

TORN ANKLE LIGAMENTS IN ELITE HANDBALL DOES A PLAYER REQUIRE SURGERY?

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INTRODUCTION

The ankle joint is a synovial hinge joint with movements in the sagittal plane. The hinge is formed between the distal epiphyses of the tibia and fibula, interlocked like a mortise, and articulating with the talus in a highly congruent joint¹.

Ankle and foot trauma is widespread in elite Handball, with ankle sprains in the leading. Most athletes have complete healing and recovery after adequate treatment but some develop chronic instability, causing impairments during physical activities².

The lateral collateral ankle complex is the most frequently affected. Approximately 85% of such injuries are due to inversion sprains of the lateral ligaments, 5% are eversion sprains of the medial collateral ligament, and 10% are inferior tibiofibular syndesmotic injuries. The anterior talofibular ligament (ATFL) is the most common component of the lateral collateral ankle complex to be injured in an ankle sprain³⁻⁵.

Knowledge of the biomechanics of the foot and ankle joints is essential for understanding the specific handball-related injuries and ignite the appropriate management and future prevention.

This article will mainly discuss the surgical considerations of ankle instability in handball players, essentially focusing on mechanical ankle instability.

Epidemiology

In general, ankle sprains are underreported because they are usually self-treated, especially in a non-athletic patients but can constitute up to 30% of injuries seen in sports medicine outpatient clinics⁶. Ankle sprains show gender differences, with female competitors being 25% more likely to sustain such injury than male competitors⁷⁻¹¹. Female handball players are more at risk of acute first-time inversion sprain than those participating in other sports (Box 1)⁷.

Injury Biomechanics

The type of ankle injury depends on 2

factors: the foot’s position at the time of impaction and the direction of the force. The typical mechanism of injury is an inversion of the plantarflexed foot (70%–91%)¹⁷⁻¹⁹. Even more, in the presence of relative weakness of the lateral collateral ligament complex (90%–95%)^{17,18} with a diminished ATFL load-to-failure (approximately 150 N)^{20,21}.

Additionally, the calcaneofibular (CFL) ligament can be injured due to an adduction force when the foot is in dorsiflexion or neutral positions, as well as the posterior talofibular ligament, which can be torn due to forced dorsiflexion.

The injury mechanism can also guide the diagnosis of potentially associated lesions, including osteochondral injuries of the talar dome, fractures, and damage to the peroneus tendons or superficial nerve.

TREATING ANKLE SPRAINS

Despite the high frequency of ankle sprains in elite handball, the ideal management is controversial, and a significant percentage of athletes sustaining an ankle sprain never

KEY POINTS

- Ankle sprains show gender differences, with female competitors being 25% more likely to sustain such injuries compared with male handball competitors.
- Despite the high frequency of ankle sprains in elite handball, the ideal management is controversial, and a significant percentage of athletes sustaining an ankle sprain never fully recover.
- Studies show that around 70% of athletes experiencing a first-time ankle sprain will recur in the future or may develop chronic ankle instability.
- The acronym POLICE (protection, rest, optimal loading, ice, compression, and elevation) can summarize the management of acute ankle sprains.
- A rehabilitation-based conservative program is the mainstream for lateral ankle sprain treatment but surgery can be considered in elite handball athletes.

BOX 1: RISK FACTORS OF ANKLE SPRAINS IN HANDBALL

- *Previous history of sprains or strains.* Athletes who have had sprains in the past are at a higher risk of sustaining the same injury again than individuals who have never had it before¹².
- *Inappropriate footwear.* Not wearing supportive footwear designed for handball surfaces increases the risk of ankle sprains. For example, wearing low-topped shoes instead of high-tops when playing handball^{13,14}.
- *Poor athletic conditioning.* Athletes attempting strenuous activities without prior conditioning, such as regular ankle and calf stretching and strengthening exercises, increase the risk of injury^{15,16}.
- *Fatigue.* Fatigued athletes, at or near the end of vigorous activity, present a higher risk of injury, especially when they “push through” the fatigue in pursuit of performance instead of resting.

fully recover²²⁻²⁴. Studies show that around 70% of athletes experiencing a first-time ankle sprain will recur in the future or may develop chronic ankle instability^{23,25-27}. A ligament tear remains the most crucial factor in determining the management and predicting the return to sport (RTS). The ankle sprain grading system is vital to differentiate between grade I sprains, in which there is only stretching or microtears; from grade II and III sprains, in which there is a tear in addition to a varying degree of instability²⁸. The treatment modalities for acute ankle sprain include the following:

Nonpharmacologic Treatment

The acronyms POLICE (protection, rest, optimal loading, ice, compression, and elevation) can summarize the management of acute ankle sprains²⁹.

