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RUPTURE OF THE LATERAL LIGAMENTS OF THE ANKLE : OPERATION OR PLASTER CAST?

A Prospective Study

B. NIEDERMANN, A. ANDERSEN, S. BRYDE ANDERSEN, V. FUNDER, J. P. JØRGENSEN, E. LINDHOLMER & M. VUUST

Departments of Orthopaedic Surgery and of Radiology, Ålborg Hospital, Ålborg, Denmark.

The material comprises 444 patients, aged 12–50 years, with acute sprain of the ankle, seen over an 11-month period (1.10. 1977 to 31.8. 1978). Clinical examination showed no rupture of the ligaments in 53. Arthrography in the remaining patients revealed rupture of the lateral ligaments in 209 (in two-thirds of the anterior talofibular ligament and in one-third of the anterior talofibular as well as calcaneofibular ligament). Conservative treatment with a below-knee plaster cast for 5 weeks was employed in 107 patients, while 102 were treated surgically by suture of the ruptured ligament(s) and subsequently wore a below-knee plaster cast for 5 weeks. The follow-up 1 year after the accident was attended by 63 per cent of the patients. Good results were found in 76 per cent of those treated by plaster cast only and in 81 per cent of those treated by surgery. The difference is not statistically significant.

Key words: anterior talofibular ligament; arthrography; calcaneofibular ligament; operation; plaster cast

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A number of studies have been carried out to elucidate the value of operative versus conservative treatment of ruptures of the lateral ligaments of the ankle (Broström 1966, Freeman 1965, Hansen et al. 1979, Kolind-Sørensen 1975, Prins 1978), but only a few of these studies have been prospective and controlled. Freeman (1965) obtained better results with conservative rather than operative treatment and found no difference between the results obtained by plaster cast and by early mobilization. He therefore recommended early mobilization. Broström (1966) reported significantly better results after operative treatment, but he did not make any special distinction between isolated rupture of the anterior talofibular ligament and rupture of the anterior talofibular as well as the calcaneofibular ligament. Prins (1978) could find no difference between the results of strapping as compared with plaster cast for 3 weeks in cases of isolated rupture of the anterior talofibular ligament, but if the calcaneofibular ligament was also ruptured the results were significantly better after operation followed by plaster cast for 3 weeks than after plaster cast alone for 6 weeks. Thus, the results obtained so far are not conclusive.

We therefore instituted the present study in an attempt to elucidate further the problem concerning operative versus conservative treatment by plaster cast in rupture of the lateral ligaments of the ankle.

Children are apt to sustain epiphysiolysis rather than rupture of the lateral ligaments of the ankle, and in elderly persons injuries to the ankle ligaments are less common and rarely serious. In our group of patients, therefore, we included only persons with closed epiphyseal lines and none older than 50 years. Like Prins (1978), we found

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arthrography to afford a greater accuracy in diagnosis of rupture of the lateral ankle ligaments isolated rupture of the anterior talofibular ligathan did examination for talar tilt and for the drawer sign. This will be discussed in a separate paper which is being prepared. Arthography is also a superior method of differentiating between isolated rupture of the anterior talofibular ligament and rupture of the anterior talofibular as well as the calcaneofibular ligament. Therefore, we chose arthrography for this differentiation. As early as 1965, Broström suggested that the time interval between the injury and the arthrography affected the arthrographic accuracy, as clotted blood can alter the appearance. Nevertheless, in most studies there have been intervals of up to 1 week or more between the injury and arthrographic examination. We made the strict demand of an interval not exceeding 24 hours, so that all the arthrographies were performed within 24 hours after the injury.

MATERIAL AND METHODS

The material comprises all patients aged 12–50 years who came to the Emergency Ward of Ålborg Hospital South during the period 1.10.77 to 31.8.78 with acute sprain of the ankle which had been sustained less than 24 hours previously. Patients with ankle fractures and patients with open epiphyseal lines were excluded. The total material comprises 444 patients, 59 per cent males and 41 per cent females. Figure 1 presents the age distribution.

