

Catastrophic Spinal Cord Injuries in Argentine Rugby. Impact of the Measures Implemented and Their Relative Reduction in Time

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ABSTRACT

Introduction: A catastrophic injury is defined as any serious trauma that involves the head, brain, spine, or spinal cord. They are life-threatening or may leave a permanent or semi-permanent disability. In Argentina, there is a high incidence of injuries. **Materials and Methods:** Data obtained from a telephone survey carried out in the collaborative framework between the *Union Argentina de Rugby* and the *Fundación para la Lucha de Enfermedades Neurológicas de la Infancia* (Fleni, by its acronym) were analyzed. We carried out a qualitative analysis of the data and their relationship to progressive changes in sports regulations. **Results:** It was observed that the number of injuries remained stable year after year. When associating this fact with a sustained increase in the number of players per year, we can see a relative decrease in the risk of injury. **Conclusion:** Catastrophic injuries have a great impact on the quality of life of the player and his environment. They must be considered inadmissible and the efforts must be increased to achieve zero risk. In recent years, multiple preventive measures have been implemented and regulations have been modified in order to avoid catastrophic injuries.

Keywords: Rugby; spinal cord; scrum.

Level of Evidence: IV

Lesiones medulares catastróficas en el rugby argentino. Impacto de las medidas implementadas y su reducción relativa en el tiempo

RESUMEN

Introducción: Se entiende por lesión catastrófica a cualquier trauma grave que comprometa la cabeza, el cerebro, la columna vertebral o la médula espinal, que pone en riesgo la vida o puede dejar una discapacidad permanente o semipermanente. En la Argentina, la incidencia de lesionados en el ámbito del *rugby* es alta comparada con la de otros países. En los últimos años, se han implementado múltiples medidas de prevención y se han modificado normas con el objetivo de evitar las lesiones catastróficas. **Materiales y Métodos:** Se analizaron datos obtenidos de una encuesta telefónica realizada en el marco de colaboración entre la Unión Argentina de Rugby y la Fundación para la Lucha de Enfermedades Neurológicas de la Infancia (Fleni). Se realizó un análisis descriptivo de los datos. Se recopilaron los cambios en las normativas del deporte, que pudieran tener impacto en las futuras lesiones. **Resultados:** Se observa que el número de lesiones se mantiene estable año tras año. Al asociar este dato con un aumento sostenido de la cantidad de jugadores por año, impresiona haber una disminución relativa del riesgo de lesionarse. **Conclusiones:** Las lesiones catastróficas generan un gran impacto en la calidad de vida del jugador y de su entorno. Deben considerarse inadmisibles y se deben incrementar los esfuerzos para lograr eliminar los riesgos de lesionarse. El esfuerzo de las entidades reguladoras impresiona tener un impacto positivo al haberse logrado una reducción relativa de las lesiones en relación con el aumento de jugadores año tras año.

Palabras clave: Rugby; médula; lesión; catastrófica; scrum.

Nivel de Evidencia: IV

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How to cite this article: Carpani F, Salvat F, Saco M, Farcy N, Zamorano C, Bruno V, Farez MF, Nogués M. Catastrophic Spinal Cord Injuries in Argentine Rugby. Impact of the Measures Implemented and Their Relative Reduction in Time. *Rev Asoc Argent Ortop Traumatol* 2021; 86 (3) :XXXX. <https://doi.org/10.15417/issn.1852-7434.2021.86.3.1154>

INTRODUCTION AND OBJECTIVES

Over the past 10 years, the professionalization and diffusion of rugby have led to an increase in the number of fans in Argentina; it currently has a base of more than 65,000 players.

Rugby is a team sport in which there is a strong exposure to physical contact. It has game-specific situations (*scrum, tackle, ruck, and maul*) where there is a dispute between two or more players to determine the position of the ball, and high-impact collisions can be generated. Such situations may pose a risk of injury that can have serious consequences. In the last 20 years, the focus has been on risk factors related to the origin of serious injuries, and this led to deepening education and prevention of these injuries.

