

# Effect of chronic adenoiditis on neutrophil-lymphocyte and platelet-lymphocyte ratios in chronic otitis media with effusion

Hazem M. Abdel Tawab

Department of Otorhinolaryngology, Faculty of Medicine, Cairo University, Egypt, Department of Otorhinolaryngology, Sultan Qaboos Hospital, Salalah, Oman.

E-mail: hazemabdeltawwab77@yahoo.com

Tel: 0096891128430

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**Objective:** Inflammation is a known cause of chronic otitis media with effusion (COME). Neutrophil-lymphocyte and platelet-lymphocyte ratios (NLR, PLR) had been used in COME diagnosis, however there is no complete evidence if this relation exists between the disease itself or its causes as adenoiditis and these parameters. Aim is to find if the relation between NLR and PLR and otitis media with effusion, if any reflects the actual relation between the disease itself or adenoiditis as a cause for COME and these parameters.

**Materials and Methods:** A retrospective-case control- study where data of eighty four pediatric patients with COME who underwent ventilation tube insertion with or without adenoidectomy were collected. A group of 52 healthy children was added as a control group to compare NLR and PLR in both groups. Patients in study group were divided into mucoid subgroup (47 patients) and serous subgroup (37 patients).

**Results:** Mean NLR was ( $1.058 \pm 0.48$ ,  $0.776 \pm 0.29$ ) in study and control groups respectively ( $p$  value= 0.000). Mean PLR was higher in study than in control group with no significant difference. NLR was ( $1.2 \pm 0.561$ ,  $0.87 \pm 0.26$ ) in mucoid and serous subgroups respectively ( $p$  value 0.001). NLR and PLR in mucoid subgroup were higher than in control group ( $p$  value 0.000, 0.028 respectively). NLR and PLR showed no significant difference between adenoidectomy, no- adenoidectomy mucoid subgroup. NLR was higher in no- adenoidectomy than adenoidectomy serous subgroup ( $1.08 \pm 0.22$ ,  $0.77 \pm 0.22$  respectively) ( $p$  value 0.000).

**Conclusion:** NLR and PLR can predict COME. Presence of chronic adenoiditis and need for adenoidectomy did not affect these parameters in the study, reflecting that these parameters are closely related to COME itself and not to adenoiditis as a cause and making these parameters valuable in diagnosis of chronic otitis media with effusion.

**Keywords:** Neutrophil; lymphocyte; effusion; otitis media.

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## Introduction

Otitis media with effusion (OME) is a disorder seen frequently in childhood characterized by accumulation of fluid in the middle ear space. [1] It is one of the commonest factors causing hearing loss and delay in language development in childhood if left untreated. [2] OME prevalence ranges between 1.3- 31.3%. [3]

Several factors as adenoid hypertrophy and adenoiditis, middle ear inflammation, allergy or Eustachian tube dysfunction may play a role in OME development. Different viscosities may result due to absorption of the trapped effusion. [4]

The differentiation of effusion into serous or mucoid is commonly done in clinical practice and according to some literature studies; serous effusion is richer in bacteria than mucoid effusion. [5]

Total white blood cell count and its subtypes especially neutrophils had been used in literature as inflammatory markers. Neutrophilia is associated with relative lymphopenia and accordingly, the neutrophil/lymphocyte ratio (NLR) and platelet/lymphocyte ratio (PLR) had been used as predictors of inflammatory response in some diseases. [6]

It has been mentioned in literature that NLR and PLR can be used to predict otitis media with effusion and to predict the nature of the fluid in the middle ear. [7]

According to Bakshi in 2018, he stated that no complete understanding of these parameters still achieved. [8]

Abakay et al., in 2016 stated that erythrocyte sedimentation rate (ESR) and C reactive protein (CRP) are more reliable worldwide indicators for inflammatory conditions and studying relation between NLR and PLR and COME should include study of adenotonsillar disease as a cause for inflammation as well. [9]

The aim of this study is to evaluate the benefit of NLR and PLR in diagnosis of otitis media with effusion and to assess if this relation exists between these parameters and the disease itself or chronic adenoiditis as a cause of chronic otitis media with effusion.