Protection and rest

A systematic review that studied the effectiveness of external ankle supports in preventing ankle sprains among athletes who had suffered a previous ankle injury showed that 70% had fewer ankle sprains with bracing or taping than those who did not wear prophylactic support³⁰. Protective measures include cast splints, air or plastic splints, and Velcro or lace-up braces. Ankle taping can also increase ankle stability but taping is less effective than bracing in preventing ankle sprains because it is highly dependent on the expertise of the individual who performs the taping³⁰⁻³².

Data about the ideal duration of protective measures are scarce. However, according to the biology of ligament healing, it is generally accepted that a minimum of 1 year of protective ankle bracing or taping

during sports activities is needed for all athletes who have sustained partial or complete (grade II or III) ankle ligament tear.

Optimal loading

The preferred management of grade II and III lateral ankle sprains is immobilization with an external splint while allowing early weight-bearing. All studies recommend early weight-bearing in the treatment of acute ankle sprain. Even complete grade III ankle sprains show a better healing tendency with early weight-bearing³³. Clinical researchers have shown that early weight-bearing optimizes the positioning of the torn collateral ligaments for healing while encouraging restoration of the “closed-pack” position of the ankle joint³⁴.

Ice

The available literature has advocated cryotherapy in the form of ice cups, ice packs, chemical cold packs, and cooling unit devices. Ice decreases pain and presumably reduces swelling after an ankle sprain³⁵. There is a controversy among researchers about the preferred cryotherapy protocol, with some recommending application for 20 to 30 minutes and others advising for 10 minutes and repeating the application at least 3 to 4 times per day during the first 5 days of treatment³⁶.

Compression and elevation

It is used to control interstitial bleeding and swelling during the acute phases of the ankle sprain. This can be done by bandaging or using easy-to-apply compression sleeves that can be reused daily³⁷.

Rehabilitation

The rehabilitation program is still mainstream in managing handball ankle injuries, and a good training program is essential. Functional rehabilitation comprises an organized and structured program for recovery of the physical and technical skills for optimal sports performance, focusing on pain relief and compensating functional impairment³⁸. The rehabilitation program should include cryotherapy, edema relief, optimal weight-bearing management, range of motion exercises for ankle dorsiflexion improvement, triceps surae stretching, isometric exercises and peroneus muscles strengthening, balance and proprioception training, and bracing/taping. Despite

the evidence showing no differences in outcomes comparing supervised and self-administered programs, the former may allow faster progression^{12,38}. Following stricter protocols for treatment will hopefully reduce the high incidence of long-term disability that currently results from severe ankle sprains.

Pharmacologic treatment

Evidence supports using nonsteroidal anti-inflammatory drugs during the acute phase of ankle sprain³⁹⁻⁴¹. The National Athletic Trainers' Association endorses using nonsteroidal anti-inflammatory drugs in managing ankle sprain as credible. These drugs reduce pain and swelling while improving short term functional improvement⁴². However, some authors warn against using them, especially long-term use because it may lead to delayed ligament healing⁴³.

Outcomes

Although ankle sprains are one of the most common injuries in handball, their outcomes are often unclear. About 70% of athletes report full recovery at 2 weeks to 36 months², most occurring within the first 6 months⁴⁴. However, 3% to 30% of patients who reported recurrent episodes at 2 weeks to 96 months after the initial sprain may develop longer-term residual pain and instability⁴⁵⁻⁴⁷. Moreover, participation in competitive sports like elite handball has been correlated with residual ankle instability and dysfunction (Table 1)^{44,48}.

The management of ankle injuries in handball varies and depends on the injury's severity and concomitant injuries^{49,50}. Most athlete cases are treated conservatively, mainly when there is no associated fracture. To date, no clinical indicator can be used to identify those who may develop recurrent instability or disability requiring

a rehabilitation program or surgery. Furthermore, radiological findings do not necessarily reflect the severity of a player's presentations and recovery time (Box 2).

HOW TO GET THE ATHLETE BACK TO THE GAME?

After an acute handball-related ankle sprain, it is hard to predict precisely when an athlete can RTS¹².

