

# Posttraumatic medial ankle instability

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Severe ankle sprain may result in up to 40% of all patients in a chronic medial ankle instability. The patients often present with instability feeling and pain on the anteromedial aspect of the ankle. The diagnosis of chronic medial ankle instability is mainly based on careful medical history and physical examination. Different imaging modalities including conventional weight-bearing radiographs and magnetic resonance imaging may provide additional useful information. Diagnostic arthroscopy should be performed routinely before a reconstruction procedure. Anatomical reconstruction procedure including repair and reattachment of the medial ligaments is the preferred therapy in patients with chronic medial ankle instability.

While numerous studies have been published in the current literature addressing the lateral ankle instability (1–7), there is still limited number of literature about the posttraumatic medial ankle instability. In 2002, Boss and Hintermann (8) performed an anatomical cadaver study exploring the medial ankle ligament complex. The medial ankle ligaments have a complex structure with five main ligaments: tibiospring, tibiocalcaneal, posterior and anterior deep tibiotalar, and superficial posterior tibiotalar (8). Severe ankle sprain may involve an injury of the lateral and/or medial ankle ligament complex resulting in chronic ankle instability in up to 40% of all patients (9,10). Patients with severe lateral ankle sprain often present a concomitant injury of the medial ligaments. Schäfer and Hintermann (11) prospectively evaluated the finding during the anterior ankle arthroscopy in 110 consecutive patients with chronic instability of the ankle joint. The authors observed concomitant lesions of the deltoid ligament in 23 ankle joints (11). Crim et al. (12) performed a retrospective review of 47 ankles with chronic lateral ankle instability and no medial ankle pain. Deltoid ligament injuries were observed in

72% of all ankles including 11 ankles with superficial deltoid injury, four ankles with deep deltoid injury, and 20 ankles with both components of deltoid ligament injured (12).

While the lateral ankle instability is an already well established clinical entity, the clinical significance of the medial instability is still controversially discussed in the current literature. Therefore, the objectives of this paper were: (1) to describe the diagnostic assessment of the medial instability, (2) to establish a reliable classification, and (3) to present our treatment algorithm in patients with medial ankle instability.

## *Diagnostic Assessment*

The diagnostic assessment of the medial ankle instability is mainly based on the medical history, careful physical examination including specific clinical tests, and radiologic assessment (Table 1).

## *Medical History*

Most patients give a history of an acute ankle injury

**Table 1: Diagnostic assessment of the medial ankle instability**

Medical history	<ul style="list-style-type: none"> <li>• Pronation-eversion trauma of the ankle in the history</li> <li>• Feeling of instability (giving away)</li> <li>• Anteromedial ankle pain/tenderness</li> </ul>
Physical examination	<ul style="list-style-type: none"> <li>• Anterior drawer stress</li> <li>• Valgus stressing test</li> <li>• Quantitative assessment of hindfoot valgus malalignment</li> <li>• Assessment of dysfunction of posterior tibial tendon</li> </ul>
Radiographic assessment	<ul style="list-style-type: none"> <li>• Conventional weight-bearing radiographs in 3 planes</li> <li>• Saltzman view for assessment of hindfoot alignment</li> <li>• Magnetic resonance imaging</li> </ul>
Dynamic pedobarography	
Diagnostic ankle joint arthroscopy	

in the past, especially pronation-eversion ankle sprain. Often, they complain about permanent or recurrent feeling of instability of the ankle like “rolling over” or “giving away”, especially on the medial or anteromedial aspect of the ankle joint. At the beginning, patients present with anteromedial recurrent swelling and painful tenderness. In further course, they develop a chronic rotational instability with increasing valgus malalignment and consecutive pain on the lateral aspect of the ankle joint.

### Physical Examination

Physical examination includes careful inspection of the foot and ankle especially regarding any hindfoot deformities. In patients with isolated medial ankle instability without posterior tibial tendon dysfunction an asymmetric planus and pronation deformity of the affected foot/ankle is usually observed (13,14). However, if the patients are asked to tiptoe, a substantial variation of the heel is observed (Figure 1) (13,14). Anterior drawer stress test is applied and compared with the contralateral unaffected side (15).

