A high rate of injury during the 1995 Rugby World Cup

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Objective. To determine the frequency and nature of injuries sustained by the 416 players from 16 countries participating in the 1995 Rugby World Cup played in South Africa in May/June 1995.

Methods. The study was a prospective analysis of all injuries requiring medical attention during that competition. Data were collected by the match doctors on duty at each of the venues at which the matches were played. Data were collated and analysed.

Results. There were 48 preliminary and 7 final-round matches. Of a total of 70 injuries during the tournament, 58 occurred during the preliminary matches (frequency 30 injuries per 1 000 player hours); the frequency was somewhat higher during the 7 final-round matches (43 injuries per 1 000 player hours). Overall injury frequency was 1 injury every 0.8 matches during the preliminary and 1 every 0.6 matches during the final-round matches. Thirty per cent of injuries were to ligaments, 27% were lacerations and 14% were muscle strains. The lower limb accounted for 42% of all injuries, the upper limb for 29% and the face for 17%. Fifty-six per cent of injuries occurred during the tackle phase of play, 23% during the ruck and maul, 11% during open play and 9% during foul play. The scrum and line-out together contributed only 1% of all injuries. Loose forwards suffered 25% of all injuries; centres and wings 20%; prop forwards and half-backs 16% each; locks 14%; hookers 7% and fullbacks 3%. One player suffered a paralysing spinal cord injury during a preliminary match. The incidence of catastrophic neck injuries in the tournament was therefore 4.6 per 10 000 player hours.

Conclusions. The frequency of injury in this competition is the highest yet recorded in any group of rugby players. The risk of rugby injury is therefore greatest in the best players in the game, challenging the view that superior fitness, skill and experience can reduce the risk of rugby injury. In contrast, the larger size, greater speed and superior competitiveness and commitment of the best rugby players in the world would explain why they are at the highest risk of injury. The high frequency of injury in international rugby has implications for: (*i*) the frequency with which such matches should be played; and (*ii*) the number of players needed to complete a season of international rugby.

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The Rugby World Cup, contested every 4 years since 1987, represents the highest level of competition in a sport that is considered to have a very high injury risk.[1-5] To our knowledge, no previous study has reported any analysis of injuries that occurred during this competition.

In 1995, South Africa became the third country in the world to host this event, and the first to host all matches in one country. As this competition boasts the highest standard of international rugby and was played in a circumscribed geographical area during a 1-month period, we considered it appropriate to analyse the frequency and nature of all injuries sustained during the competition and to compare the findings with the published literature.

It has recently been proposed that the frequency of injury in international rugby is less than at lower levels of the game, suggesting that 'fitness and experience considerably reduce the injury rate' in rugby players.[2] But this conclusion conflicts with a substantial body of evidence from the UK and South Africa, which shows that the risk of spinal cord[6] and of all rugby injuries rises with increasing age and level of play (A or 1st team) in schoolboys,[7,8] increases further in senior club rugby players,[9,10] and apparently peaks at international level.[11]

To address this issue further, we compared the frequency of injuries during the Rugby World Cup with those reported in the literature[1,3,10] to establish whether there is any factual basis for the thesis that high levels of fitness, experience and skill reduce the risk of these injuries. An alternative hypothesis is that the greater speed of the game at international level, the larger size of the players and their superior physical commitment increase injury risk, for which superior skills and fitness are unable to compensate.

Material and methods

The 1995 Rugby World Cup was played at nine venues in South Africa. At each venue a medical team, reporting to a central organising committee chaired by the first author, provided immediate care for all players injured during the matches.

For the purpose of this study, a rugby injury was defined as a new injury that necessitated the player's leaving the field of play for the remainder of the game. All lacerations were included, whether or not the player returned to the same match.

After the injured players had been treated, the doctor on duty at the match venue completed a standardised injury report form which included the following information: (*i*) personal details including name, age, country and playing position; (*ii*) injury data including the site and type of injury; (*iii*) the phase of play in which injury occurred; and (*iv*) the playing position.

Injury forms were returned to and analysed by the authors at the offices of the South African Rugby Football Union.

