

RADIOLOGICAL DIAGNOSIS OF LATERAL LIGAMENT LESION OF THE ANKLE

A Comparison Between Talar Tilt and Anterior Drawer Sign

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In a prospective study of 244 patients with ankle lesions a comparison between the talar tilt and the anterior drawer sign was made, leading to the following conclusions:

Ligament lesions which are not disclosed by the talar tilt examination may be diagnosed by the anterior drawer sign. The anterior drawer sign cannot replace the talar tilt examination, or *vice versa*. The two methods are complementary. It is not possible to differentiate between an isolated lesion of the anterior talofibular ligament and a combined lesion of the anterior talofibular and the calcaneofibular ligaments by the two methods.

Key words: ankle joint; anterior drawer sign; ligament injuries; talar tilt

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Recent ruptures of the lateral ligaments of the ankle are best diagnosed by arthrography (Brostrøm et al. 1965, Fulp 1973). However, this method is not generally accepted. In many departments, ligament lesions of the ankle are diagnosed by the instability of the talus – the talar tilt – provoked by forced supination of the foot (Rubin & Witten 1960, Freeman 1965).

During the last few years some authors have recommended examination of the anterior instability of the ankle – the anterior drawer sign – for the diagnosis of such lesions (Castaing & Delplace 1972, Larsen 1976, Lindstrand & Mortensson 1976).

In order to compare these two methods – the talar tilt and the anterior drawer sign – a prospective investigation was made in an attempt to answer the following questions:

1. Can the anterior drawer sign disclose ligament lesions which are not revealed by

the talar tilt, or *vice versa* ?

2. Can the anterior drawer sign replace the talar tilt as a means of diagnosis?

3. Is it possible to differentiate between an isolated lesion of the anterior talofibular ligament and a combined lesion of the anterior talofibular and the calcaneofibular ligaments by the two methods?

MATERIAL AND METHODS

The series studied consisted of 244 patients with recent ankle injury. All the patients were seen within 24 hours of the trauma. In all cases a lateral ligament lesion was suspected clinically. None of the patients showed radiological signs of a fracture. Radiological measurements of the talar tilt (TT) and the anterior drawer sign (ADS) were made in all cases.

Throughout the period concerned both examinations were performed using the same

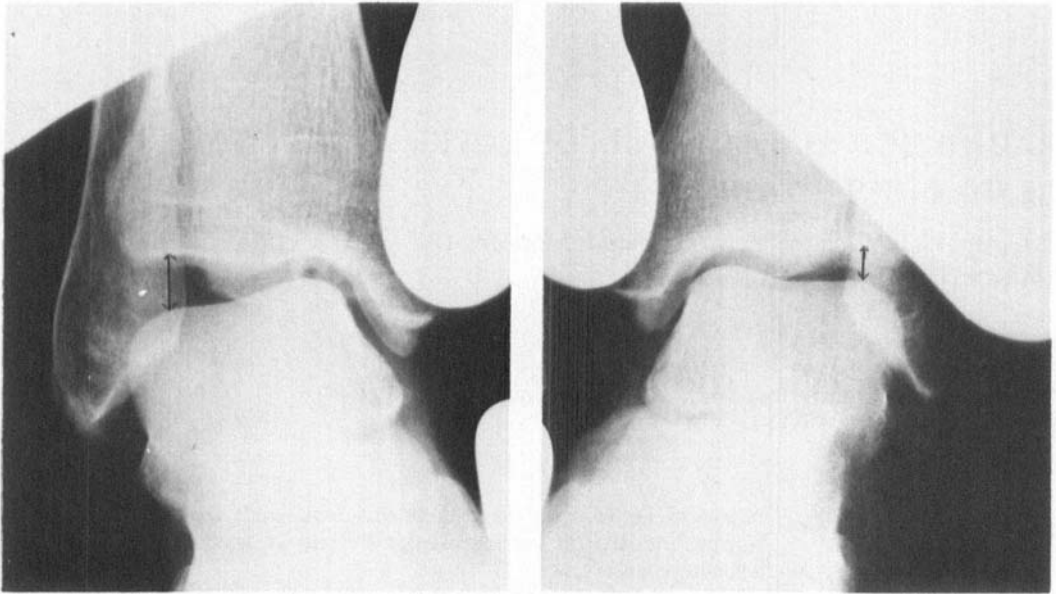


Figure 1. The difference in the distance between the articular surfaces of the talus and the tibia at the level of the top of the lateral trochlea tali on the injured (left) and on the normal (right) side.

