Paediatric sports injuries

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Background

Paediatric sports injuries are common. Fortunately, most children self-modulate their activity levels when injured until they recover, but some will seek medical help. Injury pattern varies with age, mechanism and the chosen sport.

Objectives

The aim of this article is to give a general overview of some of the more common paediatric sports injuries, including common patterns of pathogenesis, the effects of growth and biomechanics on tissue load, and issues particular to specific sports.

Discussion

The immature body has different strength ratios of bone, muscle and tendon, and is constantly developing coordination and body awareness, which are affected by growth and neurological maturation. When planning the return to sport after an injury, the demands of the chosen sport, hours and periodisation of training, and requirements of schooling need to be considered. Biomechanical issues are best addressed early in treatment to improve return-to-activity outcomes.

As medical practitioners hear over and over again in their medical training, children are not just little adults. This statement holds even truer in the athletic population. The same mechanism of injury in an adult may create an entirely different pathology in a child. Knowing these differences is integral to being able to treat paediatric sports injury accurately and efficiently to minimise the time taken out of activity.

Keeping children active is important for the prevention of obesity later in life. We know that overweight and obese children and adolescents reduce their activity levels at a younger age than their healthy-weight peers,[1] potentially setting them up for a lifetime of inactivity and difficulties with weight management.[1] There is nothing more demoralising for a sport and exercise physician than meeting a teenager with poor activity levels, fitness and strength, who relates their lack of activity directly back to an injury. It is even more demoralising when the situation may have been prevented.

In my experience, the natural instinct of most medical practitioners is to tread very cautiously where children are concerned, allowing extra time for recovery, more immobilisation and longer restrictions on activity. In reality, however, for a number of injury types, children can actually be allowed to return to activity early, as long as the predisposing factors are addressed. Examples of these include Severs disease and Osgood-Schlatter disease, where stretching and activity modification rather than complete rest can be very effective. Of course, there are also many injuries that require specific and prolonged care. Identifying the appropriate level of concern is the first step to successful management.[2,3]

Child versus adult athlete

The child and adolescent athletes differ from the adult physically in terms of tendon strength and epiphyseal closure, but they also differ in the demands that they put on their body. In the child and adolescent athlete, the injury incidence is predicted less by age and more by the chosen sport.[4] Baseball, football, gymnastics and netball all have their own injury profile and incidences.[4–8] In addition, young athletes can present with injury from unaccustomed loads rather than from their regular training. For example, a junior athlete may have extremely high skill levels in their chosen sport (Figure 1), but these may not translate to less frequent activities, such as in physical education classes.

Figure 1. Active kids are healthy kids

A good medical understanding of injury patterns can help doctors to keep them on track

Rather than being a detailed review of the literature, this article aims to give a practical understanding of paediatric injuries and the issues pertaining to junior athletes. This is by no means an exhaustive coverage of all injuries, but presents some concepts helpful to clinical practice.

Classifying injuries

In trying to classify children's injuries, it can be helpful to group them into the acute and overuse categories. In both groups, it is important to assess the child for strength, balance and proprioceptive deficiencies. However, it is extremely important to ask about training in the overuse group.

Relevant questions for potential overuse injuries include the volume and type of training, whether any sports-specific strength and flexibility work is done, as well as recovery times and routines. It is useful to know whether a coach is involved and whether there is any periodisation of activity through the year. It is also very important to ask about upcoming events or competitions, as management will often have to be structured around these.

Anterior knee pain

Anterior knee pain can have a number of anatomical and pathological causes. However, the most common underlying diagnosis by far is patellofemoral pain syndrome (PFPS), or pain related to maltracking of the patellofemoral joint.[9,10] PFPS can be due to anatomical variations such as patella alta or variation in femoral trochlea shapes,[11] but it is far more commonly seen as a result of poor foot biomechanics, poor medial quadriceps function, tight lateral thigh structures and inadequate gluteal activation in single leg stance.[10,11] One or more of these factors may be present in any patient. Treatment involves addressing all inadequacies in order to offload the knee extensor mechanism. Taping alone does not fix the problem, but may help with symptom control and may enhance the function of the medial quadriceps, allowing rehabilitation to proceed.[12]

Occasionally, the load through the anterior knee can result in the development of specific pathology. Careful questioning and examination will often help differentiate Osgood Schlatter,[13] Sindig-Larssen-Johansen, patellar tendon pain, synovial plica pain,[14] fat pad impingement and intra-articular derangements such as osteochondral defects.

