Shoulder injuries in adolescent rugby players

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Abstract

Background: Rugby is a high-intensity contact sport, frequently causing shoulder injuries. Between the ages of 12 years to 18 years, academy and county level players are being selected for professional contracts, making this is a critical stage of their career. The present study aimed to describe the patterns of injury in adolescent rugby players with shoulder injuries.

Methods: Academy and county level rugby players in the target age group, over a 7-year period, were included in the present study. Data collected included the mechanism of injury, position and level of play, radiology and surgical findings, and recurrence rate at a minimum of 2 years post-surgery.

Results: One hundred and sixty-nine cases adhered to the inclusion criteria, with most cases involving two or more pathologies in the shoulder (54%). Forwards sustained more shoulder injuries than backs, incurring more labral injuries. By contrast, backs had a higher incidence of bony pathology. The mechanism of injury frequently correlated with player positions. There was a 21% injury recurrence rate, with forwards (7%) and higher level academy players (11%) most likely to suffer a recurrence.

Conclusions: Shoulder injury patterns in this important group of adolescent contact athletes are complex, with recurrence rates being higher than those in older rugby players.

Keywords

adolescent, mechanism of injury, rugby, shoulder

Date received: 19th November 2014; accepted: 24th March 2016

Introduction

Rugby is a collision sport with intermittent bouts of high intensity requiring great levels of agility, aerobic fitness, speed, strength and power.¹ Within both disciplines, the players may be broadly classified into forwards (i.e. those involved in the scrum) and backs (i.e. those not involved in the scrum). The demands of each position varies,² with forward players often being involved in more tackles and physical collisions than backs during the course of a match.^{3,4} Consequently, forwards have been noted to suffer more match injuries than backs.^{4–6} The combination of high physical demand and low aerobic fitness is a concern identified in studies of senior, elite rugby players.³ Interestingly, when similar studies were conducted on adolescent rugby league players,³ the physiological and anthropometric differences between players of different positions in junior rugby did not vary as much as was found in

the senior, professional age groups.⁷ It could be deduced that player physiology and playing position may have less of an impact on injury acquisition among younger rugby players in comparison with their senior counterparts. However, to date, no study has examined the relationship between position of play and injury acquisition in the adolescent rugby player.

Observational studies have been undertaken in the past to determine the various mechanisms of injury to

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the shoulder in rugby.^{8,9} As an integral part of the sport, rugby tackles are known to cause the majority of injuries (65–85%).^{5,10} The tackle involves two independent, human elements (i.e. the ‘tackler’ and the ‘tackled’), both of which are subject to specific and different mechanisms of injury. A study by Crichton et al.¹¹ used video analysis of elite rugby players to identify three main mechanisms of injury namely: (i) the ‘try-scorer’ representing the hyperextension of the arm during a try being scored; (ii) the ‘tackler’ referring to the abduction of the externally rotated arm behind the player as he engages in a tackle; and (iii) the ‘direct impact’ mechanism referring to a direct blow to the shoulder when in the neutral or slightly abducted position.¹¹ The mechanism of injury previously reported as the greatest causative agent for injury in both rugby union and league players at youth level is the tackle, with studies identifying a higher incidence of injury in the ‘tackled’ group than the ‘tackler’ group.^{3,12}

There has been an increase in the frequency of shoulder injuries in rugby.¹³ The shoulder has been described as the most injured part of the body in several studies for both rugby union^{13,14} and rugby league¹⁵ at both junior and senior levels.³ Sports injuries can have a significant effect on the progression of a young athlete to higher levels of representation, with one study in Australia estimating an annual dropout rate from sport due to injury of 8%.¹⁶ With this in mind, information is needed on young rugby players.

The present retrospective case series aims to describe the patterns of injury in relation to shoulder pathology, mechanism of injury, position and level of play, and reoccurrence rates in rugby players aged 12 years to 18 years with shoulder injuries who presented to an orthopaedic surgeon.

Materials and Methods

A retrospective case controlled study was conducted on data collected from rugby players presenting with shoulder injuries over a 7-year period to the senior author (LF). Data were collected prospectively with the consent of all of the patients and recorded using a patient management data system; patient confidentiality was maintained in all cases. Inclusion criteria for cases was: adolescent male rugby players (both league and union); aged between 12 years to 18 years; playing at school, amateur club, academy or professional level; and with injury to have occurred during match play. All shoulders were examined by the same surgical shoulder consultant (LF). Collected data included: age, sex, whether league or union was played, level of play, mechanism of injury, imaging results, timescales to presentation and surgery, conservative or surgical treatment, and revisions and recurrences.