Catastrophic injury means any serious trauma involving the head, brain, spine, or spinal cord, which requires urgent admission to the hospital and must be resolved immediately, as it poses a risk to life or may leave a permanent or semi-permanent disability.¹ These injuries represent a very low percentage of the total rugby-related injuries, but, due to the severity and potential risk of disability, they tend to have a significant impact on the general population, who perceive the risk qualitatively.²

Fundación Unión Argentina de Rugby (FUAR) is a non-profit non-governmental organization founded in 2015. Its aim is to provide comprehensive assistance to players who have suffered serious injuries within the playing field. Along with the development of the “Rugby Insurance” program in 2016, they have been the two most representative actions in all aspects of spinal cord injury prevention. They have a comprehensive database and an important organizational structure focused on minimizing the obstacles generated by the inability to acquire a good quality of life.

The aim of this article is to retrospectively analyze the history of catastrophic spinal cord injuries in Argentina, according to the players who suffered them and to mention the measures implemented in order to minimize these tragic injuries.

MATERIALS AND METHODS

Within the framework of collaboration between the Argentine Rugby Union (UAR) and the Foundation for the Control of Neurological Diseases of Childhood (Fleni), we sought to update and analyze new data on *rugby* players who suffered catastrophic spinal cord injuries between 1965 and 2017. To achieve this aim, a telephone survey was conducted to all players included in the FUAR records, who had suffered catastrophic spinal cord injuries. Fleni and CEBES members (both scholars and doctors) were in charge of telephone communication with players to conduct a standardized and semi-structured survey that allowed the collection of both specific data and subjective data provided by each individual. The verbal consent of each player was requested for the use of the data provided, but no information that could identify the respondents is mentioned. As it was a personal survey, players who had died before the study were excluded. In turn, statistical data recorded since 1996 on the number of players registered in the UAR were used.

In the personal survey of players, data such as age, technical parameters of the game (position, hours of training) and details of the injury (game situation, biomechanical details of the injury, spinal location of the lesion) were obtained. Medical care received (in the field, medical care, type of surgery required, hospital stay) and chronic evolution (sequelae, social reintegration, current relationship with *rugby*) were recorded. It was decided to avoid statistical analysis, since, due to the low number of injured players, it would not have a representative value. We chose to perform a descriptive and qualitative analysis of catastrophic spinal cord lesions. We collected some of the changes in sports regulations that could have an impact on future injuries.

FINDINGS

Thirty-two out of 33 injured players were surveyed between 1965 and mid-2017. The missing injured player was the only one who had died of causes indirectly related to his spinal cord injury. The registry was created 52 years ago and injuries have been recorded in 33 players, i.e. a minimum of one case per year and a maximum of three cases per year (2016).

All players surveyed were over 18 years of age when they were injured. The median age when injured was 19.5 years (range 15-28). All injured players were amateur. 75% of injured players performed specialized training for an average of 7 hours per week (between 2 and 18 h). As for the position, 23 of the 32 athletes played as forward (74%), of whom 11 occupied the *hooker* position, the riskiest position (Figure 1).