On the basis of the clinical findings in the Emergency Ward the patients were divided into three groups (−−, +−, and ++) according to the following criteria: Patients of group −− had neither direct nor indirect tenderness of the anterior talofibular ligament or of the calcaneofibular ligament, but swelling might be present. Patients of group ++ had direct as well as indirect tenderness of both these ligaments and a circumference increase of more than 4 cm when measured around the lateral malleolus. Group +− comprises the remaining patients.

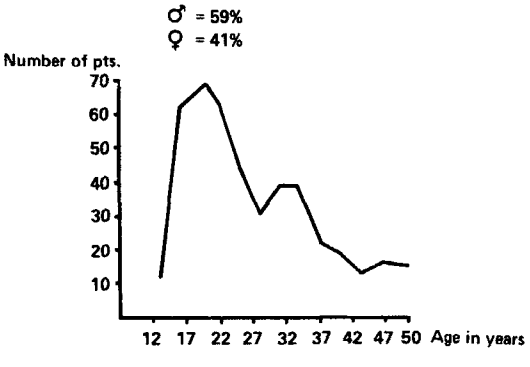

Figure 1. Age distribution curve of 444 patients with acute ankle sprain.

Thus, the 53 patients of group −− were deemed not to have ligament rupture. They did not have arthrography and were treated with strapping. The remaining 391 patients, i.e. those of groups +− and ++, had arthrography except for 19 who refused and were therefore excluded. A total of 372 ankle arthrographies were performed, as already mentioned always within 24 hours of the injury. On the basis of Percy's grading (Percy et al. 1969) 163 arthrographies (44 per cent) were assessed as negative and 209 (56 per cent) as positive as regards rupture of the lateral ankle ligaments.

The 163 patients with negative arthrography were treated with strapping. In 17 of these patients, however, the primary arthrographic diagnosis proved wrong; 16 were supplied with plaster casts, while one was treated by operation. (This operation revealed rupture of the joint capsule and partial rupture of the anterior talofibular ligament). These 17 patients were also excluded.

The 209 cases showing positive arthrography were randomly assigned to treatment by plaster cast for 5 weeks without weightbearing or to operation (suturing of the ligament) followed by a plaster cast for 5 weeks without weight-bearing. A total of 107 were treated conservatively by plaster cast and 102 by operation.

After deduction of the 19 patients who refused to have arthrography and the 17 who were treated by plaster cast or operation in spite of a negative arthrography, the original material of 444 patients is reduced to 408.

Operation

The operation was carried out in a bloodless field under general anaesthesia. An arcuate incision was made inferoanteriorly to the lateral malleolus, the joint capsule was exposed, and any capsular rupture and rupture of the anterior talofibular ligament, which is intimately connected with the capsule, were identified. The sheath of the peroneus was opened, the peroneal tendons held aside, and the calcaneofibular ligament inspected. The ligaments were sutured with Dexon® 00 and so were the capsule and subcutis, while the skin was sutured with Prolene® 0000. Thereafter, a circular below-knee plaster cast was applied and worn for 5 weeks without weight-bearing.

Follow-up

All cases were followed up 1 year after the ankle injury. Some patients failed to attend in spite of repeated invi-

tations. Questionnaires by letter were not used. A total of 256 patients (63 per cent) were seen at follow-up which consisted in all cases of an interview with the patient, with history-taking according to a fixed format. The patients were asked about possible symptoms in the ankle concerned before sustaining the injury, about athletics before and after, whether the ankle was better, unchanged, or worse 1 year after the injury, whether they had pain, swelling of the ankle, possible stiffness of the ankle or a tendency to sprain the ankle, whether they had had inflammation of the operative wound, about complaints regarding the scar, problems with the ankle during sports, running, daily function and work, and problems when walking on rough and on level ground. Objectively the mobility of the ankle, talocrural as well as subtalar, was assessed and any abnormal laxity was recorded. The muscle volume and strength were measured, and any changes in the soft tissues, including the operative scar, were noted.

