ORIGINAL ARTICLE

The predictive effect of neutrophil-lymphocyte and platelet-lymphocyte ratios in the post-operative recurrence of temporomandibular joint ankylosis

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ABSTRACT

BACKGROUND: Reankylosis is a frequent pathology in patients who are operated for post-traumatic temporomandibular joint (TMJ) ankylosis. In the current practice, ankylosing spondylitis attacks are monitored with the increases in neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR). In this study, such a relation between TMJ reankylosis and increase in these ratios was evaluated.

METHODS: Patients who were operated between January 2010 and December 2019 for unilateral or bilateral TMJ ankylosis were included in this study. Temporomandibular gap arthroplasty with an interpositional silicone block was performed for each patient by the same operative team. Each patient had standard physiotherapy. All ages and genders were included in the study. Due to the complete blood count differences between children and adults, 18 years of age was used as a cutoff between the groups. A need for reoperation was accepted as reankylosis. The NLR and PLR of children without and with reankylosis and adults without and with reankylosis were compared.

RESULTS: Twenty-nine children and 38 adults were included in the study. Mean age of the children and adults were 10.8 and 37.3 years, respectively. Eleven children and eight adults had reankylosis. In patients with reankylosis, NLR and PLR were high significantly, regardless of age. In children, PLR was significantly higher in reankylosis patients. In adults, NLR was significantly higher in reankylosis patients.

CONCLUSION: PLR and NLR may be utilized for predicting reankylosis, respectively, in children and adults who were operated for ankylosis due to TMJ fractures.

Keywords: Ankylosis; neutrophil-lymphocyte ratio; platelet-lymphocyte ratio; reankylosis; temporomandibular joint.

INTRODUCTION

With respect to osseous anatomy, the temporomandibular joint (TMJ) is an intricate structure that is formed by the mandibular condyle and the glenoid fossa of the temporal bone.[1] The mandible articulates with bilateral temporal bones and the basic functions such as speaking and nutrition are dependent on the cooperation of both joints.[2]

TMJ ankylosis is the most frequent complication of untreated or suboptimally treated mandibular condyle fractures[3] and it may limit the interincisal mouth opening.[4] The ankylosis may be either unilateral or bilateral and the patients may lose their speaking and nutrition functions partially or totally.[4] The post-traumatic TMJ ankylosis may be seen at any age, including childhood.[4]

During the surgical treatment of the TMJ ankylosis, the aberrant ossification between the mandible and the temporal bone should be resected and an interpositional material should be placed between the bones to avoid their contact.[2,5–8] The interpositional material is dependent on the surgeon's pref-

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erence and it may be either autologous tissue or biocompatible foreign bodies such as silicone.[2,6] An early, efficient, and long-lasting physical therapy regimen should be followed to maintain the post-operative interincisal opening.[2]

Incomplete surgical resection, insufficient interpositional materials, and inadequate physical therapy may cause relapsing ankylosis.[4] However, recurrences may be seen despite successful surgical interventions and effective physical therapy regimens and reoperations are mandated in several patients.[3] Although some patients may be more prone to recurrences, a specific etiologic factor has not been defined.[3,9]

Ankylosing spondilitis is a disease model that is characterized by non-traumatic ankyloses and neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR) are utilized to monitor its severity and activity.[10–12] These ratios have not been utilized in interpreting the recurrences after the surgical treatment of post-traumatic temporomandibular bony ankyloses. The aim of this study was to assess the predictive effect of NLR and PLR in the recurrence of post-traumatic bony ankylosis of the TMJ.

MATERIALS AND METHODS

This study was approved by the Institutional Clinical Studies Ethics Committee with the approval number 2021/915. All patients provided informed consent that was approved by the Institutional Clinical Studies Ethics Committee.

The patients who were operated at a single institution between January 2010 and December 2019 were included in this study. All age and gender groups were included in the study. The following criteria were required for inclusion: Having a post-traumatic unilateral or bilateral TMJ osseous ankylosis, being treated with unilateral or bilateral gap arthroplasty with a silicon block interposition; having a complete blood count 2 weeks before the operation and not having an infectious disease during the complete blood count. The patients who were operated at a different institution or who were operated with another technique were excluded from the study. The patients with non-traumatic TMJ ankyloses, with fibrous ankyloses and with overt infectious disease during the complete blood count, were excluded from the study. Ankylosis was defined as a maximal interincisal mouth opening that was <3 mm and recurrence was defined as a need for reoperation.