## Materials and Methods

This is a retrospective case control study conducted on 84 pediatric patients presenting to our Otorhinolaryngology department with bilateral otitis media with effusion in the period from September 2015 till June 2017. Patients' data

was collected after approval from the local hospital ethical committee.

A group of 52 healthy children who attended our hospital for routine examination was taken as a control group to compare the demographic and laboratory findings with the study group.

The inclusion criteria for the study group were defined as presence of otitis media with effusion based on clinical otoscopy findings and type B flat tympanogram. Post nasal space x ray was done for all children in the study group to exclude adenoid hypertrophy and need for adenoidectomy together with ventilation tube insertion.

Any patient with acute infection, asthma, allergic rhinitis, systemic disease or non-type B tympanogram was excluded from the study.

Informed consent had been taken from all patients before the procedure. Patients in the study group were divided into two subgroups according to nature of the fluid in the middle ear seen during ventilation tube insertion. The first subgroup; Mucoid group included 47 patients and the second group; serous group included 37 patients. Further division of these subgroups was done based on the need for adenoidectomy together with ventilation tube insertion.

Complete blood count was done (Sysmex XT-1800i; Sysmex, IL, USA) using a blood sample obtained from a peripheral vein. The reference value for neutrophil, lymphocyte and platelet counts in the blood count in our laboratory is 1-4.8, 1.2-3.8 and 150-450 ( $10^3/\mu\text{L}$ ) respectively. NLR was obtained by dividing neutrophil number into lymphocyte number, and PLR was obtained by dividing platelet number into lymphocyte number and compared these numbers between the study group and control group, between the mucoid and serous subgroups together and, between each

of the two subgroups and the control group. Adenoidectomy and no- adenoidectomy subgroups had been compared in both serous and mucoid types as regards NLR and PLR. All data were statistically analyzed.

### Statistical analysis

Descriptive data were presented as mean±standard deviation and different categories were presented as number and percentage. Differences between groups and subgroups regarding age, gender and blood count parameters were tested via t- test.  $P < 0.05$  value was considered significant and  $p < 0.001$  was considered as highly significant difference. Statistical Package Program for Social Sciences (SPSS) for windows version 21 (SPSS Inc., Chicago, IL, US) was used in this study.

### Results

A retrospective case control study for evaluating the role of NLR and PLR in diagnosing cases of OME and predicting the type of fluid in the middle ear and their relation with adenoiditis and subsequent adenoidectomy where it was conducted in the period from September 2015 till June 2017 from patients' files. The average age in the study group was  $6.96 \pm 2.636$  years while it was  $6.85 \pm 2.304$  years in the control group with no significant difference. The female/male ratio was 36/48 in the study group and 23/29 in the control group with no significant difference.

In the study group and in the control group, neutrophil count was  $3.3187 \pm 1.208$ ,  $2.6246 \pm 1.206$  respectively ( $p$  value 0.001). The NLR in the study group and control group was  $1.058 \pm 0.48$ ,  $0.776 \pm 0.299$  respectively with a highly significant difference (0.000). A significant difference existed (0.004) in platelet count between the study and control groups being higher in study group yet, the PLR did not show a significant difference. All characteristics of the study and control group are summarized in **Table 1**.

**Table 1 The demographic data and laboratory findings of study and control group**

	Cases (84)	Control (52)	T test	P value
Age	$6.96 \pm 2.636$	$6.85 \pm 2.304$	0.266	0.791
Neutrophils	$3.3187 \pm 1.20866$	$2.6246 \pm 1.20628$	3.3	.001
lymphocytes	$3.4800 \pm 1.21438$	$3.4596 \pm 1.09823$	0.1	0.922
Platelets	$359.93 \pm 85.021$	$306.46 \pm 110.175$	2.99	.004
NLR	$1.05882 \pm .480179$	$.77692 \pm .299797$	4.2	0.000
PLR	$113.15 \pm 33.752$	$97.64 \pm 51.755$	1.9	0.058

NLR: neutrophil- lymphocyte ratio, PLR: platelet- lymphocyte ratio

Comparing the serous subgroup to the control group; NLR was  $0.87 \pm 0.26$ ,  $0.77 \pm 0.29$  respectively with no significant difference. PLR was  $106.36 \pm 23.14$  and  $97.64 \pm 51.75$

respectively with no significant difference. Characteristic data of comparison between serous subgroup and control group are summarized in **Table 2**.

