

## ARAŞTIRMA / RESEARCH ARTICLE

# The relationship between the weather variables and secondary post-tonsillectomy haemorrhage

Ş. Civelek, İ. Sayın, Y. Helbest Akgül, C.Ş. Kalkavan, S. Turgut

### İklim değişiklikleri ile tonsillektomi sonrası kanamalar arasındaki ilişkinin incelenmesi

**Amaç:** Bu çalışmanın amacı iklim değişikliklerinin tonsillektomi sonrası kanamalar üzerine olan etkisinin değerlendirilmesidir.

**Yöntem:** 1 yıl içinde opere edilmiş olan bilateral tonsillektomi ve adenotonsillektomi hastalarının kayıtları retrospektif olarak incelenmiştir. Çalışmaya tonsillektomi sonrası kanaması olan tüm hastalar dahil edilmiştir. Çalışma süresi boyunca aylık minimum ve maksimum hava sıcaklığı ile nem oranını içeren bölgesel meteorolojik data Diyarbakır meteoroloji ofisinden elde edilmiştir. Tonsillektomi sonrası kanama ile hava değişiklikleri arasındaki ilişki incelenmiştir. İstatistiksel analiz SPSS testi (Chicago, IL, USA), tek örnekli t-test ve doğrusal ilişki analizi ile yapılmıştır.

**Bulgular:** 1210 hastanın kayıtları incelenmiştir. Toplam kanama oranı %5.52'dir. Yılın değişik aylarında meydana gelen kanama oranları açısından istatistiksel olarak anlamlı fark saptanmamıştır ( $p=0.99$ ). Doğrusal ilişki analizi ile ortalama maksimum sıcaklık, ortalama minimum sıcaklık ve ortalama nem oranı ile tonsillektomi kanaması arasında istatistiksel fark saptanmamıştır (sırasıyla  $p=0.47$ ,  $p=0.06$ ,  $p=0.71$ ).

**Sonuç:** İklim değişikliklerinin tonsillektomi sonrası kanama üzerine olan etkisi olduğu savunulan yayınlar sınırlı sayıda ve tutarsızlık gösterir. Bu çalışma  $-3.3$  to  $40.9$  °C derece arasında değişen sıcaklık değişiklikleri ile tonsillektomi sonrası kanamalar arasında ilişki olmadığını göstermiştir.

**Anahtar Sözcükler:** Tonsillektomi, kanama, iklim, sıcaklık, nem.

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Şenol Civelek, MD, Can Şinasi Kalkavan, MD; Suat Turgut, MD  
Department of Otolaryngology-Head and Neck Surgery, Şişli Etfal Teaching and Research Hospital, Istanbul

İbrahim Sayın, MD; Yekta Helbest Akgül; MD  
ENT Clinic, Diyarbakır Government Hospital, Diyarbakır

### Abstract

**Objectives:** The aim of this study is to evaluate the effect of weather conditions on post-tonsillectomy haemorrhage.

**Methods:** One-year period retrospective chart review. The charts of all patients who underwent bilateral tonsillectomy or adenotonsillectomy were reviewed. All patients with secondary post-tonsillectomy haemorrhage were included. The local meteorological data for the duration of the study including monthly minimum, maximum temperatures and relative humidity were obtained from the meteorological watch office in Diyarbakır. The relationship between secondary post-tonsillectomy haemorrhage and weather variables was studied. Statistical analysis was performed using SPSS for Windows version 13 (Chicago, IL, USA). One sample t-test and linear regression analysis were performed.

**Results:** 1210 consecutive patients' charts were reviewed. Overall haemorrhage rate was 5.52%. There was no statistical significance in secondary haemorrhage rates between different months of the year ( $p=0.99$ ). Linear regression test revealed no statistical association between mean maximum temperature, mean minimum temperature, mean relative humidity and secondary haemorrhage rates ( $p=0.47$ ,  $p=0.06$ ,  $p=0.71$ , respectively).

**Conclusion:** Literary data regarding the effect of weather on post-tonsillectomy haemorrhage is limited and shows inconsistency. This study shows that there is no correlation between post-tonsillectomy haemorrhage and weather variables, even with a fluctuating range of  $-3.3$  to  $40.9$  °C in temperature.

