

## Radiologic findings in lesions of the ligamentum bifurcatum of the midfoot

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**Abstract.** In a consecutive study of 106 patients presenting with a history of ankle sprain, 40.5% showed clinical signs of damage to the ligamentum bifurcatum. Eighteen of these patients showed 20 radiologic signs related to a lesion of this ligament; these signs included avulsions from the points of insertion and laxity in the lateral part of the transverse tarsal joint. The supplementary radiographs revealing these signs are demonstrated, and a more differentiated radiologic handling of the patient with ankle sprain is suggested.

**Key words:** Ankle sprain – Ligamentum bifurcatum – Processus anterior calcii – Stress – radiograph – Transverse tarsal joint

The routine radiographic examination of patients with ankle sprain often consists only of an anterior-posterior (AP), a lateral, and an anterior-oblique view of the ankle. These projections reveal the signs of injury to the ankle region such as fractures, avulsions, local swellings, fluid accumulations, etc. In a prospective, consecutive investigation of patients with ankle sprain, we found a surprisingly high incidence of patients with signs of a lesion of the ligamentum bifurcatum (LB), an important ligament in the lateral part of the midfoot. In this paper, we point out the radiologic manifestations of injury to the ligamentum bifurcatum.

### Anatomy

The ligamentum bifurcatum is a double ligament with a common origin on the lateral aspect of the

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anterior process of the calcaneus (PAC). It is divided into calcaneo-navicular and calcaneo-cuboid parts (Fig. 1). It is a major stabilizing factor in the corresponding joints, especially the lateral part of the transverse tarsal joint (Chopart's lateral joint line).

### Clinical findings

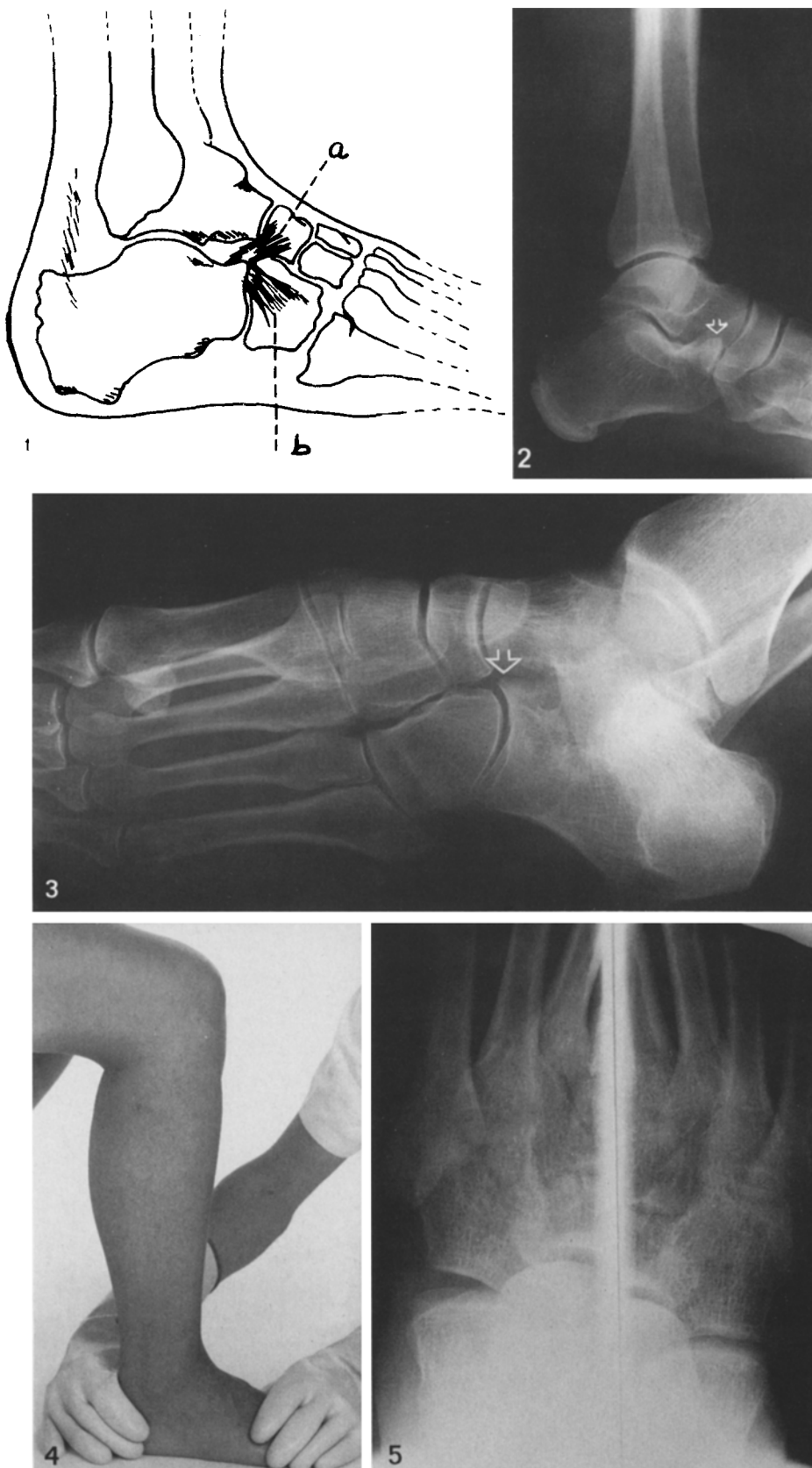
The characteristic clinical signs of a lesion of LB have been described by Baumgartner and Müller [2] and Gellman [3]. "The thumb is placed on the tip of the lateral malleolus, the middle finger is placed on the base of the fifth metatarsal bone. The slightly crooked index finger will, if it is placed equidistantly between these two bones, hit the point of swelling and maximum tenderness".

