



Medical considerations for children

Sports physician Dr Tom Cross discusses various medical considerations relating to paediatric sport and exercise.

Childhood sports participation in Australia has declined since 1985 when 86% of children aged 5–14 years were active in sport. By 2003, these levels of participation had fallen to 54% for girls and 69% for boys. In turn, during this period there has been an increase in the incidence of overweight and obese children: 30% of 12–19 year olds in Australia are 'obese'. This is related to a combination of inactivity and energy-dense food. Unfortunately the research suggests 40% of obese children and 70% of obese adolescents later become obese adults. Ironically, those children at the other end of the spectrum who are more active are training for longer and more intensively in one or multiple sports than ever before, and in turn the incidence of paediatric sporting injuries seen in the sports medicine practice is actually increasing.

Figure 1



Considerations for in sport

History and examination

The clinical assessment of a child can be rewarding and straightforward if a systematic approach is followed. Fortunately many of the conditions occurring in children are self-limited and full recovery is the usual outcome. However, more serious conditions may occasionally occur and if these are missed, especially during the rapid pubertal growth phase, the consequences of a missed diagnosis may be significant for the child. To regard all pain in a child as 'growing pains' is folly. If a careful, informed systematic approach is followed, hopefully the child with significant pathology will not be missed.

For the young child, a detailed history taken from the parents is important. Specific questions should address developmental milestones and also family history. If a parent accompanies an

older child, the clinician is advised to direct questions to the child first to develop rapport with the child and later clarify any points with the parent(s).

Special considerations

Children are not 'little adults'. They are different structurally, physiologically, neurologically and psychologically. Furthermore, these developmental characteristics will vary tremendously between children who are the same age. For example, there may be as much as six years' body size (height and mass) difference between children at the chronological age of 13 years.

Medical considerations

A number of general medical considerations for active children warrant discussion. Too little or too much sport and exercise can have multiple deleterious adverse health effects.

Personal development and mental health

The definition of 'too much' sport and exercise will vary enormously depending on the individual child.

A certain amount or 'dose' of activity for one child may be adverse to their health (i.e. cause physical and/or emotional distress) whereas for another child, that same level will not be enough to cause them harm and they may wish to do more activity to keep them happy. As a rule of thumb, if the child is not happy and/or suffering recurrent musculo-skeletal injury and/or medical illness (including excessive fatigue), then the present level of activity is too much. For the younger child, the responsibility to recognise and monitor this rests with the parents and/or coach, and on occasion the clinician.

The 'ugly parent' syndrome is a well-recognised phenomenon where a parent or parents are over-invested in the sporting participation of their child to the point where the child suffers emotional distress and often musculoskeletal overuse injury or illness.

Nutrition

Active children need enough calories to not only fuel their activities but also to grow normally. This means that for these children, they not only require a healthy, balanced diet but also require numerous snacks to supplement their three meals a day. Unfortunately in some sports, such as ballet, gymnastics and track and field where a lean body mass offers a perceived performance and/or aesthetic advantage, restriction of

calories from disordered eating behavior is prevalent. This is particularly concerning as the adolescent growth spurt is when 15% of adult height, 48% of adult skeletal mass and the majority of adult skeletal bone mineral density is accrued. Disordered eating during childhood and adolescence in mild to moderate cases can cause excessive fatigue and reversible growth retardation, but in severe cases can result in growth retardation and osteopenia that in some circumstances can never be reversed. Parents and coaches need to be vigilant and intervene early and carefully for the best treatment outcomes.

Environmental illness

Children are more susceptible to both heat and cold illness secondary to their relatively immature physiological thermoregulatory mechanisms. For this reason, parents and coaches need to protect children from both heat and cold stress and to have a number of preventative strategies in place. Furthermore, with asthma so prevalent in Australia, care needs to be taken for the child with asthma when they exercise in the cold or in air with various pollutants and allergens. The child athlete should consult their general practitioner regarding certain prophylactic medications and measures to optimise the child's lung function.

