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Conservative treatment of Osgood-Schlatter disease among young professional soccer players

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Abstract

Background The present-day conservative treatment algorithms of Osgood-Shlatter Disease (OSD) are often inadequate for young athletes because they require extremity immobilization and avoidance of sports, and hence the longer duration of rehabilitation. Therefore, the development of safe and efficacious treatment protocols for young athletes is of great practical importance.

The aim of the study The aim of the study was to assess the efficacy and safety of the conservative treatment of Osgood-Schlatter disease in young professional soccer players.

Materials and methods Medical records of young soccer players from two different Russian soccer-academies from the period January 2016–July 2019 were analyzed in a retrospective cohort study. Trauma records of young soccer players aged 11–15 years were included in the analysis. Statistical analysis was performed using IBM SPSS Statistics software, 23.0. Descriptive statistics tools were applied for the analysis.

Results A total of 280 soccer players were included in the study. The aged ranged between 11 and 15 years. Ten percent of players ($n = 28$, mean age 12.9 ± 1.3) were diagnosed with OSD during the observation period. The mean OSD treatment duration was 27.3 ± 13.9 days. Bilateral symptoms were observed in 42.9% of cases, and unilateral symptoms in 57.1%. In 53.6% of players, the first manifestation of OSD symptoms was observed during wintertime. All players were training on artificial turf playing fields. Conservative treatment without immobilization was applied to all patients. It included kinesiotherapy for quadriceps muscle lengthening and physiotherapy as well as gradual increase of physical activity. A total of 35.7% of players reported having discomfort upon resuming regular training, which caused some restrictions in exercise. However, the symptoms resolved spontaneously with time. Surgical treatment or complete avoidance of exercise was not used in any of the patients.

Conclusion High incidence of OSD was revealed among young soccer players of the leading Russian soccer academies. The OSD most commonly occurred during wintertime. Conservative treatment of OSD—i.e., physiotherapy and kinesiotherapy—enabled disease-free resuming of sports activity for the majority of patients.

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Keywords Apophysitis of tibial tuberosity · Osgood-Shlatter disease · Diagnosis and treatment of Osgood-Shaltter disease · Young soccer players

Introduction

OSD is a traction apophysitis of the tibial tuberosity, most consistent with a repetitive strain from the quadriceps muscle and chronic avulsion of the tibial tubercle [1]. Young athletes, including soccer players, are at risk of developing this condition. Currently, the data on the outcome and duration of conservative treatment of Osgood-Schlatter disease in young professional soccer players is scarce. Therefore, the study of the efficacy and safety of the conservative treatment of Osgood-Schlatter disease in young professional soccer players is of great clinical importance.

OSD most commonly occurs in boys aged 8 to 15 years, who are active in sports with repetitive sprints and jumping [2].

The duration of symptoms might be six to 18 months [3, 4].

The disease was first described in 1903 [5, 6].

OSD incidence was reported to be 21% in adolescents active in sports [7].

In non-athlete adolescents, the incidence was 4.5% [8].

OSD occurs in boys more often than in girls; the median age of onset is 13.7 years [9].

At this age, height growth accelerates, reaching its peak velocity of 9 cm/year [10].

OSD is caused by repetitive strain and chronic avulsion of the secondary ossification center (apophysis) in the course of repetitive knee extension [11–13].

The regular practice of sports in the pubertal phase and the shortening of the rectus femoris muscle, as well as more proximal patellar tendon attachment to the tibia, attachment to a broader area of the tibial tuberosity, are the main factors contributing to OSD development [9, 12–15].

Clinically, OSD presents with tibial tuberosity pain and swelling, which are aggravated by mechanical pressure and physical activity [8, 16, 17].

In 20–30% of cases, the knee pain is bilateral. However, unilateral location is more typical [11, 18].

The critical elements of good clinical diagnosis are anamnesis, clinical tests, and instrumental examination utilizing various techniques such as radiography, which enables examination of normal apophysis ossification. Ultrasound and MRI may also be useful as they determine soft tissue swelling in front of the tibial tuberosity, oedema of the patellar tendon, infrapatellar bursitis, and bone marrow edema [11, 13, 19].

