Adolescent Sports Medicine: Changing Patterns of Injury in the Young Athlete

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Summary: Injury patterns in the young athlete are changing. This can be recognized by epidemiological information, the emergence of injuries previously not seen in this age group, and treatment methods more appropriate for the sports active adolescent. An outline of the current pattern of injuries in this age group is presented as well as some examples to illustrate new types of injuries and their treatment. Key Words: Sports injuries—Epidemiology—Adolescent.

Participation levels of young athletes in both competitive and organized recreational sporting activities have increased dramatically in the past few years. With this increase in participation levels has come an increase in the number of injuries in this age group. Unfortunately, clear epidemiological information to document the changing patterns of sports injuries in the young athlete over the past twenty to thirty years is lacking. However, the frequency with which sports medicine specialists, pediatricians, orthopaedists, and general practitioners are being faced with sports injuries in this age group has increased dramatically in the same time period.

In reviewing the content of some of the early textbooks of sports medicine it is clear that there was virtually no recognition of athletic injuries in the pediatric and adolescent age group. An example is the text book entitled Treatment of Injuries to Athletes by O’Donohue (1). This was published in 1962 and represents one of the earlier textbooks devoted solely to describing the diagnosis and treatment of athletic injuries. In reviewing this text, however, the only two adolescent sports injuries included are Osgood-Schlatter disease and osteochondritis dissecans.

Now 30 years later we see entire textbooks devoted to the diagnosis and treatment of athletic injuries in the pediatric and adolescent athlete (2,3). There are a number of ways in which one can look at changing patterns of injury in the young athlete. One way is by studying epidemiological information. Epidemiological studies look strictly at the type, location, and severity of injury as well as mechanisms of injury for various injury types and sports. By collecting this information on a regular basis, trends and comparisons can be made that allow the implementation of interventions designed to prevent injury from occurring.

The second way is to look at the emergence of previously undescribed injuries in a specific population ("the young athlete"). These "new" types of injuries may arise because of more intense scrutiny of a specific population or sport in question or they may arise because different groups of individuals are now involved in sporting activities to which they were not previously exposed. A good example is the increased number of anterior cruciate ligament tears that we are now seeing in adolescent females.

A third method of looking at the changing patterns of injury in the young athlete is by looking at new and often more aggressive treatments for conditions that have existed in this age group for a long period of time. Examples are the rehabilitation...
techniques that are currently being used in such conditions as Osgood Schlatter's disease (4,5) and the more aggressive surgical procedures now being used in conditions such as osteochondritis dissecans of the knee (6).

This article will attempt to highlight some of the key changes in each of these areas. Although the specifics will be covered in more depth in the comprehensive individual chapters on each anatomical area, a few of these specific injuries will be used as examples to illustrate points regarding the changing patterns of injury in this age group.

EPIDEMIOLOGY

Unfortunately, very few good epidemiological studies exist that accurately document the type, severity, injury rate, and morbidity of sports injuries in the young athlete. Injury statistics on many sports lump the young athlete in with the adult athlete and therefore accurate statistics for the younger age group are difficult to interpret. In those studies that deal specifically with the young athlete, differences in the way the information is collected and described statistically allows little comparison between one study and the next.

In order to have some meaning, injury statistics must be accurately collected in both game and practice situations and must include information not only about the type, severity and anatomic location of an injury but also must detail participation levels so that accurate injury rates can be calculated.

Injuries must also be reported in the context of the sport. For example, a relatively "minor" injury such as a finger sprain in a soccer player (where upper extremity activity is minimal) may become a "major" injury for a volleyball player whose upper extremity use within the sport is intense. Therefore the same injury may be very disabling to one athlete but make virtually no difference to another.