technique. The TT examination was performed with the investigator placed on the contralateral side of the foot to be examined. With the left/right hand fixing the leg just above the ankle and the right/left hand fixing the heel, the foot was supinated with maximal force. An anteroposterior exposure, centred on the middle of the ankle joint, was made on both sides, the unaffected foot always being examined before the injured one. The distance between the articular surfaces of the talus and the tibia was measured at the level of the top of the lateral trochlea tali on the exposures of the injured and the unaffected sides (Figures 1 and 2) and the difference in the tilted position on the two sides was calculated.

The ADS examination was performed with the leg elevated, supported at the popliteal fossa and the heel, in such a position that the thigh was horizontal, and the foot rotated 30° medially. (The support at the popliteal fossa is very important, otherwise the weight of the leg alone may provoke a subluxation in the ankle joint.) With the beam placed horizontally, an X-ray exposure, centred just above the tip of the malleolus, was

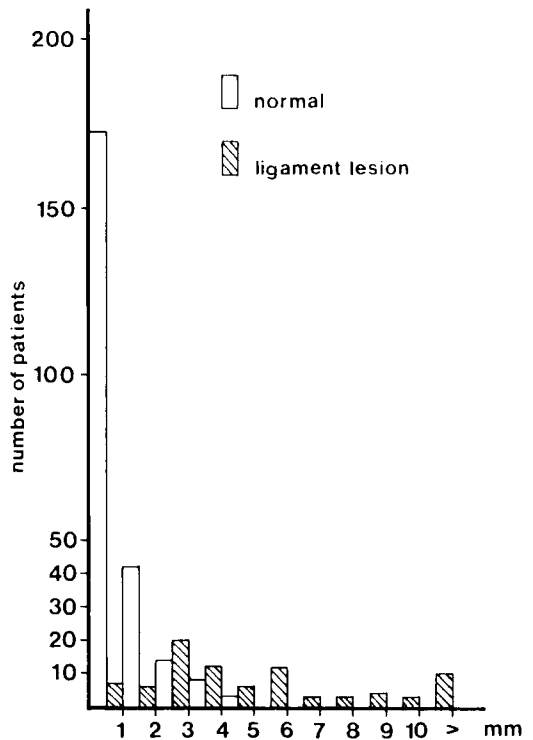


Figure 2. The difference in the distance between the articular surfaces at the level of the top of the lateral trochlea tali at rest and in forced supination in 244 normal ankles and in 85 ankles with surgically verified ligament lesions.