Ely test is utilized for assessing rectus femoris muscle flexibility, although its reliability is questionable [20].

There are other diseases that should be considered in the differential diagnosis of OSD, such as Sinding-Larsen-Johansson syndrome, Hoffa's syndrome, soft tissue or bone tumours, patellar tendon avulsion or rupture, chondromalacia patella, patellar tendinitis, infectious apophysitis, accessory ossification centers, osteomyelitis of the proximal tibia, and tibial tubercle fracture [17, 18].

Treatment methods such as physiotherapy for inflammation symptom control, exercise avoidance, and quadriceps femoris stretching are most commonly utilized for OSD treatment [21–23].

The efficacy of immobilization for OSD management is disputed. Some authors recommend the usage of short-term immobilization with a removable splint. The others do not support immobilization [23, 24].

Previous research about the duration and methods of OSD treatment is controversial [17, 25–27]. Little attention in the literature has been paid to study OSD in young professional athletes; hence, examining OSD incidence, various treatment methods, and treatment outcomes in young soccer players is of great practical interest [17].

An athlete may continue training despite the pain unless it does not restrict the exercise and is self-limiting within 24 hours [27].

Complications of OSD may include persistent prominence of the tibial tubercle, persistent pain, bone fragmentation at the tibial tuberosity [17, 20, 22, 28, 29], and rarely, genu recurvatum [30], which is more commonly associated with a series of other aetiological factors.

Complicated or therapy-refractory OSD might be treated by surgery. The most common surgical approach is arthroscopy, and the rehabilitation duration varies between one day and two months [31–33].

However, sports medicine professionals must keep in mind that anterior knee pain is a multifactorial symptom. Therefore, other potentially modifiable aetiological factors must be considered before ordering athletes for surgery [34].

Materials and methods

Medical records of young soccer players from two different Russian soccer-academies from the period January 2016–July 2019 were analyzed in a retrospective cohort study. Male soccer players diagnosed with OSD were included in the analysis. Individualization and randomization were not carried out.

The diagnosis was made based on clinical presentation (anterior knee pain and swelling after exercise and knee flexion), anamnesis (onset of pain following physical activity), and instrumental examination (Figs. 1 and 2). The following features have been assessed: anthropometric parameters (height,

Fig. 1 Sagittal MRI T1-weighted image showing the left knee of a 14-year-old patient with Osgood-Shlatter disease. Increased volume and signal intensity of the patellar tendon, consistent with tendinitis, as well as distension of the deep infrapatellar bursa are observed

weight, BMI) and the age at onset, SDI incidence in the study group, localization of the lesion (unilateral or bilateral), seasons of the year at onset, treatment methods used (independent variables), duration of treatment, the number of complicated and recurrent diseases, and the short-term outcomes of the OSD (longitudinal characteristics). The treatment duration was defined as a period between symptom onset and return to regular exercise. Statistical analysis was performed using "Microsoft Office Excel" software. Descriptive statistics tools were applied for the analysis.

The protocol of the study was approved by the official Local Ethics Committee of the Sechenov First Moscow State Medical University with the number 01–20 of 22 January 2020.

Informed consent of the players and their legal carers was obtained. All stages of the study comply with Russian and international research laws and ethics. Authors declare no conflict of interest.

Results

The results of this retrospective cohort study demonstrate OSD incidence in 10% of young soccer players ($n = 28$, average age 12.9 ± 1.3 years). OSD was not evident in other age groups. The average height was 170.6 ± 10.5 cm. The average weight was 58.2 ± 11.6 kg, BMI was 19.8 ± 1.9. The mean OSD treatment duration was 27.3 ± 13.9 days. The minimal treatment duration was nine days, and the longest was 241 days. In one particular case, the player completely avoided sports following his parents' advice. Therefore, this patient was excluded from the analysis. Typical anterior knee pain and swelling, exacerbated by exercise and knee flexion, were reported by players at first admission. Bilateral symptoms were observed in 42.9% of cases, and unilateral symptoms in 57.1%. In 53.6% of players ($n = 15$), the first manifestation of OSD symptoms was observed during wintertime, in 28.6% of players ($n = 8$), and 10.7% ($n = 3$) during autumn and spring, respectively, and in two players during summertime (Fig. 3).

