ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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The Role of Attention-Deficit/Hyperactivity Disorder in the Etiology of Osgood Schlatter Disease

Osgood Schlatter Hastalığının Etyolojisinde Dikkat Eksikliği/Hiperaktivite Bozukluğunun Rolü

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ABSTRACT Objective: Osgood-Schlatter disease (OSD) is an overuse injury and regular practice of sports activity is a major risk factor for OSD. However, OSD is not uncommon in children who do not participate in sports in routine orthopedic practice. Over activity is not always related with sports but may be related with Attention-Deficit/Hyperactivity Disorder (ADHD). This study aimed to investigate the symptoms of ADHD in children with OSD. **Material and Methods:** Forty five male patients, with Osgood-Schlatter disease, and 45 age-matched healthy volunteers were included in the study. Symptoms of ADHD of the volunteers were evaluated using Conners' Parent Rating Scale (CPRS-R:S). Both groups' functional status was evaluated using Pediatric Quality of Life Inventory (PedsQL). **Results:** In the patient group, a statistically significant increase was found in Hyperactivity and Oppositional subscales of Conners' Parent Rating Scale- Revised Short compared with the control group ($p < 0.05$). Pediatric Quality of Life Scale was significantly lower in the patient group compared with the control group ($p < 0.05$). **Conclusion:** Our findings suggest that ADHD is a significant risk factor for OSD. Especially during the evaluation of OSD patients, who do not engage in sports activity, physicians should be aware of ADHD symptoms and refer children to psychiatrists for additional evaluations.

Keywords: Osgood-Schlatter disease; Attention-Deficit/Hyperactivity Disorder; hyperactivity and impulsivity

ÖZET Amaç: Osgood-Schlatter hastalığı (OSH), aşırı kullanım yaralanmasıdır ve düzenli spor aktiviteleri OSH için önemli bir risk faktörüdür. Bununla birlikte, rutin ortopedik pratikte spora katılmayan çocuklarda OSH nadir değildir. Aşırı aktivite her zaman sporla ilgili değildir, ancak Dikkat Eksikliği/Hiperaktivite Bozukluğu (DEHB) ile ilişkili olabilir. Bu çalışmada, OSH olan çocuklarda DEHB semptomlarını araştırmayı amaçladık. **Gereç ve Yöntemler:** Çalışmaya OSH'li 45 erkek hasta ve yaş uyumlu 45 sağlıklı gönüllü alındı. Gönüllülerin DEHB belirtileri, Conners'in Ebeveyn Değerlendirme Ölçeği (CPRS-R:S) kullanılarak değerlendirildi. Her iki grubun fonksiyonel durumu Pediatrik Yaşam Kalitesi Envanteri (PedsQL) kullanılarak değerlendirildi. **Bulgular:** Hasta grubunda, kontrol grubuna kıyasla Conners Ebeveyn Değerlendirme Ölçeği, hiperaktivite ve karşı koyma alt ölçeklerinde istatistiksel olarak anlamlı bir artış bulundu ($p < 0,05$). Pediatrik Yaşam Kalitesi Ölçeği skorları hasta grubunda kontrol grubuna göre anlamlı derecede düşüktü ($p < 0,05$). **Sonuç:** Bulgularımız DEHB'nin OSH için önemli bir risk faktörü olduğunu göstermektedir. Özellikle spor aktivitesiyle uğraşmayan OSH'li hastaların değerlendirilmesi sırasında, doktorlar DEHB belirtilerinin farkında olmalı ve ek değerlendirmeler için çocukları psikiyatristlere yönlendirmelidir.

Anahtar Kelimeler: Osgood-Schlatter hastalığı; Dikkat Eksikliği/Hiperaktivite Bozukluğu; hiperaktivite ve dürtüsellik

Osgood-Schlatter's disease (OSD) is an overuse injury caused by tension on the patellar tendon placed on the anterior tibial tubercle. It presents with local pain, swelling and tenderness over the tibial tuberosity and most frequently occurs in girls between the age of 11 to 13 years and in boys between 13 and 15 years. The symptoms are usually exacerbated with sporting activities that especially involve jumping, running or stair climbing.[1-3] Radiologic studies have led to the theory that OSD may be caused by chronic tensile stress on the patellar tendon within the growth plate, which leads to irritation and inflammation. Inflammation results from micro-trauma to the growth plate with repetitive use before closure of the epiph-