Results

Sixteen teams, each comprising 26 players, participated in the 1995 Rugby World Cup. Altogether 55 matches, each lasting 80 minutes, were played for a total of 2 194 player hours of match play. Fifty-eight injuries occurred in the 48 pool games (1 915 player hours) with a further 12 injuries in the final 7 games (279 player hours). Two per cent of participants in the competition suffered injury.

The overall injury incidence was 32 injuries per 1 000 player hours. The incidence was substantially higher in the final games (43 injuries per 1 000 player hours) than in the pool games (30 injuries per 1 000 player hours).

Table I lists all the injuries according to type and location. Ligament and joint injuries (34%) and lacerations (27%) comprised the majority of injuries. A further 24% of injuries were muscle injuries (including contusions). Fractures comprised 11% of injuries whereas concussion accounted for only 3%. The proportional distribution of these injuries was as follows: lower limb 42%; upper limb 29%; face 17%; head and neck 9%; chest and torso 3%.

Table I. Nature and site of all injuries during the 1995 Rugby World Cup

Type and site	Frequency (%)
Ligament/joint injuries	34
Knee	10
Shoulder	10
Wrist	6
Ankle	3
Neck	4
Finger	1
Lacerations	27
Muscle injuries/contusions	24
Fractures/dislocations	11
Upper limb	10
Nose	1
Concussion	3

Table II lists the percentage of injuries occurring in the different phases of play. The tackling phase of the game accounted for 56% of all injuries with the ruck and maul contributing a further 23% of all injuries. Foul play accounted for 9% of all injuries whereas the scrum and line-out together were responsible for only 1% of all injuries.

Table II. Frequency of injuries in different phases of play during the 1995 Rugby World Cup

Phase of play	Injury (%)
Being tackled	29
Tackling	27
Loose scrum	23
Open play	11
Foul play	9
Scrum	1
Line-out	0

Included in the neck ligament injuries were 2 cervical ligament strains and another which caused a paralysing spinal cord injury. The incidence of significant neck injury during competition was therefore 14 injuries per 10 000 player hours and that of catastrophic spinal cord injuries, 4.5 injuries per 10 000 player hours.

Table III lists the frequency of injury by playing position. Loose forwards suffered the highest proportion of injuries (25%), which was disproportionately greater than their proportional make-up of the team (20%). Similarly half-backs and, to a lesser extent, locks were injured disproportionately more frequently, whereas backline players and fullbacks, especially, suffered disproportionately fewer injuries.

Table III. Frequency of injury in different player positions during the 1995 Rugby World Cup

Playing position (player numbers)	%	Players on the team (%)
Loose forwards (6, 7, 8)	25	20
Backline (11, 12, 13, 14)	20	27
Halfbacks (9, 10)	16	13
Locks (4, 5)	14	13
Hooker (2)	7	7
Prop forwards (1, 3)	6	13
Fullback (15)	3	7

Discussion

The measured overall injury frequency in this study (32 per 1 000 player hours) and especially the frequency during the final 7 matches (43 per 1 000 player hours) are the highest yet reported. They are 2 - 3 times higher than rates of 12 - 15 injuries per 1 000 player hours in senior rugby players in a study undertaken in the south of Scotland,[3] where the definition of injury was similar. Similarly lower rates of about 15 injuries per 1 000 player hours of match play have been reported in under 19-A (first team) schoolboy rugby players in South Africa.[1,8] The rates in South African senior club players was 17 injuries per 1 000 hours of match play.[9]

All the South African studies excluded 'transient' injuries which constitute about 22% of rugby injuries in senior players.[3] Inclusion of such injuries would have increased injury frequency to 18 and 21 injuries per 1 000 player hours in schoolboy and senior club rugby players, respectively. These values are still substantially lower than those measured during the Rugby World Cup.

Thus the study confirms the conclusion that the prevalence of rugby injury rises with the increasing competence and fitness of the players or, alternatively, with the increasing competitiveness of match play.[1] That the injury rate was highest in the final 7 matches of the tournament, contested by the best 8 teams, further confirms that the injury rate in rugby is highest when the best players in the world play against each other. This finding would also argue against any theory that mismatching of playing ability between competing teams increases the frequency of injury.