All soccer players were training on artificial turf playing fields prior to OSD onsets and after receiving treatment. In all cases, the intensity of the symptoms increased gradually and was associated with physical activity. In 53.6% of players ($n = 15$), a set of knee radiographs in the lateral aspect has been taken to confirm the initial diagnosis. A total of 39.3% of players ($n = 11$) were diagnosed based solely on clinical examination data (Fig. 4).

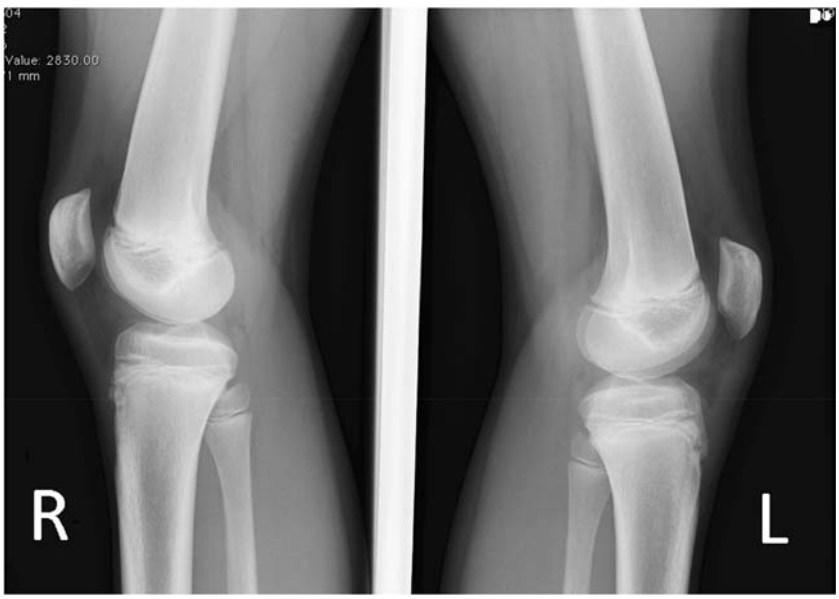

Fig. 2 Radiographic images showing left and right knees of a 12-year-old patient with Osgood-Shlatter disease, lateral view. Irregular ossification and fragmentation of the tibial tubercle and calcification and thickening of the patellar tendon are observed

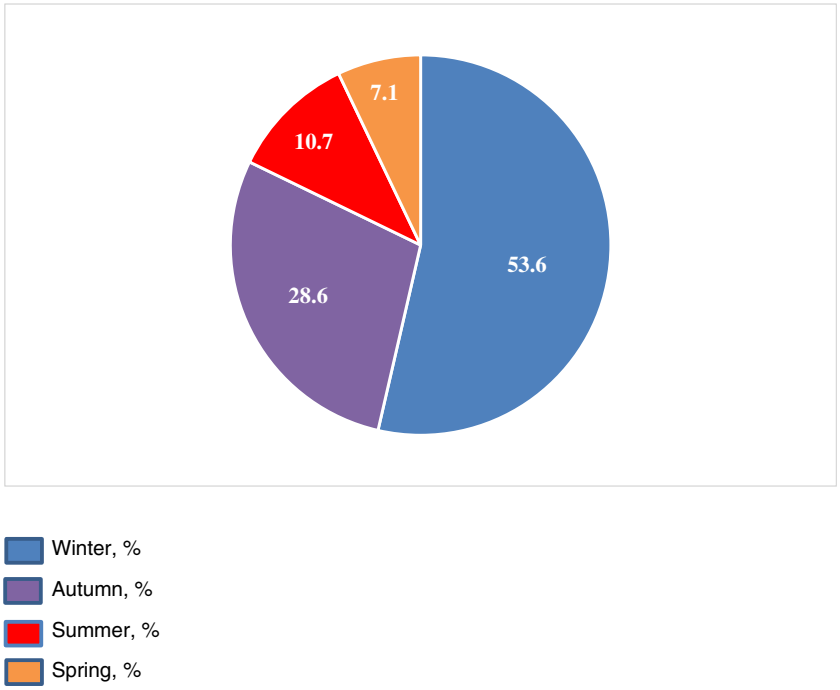

Fig. 3 OSD incidence by the season of the year

Currently, there are no universal OSD treatment algorithms for young athletes. In this study, physiotherapy for symptom control, exercise avoidance, and quadriceps femoris stretching were utilized for OSD treatment. Immobilization was not used in any of the patients.