**Table 2 Laboratory data of serous subgroup and control group**

	Serous(37)	Control (52)	T test	P value
Neutrophils	$3.1014 \pm 1.01416$	$2.6246 \pm 1.20628$	1.960	0.053
lymphocytes	$3.5770 \pm .68384$	$3.4596 \pm 1.09823$	0.62	0.537
Platelets	$374.46 \pm 89.693$	$306.46 \pm 110.175$	3.094	0.003
NLR	$.87941 \pm .264430$	$.77692 \pm .299797$	1.668	0.099
PLR	$106.36 \pm 23.148$	$97.64 \pm 51.755$	1.074	0.286

Comparing the mucoïd subgroup to the control group; NLR was 1.2±0.56, 0.77±0.29 respectively with highly significant difference. PLR was 118.49±39.62 and 97.64±51.75

respectively with significant difference. Characteristic data of comparison between mucoïd subgroup and control group are summarized in **Table 3**.

**Table 3 Laboratory data of mucoïd subgroup and control group**

	Mucoïd (47)	Control (52)	T test	P value
Neutrophils	3.4898±1.32781	2.6246±1.20628	3.397	0.001
lymphocytes	3.4036±1.51043	3.4596±1.09823	0.212	0.832
Platelets	348.49±80.271	306.46±110.175	2.183	0.032
NLR	1.20006±.561279	.77692±.299797	4.608	0.000
PLR	118.49±39.624	97.64±51.755	2.232	0.028

Comparison between the serous and mucoïd subgroups showed NLR of 0.87±0.26, 1.2±0.56 with significant difference (p value=0.001). PLR was 106.36±23.14,

118.49±39.62 respectively with no significant difference. Rest of laboratory findings in serous and mucoïd subgroups with p value are summarized in **Table 4**.

**Table 4 Laboratory findings and p value between serous and mucoïd subgroups**

	Serous (37)	Mucoïd (47)	T test	P value
Neutrophils	3.1014±1.01416	3.4898±1.32781	1.5	0.145
lymphocytes	3.5770±.68384	3.4036±1.51043	0.7	0.486
Platelets	374.46±89.693	348.49±80.271	1.4	0.166
NLR	.87941±.264430	1.20006±.561279	3.46	0.001
PLR	106.36±23.148	118.49±39.624	1.75	0.084

Regarding adenoid hypertrophy, chronic adenoiditis and consequent adenoidectomy between the serous and mucoïd subgroups; number and percentage of cases were 24(64.9%), 40(85.1%) respectively with a significant difference (p value= 0.031).

Comparing the no adenoidectomy with the adenoidectomy patients in serous subgroup shows that NLR was 1.08±0.22, 0.77±0.22 respectively with a highly significant difference (p value= 0.000). Rest of laboratory findings are shown in **Table 5**.

**Table 5 Laboratory findings and in p value between no adneoidectomy and adenoidectomy patients in serous subgroup**

	Serous(37)		T test	P value
adenoidectomy	Not done (13)	Done (24)		
Neutrophils	3.73±1.26	2.76±0.66	2.595	0.02
lymphocytes	3.44±0.74	3.65±0.65	0.884	0.383
Platelets	342.4±87.5	391.8±87.7	1.638	0.11
NLR	1.08±0.22	0.77±0.22	3.955	0.000
PLR	102.4±26.4	108.5±21.5	0.762	0.451

Comparing the no adenoidectomy with the adenoidectomy patients in mucoïd subgroup shows that NLR and PLR showed no significant difference between both subgroups (p

value= 0.987, 0.602). Rest of laboratory findings are shown in **Table 6**.