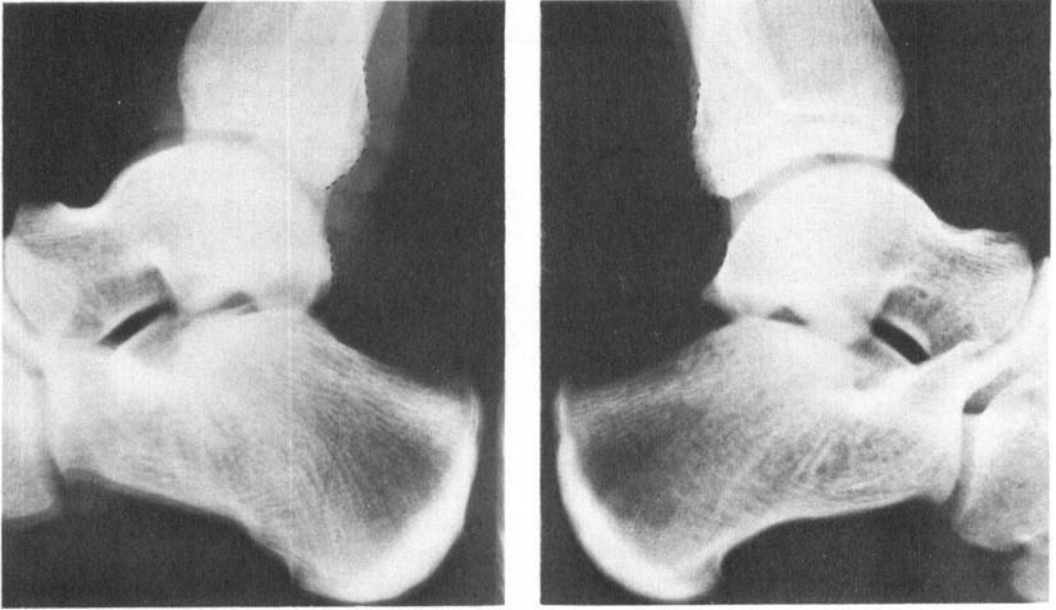


Figure 3. Double exposures showing the position of the posterior margin of the tibia and of the posterior process of the talus before and after loading on the injured (left) and normal (right) side.

made. After this, the leg was loaded with a 5 kg weight just above the ankle joint, and after the patient had relaxed completely, a new X-ray exposure was made on the same film with the X-ray equipment and the foot in exactly the same position. Both feet were examined, the unaffected always before the affected one. The displacement of the posterior margin of the tibia in relation to that of the posterior process of the talus between the two exposures was measured on the injured and unaffected sides (Figures 3 and 4), and the difference in displacement on the two sides was calculated.

Radiologically, a diagnosis of ligament rupture was made when the difference between the injured and the unaffected sides was 3 mm or more according to the TT examination and/or when the difference in displacement on the two sides was 2 mm or more according to the ADS examination.

In the event of a positive finding, the patient was usually subjected to operation, with the aim of suturing the ruptured ligaments. Patients with pronounced discrepancy between the clinical and radiological findings were referred to the outpatient department. If ligament rupture was still suspected after re-examination about 1 week after the trauma, these patients were treated with a plaster cast. Patients with normal radiological findings and without definite clinical suspicion of ligament rupture were regarded as having a simple sprain and were discharged immediately.

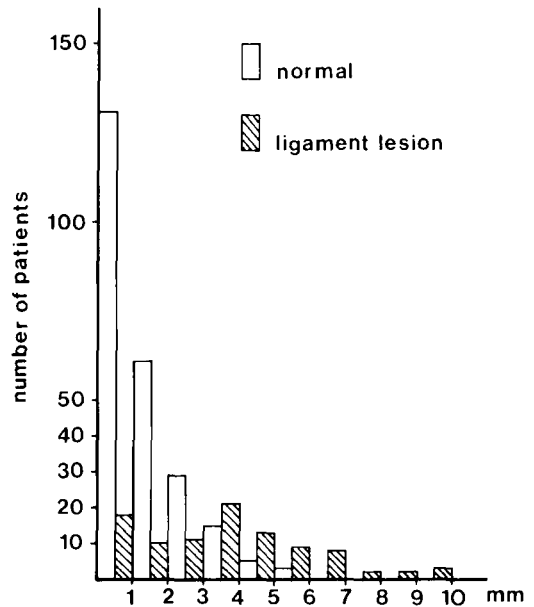


Figure 4. The displacement of the posterior margin of the tibia in relation to the posterior process of the talus after loading the distal part of the tibia with a 5 kg weight in 244 normal ankles and 85 ankles with surgically verified ligament lesions.

In the period from Oct. 1 to Nov. 30, 1976, all the examinations were assessed and almost invariably performed by the same investigator. In the few cases where this was not possible, the TT examination was performed by a doctor from the emergency ward, while the ADS examination was performed by an X-ray technician. In this period, doubtful cases and technical problems were often discussed with the staff. In the period from Dec. 1, 1976 to Feb. 15, 1977, the examinations and assessments were made routinely. In this period, the TT examinations were performed by doctors from the emergency ward and the ADS examinations by X-ray technicians, while doctors from the X-ray department assessed the findings.

In the final analysis of the series, all X-ray films were reappraised and all hospital records were reviewed as regards symptoms, clinical and operative findings.

RESULTS

Ninety-six patients were discharged immediately with simple sprain. None of these patients showed signs of ligament rupture on TT examination. In three cases, a rupture of the ligaments was suspected on ADS (difference in displacement 2 - 2.5 mm). In two of these, this finding was overlooked primarily because of wrong measurement. In the third case, the surgeon found no indication for operation in spite of the radiological finding (Table 1).

