

# SHOULDER ISSUES IN HANDBALL

## ARE THERE ANY OR ARE HANDBALL PLAYERS EITHER LUCKY, WELL-PREPARED OR JUST UNDER-INVESTIGATED?

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A systematic approach to sports injury investigation has provided strong evidence about injury incidence rates in various sports revealing that soccer and handball are the most risky summer Olympic Games sports relative to exposure time and injury severity<sup>1</sup>. Both are classified into the group of the most dangerous sports together with ice hockey, American football, Australian Rules football and rugby<sup>2</sup>. Injuries in handball, either acute or chronic, have been investigated relatively well in general in the last couple of decades, especially during the 1990s<sup>3</sup>. According to the findings in these studies, shoulder injuries in handball are either the third most frequent injury, immediately after ankle and knee injuries<sup>4</sup>, or the fourth (fingers, knees, ankles)<sup>5</sup>.

The reported estimates of either acute or chronic shoulder pain incidence in handball players ranges between 30 and 45% of the population<sup>6</sup>. However, despite this and the previous point, a search of the most acknowledged research databases (MEDLINE<sup>®</sup>, WoS) using the terms 'handball', 'shoulder' and 'injury'<sup>7,8</sup>, only a few studies have focused specifically on shoulder injuries or shoulder conditions/issues in handball players. This is surprising when we consider the fierce nature of this dynamic team game as well as the mechanical loads that shoulder structures, especially of the throwing arm, have to sustain during handball competition and training.

The game of handball imposes strenuous demands on players by combining quick

acceleration and stoppage in all directions, quick changing of direction, jumps of various kinds and body contact. The primary aim of the game is two-fold: to score by throwing, shooting the handball, precisely and powerfully, in spite of the goalkeeper in his/her goal and to prevent the opponent from scoring.

A handball shooting motion involves the whole body and highly co-ordinated movement patterns that culminates in an accurate ballistic motion of the throwing arm. It exposes the throwing arm-related musculoskeletal structures to supraphysiological kinematic loads and motions. Most throwing motions in handball are performed above 90° of shoulder abduction, thus classifying the



**Figure 1:** Impossible throw (Image provided by the Croatian Handball Federation).

game as an ‘overhead sport’. Mechanisms of overhead throwing and shoulder medical conditions in overhead sports (like baseball, softball, swimming, weight-lifting, tennis) have been investigated and explained rather satisfyingly in general<sup>9-16</sup>, especially in research studies on baseball, the American national sport<sup>17-21</sup>. Basically, in regards to the shoulder and the arm, the overhead throwing motion pattern is usually performed through 5 phases:

1. wind-up,
2. cocking (early and late),
3. acceleration,
4. deceleration and
5. follow through phase.

It also recruits the inferior glenohumeral ligament and capsule, which act as the primary static anterior restraint. Furthermore, the deltoid muscle elevates the humerus while the rotator cuff adjusts the position of the humeral head on the glenoid. The pectoralis major and latissimus dorsi power the shoulder forward<sup>22,23</sup>.

However, throwing in handball, not exclusively overhead, is a much more complex activity than throwing in baseball, not only due to many different types of shooting or passing the ball (it was documented there are more than 40 types of either supported or airborne throws at

the goal i.e. jump shots and dive shots), but also because there are many body contacts with the opponent defensive players, who are trying to prevent the shooter from his/her shooting performance using any possible method not prohibited by the rules (Figure 1). Yet, interfering actions very often exceed the borders determined by the rules. Therefore, in an actual game, shooting at the goal is almost never ‘basic’; numerous modifications are applied by attackers according to the play situation on the court and each player’s characteristic, anthropological and situational playing position.

The shoulder is not at risk because of throwing alone; there are numerous activities in handball that can cause shoulder injury. Body contact with the opponent is one of the possible trauma-inducing situations, as already stated. A player can be pushed, or somehow unbalanced, which can provoke unexpected and unprepared landing and fall, or the shooter’s arm may be pulled during the cocking phase or blocked during the acceleration, deceleration or follow-through phase. Our investigation confirmed that the injuries caused by the explained mechanism are rather difficult and serious, often requiring long-term treatment or even surgery<sup>24</sup>.

