A comparison of paediatric soccer, gaelic football and rugby injuries presenting to an emergency department in Ireland

K.P. O’Rourke a,1,*, F. Quinn a,1, S. Mun b,1, M. Browne c, J. Sheehan d, S. Cusack c, M. Molloy a

a Department of Rheumatology and Sports Medicine, Cork University Hospital, Cork, Ireland
b Department of Paediatrics, Cork University Hospital, Cork, Ireland
c Department of Emergency Medicine, Cork University Hospital, Cork, Ireland
d Department of Epidemiology and Public Health, University College Cork, Cork, Ireland

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Summary

Objectives: Children presenting with sport related injuries (SRIs) as a result of soccer, rugby and gaelic football are frequently seen in an emergency medicine (EM) setting in Ireland. A comparison of the demographics of injuries in these three sports has however not previously been performed. The purpose of this study was to provide up-to-date data on the nature of these SRIs.

Method: Data was collected retrospectively on all children (<17 years of age), injured in these three sports, presenting to an emergency medicine department over 6 months, and was entered into a database for analysis.

Results: Retrospective analysis was performed on 23,000 charts, and 409 SRIs were identified over a 6-month period. None of the children reported using any form of protective gear, and 27% reported a previous presentation to the emergency department with a SRI. Most injuries were as a result of soccer (56%), with 24% occurring in gaelic football, and 20% occurring in rugby. The predominant mechanism of injury was different in each sport, in soccer-falls (38%), in gaelic football-collisions with objects (balls) (37%), and in rugby-collision with persons (55%). Although the predominant type of injury in soccer and gaelic football was a fracture, accounting for 50% and 42% of injuries, respectively, in rugby however, skin/soft tissue injuries presented more commonly, accounting for 44% of injuries. When the general site of injury was...
Introduction

The increase in sports participation in Ireland in soccer, gaelic football and rugby has led to an increase in the number of paediatric Sports Related Injuries (SRIs). Worldwide, this trend has translated into increasing numbers of those injured interfacing with the hospital medical service. As a result of this, SRIs in children are now recognised as the second leading cause of emergency department visits and hospital admissions. Since the majority of SRIs of a serious nature initially present in this setting, an important opportunity exists for significant epidemiological and interventional study of these patients.

However, after a detailed Pubmed search, it was evident that there was a paucity of detailed data regarding paediatric injuries in these sports presenting to the emergency department. Before strategies to reduce serious injuries are formulated, it is essential to have sport-specific data on the current mechanism, type, site and management of these injuries. Therefore, the purpose of this study was to collect up-to-date data on the nature and management of paediatric SRIs, presenting to an emergency department, in these three popular and widespread ball games played in Ireland.

Method

Data was collected retrospectively on all children under 17 years of age presenting with a SRI, to the emergency department of Cork University Hospital, a major teaching hospital and trauma centre in Ireland, over six consecutive calendar months from 1st Jan 2002. For each patient, the following data was collected: day of presentation, gender, age, sport, use of protective gear, mechanism, site, side and type of injury, previous sports injury, investigations performed, and management. All data was entered into a Microsoft Access database, and statistical analysis was performed using StatsDirect, and Statcalc on EpInfo version 6. Statistical differences between means were calculated using unpaired t-tests as appropriate, differences between proportions calculated using the Clopper–Pearson method, and differences between categorical variables were determined by the chi-square method. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated were relevant. A p-value of <0.05 was deemed statistically significant (p < 0.05), p < 0.01*, p < 0.001**, p < 0.0001***). This study was performed in accordance with the ethical standards laid down by the Clinical Ethics Committee of the Cork Teaching hospitals.

Results

Over a 6-month period, 409 children presented with SRIs in these three sports, with 27% reporting a previous presentation to the emergency department with an injury as a result of sport. None of the children reported using any form of protective gear. There were significantly more soccer injuries presenting than gaelic football (56% versus 24%***), or rugby injuries (56% versus 20%***).

At weekends (Saturday and Sunday) compared to weekdays (Monday to Friday), the mean proportion of injuries presenting was significantly higher in both soccer (16% versus 10%) and gaelic football (16% versus 11%). However there was a trend towards the converse relationship for rugby injuries (13% versus 18%, p = 0.08).

