

Can Red Blood Cell Distribution Width be a Potential Marker in the Decision to Perform Tonsillectomy?

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ABSTRACT

Objective: Tonsillectomy is one of the most common surgical procedures performed at ear, nose, and throat clinics. Chronic recurrent tonsillitis, obstructive tonsillitis, and halitosis are among the most common indications for surgery. Determining whether the infection is chronic and the patient's annual number of infections are important in estimating the necessity for surgery to be performed due to infectious causes. Red blood cell distribution width (RDW) is a numerical value present in normal complete blood count that provides information about erythrocytes and their dimensions. Studies in recent years have shown that RDW increases in chronic infections, hypoxia, and oxidative stress. This study investigated the changes in RDW in patients with chronic tonsillitis and the effect tonsillectomy has on this value by comparing RDW between patients scheduled for tonsillectomy and normal population and examining preoperative and postoperative changes in RDW.

Materials and Methods: Sixty-three patients scheduled for tonsillectomy due to recurrent tonsillitis aged 4–14 years were included in the study. The control group consisted of 60 subjects comparable in terms of age and sex. Hemoglobin level and RDW were recorded by collecting 2 ml of blood before surgery and at 4 months postoperatively from all patients.

Results: Preoperative RDW was significantly higher in the patient group than in the control group. Comparison of patients' preoperative and postoperative RDW revealed a significant decrease in RDW after surgery.

Conclusion: As a biomarker showing chronic infection in patients with tonsillitis, RDW can provide support to the clinician in deciding on surgery. However, this has to be confirmed in further studies with greater participation.

Keywords: Tonsillectomy, red blood cell distribution width, chronic recurrent tonsillitis

Introduction

Tonsillectomy is one of the most common surgical procedures performed at ear, nose, and throat clinics. Chronic recurrent tonsillitis, obstructive tonsillitis, and halitosis are among the most common indications for surgery [1]. However, the great majority of tonsillectomies is conducted due to infection-related tonsillitis. Determining whether the infection is chronic and the patient's annual number of infections are also important in estimating the necessity for surgery to be performed due to infections. A marker showing the presence of chronic infection will assist the clinician when deciding on surgery.

Red blood cell distribution width (RDW) is a numerical value present in normal complete blood counts and provides information about erythrocytes and their dimensions. This value showing erythrocyte variety in the circulation is generally used to determine the type of anemia [2]. However, studies in recent years have shown that RDW also increases under conditions of chronic infection, hypoxia, and oxidative stress [3].

The purpose of this study was to determine changes in RDW in patients who underwent tonsillectomy. We hypothesized that since it is a chronic infection, RDW in patients with tonsillitis would be higher than that in the normal population. To the best of our knowledge, no previous studies have examined the relationship between tonsillitis and RDW and the effect of tonsillectomy on RDW.

Materials and Methods

Patients who were scheduled for tonsillectomy due to recurrent tonsillitis at ear, nose, and throat clinics were included in the study. Approval was received from the ethics committee with the admission number 2017:1-3. Informed consent was obtained from parents of all patients. Subjects with a history of another chronic infection or with a chronic disease such as heart and lung disorders or diabetes mellitus were excluded from the study. The control group consisted of children compatible with patients in terms of age and sex presenting to hospital for reasons other than infection, such as acute minor traumas and undergoing complete blood counts. Two cubic centimeter of blood specimens were collected from all patients and placed in blood count tubes. After being kept at +4°C for 1 h, they were centrifuged at 3000 rpm for 10 min. Hemoglobin (Hgb) and RDW were studied from the plasma obtained using an autoanalyzer (Sysmex XN 9000 Japan).

Tonsillectomy was performed using the cold dissection method. Hgb levels and RDW were recorded at 4 months postoperatively with the collection of 2-cc blood.

Statistical analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA). 17.0 software. The Shapiro–Wilk test was used to check the normality of the data. One-way analysis of variance (ANOVA) was used to compare blood values between the control and patient groups. Post-hoc Tukey's test was used to determine the source of significant results after one-way ANOVA. The Mann–Whitney U test was used to compare independent values of the control and patient groups. P values of <0.05 were considered statistically significant for all tests.

Results

Sixty-three patients aged 4–14 years (7.6±2.7; 31 females and 32 males) were included in the study. The control group consisted of 60 subjects (28 females and 32 males) comparable in terms of age (6.96±2.5) and sex (p>0.05).