In a young person with persistent pain, an X-ray is always warranted. Further investigations can be used as necessary, but bear in mind that ultrasonography will often be far more helpful than magnetic resonance imaging (MRI) in diagnosing tendon and insertional issues. MRI is especially useful for identifying intra-articular pathology.

Painful tendons

Although tendinopathy is more common in adults, its incidence increases with age during adolescence. Younger children and adolescents are far more likely to experience pain related to the tendon insertion. As growth plates mature, the tendon becomes more vulnerable.[15] This is a slow degenerative process in tendons such as the Achilles, patellar tendon or tibialis posterior tendon. Children and adolescents are far more likely to experience pain related to the tendon insertion. Depending on the location, this may be an enthesopathy or an apophysitis. Examples are calcaneal apophysitis (Sever's disease) and tibial tuberosity apophysitis (Osgood Schlatter disease).

Occasionally, the clinical picture can be confusing. Generally, plain radiographs and ultrasound will be able to clarify if the apophysis is abnormal. If further clarification is required, an MRI will deliver this, but this is not frequently required.[16]

Local anti-inflammatory measures such as ice, topical nonsteroidal anti-inflammatory drugs (NSAIDs) or iontophoresis can be of benefit to settle symptoms. During a period of offloading, strength and balance issues can be addressed. A graded return to activity can then be undertaken.

Although orthotics are often recommended for calcaneal apophysitis, there is conjecture on 'best practice' treatment. Rest, physiotherapy, heel raises and orthotics have been shown to create improvement, but there is no significant difference in the outcomes with each treatment.[2,3] Most practitioners prefer to use interventions, as they are more likely to enable the child to maintain fitness and activity levels during recovery.

Growth plate and bony injuries

In general, growth plate and bony injuries relate to weight-bearing load.[4,7] Many will only occur in a few specific sports. Load through different areas of the body will vary depending on the sport. To list all of the injuries specific to every sport would be an enormous task. Some example are listed below:

- gymnasts can develop distal radius epiphyseal pain[7]
- throwers can develop medial epicondyle avulsion or osteochondrosis of the elbow capitellum (Panner's disease)[8]
- rowers can develop rib stress fractures

- repeated high-impact or single-leg landing such as that seen in basketball
- volleyball or gymnastics are associated with pars interarticularis stress fractures[17]
- sprinters irritate pelvic apophyses at the hamstring or quadriceps origins
- running athletes can develop Sever's disease.[7,17]

Growth plate injury has even been reported at the acromion[18] and greater trochanter apophysis.[19] Most of these diagnoses involve traction-type mechanisms, can be treated conservatively and have an excellent prognosis if recognised, offloaded and treated early.[2,3,13,18,19]

When the mechanism is repeated impact, such as in Panners disease or pars interarticularis injury, recovery can be slower, particularly in areas with precarious blood supply such as the pars interarticularis, vertebral end plates or knee epiphyses.[5,17] These injuries raise higher levels of concern and more caution in offloading from activity to achieve healing before the area is gradually loaded in return to sport.

Bilateral pars stress fractures carry the risk of non-union and subsequent spondylolisthesis with potential lifelong consequences.[17] Accurate diagnosis is a must. Bracing is not essential, but can be useful. Rigid braces, such as a Boston brace, are poorly tolerated as they are bulky and uncomfortable. While flexible braces do not offer support to the pars interarticularis, they can be useful as a reminder to the athlete to reduce activity and to be more aware of resting postures.