At the same time, these "minor" injuries are very important to keep accurate track of. In many instances, medical intervention designed to prevent injury, in reality becomes "injury attenuation" (7) because the intervention does not necessarily prevent an injury from occurring but certainly lessens the severity of it. An example would be overshoe taping, which is done in football to prevent ankle sprains. This type of intervention is unlikely to completely prevent ankle sprains from occurring since the circumstances in which they occur are unaltered by that intervention. The intervention...
The skill level of participants also seems to have a bearing on injury patterns. Elite young athletes seem to have a much lower incidence of injury than those competing at a recreational level (17). This is due not only to a higher skill level seen in the elite young athlete but also to superior conditioning and fitness levels.

One of the best sources of epidemiological information on a variety of sports in the adolescent age group comes from the Canada Summer Games. This is a multi-sport event that occurs in a different Canadian city every 4 years. There are both summer and winter versions of these games. All participants are age 20 or below. Each province sends a team in a variety of sports; in 1993, athletes, coaches, and officials numbered 4,319. No individual team has a dedicated physician or therapist accompanying them. The host city and organizing committee provide all of the medical services to every sport from every provincial team and therefore the recording and collection of data on injuries and medical interventions is extremely accurate. Unfortunately, injury rates are difficult to control, since a risk “exposure” to the sport is different in each one, making the comparison difficult. The injury rates in 1993 adjusted to the number of participants show >20% of the participants in archery (upper extremity), cycling (road crashes), rugby (head and face injuries), soccer and water skiing (lower extremity), field hockey, and wrestling being injured during the course of practice and participation at these games (D. Newhouse, unpublished data, 1993).

Other typical “high risk” sports include football, gymnastics, wrestling, and soccer. They have all been found to have relatively higher traumatic injury rate than other sports such as track and field, cross-country running, or swimming (9). Sports such as swimming, however, have a higher incidence of overuse injuries than traumatic injuries (18).

In contact sports, it is evident that as athletes become older the risk of injury increases. Part of this can be explained by the fact that there is a much wider variation in size and weight between athletes of the same chronological age than there is when they are younger. For example, in ice hockey injuries Brust et al. (13) found that the injury rate was much higher in the Bantam level (ages 13-15) players than in the younger Pee-Wee (ages 11-13) and Squirt (ages 9-11) age groups. They found that between the smallest and largest Bantam player there was a difference of up to 53 kg or 55 cm in height. When looking at the injury statistics, the lighter players were much more likely to be injured. Of the total injuries, 86% involved body contact. It is evident from information like this that age matching alone in a contact sport appears to contribute to a much higher injury rate than when players are matched by both body size and age. Size and strength matching for players in team sports is much more effectively done using Tanner staging than simply the chronological age (19).

NEW INJURIES

More recently, there has been clear recognition of many changing patterns of injury in the young athlete. This has been observed for example in the pattern of overuse injuries (4, 5) in anatomic areas such as the knee (20-22) and the recognition of injuries such as tendonitis commonly seen in the adult athlete but now recognized in the pediatric athlete (23, 24).

Overuse injuries

We certainly now recognize the abundance of overuse injuries that are seen in young athletes. Tendonitis (24), the traction apophysitises (23), stress fractures (25), and other more specific injuries such as gymnasts’ wrist and shoulder impingement are now being seen with increasing frequency in the young athlete. Much of this has to do with the types of training programs to which these young athletes are being subjected to that often involve an inappropriately high volume of training or poor technique.

Another factor is “cultural deconditioning.” It is now clearly recognized in this age group that in general the participation and fitness levels of our children, especially in North America, is decreasing. The tendency to go from long periods of sedentary activity at a desk or in front of a computer terminal or television set to the 1-2 h of vigorous organized sport is much more likely. There are less free-play situations now that involve habitual physical activity. Change in body composition and increased obesity is also a factor. A recent survey comparing body composition and physical activity in children 20 years apart found a 22% increase in obesity in similar groups of children (26, 27). Other factors such as growth, anatomical malalignment and muscle-tendon imbalance also contribute (4).
Knee

