

Occupational injury in Spanish professional roller hockey during two seasons: a comparative study

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Abstract:

The purpose of this study was to evaluate the frequency and severity of the injuries suffered in two roller hockey teams, one professional and one amateur, in one of the most powerful leagues in the world, during two seasons in two different divisions. Comparative study between two roller hockey professional teams of different status: first division (professional) and regional division (amateur). The sample consisted of 10 professional players and 13 amateur players, whose injuries were recorded prospectively during the 2014-2015 and 2015-2016 seasons. Of the 88 injuries registered, 15.4% were considered mild, 50% moderate and 34.1% serious. The incidence of moderate injuries was higher in the professional compared to the amateur team (65% vs. 37.5), while serious injuries were superior in the amateur team (45% vs. 20%). The most frequent injury in both divisions was muscle-related. The most common mechanism of injury was traumatic, mainly affecting the upper extremity. The vast majority of injuries are caused by stick and/or puck strokes and generally occur during competitions. The results obtained show that in roller hockey the professional status can be a determining factor of the injuries. In the professional field, there are more moderate injuries while in the amateur field the injuries are much more serious. Furthermore, these results confirm that the risk of injury in the workplace is considerably higher in roller hockey than in most other sectors. It becomes necessary to review and modify the regulations, enforcing more security measures and making clubs analyze the importance of developing injury prevention strategies.

Key words: Roller hockey; injuries; Safety precautions.

Introduction

Roller hockey is one of the most popular sports in Argentina, Chile, Brazil, Italy, Portugal, Switzerland and Spain, where it also is one of the most successful. Spain currently occupies the first place in obtaining Men's Championship World Cups, with a total of seventeen. Roller hockey is an intense sport of collision and contact between players. The weight and speed of the puck and the stick also present a considerable risk of producing moderate and severe injuries, especially intracranial (Pelaez, Dascenzi, Savastano et al., 2008; Hootman, Dick & Agel, 2007).

There are multiple epidemiological studies related to the injuries in this sport which describe the characteristics of the injury in ice or roller hockey (Rodas-Font, Medina-Leal, Moizé-Arone et al., 2006; Junge, Langevoort, Pipe et al., 2004; Tuominen, Hänninen, Parkkari et al., 2017; McCrory, Meeuwse, Kutcher, Jordan & Gardner, 2013). There are almost no studies that show the incidence of hockey injuries; however, despite these limitations, the few existing studies show that players suffer numerous and important injuries (Pelaez, Dascenzi, Savastano et al., 2008; Hootman, Dick & Agel, 2007). Under these circumstances, in relation to the type of injuries, the analyzed studies agree that the largest amount of injuries that are suffered are head injuries (Pelaez, Dascenzi, Savastano et al., 2008; Hootman, Dick & Agel, 2007). Concussions in sports are a clinical syndrome that consists of a traumatically induced transient disturbance of a normal brain function. In hockey, concussions are more likely to occur from contact with another body part or object rather than another head (Tuominen, Hänninen, Parkkari et al., 2017). Because it is important to minimize this type of injuries, pertinent preventive measures must be established (McCrory, Meeuwse, Kutcher et al., 2013). No work has been found that analyzes the incidence of injuries in professional roller hockey or that compares the influence of the competitive level (league or division) on the injury. Thus, this study aims to examine the frequency and severity of the injuries that occurred in two roller hockey teams from two different divisions during two seasons.

Material & methods

Participants

Two Spanish leagues of roller hockey were analyzed: the first division (Professional) and the regional league (Amateur). The sample was composed of professional players of the ICG SOFTWARE LLEIDA club,

and HC VALLS amateur team of the regional league. The lesions were identified prospectively during the 2014-2015, 2015-2016 seasons. An informed consent was obtained from all the players participating in the study.

Survey

A questionnaire structured by the Royal Spanish Skating Federation was used as the instrument to collect and record the information. (http://fep.es/admin/circulars/docs/Hoja_Registro_Lesiones.pdf).

Data collection

In order to contact the physiotherapist and/or physical trainer of each club, a letter describing the project was sent to the teams' official addresses. The objectives of the letter were to explain the research's purpose, the confidentiality of the information, and the motivation of the researchers to carry it out. After two weeks, a telephone call to the teams' official headquarters was made in order to talk with each physiotherapist and/or physical trainer directly and agree upon a date to administer the questionnaire personally.