In all three sports, the proportion of males presenting with SRIs was higher than that for females; soccer (89% versus 11%***), gaelic football (82% versus 18%***), and rugby (93% versus 7%***).

When the age profile of injuries was analysed (Fig. 1), it was observed that there were proportionately few SRIs presenting between the ages of 1 and 4. However, there were proportionately more SRIs presenting, in successive higher age groups, in all three sports. Between the ages of 5 and 8, soccer injuries presented more commonly (OR = 3.3, 95% CI = 1.3–9.3) than injuries in the other sports, with a similar trend towards significance between ages of 9 and 12 (OR = 1.5, 95% CI = 0.96–2.4, p = 0.07). However between the ages of 13 and 16, rugby
injuries presented more commonly (OR = 2.7, 95% CI = 1.5—5.1**) than injuries in the other sports. In addition, when the three sports were compared, it was found that the mean age of children presenting with a soccer injury was lower than that for either gaelic football (12.4 v 13.1yrs†) or rugby (12.4 v 13.7yrs***). No significant gender differences were seen however with regard to age of injury presentation in each sport.

Mechanism, site and type of injury

Overall, 94 % of injury mechanisms fell within four groups, falls (32%), collision with objects (27%), collision with persons (26%), and twists (9%). The predominant mechanism of injury however was different in each individual sport (Fig. 2), in soccer-falls (38%), in gaelic football-collision with objects (balls) (37%), and in rugby-collision with persons (55%). When each individual mechanism of injury was compared across the three sports, it was observed that falls were implicated more commonly in soccer than in the other sports (OR = 1.8, 95% CI = 1.1—3.1†), and collisions with persons more commonly in rugby (OR = 5, 95% CI = 2.9—8.8***).

Ninety-eight percent of types of injury fell within five groups, fractures (45%), skin/soft tissue (35%), ligament (12%), avulsions (4%), and concussions (2%). Each sport showed differences in the proportion of the type of injury however (Fig. 3). The predominant type of injury presenting in soccer and gaelic football was a fracture, accounting for 50% and 42% of injuries, respectively. However in rugby, skin/soft tissue injuries presented more commonly, accounting for 44% of injuries. When each individual type of injury was compared in each of the three sports, fractures were found to present most commonly in soccer than in the other sports (OR = 1.6, 95% CI = 1.1—2.5†), avulsions in gaelic football (OR = 3.3, 95% CI = 1.1—11†), and concussions in rugby (OR = 4.3, 95% CI = 1.1—17.7†). In addition there was a trend towards more skin/soft tissue injuries presenting in rugby (OR = 1.6, 95% CI = 0.95—2.7, p = 0.07). However ligament injuries showed no predilection for any one sport.

When the general site of injury was investigated, overall, the upper limb was the most commonly
presenting site of injury (60%), followed by lower limb (30%), head (6%), and trunk (3%). Furthermore, in each individual sport (Fig. 4), the upper limb again accounted for the majority of SRIs, 59% of soccer injuries, 68% of gaelic football injuries, and 53% of rugby injuries. When each individual site of injury was compared across the three sports, it was observed that upper limb injuries more commonly presented in gaelic football than in the other sports (OR = 1.6, 95% CI = 1.1—2.7). However, when a more detailed analysis was performed using specific anatomical sites, it was observed that although hand injuries more commonly presented in gaelic football (OR = 2.5, 95% CI = 1.5—4.4**), the same was not found for either wrist, elbow or shoulder injuries. In contrast, lower limb injuries more commonly presented in soccer (OR = 1.6, 95% CI = 1.1—2.6) than the other sports. Although further anatomically based analysis revealed that there was a greater presentation of foot and ankle injuries in this sport (OR = 2.7, 95% CI = 1.1—7.1 and OR = 2.2, 95% CI = 1.2—4.2*, respectively), the same was not
observed for knee injuries. Finally, head, trunk and shoulder injuries were found to present more commonly in rugby, \((\text{OR} = 3.6, 95\% \text{ CI} = 1.5—8.8^*\) and \(\text{OR} = 6.2, 95\% \text{ CI} = 1.7—23.3\) and \(\text{OR} = 2.5, 95\% \text{ CI} = 1.1—6.7\) respectively), than in the other sports.

