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Soccer ball related posterior segment closed-globe injuries in outdoor amateur players

Amatör oyuncularda futbol topu ile oluşan arka segment kapalı göz yaralanmaları

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BACKGROUND
The aim of this study is to report the characteristics, treatment, and anatomical and functional outcomes of outdoor amateur soccer players with soccer ball-related posterior segment ocular trauma.

METHODS
We conducted a retrospective chart review of 22 patients with diagnoses of closed-globe ocular trauma caused by soccer play activity from 2004 through 2008. Injuries were classified according to Ocular Trauma Classification.

RESULTS
All patients (n=22) were male, and all injuries were caused by contact with the soccer ball itself. Sixteen (72%) patients did not require any treatment. Surgery was performed on 5 (22%) patients. Twenty (91%) patients had 5/200 or better visual acuity (VA) at presentation and 2 (9%) had hand movements or worse VA. At the final visit, all patients had 5/200 or better VA ($p<0.01$).

CONCLUSION
A soccer ball can cause significant posterior segment trauma, and using eye protection equipment might be an appropriate solution.

Key Words: Closed-globe trauma; contusion; protection; soccer.

AMAÇ
Çalışmamızın amacı amatör oyuncularda futbol topu ile oluşan arka segment kapalı göz yaralanmalarının anatomik ve fonksiyonel sonuçlarını ve uygulanan tedavileri incelemektir.

GEREÇ VE YÖNTEM
2004-2008 yılları arasında futbol oynarken kapalı göz yaralanması geçiren 22 hastanın kayıtları geriye dönük olarak incelendi. Yaralanmalar okuler travma sınıflamasına göre değerlendirildi.

BULGULAR
Yirmi iki hastanın tümü erkekti ve yaralanmaların tümü futbol topu çarpmasına bağlıydı. On altı (%72) hastaya herhangi bir tedavi uygulanmadı. Beş (%22) hastaya cerrahi tedavi uygulandı. Yirmi (%91) hastanın başvuru anındaki görme keskinliği 5/200 ve üzerindeyken iki (%9) hastanın ise el hareketi ve altındaydı. Son kontrol muayenesinde 22 hastanın tümünde 5/200 ve üzeri görme keskinlik düzeyi elde edildi ($p<0,01$).

SONUÇ
Futbol topu ciddi arka segment travmasına neden olabilmektedir ve koruyucu ekipman kullanımı uygun bir çözüm olabilir.

Anahtar Sözcükler: Kapalı göz travması; kontüzyon; koruma; futbol.

Soccer is the most popular sport in the world and it is the leading cause of sport related ocular trauma.[1] Soccer-related ocular injury is an important worldwide eye health problem because of the use of the unprotected head for controlling the ball. Injury can result from contact of the head with another head, ground, or the kicked ball.

The aim of this study is to report the characteris-

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tics, treatments, and anatomical and functional outcomes of outdoor amateur soccer players with soccer ball-related posterior segment (zone 3) ocular trauma.

MATERIALS AND METHODS

This study was performed under an institutional ethics review board-approved protocol. We conducted a retrospective chart review of 22 patients admitted to the Department of Ophthalmology at the Gulhane Military Medical Academy (Ankara, Turkey) with diagnoses of closed-globe ocular trauma caused by a soccer ball from 2004 through 2008. All patients injured in soccer play underwent an initial evaluation. All interventions were performed at our department. Injuries resulting from head to head, head to upper or lower extremity, or head to ground or other surfaces were not included in the study. Patients with only ocular adnexal damage or minor ocular injuries such as corneal abrasions or corneal/conjunctival/scleral foreign bodies and patients with concomitant non-ocular injuries were not included in the study.

Ocular injuries were classified according to the criteria of the Ocular Trauma Classification Group (OTG) including: type of injury (only zone 3 injuries were included in this study, but additional zone 1 and 2injuries were also recorded), visual acuity (VA) at initial examination, the presence of relative afferent pupillary defect (RAPD), and zone of injury.[2] The initial and final VA were categorized using the OTG grading system. Grade 1 was better than 20/40. Grade 2 was 20/50 to 20/100. Grade 3 was 19/100 to 5/200. Grade 4 was 4/200 to light perception. Grade 5 was no light perception. Final visual outcome was defined as poor if visual acuity was <5/200.