Assessment of results

On the basis of the history and the objective examination at follow-up, a total estimate was made of any possible functional inhibition that might be related to the ankle concerned. Thereafter, the results were assessed and graded as follows:

Good:
No functional inhibition, even in sport or similar physical activities.

Fairly satisfactory:
Slight functional inhibition because of the ankle, e.g. in sport or similar physical activities.

Not satisfactory:
Functional inhibition because of the ankle in daily activities and work.

Poor:
Disabled as a result of the ankle injury.

RESULTS

Only 79 per cent of the 256 patients seen at follow-up had not had any symptoms in the ankle concerned before sustaining the present injury.

Table 1 gives the number of symptom-free patients in the various treatment groups; the percentages are given in brackets. The percentage distribution is approximately the same in all groups.

The main ankle symptom before injury was a tendency for spraining to occur. Only 5 of the 256 patients included in the follow-up also complained of pain in the ankle prior to the injury and only 6 of swelling.

A mean of 64 per cent of those seen at follow-up had been active in sports prior to the injury. In the total material this percentage was 52. Table 2 sets out the number of sports performers in the various treatment groups with the percentages in brackets. There was a tendency for the sports performers to sustain serious injuries involving ligament rupture. Table 2 also shows the extent to which the sports performers had resumed their athletic activities at follow-up 1 year after the injury. There is no statistically significant difference between the groups (Fisher's exact test) when comparing the groups treated by strapping only and the plaster cast and operated groups having rupture of the anterior talofibular ligament or rupture of both the anterior talofibular and calcaneofibular ligament.

Table 3 presents the tendency to sprain the

Table 1. Number of patients who were symptom-free before ankle injury in the various treatment groups

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Number with symptom-free ankle joint before injury	29 (83)	63 (75)	37 (88)	36 (75)	15 (75)	21 (78)
( ) per cent	Not significant		Not significant		Not significant	

Table 2. Number of sports performers in the various treatment groups and effect of the ankle injury on participation in sports 1 year after injury

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Number of sports performers	22 (63)	39 (46)	30 (71)	36 (75)	14 (70)	23 (85)
Sport after 1 year:						
to the same extent	18 (82)	35 (90)	24 (80)	29 (81)	11 (79)	21 (91)
to a lesser extent	1 (5)	3 (8)	4 (13)	5 (14)	2 (14)	2 (9)
stopped	1 (5)	1 (3)	2 (7)	2 (6)	1 (7)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

Table 3. Tendency to sprain the ankle before and 1 year after injury in the various treatment groups

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Before injury:						
No tendency to sprain	29 (83)	66 (79)	38 (91)	36 (75)	15 (75)	21 (78)
1 year after injury:						
no tendency to sprain	19 (54)	40 (48)	29 (69)	40 (83)	15 (75)	19 (70)
slight tendency to sprain	11 (31)	33 (39)	11 (26)	7 (15)	3 (15)	7 (26)
marked tendency to sprain	5 (14)	10 (12)	2 (5)	1 (2)	2 (10)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

ankle concerned before and 1 year after the injury, grading the tendency at the end of 1 year. There is no statistically significant difference between the groups (Fisher's exact test).

Table 4 shows how many patients of the different groups were painless 1 year after the injury, without swelling, without stiffness, and without a tendency to sprain the ankle. There is no statistically significant difference between the groups (Fisher's exact test).

Table 5 sets out the number of patients in the various groups having ankle complaints at follow-up regarding walking on rough ground, participating in sport, running, performing their daily activities and work, and walking on level ground. There is no statistically significant difference between the groups (Fisher's exact test).