**Key Words:** Tonsillectomy, haemorrhage, weather, temperature, humidity.

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## Introduction

Post-tonsillectomy haemorrhage was and is still a dreaded complication for ENT specialists.<sup>1</sup> To date, numerous reports have tried to describe certain factors associated with posttonsillectomy haemorrhage,<sup>1-4</sup> including infection, experience of the surgeon, age and gender of the patient, the use of anti-inflammatory drugs, surgical technique (hot versus cold), volume of intraoperative blood loss, hematologic parameters, postoperative blood pressure and the presence of sleep apnea. However, few of these factors have been consistently found to be of statistical significance.<sup>5,7</sup> Among these reports, a point where literature has failed to have questioned is the influence of weather on post-tonsillectomy haemorrhage. Although there are studies reporting that the posttonsillectomy haemorrhage rate is higher in warmer months<sup>5,8,9</sup> there are also some studies that oppose this theory.<sup>3,10,11</sup> During extensive search of literature we were able to find only one study directly focused on the influence of weather on posttonsillectomy haemorrhage.<sup>10</sup>

Tonsillectomy operations were performed throughout the entire year of 2005 at the ENT Clinic in Diyarbakır State Hospital. We aimed to show the association between weather variables and secondary post-tonsillectomy haemorrhage. In this article, we report the posttonsillectomy haemorrhage rates of a region, where outside temperatures vary from -3.3 to 40.9 °C throughout the year and analyze the correlation between weather variables and secondary post-tonsillectomy haemorrhage.

## Materials and Methods

The study was performed at the ENT Clinic in Diyarbakır State Hospital. A retrospective study was undertaken from September 2005 to August 2006. The charts of all patients (adults and children) who underwent bilateral tonsillectomy or adenotonsil-

lectomy were reviewed. All patients with secondary posttonsillectomy haemorrhage were included in the study. Preoperative studies included a complete blood count, coagulation profile and serologic tests. Risk factors for hemorrhage (hypertension, intake of oral anticoagulants) were corrected preoperatively and patients with persisting abnormal values were excluded from the study. Peri-operative antibiotics were administered and the operations were carried out by eight ENT specialists in Diyarbakır state hospital. Eating or drinking was prohibited for 6 hours after surgery and patients were kept hospitalized for one day postoperatively. Local meteorological data for the duration of the study including monthly minimum and maximum temperatures, and relative humidity values were obtained from the meteorological watch office in Diyarbakır. The relationship between secondary post-tonsillectomy haemorrhage and these weather variables were evaluated. Secondary hemorrhage in our study was defined as a postoperative bleeding episode occurring after the first 24 hours of surgery. Each patient with a history of bleeding (regardless of the intensity) after discharge, was re-admitted for overnight observation. Our primary objective in patients with post-operative bleeding was to stop the bleeding without having to re-operate on the patient. If the haemorrhage was considered severe or was continuous despite medical measures, the patient was taken to the operating room to control the haemorrhage under general anesthesia. All patients admitted with post-tonsillectomy haemorrhage were treated with intravenous antibiotics, fluids, hydrogen peroxide gargles and appropriate analgesics. A complete blood count was obtained from each patient. Patients administered to our ward with postoperative haemorrhage were discharged on the basis of their general condition, hemoglobin level and state of wound healing.

Statistical analysis was performed using SPSS for Windows version 13 (Chicago, IL, USA). All data was expressed as mean+SD. One sample t- test was used to determine the significance within the secondary hemorrhage rate group. Linear regression analysis was performed to identify the relation between the mean maximum temperatures, mean minimum temperature, and mean relative humidity and secondary hemorrhage rates. Confidence interval was 95% and p value less than 0.05 was considered to be significant.

## Results

The charts of 1210 patients who underwent tonsillectomy or adenotonsillectomy were reviewed. The mean age of the study population was 11.5 years (range 3-45). 58.1% (704) percent of patients were female. 70.4% (853) percent of patients were children aged 16 years or under.

Postoperative bleeding from the tonsillar fossae occurred in 67 patients. 61.1% (41) of these patients were female. The overall haemorrhage rate was 5.52%. In 37.3% (26) of patients, haemorrhage had

stopped upon admission. In 31.3% (21) of the patients, haemorrhage had to be controlled under general anesthesia. The longest delayed bleeding occurred eleven days after surgery. A total of 3 (4.4%) patients received blood transfusions however ligation of the external carotid artery was not required in any of the patients. There was no mortality in our series.

The monthly mean maximum/minimum temperatures, mean relative humidity and monthly secondary haemorrhage rates are shown in Table 1 and Figure 1. There was no statistical significance in secondary hemorrhage rates between various months of a year (p=0.99).