All players were informed and agreed upon entering the club to be able to record the data of their injuries with scientific purpose (according to the Helsinki declaration). This study was approved by the ethical-scientific committee of the Sports Science Department of the University of Lleida (PI17/0151)

Procedure

The definition of the lesion and the way in which the information was collected was carried out following the consensus recommendations established for this type of study (Fuller, Ekstrand, Junge et al., 2006). Any injury that occurred during training or competition and that prevented the player from participating in a match or training for at least one day was considered as susceptible to being registered. Lesion exposure was defined as any type of physical activity performed under the supervision of the team coach. The competitions which were considered to track the injuries were those played throughout the two seasons analyzed, The lesions were categorized as "mild" (from one to seven days), "moderate" (from 8 to 28 days) and "serious" (more than 28 days) depending on the (actual, not estimated) recovery time elapsed until the player was able to play again. The lesions were also classified according to their nature, location and mechanism or cause. In addition, information was collected on the laterality of the lesion and the days of inactivity caused by it.

Statistical analysis

For the descriptive analysis of the different variables, such as the type and the precise location of the lesions, frequencies of each of the variables were calculated individually and in relation to the relevant independent variables. The SPSS 24.0 program for Windows was used for the statistical analysis process.

Results

From the studied seasons, 13 players competed in the regional league and 10 in the professional league, obtaining a final sample of 23 players (average age 30.48 ± 7.98 years). Table 1 shows the characteristics of the sample. A total of 88 injuries were collected: the average of injuries per team was 1.8 injuries per season in the amateur team, while the amount of injuries was superior in the professional team (2.0 injuries per season).

Table. 1. Descriptive statistics (means and standard deviation)

	Valls (n=13)		Lleida (n=10)	
	Average	SD	Average	SD
Age	31.85	8.81	28.70	6.78
Size (m)	1.79	0.06	1.81	0.03
Weight (Kg)	82.69	9.97	74.90	5.22
IMC	25.71	2.58	23.01	1.57

Severity of the lesion

From 88 injuries, 14 (15.9%) were considered mild, 44 (50.0%) were moderate and 30 (34.1%) were serious. The most frequent were of muscular, which together accounted for 25.0% of the total injuries recorded. The most frequent mechanism of injury was traumatic, which caused approximately two thirds of the total reported injuries. The upper extremities, as well as the head, were the most frequent location of lesions. If laterality is considered, the right side was the most affected part.

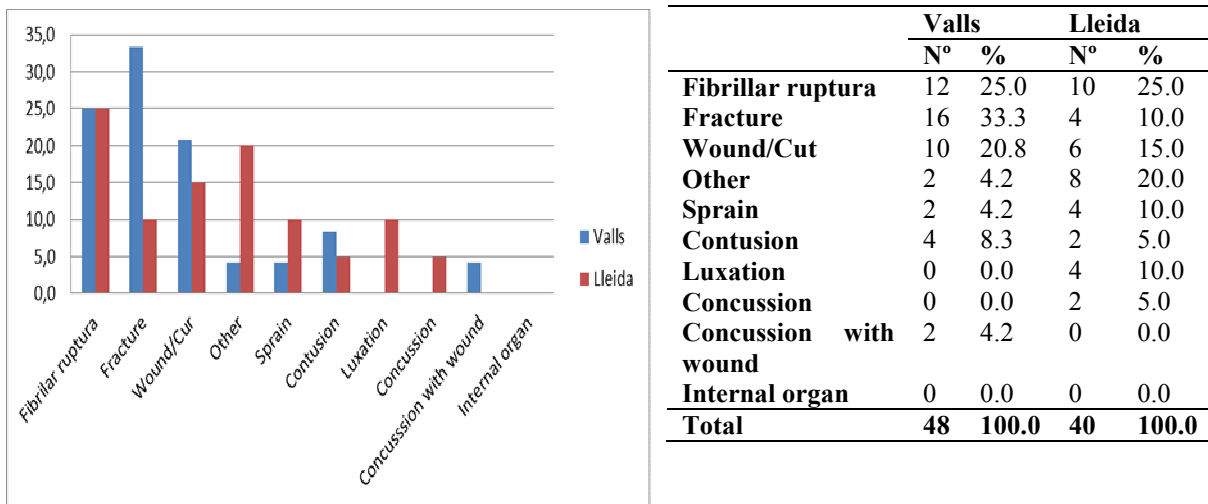


Fig.1. Percentage of the characteristics of injuries according to the location. Distribution of most frequent injuries by location.

