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Lateral ligament injury of the ankle in children

Follow-up results of primary surgical treatment

Among 40 acutely injured ankles in children, surgery revealed a cartilaginous and/or bony fragment in 19, and an isolated rupture of the anterior talo-fibular ligament without any lesion of the bone or cartilage in another 17. In four ankles there was no ligament lesion. The lesions were surgically repaired. All ankles healed well and were painless and functionally stable at follow-up. In four ankles radiographs showed a small subfibular fragment, in which bony fusion had failed, but even these ankles were stable. Two other ankles gave a slightly positive sign in the clinical anterior drawer test as compared with the contralateral uninjured ankle, but there were no signs of functional instability nor were there any subjective complaints. Our results suggest that severe ankle sprains in children may cause isolated ruptures of the anterior talofibular ligament and frequently osteochondral lesions. We therefore advocate primary suture of ruptured lateral ligaments of the ankle in children.

Key words: ankle; children; ligament injury.

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Total rupture of the lateral ligaments of the ankle is believed to be rare in children. In youngsters, however, a supination injury may result in avulsion of the bony or cartilaginous insertion of the anterior talo-fibular (ATF) ligament, and this may cause lateral instability of the ankle (Watson-Jones 1976, Jani & Baumgartner 1977). Avulsion fractures, when they affect the apex of the lateral malleolus, are not always visible on radiographs, and many probably remain undiagnosed, the result being ligamentous insufficiency (Jani & Baumgartner 1977). The few reports in the literature and our clinical experience led us to suspect that ligamentous injuries and isolated ruptures of the anterior talo-fibular ligament are not uncommon during the growth period. We therefore made a prospective study of a group of children who had a severe supination injury of the ankle. We undertook surgical exploration of the lateral ligaments of the ankle in order to verify lesions caused by the injury and to repair the ruptured ligaments.

Patients and methods

During the 14 months from 1.9.79 to 30.10.80 559 children were treated for acute sprained ankle at the outpatient department of Aurora Hospital. Of these, 28 boys and 12 girls, aged 12 (5–14) years, were operated on because of acute supination injury.

Criteria for the operation were laid down in advance. We selected patients for operation if the ankle was severely 1) swollen and 2) painful over the anterior talo-fibular ligament; 3) if the patient walked with a limp; 4) if there was evidence of clinical ligamentous instability; 5) if there was a radiographically visible and displaced avulsion fragment below the apex of the fibula. Only three ankles were examined arthrographically. Surgical intervention was carried out in most cases if the four first-mentioned criteria were present and always when the 5th criterion was fulfilled.

In one ankle there was no clinical or radiographic instability, but the ankle was surgically explored because of the presence of other severe clinical symptoms. All injuries had been caused by twisting the ankle (supination injury) during walking, running or games. About 25 per cent of injuries occurred during sport. The clinical and radiographic examination included a manual instability test (anterior drawer and lateral stress tests of both ankles) without anaesthesia.

Radiographic instability

Instability of the lateral ligaments was recorded if the anteroposterior radiographs showed that the

difference in talar tilt between the two ankles was 6° or more (Freeman 1965, Hansen et al. 1979). In the anterior drawer test the shortest distance between the posterior border of the tibia and the articular surface of the talus was measured in the lateral stress view. Anterior instability was recorded if this gap was more than 6 mm in the injured ankle and if the difference in this gap between the injured and uninjured ankles was more than 3 mm (Noesberger et al. 1977, Hackenbruch et al. 1979, Glasgow et al. 1980). In the stress tests the ankle was in slight plantar flexion.

Surgical exploration

The lateral ligaments were explored through a curved incision below the lateral malleolus (Staples 1975). The peroneal tendons and the calcaneofibular ligament were also examined. All operations were performed without a tourniquet and seven patients required only local anaesthesia. The ruptured ligament and capsule were sutured and the avulsed fragment, if not removed, was attached to the bony insertion with resorbable 0 or 2–0 suture material (vicryl, dexon). In two ankles a larger fragment was attached by tunnelling the sutures through the fragment and fibula. Immobilization in plaster lasted 4 to 6 weeks; during the last 2 weeks full weight-bearing was allowed.