Sixty-two patients were transferred to the outpatient department. After repeated clinical examination and, in some cases, repeated radiological examination (which is not included in the report), 42 of these patients were treated for ligament rupture with a plaster cast for 6 weeks. Twenty were regarded as having a simple sprain (Table 2).

Table 1. The radiological diagnosis in 96 patients with simple sprain
Talar tilt investigation

Radiological diagnosis	Normal	Ligament lesion	Total
Normal	93	0	93
Ligament lesion	3	0	3
Total	96	0	96

Anterior drawer sign investigation

One patient with a falsely positive TT finding was checked radiologically. The first examination had revealed a distance between the articular surfaces of 6 mm on the injured side and of 3 mm on the unaffected side. In the repeat exposure, the corresponding figures were 6 and 5 mm, respectively.

Eighty-six patients were subjected to operation because of suspected ligament rupture. At operation, ligament rupture was found in 85 of these patients, while the ligaments were intact in one (displacement difference 3 mm by ADS). In two cases, only a capsular lesion was found (in Table 3 these are recorded as a lesion of the anterior talofibular ligament). In three cases, both investigations were negative. Of these patients, two were operated on because of severe clinical symptoms of ligament rupture; in both cases, a rupture of the anterior talofibular ligament was found. The third patient was subjected to operation because of a primarily erroneous measurement; in this case a capsular lesion was found (Table 3).

During the period from Oct. 1 to Nov. 30, 1976, the TT and ADS examinations showed almost the same efficiency. During the subsequent period (Dec. 1, 1976 - Feb 15, 1977), a marked decrease in the efficiency of ADS was observed (Table 4).

DISCUSSION

In both investigations the purpose is the same, to disclose a ligament rupture by demonstration of instability of the talus - either instability in the frontal plane (TT) or in the sagittal plane (ADS). It is well known that the degree of TT present in the normal ankle is highly variable (Rubin & Witten 1960). This was confirmed in the present series. Moreover, a great variability in the degree of ADS was found. Because of this variation in normal ankles it is recommended that the instability of the injured ankle is compared with the movement of the normal ankle (Cedell 1975, Rubin & Witten 1960). This was also practised in the present study,

Table 2. The clinical diagnosis in relation to the radiological diagnosis in 62 outpatients with suspected lateral ligament lesion of the ankle
Talar tilt investigation

Anterior drawer sign investigation	Radiological diagnosis	Normal		Ligament lesion		Total	
		Clinical diagnosis	SS	LL	SS	LL	SS
Normal	SS	14			3		17
	LL			8		6	14
Ligament lesion	SS	3				3	
	LL			19		9	28
Total	SS	17			3	20	
	LL			27		15	42

SS: simple sprain
LL: ligament lesion

Table 3. The operative diagnosis related to the radiological diagnosis in 86 patients operated on because of suspected lesion of the lateral ligaments of the ankle. (In one patient with positive ADS no lesion was found at operation)
Talar tilt investigation

Anterior drawer sign investigation	Radiological diagnosis	Normal		Ligament lesion		Total	
		Operative diagnosis	LTF	LTF + LCF	LTF	LTF + LCF	LTF
Normal	LTF		3		4		7
	LTF + LCF					15	15
Ligament lesion	LTF	10			3		13
	LTF + LCF			12		38	50
Total	LTF	13			7		20
	LTF + LCF			12		53	65

LTF: lesion of the anterior talofibular ligament
LCF: lesion of the calcaneofibular ligament

Table 4. Monthly distribution of the results of the talar tilt (TT) and the anterior drawer sign (ADS) examinations in 86 patients operated on because of suspected lesion of the lateral ligaments of the ankle

	Ligament lesion disclosed by			Positive investigation		Falsely positive investigation		ADS + TT negative	Total
	TT	ADS	Both	TT	ADS	TT	ADS		
October	2	3	11	13	14				16
November	5	8	11	16	19			1	25
December	2	7	9	11	16				18
January	4	3	7	11	10				14
February	6	1	3	9	4		1	2	13
Total	19	22	41	60	63		1	3	86

both in the TT and the ADS examinations. A source of error in this comparison is a previous severe trauma on the now unaffected side. None of the patients in the present series had been exposed to such a trauma.

Ligament rupture was diagnosed if the TT on the injured side exceeded that on the normal side by 3 mm or more. This limit corresponds to a difference of 6° as recommended by Freeman (1965).

