A profile of paediatric sports injuries at three types of medical practice

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Introduction

Childhood sporting experiences provide a milieu of benefits, but can also carry injury risks. While the vulnerability of the developing skeleton can increase injury risk, it is unreasonable to believe that injuries in sport are all growth-related. Paediatric sports injury surveillance helps to identify future directions for injury prevention in children's sport.

Injury profiles vary according to the setting. For example, strains and sprains are frequently reported when sports trainers provide data, but acute injuries are best profiled at hospital emergency departments. However, if injury reports occur in a single setting such as hospitals or community sporting venues, the spectrum of injuries can be incomplete for adults [1, 2] and children [3]. Profiles of injuries from multiple settings are considered to be more representative of the range of all paediatric sports-related injuries.

The plethora of definitions used for "injury and injury severity" prevents a strong understanding of injury research. Reporting of injuries can also occur relative to seasons, years, or hours of

exposure. Exact comparisons are often improbable but trends in the data provide good direction for future research.

Within the limitations of injury research, existing trends include; boys incurring more injuries than girls [4], more severe injuries occurring in older than younger children [5], and games being more injurious than training [6]. When team sports in young people are assessed, moderate to high impact sports such as the football codes for boys and basketball for girls are described as the most injurious [7]. The inclusion of a broader range of sports in injury surveillance results in "high risk" individual sports (e.g. snowboarding, BMX cycling) being more injurious than team sports [8]. In other reports hours of exposure is simply a higher risk [9]. Most reports of paediatric sporting injury surveillance have been generated from nations other than Australia.

Therefore, we conducted the Paediatric Sporting Injuries Study in Sydney, Australia. The study involved a prospective surveillance study involving 235 sporting injuries in young people (60% male) aged 5 to 16 years. The objective was to profile and compare injuries presenting at three types of medical practice, with a view to broadening the understanding of the spectrum of paediatric sports injuries and developing appropriate recommendations for future injury prevention education.

Methods

Injury data were collected from patients seeking help for sports-related injuries at three types of medical practice; Sydney's largest paediatric emergency department (The Children's Hospital at

Westmead) (n = 1 site and 95 patients), sports physician practices (n = 5 sites and 88 patients) and general practices with a paediatric focus (n = 5 sites and 52 patients). Following hospital and university ethics approval, parents or guardians of young people with sports injuries were invited to participate in the study upon presentation with a sports-related injury at a site of one of three types of medical practice.

The instrument developed for the sports medicine injury surveillance project provided a standardised method for sports physicians to report injuries [1, 10]. The standardised survey formed the basis of the surveys completed for the present study and had a section for patients and one for the physician. For patients less than 14 years of age, a proxy report from the parent or guardian was requested because of younger children's poor recall reliability [11]. The patient forms had questions on the socio-demographics, sports history, and description of incidents. Physician forms required information on diagnosis, injury and treatment as well as the likely severity in "days of lost participation".

In the interest of remaining developmentally appropriate, some modifications were introduced to the original survey. The survey included a question on the hours of weekly organised physical activity outside school hours (e.g. dance, swimming, soccer). To save the often limited time of physicians, questions on the cause and intent of the injury were transferred to patients. A modification was also made to the form physicians completed. A question on the history of growth-related conditions such as Osgood-Schlatter disease and Sever's disease was added to this survey.

Data were analysed using the Stata statistical software program. Since the study was of an exploratory nature, data were analysed descriptively. Univariate statistics, are presented in frequencies and percentages of survey responses. Bivariate analyses were conducted to examine unadjusted relationships between all characteristics variables and different type of medical practices. As all variables were categorised, Chi-squared tests were applied to examine the bivariate associations. Due to the multiple tests of hypotheses, the significant level for rejecting the null hypothesis in each test conducted was adjusted to the level 1% instead of the conventional 5% for two-tailed tests.

Results

Table 1 shows the specialist practices (40%) and the children's hospital emergency department (38%) were most frequently visited by children with sporting injuries in our sample with general practice presentations (22%) not as frequently recorded. Over two thirds of the patients were aged between 12 and 16 years and only 25% of injuries occurred in individual rather than team sports. Most injuries (51%) occurred in games and more boys 60% than girls (40%) were recorded on the database.

