Importance of clinical examination in diagnostics of Osgood-Schlatter Disease in boys playing soccer or basketball

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Abstract

Introduction: Osgood–Schlatter disease is an irritation of the patellar tendon at the tibial tubercle. Sports with jumps, running, and repeated contractions of knee extension apparatus are considered to be important external risk-factors which could cause Osgood–Schlatter disease.

Objectives of the study are to draw attention to the importance of clinical examination in diagnostics of Osgood–Schlatter disease in boys playing soccer or basketball.

Methods: The research included data obtained from 120 boys, average age of 14 years. Examinees were split into two groups, one with young athletes which regularly have soccer or basketball trainings and the second one with boys who do not participating in sports. We performed anthropological measurements and clinical examinations of both knees and hips for both groups. For the statistical analysis we used point-biserial correlation coefficient.

Results: Based on clinical examination, Osgood–Schlatter disease was diagnosed in 51 examinees (42.5%). In "athletic group" Osgood–Schlatter disease had 31 boys or 52%, comparing with "non-athletic group" where we found 20 adolescents with disease (33%). Number of boys with Osgood–Schlatter disease was higher for 19% in "athletic group" comparing with "non-athletic group". Comparing incidence rate for boys in both groups with diagnosed II and III level of Osgood–Schlatter disease we found that rate is higher in "athletic group" 2.25 times comparing with "non-athletic group".

Conclusions: Clinical examination is critical method in the process of diagnosing Osgood–Schlatter disease especially for identifying II and III level of this disease. © 2012 All rights reserved

Keywords: Osgood–Schlatter disease, growth-zone, overload-syndrome

Introduction

Osgood–Schlatter disease (OSD) is the one of the most common causes of pain in anterior part of knee in young athletes participating in sport activities with a lot of running, jumping and shooting. In spite of commonly used term disease, it is in fact benign, self-limiting, inflammation process of growing apophysis. In sports medicine OSD is of special importance since it limits sports activities of children in adolescent age (1, 2).

Osgood–Schlatter disease or syndrome is an irritation of the patellar tendon at the tibial tubercle. Clinically, the main attribute of the disease is painful and enlarged tibial tubercle. Characteristically, intensity of the pain increases during or after hard training, but disappears during resting. Besides sports medicine and orthopaedics, Osgood–Schlatter disease is in the same time one of the most common problem in primary health care, since it often appears in children during the period of their growth and development and it is not linked to sports' activity. Sports where jumps (basketball, long jump), running (athletics), repeated contractions of knee extension apparatus (soccer, kick-box, dancing, skiing) are predominant, are considered to be important external risk-factor which could