Various methods have been recommended for measurement of the anterior instability by ADS (Castaing & Delplace 1972, Lindstrand & Mortensson 1976, Larsen 1976). In the present series ligament rupture was diagnosed by ADS if there was a difference in displacement of 2 mm or more between the two sides. The limit of 2 mm had been determined in a pilot investigation performed on patients with surgically verified ligament lesion.

The fixed points chosen give the methods a great advantage over those used by other authors. Both points represent midline structures, which means that both ankles can be examined from the same side. Another advantage of the method presented is that the double exposure of the film makes it possible to measure the displacement on each side on the one film.

The figures quoted regarding the outpatient department group should be taken with a certain reservation, because of the absence of verification of the ligament ruptures. However, if the clinical diagnoses are accepted as correct, about 50 per cent of the ligament ruptures were disclosed only by the ADS. This figure is very high, compared with the 25 per cent in this group with ruptures which were diagnosed only by the TT. The explanation for this is probably a certain scepticism on the part of the clinicians as to the value of the ADS, so that patients with positive signs of ligament rupture disclosed only by the ADS were more often sent to the outpatient department than patients with positive signs of ligament rupture only by the TT.

One or other of the methods failed in about 25 per cent of the surgically verified cases,

but the methods were complementary, so that if one was negative, the other was usually positive. In only 5 per cent of the surgically verified cases were both methods negative at the same time. In addition, both methods were negative in 20 per cent of the ligament lesions in the outpatient department group. The number of falsely negative examinations may possibly be reduced in both investigations by using local anaesthesia of the injured ligaments to avoid a pain-determined fixation of the ankle (Lindstrand & Mortensson 1976). Moreover it is possible that an increased load can reduce the number of falsely negative results with the ADS.

In the first period during which both methods were performed with meticulous care by one investigator, the efficiency of both methods was the same. In the second period during which both the TT and the ADS examinations were used routinely, the ADS being performed by X-ray technicians, the efficiency of the ADS showed a definite decline. The reason for this most probably is that it is of crucial importance that the patient is completely relaxed when the ADS examination is performed. This requires some time, which may be difficult for the technicians to accept, especially in a stressed situation. To make the ADS investigation just as efficient as the TT it is recommended that the examination be performed by doctors. Otherwise very careful instruction of the technicians with constant checks, giving special emphasis to the importance of a completely relaxed patient, is necessary.

The interpretation of the X-ray films was a little more difficult in the ADS investigation than in the TT. However, with some experience this gave no special problems and in the reappraisal of all the exposures only a few false measurements were disclosed.

The ADS has some very great advantages over the TT. Firstly, the ADS is definitely less painful for the patient, and secondly the ADS is safer with regard to scattered radiation, because no member of the staff has to stay in the examination room during the exposure.

The anterior talofibular ligament is the most important stabilizing ligament of the ankle (Cedell 1975). Moreover, the anterior talofibular ligament is damaged in nearly 90 per cent of all ligament injuries in the ankle – in 66.5 per cent alone and in 20 per cent in combination with the calcaneofibular ligament (Brostrøm 1966). Accordingly, it is very important to diagnose lesions in this ligament.

In an experimental study, Castaing & Delplace (1972) found that cutting of the anterior talofibular ligament was followed only by anterior instability of the ankle joint (ADS). TT occurred only when the calcaneofibular ligament was also cut. By the two methods, it should therefore be possible to differentiate between lesions of the anterior talofibular ligament and combined lesions of the anterior talofibular and the calcaneofibular ligaments.

In the series presented here, isolated lesion of the anterior talofibular ligament was found in 25 per cent of the operated cases. When only ADS was positive, the lesion was more often localized to the anterior talofibular ligament. Localized lesion of the anterior talofibular ligament was, however, in some cases disclosed only by TT, and lesion of the calcaneofibular ligament was found in some cases in spite of the negative TT.

Conclusions

Ligament lesions which are not disclosed by the TT examination may be diagnosed by the ADS.

The ADS cannot replace the TT examination, or *vice versa*. The two methods are complementary.

It is not possible to differentiate between isolated lesion of the anterior talofibular ligament and a combined lesion of the anterior talofibular and the calcaneofibular ligament by the two methods

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