Results

Preoperative radiographic findings

A displaced avulsion fragment was visible radiographically in the talo-fibular part of the joint in eight ankles. In one ankle a small displaced fragment was also seen at the apex of the medial malleolus. At the preoperative radiographic stress test the criteria for instability were fulfilled in 16 of the 36 ankles in which a lateral ligament lesion was verified operatively. The anterior drawer test was positive in 11 ankles and the lateral stress test in eight, but three ankles showed both sagittal and lateral instability.

The talar tilt ranged between 2 and 25°, and in lateral view the dorsal gap measured from 1 to 10 mm. If the sole criterion for radiographic instability had been a talar tilt of more than 10°, 12/40 acutely injured ankles would have met this criterion.

Operative findings

Cartilaginous or bony fragments were present in 19/40 ankles. These fragments varied in size from 2 mm to 12 mm; most were thin slivers. In five ankles a completely loosened and dislocated small cartilaginous or bony fragment was removed, – in two from the lateral surface of the talus and in three from the lateral malleolus.

Whenever the ATF ligament was severed, the capsule was totally ruptured. The calcaneofibular ligament was not ruptured in this series. In four ankles, however, the sheath of the peroneal tendon was torn. In two of these the calcaneofibular ligament was lax; one such ligament was tightened with a suture.

In 16 of the 17 ankles with a severed ATF ligament substance, the tear had occurred either midway between the talus and the fibula or close to the fibular malleolus. In one ankle the ligament was loosened from the talus, but there was no bony lesion.

In 11 ankles rupture of the ATF ligament was accompanied by a slight lesion of the cartilage or bone (Table 1), which was, however, not radiographically visible.

In all eight ankles in which the ATF ligament was intact, a radiographically visible avulsion fragment was displaced into the joint space.

In four ankles there was no total capsular rupture but only a small hole. The ligament was either intact or distended and there was no lesion of cartilage or bone. No haematoma was found at operation.

Follow-up findings

By the end of 1981 all ankles operated on primarily had been examined clinically and radiographically 9 (6–21) months postoperatively. Both ankles of those 19 children who had a bony or cartilaginous lesion of the ankle were clinically and radiographically re-examined in October 1982, 2–3 years after the

Table 1. Distribution of ankle lesions in 40 children

Lesion	No. of ankles				
	Age 5–10 yrs		Age 11–14 yrs		Total
	Boys	Girls	Boys	Girls	
Rupture of ATF ligament substance and capsule	–	1	4	12	17
Rupture of ATF ligament substance and capsule with a cartilage/bone lesion at the lateral malleolus	1	5+	2+	3	11
Intact ATF ligament attached to a bony avulsion fragment from the fibula; capsule ruptured	2	4	1	1	8
Partial capsular lesion with ATF ligament intact	1	–	1	2	4
Ankles	4	10	8	18	40

+ Avulsion fragment from the talus, 2 cases.

injury. During that period there had been no new severe supination injury which would have required surgical treatment. Only one ankle required immobilization in a plaster boot for 3 weeks because of a new slight supination injury.

All ankles had healed well after surgery without any complications of the wound. At the first examination all ankles were clinically and radiographically stable and painless. In four ankles the sutured fragment was still visible in the radiographs and caused roughness on the surface of the lateral malleolus, but the ankles were stable. At late re-examination of the same four ankles a submalleolar small bony fragment was clearly seen in the radiographs, but without signs of radiological instability. The sutured fragments had only a fibrous union.