Table 1 ***Descriptive characteristics of participants***

Characteristics		Frequency* (%)
Type of medical practice	Specialist practice	95 (40.4)
	General practice	52 (22.1)
	Children's hospital emergency dep't	88 (37.5)
Age group	6-11 years	72 (30.6)
	12-16 years	163 (69.4)
Sex	Male	141 (60.0)
	Female	94 (40.0)
Type of sports	Team sports	167 (75.2)
	Individual sports	55 (24.8)
Activity involved at the time of injury	Playing the game	108 (50.9)
	Unsupervised training	62 (29.3)
	Supervised training	35 (16.5)
	Others	7 (3.3)

Table 2 shows contact-related incidents, represented over 40% of the described mechanisms of injury. Falls or jumps make up another 30% of presentations for medical support. Not

surprisingly, injuries to the musculoskeletal system represented over 80% of the nature of injuries. Most injuries presenting to medical practices and the emergency department (48%) were of a severe nature (incurring 21 or more lost days of participation) and 66% of children presenting to the hospital did not use protective gear at the site of injury, when it could have been appropriate.

Table 2 ***Frequency distributions of the characteristics of injuries of survey participants*** *(N=235)*

Characteristics		Frequency (%)
Mechanism of injury	Collision with player/tackle	71 (33.2)
	During a fall	42 (19.7)
	Overuse	30 (14.0)
	During a jump	22 (10.3)
	Struck by ball/other sports equipment	15 (7.0)
	Sudden stopping	9 (4.2)
	Swerving/pivoting	8 (3.7)
	Collision with a fixed object	5 (2.3)
	Other	12 (5.6)
Broad classification	Joint (e.g. dislocation)	91 (39.9)

of the nature of injury	Bone (e.g. fractures)	82 (36.0)
	Tendon (e.g. torn, overuse)	24 (10.5)
	Muscle (e.g. contusion & strain)	13 (5.7)
	Closed Head Injury	11 (4.8)
	Other	7 (3.1)
Severity of injury	Severe (21^{+} days of modified activity) Mild (1-7 days modified activity)	93 (47.7)
	Moderate (8-20 days modified activity	56 (28.7)
		46 (23.6)
Protective gear	No or n/a	195 (83.3)
	….Yes	39 (16.7)
Growth condition	No	213 (90.6)
	Yes	22 (9.4)**
Injury occurred before	No	175 (80.3)
	Yes	43 (19.7)

Reason for presenting to practice	New injury	168 (71.8)
	Recurring injury	37 (15.8)
	Exacerbated/aggravated injury	8 (3.4)
	Chronic conditions	21 (9.0)
Imaging conducted	Yes	165 (70.2)
	No	70 (29.8)

** 9 Osgood-Schlatter disease, 2 Sinding-Larsen-Johansson Syndrome, 1 Hypermobility, Sever's Disease,

Table 3 shows a higher percentage (63%) of children had impact-related injuries and presentations at the emergency department, compared with 35% at general practices and 24% at specialist practices (χ^2 =26.97, p<0.001). In contrast, presentations from individual sports (37%) (χ^2 =11.36, p=0.003) and young people with growth-related injuries (17%)(χ^2 =9.67, p=0.008) were higher at specialist practices than generalist practices and the emergency department.

Table 3 Frequency distributions and percentages of responses by type of medical practices and their unadjusted associations

Characteristics of Injuries		Type of medical practice			Results
		Specialist	General	Hospital	
Type of sports	Team sports	52 (62.7)	43 (84.3)	72 (81.8)	χ^2_2 =11.36, p=0.003
	Individual sports	31 (37.4)	8 (15.7)	16 (18.2)	
Hours of training (per week)	≤5 hours	33 (44.0)	21 (42.9)	50 (75.8)	χ^2_2 =18.05, p<0.001
	6 hours or more	42 (56.0)	28 (57.1)	16 (24.2)	
Mechanism of injury	Impact-related**	19 (24.4)	18 (35.3)	54 (63.5)	χ^2_2 =26.97, p<0.001
	Non-impact-related	59 (75.6)	33 (64.7)	31 (36.5)	
Growth condition	Yes	16 (16.8)	4 (7.7)	3 (3.4)	χ^2_2 =9.67, p=0.008
	No	79 (83.2)	48 (92.3)	85 (96.6)	
Return to activity advice given	Return	46 (53.5)	12 (25.0)	11 (13.9)	χ^2_2 =30.99, p<0.001
	Unable to return	40 (46.5)	36 (75.0)	68 (86.1)	
Imaging conducted	Yes	53 (55.8)	31 (59.6)	81 (92.1)	**χ^2_2 =32.31, p<0.001**
	No	42 (44.2)	21 (40.4)	7 (7.9)	

** Impacted-related mechanism included: collision with fixed object; collision with player/tackle; struck by ball/ or other sports equipment. Non-impact-related mechanism included: sudden stopping; jumping and falling; swerving and pivoting.