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cause occurrence of Osgood–Schlatter disease. Most authors consider cause for developing of OSD in youth athletes sensibility of apophysis which is not able to tolerate strong stretching forces of chronic repeated traction of quadriceps tendon on immature tibial tubercle (3, 4). Apophysis injuries are characteristic for patients which have not been reached full skeletal maturity (2). Apophysises are secondary ossification centres located on place of attachment of big tendons to a growing bone. They contribute in creating contours and shapes of bones, but they do not play role in longitudinal growth. Because of that, acute or chronic injury which affects traction growth zones generally will not cause disturbance of bone growth in length (3). During the period of physiological physiodesis, apophysis has reduced resistance to mechanical stress which makes it vulnerable and susceptible to injury in the period of rapid growth. Injuries could occur after strong trauma of apophysis itself (strong muscle contraction), repeated micro trauma (often repetition of same moves through running or jumping) or micro trauma of apophysis which preceded multiple episodes of repeated micro trauma (3). With increased participation of youth in sport activities, sports become leading cause of injuries in adolescents (5). Soccer and basketball are currently the most attractive and popular and the most common activities for youths around the world. Those are the sports where dominate activities which activate knee extension apparatus, and during the time they could lead to occurrence of OSD. If the disease is timely diagnosed and cured, prognosis is very good. After the reaching full bone maturity (age of 18), under a patella will stay slight protrusion that would pose an aesthetic defect (6). In order to prevent long run consequences and enable athletes to carry on with sport activities, it is necessary to perform knee examination and diagnose OSD timely. Taking sport anamnesis it is important to get data on possible risk-factors. Depending on clinical presentation sport activity could be stopped, intensity of trainings could be decreased or clinician could propose alternative sport activities. Athlete should be included in the programme of physical therapy and functional rehabilitation (6, 8-10). Characteristics of clinical picture in early stage are feeling of tension or queasy during activities. In the beginning pain is mild, durable and presented for a short period of time. During the time, pain is more intensive and become permanent and it could lead to suspension of sport activities through certain period of time (6, 11, 12). Pain getting worse during the activities with running, shooting, squatting, walking upstairs or downstairs, direct contact and all activities with strong contractions of quadriceps. Clinically, for OSD is typical painful and enlarged tibial tubercle (6, 8). Palpation or percussion will cause pain and in some patients physician can find crepitating quadriceps tendon (13). Skin above tibial tubercle could be slightly red and worm on palpation which guides to existence of inflammation process. Mobility is difficult and painful. In the initial stage of disease pain can be induced by extension of the knee with resistance from the examinee. In acute stage, pain occurs at the very attempt at extension of the knee or leg elevation and at maximum knee flexion. Intense pain can also occur when performing deep squat, when performing jumps as well as the kneeling (2). Because of the knee pain quadriceps contractions were painfully limited what results with the development of hypotonia and hypertrophy of haunch muscles (6, 8). Most authors report that in 20-30% of patients symptoms occur at both sides. It is considered that there is close relationship between the occurrence of this disease and leg which is predominantly involved in jumping or sprinting (14). Eric J. Wall describes three stages of Osgood-Schaltter disease. Criteria for classification are relationship between pain sensitivity and intensity of physical activity (6) (Table 1). The key to successful diagnostic of OSD lies in taking thorough sport anamnesis and history of the disease. It is important to obtain data on pa-

TABLE 1. Three stages of OSD - Criteria for classification

Disease stage	Pain – Intensity of physical activity
I	Pain withdraws after physical activity within 24 hours.
II	Pain occurs only during after physical activity, but it is not restricting and does not disappear within 24 hours.
III	Permanent pain which limits not only physical but also everyday activities.

tient age, type of sport practiced, length of sport experience, frequency, intensity and duration of training as well as changes in training process introducing new techniques or equipment changes, involvement of athletes in other forms of sport activities, the influence of risk-factors (trauma, poor technique, old equipment, hard surface, etc.), sudden changes in weight and height, time of onset of first symptoms, mechanism of injury, previous injury and how it was treated, and the basic characteristics of pain (location, start, duration, intensity changes of pain related to activities and period of resting) (1, 6, 12, 16). Diagnosis is made after clinical examination. The main feature of the clinical examination is painful and enlarged tibial tubercle with the surrounding soft tissue swelling, and painful and restricted mobility. Before definitive diagnosis of OSD, other possible diseases must be considered in differential diagnosis having in mind pain in front of the knee (6, 8). Laboratory test are not required for diagnosis of OSD unless there is suspected inflammatory or other disease aetiology (8, 12). Knee x-ray examination snapshot shows enlarged and fragmented tibial tubercle (1, 8). In most medical centres clinical examination of OSD diagnosis is considered to be sufficient and even routine ultrasound examination is not recommended. However, many authors believe that ultrasound examination should be first option. Ultrasound examination is fast, simple and economic method and reliable as x-ray. CT and MRI examination should be performed only in some atypical or non-clear cases (15, 16). Objectives of the study are to draw attention to the importance of clinical examination for diagnosis of Osgood–Schlatter disease in boys playing soccer or basketball.

Methods

The study was prospective, comparative, clinical and descriptive. Research was performed in the period January – December 2008 at the Institute for Sport Medicine, Canton Sarajevo.