**Management and outcome**

There were no significant differences regarding tests ordered in the assessment of children with SRIs, blood tests (0.5%), plain X-rays (91%) and CT scans (0.6%). No ultrasound examinations or MRI scans were arranged, nor urine specimens taken in any emergency assessment. There were no significant differences in analgesic prescription between sports, with 50% of those presenting requiring medication. However, it was observed that no use was made of topical, intra-muscular nor rectal analgesic routes of analgesic administration. Only 0.8% required antibiotics, and 0.3% tetanus, for contaminated skin/soft tissue injuries.

Other treatment modalities included slings/splints (47%), sutures/steri-strips/glue (47%), plaster of Paris (POP) casts (31%), RICE (Rest, Ice, Compression, Elevation)/general injury advice (27%), crutches (11%), reduction of fractures (2%) and physiotherapy (2%). No injury preventive advice was given to any child. Slings/splints and sutures/steri-strips/glue were more commonly used for treating gaelic football injuries than other sports \((\text{OR} = 1.7, 95\% \text{ CI} = 1.1—2.8^i\) and \(\text{OR} = 1.7, 95\% \text{ CI} = 1.1—2.8^i\), respectively), and POP casts more commonly used for treating soccer injuries \((\text{OR} = 1.9, 95\% \text{ CI} = 1.2—3.1^*\). In addition, there was a trend towards crutches being used in the treatment of soccer injuries, than any other sport \((\text{OR} = 1.7, 95\% \text{ CI} = 0.9—3.5, p = 0.09\) (Fig. 5).

Overall, 8% of patients needed to be admitted, with no statistical differences between sports regarding the proportions admitted.

**Discussion**

Previous studies on SRIs involving these three sports have tended to describe injuries in adults, or both adults and children. \(^{4,8,10,22,24,25,29,36}\) Few studies have specifically investigated injuries in children under 17 years, particularly those in the youngest age groups under 8, who are often just beginning their participation in sport. \(^{17}\) Also, many studies omit vital detail on injury management. \(^{13,30}\) In addition, since many of these studies were conducted in single sports, and some time ago, comparison with other sports is difficult due to the heterogenous methods of data collection, observation periods, study design, and sample characteristics. \(^{29,32,35}\) Furthermore, many studies have been conducted in non-hospital (NH) settings, and they tended to document injuries of a less serious nature, which did not necessitate specific immediate hospital referral. \(^{1,8,15,17,24,30,36}\) The injuries described were therefore not representative of injuries encountered in the emergency medicine (EM) setting, which often deal with injuries of a more serious nature and those which more often require surgery, contributing to a significant workload in these departments. \(^{31}\)

This study however, is the largest and most comprehensive analysis in Ireland or worldwide, detailing soccer, rugby and gaelic football injuries in children under 17, presenting to the Emergency Department. It highlights important similarities and differences in the mechanism, site, type and management of injuries that can occur in these sports, which often necessitates hospital based treatment. Furthermore, it provides data on the odds of injury presentation, which may be useful when considering a child's suitability for participation in a sport, and assessing potential for harm, which is an important consideration, especially in the youngest children, where the process of growth and maturation is incomplete.

**Age**

This study identified an increased presentation of SRIs with increasing age, and is consistent with other studies in these sports. \(^{12,17}\) Although this may reflect increased participation, this may also be as a result of older age groups being larger, heavier, stronger, more aggressive and more enthusiastic to compete in their selected sport, contributing to increased SRIs. This may particularly be the case in rugby, in which a highest proportion of paediatric injuries presented in the older age group 13—16, the majority of which were as a result of forcible collisions with persons. Conversely, the smaller build, lesser strength, reduced force of contact, and slower speed of younger children may limit the number and extent of their injuries.