Table 4. Status of the ankle in the various treatment groups 1 year after injury

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
No pain	26 (74)	57 (68)	33 (79)	41 (86)	12 (60)	19 (70)
No swelling	28 (80)	63 (75)	33 (79)	39 (81)	14 (70)	22 (82)
No stiffness	32 (91)	81 (96)	39 (93)	39 (81)	14 (70)	22 (82)
No tendency to sprain	19 (54)	40 (48)	29 (69)	40 (83)	15 (75)	19 (70)
( ) per cent	Not significant		Not significant		Not significant	

Table 5. Complaints regarding the ankle in the various treatment groups 1 year after injury

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Complaints:						
when walking on rough ground	12 (34)	27 (32)	8 (19)	7 (15)	5 (25)	7 (26)
during sports	9 (26)	9 (11)	8 (19)	5 (10)	5 (25)	5 (19)
when running	5 (14)	13 (16)	7 (17)	4 (8)	5 (25)	8 (30)
during daily activities and work	3 (9)	7 (8)	4 (10)	3 (6)	2 (10)	4 (15)
when walking on even ground	0 (0)	5 (6)	3 (7)	0 (0)	3 (15)	1 (4)
( ) per cent	Not significant		Not significant		Not significant	

Table 6. Patient's own assessment of the ankle after 1 year (Subjective assessment of the results)

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Ankle unchanged or better	24 (69)	48 (57)	25 (60)	34 (71)	10 (50)	19 (70)
Ankle somewhat worse	8 (23)	29 (35)	14 (33)	13 (27)	10 (50)	6 (22)
Ankle much worse	1 (3)	5 (6)	2 (5)	1 (2)	0 (0)	2 (7)
( ) per cent	Not significant		Not significant		Not significant	

Table 6 gives the patients' own assessment of the ankle joint at the end of 1 year. They were asked whether they felt that the ankle was better, unchanged, somewhat worse, or much worse than prior to the injury. There is no statistically significant difference between the groups (Fisher's exact test).

Among the 75 operated patients who attended the follow-up the following operative complications had occurred: In 4 per cent wound infection, but in all the cases merely a superficial infection. There had been no cases of deep infection, and in particular no purulent arthritis. In 7 per cent there had been dysaesthesia around and distal to the operative scar, and 9 per cent had a neuroma-like tenderness of the scar, suggesting total or partial division of the sural nerve with neuroma formation in the scar.

Table 7 lists the number of patients in the various groups having tenderness of the anterior

Table 7. Objective findings in the ankle at follow-up: Tenderness of ligaments

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Tenderness of ant. talofibular ligament	7 (20)	37 (44)	11 (26)	14 (29)	7 (35)	8 (30)
	$P = 1.02$		Not significant		Not significant	
Tenderness of calcaneofibular ligament	4 (11)	8 (10)	3 (7)	6 (13)	1 (5)	3 (11)
	Not significant		Not significant		Not significant	

( ) per cent

Table 8. Objective findings in the ankle at follow-up: Lateral instability – stiffness

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
No instability of ankle joint	30 (86)	67 (80)	34 (81)	46 (96)	15 (75)	24 (89)
	Not significant		$P = 2.73$		Not significant	
No stiffness of ankle joint	35 (100)	81 (96)	41 (98)	39 (81)	18 (90)	21 (78)
	Not significant		$P = 1.35$		Not significant	

( ) per cent

Table 9. Objective findings in the ankle at follow-up: Talocrural mobility

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Talocrural mobility:						
Increased by 10°	0 (0)	4 (5)	1 (2)	1 (2)	0 (0)	0 (0)
Equal on both sides	33 (94)	72 (86)	35 (83)	38 (79)	17 (85)	23 (85)
Reduced by 10°	2 (6)	4 (5)	5 (12)	8 (17)	3 (15)	4 (15)
Reduced by 20°	0 (0)	4 (5)	1 (2)	1 (2)	0 (0)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

Table 10. Objective findings in the ankel at follow-up: Muscular atrophy (calf) – muscular strength (ankle)

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
No atrophy (calf)	28 (80)	64 (76)	36 (86)	41 (85)	9 (45)	19 (70)
Equal muscular strength (ankle joint)	35 (100)	82 (98)	40 (95)	46 (96)	19 (95)	22 (82)
( ) per cent	Not significant		Not significant		Not significant	

Table 11. Assessment of the overall clinical result in the various treatment groups 1 year after ankle injury

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Good	30 (86)	64 (76)	33 (79)	41 (85)	14 (70)	20 (74)
Fairly satisfactory	2 (6)	18 (21)	9 (21)	5 (10)	5 (25)	7 (26)
Not satisfactory	3 (9)	1 (1)	0 (0)	2 (4)	1 (5)	0 (0)
Poor	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

talofibular ligament or the calcaneofibular ligament. As regards tenderness of the anterior talofibular ligament there was a statistically significant difference ($P = 1.02$) in the groups treated by strapping, but not in the other groups.