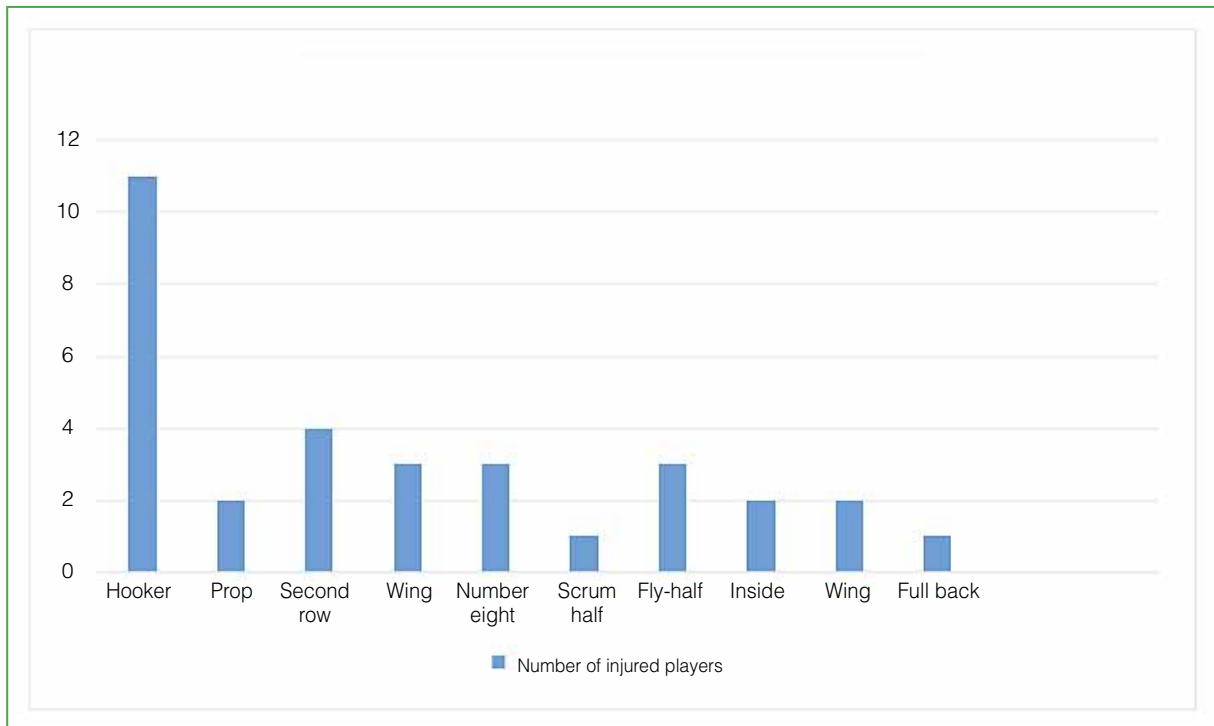


Figure 1. Bar chart showing the number of injured persons based on position. It highlights the huge prevalence of the first row of strikers, specifically the *hooker* position.

Among the game situations, 50% of the injuries occurred during the *scrum*, 22% in *tackle* situations, 19% during *ruck* and the remaining 9% in other unspecified situations.

As the mechanism of injury, cervical hyperflexion with rotation or without rotation was identified in 59% of cases. The most frequently affected spinal sector was between levels C4-C5 and C6-C7; the compromise of more than one level is possible (Figure 2). Spinal lesions are divided into complete or incomplete section, and the first is the most frequent.

75% of players received medical attention on the pitch. The transfer to hospital facilities was carried out within 30 min in 41% of cases, 30-60 min in 40% and after 60 min in the rest (19%). In 84% of cases, the spine was immobilized for the player's transfer. The majority of the injured players (93%) required emergency surgery to prevent the progression of the injury.

Concerning the evolution of players, 97% suffered motor sequelae that included motor, sensory or autonomic deficit. The most frequent neurological sequela was quadriplegia with different levels of severity. 87% achieved an adequate return to the workforce and that same percentage remains linked to *rugby* in some way. Outside the statistical analysis, a large number of injured players felt that the main factor to improve is the change of standards and education for the prevention of such injuries. Concerning the measures taken by the UAR, those who expressed their opinion considered that they were appropriate and that changes could be observed in the management of such catastrophic situations. Their first-person experience provides useful data that is beyond the reach of experts on the subject.