Subjects

120 examinees born in 1994 were included in the study and split into two groups. First group of 60 examinees was made of athletes who actively participate in soccer or basketball trainings. Eligibility criteria for those athletes to be include in the study fulfilled ones who have had trainings five times a week, for one hour and half long for the period of at lest one year. During a week they have one mach and one only day off to rest. Other age groups athletes and athletes who participate in other sport disciplines we excluded from the study, athletes who additionally train some other sport and athletes who have come to visit physician with OSD diagnosis and do not actively practice soccer or basketball. Control group we made of boys who do not actively participate in soccer or basketball trainings, neither in other sports and born in 1994. Sample was made randomly, five examinees from six different soccer and basketball clubs and 15 examinees from four schools in Sarajevo Canton.

Procedures

In accordance with our research goal we wanted to calculate the cumulative incidence of Osgood-Schlatter disease for all patients, then to analyse the relationship between intensity of physical activity and the occurrence of pain sensitivity in patients with symptoms of OSD (analysis of OSD clinical stages by J.Wall Eric method). Also, we wanted to investigate the representation of OSD at one or both knees of all examinees in both groups and to see the correlation between the positive findings of clinical examination of all examinees and OSD. We wanted to analyse the correlation of positive findings of clinical examination of patients and clinical stage of OSD and pain score using a pain scale for all patients with OSD. During the study we completed questionnaire containing personal data of all examinees. Sport history was taken from examinees who actively train soccer of basketball, while for athletes from control group we have asked questions related to physical activities. From all examinees with symptoms of OSD is further taken history of disease. We conducted clinical examination of both knees and hips for all examinees. Examination was consisted of inspection, palpation and percussion. We performed measurements of volumes: maximal thigh volume, lower leg volume in the height of tibial tubercle and below. Examination of knee joint mobility and stability was performed using appropriate tests (Lachman test, lateral

drawer test, anterior and posterior drawer test). After the examinations we classified all examinees in three clinical stages of OSD as per Eric J. Wall classification. Classification criteria were relationship between pain sensibility and intensity of physical activity. Pain score was analysed using a pain scale. Although subjective, the method is important because children assessed intensity of pain independently, without influence of parents or coaches, and approach to the evaluation process very seriously. During the research we also performed electronic research of data bases and manual research of selected scientific journals using key words: Osgood-Schlatter disease, tibia, tibial tubercle, apophysis, knee, rapid growth, growth zones, adolescent age, sport, overload syndromes, apophysitis, juvenile osteochondritis.

Statistical analysis

Point-biserial correlation coefficient was used for the statistical analysis and analysis was performed using SPSS software. Statistically significant differences were considered those in which the p value was less than 0.05 (p <0.05).

Results

The cumulative incidence of OSD of all examinees

Table 2 shows results that we got from a clinical examination of both knees from all examinees. We concluded that the athletes in the study group (n = 60) OSD was diagnosed in 31 patients (52%), while 29 examinees (48%) were healthy (48%). In the control group of non-athletes (n = 60), OSD was diagnosis in 20 examinees (33%), while 40 boys (67%) were healthy. Analyzing given data, we concluded that the number of adolescents with OSD is higher by 19% in the study group of athletes compared to the control group, but the percentage difference is not statistically significant p = 0.0548 (p > 0.05).

$$\mathbf{RR = KI \times S / KI \times NS = 0.52/0.33=1.58}$$

RR = relative risk; KI= cumulative incidence;
S = athletes; NS = non-athletes

OSD cumulative incidence rate in the study group of athletes was 0.52 while in the control group was 0.33. The difference in the incidence rate was 0.18.

TABLE 2. Osgood-Schlatter disease cumulative incidence of all examinees

Examinees	Osgood-Schlatter (%)	Healthy (%)	Total (%)
Athletes	31 (52%)	29 (48%)	60 (100%)
Non-athletes	20 (33%)	40 (67%)	60 (100%)

Analysing obtained results we concluded that the incidence in study group of athletes is 1.58 times higher comparing to the control group (p>0.05).