Hence the important conclusion from this study is that the frequency of rugby injury is highest at the very highest level of the game, in contrast to a previously published opinion.[2] Although this does not disprove the theory that 'fitness and experience considerably reduce the injury rate',[2] it does indicate that the data on which that conclusion was based are not representative. Indeed, more careful review of the

paper by Seward *et al*.[5] from which that conclusion was drawn, fails to provide any evidence that data for international rugby union players were even reported. Rather, the authors' own conclusion[5] was that 'the injury rate in senior rugby union is much higher than the schoolboy rate'. This conclusion is compatible with all the other published evidence.[1,6-11]

The finding that the injury frequency in this competition was the highest yet recorded therefore confirms the alternative thesis that injuries in rugby are a result of the speed of the game, the size of the players and the physical nature of the game.[1,8] Whereas fitness, experience and skill may reduce injury risk for any individual player, the nature of the international game overwhelms any such protective effect.

Despite the higher frequency of injury in Rugby World Cup players, it is of interest that the anatomical distribution and type of injuries and the phase of play in which they occur are similar to findings from studies of less-skilled players.[1,3,5,7-10] However, the incidence of scrum injuries (1%) is substantially lower than values of 7 - 8% in other studies of schoolboy[7,8] or senior[3,9] rugby players. There was a similarly low incidence of injuries in the line-out (0%), compared with data for Scottish (12%) and South African (3%) senior rugby players.[3,9] The reason for these discrepancies is not immediately clear.

In this study, loose forwards and halfbacks were injured disproportionately, whereas the other backline players and prop forwards had disproportionately few injuries. This contrasts with findings from senior club rugby in which the hooker, wing, fullback, centre, eightman and flank are the high-risk positions.[9] These differences may reflect recent changes in the way in which the game is played at international level.

No data are yet available on the frequency of spinal cord injuries in rugby players[1,6,12] and this is one of the first studies that allows for this analysis. Three cervical ligament injuries, one catastrophic, occurred. The prevalence of neck injuries in this group was therefore 13.7 per 10 000 player hours, and the prevalence of catastrophic injuries was 4.6 injuries per 10 000 player hours. In the study of Scottish senior players, no spinal cord injuries occurred in 30 750 playing hours.

In summary, this study documents for the first time the frequency and nature of injuries at the highest level of the game. It records the highest frequency of injury yet reported in the game, and perhaps a change in patterns of injury per playing position with fewer injuries in the scrum and line-out, the two phases of play that have been marginalised in the modern game.

This finding shows that the high levels of skill and fitness of international rugby union players are not sufficient to offset the greater risk of injury consequent on the more physical and faster nature of the modern international game. Indeed, the probability is that the only effective interventions that might reduce injury risk at international level would be the introduction of laws that reduce the speed of the game, the size of the players and the amount of contact in the game.

In as much as those laws would also detract from the allure of the game, it is unlikely that there is any realistic possibility of introducing rule changes that would significantly reduce risk in international rugby. The responsibility therefore remains with the individual players and their coaches to explore all techniques to reduce their personal risk in this high-risk activity.[1]

Finally, these data allow an approximation of the number of players on a team likely to be injured during a season of matches of international standard. An international team of 15 players, for example, would accumulate 500 hours of match play for every 25 international standard matches that they played. This would result in between 15 and 21 injuries, according to the injury frequency of between 30 and 43 injuries per 1 000 hours measured during the 1995 Rugby World Cup.

Of the injuries reported in this study, ligament/joint injuries to the knee (10%), shoulder (10%) and neck (4%), fracture injuries of the upper limb (10%) and a proportion of muscle injuries would probably have required a more prolonged recovery period (> 6 weeks), effectively removing players from international rugby for a substantial part of the season. Therefore perhaps as many as 40% of injuries sustained during international rugby might require prolonged recovery periods and qualify as serious injuries.[3,10]

This prediction suggests that, at an injury frequency of between 30 and 42 injuries per 1 000 hours of international match play, between 6 and 8 members of each international rugby squad that plays 25 or more test matches per season might expect to suffer a serious injury. This prediction has implications for the size of the squads needed to complete a season of international rugby and begins to quantify the human cost of the increasingly demanding calendar of international rugby in the modern professional era ushered in by the 1995 Rugby World Cup.

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