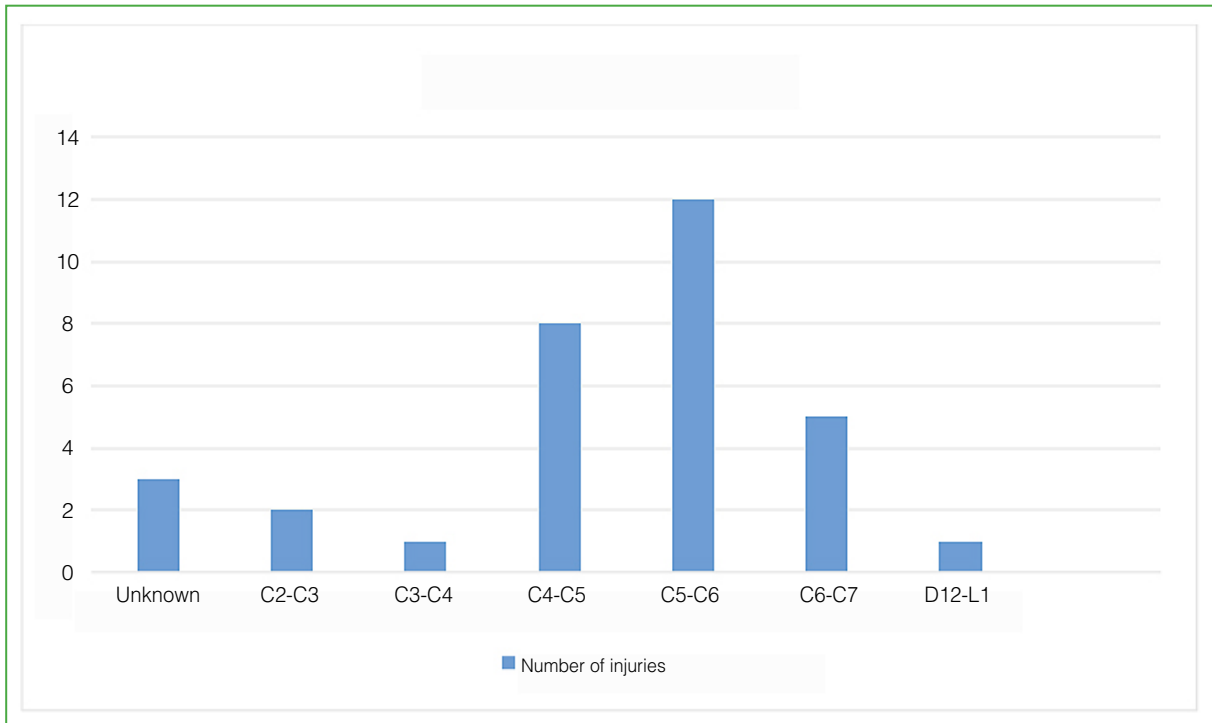


Figure 2. Bar chart showing the spinal cord levels where the injuries occurred. The prevalence of the proximal half of the cervical spine is highlighted.

DISCUSSION

Currently, in Argentina, there are no official statistics on the extent of spinal cord injuries associated with sport, and the economic impact these injuries generate on both individuals and society is unknown. Chan et al. conducted a review of population data provided by each country. Only 25 countries conducted epidemiological studies on sports-related spine injuries, accounting for 13% of spinal cord injuries.⁴ Among other sports, rugby is considered to have a moderate to high risk of spinal cord injury. In 1999, Secin et al. described the first series of cases of catastrophic and almost catastrophic injuries in Argentina.⁴ In the period we analyzed, the incidence of injuries was 1.4-5.1 cases per 100,000 players per year. In countries with the highest number of rugby players, the different series report the following incidence of cases every 100,000 players, per year: England 0.48-1.5; France 1.4-2.1 and South Africa 1.04-1.8.^{5,6}

According to current statistics, there are more than 65,000 UAR-affiliated rugby players. There is a steady growth in the number of registrants; in the last 20 years, the number of players registered in the different unions that depend on the UAR has doubled.