Last but not least, the phase of attack is not the only phase of the game where players’ shoulder can be injured. Injuries often happen while defending, when a defence player tries to prevent the penetration of an attacker. In this case the shoulder, usually positioned in abduction and external rotation, can be literally ‘pushed’ and dislocated by the attacker’s accelerating body. If the trauma is repeated, the shoulder becomes unstable, a condition which requires surgery followed by a long period of recovery. For the two latter injury-inducing mechanisms one should refer to research literature on rugby and American football or even judo<sup>25,26</sup> since the data from handball, if any, are scarce.

**most throwing motions in handball are performed above 90° of shoulder abduction**



**Figure 2:** Rope technique in acute acromioclavicular dislocation, 1 month postoperative.

#### SHOULDER INJURIES IN HANDBALL

According to the previous studies on handball, other overhead sports and our investigation<sup>24</sup>, we can divide handball shoulder injuries in two major groups: traumatic, acute injuries and overuse syndromes. Both of these have a large spectrum of consequences on quality of life and sport engagement. While the prevalence and severity of shoulder injury in handball players was found to be significant, we note that no players ceased participation because of their injury.

The simplest and the most common injuries are certainly contusions treated on a daily basis by therapists and players themselves. They usually have no negative effect on a player. A contusion may be incurred in any phase of the game by either contact with another player or a fall. The treatment is a rather simple one – cryotherapy should be applied immediately in situ, on the bench or on the court during the play stoppage, and should be

continued afterwards, coupled with rest and physiotherapeutic procedures. The player will be able to return to the court immediately or after a few minutes and continue to play, but the next morning he/she will experience stiffness and pain when first trying to perform movements. Contusions usually do not cause any absence from sport activity, especially during particular tournaments such as national championships, when the rhythm of matches is not as hectic as in the regular tournament competition.

Shoulder sprains, very often involving the acromioclavicular joint, are the next in line, not only by incidence but also by seriousness. The major pathological mechanism is a fall on the shoulder. Acromioclavicular sprains are often very painful even when there is no coraco-acromial ligament lesion. The acromioclavicular joint is usually swollen and there is no pathological motion in between acromion and distal end of the clavicle bone. Even the lowest grade sprains

require a certain period of rest that could last for several weeks before throwing can be resumed. According to our experience, the healing process could be sped up with the local application of platelet-rich plasma (PRP). The highest-grade sprain or acromioclavicular dislocation (4 to 6 Grade according to the Rockwood's classification), being among the most serious shoulder injuries, have to be approached surgically immediately. The first author's treatment of choice is arthroscopic acromioclavicular stabilisation using rope techniques (Figure 2). Any delay in treatment leads the dislocation into the chronic phase requiring a more complex surgery using not only ropes but also gracilis tendon transfer and, naturally, a much longer period of recovery and absence from the activity.

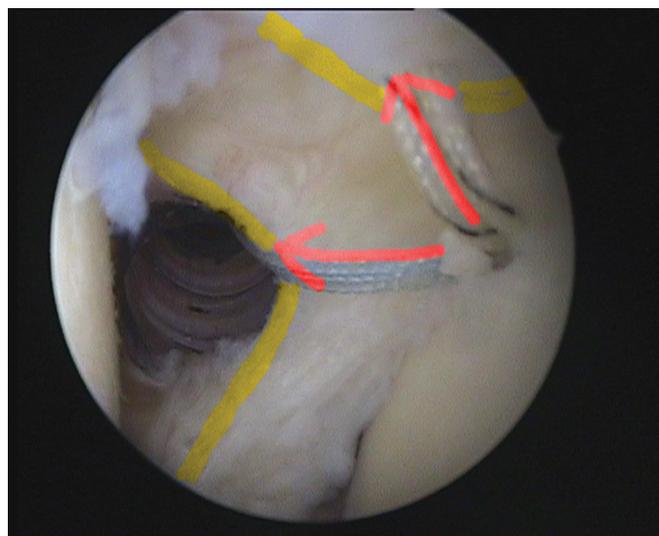
The next most serious acute shoulder injuries are shoulder dislocations and shoulder tendon tears that may cause long-term absence from the court. There is a consensus among shoulder surgeons that even the first dislocation of the dominant arm shoulder should be treated surgically (Figure 3). The risk of the second dislocation is age- and sport-related. According to McLaughlin and Cavallaro<sup>27</sup> and Rowe<sup>28</sup> the risk of the second dislocation is almost 90% in patients under the age of 20 and decreases to a 10% risk in the population over 40 years of age. On the other hand, in contact sports the risk of second dislocation is almost 100% if the first dislocation has been treated conservatively and the player wants to continue playing at the pre-injury level<sup>29</sup>. The authors also prefer a surgical approach, but would like to underline the following: both shoulders are 'dominant'



