

Wheelchair basketball: influence of shoulder pain in sport skills

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WHEELCHAIR BASKETBALL: INFLUENCE OF SHOULDER PAIN IN SPORT SKILLS.

KEYWORDS: adapted sport, Paralympic sport, physical disability, shoulders injuries.

ABSTRACT: Shoulder injuries are a common problem among wheelchair basketball players (WB). The purpose of this study was to detect the influence of shoulder pain (SP) in WB sport skills. Fifty-one WB players aged from 15 to 42 (21 females, 23, 86±1, 38 years and 30 males, 23, 90±1, 46 years) were evaluated. Shoulder Pain Index for Wheelchair Basketball (SPI-WB) was used to determine SP in relation to specific WB skills. Gender and age were compared using T-test and One Factor ANOVA, respectively. The level of significance was set at $p \leq 0,05$. 27, 5% of the sample reported actual SP. Statistical analysis revealed a main effect for gender regarding SP during shooting skills, especially for females. There were no significant differences according to rebounding/one-handed long passes and other sport situations. In conclusion, SP could affect the specific activities of WB according to gender, especially during shooting in females, so ways to promote shoulder health must be develop.

Degenerative conditions of the shoulder remain a significant source of pain and impairment in general population (Killian, Cavinatto, Galatz and Thomopoulos, 2012; Zurita et al., 2016). In wheelchair users, previous studies reported shoulder pain (SP) as a common problem in this population, showing a range from 14 up to 85 percent of SP in different studies (Curtis and Black, 1999; Ballinger, Rintala and Hart, 2000; Fullerton, Borckardt and Alfano, 2003; Pérez-Tejero, Martínez-Sinovas and Rossignoli, 2006; Samuelsson, Tropp and Gerdle, 2004; Wessels, Brown, Ebersole and Sosnoff, 2013), mainly as a consequence of the increased load at this joint and repetitive stress of daily and sport activities (Fullerton et al., 2003).

Shoulder injuries such as sprains, strains, tendinitis, bursitis, impingement syndromes and avascular necrosis are a common problem in wheelchair basketball (WB) players (Nyland, Robinson, Caborn, Knapp and Brosky, 1997; Curtis and Black, 1999). WB is characterized by high-intensity activity for wheelchair propulsion and maneuvering as well as reaching overhead for shooting, passing, and rebounding, being these a risk for overuse and impingement syndrome (Vanlandewijck et al., 2001; Curtis and Black, 1999). Different aspects of the propulsion technique, as fast propulsion to create greater forces and increasing the number of push cycles per minute, put a high demand through the shoulder grid (Kulig et al., 2001). Also, muscle imbalance has been shown to be a factor that can be implicated in the pathogenesis of the SP in wheelchair athletes (Burnham et al., 1993; Curtis and Black, 1999; Kulig et al., 2001).

Some studies stated that sport activities could be affected by the physical condition of the player, specifically SP (Burnham et al., 1993; Fullerton et al., 2003, García-Gómez and Pérez-Tejero, 2016). The amounts of training hours and active competition have been associated with incidence of injuries in wheelchair users (Curtis et al., 1999). In some studies, 85% of WB players have been reported to experience SP along some part of season related to competition (Pérez-Tejero, Martínez-Sinovas and Rossignoli, 2006).

Wheelchair basketball is an intermittent activity demanding several skills (Cavedon, Zancanaro and Milanese, 2015; Pérez-Tejero and Pinilla, 2015), implicating specific movements as pushing the wheelchair, braking and pivoting, dribbling, shooting, passing, catching, rebounding, tilting and reacting to contact (IWBF, 2014). Several authors explain the relationship of fundamental WB movement or skills and game statistics (Pérez-Tejero and Pinilla, 2015; Wang et al., 2005; Gómez, Pérez-Tejero, Molik, Szyman and Sampaio, 2014; Goosey-Tolfrey, Morriss and Butterworth, 2002; Malone, Gervais and Steadward, 2002). According to previous studies (García-Gómez and Pérez-Tejero, 2016; Wessels et al., 2013) the correlation between SP and joint mobility could affect WB skills performance. These can be affected by the health condition of the player, as a shoulder injury, functional class and wheelchair propulsion, among others. For instance, Wang et al., 2005, showed in a sample of male and female the significant influence of the sitting height on average rebounds per game. On the other hand, according to Gómez et al. (2014) recovering the ball, steals, blocked shots or opponent's turnovers are the