The clearest example of this changing pattern, however, is seen in the knee. No more than 15 years ago it was noted by many prominent authors that injuries of the ligaments of the knee and shoulder were extremely rare (20,21). Meniscal tears in the young athlete were also thought to be relatively rare. Upon more close scrutiny, it is evident that this is not the case. In those young athletes presenting with an acute hemarthrosis, 47% of them are found to have meniscal pathology and 47% are also found to have anterior cruciate ligament pathology (22). The majority of these anterior cruciate ligament tears are partial tears, however. Common practice years ago, when presented with a child with an acute hemarthrosis, was to place the knee in a Jones bandage or cast for comfort and allow the symptoms to settle. With the recognition of these injuries, it is clear that this is not an acceptable method of management and that pinpointing the diagnosis and treating it appropriately with meniscal repair, resection, or appropriate bracing and rehabilitation of a ligament tear is far more effective. In addition, with more children involved in competitive and organized athletic activities, their desire to get back to competitive athletics is often quite acute. Therefore the sports medicine specialist is challenged to treat these injuries in a timely manner with early accurate diagnosis and anatomic treatment.

One of the other most prominent changing patterns that we see in the adolescent athlete is the recognition of the increased number of anterior cruciate ligament tears in the young adolescent athletic female. These injuries have been seen in increasing numbers in female youth soccer, basketball, and lacrosse (28). Whether this is due to increasing participation of female athletes in sport or represents a true increasing incidence of these injuries is not yet clear. Some of the factors that may be involved include the narrower notch width index seen in the female (29), lack of habitual physical activity and physical fitness, or a more aggressive style of play without proper adaptation to that style of play. Hormonal factors may also play a role. In a pilot study of female ACL tears over the past year, a definite temporal relationship between time of injury and stage of the menstrual cycle in those female athletes with complete ACL tears and a "noncontact" mechanism of injury has been noted. Whether this is due to actual changes in the mechanical properties of the supporting ligamentous structures or other factors associated with the menstrual cycle is not yet known.

NEW TREATMENTS

Some conditions seen typically in the young athlete are now being treated in a more aggressive manner. The logic behind this arises from a rejection of the passive attitude regarding the treatment of paediatric injuries in general and adoption of the active methods of treatment used for years in adult sports medicine. The goal is the early return of the young athlete to full participation without risking further injury. This type of approach is used for example in tibial eminence fractures, osteochondritis dissecans, and some of the traction apophysitises such as Osgood-Schlatter disease and calcaneal apophysitis.

The treatment of tibial eminence fractures in the skeletally immature athlete is undergoing change. Common practice was to treat these injuries in a cast with the knee in extension with the assertion that pressure from the femoral condyles would reduce these fractures (30). Follow-up results, however, have clearly shown residual A-P laxity in the knee after this type of treatment (31,32).

A more aggressive approach in the treatment of these fractures has been used at the Boston Children's Hospital. Arthroscopic visualization of these fractures has shown that in extension the bone fragment is lifted out of its bed and remains displaced. In addition, a portion of the medial meniscus and transverse ligament is often observed preventing the reduction of the fragment. By manipulating the fragment back into its bed, an anatomic reduction can be gained. Rigid fixation using cannulated screws allows immobilization of the knee in 30–40° of flexion, providing the lowest level of tension on the ACL as the fracture heals. Immobilization continues for 6 weeks followed by a rehabilitation program designed to regain strength and range of motion. Results using this more aggressive technique have been satisfactory to date.

Osteochondritis dissecans is also now being treated more aggressively. The etiology of this lesion of articular cartilage and subchondral bone is unknown, but repetitive trauma is likely in many cases. It has been typical in the skeletally immature athlete to treat the lesion conservatively in most cases (33) because the long-term course was thought to be benign (34). This does not recognize the immediate problem with painful lesions in those
The pattern of injuries in the young athlete are changing. This can be seen by the recognition of new injuries and some limited epidemiological studies. Further and more accurate information is required to document this as well as to give us more specific information on which to build prevention and treatment programs.

REFERENCES


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