bone gap)	60 (83.3%)	15 (20.8%)	14 (19.4%)
Moderate (>25 dB air-bone gap)	7 (9.7%)	0 (0.0%)	0 (0.0%)

5. Discussion

The current study aims to detect the outcome of different management plans for treatment of OME according to Eosinophilic count in blood. CBC with blood Eosinophils was the reference for grouping, thus 2 groups were established for different management plans: Group A: (Eosinophilic group) and Group B: (Non-Eosinophilic group).

Different management plans were applied in our study in terms of allergy status to reach the best outcome and results. Most of the past studies were helpful to compare the management plans for SOM with selecting cases in groups randomly but not depending on any reference as in (Ahmad et al, 2016), (Khan et al, 2018) and (Aboulwafa et al, 2019) [10,2,11].

As regards demographic data, our study included children aged 5-15 years. The mean age was 7.06 ± 2.51 years old, nearly same as in (Khan et al 2018) [2] study. Also, in study of (Rasheed et al 2023) [12] age ranged from 6-12 years which was closely related age.

There was a male predominance when compared to females (62% vs. 38%, respectively).

(Siyad and Venkataramanan 2021) [13] agreed with our study that there is more incidence in boys (58%) when compared to girls. (Chen et al 2023) [14] suggested that the disease is expected to be more common in boys as mastoid pneumatization is more rapid in girls and boys experience upper respiratory infection episodes more frequently. Clinically, cases were categorized according to allergic manifestations then two groups were established as follows: Group A: The Eosinophilic group who have high blood Eosinophils, only 9 of them (64.2%) have allergic manifestations by clinical examination. Signs of allergic rhinitis as dry, bluish and pale nasal mucosa with hypertrophy of Inferior turbinates were recorded. Also, some cases had recurrent URT infections such as rhinosinusitis.

Group B: The non-Eosinophilic group who have normal blood Eosinophils, but 16 out of them (44.4%) have allergic manifestations also. (Yegin et al, 2015) [15] included in their study 72 patients who underwent adenoidectomy and Ventilation tube insertion as Group A in our study with (31.95%) allergic rhinitis symptoms, also (32.9%) of the other group who included 76 patients and underwent adenoidectomy with myringotomy only had allergic rhinitis. Our study agreed to (Hardani et al 2020) [16] that allergic rhinitis was one of the most important risk factors in OME, also (Byeon 2019) [17] approved that children with AR had significantly higher risk of OM.

Radiological assessment of Adenoid Hypertrophy (AH) was classified into 4 grades in both groups : Group A: Majority of cases were Grade 2 (57.1%) , then grade 4 (28.6%),and at last grade 3 (14.3%) .Group B: Majority of cases were grade 3 (38.9%) and grade 2 (33.3%), then grade 4 (16.7%), and at last grade 1 (11.1%). Our study shows no statistically significant difference between grading of Adenoid with the occurrence of OME. On the contrary, (Chen et al 2023) [14] showed a significant correlation between the degree of AH and OME. In addition, OME tends to persist, and conservative treatment tends to fail in cases of higher degrees of AH.

Also (Aboulwafa et al., 2019) [11] in their study approved that OME frequently co-occurs with allergic rhinitis. The mediators released in the nasal mucosa of individuals with allergic rhinitis can directly impact eustachian tube function. Moreover, Adenoid hypertrophy particularly near the torus and pharyngeal opening of the ET, can directly compress and obstruct the ET, resulting in impaired middle ear drainage, negative middle ear pressure, mucosal exudation, and OME (Chen et al 2023) [14] In (Siyad and Venkataramanan 2021) [13] study, ET dysfunction was the most predisposing factor for SOM in his patients either due allergy or Adenoid hypertrophy (66%).

Our study includes 14 cases (Group A) with mild Eosinophilia representing allergic disorders that may cause OME. And also, it includes 36 cases (Group BB) with no Eosinophils in blood and SOM, showing no significant correlation between occurrence of SOM and blood Eosinophilia.

In agreement to our study, (Koohpayeh et al 2022) [4] studied the correlation of different allergic mediators with occurrence SOM and found that SOM was positively correlated with neutrophils and mast cells but was negatively correlated with eosinophil in blood. So, this study showed no significant difference in the role of allergy in the development of SOM in children with adenoid hypertrophy based on the skin prick test, absolute eosinophil count, and IgE level.

5 cases (35.7%) of Group A had no allergic manifestations during clinical examinations though there is high blood Eosinophilia. On the other hand, 16 cases (44.4%) of Group B had allergic manifestations but were not confirmed with high blood Eosinophilia.

The causes of eosinophilia are various as Allergic disorders, Parasitic infections, Leukemia/ Lymphomas and Vasculitis-Immunodeficiency diseases, with allergic disorders and parasitic infections representing the most commonly identified causes in children. Allergic disorders are usually associated with mild Eosinophilia (500-1500 cells/ μ l) agreed to our study. (Costagliola et al 2020) [18]. Group A (14 cases = 28 ears) underwent Myringotomy with grommet tube insertion (100.0%) and Group B (36 cases = 72 ears) underwent Myringotomy only (100.0%)

Moreover, Adenoidectomy was done in our study for all cases in both groups (50 cases) agreed to (Abdel Tawab 2020), [19] (Rasheed et al. 2023) [12] and (Farhadi et al. 2011) [20] who found that adenoidectomy with ventilation tubes showed better improvement in tympanogram than without Adenoidectomy. Also, Van den et al., (2010) [21] reported that the insertion of

grommets (Ventilation or tympanostomy tubes) into the ear drum was a surgical treatment option commonly used to improve hearing in children with otitis media with effusion results in minimal, if any, hearing disability. In addition, previous results are in accordance with those of Shishegar and Haghoghi (2007) [22] and Vlastos et al. (2011) [23] who reported that adenoidectomy with ventilation tube insertion had better outcome on tympanogram and PTA in children with otitis media with effusion.