Offloading of the spine by resting from impact activity and monitoring of recovery is imperative. Almost universally, in my experience, these athletes have deficiencies in pelvic control when landing. These can result from muscular tightness or underactivity and must be addressed before any return to impact-loading is considered. As a general rule of thumb, six to eight weeks of rest, followed by six to eight weeks of graduated return to activity is required for these injuries.

Healing is usually assessed clinically but, if required, can be monitored with monthly CT imaging directed at the affected level only. There are no specific guidelines for this follow up and therefore, for these athletes, follow-up and repeat imaging should be undertaken by a practitioner with experience and knowledge particular to the field in order to ensure that excessive exposure to ionising radiation is avoided.

Osteochondritis dissecans (OCD) of the knee has a prognosis that varies by stage. A painful, effused knee in a child or adolescent must be investigated. OCD can vary from mild to severe. In its severe form, the cartilage may separate with or without an associated piece of bone and become a loose body in the knee, leaving a cavity in the distal femur. Early, accurate diagnosis with appropriate offloading, or early surgical intervention, depending on fragment stability, is the most important step to giving the patient a chance of a positive outcome.

Acute injuries

Many of the injuries sustained by adolescent athletes are very similar to their adult counterparts. Joint instability is common and mostly treated conservatively. The one notable exception to this is shoulder dislocation. In an athlete younger than 20 years of age, repeat dislocation is virtually inevitable and is often quoted as >90%, but a recent analysis suggests that this rate is >70%, which is still much higher than the redislocation rate of 17% post surgery.[20] In a young patient with dislocation, surgical intervention in the form of shoulder reconstruction is highly recommended.[20,21] This involves tightening the anterior structures and forming a more effective buttress at the anterior labrum. The major exception is patients with multidirectional laxity of the joint. Rehabilitation should be rigorously pursued, as stabilising the anterior structures in isolation can simply exacerbate laxity in a posterior and inferior direction. Surgery is indicated for these athletes only if appropriate rehabilitation has failed.

The major difference between adult and paediatric ligament injuries relates to the weak point in the ligamentous chain. In an adult joint, bone joins to ligament, which in turn joins to bone. The weak point in this chain is the soft tissue, that is, the ligament. In an immature joint, the epiphysis joins to ligament, which in turn joins to epiphysis. In this situation, the ligament is the stronger structure. This means that ligamentous injuries in children are far more likely to result in an avulsion fracture.[22] While this sounds dire, bony tissue has an excellent blood supply and healing response. A small, non-displaced avulsion will often heal well with conservative treatment, which can be the same as treatment for a soft tissue injury.

Apophyseal avulsions at the hamstring or rectus femoris origins can look alarming clinically and the X-ray findings often show marked displacement of fragments, but almost universally do very well without surgery. The old rule of thumb is that less than 2 cm of displacement is reason for conservative therapy. This can be difficult to explain to a parent looking at a very impressive X-ray, where 2 cm looks enormous.

A child with a suspected bony injury should always have an X-ray. If the X-ray is normal and suspicion is still high, MRI is the next investigation, to minimise radiation exposure. If further clarification is required, limited computed tomography (CT) can be helpful. If suspicion remains high with a negative MRI scan and a definitive diagnosis will potentially alter management, a bone scan can be considered.

A comment on footwear

The creation of athletic shoes is a scientific and mechanical engineering feat. Unfortunately, the footwear deemed most socially appropriate may not be the footwear most mechanically appropriate. The wrong choice may be a direct cause or perpetuating factor of injury. Always check what your patient is wearing on their feet for school and sport. Fixing up a mechanical overload from the wrong shoes could well be the turning point in offloading their injury and kick starting recovery.

Summary

Adolescent and child sports injuries differ widely from those sustained by their adult counterparts. With accurate diagnosis, a specific plan of management can be applied, ensuring that time out of activity is appropriate and recovery is achieved efficiently. Knowledge of the specific demands of each sport and the biomechanics of injury can help to create appropriate return to sport plans and rehabilitation programs to address any underlying risk factors for further or recurrent injury.

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