Research Article / Araştırma Makalesi

# The Importance of Refractive Status and Axial Length in Patients with Subconjunctival Hemorrhage
## Subkonjonktival Kanaması Olan Hastalarda Refraktif Durum ve Aksiyel Uzunluğun Önemi

Erdogan Yasar, Ugur Gurlevik

Aksaray Faculty of Medicine, Ophthalmology Department, Aksaray, Turkey

**Abstract:** Subconjunctival hemorrhage(SCH) is a painless disease that occurs as a result of the localized extravasation of blood to subconjunctival tissue and episcleral space by suddenly rupturing conjunctival vessels. Our aim is evaluate the refractive status, axial length and anterior segment parameters in patients with subconjunctival hemorrhage in this study. A fifty-one eye of 51 patients with subconjunctival hemorrhage and 40 eyes of 40 healthy individuals were enrolled in this prospective study. In detail, systemic diseases, used drugs, and other risk factors were questioned. After demographic questioning, a detailed biomicroscopy eye examination was performed for risk factors. Then refractive error, intraocular pressure, axial length, lens thickness, central corneal thickness, and anterior chamber depth were measurements performed. The mean age of patients with SCH was 49.4±6.8 (28-59) and the mean age of the control group was 50.4±6.8 (32-57). In terms of risk factors of SCH, the patients were divided into 3 groups that had sufficient statistical analysis (HT, use of anticoagulants and history of Valsalva). According to results, a significant difference was found between patients with HT and control groups in terms of spherical refraction (hyperopia) (p<0.001), short axial length (p<0.001) and narrow anterior chamber depth (p<0.001). In addition a significant negative correlation between axial length and SCH repeat number (p= 0.036, r =-0.544). No significant difference was detected between anticoagulant usage-Valsalva patients and the control group in terms of refractive error, anterior segment parameters and axial length(p>0.05). If the hyperopia, short axial length, and narrow anterior camera are detected in the examination of patients with SCH, the patients should be investigated in detail in terms of HT. In addition, eye related parameters were found to be important in SCH etiology.

**Keywords:** Subconjunctival hemorrhage, hyperopia, axial length, hypertension

**Özet:** Subkonjonktival kanama (SKH), konjonktival damarların aniden yırtılması ile kanın subkonjonktival dokuya ve episkleral boşluğa lokalize sızması sonucu ortaya çıkan ağrısız bir hastalıktır. Bu çalışmada amacımız subkonjonktival kanamalı hastalarda refraktif durum, aksiyel uzunluk ve ön segment parametrelerini değerlendirmektir. Bu prospektif çalışmaya subkonjonktival kanaması olan 51 hastanın 51 gözü ve 40 sağlıklı bireyin 40 gözü dahil edildi. Ayrıntılı olarak sistemik hastalıklar, kullanılan ilaçlar ve diğer risk faktörleri sorgulandı. Demografik sorgulamadan sonra risk faktörleri için ayrıntılı biyomikroskopi göz muayenesi yapıldı. Daha sonra kırma kusuru, göz içi basıncı, eksenel uzunluk, lens kalınlığı, santral kornea kalınlığı ve ön kamara derinliği ölçümleri yapılarak sonuçlar kaydedildi. SKH'li hastaların yaş ortalaması 49.4±6.8 (28-59) ve kontrol grubunun yaş ortalaması 50.4±6.8 (32-57) idi. SKH risk faktörleri açısından hastalar yeterli istatistiksel analize sahip 3 gruba ayrıldı (HT, antikoagülan kullanımı ve Valsalva öyküsü). Sonuçlara göre, HT'li hastalar ile kontrol grupları arasında hipermetrop (p <0.001), kısa aksiyel uzunluk (p<0.001) ve dar ön kamara derinliği (p<0.001) açısından anlamlı bir fark saptandı. Ek olarak, aksiyel uzunluk ile SKH tekrar sayısı arasında anlamlı negatif korelasyon(p=0.036, r=-0.544) saptandı. Antikoagülan kullanımı ve Valsalva öyküsü olan hastalar ile kontrol grubu arasında kırma kusuru, ön segment parametreleri ve aksiyel uzunluk açısından anlamlı fark bulunmadı (p> 0.05). SKH'li hastaların muayenesinde hipermetrop, kısa aksiyel uzunluk ve dar ön kamara tespit edilirse, hastalar HT açısından ayrıntılı olarak araştırılmalıdır. Ek olarak SKH etiyolojisinde gözle ilgili parametrelerin de önemli olduğu bulunmuştur.