Differences between the leagues

The most frequent injury in the two leagues was in the muscles. Fractures and wounds/cuts were more frequent in amateur leagues, while in professional players small discomforts (cataloged with others) were the most common after the muscular ones (Fig. 1). Considering the severity of the injury, it may be observed that there are no significant differences in the minor injuries, while moderate injuries were higher in the professional team compared to the amateur (65.0 vs. 37.5%). Finally, there were more serious injuries in the amateur compared to the professional team (45.8 vs. 20.0%), (Fig. 2).

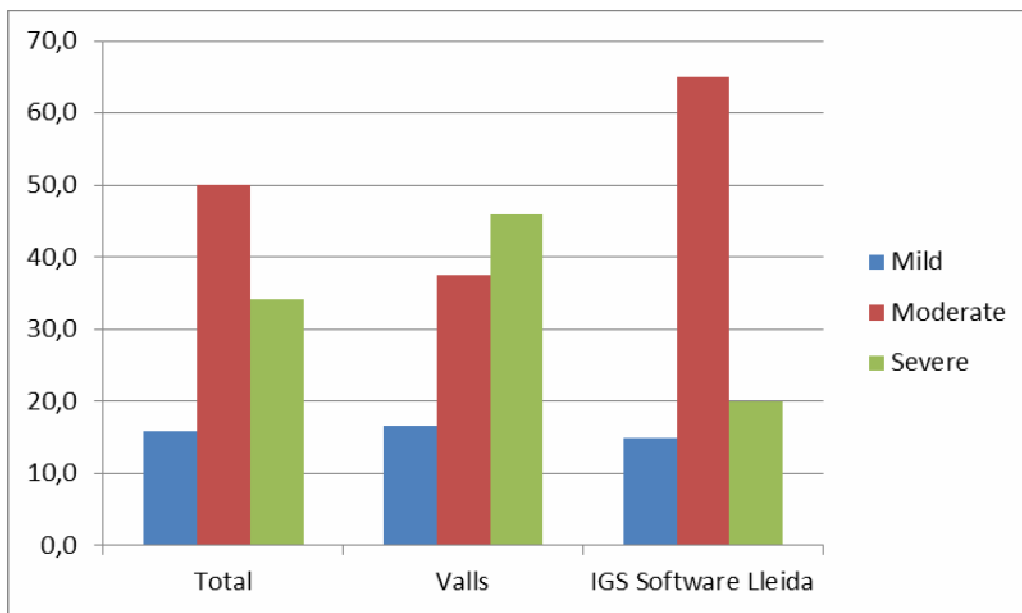


Fig. 2. Classification of the injuries according to the time outside the competition

According to the nature of the injury, trauma is the most common in the amateur league (66.7%), while overloads are the most common in the professional team (60.0%) (Table 2).

Tab. 2. Distribution of injuries according to the variables analyzed

Type		Mild		Moderate		Severe							
		Nº	%	Nº	%	Nº	%						
		Valls	Lleida	Valls	Lleida	Valls	Lleida						
	Sprain	0	0.0	0	0.0	2	11.1	4	15.4	0	0.0	0	0.0
	Fracture	0	0.0	0	0.0	2	11.1	2	7.7	14	63.6	2	25.0
	Luxation	0	0.0	0	0.0	0	0.0	4	15.4	0	0.0	0	0.0
	Break fibers	0	0.0	0	0.0	6	33.3	6	23.1	6	27.3	4	50.0

