



BARÇA
INNOVATION HUB
Universitas

PATHOLOGY IN TEAM SPORTS

Indoor Team Sports.

→ 3.2 Handball

Authors: Mauricio Monaco, Jose A Gutierrez Rincon

3.2.1 General Characteristics of Handball

Handball made its Olympic debut in the 1972 Munich games. (Melendez-Falkowski M, 1992) However, its standardization dates back to 1936, and the game probably has its roots in the ancient games of Urania (Greek) and Harpastum (Roman).

In handball, each team has 7 players on the court, including the goalkeeper. Each team's substitute bench could have 7 or 9 players, depending on the competition. The field of play is 40 by 20 meters, so each half of the court is a square with 20-meter-long sides. One of the main characteristics of this sport is the high level of physical contact, a result of game regulations that allow for decisive actions such as goal shots and penetrations. Strength-intensive body contact with opponents is very common in this sport, although it is always covered by the regulations. The rules have changed over time in order to make handball a more dynamic game, by decreasing the possibility of passive or prolonged possession, thus requiring more frequent possession changes and bringing more speed and hustle to the game. The players move the ball with their hands by dribbling (continuously bouncing the ball on the court), and the player can take a maximum of 3 steps with the ball in his possession without releasing it. The size and weight of the ball varies depending on the training age. Players are not allowed to touch the ball with their feet, except for the goalkeeper who is allowed to use any part of the body while attempting to block an opponent's shots. Goals are scored when a shot is made and the ball crosses the opposing team's goal line. The goal area is delineated by a straight line 3 meters in length, marked 6 meters from the goal, parallel to the goal line and extending out at each end in a quarter-circle with a 6-meter radius; its center is the back internal edges of each goal post. The game is played in two 30-minute halves, although in lower categories the periods last only 25 minutes. There are no limits to the quantity and frequency of substitutions, and the only limiting factor is the way and time in which these substitutions take place. There are five playing positions within the game: pivot, back, wing, central back and goalkeeper. (Real Federacion Española de Balonmano, 2010) Within

these positions are three distinct tactical roles: goalkeepers, first line of attack (back and center back) and the second line (wing and pivot).

Player Attributes Based on Their Positions and Functions Within the Game.

Pivot: has a strong build, and is situated within the opponent's line of defense. Their role is to make their teammates' job easier by creating openings and making space for their actions.

Wings: as their name indicates, this position on the field is for the players who patrol either the left or right sides of the court throughout the entire process of the match. These players are characterized by their speed, agility and jumping capabilities.

Center back: also known as the first-line player. In terms of position, he is located between the backs. The center back stands out for his vision of the game and his skill, and is of vital importance to the coordination of the match, and particularly to attacks, since he initiates them.

Backs: backs are located on each side of the center back, and their function within the field of play is to "break down" the blocking defensive lines created by the opponents from the 9-meter line. They tend to be tall and well-built.

Goalkeepers: goalkeepers are characterized by their impressive range of leg movements due to the typical motor patterns used while blocking shots. This is accompanied by agility and oculomotor response capabilities. Although the injury rate is lower among these players compared to those playing other positions, there is still a characteristic injury pattern. The greatest number of injuries are to the hamstrings and adductor muscles, and to the head and face, as well as specific elbow injuries. According to the regulations, the goalkeeper is the only player who can take steps while carrying the ball without having to bounce it (while inside the goal area).