Statistical analysis

The data were pooled into Excel (Microsoft, Redmond, WA, USA) for analysis. Raw data tables were created from which relative proportions were also calculated. An absence of overlap between the 95% confidence interval indicators upon graphs was considered as statistically significant.

Results

Of the 169 cases (all males aged 12 years to 18 years), 81 (48%) were rugby union players, 79 (47%) were rugby league players, and two cases participated in both. In seven cases, there was no differentiation between rugby union or rugby league.

Furthermore, 148 cases had surgical treatment. Twenty cases were treated conservatively and one case of treatment was not documented. Of the surgical patients, there were 17 cases of revision surgery, with 131 accounting for primary procedures. The two main operations performed were arthroscopic stabilization procedures ($n=118$) and Bristow–Latarjet procedures ($n=18$). The mean injury to presentation time was 171 days (range 2 days to 730 days) and the mean injury to surgery was 217 days (range 8 days to 951 days). The mean time to return back to playing in a game of full contact rugby was 131 days (range 60 days to 445 days).

Pathologies

There were eight cases of unknown pathology. Of the cases with known pathology, 87 patients presented with at least two pathologies. The most common pathologies reported were Bankart tears (43%), followed by reverse Bankart tears (26%), Bony Bankart (26%) and superior labral anterior to posterior (SLAP) tears (17%). There was a 6% incidence of humeral avulsion glenohumeral ligament (HAGL) tears and 13% anterior labral periosteal sleeve avulsion (ALPSA) lesions as co-pathologies. As shown in Figure 1, Bankart lesions accounted for 30% of all school level pathologies, which is similar to the 29% observed in professional rugby players. In the amateur group, there was a greater proportion of Hill–Sachs (17%) and ALPSA lesions (10%) than at any other level of play.

Mechanism of injury

A total of 294 pathologies occurred amongst the 169 patients in this study. Only 74 (44%) patients reported one isolated injury. The mechanism of injury was unknown in 27 pathologies (9%). The mechanisms of injury reported per pathology were: direct ($n=79$), try scorer ($n=25$), throw ($n=1$), gradual onset of injury ($n=3$), no specific injury ($n=8$), pain noticed

Figure 1. Percentage of pathologies per level of play.

CI, confidence interval; SLAP, superior labral anterior to posterior; ALPSA, anterior labral periosteal sleeve avulsion.

Figure 2. Distribution of injuries as a function of pathology and mechanism of injury.

SLAP, superior labral anterior to posterior; ALPSA, anterior labral periosteal sleeve avulsion.

post-match ($n=7$) occurred as tackler ($n=72$), occurred when tackled ($n=72$) and unknown cause ($n=27$). Figure 2 illustrates the proportion of pathologies with mechanism of injury. Bankart lesions were high amongst players, both tackled (29%) and tackler (31%). However, reverse Bankart lesions were higher in the tackled (17%) and the try scorer (16%) groups. Conversely, the bony Bankart lesions were experienced at higher numbers by the tacklers (15%) and direct impact group (18%). SLAP lesions were highest in

the tackler (14%) and try scorer (16%) groups. The majority of acromioclavicular joint (ACJ) injuries (seven of 10) were a result of direct impact. Similarly, there were six fractures overall, half of which were a result of direct impact. The HAGL tears ($n=9$) were more evenly spread throughout the different mechanisms of injury: one tackler, one caused by being tackled, four in the direct group, two try scorers and, lastly, one case where no specific injury was recalled.

Level of participants

Direct impact (30%) was the most common cause of all injuries and most prevalent in school players (46%). Tacklers were most commonly affected across all levels: amateur club level (29%), academy level (29%) and at school level (31%). Try scorer injury prevalence increased with increasing level, with no incidence at school level versus 15% occurrence at professional levels.

Positions

The absence of overlap amongst most of the 95% confidence interval indicators suggests a difference between the pathologies experienced between forwards and backs. Forwards had a greater number of labral injuries (i.e. Bankart and reverse Bankart tears) (Figure 3). It is noted that SLAP tears were equal in both groups (Figure 3). On the other hand, bony lesions such as bony Bankart tears, Hill–Sachs lesions, fractures and ALPSA lesions were much more prominent amongst the backs (Figure 3).