more important variables in both genders in unbalanced WB games in major competitions. Even more, some authors (Goosey-Tolfrey, Morriss and Butterworth, 2002; Malone, Gervais and Steadward, 2002) explained how functional class can influence shooting performance in WB. In this regard, it seems relevant to explore the possible consequences SP on WB sport skills, this information important for the physiotherapist and coach to consider the health assessment and screening of the player along the sport season, and also to develop specific preventive training programs considering the shoulder joint.

Performance optimization of WB players is dependent on the use of a multidisciplinary approach. Evidence is available about WB performance in male and female players focusing in physiological, biomechanics, technical and tactical aspects (Goosey-Tolfrey et al., 2005; Vanlandewijck et al., 2004; Wang et al., 2005). However, on the authors' knowledge, it is still unknown how SP could influence specific WB skills as shooting, rebounding, one-handed long passes and other sport situations. Therefore, the purpose of this study was to assess the influence of SP in those WB sport skills (SS).

Methods

Participants

Fifty-one WB players, 21 females and 30 males, aged from 15 to 45 years, were evaluated through the *Shoulder Pain Index for WB (SPI-WB)* (García-Gómez and Pérez-Tejero, 2016). All participants were given the information about the purpose of the study and signed an informed consent form before the study. Also, declaration of Helsinki (2013) for research on humans was observed. The study protocol was approved by ethical committee of the Technical University of Madrid. The following inclusion criteria for participation were determined: (1) to be a WB player the actual season, (2) to be selected as member of the Spanish preselection sub 23, female or male national team, (3) to use a manual wheelchair for at least 3 hours a day and at least one year before the study for the subjects who use wheelchair for daily activities, (4) at least one year using wheelchair for WB practice for subjects that use wheelchair only for the sport and (5) to accept the voluntary participation in the study by signing the informed consent.

Measures

The SPI-WB was used to measure SP in the population studied and it was developed by Pérez-Tejero, Martínez-Sinovas and Rossignoli (2006) based on the Wheelchair Shoulder Pain Index (WUSPI) (Curtis et al., 1995; Park and Cho., 2013) with the inclusion of specific WB skills and its aim was to analyze the perception of SP during a functional activity and how it affects the development of the WB players.

This self-reported questionnaire assesses individual data and pain characteristics related to functional activities of WB players along three main domains: transfers, activities of daily living (ADLs) and sport skills (SS; as shooting, rebounding/ one-handed long passes and other WB situations). It has 40 items, where the first 11 items contain information concerning general and individual data, six items about the actual situation of pain, four items of pain characteristics, five items related to pain perceived during transfers (transferring in and out of the wheelchair by lifting own's body weight from a seated position), nine items assessing SP when performing ADLs and four items related to

pain perceived while performing WB sport-specific skills (Pérez-Tejero, Martínez-Sinovas and Rossignoli, 2006).

A previous study has demonstrated that SPI-WB shows high internal consistency ($\alpha=0,899$), high test-retest reliability ($ICC=0,976$) and concurrent validity was assessed through significant negative correlations between SPI-WB scores and goniometric measurements (range of motion) of shoulder (García-Gómez and Pérez-Tejero, 2016).

Procedure

Procedures for questionnaire administration were as follows: First, all the process to the participant to fill out the SPI-WB was explained; secondly players had to complete the questionnaire by their own (paper and pencil). To deal with study aims, analysis was focused in the activities related WB skills as shooting, rebounding/one-handed long passes and other WB situations.

Shooting: Is considered as the most important part for determining the outcome of a game. A shot for a field goal is when the ball is held in a player's hand(s) and is then thrown into the air towards the opponents' basket.