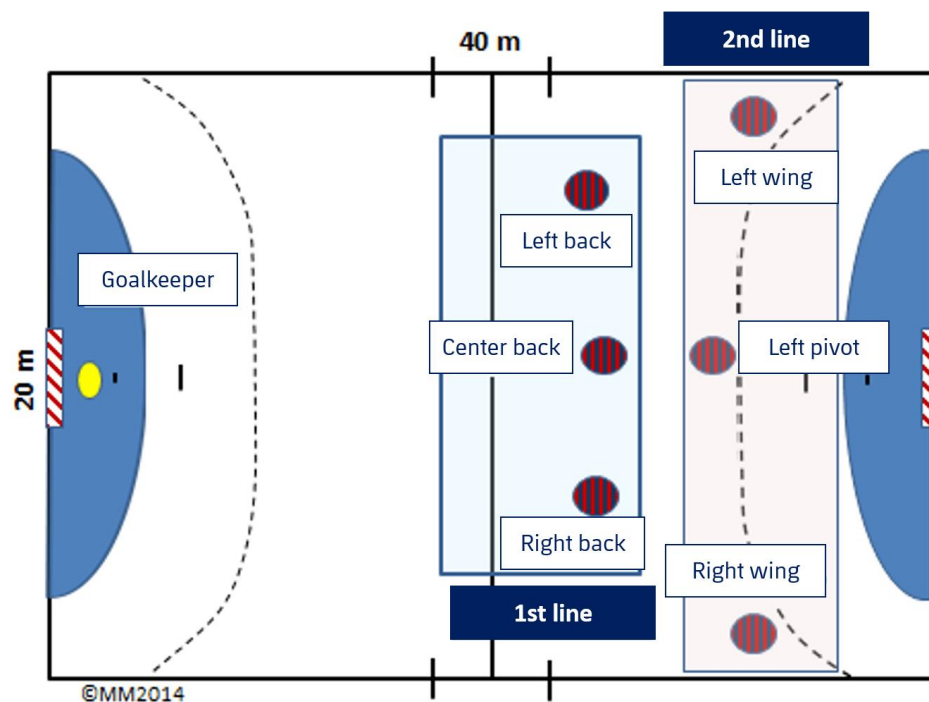
Outside the goal area, he is subject to the same restrictions as any other player.

His clothing must be different to that of the other players in order to easily identify him.

(Real Federacion Española de Balonmano, 2010)(Mohamed H et al., 2009)(Zapartidis I, Kororos P, Christodoulidis T, Skoufas D, Bayios I, 2011)(Ghobadi H, Rajabi H, Farzad B, Bayati M, Jeffreys I, 2013)

In this type of shared-space interactive sport, it can therefore be seen how the players are grouped according to their position and function in the field of play, and to anthropometric characteristics, and any specific requirements, including when they are grouped together near the line of attack, as seen in figure 1.

Figure 1: Player positions based on typical tactics and techniques



Source: Mónaco, 2015.

Handball has different categories, divided by age. This ensures that each group will be conditioned according to its specific requirements, and as a result, the competition rules for each category are modified and adapted.

One example of this division and adaptation of the rules would be player substitution during the competition. In children's and cadet categories, substitutions are not permitted in defensive situations. In other words, they are only allowed when the team is in possession of the ball (when the team has a chance to attack). In these categories, this type of regulation produces a less specific game, while at the same time conditioning the intensity of the actions produced during the development of the match. In contrast to the children's and cadet categories, at the junior and senior levels these substitutions can take place in either an attacking or a defensive situation.

These differences allow the evaluation of the number of hours that a player puts in with respect to intensity and volume. This type of analysis makes it clear that each player will have different workloads (volume and intensity) during a game, depending on the position they play and the regulations, and so the types of injuries that they have will also be different. We should remember that in this type of division by categories, as well as adapting the rules to the game and to the players, and differentiating between different levels of competition, the age categories have factors which are crucial for performance in each playing position. These factors could be coordinative, cognitive, anthropometric or developmental, among others (Monaco, 2015).

In fact, Fernandez, Vila and Rodriguez (2004) determined that the optimal moment for detecting handball talent is between 14 and 15 years old.

It can therefore be seen that when conditioning different variables, these must be taken into account for the epidemiological analysis of injuries that occur in this sport.

3.2.2 Handball Injuries

Risk Factors and Injury Mechanisms

Handball is an interactive sport that takes place within a shared space, in which there are permanent physical demands. These demands may be intermittent or at intervals.