Immunity and infectious disease

The immune system responds to exercise in children in a similar fashion to adults, with an inverted bell-shaped response. A healthy dose of exercise will strengthen immunity and excessive exercise will lead to an exponential decrease in immunity. Mucosal immunity is often first affected and the child may suffer more upper respiratory tract infections. If this becomes a recurrent problem, simply reducing the level of activity often will promptly reverse the problem.

Head injury

Concussion is defined as a transient disturbance of neurological functioning for a variable period of time with no long-term neurological harm. However, there are some scientists who do believe there may be subtle long-term neurological consequences from one or more concussive injuries, but that these effects are very hard to study and measure as there are numerous confounders for this research, and also such a study would require large numbers and would need to be done over a long period.

In general, concussion should be taken seriously in both adults and children, but even more so in children as their neurological development is incomplete. The child who is



concussed should be immediately removed from the field of play and not be allowed to return to play that day. Any 'red flag' symptoms or signs, including worsening headache, nausea/vomiting, decreased level of consciousness, requires urgent transfer to hospital.

The child may take days and sometimes many weeks to recover. Children (aged less than 16 years) should not be returned to play following a concussive injury without medical clearance. As a general rule, the doctor needs to be more conservative in returning children to play after concussion compared to adults, as there are data to suggest children take longer to recover than adults. Recovery is when there is no headache, normal concentration and no fatigue. The child can then return to aerobic exercise with no contact. If symptoms recur, they should be rested longer and then try again. To simplify matters, in schoolboy football a mandatory three-week exclusion rule exists where the footballer cannot return to play.

This is enough time for the vast majority of concussions to improve. However, three weeks may not be enough time for some to recover and this is why medical consultation is recommended prior to returning to play. If symptoms do persist or any 'red flag' features occur during the recovery period, the child requires prompt investigation, usually involving an MRI of the brain.

There are certain children and adults who do suffer concussive injury more easily than others and often suffer numerous concussions. This often relates to the intrinsic vulnerability of their brain to deceleration/acceleration forces and occasionally is also related to the style of play of the athlete. Such athletes should be identified, monitored closely and on occasion advised to change sports. Concussion is a significant sports medicine problem and for this reason an international collaborative society exists. The 3rd International Conference on Concussion in Sport will be held in Zurich in October this year.



Figure 2

General guidelines for training the younger

- Children are not 'little adults'. They have a unique biology that needs to be considered.
- Specialisation of sporting activity is discouraged before age 10. Young children are encouraged to participate in a wide variety of sports/activities with the emphasis on enjoyment, and delay specialisation for as long as possible. Unfortunately in many sports (tennis, gymnastics, ballet etc.), the child's competitors are specialising at younger ages and this accounts for this trend.
- The coaching and degree of participation of children should be individualised to a certain degree to consider differences in age, biological development, skill level, psychosocial maturation, and enthusiasm.
- How much activity for a child is too much? Some children can train and play for their school, club and representative team without injury or illness with great enjoyment. This level of activity needs to be closely monitored by responsible parents and coaches. If a child is no longer enjoying their sport and exercise, are being injured recurrently or getting fatigued and sick often, the level of activity for that child is too much. For contact sports, particularly the football codes, some children play three games in a given weekend. I would recommend this be discontinued after year 6 or rather the age of 11–12 years. I believe the risk of injury increases thereafter as the children grow taller and heavier and can therefore generate more force. Moreover, the ability to recover for the next game, sometimes within a 24-hour period, is not possible and this significantly increases the risk of injury. Also the mismatch in sizes of the players is much more marked in the high school years. Furthermore, the child's academic and general curriculum is 'busier' in high school and this creates time pressure.
- Numerous sports have specific guidelines for training and competition volumes to protect children and adolescents from well-recognised 'sport-specific' overuse injuries. For example, in baseball and cricket the number of 'pitches' thrown or 'overs' bowled respectively is monitored. Injuries to the elbow and shoulder in baseball and injuries to the lumbar spine in

Diagnostic radiation exposure

Talented active children may suffer numerous injuries during their childhood, and then into their adult years. Therefore, they may require numerous X-rays, CT scans and bone scans to diagnose their injuries. These tests all involve diagnostic ionising radiation. The radiation dose and, in turn, the health risks incurred from these numerous investigations is cumulative. A critically important consideration is that children not only have more 'radio-sensitive' tissue than adults do, but also because of their younger age they will carry the health risk of that radiation exposure for longer. It is therefore incumbent on the doctors and parents to limit and monitor the number of these tests. The diagnostic test should only be performed if it is truly indicated and another test that does not involve diagnostic radiation (ultrasound or MRI) cannot be used.