### Radiographic Assessment

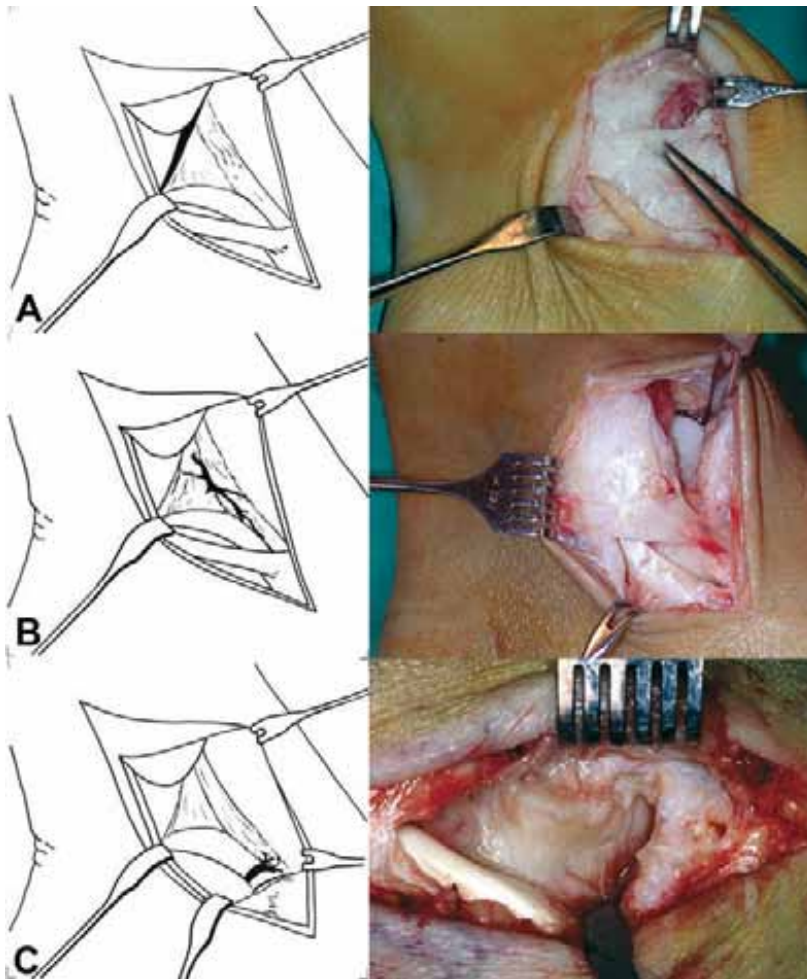
The initial conventional radiographic assessment should include anteroposterior, lateral, and mortise views of the foot/ankle. All radiographs should be performed while the patient is standing to be able to quantify the lower leg alignment. Saltzman view should be acquired to assess for inframalleolar alignment: heel position in relation of longitudinal axis of the tibia (16,17). In patients with tarsal coalition computed tomography should be performed (18). Stress radiography has been described in radiographic assessment of the ankle instability (19,20). However, we do not recommend to perform the stress radiography in patients with ankle instability. First, we do not believe that this radiographic modality may provide useful clinical information. Second, it is possible that stress applied to the ankle joint may increase the ligamental damage. Magnet resonance imaging may provide an important information regarding the localization and extent of deltoid ligament injury (12,21).



*Figure 1 (A) A 42-year-old male presented with posttraumatic medial ankle instability with asymmetric planus and pronation deformity of the left foot/ankle. (B) A substantial variation of the heel is observed at tiptoeing.*

**Table 2: Intraoperative tests/maneuvers to assess the ankle instability at the anterior ankle arthroscopy**

Maximal axial tension	<ul style="list-style-type: none"> <li>• Measurement of tibiotalar distance</li> <li>• Assessment of ankle joint laxity</li> </ul>
Anterior drawer test	<ul style="list-style-type: none"> <li>• Assessment of the anteromedial instability</li> <li>• Assessment of the anterolateral instability</li> </ul>
Application of valgus stress	<ul style="list-style-type: none"> <li>• Assessment of the medial instability</li> </ul>
Application of varus stress	<ul style="list-style-type: none"> <li>• Assessment of the lateral instability</li> </ul>



*Figure 2 Classification of the medial ankle instability. (A) Proximal „interval“ lesion, (B) intermediate lesion, and (C) distal lesion of the deltoid ligament.*

### **Ankle Joint Arthroscopy**

Ankle joint arthroscopy is a helpful diagnostic tool which may help to confirm or to exclude clinically suspected medial and/or lateral instability and to detect structural pathological changes, e.g. cartilage lesions (22). Ankle arthroscopy is performed using regular arthroscopic portals (23–25). Tests/maneuvers listed in table 2 should be performed to ensure standardized assessment of ankle instability. Cartilage degeneration is assessed using Outerbridge classification (26).

### **Differential Diagnosis**

Differential diagnoses of the medial ankle instability include:

- posterior tibial tendon dysfunction;
- tarsal coalition;
- posttraumatic and/or neurologic valgus hindfoot deformities.