**Gaelic football**

In the current literature, data regarding paediatric gaelic football SRIs in an EM setting is scarce. \(^6,25\) However, previous NH studies highlighted that injuries occur frequently in gaelic football, and may reflect the speed at which the game is played and its aggressiveness. \(^{36}\) In addition it is generally accepted that the play in gaelic football is generally less tightly controlled than it is in rugby and soccer,
and that in gaelic football, the penalties for illegal play are generally less severe. 36

While NH studies have identified sprains as the most frequent type of injury (25%), 36 (32%), 8 and fractures occurring less frequently (14%), 36 (5%), 8 the converse was observed in an EM setting in this study, with fractures represent the majority of presentations, accounting for 42% in this study, with ligament sprains observed in 12%. The difference in injury types most likely represents the difference in the need for treatment, with suspected fractures being more serious injuries, often necessitating hospital treatment, while many sprains, which are often perceived to requiring little attention, may alternatively often present to NH doctors or paramedical personnel.

Studies performed in a NH setting previously identified the lower limb as the predominant site of injury in adults (mean age 24) (77%), 8 and young men (mean age of 17) (32%). 36 However this study in an EM setting reveals that in children, upper limb injuries presented more frequently (66%). The majority of which involved the hand, which were as a result of direct contact with the ball. Furthermore the hand was more commonly injured in gaelic football compared to the other sports. Because of high ball speeds, and the frequency of the need for jumping, catching and dispossessing opponents, the frequency of these injuries could conceivably be due to poorer judgement and skill levels in the younger age groups, and the vulnerability of childrens upper limb bones to injury, particularly at musculo-tendinous junctions, physis, metaphysis, and joint surfaces. 16,38

As a result of the high occurrence of fractures and avulsion injuries, predominantly of the hand, it is not surprising that one of the most frequent management intervention was the use of slings/splints in this sport compared to the others. Since loss of proper hand function can result in a significant loss of ability to carry out normal activities of daily life, 25 prevention is important. Initial attempts at injury prevention could be focused on improving training in grasping techniques and strengthening of the fingers, in addition to tighter enforcement of the rules of play by referees in areas such as harsher penalization for two-handed tackling, and fouls leading to forward falls. Furthermore, the use of a smaller, lighter ball, matched for a child's weight or skeletal age, could limit avulsion injuries. However, a smaller ball may prove more difficult to catch, and may necessitate and encourage more aggressive attempts at dispossessing. A reduction in ball weight could also lead to difficulties in catching a 'high ball' and reduced scoring accuracy in windy playing conditions, leading to player frustration. Finally, light-weight protective gloves with reinforced backing, which could potentially reduce the likelihood of injury, are inexpensive and can be purchased at most sports outlets. At present, although this equipment is available, 25 it is not widely used.

Rugby

Although rugby in particular has a reputation for the potential of serious and/or catastrophic types of injury, 31 there is a paucity of data regarding the nature of injuries sustained by children presenting to the EM department. In this study, we observed that the majority of injuries that presented were of a less serious nature, being predominantly skin/soft tissue complaints (44%). However, we also found that concussions occurred in 6% (and head injuries in 11%), with no child wearing any type of protective headgear. The high risk of concussion and the potential for head injury in rugby has been recognized by other investigators, 15,17,23,28 and this study emphasizes that these particular injuries present proportionately more frequently in children in rugby than in soccer or gaelic football. It is recognized that repeated concussion may irreversibly affect attention and memory, 26 but it is presently unclear if the current available headgear will adequately protect against concussion, although affording some protection against skin and soft tissue head wounds. 26

Since rugby entails forceful and frequent body contact and the absence of external protective gear, which could protect vulnerable anatomical structures, it is not surprising that we found that collisions with another person was the commonest injury mechanism presented more commonly in rugby compared to either soccer or gaelic football. It is known that the majority of rugby players that go on have a professional career have some form of long-term injury, arthritis or restricted joint mobility, 19 and since this study shows that the shoulder appears to be particularly susceptible to injury in rugby, consistent with data from other studies, 15 the development of suitable protection, and stricter enforcement of the rules of tackling and engagement may be areas where it may be possible to reduce injuries, without detracting from the enjoyment of the sport or its appeal.

