Orthopaedics & Traumatology: Surgery & Research 101 (2015) S139–S147

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Review article

Sports-related overuse injuries in children

F. Launay*

Service de chirurgie orthopédique et pédiatrique, hôpital Timone-Enfants, 264, rue Saint-Pierre, 13385 Marseille cedex 5, France

ARTICLE INFO

Article history:
Accepted 16 June 2014

Keywords:
Overuse
Sports
Child
Trauma

ABSTRACT

Increased intensity of sports activities combined with a decrease in daily physical activity is making overuse injuries in children more common. These injuries are located mainly in the epiphyseal cartilage. The broad term for these injuries is osteochondrosis, rather than osteochondritis, which more specifically refers to inflammatory conditions of bone and cartilage. The osteochondrosis may be epiphyseal, physeal, or apophyseal, depending on the affected site. The condition can either be in the primary deformans form or the dissecans form. While there is no consensus on the etiology of osteochondrosis, multiple factors seem to be involved: vascular, traumatic, or even microtraumatic factors. Most overuse injuries involve the lower limbs, especially the knees, ankle and feet. The most typical are Osgood-Schlatter disease and Sever's disease; in both conditions, the tendons remain relatively short during the pubescent grown spurt. The main treatment for these injuries is temporary suspension of athletic activities, combined with physical therapy in many cases. Surgery may be performed if conservative treatment fails. It is best, however, to try to prevent these injuries by analyzing and correcting problems with sports equipment, lifestyle habits, training intensity and the child's level of physical activity, and by avoiding premature specialization. Pain in children during sports should not be considered normal. It is a warning sign of overtraining, which may require the activity to be modified, reduced or even discontinued.

1. Introduction

When we draw up certificates of fitness or unfitness, we often use the term "physical and sports activities". Although it is true that sports activity is a physical activity, it is questionable whether physical activity is really a sport. In fact, physical activity ranges from a simple combination of bodily movements such as walking, to recreational physical activity and physical activity in school or in a club, to competitive physical activity in which the goal is to win. Analyzing a child's athletic activity is not simply a matter of adding up the number of hours spent each week in organized sports, but also the number of recreational physical activities in and out of school. This shows us that a certain number of children and adolescents may be overextending themselves physically, which may result in overuse injuries to the musculoskeletal system.

Moreover, there has been an overall decrease these days in daily physical activity such as walking to school or playing with friends [1]; these activities have been replaced with much more sedentary activities such as watching television or playing video games. That leads to a lower baseline fitness level in children starting a sport, further increasing the risk of overexertion injuries [1].

This creates the perfect environment for an increase in musculoskeletal overuse injuries. We see this every day in our practices. There are even places, such as Boston, where dedicated children's sports medicine clinics have been set up. It is important for us to better grasp this problem to improve our understanding of why these injuries occur. Curative treatment should no longer mean suspending all sports activities until the child stops growing, but it must be adapted on a case-by-case basis. Preventive treatment should remain the main goal so that children can resume their favorite physical activities as quickly and as fully as possible under optimal exercise conditions.

Legg-Calvé-Perthes disease, Scheuermann's disease and spondylolysis have intentionally been excluded from the scope of this work since they do not fall under the category of children's sports-related overuse injuries.

2. Pathophysiology

The epiphyseal cartilage is a mosaic of interacting growth plates. It is found in the epiphyses, apophyses, and physes. There is a certain vagueness that leads to confusion when naming growth diseases in this area. Strangely, we use the suffix "-itis", which

* Correspondence. 1071, chemin des Rouvières, 13830 Roquefort-la-Bédoule, France. Tel.: +33 4 91 38 69 05, +33 6 84 50 17 97; fax: +33 4 91 38 42 27.
E-mail address: franck.launay@ap-hm.fr

http://dx.doi.org/10.1016/j.otsr.2014.06.030
1877-0568/

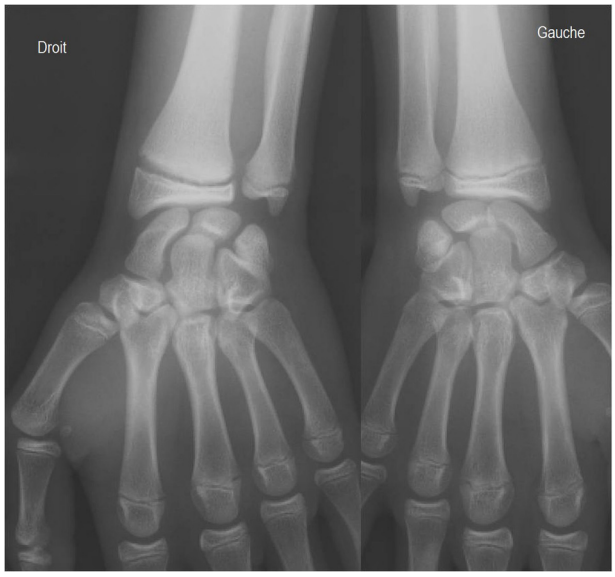

Fig. 1. Physeal elongation of the right distal radius compared with the left distal radius in a 13-year-old tennis player.

indicates the presence of infection or inflammation. Thus we speak of osteochondritis, apophysitis, or epiphysitis. It seems more accurate to use the generic term osteochondrosis [2], which is a disruption of endochondral ossification, including osteogenesis and chondrogenesis, in subjects with no initial growth disorder. Therefore, we can refer to epiphyseal, apophyseal, or physeal osteochondrosis.