On further analysis of data from forwards and backs, it was noted that almost half (47%) of all pathologies in the halfback group were a result of being tackled (Figure 4). Of all of the tackled, back positions (halfbacks, three-quarter backs and fullbacks), the halfbacks counted for 53% of these injuries. As expected, the front row (consisting of props and hookers) experienced the greatest number of pathologies and fullbacks

showed the least. The direct mechanism was the most prevalent cause of injury in front row players and locks. As predicted, forwards incurred more injuries than backs during tackling and direct impact, whereas the backs had more injuries when being tackled and were equal with forwards when scoring a try.

Rugby league and union

An even spread of pathologies was noted between rugby league and union players (Figure 5). In both rugby league and union, forwards are more likely to sustain shoulder injuries than backs. When individual player positions are analyzed, prop forwards were twice as likely to be injured in rugby league (30%) than rugby union (14%). Second row forwards had three times the number of shoulder injuries in rugby union (27%) than rugby league (9%).

Recurrence

There were 35 (21%) recurrences post-management. Amongst the different levels of play, academy players accounted for 19 (54%) of all recurrences. Professional players had the least number of recurrences post-management, with 9% of all recurrences, whereas school rugby players accounted for 17%. Of the 35 recurrences, twice as many forwards ($n=12$) than backs ($n=6$) had a recurrence. The remaining 17 recurrences were of unknown positions.

Figure 3. Pathologies in forwards and backs.

CI, confidence interval; SLAP, superior labral anterior to posterior; ALPSA, anterior labral periosteal sleeve avulsion; HAGL, humeral avulsion glenohumoral ligament; ACJ, acromioclavicular joint.

Figure 4. Percentage of forwards and backs injured by each mechanism of injury (MOI).

Figure 5. Percentage of injuries per position in both rugby union and league players.

Discussion

Pathology

The present study found that multiple pathologies were present in adolescent injured rugby shoulders. Labral tears (Bankart tears, reverse Bankart tears and SLAP lesions) affected 107 patients (63%), which is consistent with recent findings.^{9,13} Interestingly, the 10 ACJ cases noted make this the seventh most common pathology found in this group of adolescent rugby players. This is contrary to previous studies that have reported this pathology to be the most common shoulder injury in rugby players.^{13,17}

Mechanism of injury

The tackle was responsible for 49% of shoulder injuries, which is lower than reported in the past, with

previous studies reporting rates of 65% to 71%.^{9,13} The tackle has been accepted as the most common cause of injury at both junior and senior levels.^{4,8,9,13,18–21} A rugby player can experience up to 40 tackles in a game.¹ Although the collision nature of rugby cannot be changed, the control of frequency of tackles in training and appropriate tackling training may reduce the risk of shoulder injury in young rugby players.

Level of play

In the present study, the level of play was correlated with pathology. There was little difference identified between the school, amateur club level, academies and professional rugby players in terms of the number of pathologies detected. An epidemiological study on English youth rugby union, conducted by Palmer-Green et al.,²⁰ showed that the highest number of pathologies were amongst school groups of rugby players. This contradicts previous research, which has suggested that those who played rugby at a higher level were indeed at a greater risk of injuring themselves.^{12,19}

Playing position

In the present study, we found that forwards suffered from a high number of labral lesions; in particular, Bankart and reverse Bankart tears. Amongst the back positions, there were higher rates of bony injuries, with not only substantially more bony Bankart lesions and Hill-Sachs, but also slightly more ALPSA lesions. These pathologies have been linked to groups of

rugby players who experience abduction and external rotation of the humerus at the point of collision.²¹ This occurs mainly during the faster, open play that the backs undertake, with more tackles involving the outstretched arm and more frequent try scoring opportunities.²¹ The increased force at which these players are engaged can result in an augmentation of the forces experienced upon collision. Such great forces are clearly sufficiently high to not only create labral damage, but also to impose a risk upon the much stronger bony structures of the shoulder. This was evident in our data because it showed that backs suffered a greater number of tackled injuries and a high proportion of try scorer injuries (although this was equal to the forwards), as was seen in other studies.¹³