The pars plana vitrectomy (PPV) procedure was performed using standard 20-gauge three-port pars plana technique. A non-contact fundus observation system (EIBOS; Möller-Wedel GmbH, Wedel, Germany) was used for wide-angle viewing. In the presence of lens damage, PPV was combined with Lens aspiration. One thousand centistokes (cs) silicone oil was used for internal tamponade. Silicone oil was chosen based on the surgeon's preferences and the patient's retinal conditions.

Statistical analysis was performed using SPSS 15.0 for Windows (SPSS, Chicago, IL, USA). McNemar's tests were used to analyze before vs. after comparisons. Statistical significance was set at $p<0.05$.

RESULTS

Patients (n=22) ranged in age from 13 to 32 years (mean age 21.8±4.0 years) and were all male. All injuries were contusions caused by contact with a soccer ball. Mean follow up time was 12.6±7.7 (2-30) months. On initial ophthalmic examination, hyphema existed in 8 (36%) patients, and commotio retinae was present in 8 (36%). Macular edema was found in 5 (22%) patients. One (4%) subject presented with choroid rupture. Retinal detachment (with retinal tears) was found in 5 (22%) patients. Retinal tears without detachment were found in 1 patient (4%). Traumatic lens injury was observed in 4 (18%) patients, one of which had lens subluxation. Vitreous hemorrhage was present in 11 (50%) subjects. RAPD was documented in only 1 (4%) patient. Sixteen (72%) patients did not require any treatment. Surgery (including lens aspiration, buckle, vitrectomy, or their combination) was performed in 5 (22%) patients. Twenty (91%) patients had 5/200 or better VA at presentation, and 2 (9%) had hand movements or worse VA. At the final visit, all 22 patients had 5/200 or better VA ($p<0.01$). Postoperative PVR was observed in 2 patients that underwent vitreoretinal surgery. No postoperative vitreoretinal complication requiring additional vitreoretinal surgery was noted in any of the eyes that underwent PPV. Silicone oil was left as a permanent tamponade in an eye with severe PVR in case of subsequent hypotony and phthisis. Demographic features of the patients and interventions are listed in Table 1.

DISCUSSION

Closed-globe ocular trauma is a common result of sports-related injury. Although the integrity of the eye wall remains intact, contusion type trauma may cause serious posterior segment damage.[3] Because of the popularity of soccer all over the world, serious eye injuries might be encountered any time. According to Larrison, hyphema was the most frequent symptom after soccer-related eye injury.[4] Our study excluded isolated zone 1 and 2 contusion injuries. Vitreous hemorrhage was the posterior segment injury found in the highest percentage in our study (50%). Firm attachments of the vitreoretinal base in young population probably are responsible for these haemorrhages.

The soccer ball is different from the other sports balls: orbital penetration is lower, but the time in the orbit is longer.[5] So the characteristics of eye trauma caused by a soccer ball is different from other traumas and may be associated with severe ocular morbidity and visual impairment. Studies revealed that soccer ball penetration is not significantly related to the size of the ball.[5] The impact-related energy causing ball molding to facial contours is more associated with penetration. The energy correlates with velocity. In a study, professional players kicked the ball at a mean velocity of 26.2 m/s (58.6 mph) while amateurs kicked the ball at a mean velocity of 18.5 m/s (41.4 mph). They both produced significant energy.[6] According to Reed, the energy from the kicked ball is not enough to cause retinal haemorrhage.[7] In contrast to this study, eight players (36%) had retinal haemorrhages in our

Table 1. Demographic features, ocular examinations of the patients and interventions