'Red flag' conditions

The aphorism 'not everything that presents as a sports medicine/musculoskeletal problem should be strictly regarded as a sports injury' is true both in adults and in children.

Tumours

Unfortunately benign and malignant (primary and metastatic) tumours do occur in children. Local trauma often focuses attention on an area in which a tumour is subsequently diagnosed (Figures 1 and 2). Tumours can present with pain, swelling or pathological fracture, and one should always bear this diagnosis in mind when the symptoms and signs are atypical. For example, rest pain and night pain are absolute 'red flag' symptoms that require thorough investigation.

Infection

The most common organisms responsible for osteomyelitis are *Staphylococcus aureus*, *Streptococci*, *E. Coli*, *Proteus* and *Pseudomonas*. Often no primary infective site is found and the theory is that the

microorganism becomes seeded to the bone or joint by haematogenous spread via the oropharynx. On other occasions the microorganism may spread by direct extension from a wound. The most common presentation is pain (once again rest pain and night pain are 'red flags'), warmth and tenderness over the affected part (usually the metaphysis of a long bone), and an unwillingness to move the adjacent joint. All these children should be checked for diabetes or impaired immune function.

Inflammatory conditions

Autoimmune conditions occur in children and inflammatory arthritis should also be part of one's differential diagnosis, particularly when assessing an atraumatic swollen painful joint(s).

Hip pathology masquerading as knee pain

Just like in adult patients, the clinician should always examine the hip joint first in any child presenting with 'knee pain'. Serious hip pathologies (Perthes disease,

slipped capital femoral epiphysis) may present with knee pain only.

Conclusion

The management of medical conditions in children requires both an understanding of the biological differences between children and adults, and moreover the age-specific injuries and illnesses children are 'at risk' of sustaining. Armed with this knowledge, the clinician will gain great satisfaction out of caring for these patients and their families.

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athlete

- cricket are in turn minimised.
- Never ridicule children for mistakes. Constructive comments/coaching and enjoyment is essential. A negative experience for a child may turn them off sport and exercise for life.
- Be aware of the 'ugly parent syndrome'. This is a very delicate situation for a clinician and all concerned. Intervention is warranted if the child's health is affected/at risk. An opportune time to confront this issue is at the time of consultation for an injury. Consult the parent individually away from the child.
- Create a safe sporting environment for children. Organised sports and activities require responsible adult supervision; for example, protection from dehydration, sunlight, children being mismatched by physical size and identification of dangerous sporting grounds/equipment. General first aid provisions (ice, bandages, paracetamol etc.) should be made available at sporting venues.
- Some active children do not eat enough calories for the requirements to both train and to grow and develop normally. Significant prolonged poor nutrition (chronic negative energy balance) during childhood and adolescence may result in menstrual/pubertal delay, growth retardation, chronic disordered eating, poor bone health, excessive fatigue and increase risk of injury.
- Children are more at risk of heat/cold illness than adults. They are less efficient at thermoregulation and therefore hydration and clothing are very important considerations.
- Strength training is safe but should only be undertaken with lightweights (e.g. the child can lift that weight more than 12 times) and under responsible adult supervision. Ideally resistance training that utilises the child's own body weight (e.g. push ups) is recommended. In general, this will not arrest growth and therefore will not affect the genotypically determined maximal height for that child.
- Strength training before puberty in boys (lack of testosterone) and in girls leads to strength gains largely by neuromuscular facilitation. Strength training in adolescent boys (testosterone present) causes both muscle hypertrophy and neuromuscular facilitation.