Examination for a possible lateral instability or increased stiffness of the ankle concerned (Table 8) revealed, as might be expected, a tendency for the operated ankles to be a bit stiffer than the conservatively treated ankles of the plaster groups. Conversely, in the plaster cast groups there was a tendency for a little more instability of the ankle joint than in the operated group. In this respect there was a statistically significant difference in the group of patients with rupture of the anterior talofibular ligament, there being greater stiffness in the operated group and greater instability in the plaster group, P values 2.73 and 1.35, respectively.

From Table 9 it can be seen that there was no statistically significant difference between the groups as regards range of movement in the talocrural joint.

The presence of muscular atrophy of the calf was evaluated by measuring the difference in circumference as compared with the unaffected leg. Most patients had no atrophy, some of them atrophy of 1 cm, and a few atrophy of 2 cm. According to Table 10, there is no statistically significant difference between the groups.

There was no difference in muscle strength, assessed as the strength on dorsal flexion and plantar flexion of the ankle as compared with the other ankle.

On the basis of a total estimate of the patients' functional inhibition, as determined by the history and the objective findings at follow-up 1 year after the injury, the clinical results were evaluated according to the above criteria. The result was judged to be good, fairly satisfactory, not satisfactory, or poor *(vide supra)*.

Table 11 presents the assessment of the results. Among the conservatively treated plaster cast group as a whole there were 76 per cent good results as against 81 per cent good results in the operated group as a whole. However, these differences were not statistically significant; nor were they significant for the subgroups having rupture of only the anterior talofibular ligament or of both the anterior talofibular and the calcaneofibular ligament (Fisher's exact test).

DISCUSSION

Only a mean of 79 per cent of the patients in the various treatment groups had not had symptoms in the ankle concerned before injury. Thus, *a priori* one cannot expect good results essentially above 80 per cent. There were 81 per cent good results in the operated group, i.e. as favourable as could be expected. It is remarkable that in the present material, in contrast to the findings of Prins (1978), the results of conservative treatment with plaster cast were just as good as those after operative treatment. Prins found that the results of plaster cast treatment were significantly inferior to those of operative treatment in cases with rupture of the anterior talofibular as well as the calcaneofibular ligament. The explanation may be that in his study the follow-up examination was carried out as early as 6 months after the injury; in the present study it was after 1 year. As already mentioned, a number of investigations have been published on this subject. Only Freeman (1965) recorded poorer results after operative treatment. Freeman's publication is based upon a fairly small material of 45 patients, divided into three treatment groups of 12–18 patients.

Broström (1966) obtained significantly better results with operative treatment of ruptures of the lateral ligaments, but nevertheless he recommended conservative treatment with a plaster cast in most cases. His reason for this was that operative treatment of all these ankle injuries would be too much of a strain on the surgical departments and emergency wards. However, Broström recommended operative treatment in special cases, especially in active sports performers. In the present material, however, there was no statistically significant difference between the number of sports performers in the various treatment groups that had resumed their sport, to the same extent as before, 1 year after sustaining the ankle injury (Table 2). Thus, there appeared to be no advantage in treating athletes by operation.

CONCLUSIONS

In the present study there was no statistically significant difference between the results of conservative and operative treatment of rupture of the lateral ligaments of the ankle. This applied to isolated rupture of the anterior talofibular ligament and also to rupture of the anterior talofibular and the calcaneofibular ligament. Taking into consideration the complications and risks involved in an operation, conservative rather than operative treatment must be recommended.

The present study does not, however, contribute to solving the problem concerning early mobilization versus immobilization by plaster cast in rupture of the lateral ligaments of the ankle.

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Correspondence to: B. Niedermann, Bakkedraget 12, DK-3400 Hillerød, Denmark.

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