**Anahtar Kelimeler:** Subkonjonktival kanama, hipermetrop, aksiyel uzunluk, hipertansiyon

***ORCID ID of the author:*** E.Y 0000-0001-5129-9397, U.G 0000-0003-2965-481X

**Correspondence:** **Erdoğan YASAR-** Aksaray Faculty of Medicine, Ophthalmology Department, Aksaray, Turkey
e-mail: dr_erdoganyasar@hotmail.com

## 1. Introduction

Subconjunctival hemorrhage (SCH) is a painless disease that occurs as a result of the localized extravasation of blood to subconjunctival tissue and episcleral space by sudden rupturing conjunctival vessels (1-2). Conjunctiva consists of many small and fragile blood vessels that can be easily ruptured. The fragility of conjunctival vessels increases with age and vascular diseases such as hypertension (HT), diabetes and atherosclerosis (3). Prevalence of non-traumatic SCD is estimated 0.8-2.9% according to various studies (4-6).

The most common causes for SCH are trauma and contact lens-induced injury in younger patients, whereas hypertension is the main cause in older patients and HT frequency was found 31.2% - 51% in studies (4-5,7). The other common causes of SCH are the usage of drugs ( anticoagulants, NSAIDs and antihistamines) (6,8) and increasing of venous pressure due to Valsalva (severe coughing-vomiting-sneezing)(3). In addition to all, the presence of diabetes (1), bleeding disorders(9), conjunctivochalasis (10), infected conjunctiva (11), ocular amyloidosis (12), conjunctival tumors (13), and carotid-cavernous fistula (14) are determinated in etilogy.

It is not known why SCH did not occur in all patients with these risk factors. To the best of our knowledge, there is no study in the literature on this subject with detailed eye measurements. For this reason, we investigated refractive errors, axial length and anterıor segment parameters in patients with SCH.

## 2. Materials and Methods

Fifty-one eyes of 51 patients with SCH and 40 eyes of 40 healthy individuals were included in this prospective study. All of the study procedures were performed under the Declaration of Helsinki. Written informed consent was obtained from all subjects before the examination and The Ethical Committee approvement was obtained.

Exclusion criteria for both groups were a presence of traumatic SCH, multiple risk factor presence for SCH at the same time (HT with the use of anticoagulant), cataract, keratitis, corneal scar, uveitis, a history of ocular refractive surgery, cataract surgery or vitreoretinal surgery, use of topical or systemic drugs that may affect the refractive error, a history of systemic disease affecting the refractive error.

In detail, systemic disease (HT, diabetes mellitus, bleeding disorders), used drugs(anticoagulants, NSAIDs and antihistamines) and other risk factors (severe coughing-vomiting-sneezing) were questioned. After demographic questioning, the blood pressure (BP) of the patients was measured by an expert nurse in a sitting position with an aneroid sphygmomanometer after a rest of 15 minutes. In HT patients with systolic BP>140 mmHg and/or diastolic BP> 90 mmHg, SCH was thought to due to HT. In other patients, those with systolic>140 mmHg and/or diastolic>90 mmHg on two different measurements were considered HT and referred to a cardiologist (15-16).

Detailed biomicroscopy eye examination was performed to all participants for conjunctivochalasis, infected conjunctiva, ocular amyloidosis, conjunctival tumors. The refractive error measurement was performed with Tonoref ™ III (Nidek Co. Ltd. Japan) auto refractometer. Spherical equivalent (SE) was used a refractive error and SE value was recorded as spherical value + cylindrical value /2. Intraocular pressure was measured with Icare tonometer (Icare; Finland Oy). Axial length and lens thickness measurements were performed with Lenstar optical biometer (Lenstar APS, Haag-Streit Koeniz, Switzerland). Central corneal thickness and anterior chamber depth measurement were performed with corneal topography (Sirius, Costruzione Strumenti Oftalmici, Firenze, Italy). Conjunctiva was divided into 4 quadrants depending on the localization of SCH and one or more involvement was recorded such as superior-inferior-temporal-nasal localization.

*Statistical Analysis*

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS)version 23.0 for Windows (SPSS Inc., Chicago, IL. The normality of the data distribution was evaluated by the Shapiro-Wilk test. An independent t-test test was used to compare the mean of numeric variables between the two groups. One-way ANOVA and posthoc tests were used to compare the mean of numeric variables between the multiple groups. Pearson correlation analysis was used to estimate the linear relationship between continuous variables. The p-value was statistically significant at 0.05 or smaller.

