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A novel predictive marker for the viscosity of otitis media with effusion

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ABSTRACT

Objectives: To evaluate the significance of neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio for the prediction of the viscosity of otitis media with effusion.
Methods: This retrospective study was performed on 81 patients who were admitted to the otolaryngology clinic. The patients were divided into two groups according to their effusion type, as serous or mucoid, which was defined intraoperatively after myringotomy. The NLR and PLR were calculated as a simple ratio between the absolute neutrophil/platelet and absolute lymphocyte counts.Tympanostomy tube insertion was performed for all cases.Under direct visualization, the effusion was aspirated and classified as serous or mucous.
Results: We postulated that an NLR value of less than 1.38 may show mucoid effusion and if the PLR value is less than 97.96, the effusion is mucoid.
Conclusions: We speculate that a useful predictor of viscosity for a middle ear effusion could prevent unnecessary surgeries and additional costs in the treatment of EMO. Additional studies are needed to confirm our results.

1. Introduction

Otitis media with effusion (OME) is one of the most common childhood conditions, affecting approximately 90% of children before school age [1]. OME is characterized by an accumulation of fluid in the middle ear, behind an intact tympanic membrane, in the absence of signs or symptoms of acute infection [2].

The exact mechanism for the pathogenesis of OME is not clearly understood. However, bacterial infection, Eustachian tube dysfunction, allergy and immunologic factors are reported as major causes in the literature [3]. Sinusitis and adenoid hypertrophy are also known to be involved in the disease process [4].

The fluid in otitis media with effusion is characterized by the presence of mucin glycoproteins, which are the macromolecules that are primarily responsible for the viscoelastic properties of middle ear fluid [5]. The factors affecting the viscosity have not been identified, even though some studies have discovered that the bacteria in serous fluid are more than in mucous [6].

The neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) are defined as potential markers of inflammation, and they can routinely be measured in peripheral blood without additional cost [7,8].

To the best of our knowledge, the NLR and PLR values in otitis media with effusion and their role in the viscosity of fluid in the middle ear have not been investigated. Considering this, our aim was to investigate the relationship between viscosity in otitis media with effusion and inflammation by considering NLR and PLR, which are measured routinely in complete blood count (CBC) tests without additional cost.

2. Materials and ethods

This retrospective study was performed on 81 patients who were admitted to the otolaryngology clinic. All of these patients underwent an operation for otitis media with effusion, between 2010 and 2015. Our study was approved by the local ethics

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committee and conducted in accordance with the ethical principles of the Declaration of Helsinki.

We reviewed the patients' files for their clinical, tympanometric and laboratory data. The patients were preoperatively classified with otoscopic examination and tympanometry. The otoscopic appearance of an effusion/bubble or abnormal tympanogram type B tympanogram (Fiellau—Nikolajsen's modified Jerger's nomenclature) was considered a positive screen [9,10]. The patients were divided into two groups according to their effusion type, as serous or mucoid, which was defined intraoperatively after myringotomy.

Only subjects with available preoperative complete blood counts (CBC) were included in the study. The preoperative NLR, PLR, white blood cell (WBC), platelet (PLT), neutrophil (NEUT), and lymphocyte (LYM) counts; demographic characteristics; and operation reports of the patients were analyzed. None had any signs or symptoms of acute infection or received antimicrobial therapy for at least two weeks prior to the procedure. The patients who had inflammatory, autoimmune, acute or chronic infectious disease, malignancy, hematological disorders, and a history of corticosteroid therapy, of ear surgery, and of a congenital anomaly, such as cleft palate, were excluded.

CBCs were obtained within the week prior to surgery. The NLR and PLR were calculated as a simple ratio between the absolute neutrophil/platelet and absolute lymphocyte counts. Blood samples were collected to determine the hematological parameters using a Sysmex 1000i analyzer (Sysmex, Kobe, Japan). CBC analysis was performed within 2 h after blood sampling.

Tympanostomy tube insertion was performed for all cases. The same surgeon (OFB) performed all of the procedures. With a surgical microscope, a myringotomy incision was made in the tympanic membrane. Under direct visualization, the effusion was aspirated and classified as serous or mucous. Adenoidectomy with/without tonsillectomy was performed, if necessary.

To compare the biomarker profile, 73 age-and sex-matched healthy people with no chronic illness who presented to our hospital for regular health checkups were also included in this study. None had acute inflammation.

