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Original Article

The neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, and mean platelet volume in patients with chronic otitis media and cholesteatoma

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Abstract

Aim: The neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and mean platelet volume (MPV) are widely used simple markers of subclinical inflammation. We explored whether these parameters were affected in patients with chronic otitis media (COM) with and without cholesteatoma.

Material and Methods: We studied 295 COM patients operated upon in our hospital and 135 healthy subjects were devoid of inflammation (controls). The patients were divided into two groups depending on cholesteatoma status: COM with cholesteatoma (the COMch group) and COM without cholesteatoma (the COM group). The groups were compared in terms of their NLRs, PLRs, and MPVs. The NLR and PLR were calculated by dividing the numbers of neutrophils and platelets by that of lymphocytes.

Results: Of the 295 patients, 149 and 146 had COMch and COM, respectively. No significant difference (P 0.05) was evident in any of NLR, PLR, or MPV between the study groups.

Conclusion: None of LNR, PLR, or MPV differed significantly in COM patients with and without cholesteatoma. Although inflammation plays an important role in cholesteatoma pathogenesis, any effect thereof is local rather than systemic.

Keywords: Chronic otitis media; cholesteatoma; neutrophil to lymphocyte ratio; platelet to lymphocyte ratio; mean platelet volume.

INTRODUCTION

Chronic otitis media (COM) is a recurrent infection of the middle ear and/or mastoid air cell tract in patients with tympanic membrane perforations. COM is of two general types: atticoantral COM (the more aggressive type, closely related to cholesteatoma) and tubotympanic COM (less aggressive). Symptoms commonly associated with chronic ear disease include hearing loss, otorrhea, a sense of aural fullness, otalgia, and vertigo (1).

Cholesteatoma is a non-neoplastic lesion of the temporal bone that can gradually expand to erode the bone of nearby structures. To date, surgery is the only option for COM patients with cholesteatoma [2). Although the extent of surgery depends on the severity of disease, conservative organ-saving approaches are increasingly preferred. However, more conservative approaches increase the risk of recurrence and the need for closer follow-up (3). In addition, tympanic membrane grafting renders otoscopic surveillance difficult. Thus, systematic second-look surgery is often performed 12–18 months after the first 'canal wall-up' tympanoplasty to detect and treat any residual lesions (4). Recurrent cholesteatoma is found in 10–44% of patients during second-look surgery more than half of all second-look operations are performed only to evaluate the middle ear (5).

Diffusion-weighted magnetic resonance imaging (DW-MRI) effectively detects cholesteatoma (4). There can be other diagnostic tools to detect cholesteatoma. The neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and mean platelet volume (MPV) are markers of subclinical inflammation that have been

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used as novel prognostic parameters in patients with varying cardiac and neoplastic disorders (6). The NLR has been employed to detect inflammation in patients with facial paralysis, sudden hearing loss (SHL), and chronic otitis media with effusion (COME) (6-8).

We calculated the NLRs, PLRs, and MPVs in COM patients with and without cholesteatoma.

MATERIAL and METHODS

This Study has been approved by the Research Ethics Committee and performed in accordance with accepted ethical standards (Istanbul Bakirkoy Sadi Konuk Training and Research Hospital, Ethics Committee, No: 2017/19, date: April 17th, 2017). We retrospectively reviewed the medical records of 402 consecutive patients who were diagnosed with COM and underwent surgery between January 2011 and July 2016. The inclusion criteria were: age 16–65 years, COM with or without cholesteatoma confirmed histopathologically after surgery, and a preoperative complete blood count with no indication of active infection (no elevation in erythrocyte sedimentation rate or C-reactive protein level, and a white blood cell count <10,000/mL). The exclusion criteria were: any history or clinical indication of an inflammatory, autoimmune, acute, or chronic infectious disease; cardiac or coronary artery disease; any malignant neoplasm; diabetes mellitus; chronic obstructive pulmonary disease; metabolic syndrome; amyloidosis; and/or chronic renal insufficiency. Of the 402 patients, 295 were ultimately included.

Patients were divided into two groups by cholesteatoma status: COM with cholesteatoma (the COMch group) and COM without cholesteatoma (the COM group). A total of 135 age- and sex-matched controls lacking acute inflammation and all diseases mentioned above served as controls. The latter subjects visited our hospital for routine health check-ups.

All preoperative blood data (white blood cell [WBC], neutrophil, lymphocyte, and platelet counts, and the MPV) were obtained in-house using an automated blood cell counter (XN-1000; Sysmex, Kobe, Japan). All samples were run in duplicate and the means were used in statistical analysis. The NLR and PLR were the simple ratios between the absolute neutrophil and lymphocyte counts, and the absolute platelet and lymphocyte counts. Statistical analysis was performed using the SPSS 22.0 Evaluation for Windows. Descriptive statistics were stated as mean (SD). Normal distribution of continuous variables was tested with Kolmogorov-Smirnov test. Chi-squared test was used for comparisons between categorical variables, and Mann-Whitney tests were used for continuous variables when comparing the groups. The statistically significant level was accepted as $P < 0.05$.