All ankles were painless. There was no pain on palpation, or swelling. The motions of the ankle were symmetrical compared with the uninjured ankle. The injured ankles were clinically stable, except two ankles which had a slightly positive anterior drawer test but even these two patients had no complaints. Radiographically, the bony and ligamentous lesion had healed and was symptomfree. The radiographic stress examination was normal.

All the children in this study were satisfied with the results of the operation and could participate in school sports.

Discussion

The type of injury to the ligament and bone varied with the age of the child (Table 1). In only one child less than 11 years old (a 10-year-old girl) was a complete tear of the ATF ligament substance not accompanied by a bony or cartilaginous lesion. Schütze et al. (1982) also reported this observation. In older children, because the bone is less soft, fractures of the lateral malleolus are less common. In one study of children between 2 and 14 years old, the mean age at the time of such a fracture was 10 years (Vahvanen & Aalto 1980).

Typically, six of the eight children with an avulsion fracture, but with intact ligament substance, were between 5 and 10 years old. Injuries in which bony-cartilaginous lesions were accompanied by lesions to the ligament substance and capsule were about equally frequent in the two age groups (Table 1). During the growth period, however, the ATF ligament may be severed completely – although mainly in older children – even when there is no avulsion fracture of the talus or fibula. This conflicts with the observation of Jani & Baumgartner (1977) that an avulsion fracture always accompanies such a tear.

Our observation that a torn ligament was always associated with capsule injury agrees with observations in adults (Anderson & LeCocq 1954, Broström 1964, and Lindstrand 1976).

Figure 1. Displaced avulsion fragment of the fibula with a capsular rupture in an 8-year-old boy. Radiographic and clinical signs of lateral and anterior instability were present. The fragment was sutured to the lateral malleolus and the capsule was repaired.

Although misdiagnosis of the injury to the ATF ligament occurred in four cases among 40 acutely injured ankles, the clinical diagnosis of instability of the ankle was much more reliable than the radiographic diagnosis. The information given by the radiographic stress test is difficult to interpret and at times may even be unreliable (Rubin & Witten 1960, Staples 1975). Radiographic instability has correlated poorly with functional instability and also with subjective complaints (Freeman 1965, Hansen et al. 1979).

The manual radiographic stress test was unreliable in our study and we therefore need more objective methods for measuring instability. A device is needed that gives more objective information on the stability of the ankle even in children. The anterior drawer test has been reported to yield valuable information (Lindstrand 1976), as we also found in our study.

When the ATF ligament is ruptured in adults, especially in young people and athletes, many authors favour primary suture (Ruth 1961, Bonnin 1965, Freeman 1965, Weber & Hupfauer 1969, Reichen & Marti 1974, Staples 1975, Hackenbruch et al. 1979). Others favour conservative treatment (Hansen et al. 1979). Residual disability after non-operative treatment has ranged from 21 per cent (Hansen et al. 1979) to 58 per cent (Ruth 1961). In his series, Broström (1966) observed residual symptoms of instability in only 3 per cent of ankles in which a ruptured ATF ligament was sutured primarily. In injuries of the lateral ligaments in the ankle, delayed suture and ligament reconstruction do not always give good results and are almost never as successful as primary sutures (Weber & Hupfauer 1969, Reichen & Marti 1974, Staples 1975, Hedeboe & Johannsen 1979).

A displaced fibular or talar avulsion fragment, which is radiographically visible (Figure 1), can be fixed surgically or removed, and

the damaged ligament and capsule repaired at the same time.

In conclusion, it may be stated that:

1. In children who have had a severe supination injury of the ankle, injuries of the anterior talo-fibular ligament and osteochondral lesions of the lateral malleolus are frequent.
2. Total rupture of the anterior talo-fibular ligament may occur without any osteochondral lesion, especially in children over 10 years of age.
3. Suture of the lateral ligaments of the ankle is one way to ensure a stable and painless ankle in children with ligament rupture.