The findings of the present study, along with similar studies, suggest that individualized training programmes would be beneficial for different playing positions. The physiological demands of different rugby positions have been assessed by Gabbett,³ who found little difference in positions amongst the junior levels. However, it is possible that this method will potentially become more effective when these players progress further in their careers because, at senior levels, the physiology and physicality required of each position differs much more than at junior levels.³

League versus union

Analysis of the rugby league and union data displayed only slight variations. Hoskins et al.²² conducted a study that was not limited to shoulder injuries; however, they did find that rugby league is more likely to cause injury than rugby union. Rugby league players have been shown to experience up to 20 to 40 tackles per game,¹ whereas rugby union players have been noted to have six to 13 tackles per game.²³ Also, as a result of the greater ball play and speed in rugby league, attacking players have more opportunities to attack the defensive line before the opposing defence can prepare properly.⁵ This is a possible explanation for the slightly higher percentage of forwards observed to be injured in rugby league (62%) than in rugby union (59%). In both disciplines, however, forwards are injured more than backs. Interestingly, the present study also showed that prop forwards are twice as likely to be injured in a game of rugby league as in union, yet the opposite was true of the second row forwards, who showed a higher number of cases in rugby union than rugby league. Shoulder pathology is one of the most common injuries in both rugby league and union,¹³ although the same study showed numbers to be slightly higher in rugby league, which is similar to the results of the present study. With the differences that exist

between the game play of the two sports, there is scope for further research into the comparisons between the two versions of rugby in relation to injuries experienced per game and, specifically, with regard to shoulder pathology.

Reoccurrence

There is limited documented data on injury recurrence rates amongst rugby players and even less on adolescent age group shoulder injuries. Academy players had the highest rate of recurrence post-management (11%). This proportion is lower than the 25% recurrence rate noted in adult amateur players¹⁷ and 23.8% in professional clubs.⁴ Unfortunately, it is not clear whether the recurrence rates noted by in these previous studies were pre-management or post-management. Consequently, it is difficult to make comparisons. Of note, the forwards in the present study were also twice as likely to suffer a recurrence post-management as the backs. Commitment to rehabilitation is an important factor in decreasing the time to return to sport and also in reducing the risk of recurrence post-injury. Yet, the adolescent age group may have several factors that can impede their ability to commit fully to rigorous rehabilitation protocols, such as their educational time commitments, social activities and work. Generally, the higher the level that each player progresses in their rugby career, the more available resources will be for them, with less constraints being placed on them outside of rugby.¹⁵ This may explain why the present study found the professional level rugby players to have the lowest recurrence rates of all of the levels we assessed.

Limitations

The main limitation of the present study was the method of data collection. All clinical and surgical findings were attained by our senior author; however, all other patient data were collected from the rugby players themselves. Data such as the mechanism of injury, playing position on the match day and initial symptoms experienced were difficult to determine as a result of the self-reported nature of these aspects. Occasionally, the study participants could not accurately remember the precise details of the injury, often as a result of the speed at which the incident occurred or the time that elapsed between the injury and presentation to a specialist. Ideally, video analysis methods of data collection would be more accurate, although this is only possible in prospective studies. Increasing age amongst adolescents is accompanied by the development of speed and strength, resulting in more power

generated per player.²⁴ Thus, there may indeed be a correlation between the collision forces experienced during match play and the players' physiques. This is certainly an element of the study that could be expanded upon in the future to gain a more accurate picture of the correlations between individual players and shoulder injuries.

Conclusions

The present study found a wide range of shoulder pathologies encountered by adolescent rugby players and showed that most episodes of trauma caused two or more pathologies in the shoulder. Forwards were shown to be more predisposed to shoulder injury than backs as a result of the nature of their position, incurring more labral injuries. By contrast, backs had a higher incidence of bony pathology. The mechanism of injury frequently correlated with player positions; thus, forwards were often injured in the tackler and direct impact situations, whereas backs were more often tackled at the point of trauma. Forwards were more likely to suffer a recurrence post-management. Between the ages of 12 years to 18 years, young rugby players are developing their sport, whereas academy and county level players are being selected for professional contracts, making this is a critical stage of their career. There is a growing need for a more rigorous analysis of the many dimensions in this field of study and, consequently, there is also the exciting potential for further exploration of shoulder rugby injuries in the adolescent age groups.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Review and Patient Consent

All patients in this study signed consent forms for their anonymised data to be utilised for scientific and research purposes. Data was analysed retrospectively and there was no change in the patients' standard of care or decision-making.

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