The average age when injured was 19.5 years, a time of transition between the youth leagues and the upper squad. The literature is contradictory regarding the relationship between age and catastrophic lesions. There is no reported case series comparing the dispersion of age in spinal cord lesions within the highest age category, nor is there evidence to support that the musculoskeletal immaturity observed in younger players or the different fitness levels are related to the frequency of injuries.⁶ In turn, in Argentina, there are no reports of professional players who have suffered this type of injury, implying that proper technique and specific training are mitigating factors.⁵

In our series, about three-quarters of the injured were playing in striker positions. In this outstanding difference between the strikers and defenders, players on the front lines are the ones who are exposed to greater risk. In concordance with historically reported data, the hooker position, especially when forming the *scrum*, remains the riskiest. These data coincide with international statistics and are reflected in the Argentine population.⁴ As a general rule, there is a tendency to avoid a large disparity in both technical and physical training between teams, as this would put both sides at risk.⁷ The general recommendation remains to encourage the generation of an appropriate physical framework for the position and that specific training be carried out for players participating in the *scrum* (especially the front lines). *Scrum* is the training in which the largest number of catastrophic injuries occurs, reaching half the total among the players surveyed. A systematic review published in 2015 on scrum-related spinal lesions concluded that the percentage of spinal lesions may be similar in *tackle* and *scrum*, but those caused by the latter tend to be more severe and produce permanent sequelae. Different series have reported that the lesions associated with *scrum* cause a permanent deficit in 60% of the injured, while those in *tackles* cause 29%.⁸ In the *scrum* is where the most prevention measures were taken. Reboursiere et al. demonstrated the effectiveness of the rules concerning *scrum*, implemented in France and how the incidence of spinal cord injuries decreased.⁵ In Argentina, specific measures related to the prevention of *scrum* injuries were taken, including:

- Amendments to the referee's orders. Currently, "Crouch - Bind - Set". Minimizing the onslaught between rival front blocks.
- Limitation in juvenile divisions to push more than 1.5 meters when a *scrum* is formed.
- Assistant referee's entry to control, along with the referee, both sides of the scrum.
- Generation of the FRA (Front Row Accreditation) with training for players who occupy those positions.

It should be noted that the vast majority of serious and non-serious injuries are related to *tackle*, as it is the individual action that is most observed in a rugby match. In our Argentine experience, we identified that 22% of the lesions were tackle-related, representing a lower percentage than in other series. There are specific types of *tackle* that increase the risk of injury (e.g., a high *tackle*, more than a player involved or tackling a player who is not standing), so they are considered illegal in modern rugby. The risk of tackle-related spinal cord injury remains low and the rules set by regulators tend to reduce those risks. Year after year, training is strengthened for players and referees on the appropriate techniques to avoid serious injuries.

Concerning the mechanisms of trauma, it is believed that injuries occur at the time when the player undergoes an exaggerated flexion of the neck, which causes a fracture of the anterior wall of the cervical vertebra and dislocation of the said vertebra into the medullary canal.⁸ In our series, this was the mechanism reported as most frequent. According to the literature, lesions with catastrophic results are generated in the most mobile parts of the cervical spine, especially between the C4-C5 and C5-C6 levels.⁹ In our series, the mechanism of the lesion was identified as cervical hyperflexion with or without rotation in 59% of cases and more than 90% were between C3-C4 and C6-C7 levels. This kinetic mechanism was most often observed in the *scrum*, especially when the scrum collapsed or when one team rammed the other before it was properly formed.