**Table 3: Classification systems of the medial ankle instability**

Clinical Classification (Type I-IV)						
	Giving way	Hindfoot valgus	Medial ankle pain	Anterolateral ankle pain	PTTD	Heel varization
Type I	+	+	+	(+)		yes
Type II	++	+	+++	(+)		yes
Type III	+++	++	+++	+	+	none
Type IV	++++	+++	++++	++	++	none
Arthroscopic Classification (Type 1-4)						
	Superficial deltoid	Deep deltoid	Medial malleolar periosteal hypertrophy	Medial malleolar osteophytes	Tibiotalar distance (mm)	Lateral ligament lesion
Type 1	elongated, partially ruptured	normal	+	+	2-5	yes
Type 2	ruptured	elongated, partially ruptured	++	++	2-5	yes
Type 3	ruptured	elongated, partially ruptured	+++	+++	> 5	none
Type 4	ruptured	ruptured	++++	++++	> 5	none
Classification Based on Intraoperative Findings (Type A-C)						
Type A	Proximal "interval" lesion of medial ligaments: proximal part of tibionavicular ligament, tibiospring ligament, (spring ligament), anterior and posterior tibiotalar ligaments, tibiocalcaneal ligament					
Type B	Intermediate lesion of medial ligaments: intermediate part of tibionavicular and tibiospring ligaments, (spring ligament)					
Type C	Distal lesion of medial ligaments: distal part of tibionavicular and tibiospring ligaments, spring ligament					

### *Classification of Medial Ankle Instability*

There are different classification systems of medial ankle instability based on clinical assessment, arthroscopic assessment, or intraoperative surgical findings (Figure 2) (Table 3) (11,14,22,27).

### *Surgical Treatment*

The procedure can be performed under general or regional anesthesia. The patient is placed in a supine position. The ipsilateral back of the patient is lifted un-

til a strictly upward position of the lower extremity is achieved. A pneumatic tourniquet is applied on the ipsilateral thigh. Prior to reconstructive surgery, an anterior ankle arthroscopy is performed using standard arthroscopy portals (23–25,28). Ankle arthroscopy is a helpful diagnostic tool. Ankle arthroscopy has also clinical significance. Following procedures can be performed by arthroscopy: removal of loose bodies, arthroscopic debridement, and microfracturing. Surgical exploration of the medial ankle ligament is performed through a 4-8 cm skin incision, starting 1-2 cm above

the medial malleolus tip toward the medial aspect of the navicular bone. The anterior aspect of the deltoid ligament is exposed by dissection of the fascia. The sheath of the posterior tibial tendon is longitudinally incised and tendon is carefully checked. After exploration of the posterior tibial tendon, the spring ligament is identified and inspected, then the tibionavicular and tibiospring ligaments are explored. In most cases, anatomical repair and reattachment should be performed. The anterior border of the medial malleolus is exposed by a short longitudinal incision between the tibionavicular and tibiospring ligaments. The surface of the medial aspect of the medial aspect is roughened with a rongeur. The ligament reattachment can be performed using an anchor or transosseous sutures. If necessary, nonresorbable sutures are placed in the spring ligament. The tibionavicular and spring ligaments are further stabilized using resorbable sutures. In cases with significant degenerative changes of the ligament, plantaris graft technique can be used (29). Wound closure is performed sequentially. A splint is used to keep the foot in a neutral position.

### *Additional Procedures*

- reconstruction of posterior tibial tendon (debridement, shortening, flexor digitorum longus transfer (30) etc.) in patients with degenerative changes of the tendon;
- anatomic repair of the lateral ankle ligaments (31,32) in patients with additional lateral instability of the ankle;
- lateral column lengthening by calcaneal osteotomy (33) in patients with preexisting valgus and pronation deformity;
- double arthrodesis (34) when medial ankle instability is so pronounced that a valgus tilt of talus within the mortise is observed.

### *Postoperative Rehabilitation*

The dressing and splint are removed and changed at the second postoperative day. The foot is protected in a plaster cast or stable walker for 6 weeks postoperatively. Full weight-bearing is allowed. Rehabilitation starts after 6 weeks with passive and active mobilization of the ankle joint, muscle training, and improvement of proprioception.

### *Conclusion*

Medial ankle instability is getting more acceptance as an important orthopaedic entity. The mechanism of injury leading to chronic medial ankle instability can vary from an acute eversion trauma to a repetitive rotational trauma of the ankle. Hintermann et al. (14) performed an exploratory, prospective study including 52 consecutive cases with medial ankle instability. In the entire patient cohort, 22 patients reported about a previous supination trauma and 18 patients had an eversion trauma. The clinical manifestation of chronic medial ankle instability is a persisting valgus and/or pronation deformity of the hindfoot with anteromedial pain. However, the patient with rotational ankle instability involving the lateral ankle ligaments may also present with pain on the lateral aspect of the ankle. In patients with persistent instability and/or pain, surgical anatomical reconstruction including all involved ligaments at the medial, and, if necessary, lateral aspect of the ankle should be performed.

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