Soccer

Although soccer is the most popular sport worldwide, 31 and participation growing, 7 few detailed studies focus on paediatric injuries in an EM setting, or compare presentations with other sports. 1
In this study we found that falls while running, turning and making cutting movements with the ball, were the most frequent injury mechanism in soccer, accounting for 38% of injuries. Although these falls were predominantly due to timed tackles, falls were also observed to cause injury as a result of tripping over the ball (while running, or moving from a stationary position) and loosing balance when landing after heading the ball. Untimely or illegal tackling (fouls), in which the primary mechanism of injury was initially body contact between opponents (as opposed to ball contact) leading to a fall, was designated as a collision with person, and was a less frequent observed injury mechanism in children presenting with a soccer related injury. Improved coaching practices, concentrating on proprioceptive and balance training may potentially lead to lessening of falls as an injury mechanism, and evaluation of this injury prevention measure has proven useful in reducing other mechanisms of injury. 14

Most of the injuries sustained in soccer were in the upper limb (59%), occurring at the wrist and hand, and it has been observed that that children who sustain an injury at this body site are more likely and to have been playing with an adult sized ball, 5 and to have a significant injury. 13, 27 Subsequent analysis of the type of injury in these cases revealed that fractures were the commonest type of injury at this particular body site (data not shown), and furthermore, this injury type was also observed to present more commonly in soccer than in the other sports. Other authors have also echoed our findings, describing the greater risk of fractures in younger soccer players, compared with college or professionals, and is a likely consequence of the increased vulnerability of immature bone at this younger age. 3, 9 Concentrating injury prevention strategies on this type of injury again may be an interesting avenue for further research, and prove worthwhile in limiting the extent of serious injury.

Previous SRI/protective gear/analgesia/physiotherapy/RICE/serious injury

With 27% of children having attended our emergency medical department previously with a SRI, this study highlights the need to identify those at high risk of recurrent injury, and encourage greater use of protective gear, which was universally underused. Improved management of injuries, after presentation, could also be addressed, with a greater prescription of RICE, administration of general injury and preventive advice, and physiotherapy, all of which were poorly utilized. In addition, treatment with topical analgesia, which has proven efficacy, 21 without detrimental adverse effects was not considered for any patient. These are all simple measures that could improve management, and potentially lead to a decrease in injuries sustained, or their severity.

This study highlights that 8% of injuries are serious and require admission, similar to other studies. 29 Fortunately, there were no deaths reported. However, death in sport has been reported by other authors. 2 One known, underestimated cause is from equipment failure, which can lead to significant injury and mortality. Although uncommon in our study, we observed four serious, but preventable injuries as a result of ‘tip over’ of non-fixed movable goalposts. Although the potential for injury is recognized with this equipment, improper use continues to be widely practiced. 2

Limitations

Although this study describes in detail the characteristics of injury that present to the emergency department, we were unable to comment on and compare rates of injury in each individual sport. Although the results of this study indicate that soccer injuries present most frequently, and rugby injuries less so, other authors have described that per 10,000 h of participation, rates of injury are higher in rugby (60/10,000) than either gaelic football (45/10,000) or soccer (44/10,000), 37 with match related injuries occurring at a higher rate than injuries during training in each of the three sports. 15, 36

Secondly, although we focused on the nature of injuries sustained by children presenting to the emergency department in three of the popular sports in Ireland, we did not include hurling and camogie injuries in this analyses, because of the differing nature in the way this Gaelic sport is played. The use of a long stick, the hurley, and a much smaller harder ball, could theoretically lead to a different, less comparable spectrum of injuries.

Finally, although we took care to perform the correct statistical tests for the data being analysed, we accept that some of the differences found in this study may be of statistical, but not clinical significance, may be of a small magnitude, could potentially be due to artifact from ‘over-testing’, and may be weakened as a result of ‘data-driven hypothesis testing’. However we believe that this study has produced some interesting and highly significant results that address gaps in the current literature and our understanding of children sports injuries.
Conclusion

Injuries seen in the emergency department are usually biased towards the more serious injuries, those needing emergency treatment, and those needing surgery. In many cases this treatment cannot be offered in a non-hospital setting. The results of this study provide a useful insight into the nature of injuries that present to the emergency department, and is the first study to exclusively compare such injuries in these three popular sports played by children in Ireland. In addition, it suggests areas in which management of these injuries could be enhanced, and potentially lead to fewer injuries and EM presentations. Only by identifying the specific site, type and mechanism of sports related injuries, and scrutinising current management strategies, can more effective measures be devised and implemented to decrease injuries, and the information provided in this study may provide a platform for the development of interventions that could reduce SRIs presenting to other EM departments.

The authors have declared no conflict of interests.

References