RESULTS

Of all 295 patients, 149 were diagnosed with COM with cholesteatoma (the COMch group) and 146 with COM without cholesteatoma (the COM group). The groups were similar in terms of both age and sex (both P values > 0.05). All hematological parameters (WBC, neutrophil, lymphocyte, and platelet counts, and the MPV) were within normal ranges and did not differ between the three groups (Table 1, Fig. 1).

Table 1. The hemogram results of the study groups.

		COMch group			COM group			Control group			P	
		Mean±s.d.		Median	Mean±s.d.		Median	Mean±s.d.		Median		
Age		38.7	±14.438	38.5	36.7	13.6	38.0	39.8	±15.347	39.0	0.093	K
Sex	Female	80	53.3%		68	46.6%		85	56.%		0.130	X^2
	Male	70	46.7%		82	56.2%		65	43.3%			
WBC		7.5	±1.5194	7.6	7.4	±1.4382	7.4	7.6	±1.4305	7.9	0.278	K
Lymphocyte		2.5	±0.5839	2.5	2.7	±0.7225	2.5	2.6	±0.6941	2.6	0.072	K
Neutrophil		4.5	±1.3169	4.4	4.2	±1.0907	4.0	4.5	±1.1326	4.5	0.081	K
PLT		243.2	±59.717	229.0	252.4	±60.199	249.0	243.0	±62.358	234.0	0.132	K
MPV		9.2	±0.9997	9.3	9.4	±1.0903	9.4	9.7	±7.8928	9.0	0.057	K
NLR		1.9	±0.7368	1.8	1.8	±0.6376	1.6	1.8	±0.524	1.7	0.102	K
PLR		10.0	±36.146	94.4	98.2	±30.496	96.4	97.8	±31.976	92.0	0.431	K

[K] Kruskal-Wallis (Mann-Whitney u test) / X^2 Chi-square test
COMch (Chronic otitis media with cholesteatoma), COM (Chronic Otitis Media without cholesteatoma),
WBC(White blood cell), PLT (Platelet), MPV (Mean Platelet volume)
NLR (The neutrophil-to-lymphocyte ratio), PLR (platelet-to-lymphocyte ratio).

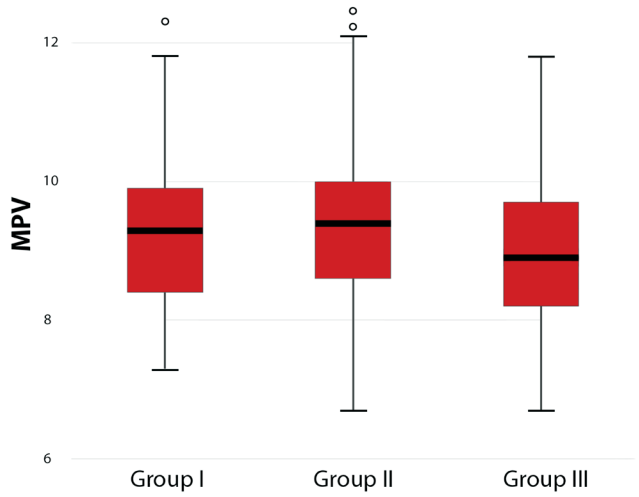

Figure 1. MPV in the COMch, COM and control groups.