## 3. Results

Five of the 51 patients were excluded (2 have diabetes mellitus, 2 have adenoviral conjunctivitis, 1 has the bleeding disease) from the study because there were not enough patients to perform statistical analysis in terms of these diseases. The mean age of 46 patients with SCH was $49.4 \pm 6.8$ (28-59) and the mean age of the control group was $50.4 \pm 6.8$ (32-57) (p>0.05). Of the 46 patients with SCH, 28(60.9%) were male and 18(39.1%) were female. 22(55.0%) were male and 18(45.0%) were female in 40 patients of the control group. In terms of risk factors of SCH, the patients were divided into 3 groups that had sufficient statistical analysis (HT, use of anticoagulants and history of Valsalva). Of the 46 patients, 21(45.7%) had HT, 14 (30.4%) had anticoagulant use and 11(23.9%) had patients with a history of Valsalva.

The mean age of 21 HT patients was $54.2 \pm 5.6$ (35-58) and 13 (61.9%) were female and 8 (38.1%) were male. 12 (57.1%) of the right eye and 9 (42.9%) of the left eye involvement was detected. The mean number of involved quadrant was $1.95 \pm 0.94$. The mean number of SCH repeats was $1.4 \pm 0.9$. Comparison of HT patients and control group according to refractive error, anterior segment findings, and axial length measurement results are shown in Table 1. According to these results, a significant difference was found between patients with HT and the control groups in terms of spherical refraction (hyperopia) (p<0.001), short axial length (p<0.001) and narrow anterior chamber depth (p<0.001).

**Table 1.** Comparison of HT patients and control group

| Parameter | Patients with Hypertension( n=21) Mean ± SD | Control group (n=40) Mean ± SD | p |
|---|---|---|---|
| Spherical equivalent | +0.71 ± 0.88 | -0.45 ± 1.05 | **<0.001** |
| Axial Lenght (mm) | 22,40 ± 0,57 | 23.74 ±1.11 | **<0.001** |
| Central corneal thickness(µm) | 549.9 ±27.62 | 528.4 ±29.8 | >0.05 |
| Anterior chamber depth(mm) | 2.53 ±0.25 | 2.99 ±0.27 | **<0.001** |
| Lens thickness(mm) | 3.85 ± 0.37 | 3.73 ± 0.33 | >0.05 |
| İntraocular pressure(mmHg) | 16.5 ± 2.7 | 15.7 ± 2.1 | >0.05 |

The mean age of 14 anticoagulant agent usage patients was $52.4 \pm 5.2$(39-57) and 9 (%64.3) were male and 5 (35.7%) were female. 8 (57.1%) of the right eye and 6 (42.9%) of the left eye involvement was detected. The mean number of involved quadrant was $1.86 \pm 0.66$. The mean number of SCH repeats was $1.5 \pm 0.7$. Comparison of anticoagulant usage patients and control group according to refractive error, anterior segment findings, and axial length measurement results are shown in Table 2. According to these results, no significant difference was detected between anticoagulant usage patients and control groups in terms of refractive error, anterior segment parameters and axial length (p>0.05).

**Table 2.** Comparison of anticoagulant usage patients and control group

| Parameter | Patients with anticoagulant usage (n=14) Mean ± SD | Control group (n=40) Mean ± SD | p |
|---|---|---|---|
| Spherical equivalent | -0.02 ± 1.16 | -0.45 ± 1.05 | >0.05 |
| Axial Lenght (mm) | 23,92 ± 0,75 | 23.74 ±1.11 | >0.05 |
| Central corneal thickness(µm) | 547.7 ±27.6 | 528.4 ±29.8 | >0.05 |
| Anterior chamber depth(mm) | 3.01 ±0.34 | 2.99 ±0.27 | >0.05 |
| Lens thickness(mm) | 4.01 ± 0.13 | 3.73 ± 0.33 | >0.05 |
| İntraokuler pressure(mmHg) | 16.7 ± 2.5 | 15.7 ± 2.1 | >0.05 |

The mean age of 11 patients with a history of Valsalva was 42.7 ± 6.3 (28-51) and 7 (63.6%) were male and 4 (36.4%) were female. 7 (63.6%) of the right eye and 4(36.4%) of the left eye involvement was detected. The mean number of involved quadrant was 1.27 ± 0.46. The mean number of SCH repeats was 1.1 ± 0.4. A comparison of patients with a history of Valsalva and the control group according to refractive error, anterior segment findings, and axial length measurement results are shown in Table 3. According to these results, no significant difference was determined between patients with a history of Valsalva and the control group in terms of refractive error, anterior segment parameters and axial length (p>0.05).