Discussion

A spectrum of sports-related injuries was reported from children presenting to three different types of medical practices. Overuse injuries were more frequently seen at specialist practices, but acute injuries were more prevalent in the emergency department. This finding supports the need for the inclusion of paediatric sports medicine in training for Emergency Physicians and hospital medical staff and a strong emphasis on links between training during growth, and maturation for sports medicine specialists. Indeed knowledge of growth-related conditions may be salient for all forms of medical practice given that results of the present study raised concerns about the vulnerability of the growing skeleton. Approximately 80% of the injuries were of a musculoskeletal nature.

Sports-related injuries presenting for medical attention in any setting warrants a high quality and often urgent response. A majority of high severity ratings in the present study support the previous finding that sports-related injuries were linked to a higher likelihood of hospital admission than other types of presentations at a children's hospital emergency department [12]. Head injuries and concussion however, were lower in this study than previous reports of children in Australia [5], but may reflect the greater complexity of asking permission for participation rather than using data on existing hospital databases.

Subsequently, the need to obtain parental and guardian consent may have resulted in not all injuries being captured within this study. Difficulties in obtaining data may also be due to parents or guardians seeking support for a relatively severe condition and the opportunity to

take part in a research study may therefore have rated as a lower priority at this point in time for both parents and the attending medical professionals. Future studies would benefit from recording data on refusals to participate to help more accurately describe the representativeness of the population sampled. It is difficult to generalise on the basis of these results but trends show some similarities with national and international reports and provide a starting point for larger studies in Australia.

Nevertheless, results showing more boys than girls presenting with injuries, supports national statistics on sports participation in children aged 5 to 14 years (ABS 4901.0, 2006www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/4767CFCBCB66F4DECA257244007802 1A/$File/49010_apr%202006.pdf) and may simply reflect greater exposure. According to the Bureau of Statistics, 69% of boys and 58% of girls had played sport outside of school in the 12 months prior to April, 2005, so on the basis of participation, more boys than girls are likely to present with injuries. However, given that sports participation also decreases with age, it is likely that adolescent boys participating in sport may engage in a higher level of risk taking behaviour. In previous sport studies boys have reported higher levels of risk taking and lower levels of perceived risk when compared with girls [13].

More injuries in games than training may reflect greater emotional demands in games than training such as perceptions of coach, or peer pressure, or increased physical demands that are often more intense in games than training. In recent decades, the challenge for many team sports has been to understand more about competitive demands so that duplication of intensities can occur during training [14]. Despite games or competition presenting higher injury

risks than training for young people, injuries occurring in children's sport are often preventable. Therefore injuries may best be prevented by strategic activities on injury prevention at training, prior to competing in the more injurious game situations. Activities such as deceleration as well as acceleration, avoiding collisions or safety in falls may help young people enjoy sports more and lose less time through injury.

Two thirds of sports injury presentations were in the adolescent years (12-16 years). Sporting injury risks are known to increase with age through the first two decades of life [15]. This preponderance of injuries in the adolescent years has been reported in previous studies [16] and may reflect a number of maturational and skeletal changes which occur during this time. Reduced motor performance has been observed in the adolescent years [17] and it is also a time of peak fracture incidence in both males and females [18]. Skeletal integrity may be compromised during this time of rapid growth with longitudinal bone growth occurring temporarily at the expense of bone strength. The onset of sex hormones which marks adolescence, results in increased muscle bulk, particularly in males and this, combined with increased aggression and risk taking behaviour, may also partly explain the increased risk of sports injury associated with contact or collision sports in this age-group. Adolescence is also a time when adult sports rules are adopted with a phasing out of modified rules. This may also impact on injury risk.

Mechanisms of injury may best be reported with a slow motion replay and biomechanical analysis. The present study is limited by parental or self reports of the mechanism of injury. However, given medical assistance is more likely to be sought for injuries of a more serious nature, it is possible that the high incidence of contact related injuries (40%) is credible. These

data were supported by the medical prognoses of approximately half of the patients likely to incur 21 days or more days of lost participation.

Summary

This study provides a profile of the differing patterns of injury presenting to three different clinical settings. Overuse injuries unique to the paediatric skeleton are a relatively common presentation to sport medicine specialists and it is therefore important for sports physicians to have a good understanding of growth-related conditions and the age at which children are vulnerable to specific musculoskeletal pathologies. There are no existing data to support any intervention for the prevention of these common, growth-related musculoskeletal conditions. This research is urgently needed.

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