During competition, many different motor actions are carried out due to the high-intensity development of the game; movements take place in reduced spaces, such as direction changes, high-intensity running forwards, backwards and to the side, and a high number of acceleration

and deceleration movements and jumps. In this type of contact sport, blocking opposition players' movements, and passing and dribbling the ball, are some of the characteristics of this sport and are conditioning game factors which influence the injury mechanism (Monaco 2015). Like most shared field sports where high-intensity, high-speed physical contact is vital, the higher the competition level, the higher the injury risk due to the increase in frequency and power of these actions.

Intrinsic Risk Factors in Handball:

Age: According to Karanfilci, Muharren and Kabak (1986), the determining factor in relation to age and the presence of injury is an increase in the number of hours exposed to risk, mainly due to the early specialization that often takes place within this sport. Despite the controversy over age analysis, it could be an area to debate. Even so, this indicates that there is no clear relationship between age and total injury incidence.

However, there is an association between the location of an injury and the affected structure based on age. Often when age is analyzed as an age category, it is conditioned more by the level or competitive progression than by age as the sole conditioning factor. Thus, the majority of studies suggest that senior or professional categories have higher injury instance. Apophysitis and spondylolysis are prevalent in young people, and muscle injuries in older players. The most common areas of injury are the ankle, thigh and head in adults. However, the knee is the most prevalent area among all age groups. (Mónaco M, 2015).

Compared to men, females have a somewhat higher total injury incidence per one thousand hours of exposure, and they are three times more at risk of suffering an anterior cruciate ligament injury than men. However, it seems to be the relationship between gender and the specific demands of the sport's training and competition model which conditions a higher injury risk for women, and gender alone is not an isolated factor that predisposes an athlete to injury. (Monaco, 2015).

It is important to note the recurrence of injuries, commonly called relapse, which could also be seen as an intrinsic risk factor. This could be because athletes return to competition too soon, as a result of the legal substitution possibilities allowed in this sport, which are both numerous and unlimited.

Some of the extrinsic factors are:

Game situation: As previously described, there is a higher injury risk in major leagues and during competitions than during training. Likewise, the more important the competition, the greater the intensity of the game and the physical qualities of the players, which increases the risk of injury, for example in international tournaments or the Olympic games.

Playing Position: Although the authors who have studied this subject matter have not found any significant differences in the occurrence of injuries based on playing position, we should mention that the demands of the game and the injury mechanisms will be specific for each position (Monaco 2015).

Playing surface: there is a greater ACL injury index on artificial surfaces with a higher friction coefficient, compared to wooden surfaces. (Monaco, 2015)

Situations during the match: Regarding the specific times when injuries takes place, some authors have described a higher incident rate after the first 10 minutes of each half, while others suggest that it occurs during the second half. Nevertheless, this research is not comparable because the populations studied and the competition levels were different between the studies. Other authors have suggested that attacking situations have the highest injury frequency, which would explain the higher number of injuries to center backs and wings described by the same author. The majority of injuries take place during physical contact; however, ACL injuries tend to occur during non-contact situations (Monaco 2015).

Patterns and Types of Injuries:

To date, different scientific studies have been carried out which have featured samples with very diverse characteristics. According to the data taken from these studies, it can be observed that both the ankle

and the knee have been presented as the most frequent location for an injury (Monaco 2015).

Other authors reverse this order (Backx FJ, Beijer HJ, Bol E, Erich WB, 1991) (Olsen OE, Myklebust G, Engebretsen L, Bahr R, 2006), or occasionally decide that the head is the main injury location,(Langevoort G, 2007) followed by the fingers. In these cases, the differences in order are due to the type of competition and the population studied. (Monaco, 2015)

To date, different scientific studies have been carried out which have featured samples with very diverse characteristics. According to the data taken from these studies, it can be observed that both the ankle and the knee are presented as the most frequent locations for injury. On the other hand, in recent years, the trend in shoulder injuries has not been presented among the top two most frequent injuries. This disposition offers clear guidance on the importance of improving the preventive programs that have been implemented in the training process over the past twenty years. The most common injuries are articular sprains, non-traumatic muscle injuries and contusions.