The current literature lacks formal criteria to assist in the decision to RTS of athletes with a ligamentous ankle injury.

There is strong evidence that residual disability of ankle joint injury is often caused by an inadequate rehabilitation and training program and early RTS⁵⁹. Therefore, the athletes should start their criteria-based rehabilitation and gradually progress through the programmed activities. For example, the medical team focuses firstly on painfree straightforward jogging or cycling before progressing to running with cutting or a change of direction (agility T-test or zigzag test).

Furthermore, medical teams must develop ankle-specific programs for handball athletes performing through pain. Skill-related activities such as pivoting and cutting must be added to the proposed training program when the athlete is pain-free or has mild symptoms with the previously programmed activities. It is helpful to evaluate the effectiveness of the rehabilitation protocol by using self-reported ankle scoring systems (e.g., Foot and Ankle Outcome Score [FAOS])⁶⁰. However, functional performance tests are used to assess the athlete's ability to perform sport-specific skills and to prepare him/her for the next level of training⁴². Therefore, data from these outcomes must be evaluated during the rehabilitation protocol as a baseline to assess the progression contrasting with the contralateral normal side⁶¹⁻⁶⁴. For a handball athlete to RTS, an ideal functional performance of a minimum of 90%, compared with the contralateral side, has been recommended⁶⁵.

In general, athletes with ankle injuries may return to play depending on their signs and symptoms (Box 3).

The RTS in amateur and professional handball players after an acute ankle sprain has been reported between 7 and 15 - 19 days, respectively^{18,66}. Nevertheless, the time required depends on several factors, including the following:

TABLE 1

Factor	Description
Pathoanatomy of the injury	Single-ligament injuries have better outcomes than multiple and complex tears ⁵¹⁻⁵⁴
Imaging	Ottawa foot and ankle rules are valuable to determine the suitability of plain radiographs for investigating ankle sprains ⁵⁵
Participation in competitive sports	Sports activity at a high level (training >3 times a week) is a significant prognostic factor for residual symptoms
Swelling	Reflects the severity of the injury—persistent swelling (more than 3 mo) after the initial injury is associated with poorer outcomes Because ankle swelling is a primary contributing factor to a range of motion loss, patients are advised to use cryotherapy, compression, and elevation to decrease swelling and pain ⁵⁶
Range of motion	Restricted range of motion at the ankle can lead to functional dysfunction for patients with even daily physical activity. This is why gaining a full range of motion is considered by many authors as a sign of recovery ^{53,57,58}
Mechanical instability	Ligamentous laxity caused by tears ^{51,54}
Functional instability	This instability is due to neuromuscular dysfunction due to damage to the articular mechanoreceptors in the injured ligaments and deconditioning during the postinjury period ⁵²

Table 1: Factors affecting the outcomes of ankle sprains.



1. The severity of the injury and associated bony injuries
2. Athlete's compliance, cooperation, performance level, and baseline functional demands. Players with highly functional baseline demands may take longer to return to preinjury level⁶⁷.
3. Rehabilitation program

WHAT IS THE ROLE OF SURGERY IN ACUTE ANKLE SPRAINS TREATMENT?

The surgical repair of acute ankle sprains is controversial. Most of the studies have methodological flaws and, thus, should be interpreted carefully⁶⁸. Surgery can be done acutely or after failing conservative treatment because it does not seem to yield different outcomes⁶⁹. Although conservative and surgical therapies produce satisfactory results, subtle differences favoring surgery on pain and recurrent instability have been reported⁷⁰.

Surgical techniques can follow 2 principles⁷¹:

- Anatomic techniques: anatomical reinsertion of the ligament or reconstruction with a graft, for example, Brostrom technique.
- Functional crutch techniques: improving the healing response of the native ligament to its normal length and tensile conditions by using a functional crutch.

The Brostrom-Gould technique shares both principles and, similar to most techniques, can be performed in various approaches: open, percutaneous, and arthroscopically.