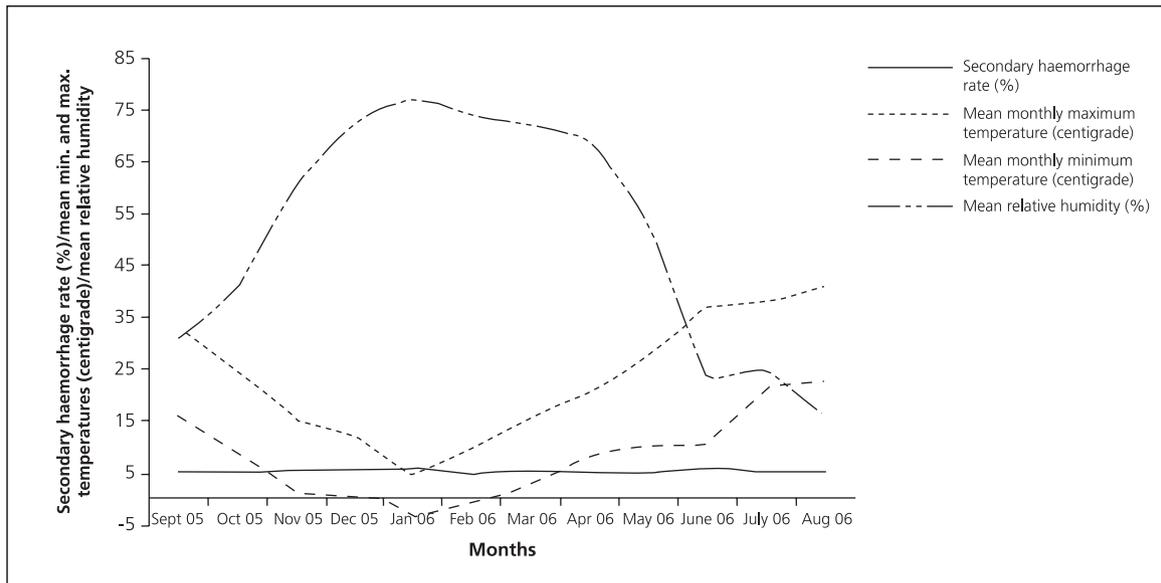
Linear regression tests revealed no statistical association between mean maximum temperature, mean minimum temperature, mean relative humidity and secondary haemorrhage rates (p=0.47, p=0.06, p=0.71, respectively).

## Discussion

The first description of tonsil surgery is reported in Hindu medicine in 1000BC.<sup>12</sup> Around AD30 Aulus

**Table 1.** Monthly secondary post-tonsillectomy haemorrhage rates and weather variables.

Months	No of tonsillectomies (n)	Secondary haemorrhage rate (%)	Mean monthly maximum temperature (°C)	Mean monthly minimum temperature (°C)	Mean relative humidity (%)
September 2005	112	6 (5.35%)	(32.8)	(16)	(30.9)
October 2005	98	5 (5.10%)	(24.7)	(8.7)	(40)
November2005	103	6 (5.82%)	(15)	(1.3)	(60.4)
December2005	123	7 (5.59%)	(11.9)	(0.6)	(72.5)
January 2006	136	8 (5.88%)	(4.4)	(-3.3)	(77.1)
Februray 2006	109	6 (5.50%)	(9.6)	(-0.4)	(74)
March 2006	89	5 (5.61%)	(15.9)	(2.4)	(72.1)
April 2006	111	6 (5.40%)	(20.6)	(8.6)	(68.9)
May 2006	93	5 (5.37%)	(27.5)	(10.1)	(53)
June 2006	85	5 (5.88%)	(37)	(10.4)	(23)
July 2006	77	4 (5.19%)	(38.1)	(21.8)	(25)
August 2006	74	4 (5.40%)	(40.9)	(22.5)	(16)



**Figure 1.** The graph depicts the monthly alterations in secondary haemorrhage rates (%), mean min. and max. temperatures (°C) and relative humidity (%).

Cornelius Celsus performed tonsillectomy with the use of his fingernails.<sup>4,7</sup> In *De Re Medicina*, he was the first to address the management of post-operative bleeding ‘... wash them with vinegar and anoint the wound with styptic application...’.<sup>12</sup>

The evolution of surgical techniques over 3000 years has decreased complication rates immensely. However haemorrhage is still accepted a significant risk regarding tonsil surgery.<sup>1,2</sup> Despite numerous efforts to explain certain risk factors of post-operative haemorrhage after tonsillectomy, results were mostly inconsistent and sometimes not comparable.<sup>13</sup> It has also been reported that the skill and experience of the surgeon, operative technique, study design, data collection, demographic factors, have individual influence on the results in different studies. Among these reports, data on the effect of weather are uncommonly reported and no conclusions can be derived to define a direct correlation between weather variables and post-tonsillectomy haemorrhage.