Rebounding: It refers to the capacity of the player to take possession of the ball.

One-handed long passes: It refers to making a pass using a hand, normally pumped an interior player.

WB situations: Fundamental movements to performance WB such as pushing the wheelchair, braking and pivoting, dribbling, catching, tilting and reacting to contact.

Statistical Analysis

All demographic data were analyzed using descriptive statistics. Gender and age referred SP were compared using independent T-student and ANOVA respectively after check the normality of the data, indicating the value of effect size. The interpretation of the effect size was performed considering Cohen's d; $d=0.2$ small effect, $d=0.5$ moderate effect and $d=0.8$ or more large effect and partial eta squared considering $\eta^2 =$

0.01 small effect, $\eta^2 = 0.06$ moderate effect and $\eta^2 = 0.138$ large effect. SPSS V18.0 program was used for the data analysis. The level of significance was set at $p \leq 0,05$.

Results

Table 1 shows sample's demographic data. At the moment of the study, 27. 5% of the sample reported SP.

According to the results, the type of disability of the population studied was spinal cord injury, amputation and others disability related to orthopedics lesion being most common SCI (21. 6% females, 39. 2% males). 33.3% of the players are class 2-2.5 (13.7% females, 19.6% males). In WB, as a descriptive aspect, according to the subjects that use wheelchair for daily activities more females than males use wheelchair as an element to mobility for ADLs (Table 2). In this regard, there are more lower classes in this sample.

According to general data, females reported more SP than males (Table 2). In this regard, there is a difference between the type of pain in females and males, being more affected players who use wheelchair as an element to mobility. On the other hand, according to age, shoulder pain relate to shooting is more frequently in players with less than 20 years; however players with age less than 20 and between 20 and 30 years had shoulder pain when performing rebounds and one handed long passes.

Statistical analysis revealed a main effect for gender regarding SP during shooting skills, especially for females ($t_{39}=2, 44; p<0.05$). According Cohen's (effect size for interaction) there was a moderate positive association between SP while shooting and gender (Table 3), so females had significantly more SP than male while shooting. In this regard, there was no statistical significant difference according to other

SS such as rebounding/one-handed long passes and other sport situation; however the practical significance was small to moderate (Table 3).

Also, the value of F for shooting, rebounding/one-handed long passes and SS indicates that there were no statistical significant differences for SP according to the age; practical significance is small.

Gender	Age (years)	Years since disability	Years of federated sport	Years of recreative sport
Female	23.86±1.38	14.60±7.41	7.83±1.75	5.31 ±1.16
Male	23.90±1.46	16.05±8.27	8.22±1.50	6.29±1.15

Table 1. Demographic characteristics of the sample.

	Gait		Shoulder pain		Type of shoulder pain		
	Wheelchair Users	Crutch/Prosthesis and others	Without Pain	With pain	Acute pain	Subacute pain	Chronic pain
Female	0,57	0,43	0,62	0,38	0,56	0,17	0,28
Male	0,53	0,47	0,8	0,2	0,67	0,17	0,17

Table 2. Comparison of gait, shoulder pain and type of shoulder pain by gender.

Gender	Statistical	Practical Significance
(n= 51 subjects, 21 female and 30 male)	Significance	Cohen's d
Shooting	$p<0.05$	Moderate
Rebounding/one-handed long passes	$p>0.05$	Small
Sport situation	$p>0.05$	Moderate

Table 3. Statistical and practical significance according to gender.

Discussion

The 27, 5% of the sample reported actual SP. This observation is congruent with previous reports which show a range from of 14 to 85 percent (Curtis et al., 1999, Pérez-Tejero, Martínez-Sinovas and Rossignoli, 2006, García-Gómez and Pérez-Tejero, 2016, Ballinger et al., 2000, Samuelson et al., 2004, Fullerton et al., 2003, Wessels et al., 2013).

In WB, those who have high classes (3 – 4, 5 points) normally crutches, prostheses and other items for ADLs, but for trainings and sports competitions they sit down and use the wheelchair. In the case of the sample studied more females than males use wheelchair as an element to mobility in everyday activities. In general, most players in the sample studied use wheelchair in ADLs which explains mostly with lower classes.