**Table 6 Laboratory findings and in p value between no adenoidectomy and adenoidectomy patients in mucoïd subgroup**

	Mucoïd (47)		T test	P value
Adenoidectomy	Not done (7)	Done (40)		
Neutrophils	3.7±1.4	3.45±1.3	0.465	0.644
Lymphocytes	3.7±2	3.34±1.43	0.591	0.557
Platelets	344.1±76.3	349.25±81.85	0.154	0.879
NLR	1.2±0.52	1.2±0.57	0.016	0.987
PLR	111.17±32.2	119.77±41	0.526	0.602

## Discussion

OME is the commonest cause of hearing loss, delay in language learning, and decrease in school performance in addition to some behavioral problems in pediatric population. [10]

Despite that Eustachian tube dysfunction had been correlated with development of OME together with other factors like allergy yet, inflammation and persistent infection play an important role in this condition. [11]

Middle ear effusion can be classified into different categories according to its viscosity as serous, seropurulent, purulent, mucopurulent and mucoid however, in this study classification was based on two categories which are serous if it is easy to flow thin fluid and mucoid if it is sticky and thick fluid. This classification had been used in many studies in literature. [12,13]

Total white blood cell and its subtypes are useful indicators for inflammation. NLR and PLR were introduced as simple and cheap markers for inflammatory reaction. [14]

Different studies in literature stated that NLR and PLR are useful indicators for otitis media with effusion. [12,13,15]

In this study, there was no significant difference as regards age and gender between the study and control groups.

In literature, it had been mentioned that NLR and PLR were higher in the middle ear effusion group than in the control group. [12] They also found that they were significantly higher in the serous subgroup while no significant difference existed between the mucoid group and study group regards both ratios. They concluded that NLR and PLR are useful predictors for middle ear effusion and also can help in predicting nature of fluid in the middle ear. They correlated serous effusion with inflammation while mucoid type with more likely Eustachian tube dysfunction. [12]

Boztepe et al., [13] mentioned that NLR and PLR can help in detecting nature of fluid in middle ear effusion. They postulated that NLR less than 1.38 is usually found in mucoid secretions and PLR less than 97.96 is also suggestive of mucoid secretion in the middle ear.

Atan et al., [15] found that NLR was significantly higher in cases with OME while, PLR though was higher than in control group yet, did not show significant difference.

In this study, NLR showed highly significant difference between study and control group which might point to inflammation as an etiology of OME however, PLR did not show any significant difference between the two groups.

Literature results presented elevated NLR or both NLR and PLR in cases of serous middle ear effusion more than mucoid type. In this study, NLR was significantly higher in the mucoid type while PLR did not show significant difference. This result might reflect an inflammatory process in the pathogenesis of mucoid type based on NLR as a marker which was denied in other literature studies.

Abakay et al., [9] stated that correlating groups who underwent adenoidectomy with or without tonsillectomy as a separate group would be more representative because adenotonsillar disease is closely related to inflammation.

In this study, a significant difference existed between the mucoid and serous subgroups as regards adenoid hypertrophy and adenoidectomy which might reflect that

NLR and PLR were initially raised because of adenotonsillar disease not COME.

In the mucoid subgroup, no significant difference existed between the adenoidectomy and no- adenoidectomy groups regarding NLR and PLR. Cases of no adenoidectomy patients in serous subgroup showed significant elevation of NLR than the adenoidectomy patients.

This study showed elevated PLR in COME together with highly significant correlation between NLR and middle ear effusion despite presence or absence of adenoid disease. This reflects the value of these tests in diagnosis of such a condition.

## Conclusion

NLR and PLR are good, cheap and easy to make parameters that can help in diagnosing certain conditions as COME where inflammation is suspected as an etiological factor. Chronic adenoiditis was not found to be the cause of elevation of these parameters in COME making them valuable and efficient in diagnosis of such a condition.

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## Conflicts of interest

No conflicts of interest existed.

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