2.1. Statistical analysis

SPSS for Windows version 20.0 was used for analysis (SPSS Inc., Chicago, IL, USA). Normallity tests were performed with the Shapiro Wilk and Kolmogorov Smirnov Tests. Parametric continuous variables were expressed as the mean ± standard deviation (SD) and compared using one way ANOVA, followed by the Sheffe post hoc-test. Parametric continuous variables were analyzed using the Kruskal Wallis test by the median (min–max), and the required post-hoc tests were applied using the Bonferroni–Dunn Test. Categorical data were presented as the frequencies and percentages were analyzed using the Pearson chi-square test.

To evaluate the serous and mucoid otitis media, NLR and PLR, receiver operating characteristics (ROC) curves were generated, and the areas under the curve (AUC) were measured and compared. The ROC statistical analyses were performed using Med Calc software. A p value <0.05 was considered statistically significant. The cut-off values of the parameters for discriminating between the NLR and PLR patient groups were determined using ROC analysis. For each value, the sensitivity and specificity for each outcome under study was evaluated.

3. Results

A total of 154 patients, 77 (50%) males and 77 (50%) females, were included in the current study. The demographic values were primarily compared. The serous group included 47 subjects (27 (57.4%) M/20 (42.6%) F), and the mucoid group included 34 (16 (47.1%) M/18(52.9%) F) subjects.

The control group included 73 (34(46.6%) M/39(53.4%) K) age- and sex-matched healthy subjects. There was no significant difference between the groups according to gender ($p = 0.281$). The mean age for the serous group was 7.89 ± 3.87, for the mucoid group was 6.79 ± 3.58, and for the control group was 7.41 ± 3.12 years. There was no significant difference between the groups according to age ($p = 0.346$).

Of the 81 patients, 34 (42%) had a thick (mucoid) effusion and 47 (58%) had a thin (serous or purulent) effusion, which was based on visual inspection of the fluid after myringotomy.

The comparison of the WBC, LYM, NEUT, PLT, NLR and PLR levels are shown in Table 1. For all of the measurements, at least one group was different from the other group (Table 2).

The WBC counts were significantly higher in the mucoid OME groups compared to the controls ($p = 0.022$). In contrast, no significant difference was observed between the serous-mucoid OME groups ($p = 0.416$) and serous-control groups ($p = 0.324$).

The LYM counts were significantly higher in the mucoid OME groups than the serous OME groups ($p = 0.003$). However, no significant difference was observed between the serous-control groups ($p = 0.232$) and mucoid-control groups ($p = 0.093$).

The NEUT counts were significantly lower in the control groups compared to the serous and mucoid OME groups ($p = 0.002$). However, the serous and mucoid groups were not statistically significant ($p = 0.999$).

The PLT counts were significantly lower in the mucoid groups than in the serous OME groups ($p = 0.004$). In contrast, no significant difference was observed between the serous- control groups ($p = 0.112$) and mucoid-control groups ($p = 0.203$).

The NLR levels of the serous OME groups were significantly higher than for the mucoid ($p = 0.036$) and control groups ($p < 0.001$). No significant difference was observed between the mucoid and control groups ($p = 0.257$).

The PLR levels varied significantly among the 3 groups. The serous OME groups were significantly higher than the mucoid ($p < 0.001$) and control groups ($p = 0.003$). Similarly, a significant difference was observed between the mucoid and control groups ($p = 0.043$).

Table 1
Differences between the three groups.

Variables	Serous (n:47)	Mucoid (n:34)	Control (n:73)	p^*
WBC[+]	8.18 ± 2.31	8.74 ± 1.70	7.66 ± 1.59	0.019
LYM[+]	2.34 ± 0.77	3.15 ± 0.84	2.81 ± 0.67	0.003
NEUT[#]	4.73(2.10–8.60)	4.47(3.47–6.97)	3.66(2.33–6.06)	<0.001
PLT[+]	296.85 ± 72.93	248.35 ± 63.74	271,91 ± 55.82	0.003
NLR[#]	1.81(1.08–4.20)	1.59(1.01–2.54)	1.29(0.81–2.89)	<0.001
PLR[#]	123.71(50.71–212.34)	82.61(39.95–93.75)	93.89(53.06–178.98)	<0.001

[+] One-way ANOVA.
[#] Kruskal Wallis parametric test. The results are presented as the Mean ± SD and Median (Min–Max). The Sheffe test was performed after ANOVA, and the Bonferroni–Dunn Test was performed after the Kruskal Wallis test.
[*] $p < 0.05$ was accepted as the significance level.