BOX 2: COMPLICATIONS AFTER AN ANKLE SPRAIN

- *Chronic ankle instability: It is accompanied by a feeling of instability by the patient, swelling after activity, and prolonged recovery*
- *Impingement syndrome: Intra-articular localized fibrotic synovitis in the lateral gutter of the ankle following inversion injuries*
- *Fractures and osteochondral injuries include osteochondral injuries of the talar dome due to inversion and eversion mechanisms and fracture of the anterior calcaneal process due to inversion injuries. Athletes with a fracture commonly complain of bony tenderness*
- *Recurrent peroneal tendon subluxation: It occurs due to injury and detachment of the peroneal retinaculum from the posterior aspect of the fibula*
- *Complex regional pain syndrome: It may develop after ankle injuries. The actual cause for this is unknown; however, it may develop from an unusual response of the ankle and foot to disuse and/or immobilization of the ankle and foot. Early, controlled weight-bearing and rehabilitation may prevent the development of complex regional pain syndrome*
- *Syndesmotic injury: This condition is diagnosed clinically by the presence of tenderness over the anterior aspect of the ankle and pain when squeezing the fibula against the tibia at the midshaft (squeeze test).*

BOX 3: RETURN-TO-PLAY CRITERIA AFTER AN ANKLE SPRAIN

- *No pain*
- *Full active and passive range of motion*
- *About %90–%70 of muscle strength compared with the uninjured ankle*
- *Negative clinical examination*
- *Balance on one leg for more than 30 s with eyes closed*
- *Satisfactory functional examination ensuring that all dysfunctions resulting from the injury have been restored*
- *Preinjury cardiorespiratory fitness status*
- *No doubts about the handball athlete's health and safety*