Clinical stage of examinees with OSD

Out of 60 athletes, 29 (48%) boys were healthy (stage 0). OSD was diagnosed in 31 patients (52%). Analyzing the relationship between intensity of physical activity and the occurrence of pain sensitivity we concluded that 13 examinees (22%) were in stage I, eleven patients (18%) in II, and 7 patients (12%) were in clinical stage III. In the control group of 60 boys who do not train soccer or basketball, 40 (67%) of them were clinically healthy and OSD was diagnosed in 20 boys (33%). Analyzing the relationship between intensity of physical activity and the occurrence of pain sensitivity we concluded that 12 examinees (20%) had symptoms of I stage, 5 examinees (8%) had symptoms of II stage and 3 of them (5%) had symptoms of OSD III clinical stage (Table 3).

TABLE 3. Analysis of clinical stages of examinees with OSD

Examinees	Stage 0 (%)	Stage 1 (%)	Stage 2 (%)	Stage 3 (%)	Total
Athletes	29 (48)	13 (22)	11 (18)	7 (12)	60
Non-athletes	40 (67)	12 (20)	5 (8)	3 (5)	60

Prevalence of OSD in one or both knees

Examining the presence of the disease in one or both knees, the analysis of results showed that in the study group of 60 athletes, 31 patients had symptoms of OSD. The symptoms were present unilaterally in 20 athletes (64.5%), and bilaterally in 11 athletes (35.5%). In the control group of 60 examinees who were not actively involved in sports, 20 patients had symptoms of OSD. 16 (80%) of those had unilateral symptoms, and only 4 patients (20%) had symptoms bilaterally (Table 4). In both groups 51 examinees had OSD diagnosed; unilaterally symptoms had 36 examinees (70.5%) and bilaterally 15 (29.5%) boys.

TABLE 4. OSD disease prevalence estimation in one or both knees

Examinees	One knee (%)	Both knees (%)	Total (%)
Athletes	20 (64.5%)	11 (35.5%)	31 (100%)
Non-athletes	16 (80%)	4 (20%)	20 (100%)
Total	36 (70.5%)	15 (29.5%)	51 (100%)

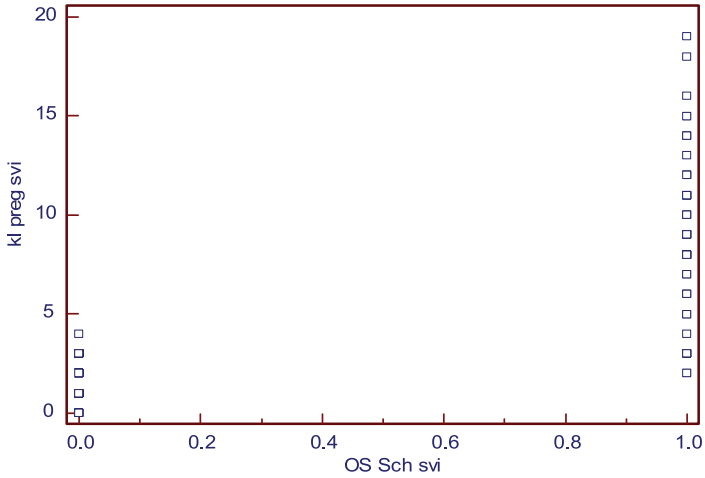

FIGURE 1. Correlations between the positive findings of clinical examination of examinees and OSD

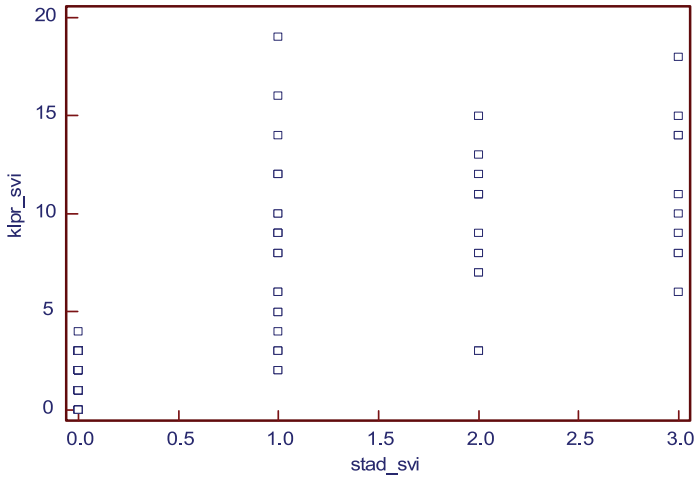

FIGURE 2. Correlations between scores of clinical symptoms and stages of OSD

TABLE 5. Assessment of pain in patients with Osgood-Schlatter disease

	N	Mean	SD	Median	95% CI	Minimum	Maximum
Pain scale - athletes	31	10.58	9.11	9.00	5.17 – 14.41	0.00	35.00
Pain scale - non-athletes	20	10.30	8.96	8.00	4.17 – 11.83	0.00	34.00