### Radiology

The radiologic aim of finding signs of avulsion and laxity is not attained in the routine examination of the ankle. The PAC is seen on the lateral view, but projected over the talus (Fig. 2). Gellman [3] and Parkes [4] proposed an oblique view of the midfoot, and this will often show the PAC free of the talus (Fig. 3). The point of insertion of the LB on the cuboid is not seen on the routine views of the ankle. An anterior-posterior view of the lateral part of the midfoot will do in this respect. Adler [1] has described radiographic examination under stress showing instability in the calcaneo-cuboid joint.

### Material and methods

A consecutive study, including all patients admitted to the emergency ward with a history of ankle sprain, was undertaken over a 2-month period. Patients with other trauma requiring



**Fig. 1.** Drawing showing the ligamentum bifurcatum with its two parts: *a* calcaneo-navicular ligament and *b* calcaneo-cuboid ligament

**Fig. 2.** Lateral view of the ankle showing the anterior process of the calcaneus projected over the talus

**Fig. 3.** Oblique view of the midfoot showing the anterior process clear of the talus

**Fig. 4.** Method to obtain stress-radiographs (see text)

**Fig. 5.** Stress-radiograph showing lateral separation at the calcaneo-cuboid joint (left) in compared to the non-affected side (right)

surgical treatment to such an extent that it delayed the clinical and radiologic examination for more than 24 h, were excluded.

With these inclusive and exclusive criteria, the material comprised 106 patients. Forty-seven percent were females (age: 8–80 years, mean 23 years) and 53% were males (age: 8–79 years, mean 25 years).

The examination included a clinical evaluation of the ankle joint as described in orthopedic text books with certain differences. The LB was examined as described by Gellman [3]. When the patients presented with discoloration, swelling, or maximum local tenderness over the LB, they were selected for supplementary radiographic projections. These were (a) an AP view of the midfoot; (b) an oblique view of the midfoot [3, 4]; and (c) stress radiographs to show laxity of the lateral part of the transverse tarsal joint (Chopart's lateral joint line). The patient was placed on a chair with the knee and ankle flexed 90 degrees and the tibia vertical. The foot was fixed from the medial aspect by the examiner's hand around the calcaneus from behind; the forefoot was adducted with the examiner's other hand. The central X-ray beam was vertical and centered on the transverse tarsal joint. The same procedure was made on the unaffected side for comparison. An increase in joint space on the affected side in comparison to the nonaffected side was taken as a sign of ligamentous laxity (Fig. 5). The stress radiographs were performed soon after admission and were done without the use of local anesthetics.

## Results

Of the 106 patients included in the study, 40.5% showed clinical signs of a lesion of the LB. In 18 of these patients 20 radiologic signs related to a lesion of the LB: five patients showed avulsion from PAC, two had an avulsion from the cuboid, one had avulsion from the navicular, and 12 patients had signs of laxity in the calcaneo-cuboid joint.

All of the avulsions from PAC were demonstrated on the lateral projection of the ankle as well as on the oblique view of the midfoot. The two avulsions from the cuboid bone and the one from the navicular were only observed on the AP view of the midfoot including the stress-radiographs (which are AP views of midfoot).

## Discussion

A need exists for a clearer attitude towards the radiologic handling of patients with ankle sprain when there are signs of lesion of the LB. The AP view of the midfoot and the stress radiograph are of particular importance in this respect in supplementary radiologic management. The clinical significance of the injury needs further investigation, and a follow-up study is planned. This is important for the radiologic management and especially the question of the need for radiographic examination during stress of the foot.

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