The result suggests that the origin of SP on the sample of players who use the wheelchair just to perform in WB probably is caused by SS like shooting, pushing wheelchair and specific sport situations. According to some authors, SP may result from lifting, especially with abduction and internal rotation (Curtis et al, 1995; Park et al, 2005). It is important to consider deficiency in flexion and shoulder abduction in training, also must consider that the internal rotation could influence rebounds in conducting, being the internal rotation a very important factor to performance WB (Wang et al., 2005).

One study addressed the association of age and gender with SP (Alm et al, 2008). There are a few studies (Fullerton et al., 2003, Wessels et al., 2013) dealing with gender difference regarding the prevalence of SP; however Boninger et al., (2003) explain the association of female gender and development of degenerative changes at shoulder level. Thus, there are no studies in our knowledge addressing SP incidence according to gender during specific WB skills as shooting, rebounding/one-handed long passes and specific sports. Some studies (Goosey-Tolfrey, Morriss and Butterworth, 2002; Malone, Gervais and Steadward, 2002; Wang et al., 2005) demonstrate how different characteristic can influence shooting, rebounding and others WB performance.

SP is more prevalent among females than males; these results are in line with the data of Wessels et al. (2013). According to our results, females presented SP during SS, specifically shooting; however, they suggest the relationship of SP with the extension of the shoulder: this can be related with anatomical differences or difference in muscle mass. Therefore, we could relate as SP could affect WB performance and how this could affect game statistics (Figure 1).

The results obtained offer relevant information for comparing the females and males' performance in WB training and competition as well as to create a tool to prevent shoulder pain in

this population. This information might be useful for clinical practice and research. Further research is needed to determine the relationship between SP, as a consequence of SP, and games statistics. On other hand, it is required to establish the difference of SP according to classes and use of wheelchair.

Conclusions and implications

SP might affect the specific activities of WB according to gender, especially during shooting in females, so ways to promote shoulder health must be develop.

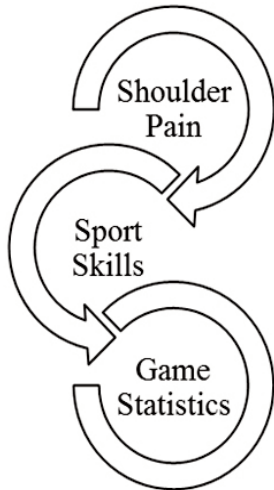


Figure 1. Relationship between shoulder pain, sport skills and game statistics.

BALONCESTO EN SILLA DE RUEDAS: INFLUENCIA DEL DOLOR DEL HOMBRO EN GESTOS DEPORTIVOS

Palabras clave: deporte adaptado, deporte paralímpico, discapacidad física, lesiones de hombros.

Resumen: Las lesiones del hombro son un problema común entre los jugadores de baloncesto en silla de ruedas (BSR). El objetivo de este estudio fue detectar la influencia del dolor de hombro (DH) en las habilidades deportivas propias del BSR. 51 jugadores de BSR entre 15 y 42 (21 mujeres, 23, 86 ± 1, 38 años y 30 hombres, 23, 90 ± 1, 46 años) fueron evaluados. El Cuestionario del Dolor de Hombro en BSR se utilizó para determinar el DH en relación a las habilidades específicas del BSR. El género y la edad se compararon mediante la prueba t y ANOVA de un factor, respectivamente. El nivel de significación se estableció en $p \leq 0,05$. 27, 5% de la muestra informó SP en el momento del estudio. Los resultados muestran diferencias significativas de acuerdo al género en relación con DH en habilidades como el tiro, especialmente para las mujeres. No hubo diferencias significativas en función de realizar acciones de rebote y pases largos/una sola mano y otras situaciones propias del BSR. En conclusión, SP podría afectar a las actividades específicas del BSR en función del género, especialmente en las mujeres, por lo que se debe promover la salud del hombro.

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