No	Age	Eye	Ocular presentation	Treatment	Follow up (m)	Initial VA	Final VA	Final examination complication
1	21	Right	I+VH	No	6	1	1	I (small)
2	27	Left	VH+RT	LPC	9	1	1	No
3	30	Left	LI+Co	No	12	1	1	Ca
4	23	Right	RD	PPV+Buckle	24	2	2	No
5	19	Left	H+VH	No	8	2	1	No
6	21	Right	Co	No	2	1	1	No
7	26	Right	H+VH+RH+Co	No	18	3	3	MS
8	45	Right	H+VH	No	6	1	1	No
9	20	Left	H+Co	No	3	1	1	No
10	21	Left	H+VH+RT+RD	Buckle	20	1	1	No
11	13	Left	LI+RD	L.Asp+PPV+Silicone oil	26	4	3	PVR
12	21	Right	LI+LS+Co	No (patient refused)	12	2	2	Ca+LS
13	21	Left	RH+ME+Co	No	14	2	1	No
14	17	Right	RH+ME+RD	PPV+Gas	22	2	2	No
15	21	Right	H+VH+Co	No	6	1	1	No
16	21	Right	H+RH+Co	No	8	1	1	No
17	20	Right	H+VH+RD	PPV+Gas+Buckle	30	4	2	PVR
18	21	Left	VH+CR+RH+ME	No	13	2	2	CR
19	21	Left	VH+RH	No	9	1	1	No
20	20	Right	I+ME	No	8	2	2	I+MS
21	23	Right	LI+RH+ME	No	17	2	2	Ca
22	21	Left	VH+RH	No	6	1	1	No

VA: Visual acuity; Ca: Cataract; Co: Commosio retina; H: Hyphema; I: Iridodialysis; VH: Vitreous hemorrhage; RH: Retinal hemorrhage; RD: Retinal detachment; RT: Retinal tear; ME: Macular edema; MS: Macular scar; No: No abnormality; CR: Choroid rupture; LS: Lens subluxation; PPV: Pars plana vitrectomy; LI: Lens injury, L.Asp: Lens aspiration; LPC: Laser photocoagulation; PVR: Proliferative vitreoretinopathy; m: Months.

study. Furthermore, we found that when the kicked ball hits the head and deforms significantly to fit facial contours, the energy is directly transmitted to the retina, resulting in tears. Retinal breaks are the most frequent diagnosis in follow up period.[8] In most cases (80%) retinal tears caused by soccer balls were associated with retinal detachment in our study, which may reveal that much more energy transmits to the retina than estimated. Although the injury is caused by inferotemporal contact with the ball in most cases (the frontal bone and nose usually make a protection from the impact coming from other directions[9]), it is essential to examine all the quadrants of peripheral retina.

Retinal detachment was the main indication for vitreoretinal surgery in three patients in our study. The development of PVR was the most frequent reason for poor visual outcome in patients with retinal detachment and was responsible for surgical failure. A sudden anteroposterior compression and the expansion of the eyeball perpendicular to the direction of impact has been proposed as the major cause of the contusion injuries.[5] In all patients with ocular contusion, careful peripheral retinal examination with scleral depression should be performed irrespective of the presence of damage to the anterior segment. Otherwise, retinal breaks may remain unnoticed for years until the development of retinal detachment.[3] However, in cases with vitreous hemorrhage from ocular trauma, this examination may not be possible and retinal damage may not be accurately and completely diagnosed. In such cases, B-mode ultrasonography is helpful for the assessment of the posterior segment.[10]

Choroidal rupture is a common finding in smaller ball traumas (paint ball, tennis, golf) rather than soccer-related ones and it was an unusual finding in our study. It was temporally located near macula, and resulted in poor visual outcome. This finding may reveal that orbital penetration secondary to soccer ball is deeper than estimated.

Some limitations in this study should be noted including its retrospective design. Additionally only males participated in our study. Gender differences that may be present within these injuries could not be analyzed. In our country, soccer is not popular among women, so this is the main source of this limitation. Another limitation of the study was the relatively short follow-up period; patients who underwent observation

without treatment could not be evaluated in terms of long-term complications.

In our study we have identified that soccer can cause significant posterior segment trauma and using eye protection equipment according to ASTM standard F803 might be an appropriate solution for this important and frequent ophthalmologic problem.

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