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ysis, causing traction injury and microavulsions of the tubercle.[3-5]

Attention-Deficit/Hyperactivity Disorder (ADHD) is a heterogeneous neurodevelopmental disorder characterized by the co-existence of inattention, impaired cognitive function, lack of coordination, hyperactivity, and impulsivity which cause functional impairment. It is one of the common psychiatric disorders among children with an estimated prevalence between 6.7 and 7.8% of all children in school age.[6,7]

We hypothesized that ADHD might be another risk factor for those who do not participate in sports. The purpose of this study was to investigate the relationship between OSD and ADHD.

MATERIAL AND METHODS

Forty five male patients with OSD, aged between 9-15 years, and 45, age- matched healthy controls were included in the study.The study was approved by the local research ethics committee of Necmettin Erbakan University Medical Faculty. The diagnosis of OSD was made based on patient history and physical examination findings. To confirm the diagnosis of OSD, the following diagnostic criteria were applied:[3,8] (1) pain localized to the tibial tubercle, especially after severe physical activity, (2) tenderness, erythema and local swelling and over the tibial tubercle, (3) pain should be present on the tibial tubercle resulting from forced knee extension. Knee radiographs were taken in all patients. Radiographs may illustrate OSD and are confirmatory for the diagnosis. Lateral radiographs can show prominence of the tibial tuberosity with anterior ossification separating from the proximal tibia.[3,8] The presence of ADHD was assessed using Conners' Abbreviated Rating Scale (CARS) answered by the parents.

Conners Parent Rating Scale-Revised Short (CPRS-R:S):CPRS-R:S was created by Kumar et al. The CPRS-R:S is a 27-item questionnaire divided into four subscales: opposition, cognitive problems/inattention, hyperactivity, and ADHD index.[9,10] Each item is rated on a four-point scale, from 0 (not true at all) to 3 (very much true). The Turkish version of the CPRS was studied by Kaner et al.[10]

Pediatric Quality of Life Inventory (PedsQL): which has been used in this study has 23 questions including physical functioning, emotional functioning, social and school functioning, to assess health-related quality of life in children.[11] Five choice Likert type visual scale is used in the inventory (0=never, 1=almost never, 2=sometimes, 3=often,4=almost always). Points obtained from the items are converted linearly to a value ranging between 0 and 100 (0=100, 1=75, 2=50, 3=25, 4=0). Higher scores reflect higher quality of life. The reliability and validity of the Turkish PedsQL 8-12 and 13-18 age group forms have been studied by Memik et al. and reported to have high reliability and validity.[12,13]

STATISTICAL ANALYSIS

The SPSS for Windows 15.0 software package . (SPSS for Windows, Version 16.0. released 2007; SPSS Inc.,USA) was used for the statistical evaluation of the data. Conformity of continuous variables with normal distribution was investigated using the Kolmogorov-Smirnov test. All variables were distributed normally. Descriptive data are presented as mean ± standard deviation. Demographic and clinical characteristics were compared using the Chi-square test. The independent samples t-test was used to compare the two groups. The significance level was accepted as $p < 0.05$.

RESULTS

The baseline characteristics of the patients are given in Table 1. In the patient group, a statistically significant increase was found in Hyperactivity and Oppositional subscales of CPRS-RS compared with the control group ($p < 0.05$) (Table 2). The PedsQLS was significantly lower in the patient group compared with the control group ($p < 0.05$) (Table 2).

TABLE 1: Demographic characteristics of the patients.

	Study group (n=45)	Control group (n=45)	p
Age (years)	12.20±3.08	11.80±3.24	0.82
BMI (kg/m^2)	20.01±2.36	21.12±2.98	0.86

Data are given as mean±SD, BMI: Body Mass Index.

TABLE 2: Assessment of Conners' Parent Rating Scale-Revised Short and Pediatric Quality of Life Scale.

CPRS-RS	Study group	Control group	P value
Oppositional subscale	7.01±4.45	5.22±4.28	**0.032**
Cognitive problem subscale	5.14±4.21	4.78±3.98	0.720
Hyperactivity subscale	9.80±2.65	5.29±2.89	**0.016**
ADHD Index	16.02±5.05	13.82±4.95	**0.021**
PedsQL	42±10.02	82.2±11.32	0.001

Data are given as mean±SD, CPRS-RS: Conners' Parent Rating Scale-Revised Short; PedsQL: Pediatric Quality of Life Scale.