**Figure 3:** Essential lesion of the instable shoulder. Bankart's lesion together with Hill-Sachs lesion, both confirmed during arthroscopic capsulolabral reconstruction.

in handball since a player does not use arms exclusively for shooting, but also for the performance of gross movements, landing and many playing-position-specific technical-tactical tasks in attack and defence. In fact, in our study<sup>24</sup> more shoulder dislocations were incurred in the phase of defence and involved a non-throwing hand. The authors' preferred treatment is an arthroscopic capsulolabral reconstruction with the mean time away from sport and full handball activities of about 6 months. Unfortunately, shoulder surgery is not as common as knee ligament surgery and specialised shoulder surgeons are not widely available. Consequently they are less accessible to injured players. In addition, players tend not to be familiar with the procedure and postoperative recovery and therefore try to avoid surgery in favour of conservative treatment. Such a decision usually initiates the pathology cascade because, after their return to the sport activity, the next major contact may, and usually does, provoke a second dislocation and a vicious circle begins: the shoulder becomes unstable, provoking bony defects that require open surgical procedures (the Latarjet procedure).

Rotator cuff tears or SLAP tears (superior labrum anterior to posterior) also require arthroscopic surgery. The authors' preferred procedure for arthroscopic reconstruction is the utilisation of double-loaded anchors for SLAP reconstruction (Figure 4) and double row techniques for the rotator cuff reconstruction. The mean recovery time period to full activity is almost the same as after a capsulolabral reconstruction – some 6 months.



**Figure 4:** Authors' method of choice in SLAP reconstruction – double loaded anchor and the 'saddle' knots. SLAP=superior labrum anterior to posterior.

Injuries that should be treated conservatively are mild shoulder sprains, distensions of the long head of the biceps tendon or partial supraspinatus tendon tears. The usual treatment is rest from specific activities and a period of physiotherapy followed by specific

shoulder strengthening and stretching exercises ('shoulder 10', scapular rehabilitation, sleeper stretch etc) aimed at restoring normal mechanisms of the shoulder joint. Unfortunately, the period without activity can be even longer than the recovery period after shoulder surgery.

**“ both shoulders are ‘dominant in handball since a player uses their arms in many technical-tactical tasks in attack and defence”**



The second big group of shoulder injuries is overuse injuries or conditions, described by Burkhart et al in their articles on the disabled throwing shoulder<sup>30-32</sup>.

High level handball players train for more than 1,400 hours a year<sup>33</sup>. During a season the players in the investigated population<sup>24</sup> had training sessions twice a day for 4 to 6 hours and performed at least 30 to 50 shots at the goal per training session, either freely or against more or less active defensive player(s), which cumulated in an average of 300 to 500 shots a week. If this number is multiplied by 45 to 50 weeks of pre-, in- and post-season practice, it can reach an average of 13,500 to 25,000 shots per year, not including shots performed in a match and numerous throws made when passing the ball to a teammate over varying distances. In a study by Pieper<sup>6</sup>, the estimated minimal number of throwing motions was reported to amount to 48,000 throws per season. Such a high number of powerful throws (up to and over 100 km/hour) may lead to the condition described by Burkhart and associates<sup>30-32</sup> if there is no optimal shoulder strength and flexibility training (as opposed to just fitness and power-enhancing training without focusing on injury prevention).

The condition first occurs like a sharp pain when the most powerful throws are performed. The shoulder pain can be soothed temporarily with cryotherapy application and rest. However, the pathological cascade has been initiated – pain and discomfort become ever stronger and the ball release force is considerably decreased. The syndrome of the 'dead hand' or disabled throwing shoulder is at the end of the spectrum of pathologies.