**Table 3.** Comparison of history of valsalva patients and control group

| Parameter | Patients with history of Valsalva (n=11) Mean ± SD | Control group (n=40) Mean ± SD | p |
|---|---|---|---|
| Spherical equivalent | -0.15 ± 0.52 | -0.45 ± 1.05 | >0.05 |
| Axial Lenght (mm) | 23,26 ± 0,66 | 23.74 ±1.11 | >0.05 |
| Central corneal thickness(µm) | 552.9 ±28.1 | 528.4 ±29.8 | >0.05 |
| Anterior chamber depth(mm) | 3.08 ±0.25 | 2.99 ±0.27 | >0.05 |
| Lens thickness(mm) | 3.91 ± 0.14 | 3.73 ± 0.33 | >0.05 |
| İntraocular pressure(mmHg) | 16.9 ± 1.9 | 15.7 ± 2.1 | >0.05 |

A comparison of the parameters of the SCH eye and the other eye is presented in Table 4. According to these results, no significant difference was found between eye with hemorrhage and another eye in terms of refractive error, anterior segment parameters and axial length (p>0.05).

**Table 4.** Compare with eye of SCH and other eye

| Kolej | Eye of SCH Mean ± SD | Other eye Mean ± SD | p |
|---|---|---|---|
| Spherical equivalent | +0.33 ± 0.91 | +0.36 ± 0.85 | >0.05 |
| Axial Lenght (mm) | 23,09 ± 0,88 | 23.08 ±0.94 | >0.05 |
| Central corneal thickness(µm) | 551.4 ±36.9 | 551.9±30.5 | >0.05 |
| Anterior chamber depth(mm) | 2.86 ±0.37 | 2.82 ±0.36 | >0.05 |
| Lens thickness(mm) | 3.95 ± 0.29 | 3.91 ± 0.34 | >0.05 |
| İntraocular pressure(mmHg) | 17.3± 2.3 | 17.1 ± 2.2 | >0.05 |

Pearson correlation analysis showed a significant negative correlation between axial length and SCH repeat number (p = 0.036, r = -0.544). Also, no significant relationship was found between axial length and involved SCH quadrant number (p>0.05).

## 4. Discussion

The most common causes for SCH are HT, anticoagulant agent and history of Valsalva(3-8). Other causes of SCH are rarely seen (1,9-14). The most important result of this study is; HT, anticoagulant agent and patient with a history of Valsalva were compared with the control groups in terms of refractive error, anterior segment parameters and axial length measurements and a significant difference were detected in patients with HT. The results of this study demonstrated that a significant difference was found between patients with HT and control groups in terms of spherical refraction (hyperopia) (p<0.001), short axial length (p<0.001) and narrow anterior chamber depth (p<0.001). In addition significant negative correlation was detected between axial length and SCH repeat number (p = 0.036, r = -0.544).

Studies on SCH generally has performed about investigating systemic etiology and any studies are not evaluating detailed anterior segment parameters according to our knowledge. Hypertension is the main cause in older patients and HT frequency was found 31.2% - 51% in various studies (4-5,7). Similarly, the most common cause of SCH was HT and its frequency was determined 45.7% in our study.

In our study, axial length, low anterior chamber depth, and hypermetropic refraction error were found in patients with hypertension. The short axial length causes the scleral canal to be smaller and the passing vessel structures pass through a narrower area (17). The results show that there is an increased risk of retinal vein occlusion in eyes with narrow anterior chamber (18-19), short axial length (20-21) and hyperopia (22-23) in various studies. Conjunctiva consists of many small and fragile blood vessels that can be easily ruptured and fragility of conjunctival vessels increases with age and vascular diseases such as hypertension (3).

In our study, as the scleral canal is narrower in patients with short axial length, increased vascular stress may be effective in SCH etiology. In addition, in cases where blood pressure increases, SCH may occur because the fragility of conjunctival vessels has previously increased due to HT.

In this study, we found that short axial length, narrow anterior chamber, and hyperopia were significantly related to HT patients who presented with the diagnosis of SCH. There was no significant difference in refraction error, axial length and anterior segment parameters in anticoagulant use and patient with a history of Valsalva.

A limitation of our study is that the relatively low number of patients. Another limitation of our study is that it does not include other rare causes of SCH.

In conclusion, our study will contribute to the literature in terms of showing that patients should be investigated more in terms of HT on the presence of hyperopia, short axial length and narrow anterior chamber in patients with SCH. In patients with these risk factors, even if the results obtained at 2 different times are normal, HT should be investigated in detail by performing 24 hour BP measurement if necessary. Also, these findings can help expand our knowledge of the etiology of SCH and may contribute to the early diagnose of major SCH risk factors such as HT. Future studies with a large number of patients with other rare risk factors are needed in the etiology of SCH.

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