Blood values of the control and patient groups are summarized in Table 1. There was no significant difference in terms of Hgb levels between the control and patient groups. RDW was significantly different between the control, preoperative, and postoperative groups (p<0.001). Post-hoc Tukey's test was performed to determine the source of significance. The results are summarized in Table 2.

As seen from the table, preoperative RDW values were significantly higher in the patient group than in the control group. Comparison of patients' preoperative and postoperative RDW revealed a significant decrease in RDW after surgery. When postoperative values were compared with those of the control group, no significant difference was observed between the control and postoperative RDW values.

A receiver operating characteristics curve was plotted to establish the usefulness of RDW in the decision of tonsillectomy (Figure 1). The area under the curve was 0.709 and p<0.001, which means RDW may be a marker in the decision to perform surgery in chronic tonsillitis. An optimum cut-off point was calculated as 13.5 for RDW, which has 64% sensitivity and 66% specificity.

Discussion

In our study, preoperative RDW was found to be higher in patients scheduled for tonsillectomy than in the normal population. In addition, a decrease in RDW values was observed postoperatively, which decreased to normal values at 4 months postoperatively.

Tonsillectomy is one of the most common surgical procedures at ear, nose, and throat clinics. In the USA, more than 530,000 tonsillectomies are performed per year due to recurrent tonsillar infection and sleep-related breathing disorders. Tonsillectomies are performed in cases of obstruction, infection, suspected neoplasia, and halitosis. For infectious reasons of tonsillectomies, infection must be chronic and recurrent. The American Academy of Otolaryngology–Head and Neck Surgery guideline defines recurrent tonsillitis as three attacks in each of the preceding 3 years, five attacks in both of the preceding 2 years, or seven attacks in the preceding 1 year [4].

	Control	Preoperative	Postoperative
Hgb (g/dL)	13.3±1.2	13.2±0.8	13.4±1.2
RDW (%)	12.8±1.2	14.7±1.4	13±1.1

Hgb: hemoglobin; RDW: red blood cell distribution width

(I) GROUP	(J) GROUP	Mean Difference (I–J)	Std. Error	Sig.
Control	Preoperative	-.95646*	.21595	.000
	Postoperative	.12832	.28076	0.901
Preoperative	Postoperative	.82813*	.24386	.004

*: the mean difference is significant at the 0.05 level.

Red blood cell distribution width is a numerical value showing the variation in erythrocyte dimensions that can be obtained simply and economically. It is routinely used in the differential diagnosis of anemia. Several studies in recent years have shown elevation of RDW in diseases such as coronary artery disease, cerebrovascular diseases, heart failure, diabetes-related complications, obstructive sleep apnea (OSA) syndrome, and rheumatoid arthritis [3, 5-8]. A study has even shown that high RDW is correlated with mortality [9].

Nonoyama Hiroshi et al. [10] reported high RDW in patients with sudden hearing loss not exhibiting a likelihood for improvement and suggested that this might be associated with inflammation and oxidative stress in sudden hearing loss.

Similarly, Özsu et al. [3] reported high RDW associated with inflammation and oxidative stress resulting from hypoxia in patients with the OSA syndrome.

As these studies show, although the reason for the increase in RDW is uncertain, inflammation, hypoxia, and oxidative stress are implicated. RDW, which is closely correlated with inflam-

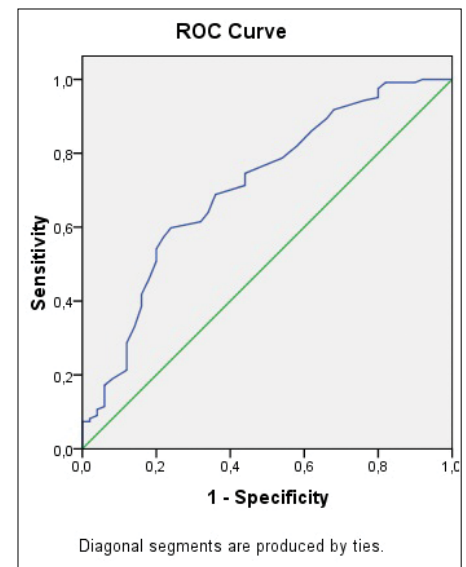


Figure 1. The receiver operating characteristics curve between the control and tonsillectomy group

matory markers, is independent of age, sex, and hematological variations [11]. Recent studies have shown that RDW is closely associated with the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) in patients with inflammation. However, since the life span of erythrocytes is 120 days, CRP and ESR are evidently more effective and significant in showing acute events than RDW. RDW should be more significant in chronic infection [12].