Players, team physiotherapists and coaches, especially physical conditioning specialists, should react immediately when pain occurs to prevent this very serious condition by breaking the pathological cascade. The shoulder should be checked for range of motion and scapular kinetics. The most common condition, even in asymptomatic players, will be an increased external rotation in the shoulder abduction of 90° and a decreased internal rotation of the dominant arm when compared with the non-dominant arm, the condition known as the 'GIRD syndrome' (glenohumeral internal rotation deficit). Sometimes, the condition is worsened by the so-called 'SICK scapula syndrome' (Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition and dysKinesis of

the scapular movement). The treatment is conservative and includes rest, the previously mentioned physiotherapeutic procedures with stretching of the shoulder girdle (sleeper stretching) and progressive strengthening of the rotator cuff muscles and scapular stabiliser. Verna<sup>34</sup> and Burkhart, Morgan and Kibler<sup>30-32</sup> demonstrated that the symptoms of disability and pain were decreased as soon as the internal rotation had become even with the internal rotation of the non-dominant arm (acceptable level is, according to the cited authors, 20° of difference between the dominant and non-dominant arm).

Finally, Pieper's study<sup>6</sup> must also be mentioned. He has indicated that the increase of humeral retrotorsion in the throwing arm of handball players should be recognised as an adaptation to extensive external rotations in throwing practice during growth. The increased retrotorsion allows more external rotation of the shoulder before the humeral head puts excessive strain on the anterior capsulolabral complex, thus protecting the joint from anterior instability. The athletes who do not exhibit this biopositive response to practice, due to some yet unknown reason, seem to have to sustain more strain



## ***PRP has opened a new frontier in the treatment of inflammatory problems and pain in the shoulder***



on their anterior capsules at an earlier degree of external rotation and become prone to developing chronic shoulder pain due to anterior instability. The finding has not been confirmed yet nor has it been elucidated whether the torsional changes correlate with the starting age of handball playing, or with the intensity of training practice.

Introduction of PRP has opened a new frontier in the treatment of inflammatory problems and pain in the shoulder<sup>35</sup>. Despite a lack of research evidence to justify its use, it is the authors' experience that the addition of PRP is clinically worthwhile. These injections of the autologous rich plasma can be made in the subacromial bursa or around the shoulder tendon.

Shoulder pain, acute or chronic, in either the dominant or non-dominant arm may jeopardise not only a promising handball career but also a person's quality of life. Discomfort caused by pain are major obstacles to handball involvement; it distorts throwing and shooting technique, thus elevating injury risks and considerably reduces shooting and passing accuracy.

### **WHAT IS TO BE DONE?**

Issues with the shoulder(s), especially immediately upon their occurrence, are too often overlooked (by coaches), disregarded (by players) or not properly recognised. Too often conservative therapy is recommended, sometimes because players are afraid of surgical treatment, in spite of the fact that surgery is necessary and presents a much better and even faster option in terms of health profile or an athlete's return to

competition activity. The field of research on handball-related shoulder conditions and injuries, to the best of the authors' insight into the published research reports, appears almost intact regarding, for example, retrospective and prospective studies searching for evidence-based epidemiology data, preferably using the most efficient methodology<sup>36</sup>. Further research is warranted to clarify the mechanisms, like detailed biomechanical descriptions of more technical elements, muscular strength balance/imbalance effects on injury rates, acute and chronic training effects, injury-threatening play situations etc, as well as management of shoulder injuries and their outcomes. Although seeming epidemiologically less significant than knee or ankle injuries, shoulder injuries and condition issues may have very serious (postponed) effects on a player's handball career and/or post-competition life<sup>37</sup>. As previously stated, injuries to the shoulder in handball are positioned in the third place regarding incidence rates. The authors believe, based not only on their experience but also on their research, that shoulder injuries in handball are more severe and threatening than knee and ankle injuries. Therefore, more information on incidence risks and the consequences of shoulder injuries should be disseminated among handball coaches, physical conditioning coaches and physiotherapists, as well as handball players themselves. Fortunately, training programmes in handball, especially strength and conditioning programmes, seem to have been well designed and implemented; much attention is devoted

and various training methods (like resistance training) are applied to enhance the power of shots<sup>38</sup> by improving technical preparedness, physical condition and fitness of players, who are usually referred to as 'decathlon athletes with a ball'. The kinematic chain of shots which involves the whole body, as well as various types of throws at the goal<sup>39</sup> probably contribute to a lower incidence rate of shoulder injuries in handball than in baseball, but this is yet to be investigated.

*References at [www.aspetar.com/journal](http://www.aspetar.com/journal)*

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