All patients were operated by the same operation team and gap arthroplasty was performed. The aberrant bone that was between the mandible and the temporal bone was resected. The ipsilateral coronoid process was resected in all patients. The interosseous gap was reconstructed with a silicon block whose height was equal to the difference between the heights of the mandibular rami. An early physiotherapy regimen was initiated at the 1st post-operative week and all patients were instructed to stretch their TMJ s passively with the help of wooden tongue depressors.

Neutrophil, lymphocyte, and thrombocyte values are higher during childhood and they are prone to lowering with age.[13] These changes may be seen in NLR and thrombocyte lymphocyte ratios.[14] With respect to the changes in the complete blood count values, pediatric (younger than 18 years) and adult (older than or equal to 18 years) populations were evaluated separately. The mean NLR and PLR of the children without recurrences were compared with the ratios of the children with recurrences. The mean NLR and PLR of the adults without recurrences were compared with the ratios of the adults with recurrences.

Statistical Analysis

SPSS 22 software was used for the evaluation of the data. The data without normal distribution were analyzed with the Mann–Whitney U-test and the categorical data were analyzed with Chi-square test. The quantitative data were defined with mean, standard deviation, and median and the categorical data were defined with numbers and percentages. Further, evaluations were made with ROC, regression and correlation analyses. P<0.05 was accepted as statistically significant.

RESULTS

Sixty-seven patients were included in the study. Twenty-nine patients were under 18 years of age (children) and 38 patients were adults. The mean age of the children was 10.8±4 years (1–17 years) whereas the mean age of the adults was

Table 1. The distribution of the patients was made according to the age group and the recurrence status

	Number of patients	%
Age group		
Pediatric	29	43.3
Adult	38	56.7
Recurrence status		
No recurrence	48	71.6
Recurrence	19	28.4
Recurrence and age group		
Pediatric without recurrence	18	26.9
Adult without recurrence	30	44.8
Pediatric with recurrence	11	16.4
Adult with recurrence	8	11.9
Number of operations		
1	48	71.6
2	13	19.4
3	6	9.0
Total	67	100.0

37.3±13 years (19–76 years). There was recurrence in 11 children (11/29) and in eight adults (8/38). A single gap arthroplasty with silicone block interposition was performed in 13 patients and the operation was performed twice in six patients (Table 1). The mean follow-up period was 4 years (2–7 years).

When all the patients were evaluated regardless of their age, the mean NLR and PLR of the patients with recurrence were higher than the ratios of the patients without recurrence and the difference was significant (p=0.011). In the pediatric age group, the patients with recurrence had a higher mean PLR (p<0.001) and in the adult age group, the patients with recurrence had a higher mean NLR (p=0.021) (Table 2).

According to the logistic regression analysis that was independent of age, NLR and PLR were found to be predictive for recurrence (Omnibus test, p=0.005). The increases in NLR and PLR increased the risk of recurrence by 2.105 and 1.022 times, respectively. According to the ROC analysis that was independent of age, the areas under the curve were significant for both NLR (0.700) and PLR (0.744) values.

DISCUSSION

Mandibular condyle fractures may be complicated by osseous ankyloses which may recur despite appropriate management.[8] Microenvironmental changes of the TMJ and aberrations in the intracellular signaling pathways may cause the evolution of fibrous ankylosis to its osseous form and ankylosis recurrences.[8] Zhao et al.[15] evaluated the ankylosis tissues of animal models and humans; in fact, a numerical increase of macrophages inside the TMJ increased the ankylosis risk. They found that the interventions which decreased the macrophage count decreased the ankylosis risk.[15] In this study, histopathological examinations were not performed on the ankylosis tissues and neutrophil, platelet, and lymphocyte counts and their ratios were obtained from the peripheral blood. The recurrence risk was assessed with such basic tests.