Thus, in accordance with the line of research followed by various authors, a relationship does exist between specific injuries and player position during competition.

It is important to note that there are significant levels of elbow and lumbago injuries among adult female goalkeepers.

Finally, lower-level categories have a higher prevalence of apophysitis and lumbago, in up to 20% of cases (Mónaco M, 2015). Of these, spondylolysis and listhesis represent the most serious injuries in this sport due to the high risk of recurrence. (Mónaco M, 2015)

1.1.1.1 Injury Incidence and Severity

The total injury incidence (II) varies from 2.5-6.6 per 1000 total hours of exposure. The injury instance in competition / training is 9.9-21.8 / 0.6-4.6, and even higher rates are recorded during international competitions and the Olympics.

At the same time, the severity parameters vary from 10-30, and are somewhat higher in senior categories than in the formative period. The injuries that lead to the most days lost vary between ACL injuries and their recurrence, facet syndrome, and spondylolysis. However, it is evident that higher levels of competition or professionalism (adults vs. young adults) reflect a greater severity of these injuries (Monaco 2015)

1.1.1.2 Common Injuries in Handball

Head trauma or concussion is frequent in offensive (attacking) situations, or as a result of being hit by the ball (goalkeepers). This type of injury requires removal from the field of play until the symptoms have completely disappeared. Follow-up requires the use of SCAT3 with a protocol of standardized gradual return to play. (McCrory P, 2017)(Ledoux A-A, et al. 2017).

There is a low incident rate of eye trauma in this sport, and it generally occurs as a result of face trauma in goalkeepers, or from an opponent's fingers in offense-defense situations. The use of resin on a player's hands is particularly important, since it is an aggravating factor.

As previously mentioned, knees are one of the most frequently injured areas. The anterior cruciate ligament (ACL) in valgus stress and flexing mechanisms is the most serious injury, and has a higher incidence among females. (Myklebust G, Skjølberg A, Bahr R, 2013)(Caine D, Purcell L, Maffulli N., 2014) The treatment of choice is the bone-patellar tendon-bone technique, especially when BMI is high and in the presence of congenital joint hypermobility. Injury to the posterior cruciate ligament (PCL) often goes unnoticed and does not always require surgery. The medial and lateral collateral ligaments require conservative treatment in the majority of cases(Olsen O-E, Myklebust G, Engebretsen L, Bahr R, 2004).

Hands and wrists play a very important role in this sport. Acute traumatic hand and finger injuries do not usually prevent an athlete from playing; however, differential diagnosis is required with finger dislocations and metacarpal-carpal fractures. Scaphoid fractures require special attention, since their insidious progression often goes unnoticed. In this case a CT scan is the diagnostic method of choice.(Gregory A, Kerr Z, Parsons J, 2016)

A handball player's elbows have many clinical manifestations. Injury to the medial ulnar ligament, and chondral injuries to the elbow due to repetitive trauma, are characteristic among goalkeepers, though not pathognomonic. Strength training is the best preventive strategy, along with appropriate training loads.(Piry H, Fallahi A, Kordi R, Rajabi R, Rahimi M, Yosefi M, 2011)(Tyrdal S, Bahr R, 1996)(Gregory A, Kerr Z, Parsons J, 2016)

In terms of shoulders, special attention to assessment and pathology is required when the dominant or throwing side is affected. Acute injuries such as dislocation are associated with Hill Sachs and/or Bankart lesions, and may restrict a player's future in sports. Articular instability requires initial rehabilitation treatment, regardless of surgical criteria. In this case, the latarjet technique is the method of choice(Gregory A, Kerr Z, Parsons J, 2016)(Pieper H-G).

The best preventive strategy includes the identification of factors which might predispose an athlete to injury during the sports medical exam, planning a preventive program based on this information, and assigning appropriate training and playing loads during the season. This requires interdisciplinary work with the coaching team.