The traumatic origin of physeal [3–5] and apophyseal osteochondrosis is not an issue. Apophyseal osteochondrosis is traumatic in origin. The bones and the myotendinous system grow at different rates [1,3], which sometimes leads to excessive traction on the secondary ossification centers, especially during the period of rapid pubescent growth when intense sports activities are performed. Microtears, inflammatory scar reactions, and ectopic ossifications have been found [2]. Physeal osteochondrosis is often found in the distal radius growth plate in gymnasts or tennis players with mineralization defects in the ossification area, resulting in metaphyseal cartilage inclusions, physis elongation (Fig. 1) and even secondary growth disorders [3–5]. Most of these injuries are reversible early on if the repetitive action causing the injury is stopped [4].

On the other hand, there is no consensus on the etiology of epiphyseal osteochondrosis. There are endocrine, genetic, vascular, and traumatic theories [2,6], leading to confusion. Thus, either the term "osteochondritis deformans" or "osteochondritis dissecans" is used, depending on the anatomical site and its presumed etiology. Osteochondritis deformans affects the entire primary ossification center in young children (Legg-Calvé-Perthes disease, Köhler's disease, Panner's disease), while osteochondritis dissecans affects a more limited bone and cartilage portion of weight-bearing areas in older children (femoral condyle, talus). It is customarily said that osteochondritis deformans has a vascular origin while osteochondritis dissecans has a traumatic origin [6]. The reality is probably more complex. If osteochondritis deformans was exclusively vascular in origin, this would not explain the high proportion of hyperactive children with Legg-Calvé-Perthes disease. Furthermore, if osteochondritis dissecans was exclusively traumatic in origin, this would not explain why it does not consolidate like a fracture when immobilized. Both pathologies seem to be caused by multiple factors, including vascular, traumatic, and even microtraumatic etiologies. Thus, it seems more appropriate to use the term epiphyseal osteochondrosis deformans for injuries affecting the whole ossification center and the term epiphyseal osteochondrosis dissecans for osteochondral injuries confined to weight-bearing areas. Therefore, both forms of osteochondrosis can be found in the same anatomical location. The most widely known example is the lateral condyle of the elbow in Panner's disease, which corresponds to osteochondrosis in children between the ages of 6 and 10 (Fig. 2), and osteochondritis dissecans in gymnasts over age 10 (Fig. 3).

3. Diagnosis

History taking is essential to making a diagnosis. Most of all, it optimizes prevention while minimizing the recurrence of overuse injuries. Mechanical pain is the main sign of overuse injuries [2,4]. It allows injuries to be divided into 4 stages [7]:

- stage 1: pain after physical activity;
- stage 2: pain during physical activity with no impact on function (can continue participating in activities);
- stage 3: pain during physical activity that lasts all day and has an impact on function (need to decrease or even stop the activities);
- stage 4: pain during all physical activities, even basic musculoskeletal functions.

Pain is generally hard to pinpoint in epiphyseal and physeal osteochondrosis. On the other hand, a child can easily locate pain caused by apophyseal osteochondrosis.

It is necessary to know how to look for the earliest signs of overuse—fatigue and decreased sports performance [1,4,7]. It is also necessary to be able to analyze the sports activity and the conditions under which exercise is performed. This relates to the child, equipment, and sports technique: What is the child's level of athletic ability? Does the child participate in the right age group? How many hours per week does the child spend on sports? Is there a nutritional or sleep disorder? Is the child really motivated to play sports? What type of playing surface is used (e.g., dirt, synthetic or natural turf for soccer)? Is the child's footwear appropriate for the playing surface? What types of balls, rackets, and other equipment are used? Have there been recent changes in the sports technique? Could improper technique be causing the overuse injury?

The clinical exam seeks first of all to reproduce the pain by palpation. The patient should be checked for muscle and tendon stiffness, especially in the lower limbs. Conversely, hyperlaxity can also be a source of midfoot pain in runners [8].

Imaging is rarely helpful in the diagnosis, but it should be requested in the case of unilateral injuries or unusual pain such as nighttime or inflammatory pain. There is a risk of too quickly assuming that the pain is caused by osteochondrosis when it could be the result of inflammation, infection, or even a tumor [2,9].

4. Major pathologies

4.1. Upper limb

4.1.1. Shoulder

Overuse injuries of the upper limbs are less common than that of the lower limbs. Shoulder injuries are even less common. Cases can be cited of rotator cuff injuries or subacromial impingement in patients who practice tennis, gymnastics, or handball intensively [10–12]. Physeal microtrauma can also be found in the proximal humerus with elongation of the proximal physis. These lesions are found mainly in baseball pitchers (Little Leaguer's shoulder) [12], but also in children who practice gymnastics, tennis, volleyball, or swimming [13].