Chen et al.[3] classified the patients with TMJ ankylosis relapse according to age groups and the pediatric patients were more prone to recurrence. In this study, the recurrence prevalence was 37.9% and 21% in the pediatric and adult groups, respectively, and the results were concordant with the literature. This difference between the age groups did not confound the

Table 2. The NLR and PLR values were compared with respect to the age group and the recurrence status of the patients

	Mean±Standard Deviation	Median (Range)	p
Neutrophil lymphocyte ratio			
Recurrence without age grouping			
No	1.44±0.52	1.36 (0.8–3.29)	0.011
Yes	1.93±0.73	1.75 (0.88–3.40)	
Recurrence with respect to age group			
Pediatric			
No	1.15±0.38	1.29 (0.28–1.59)	0.076
Yes	1.84±0.80	1.73 (0.88–3.08)	
Adult			
No	1.62±0.51	1.43 (1.12–3.29)	0.021
Yes	2.05±0.65	1.78 (1.45–3.40)	
Platelet lymphocyte ratio			
Recurrence without age grouping			
No	82.06±25.67	77.45 (39.70–151.25)	0.002
Yes	105.12±27.61	100.00 (67.10–155.00)	
Recurrence with respect to age group			
Pediatric			
No	63.77±15.29	62.25 (39.70–96.80)	<0.001
Yes	103.81±23.99	100.00 (73.30–142.50)	
Adult			
No	93.04±24.47	85.75 (62.50–151.25)	0.297
Yes	106.91±33.65	101.87 (67.10–155.00)	

NLR: Neutrophil lymphocyte ratio; PLR: Platelet lymphocyte ratio.

results of this study, because the patients were evaluated in two separate groups according to their age.

The resection of the osseous tissue between the temporal bone and the mandible and the application of the early physical therapy is among the main treatment principles of TMJ ankylosis.[5] There is not a single technique of treatment. In fact, gap arthroplasty may be performed alone or an interpositional tissue or medical material may be placed in the gap.[2,5,6] Furthermore, the joint may be reconstructed with a costochondral graft or an alloplastic joint prosthesis after the release of the ankylosis.[2,5] Al-Moraissi et al.[5] demonstrated that the gap arthroplasty with an interposition increased the interincisal mouth opening and decreased the ankylosis recurrence significantly, with respect to the techniques without an interposition. Besides, interpositional gap arthroplasty increased the interincisal mouth opening more than the costochondral graft technique.[5] Rozanski et al.[16] suggested to perform the gap arthroplasty technique for the pediatric patients due to the technical ease and they did not demonstrate a significant advantage of an interposition with an autologous tissue. Gupta et al.[6] compared the results of the interpositional silicone and autologous tissues and they did not find a significant difference. Thus, silicone interposition was suggested due to lack of donor site morbidity. In this study, gap arthoplasty with silicone block interposition was performed and the following advantages were observed: technical ease, maintained increase in interincisal mouth opening, decrease in recurrence risk, and lack of donor site requirement.

Neutrophil and PLR which are calculated from peripheral blood count are used for the diagnosis and surveillance of various diseases.[17,18] If the lymphocyte count is low relative to the other white blood cells, NLR and PLR will increase, indicating a loss of control in the inflammatory response.[17] These ratios are used to evaluate the severity and the prognosis of some infectious diseases such as bacteremia.[18] Furthermore, high NLR is utilized as a bad prognostic predictor in the cancers of the gastrointestinal system, the central nervous system, and the skin.[17] NLR and PLR are utilized in the surveillance of various rheumatologic diseases such as rheumatoid arthritis, Behçet's disease, familial Mediterranean fever, and systemic lupus erythematosus.[11,19] An increase in these ratios may demonstrate a reactivation of the rheumatic diseases and a novel damage at the organs, whereas a decrease in the ratios may show the efficacy of the treatment.[11]

Ankylosing spondylitis is one of the rheumatic diseases whose surveillance and treatment plan may be performed with NLR and PLR.[10,12,19–22] Although there are different results in the literature, high NLR and PLR are found in active disease.[10,12,19–22] Vertebral column and sacroiliac joints are affected in ankylosing spondylitis and TMJs are spared.[20] The hypothesis of this study was based on the relationship between the major joint ankyloses in ankylosing spondylitis and the increases in NLR and PLR. In this study, the relationship between the recurrence of the post-traumatic osseous TMJ ankylosis and these ratios were assessed and the predictive values of elevated PLR and the NLR were found in pediatric and adult populations, respectively. According to these results, the NLR and PLR may be utilized in the surveillance of the post-traumatic TMJ fracture patients.