	Contusion	2	25.0	0	0.0	4	22.2	2	7.7	0	0.0	0	0.0
	Wound/Cut	6	75.0	6	100.0	4	22.2	0	0.0	0	0.0	0	0.0
	Concussion	0	0.0	0	0.0	0	0.0	2	7.7	0	0.0	0	0.0
	Internal organ	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Other	0	0.0	0	0.0	0	0.0	6	23.1	2	9.1	2	25.0
Nature	Acute (direct trauma)	8	100.0	6	100.0	10	55.6	10	38.5	14	63.6	0	0.0
	Overload	0	0.0	0	0.0	8	44.4	16	61.5	8	36.4	8	100.0
Localization	Head/Face	6	75.0	6	100.0	6	33.3	2	7.7	4	18.2	0	0.0
	Trunk/Pelvis	0	0.0	0	0.0	0	0.0	4	15.4	2	9.1	0	0.0
	Upper extremity	2	25.0	0	0.0	4	22.2	10	38.5	10	45.5	2	25.0
	Lower Extremity	0	0.0	0	0.0	8	44.4	10	38.5	6	27.3	6	75.0
Laterality	Right	2	25.0	0	0.0	8	44.4	14	53.8	10	45.5	4	50.0
	Left	0	0.0	0	0.0	4	22.2	6	23.1	6	27.3	4	50.0
	Without laterality	6	75.0	6	100.0	6	33.3	6	23.1	6	27.3	0	0.0
Cause	Hit with the puck	2	25.0	4	66.7	2	11.1	4	15.4	4	18.2	0	0.0
	Hit with stick (SL)	4	50.0	2	33.3	6	33.3	2	7.7	6	27.3	0	0.0
	Shock with the goal	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Shock with player	0	0.0	0	0.0	0	0.0	2	7.7	4	18.2	0	0.0
	Shock with the fence	0	0.0	0	0.0	2	11.1	2	7.7	0	0.0	0	0.0
	Load with the body	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Load with stick (CC)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Load from behind	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Tripped up	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	No contact	0	0.0	0	0.0	0	0.0	8	30.8	2	9.1	2	25.0
	Skating	0	0.0	0	0.0	8	44.4	6	23.1	2	9.1	2	25.0
	Fight	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Other	2	25.0	0	0.0	0	0.0	2	7.7	4	18.2	4	50.0

Cause of the lesion

The great majority of lesions are caused by blows of stick (22.7%) or with the puck (18.2%). Also, many of them occur skating (20.4%) or without contact (13.6%) (Tab. 2).

Differences between leagues

There are significant differences in the serious injuries, generally, by blows of stick or with the puck between the amateur league and professional league (11.4 vs. 0.0%). Significant differences were also identified in moderate injuries without contact between the professional and the amateur team (9.0 vs. 0.0%), for they were more frequent in the former.

Moment of the lesion

Differences were found in the number of injuries produced during competitions and during training. In the study, 73.9% of injuries occurred during the first (Tab. 3).

Differences between leagues

A higher percentage of injuries in the amateur team were caused during competitions as compared to trainings (75.0 vs. 25.0%, $p < 0.05$). In the professional team, it was also found that most injuries occurred during competitions (7.5 vs. 27.5%, $p < 0.05$).

Tab. 3. Number of lesions produced

	Valls (n=13)	Lleida (n=10)
Competition	36	29
Training	12	11
Total	48	40

Discussion

The objective of this study was to analyze the incidence of injury in two teams, one professional and one amateur, and to compare the influence that the league has on the development of its sports activity. No study has been found that analyzed the injury incidence in roller hockey teams considering two divisions of different leagues and none that analyze professional players. Therefore, the methodology used and the results obtained can serve as a basis for future investigations of this type.

The main finding of this study was that there are significant differences in injury incidence and injury patterns between teams of different competitive leagues. Overall, the results of this study do not correspond with

previous observations regarding roller hockey: the upper extremity was documented as the most injured area, while in other studies the head had been the area with the highest incidence of injuries (Pelaez, Dascenzi, Savastano et al., 2008; Hootman, Dick & Agel, 2007). Also, because the incidence of injury in roller hockey has not been studied much, many more epidemiological studies are needed to confirm the most harmful areas. When comparing the influence that the league has on the injuries in the hockey player, the data obtained indicate that the professional presents a greater risk of injury in relation to the amateur league, although the injuries of these are more serious.