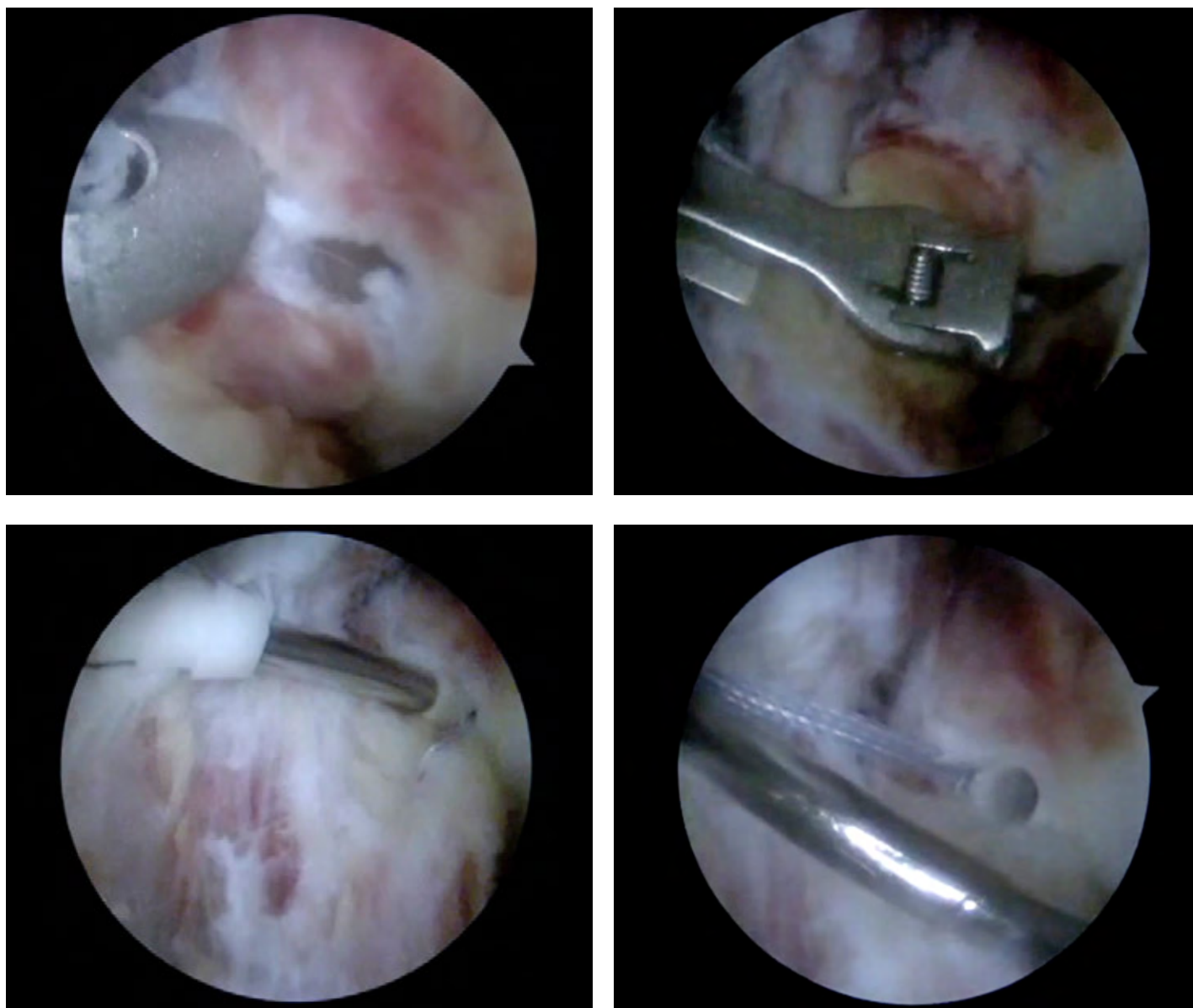


Figure 1: Arthroscopy of the ankle.

BOX 4: CRITERIA FOR SURGICAL REPAIR/RECONSTRUCTION OF ACUTE LATERAL ANKLE SPRAIN

- *Failed conservative treatment^{69,71}*
- *Athletes or high-demand patients⁶⁹*
- *Grade III lateral ankle sprains⁷⁶*
- *Combined ATFL and CFL ligament injury⁷⁶*
- *Acute injuries with mechanical instability^{71,76}*
- *Reconstruction with extensor retinaculum or tendon graft should be considered in the presence of an irreparable ATFL injury⁷⁷*

At present, arthroscopic techniques are preferred because they allow for assessing and potentially addressing concomitant injuries, which can be present ranging from 42% to 93% of athletes⁷²⁻⁷⁴.

RTS typically ranges between 12 weeks and 4 months following surgery⁷⁵. In a case series including 42 professional athletes with an acute lateral ankle sprain, White and colleagues⁷⁶ reported a mean return to training time of 63 days (49–110) and an RTS of 77 days (56–127) with diagnostic ankle arthroscopy and open modified Brostrom repair. Similarly, Sanchez and colleagues⁷⁷, in their case series of 40 patients, reported more than 30 points of American Orthopaedic Foot & Ankle Society (AOFAS) improvement in function and pain

CLINICS CARE POINTS

- *Early weight-bearing is recommended in the treatment of acute ankle sprain.*
- *The rehabilitation program should include cryotherapy, edema relief, optimal weightbearing management, range of motion exercises for ankle dorsiflexion improvement, triceps surae stretching, isometric exercises and peroneus muscles strengthening, balance and proprioception training, and bracing/taping.*
- *To date, no clinical indicator can identify those who may develop recurrent instability or disability requiring a rehabilitation program or surgery.*
- *The current literature lacks formal criteria to assist in the decision to RTS of athletes with a ligamentous ankle injury.*
- *For an athlete to RTS, an ideal functional performance of a minimum of %90, compared with the contralateral side, has been recommended.*
- *There is strong evidence that residual disability of ankle joint injury is often caused by an inadequate rehabilitation and training program and early return to sports.*
- *Surgical treatment is safe, and return to handball can be expected at a mean of 16 weeks with an %89 rate of return to preinjury performance.*

control with an arthroscopy-assisted ATFL reconstruction.

Although all patients had a preoperative diagnosis of chronic lateral ankle instability, 2 acute instability cases were of high-performance athletes who required an early RTS.

Finally, a recent systematic review by Goru and colleagues⁷⁸, comprising 10 studies (343 athletes), showed that the modified Brostrom technique using an anchor provides satisfactory outcomes in athletes with lateral ankle instability. The technique is safe, and RTS can be expected at a mean of 16 weeks, with an 89% rate of return to preinjury performance. However, associated injuries are correlated with delayed RTS (Box 4)^{75,76,78}.

SUMMARY

The major cause of ligamentous ankle lesions in elite handball players involves plantarflexed and inversion ankle movements. Due to the decreased positional stability and taking into account the handball-specific cutting actions, significant inversion/ eversion ankle injuries can occur. Acute lateral ankle injury is initially managed with functional treatment. A short immobilization period is followed by neuro-motoric training to obtain full recovery of ankle function. When chronic lateral ankle instability occurs (following repeated episodes of ankle sprains) and/ or when functional rehabilitation fails, surgery

can be indicated. Arthroscopic or Open ligament repair/reconstruction is currently considered the surgical option with the most successful outcome, especially considering the nature of an explosive impact sport such as elite handball.

References

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