Kinesiotherapy was the main treatment method. It included exercises for stretching of the quadriceps femoris muscle. During the sports avoidance period, the exercise was performed four times a week and comprised three sets of ten to 12 reps. Following the resuming of sports activity, the exercise was performed three times a week, comprising two sets of ten to 12 reps prior to the play.

Physiotherapy was also used to improve OSD symptoms. Players received ten magnet field therapy sessions, 20 minutes each (a series of magnetic impulses lasting 6–8 ms with 32–212 ms intervals, magnetic field strength 61mT/10). They also received five to seven sessions of transcutaneous calcium chloride applications in front of the tibial tuberosity a week, 30 minutes each, as well as local cryotherapy utilizing Game Ready® cold and compression device, 15 minutes following rehabilitative exercise.

One player completely avoided sports according to his parents' advice. The treatment duration was 241 days in this particular case.

A total of 35.7% of the players ($n = 10$) reported having discomfort upon resuming of sports activity, which led to restriction of the activity.

Ten percent of players ($n = 3$) suffered a recurrence of OSD, which required conservative treatment and additional activity avoidance for the period of 25.3 ± 8.1 days.

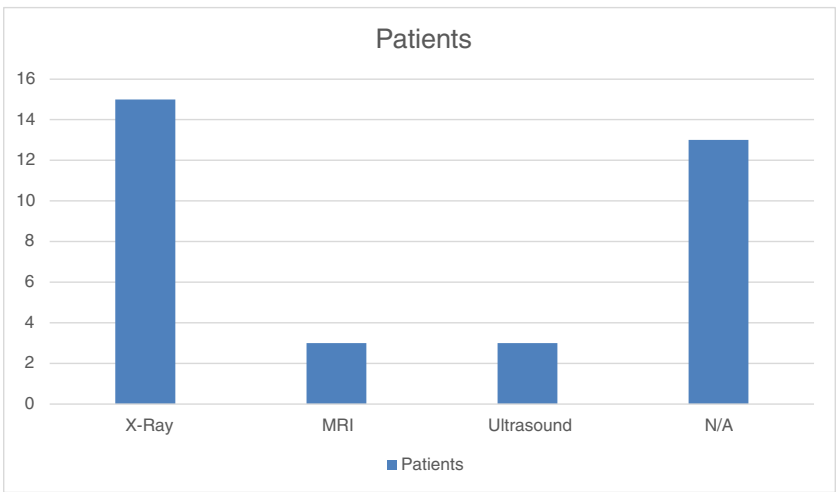

Fig. 4 The number of diagnoses by imaging modality

NSAID's and painkillers were not applied for symptom control in any of the cases.

No complications or allergic reactions were observed after or during treatment. Follow-up duration was 6 months. All players resumed regular training and did not report any restrictions due to anterior knee pain. No surgery was required for symptom control in any of the patients.

Discussion

In the current research, efficacy and safety of conservative treatment methods were confirmed. Physiotherapy was applied for inflammation symptom management, and kinesiotherapy (exercises for quadriceps femoris lengthening) was utilized for definitive treatment of the OSD. The overall OSD incidence of 10% was revealed among young soccer players, which is lower than the level previously reported [12]. It seems possible that these results are due to better-educated coaches, who might develop their programs more efficiently and expose their players to prophylactic exercise for OSD prevention. A high incidence of OSD during wintertime (53.6%) might be explained by the fact that players in Moscow train at below zero outside temperatures, which may negatively affect the muscles. Another possible explanation is the vitamin D3 deficiency, widely spread in young soccer players who are resident in Moscow. Low total serum D3 levels may have a negative influence on the development of tibial enthesis and apophysis [28, 35, 36]. In the majority of cases, the diagnosis was made based on the anamnesis, typical clinical findings, and radiography, which is in line with previous studies' methodology. However, ultrasound and MRI may also be useful as they determine soft tissue swelling in front of the tibial tuberosity, oedema of the patellar tendon, infrapatellar bursitis, and bone marrow oedema [18]. Moreover, MRI can be utilized to study patellar tendon attachment to the tibia. It was reported that patellar tendon attaches more proximally and in a broader area to the tibia, which may probably cause OSD [14].