DISCUSSION

In this study, the relationship between ADHD and OSD was investigated. Several studies have examined the risk factors for Osgood-Schlatter disease. Lucena et al. showed that OSD was caused by shortening of the rectus femoris muscle.[14] Shortening of the rectus femoris may substantially affect the biomechanical function of the knee. Demirbag et al. evaluated patellar tendon insertions in 20 patients with OSD and 15 healthy children using knee magnetic resonance imaging (MRI). Their study showed that if the patellar tendon attachment was more proximal and in a broader area to the tibia, this might play a role as a predisposing mechanical factor in the onset of OSD.[15] Gigante et al. studied the relationship between Osgood-Schlatter disease and torsional abnormalities of the lower limb. They evaluated 21 patients with OSD and 20 healthy controls using computed tomography (CT). They found that increased external tibial torsion might be a risk factor in OSD.[16] Nakasew reported that increased quadriceps femoris muscle tightness and muscle strength during knee extension and flexibility of the hamstring muscles were risk factors for OSD.[17] Sarcević evaluated the relationship between limited dorsiflexion of the ankle and the occurrence of OSD in sports-active children. The author reported that limited dorsiflexion of the ankle joint might be of significant importance for OSD. The limitation of dorsiflexion within the ankle joint is associated with a compensatory increased knee flexion, tibial inversion, and foot pronation during the stance phase of running, thus increasing the stress on the patellar tendon.[18]

Most of these studies evaluated anatomic and mechanistic causes to clarify the pathophysiology of OSD. Current evidence indicates that OSD is an overuse injury and regular practice of sports activity is major risk factor for OSD.[1] However, OSD is not uncommon in children who do not participate in sports in routine orthopedic practice. Over activity is not always related with sports but may be related with ADHD. Some authors reported that ADHD was a risk factor for acute traumatic injuries in children.[19-21] Uslu et al. reported that children treated for extremity fractures would present with higher levels of impulsive-hyperactivity behavior problems than children treated for conditions other than fractures.[19] Rowe revealed that children with ADHD were prone to all kinds of injury, more than the healthy population.[20] In a similar study, İz et al. showed that ADHD symptomatology was observed in most children admitted to the emergency department for accidental injuries.[22]

Children with impulsive-hyperactivity behavior have been reported to have 1.5-2 times higher risk for injury and extremity fractures.[21-25]

In a retrospective cohort study, Guy et al. assessed musculoskeletal injuries in patients aged under 17 years with ADHD. In the 11-year study period, the following traumatic musculoskeletal injuries were diagnosed in patients with ADHD; sprains (27.2%), fractures (21.2%), concussions (4.5%), dislocations (2.8%), and thoracic and pelvic injuries (0.6%). In this study, fractures were most frequently detected in the upper extremity injuries (60.5%), whereas sprains were most frequently detected in the ankle and foot injuries (36.0%). Among the categories of overuse injuries, specific arthropathies and connective tissue disorders have been identified in 29.1% of individuals with ADHD.[26]

These studies showed that ADHD was a significant risk factor for acute injuries. However, we be-

lieve that children with ADHD are prone to both acute injuries and chronic repetitive injuries. Güler et al. investigated the relationship of OSD and ADHD. They found that ADHD was a significant risk factor for OSD; however no control groups were used in that study. The author recommended future case-control studies.[8] In our study, there was a control group and the evaluation was performed in the male sex only. Therefore, we cannot generalize our results for both sexes. This is the most important limitation of our study. The assessment of ADHD symptoms was based on parent reports rather than psychiatric interviews. However, our main goal was to investigate the symptoms of ADHD in children with OSD. A statistically significant increase was found in favor of ADHD in hyperactivity and oppositional subscale scores compared with the control group. There was also a statistically significant decrease in quality of life in the patient group compared with the control group.

CONCLUSION

During the evaluation of patients with OSD, physicians should be aware of ADHD symptoms and refer children to psychiatrists for additional evaluations.

Informed Consent

All procedures performed in studies involving human participants were obtained from all participants who participated in the study in accordance with the ethical standards of the institutional and national research committee and the 1964 Helsinki Declaration.

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