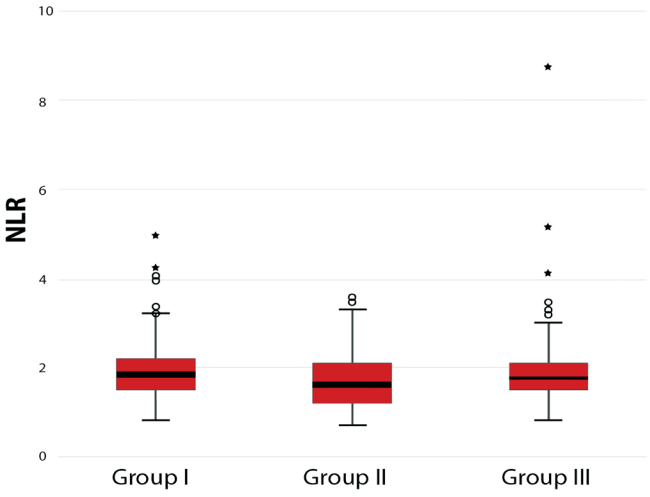

Figure 2. NLR values in the COMch, COM and control groups

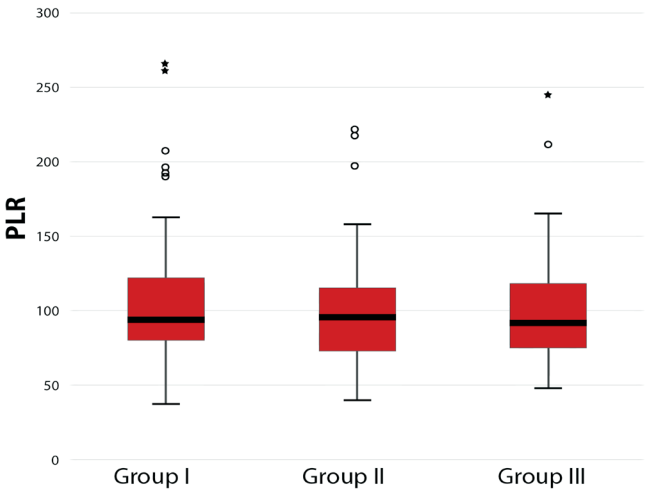

Figure 3. PLR values in the COMch, COM and control groups

The NLR of the COMch group was somewhat higher than those of the COM and control groups, but this was not statistically significant (P > 0.05) (Fig. 2). The PLR of the COM group was somewhat higher than those of the COMch and control groups but, again, the difference was not significant (P > 0.05)(Fig. 3).

DISCUSSION

Chronic suppurative otitis media (CSOM) is defined as a perforation of the tympanic membrane, with persistent drainage of pus from the middle ear, lasting at least 2 weeks (2). Globally, CSOM affects 65–330 million individuals. Over 90% of cases occur in the developing countries of Southeast Asia, the Western Pacific Region, and Africa (1). Cholesteatoma is one of the most important prognostic determinants of COM. Cholesteatoma can sometimes be difficult to detect, especially during postoperative follow-up. DW-MRI is effective in this regard, but more accessible and practical diagnostic tools are needed (4,9).

A cholesteatoma is a keratinized mass in the middle ear or mastoid, and may be either a primary lesion or develop secondarily to tympanic membrane perforation and COM (2). The pathogenesis thereof remains controversial. There are several theories of how acquired cholesteatoma develops, including the metaplasia, hyperplasia (proliferation), invasion (immigration), invagination (retraction pocket), and implantation theories; however, none explains all features of cholesteatoma pathogenesis (2). Eustachian tube malfunction, a small mastoid volume, and infection are thought to predispose individuals to cholesteatoma (10,11). Recently, cell-mediated immunity has been shown to be important, as has tissue destruction by (particularly) T-lymphocytes (12-14). In addition, biofilm formation on the keratin layer has been shown to be associated with cholesteatoma development (13). Biofilms of (usually) *Pseudomonas aeruginosa and Staphylococcus aureus* trigger chronic inflammation, cell proliferation, and bone resorption; and stimulate the production of inflammatory mediators (particularly interleukin (IL)-1β, IL-6, prostaglandin (PG) E2, and tumor necrosis factor alpha (TNF-α)] by neutrophils, lymphocytes, macrophages, and monocytes, thus increasing inflammation (13,14). Cytokines play significant roles in immune responses and inflammation. Recently, cytokines have been shown to initiate chronic inflammation and osteoclast recruitment, triggering the bone resorption characteristic of cholesteatoma (2,14,15). Chronic inflammation is thus in play.

Clinically, the peripheral blood leukocyte count is closely related to the extent of inflammation. An increase in leukocyte numbers reflects the immune response to malignancy, inflammation, and infection (6). The NLR, PLR, and MPV (markers of inflammation and immune status) are highly repeatable, inexpensive, and simple to calculate (6,7,16,17). The NLR and PLR are inflammatory parameters associated with poor prognoses in patients with peripheral arterial occlusive disease (16,18). The NLR serves as a prognostic marker in various cancers, including colon,

esophageal, gastric, ovarian, and breast cancer (16,17,19). In addition, the NLR may predict the short-and long-term mortality of patients with acute coronary syndrome. Recently, Ozbay et al. showed that the NLR of patients with peripheral vertigo (PV) was significantly higher than that of healthy subjects (20). This was considered to reflect stress-related inflammation, and suggested that the NLR could be used to monitor PV patients during follow-up. Kiliçkaya et al. found that the LNR of patients with pathological diagnoses of cholesteatoma, with and without bone erosion, was not significantly elevated (mean =1.94), concluding that cholesteatoma-induced inflammation was not systemic, but rather local (20).

We examined COM patients with and without cholesteatoma and, similarly, found that the NLR of the COMch group was not significantly greater than those of the COM and control groups (1.9, 1.8, and 1.8, respectively). In addition, the PLR and MPV did not differ between any of the three groups. Thus, cholesteatoma is not associated with a systemic response.

CONCLUSION

To the best of our knowledge, this is the first study to explore the three systemic parameters in patients with COM and cholesteatoma. The disease did not affect any parameter, and the NLR, PLR, and MPV cannot be used to detect cholesteatoma.

Competing interests: The authors declare that they have no competing interest.

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