Analysis for correlation between positive findings of clinical examination and OSD

Point biserial correlation coefficient (r_{pb}), was used to be examined correlation between clinical findings and the OSD. Preliminary analyzes were done to prove the assumptions of normality, linearity and homogeneity of variances. Strong positive correlation $r_{pb} = 0.78$, n = 120, $p < 0.05$. Based on these results we concluded that the higher the score of the positive findings of clinical examination is more associated with the OSD and that the clinical examination is a key for the diagnosis of this disease (Figure 1).

Analysis for correlation between positive findings of clinical examination and clinical stages of OSD

Point biserial correlation coefficient (r_{pb}), was used to be examined correlation between clinical findings and the OSD. Preliminary analyzes were done to prove the assumptions of normality, linearity and homogeneity of variances. Strong positive correlation $r_{pb} = 0.76$, n = 120, $p < 0.05$. Based on these results we concluded that the higher the score of the positive findings of clinical examination is more associated with the severe stages of OSD (Figure 2).

Analysis of pain scale of all examinees with OSD

Based on subjective evaluation of pain, we compared results obtained for both groups. According to the scale of pain a little more felt sportsmen M = 10.58

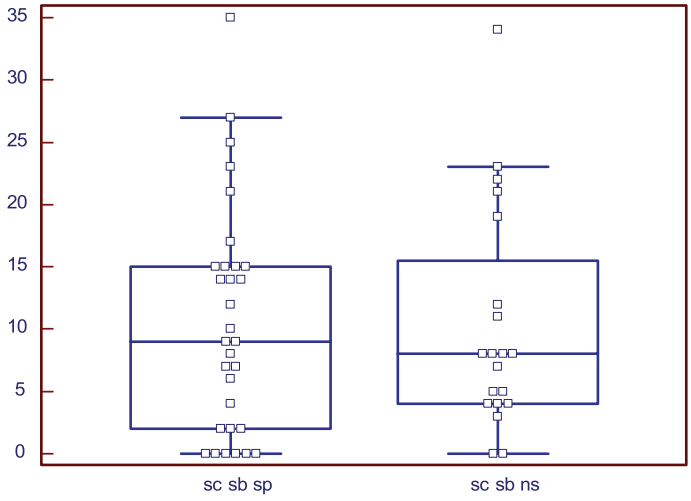

FIGURE 3. Results obtained based on pain scale for both groups

(SD = 9.11), n = 31, compared to non-athletes M = 10.30 (SD = 8.96), n = 20. Mean (Md) score for the athletes was Md = 9.0, for non-athletes Md = 8.0. For the analysis of results it was used Mann-Whitney test which showed no statistically significant difference in pain scale of the test group of athletes compared to the control group (Z= -0.174, $p > 0.05$) (Table 5, Figure 3).