The incidence of haemorrhage varies according to different studies.<sup>5</sup> In most recent reports the post-tonsillectomy haemorrhage rate was reported with a range of 2% to 4%.<sup>4</sup> Haemorrhage rates in our study were relatively higher than in these studies. This could be due to the fact that the term of ‘haemorrhage’ varies according to studies. When questioning patients directly the post-tonsillectomy haemorrhage rates can rise up to 18%.<sup>14</sup> Retrospective design of the study did not allow questioning of the patients. In our study any patient referring to hospital with a history of bleeding was regarded as postoperative haemorrhage. It is well known that there is a risk of subsequent haemorrhage after tonsillectomy. Wei et al.<sup>13</sup> reported a subsequent haemorrhage rate of 12% in his study in which patients were re-admitted for overnight observation. Among these patients 37.3% (26) percent of haemorrhages had stopped upon admission.

The region of Diyarbakır is suitable to initiate a study where the effect of weather on post-tonsillectomy

tomy haemorrhage is sought as fluctuation in weather variables is distinct for this region 1210 tonsillectomies were performed during the study period. The fact that our study group had such a substantial volume was also convenient for the evaluation of the effect of weather variables on post-tonsillectomy haemorrhage and allowed for a powerful statistical analysis.

Room temperature in the operating room where tonsillectomies are performed and the room where the patient will stay after the procedure do not show major differences in medical practices around the world. However, the temperature the patient is exposed to after tonsillectomy in her/his home can show great variability. Therefore, in our study, secondary post-tonsillectomy haemorrhage rates were assessed to show the influence of the weather.

In relevant literature only one report directly investigated a possible correlation between weather variables and post-tonsillectomy haemorrhage.<sup>10</sup> Lee et al. reviewed 348 patients and found a negative correlation between secondary haemorrhage rate and average monthly temperature and water vapour pressure. In that report post-tonsillectomy haemorrhage rate was higher in colder months. They concluded that infection (viral pharyngitis) was the possible cause of this finding. This study was lacking in some aspects including the fact that the highest mean temperature was 20.4 °C which is very close to room temperature (min 6.4-max20.4). This highest temperature could be regarded as a normal temperature in some regions, whereas the highest temperature can be as high as 40.9 C, as in our region. We believe that a range of -3.3 to 40.9°C will better show the effect of weather conditions. In addition to this, the sample size is relatively small in that study and statistical analysis could contain bias. In contrast, Roberts et al.<sup>8</sup> found an increase in risk for warmer months between May to July and high-

lighted the month of operation as a risk for post-tonsillectomy haemorrhage. Some recent reports also support this finding.<sup>5,9</sup>

Collision and Matller<sup>5</sup> found an increase in haemorrhage rates in late spring and summer. They noted that no definitive conclusions could be drawn for this observation in the previous studies. They “reasonably inferred” a hypothesis ‘... early return to vigorous activity makes delayed bleeding more likely...’

Sloughing of the superficial eschar is regarded as the provoking event in post-tonsillectomy haemorrhage.<sup>4</sup> Although the cause of secondary haemorrhage is less certain, two possible factors are commonly accepted as possible factors for late posttonsillectomy haemorrhage: the residual tonsillar tissue in the tonsillar bed and infection.<sup>4,10</sup> In literature no correlating incidence of post-tonsillectomy haemorrhage due to residual tonsillar tissue has been reported.

Upper respiratory tract infections are higher in colder months.<sup>10</sup> If infection is found, then this may explain why the posttonsillectomy haemorrhage can be higher in colder months. Most of our patients came from a lower socio economical status and their general individual care was poor. Antibiotic prophylaxis was provided for 3 days after surgery for all patients. This may be a factor for reduced haemorrhage rates in colder months. However the relation between infection and secondary haemorrhage has not been clearly described.<sup>3,7</sup> Most of the cultures from bleeding tonsil beds have been found to be negative.<sup>7</sup>

In our study we did not observe an increase in post-tonsillectomy haemorrhage in warmer or colder months. As a conclusion, it is evident that there is no association between the weather condition and post-operative bleeding after tonsillectomy. Therefore, it is not reasonable to make seasonal choices for the performance of tonsillectomy.

## Conclusion

Our study showed that there is no statistically significant correlation between weather variables and secondary post-tonsillectomy haemorrhage. We concluded that performing tonsillectomies throughout the entire year, regardless of the outside temperature, is safe. Additional studies may be helpful in explaining the effect of weather on post-tonsillectomy haemorrhage.

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### Conflict of interest statement:

No conflicts declared.

### Correspondence: Şenol Civelek, MD

Hukukcular Sitesi A-4 Blok  
Kat: 1 Daire: 5 Yeni Levent  
Beşiktaş 34330 İSTANBUL  
Phone: +90 532 455 50 28  
Fax: +90 212 531 85 16  
e-mail: scivelek@hotmail.com