In this study performed based on the hypothesis that RDW may be an inflammation marker in chronic tonsillitis, RDW values were significantly elevated in patients scheduled for surgery. This elevation in RDW values may be an indicator of chronic infection in the decision of performing surgery. In addition, RDW decreased following surgery, and the values decreased to normal values at 4 months postoperatively. The usefulness of RDW in the decision of tonsillectomy was calculated to have 64% sensitivity and 66% specificity. Of course, the low sensitivity and specificity are not enough to recommend this test as a marker for chronic tonsillitis in an individual patient, but it may be a guiding light for upcoming studies. The most important limitation of our study is the small sample size. This may be a possible cause of low sensitivity and specificity.

To the best of our knowledge, this is the first study to investigate RDW in patients with tonsillitis. As a biomarker showing chronic infection in patients with tonsillitis, RDW can provide

objective support to the clinician when selecting surgery. However, this has to be confirmed in further studies with greater participation.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Atatürk University School of Medicine Clinical Research (No: 03).

Informed Consent: Written informed consent was obtained from patients' parents who participated in this study.

Peer-review: Externally peer-reviewed.

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References

1. Bluestone CD. Current indications for tonsillectomy and adenoidectomy. *Ann Otol Rhinol Laryngol* 1992; 101: 58-64. [\[CrossRef\]](#)
2. Gorelik O, Izhakian S, Barchel D, et al. Changes in Red Cell Distribution Width During Hospitalization for Community-Acquired Pneumonia: Clinical Characteristics and Prognostic Significance. *Lung* 2016; 194: 985-95. [\[CrossRef\]](#)
3. Ozsu S, Abul Y, Gulsoy A, Bulbul Y, Yaman S, Ozlu T. Red cell distribution width in patients with obstructive sleep apnea syndrome. *Lung* 2012; 190: 319-26. [\[CrossRef\]](#)

4. Randel A. Guidelines for Tonsillectomy in Children and Adolescents. *Fam Physician* 2011; 84: 566-73.
5. Siegler JE, Marcaccio C, Nawalinski K, et al. Elevated Red Cell Distribution Width is Associated with Cerebral Infarction in Aneurysmal Subarachnoid Hemorrhage. *Neurocrit Care* 2017; 26: 26-33. [\[CrossRef\]](#)
6. Tonelli M, Sacks F, Arnold M, Moye L, Davis B, Pfeffer M. Relation Between Red Blood Cell Distribution Width and Cardiovascular Event Rate in People With Coronary Disease. *Circulation* 2008; 117: 163-8. [\[CrossRef\]](#)
7. Magri CJ, Fava S. Red blood cell distribution width and diabetes-associated complications. *Diabetes Metab Syndr* 2014; 8: 13-7. [\[CrossRef\]](#)
8. Tecer D, Sezgin M, Kanik A, et al. Can mean platelet volume and red blood cell distribution width show disease activity in rheumatoid arthritis? *Biomark Med* 2016; 10: 967-74. [\[CrossRef\]](#)
9. Patel KV, Ferrucci L, Ershler WB, Longo DL, Guralnik JM. Red blood cell distribution width and the risk of death in middle-aged and older adults. *Arch Intern Med* 2009; 169: 515-23. [\[CrossRef\]](#)
10. Nonoyama H, Tanigawa T, Shibata R, et al. Red blood cell distribution width predicts prognosis in idiopathic sudden sensorineural hearing loss. *Acta Otolaryngol* 2016; 136: 1137-40. [\[CrossRef\]](#)
11. Yang W, Huang H, Wang Y, Yu X, Yang Z. High red blood cell distribution width is closely associated with nonalcoholic fatty liver disease. *Eur J Gastroenterol Hepatol* 2014; 26: 174-8. [\[CrossRef\]](#)
12. Peng YF, Zhang Q, Cao L, et al. Red blood cell distribution width: a potential maker estimating disease activity of ankylosing spondylitis. *Int J Clin Exp Med* 2014; 7: 5289-95.