Discussion

The main findings of the study are: 1) By clinical examination of both knees of 120 participants we diagnosed OSD in 51 examinees (42.5%), while 69 were healthy (57.5%); 2) In the group of athletes 31 examinees had OSD (52%), while 29 examinees were healthy (48%). In the control group of non-athletes OSD had 20 examinees (33%), while 40 were healthy (67%); 3) Number of boys with OSD is higher by 19% in athletes group compared with non-athletes group, but the percentage difference is not statistically significant $p = 0.0548$ ($p > 0.05$); 4) In the group of athletes the incidence is higher by 1.58 times compared to non-athletes ($p > 0.05$); 5) The average incidence rate was 2.14 times higher in the exposed group (athletes) in relation to the not exposed group (non-athlets), or the likelihood of exposure was 2.14 times higher among athletes than in non-athletes; 6) Analyzing the differences in the incidence rate among clinical stage I, II, and III of OSD in both groups, we concluded that the incidence rate is greater in athletes than non-athletes, but that was not statistically significant ($p > 0.05$). Analyzing differences in the incidence rate for II and III clinical stage of OSD both groups, we concluded that the incidence rate for athletes is greater 2.25 times then in the non-athletes group and that is statistically significant ($p < 0.05$); 7) Unilaterally presented symptoms had 36 examinees (70.5%), and bilaterally 15 (29.5%) of them; 8) Analyzing the differences in the incidence rate of OSD at both knees in both groups, we concluded that the incidence rate among athletes is higher by 1.77 times compared to non-athletes group and not statistically significant ($p > 0.05$); 9) Clinical examination is essential in the diagnosis of OSD because the higher score of positive findings of clinical examination is more associated with the OSD; 10) Clinical examination has an important role in recognizing the severe stages of OSD because the higher scores of positive clinical examination findings are associated with more severe clinical disease stages. Analyzing the relationship between intensity of physical activity and pain sensitivity J. Wall Eric stated that at the time of diagnosis of Osgood-Schlatter disease are the most affected children in the first, and the least in the third clinical stage (6). We have made the same conclusion in our research. In both groups the most patients were in the first (25), slightly less in the second (16), and at least children were in the third clinical stage. In one-year epidemiological study of orthopaedic diseases that affect adolescent boys who have been training basketball or volleyball, Gigante et al. (14) has diagnosed and treated OSD in 21 boys. 14 boys (66.7%) had expressed unilateral symptoms, and bilaterally 7 (33.3%). Gholve and Bloom considered that about 20% -30% of cases, disease develops at both knees (1, 9). Examining presentation of OSD at one or both knees in our study we concluded that the athletes in the study group had symptoms unilaterally in 20 (64.5%) cases, and bilaterally in 11 (35.5%). In the control group, this ratio was 16:4 (80% : 20%). Conclusion was that the unilaterally expressed symp-

toms had 70.5% and 29.5% examinees bilaterally. Houghton, Cassas and many other authors believe that the most important in the diagnosis of OSD is to take a detailed personal and sport history, medical history, to perform a clinical examination, and sometimes take targeted x-ray examination (13, 16). By analyzing the correlation between the positive findings of clinical examination of examinees and OSD, we concluded that the clinical examination is a key in the diagnosis of this disease, and it is especially significant in recognizing the severe stages.

Conclusions

Sports are the leading cause of injury in adolescents and one half of all sports injuries in children are preventable with proper education and use of protective equipment. Children and adolescents may be particularly at risk for sports-related overuse injuries as a result of improper technique, poorly fitting protective equipment, training errors, and muscle weakness and imbalance. OSD is one of these injuries which can be managed conservatively with proper and timely diagnosis (16, 18). Diagnosis of OSD is clinical and based on history and clinical examination. Patients usually present with onset of pain at the tibial tubercle, relieved by rest and aggravated by exercise, especially sports involving running and jumping like soccer and basketball. Study results have drawn attention to the importance of clinical examination in diagnostics of Osgood–Schlatter disease in boys playing soccer or basketball. Clinical examination is critical method in the process of diagnosing Osgood–Schlatter disease especially for identifying II and III level of this disease. Physician should explain to the patients and their parents that sporting activity does not have to stop completely and that a reduction in activity may be sufficient to control the pain. Young athletes with diagnosed OSD should reduce exercise duration, frequency, and intensity for a limited period of time, sufficient to resolve or tolerate pain. When pain becomes tolerable it should be considered gradual increases in exercise levels, depending to symptoms, adjusting levels, and repeating this process as required. It is very important to educate parents of young athletes and patients on OSD in order to act proactive and preventive. Also, education of health professionals from primary health care level as well hospital-specialist orthopaedists who sometimes unnecessary recommend even cast protector for children with OSD and total sport cessation. Simple leaflet may be a useful source of further information for parents, patients and healthcare professional.

Competing interests

The authors declare that they have no financial or personal relationship with people or organizations that could influence this work inappropriately.

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