Initial medical care represents a vital point in the evolution of catastrophic lesions. Our series shows a high heterogeneity in the type of medical treatment, probably related to the temporal dispersion of the analysis. In 2017, Badenhorst et al. reported a large variability of health care in different regions of South Africa and that lower socioeconomic levels were more vulnerable to these conditions, which was associated with a worse prognosis.¹⁰ While there is currently no regulation for medical care on the pitch of amateur rugby matches, online and face-to-face training is encouraged for club physicians and those attending matches within the UAR orbit. Adequate transfer conditions and urgent referral to high-complexity centers specialized in the management of neurosurgical pathologies may be the difference between complete recovery and permanent sequelae. Within the orbit of the BokSmart program in South Africa, the "SpineLine" program was developed to facilitate the injured player's access to a facility trained to quickly resolve the injury and thus prevent its progression.⁶ In our series, virtually all patients required some kind of surgical instrumentation to achieve stabilization of the cervical spine and thus prevent the progression of spinal cord injury.

The analysis of the prognosis of these lesions remains overwhelming. Although 87% of patients achieved some degree of reintegration into the workforce, they all have some kind of motor, sensory or autonomic sequelae. 70% require some kind of urinary tract instrumentation, which generates a serious compromise in daily-life activities. It should be noted that most players who suffered catastrophic injuries continue to be related to *rugby*, demonstrating the importance of the emotional and economic support provided by the rugby community to such events. Badenhorst et al. made an interesting contribution in assessing the quality of life of rugby players with spinal cord injuries in South Africa. Among the conclusions, it is noted that the support of the sports group is a factor that improves the social reintegration of injured persons.¹¹ Concerning the opinion of injured players, there is a general consensus that intensive work is being done on the issue and that the measures implemented are adequate.

Countries such as South Africa and New Zealand have developed programs for the prevention and treatment of rugby-related injuries (BokSmart and RugbySmart, respectively) that require constant training of coaches, physicians and referees.^{11,12} In Argentina, the “Rugby Seguro” program was designed to identify and remove players who suffer an injury during training or on the day of the match. This initiative was launched in 2016 with the main focus on player and medical staff education and training to increase awareness and decrease the number of injuries.

Both training programs and numerous regulatory changes have been implemented to promote the safety of players, for example,

- Regular pre-competitive medical examinations and the generation of the pre-competitive medical electronic card.
- More severe penalties for dangerous play, such as aggravated yellow card.
- Generation of specific training programs for players, authorities and physicians.
- Encouraging the “IDENTIFY AND WITHDRAW” premise on suspicion of a major injury.

These changes have strengthened the idea of safe play and shown their short-term results, as a low number of spinal cord injuries has maintained, despite a significant increase in the number of players. This can be interpreted as a relative decrease in catastrophic injuries as the number of players increases each year. This relative decrease in the annual risk of catastrophic injuries is associated with the intensification and promotion of continuing education programs combined with less flexible regulations. In turn, the result of these changes resulted in the absence of new catastrophic lesions from 2017 to date.

Our study has certain limitations, such as the temporary extension of registration, the fact that rules have changed multiple times and the transition from amateur to professional rugby. In turn, long-term follow-up and the difficulty in grouping all the injured may mean that not all patients have been included in the survey. The calculated incidence corresponds to the number of players injured by the number of players per year. By not calculating the risk according to hours of exposure, the results may be inaccurate. We believe that this should be the starting point for a prospective analysis of the impact of prevention measures, and the initiation of collaborative and multidisciplinary work that will reduce this type of injury to a minimum, while keeping the spirit of rugby intact.

CONCLUSIONS

Over the past four decades, the number of patients with rugby-related spinal cord injuries in Argentina remained stable. When compared with the increase in the total number of players, a relative decrease in the ratio between injured players and the total number of players each year has been achieved. This shows that efforts to improve standards and constant education are key factors in prevention. *Tackle* and *scrum* are the riskiest situations of the game and where more emphasis has been placed on minimizing the risks of this type of injury. Especially the front rows of all divisions should receive supervised theoretical and practical education in order to achieve an appropriate technique that reduces risks. It is essential to deepen the learning of the correct approach techniques in training, especially in the area of youth divisions.

Conflict of interests: The authors declare they do not have any conflict of interests.

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