Previous research reports the safety and efficacy of the OSD conservative treatment. Nonetheless, in most cases, the treatment duration varied strongly from two weeks to 1.5 years, and no studies investigated OSD in professional athletes.

Our data are consistent with the findings of Vaishya et al., who recommended the limitation of physical activities and exercises for the improvement of the quadriceps, hamstrings, and gastrocnemius muscles and describe beneficial effects of the use of ice packs, NSAIDs, and physiotherapy [18].

Circi et al. noted the importance of conservative treatment in reducing the stress on the tibial tubercle and tension in the quadriceps muscle [31]. However, Baltaci et al. and several other studies report immobilization of the affected extremity by casting or bracing if the knee pain causes impairment of daily activities [30]. Immobilization might cause muscle atrophy and knee flexion contractions, which severely impair sports performance and lead to increased treatment and rehabilitation duration. In our study, no extremity immobilization by casting or bracing was applied; therefore, all patients could return to sports without any impairment.

Gerulis et al. demonstrated that physical activity restriction combined with physiotherapy leads to symptom disappearance after 13 months of treatment, compared to 15 months after physical activity restriction alone [25]. In contrast to this research, our study was done on professional athletes, and the patients returned to sports without any impairment after six months of treatment, which is much less than the treatment duration described by Gerulis et al.

Untreated OSD has relatively good long-term outcomes. Krause et al. showed that 76% of patients with OSD who did not receive any treatment had no limitation of activity, although 60% still could not kneel without discomfort. The authors noted a low incidence of patellar instability or anterior knee pain and no case of premature proximal tibial epiphyseal arrest [26].

Herrero-Morín et al. described successful OSD treatment in a 12-year-old soccer player by activity avoidance and NSAID treatment. Warming up and stretching were recommended before and after the exercise, respectively. The patient resumed regular training 4 months following treatment. Regularly appearing knee pain and swelling were treated by cooling [17]. In contrast to our research, the work of Herrero-Morín et al. is a case report.

Danneberg et al. reported successful treatment of OSD with autologous-conditioned plasma in two patients. The patients were pain-free after three and six weeks, respectively, and able to return to sports. Both patients had treatment-resistant OSD [27]. The sample comprising two patients is hardly sufficient to prove the clinical efficacy of platelet-rich plasma for OSD treatment. However, it might be an interesting hypothesis for future investigations.

We observed good short-term outcomes (follow-up duration of 6 months). No player skipped training because of anterior knee pain. Nonetheless, there are reports regarding continued pain during two to four years, which might lead to impaired physical activity [37].

The literature on OSD has described several surgical treatment methods, including the cases not responding to conservative therapy [33]. However, no surgery was needed for any patient in our research.

The limitations of this study are the absence of a reference group of athletes and objective pain assessment utilizing special pain scales and questionnaires. The limitations of this study are the absence of a reference group of athletes and objective pain assessment utilizing special pain scales and questionnaires.

Further research should focus on elucidating new conservative treatment methods to reduce OSD treatment duration. In future investigations, we are planning to study the relationship between OSD and season of the year in athletes active in

different sports, as well as the relationship between OSD and the total serum vitamin-D3 level. We aim to develop special protocols for OSD diagnosis, conservative treatment, and primary and secondary prophylaxis.

Conclusion

A high incidence of OSD was revealed among young soccer players of the leading Russian soccer academies. The OSD most commonly occurred during wintertime. Conservative treatment enabled to minimize symptoms duration and to resume regular physical activity promptly. These factors are of crucial importance for young soccer players, who are at the start of their professional careers.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The study was performed according to the standards of the Sechenov University ethical committee. Informed consent of the players and their legal carers was obtained. All stages of the study comply with Russian and international research laws and ethics.

Informed consent Informed consent was obtained from all individual participants included in the study.

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