References

Anderson, K. J. & LeCocq, J. F. (1954) Operative treatment of injury to the fibular collateral ligament of the ankle. *J. Bone Joint Surg.* **36**-A, 825–832.

Bonnin, J. G. (1965) Injury to the ligaments of the ankle. *J. Bone Joint Surg.* **47**-B, 609–611.

Broström, L. (1964) Sprained ankles. I. Anatomic lesions in recent sprains. *Acta Chir. Scand.* **128**, 483–495.

Broström, L. (1966) Sprained ankles. V. Treatment and prognosis in recent ligament ruptures. *Acta Chir. Scand.* **132**, 537–550.

Freeman, M. A. R. (1965) Instability of the foot after injuries to the lateral ligament of the ankle. *J. Bone Joint Surg.* **47**-B, 669–677.

Glasgow, M., Jackson, A. & Jamieson, A. M. (1980) Instability of the ankle after injury to the lateral ligament. *J. Bone Joint Surg.* **62**-B, 196–200.

Hackenbruch, W., Noesberger, B. & Debrunner, H. U. (1979) Differential diagnosis of ruptures of the lateral ligaments of the ankle joint. *Arch. Orthop. Traumat. Surg.* **93**, 293–301.

Hansen, H., Damholt, V. & Termansen, N. B. (1979) Clinical and social status following injury to the lateral ligaments of the ankle. Follow-up of 144 patients treated conservatively. *Acta Orthop. Scand.* **50**, 699–704.

Hedeboe, J. & Johannsen, A. (1979) Recurrent instability of the ankle joint. Surgical repair by the Watson-Jones method. *Acta Orthop. Scand.* **50**, 337–346.

Jani, L. & Baumgartner, R. (1977) Injury to the talofibular ligament in children. In: (Ed. G. Chapchal) *Injuries of the ligaments and their repair*, pp. 197–200. Georg Thieme Publishers, Stuttgart.

Lindstand, A. (1976) New aspects in the diagnosis of lateral ankle sprains. *Orthop. Clin. N. Am.* **7**, 247–249.

Noesberger, B., Hackenbruch, W. & Müller, M. E. (1977) Diagnosis of lateral ligament lesion in the ankle joint. In: (Ed. G. Chapchal) *Injuries of the ligaments and their repair*, pp. 182–183. Georg Thieme Publishers, Stuttgart.

Reichen, A. & Marti, R. (1974) Die frische fibulare Bandruptur – Diagnose, Therapie, Resultate. *Arch. Orthop. Unfall-Chir.* **80**, 211–222.

Rubin, G. & Witten, M. (1960) The talar-tilt angle and the fibular collateral ligaments. A method for the determination of talar tilt. *J. Bone Joint Surg.* **42**-A, 311–326.

Ruth, C. J. (1961) The surgical treatment of injuries of the fibular collateral ligaments of the ankle. *J. Bone Joint Surg.* **43**-A, 229–239.

Schütze, U., Mischkowsky, T., Götze, V. & Amberger, H. (1982) Diagnostik und Therapie der lateralen Bandruptur am oberen Sprunggelenk. *Z. Kinderchir.* **36**, 128–130.

Staples, O. S. (1975) Ruptures of the fibular collateral ligaments of the ankle. Result study of immediate surgical treatment. *J. Bone Joint Surg.* **57**-A, 101–107.

Vahvanen, V. & Aalto, K. (1980) Classification of ankle fractures in children. *Arch. Orthop. Traumat. Surg.* **97**, 1–5.

Watson-Jones, R. (1976) *Fractures and joint injuries*, (Ed. J. N. Wilson), Vol. 2, 5th ed., pp. 1112–1116. Churchill Livingstone, Edinburgh, London and New York.

Weber, B. G. & Hupfauer, W. (1969) Zur Behandlung der frischen fibularen Bandruptur und der chronischen fibularen Bandinsuffizienz. *Arch. Orthop. Unfall-Chir.* **65**, 251–257.