The absolute values and ratios of the peripheral blood cells may vary with age.[13,14] Nah et al.[13] evaluated the peripheral blood samples of healthy individuals and they demonstrated the temporal change of peripheral blood values. Lee et al.[14] suggested the utilization of different cutoff values for NLR and PLR in pediatric and adult populations. In this study, the confounding effect of the temporal changes in NLR and PLR were prevented by evaluating pediatric and adult patients in separate groups.

To the best of our knowledge, no prior studies have been conducted on the predictive value of NLR and PLR in post-traumatic TMJ ankylosis recurrence. The performance of a standard surgery by the same surgeons, the presence of a standard physical therapy regimen, the high number of patients, and the long follow-up periods were the strong aspects of this study. The inability to detect specific cutoff values for NLR and PLR was the weakness of this study and it may be overcome by future studies that may be performed with larger cohorts. Furthermore, any potential correlation between the NLR and PLR values and the time of recurrence may be assessed in future studies. On the other hand, NLR and PLR of the peripheral blood may be affected by various factors and it would be more precise to calculate these ratios from the TMJ s samples. Due to the retrospective nature of this study, such samples were not evaluated and it may be regarded as another weakness of this study. Future prospective studies are required to assess the NLR and PLR of the joint samples such as the synovial liquid or the excisional biopsy specimen.

Conclusion

An inexpensive and easily accessible blood count is sufficient to calculate the neutrophil and PLR that are dependent on the age of the patient. The post-treatment recurrence of post-traumatic TMJ osseous ankylosis may be predicted by high PLR in pediatric patients and by high NLR in adult patients.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Temporomandibular eklem ankilozunun ameliyat sonrası nüksünde nötrofil lenfosit ve trombosit lenfosit oranlarının öngörü etkisi

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AMAÇ: Ankiloz nüksü, travma sonrası gelişen temporomandibular eklem (TME) ankilozuna yönelik ameliyat olan hastalarda sık görülen bir sorundur. Günümüzde, ankilozan spondilit alevlenmeleri, nötrofil (NLO) ve trombosit (TLO) lenfosit oranlarındaki artışlar ile takip edilmektedir. Bu çalışmada, TME ankiloz nüksü ve bu oranlardaki artış arasında benzer bir ilişinin olup olmadığı değerlendirildi.

GEREÇ VE YÖNTEM: Ocak 2010 ile Aralık 2019 arasında tek veya çift taraflı TME ankilozu nedeniyle ameliyat edilen hastalar çalışmaya dahil edildi. Her hastaya aynı ekip tarafından temporomandibular eklem boşluk artroplastisi ve araya silikon blok yerleştirilmesi uygulandı. Her hastaya aynı fizyoterapi uygulandı. Çalışmaya çocuk ve erişkin hastalar dahil edildi ve cinsiyet ayrımı yapılmadı. Çocuk ve erişkinler arasında tam kan sayımı farkı olduğundan 18 yaş gruplar arasında sınır olarak belirlendi. Yeniden ameliyat gereksinimi ankiloz nüksü olarak kabul edildi. Ankiloz nüksü olan ve olmayan çocukların NLO ve TLO'ları karşılaştırıldı. Ankiloz nüksü olan ve olmayan erişkinlerin NLO ve TLO'ları karşılaştırıldı.

BULGULAR: Çalışmaya 29 çocuk ve 38 erişkin dahil edildi. Çocukların ortalama yaşı 10.8 iken erişkinlerin ortalama yaşı 37.2'idi. On bir çocuk ve sekiz erişkinde ankiloz nüksü saptandı. Yaştan bağımsız olarak, ankiloz nüksü olan olguların NLO ve TLO'ları daha yüksekti. Çocuklarda olan nükslerde TLO anlamlı olarak yüksekken erişkinlerde NLO anlamlı olarak yüksekti.

TARTIŞMA: Temporomandibular eklem kırığına bağlı gelişen ankilozların cerrahisi sonrası çocuklarda TLO ve erişkinlerde NLO kullanılarak ankiloz nüksü öngörüsü yapılabilir.

Anahtar sözcükler: Ankiloz; ankiloz nüksü; nötrofil lenfosit oranı; temporomandibular eklem; trombosit lenfosit oranı.

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