On the other hand, Casselbrant et al. (2009) [24] found that adenoidectomy with or without tube insertion provided no advantage to young children with chronic OME in regard to time with effusion compared to tube insertion alone. (71.4%) of Group A and (72.2%) of Group B underwent tonsillectomy, in agreement with a study done by (Abdul-Baqi et al. 2001) [25] on 48 children aged 2-14 years with AH and OME, half (50%) of them had symptoms of chronic tonsillitis and needed tonsillectomy.

In our study, we noted the consistency of middle ear effusion during surgery either mucoid or serous in both groups and found that (92.7%) in group A and (52.7%) in group B of mucoid type with a highly statistically significant difference between the studied groups.

(Ahmed et al. 2022) [26] agreed with our study and showed that the nature of middle ear fluid was glue in most of the operated ears (63%) and serious in (37%) of the rest. Histopathological examination has been done to adenoid tissue to search for eosinophils in tissue and resulted negative in all specimens (0%). We aimed to find Eosinophils in adenoid tissue whether the cases have allergic symptoms and signs or not, and whether they have blood Eosinophilia or not. No correlation has been detected between blood and adenoid tissue Eosinophils.

(Cho et al 2018) [27] agreed to our study in importance of evaluation of the clinical

significance of local atopy of Adeno-tonsillar tissues of children, and not only the systemic allergy. But in their study, they focused on the level of IgE in adenoid and tonsillar tissue not the eosinophils.

Follow up of patients has been done up to 6 months post operation. Tympanometry was done after 1 month of surgery. Then Tympanometry and PTA were done after the 3rd month then repeated again at the 6th month.

Group A: (25.0%) improved in the 1st month with type A tympanogram then increased to (35.7%) in the 3rd month. At the 6th month, (50.0%) became type A and (17.9%) became type C. (32.1%) in the last clinic visit at the 6th month were type B indicating recurrence or persistence of SOM.

(Aboulwafa et al. 2019) [11] agreed to our study that tympanogram was significantly improved in group II (60 ears) who operated Adenoidectomy with ventilation tube insertion. After 1 month 54 ears (90%) were type A and then remain with the same percentage in the 3rd month.

PTA of operated ears showed improvement in the 6th month in (71.4%) with normal air-bone gap. (Popova et al 2010) [28] agreed our study in term of hearing follow up in their cases, mean of hearing loss decreased in every visit denoting hearing improvement in the 1st, 6th and 12th months in both groups. After clinical examination and audiological assessment, Recurrence or persistence of effusion occurs in (32.14%) in Group A at the 6th month, all related to allergic category.

Group B: Type A increased over the 6 months follow up till it reaches (47.2%). Also (20.8%) were type C in the 6th month. (31.9%) have type B curve in Tympanogram in the last visit at the 6th month indicating recurrence of SOM.

PTA of the operated ears show improvement in the 6th month in 58 ears (80.6%) while only 14 ears (19.4%) recorded as mild CHL with air-bone gap (10-25 dB).

After clinical examination and audiological assessment,

Recurrence of effusion occurs in (31.94%) in Group B in the 6th month, (26.38%) related to allergic category and (5.5%) related to non-allergic category.

Contrary to our study, (Popova et al. 2010) [29] who compared between myringotomy and tympanostomy tubes in combination with adenoidectomy in 3–7 years old children with otitis media with effusion. They found that the recurrence of OME was higher in adenoidectomy with myringotomy group compared to adenoidectomy with ventilation tube group.

Half of the cases (50%) included in our study have sign & symptoms of allergy. Recurrence of SOM occurs in 28 ears (28%) of the total ears in our study, related to cases with allergies confirmed with clinical examination and history. There is an association between allergy and SOM recurrence.

(Döner et al 2004) [29] approved this association when allergy evaluation was done to 22 cases underwent Adenoidectomy and ventilation tube insertion. (36.4%) of patients had positive skin tests for inhalation and food allergens. Against our study, (Yeo et al. 2007) [30] in their study on 123 children found allergic rhinitis may not be related to the development of OME in children.

In our study, Adenoid tissue was examined for Eosinophils as it may have a role in the pathogenesis of SOM, but we did not examine middle ear fluid or mucosa for allergic mediators.

Several authors as (Nguyen et al 2004) [31] and (Sobol et al 2002)[32] supported our study and have demonstrated a higher percentage of TH-2 mediators (eosinophils, T lymphocytes, IL-4, and IL-5), as well as a hyper-expression of major basic protein and eosinophilic cationic protein in the middle ear fluid, adenoid tissue, and middle ear mucosa in atopic versus non-atopic children with OME.

Histological studies in (Juszczak and Loftus 2020) [33] have demonstrated that there is an increased level of IL-4, IL-5, and eosinophils in middle ear fluid and at both ends of the ET suggesting the possibility of activating an allergic mechanism in sensitized children.

6. Conclusion

The present study concluded that no correlation has been found between blood and tissue Eosinophilia as all Adenoid tissues from cases did not have atypical cells as Eosinophils.

As regards outcome of surgical operation myringotomy operations are sufficient in patients with normal eosinophil and grommets tube are necessary for patients with high eosinophil in blood. No correlation has been found between type of MEE and level of eosinophils in blood.

7. Recommendations

ENT specialists should pay attention to the predisposing factors of OME carefully by clinical examination as allergies are important and should be screened more widely.

Allergic evaluation is required even after surgery to guarantee a long disease-free period.

Analysis of middle ear fluid regarding Eosinophilic cells is recommended.

Further studies with large number of patients and long-term follow-up might be more beneficial.

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