It was commented that the most frequent type of injuries was muscle-related. Muscle injuries are the most important in senior teams, as in other sports (Ekstrand, Hägglund & Walden, 2011). This greater affectation of muscular injury by indirect mechanism in the players could be related to the physical or psychological stress generated by the intensity of the sports practice, as some authors have suggested (Cavalcante de Sá, Begatti & Vaisberg, 2012; Olmedilla, Laguna & Blas Redondo, 2011). On the other hand, it would also be necessary to optimize the prevention programs for these muscle groups so that certain injuries related to overloads could be prevented. Regarding the severity of the injury, it can be seen that the most serious injuries occur in the amateur team. The cause could be the difference between the way in which the technical staff designs and develops the conditioning of their players, including injury prevention. These differences have been demonstrated by professional versus amateur teams roller hockey (Reverter-Masia, De Vega Cassasas, Hernández-González et al., 2017). On the other hand, the lesser mastery of the technical skills of the sport of the amateur team may cause more hits and/or bruises, which at the same time can make the injury more serious.

Considering how most players use the stick in the right arm, the most affected laterality is the right one. This is frequent for asymmetric sports, such as hockey or tennis. This type of injuries is usually conditioned by unbalanced muscle development, which is why specific muscle strengthening programs are necessary (Balius, Pedret, Pacheco et al., 2011; Balius, Pedret, Galilea et al., 2012).

Professional players are injured more than amateurs, which may be a surprising result, because it is usually assumed that players from a lower category could have poorer technique and physical conditioning, as well as worse material conditions and environments. However, although it is known that skill is a determining factor in the risk of injury (Peterson, Junge, Chomiak et al., 2000), recent scientific evidence also suggests that the most skilled players are those who seem to have a higher probability of suffering an injury (Soligard, Grindem, Bahr et al., 2010). It could be argued that professional players are injured more because their competitive calendar is usually more concentrated and that scoring goals can put more stress on the player. However, some studies suggest that it is not always the players who play the most games with the highest risk of injury (Ekstrand, Walden & Hägglund, 2004). Therefore, it would be necessary to perform actions aimed at the prevention of injuries, for despite having shown high efficacy (Casáis Martínez, 2008), they have not been implemented systematically in many sports. Regarding the difference between leagues in other sports analyzed, Hawkins & Fuller (1999) found no differences when analyzing the injury index between the Premier League and the English First Division. On the contrary, Nielsen & Yde (1989) observed that Swedish soccer players showed differences in injury incidence, injury mechanism and trauma according to their level of competition, as the present study also did. Therefore, and as there is no clear consensus, it seems that more studies are needed in this regard. Differences were also found in the number of injuries produced during competitions and during training. In this study, 75% of the injuries occurred during the competition. The data of Patel, Stier & Luckstead, (2002) show that the incidence during the competition doubles that of the trainings; these data agree with those published for other contact sports. It would be thus interesting to review the regulation. The differences between the rules of roller hockey and ice hockey, which despite being equally rough and high impact sports, differ considerably in the safety measures applied to athletes (Davis & McKelvey, 1998) and are striking. The incorporation and modification of game rules reduces the frequency of minor injuries (Biasca, Wirth & Tegner, 2002). Injuries by trauma are the most common in the amateur league, possibly due to the lack of sufficient motor control to comply with the regulations.

Overload injuries are the most common in professional players, generally associated with decreased physical condition and muscle fatigue at the end of competitions or training (Árnason, 2009). For this reason, it would be interesting to determine the periods of high risk during the year, establishing preventive programs especially in the competitive season, when the training is more intense and a large number of matches and training sessions are held.

Conclusions

The results of this study should be interpreted taking into account the following limitations: In the first place, only two seasons and one team from each division were analyzed, and therefore the results obtained can be very influenced by chance. Secondly, the different objectives pursued in each season (promotion or permanence) are important variables to consider.

To conclude, it is considered that the present study opens the doors for future researches on roller hockey issues still lacking in analysis, such as injuries in women and in lower categories, the longitudinal monitoring of injured players looking for sequels at medium and long term, number and type of injuries

according to age, weight and years of experience, among others. The need for valid epidemiological data for the decision and action of the different actors involved, players, clubs, technical personnel and institutions is indisputable.

Conflicts of interest: The authors declare that they have no conflicts of interest.

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