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Structural abnormalities and persistent complaints after an ankle sprain are not associated:

an observational case control study in primary care

Abstract

Background
Persistent complaints are very common after a lateral ankle sprain.

Aim
To investigate possible associations between structural abnormalities on radiography and MRI, and persistent complaints after a lateral ankle sprain.

Design and setting
Observational case control study on primary care patients in general practice.

Method
Patients were selected who had visited their GP with an ankle sprain 6–12 months before the study; all received a standardised questionnaire, underwent a physical examination, and radiography and MRI of the ankle. Patients with and without persistent complaints were compared regarding structural abnormalities found on radiography and MRI; analyses were adjusted for age, sex, and body mass index.

Results
Of the 206 included patients, 98 had persistent complaints and 108 did not. No significant differences were found in structural abnormalities between patients with and without persistent complaints. In both groups, however, many structural abnormalities were found on radiography in the talocrural joint (47.2% osteophytes and 45.1% osteoarthritis) and the talonavicular joint (36.5% sclerosis). On MRI, a high prevalence was found of bone oedema (33.8%) and osteophytes (39.5) in the talocrural joint; osteophytes (54.4%), sclerosis (47.2%), and osteoarthritis (55.4%, Kellgren and Lawrence grade >1) in the talonavicular joint, as well as ligament damage (16.4%) in the anterior talofibular ligament.

Conclusion
The prevalence of structural abnormalities is high on radiography and MRI in patients presenting in general practice with a previous ankle sprain. There is no difference in structural abnormalities, however, between patients with and without persistent complaints. Using imaging only will not lead to diagnosis of the explicit reason for the persistent complaint.

Keywords
ankle; abnormalities; general practice; imaging; sprain.

INTRODUCTION

Ankle sprains are one of the most commonly occurring musculoskeletal injuries. In the Netherlands, about 16 000 athletes visit an emergency department each year,[1] and about 300 000 patients are seen each year in general practice.[2] The incidence of sprains is higher in males than females, and higher in young people.[2] The incidence of a fracture after an ankle sprain is 5% in general practice and up to 20% in the emergency departments of hospitals.[2]

More than 75% of the injuries are caused by an inversion sprain, in which the lateral collateral ligament complex generally gets strained or ruptured.[2] Most commonly, the anterior talofibular ligament (ATFL) is the first ligament to be injured.[3] Other structures that may be injured during a lateral ankle sprain are the calcaneofibular and posterior talofibular ligaments, the peroneal tendons, joint capsule, and the proprioceptive nerve endings found within the surrounding soft tissues.[3]

Despite the many treatment options available, such as early mobilisation, cooling, instruction for weight bearing, taping, and exercises, many patients have persistent complaints after an acute ankle sprain.[4–7] Up to 33% still experience pain after 1 year and re-sprains occur in up to 34% of all patients.[8] When complaints last for at least 6 months, the terms chronic or functional ankle instability are used.[9] In the Netherlands, annual sport-related ankle sprain costs are estimated to be €187 million and persisting complaints are expected to lead to more costs as a result of productivity loss and healthcare costs.[10]

It is not known whether these persistent complaints are associated with structural changes or abnormalities in the ankle caused by the trauma. Identification of structural abnormalities possibly associated with persistent complaints could provide help in prognosis and treatment for patients with persistent complaints after a lateral ankle sprain in general practice. Radiography is generally regarded as a reliable method for detection of fractures, sclerosis, or osteophytes, but is not suitable for assessment of soft tissue, bone marrow oedema, or lesions of cartilage and ligaments.[11] These can be assessed more directly and accurately using magnetic resonance imaging (MRI).[12] The purpose of this study, therefore, was to investigate the association between persistent complaints after a lateral ankle sprain and possible structural abnormalities found on radiography and MRI.

METHOD

Patients

The present study is an observational case control study on primary care patients after a lateral ankle injury. Patients were selected from the medical records of 84

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How this fits in

More than 30% of patients with a lateral ankle sprain in general practice report persistent complaints after 1 year; however, the cause of these complaints is still unknown. The present study, therefore, selected patients with and without persistent complaints, 6–12 months after they visited general practice with an ankle sprain. In both groups many structural abnormalities were seen on radiography and MRI, but there were no significant differences between the study groups. It therefore seems that further examination with imaging will not assist in diagnosing the explicit reason for the persistent complaints.

participating GPs using the diagnostic International Classification of Primary Care (ICPC) code (L77) 'ankle sprain' and with the search terms: ankle, distortion, and sprain. Patients were eligible if they had presented themselves to the GP 6 to 12 months before the start of the study with an inversion trauma of the ankle and were aged 16 to 65 years. Patients with known fractures, other osseous damage, a reported history of former operations on the ankle, and known systemic diseases with impact on functioning of the musculoskeletal system (for example, amyotrophic lateral sclerosis, multiple sclerosis, or rheumatoid arthritis) were excluded, as were patients with insufficient knowledge of the Dutch language.

Procedure

Selected patients received a letter with a response card for participation on behalf of their GP. Interested patients were subsequently approached by telephone by the research assistant and inclusion criteria were checked. Additionally, the presence of persistent complaints was checked using a 7-point Likert scale (1 = completely recovered, 7 = worse than ever). Based on this score, patients were divided into two study groups: patients without persistent complaints (score 1–2, completely recovered or strongly improved), defined as control participants; and patients with persistent complaints (score 3–7, slightly improved to worse than ever), defined as cases.

After providing written informed consent, patients were included, asked to fill in an online questionnaire, and were invited for a physical and radiological examination, consisting of radiography and MRI of the injured ankle. Findings from the physical examination were not used for the purpose of the current study.

Measurements

The standardised questionnaire contained questions on patient characteristics (age, sex, body mass index [BMI], and education level), the initial ankle sprain (side, history of previous injuries, and activity that caused the sprain), local symptoms such as swelling (place and severity), and current complaints including pain severity (numeric rating scale [NRS-11]), subjective feeling of instability (yes/no), and function (Ankle Function Score, 0 representing the worst possible and 100 representing the best possible function).[13]

The radiological examination consisted of a standard anterior-posterior and lateral (non-weight-bearing) radiograph of the injured ankle followed by a routine ankle MRI (1.5 Tesla) of the injured ankle.

All X-rays and MRIs were scored by one musculoskeletal radiologist, using a standardised scoring form. A random subsample of 32 X-rays and MRIs was scored by a second musculoskeletal radiologist to determine the inter-observer reliability. The inter-observer reliability was calculated using Cohen's kappa (range 0.653–1.00) between the different items. The percentage agreement was 99.1% (1681 of the 1696 scored items) and 98.8% (5883 of 5952) for the radiography and MRI items, respectively. Both radiologists were blinded for the clinical scores and group status.

On radiography and MRI the following osseous structures were examined: medial and lateral malleolus, surface of the tibia at the tibiotalar joint, talus at the talocrural joint, subtalar joint, and os naviculare at the talonavicular joint.

Structural abnormalities scored from the radiography included fractures, osteophytes, subchondral cysts, sclerosis, osteochondral lesions (only in the talocrural joint), cartilage loss (only scored in the talocrural joint), joint space narrowing, hydrops, the presence of a loose body, and soft tissue swelling.

MRIs were scored for the same items, as well as for the presence of bone marrow oedema, cartilage loss, and osteochondral lesions for all joints round the ankle. Furthermore, the presence of synovitis and anterolateral impingement was examined on MRI. Muscles, peroneal tendons, and the anterior/posterior tibiofibular and talofibular ligaments, calcaneofibular ligament, deltoid ligament, and the plantar calcaneonavicular (spring) ligament were assessed.

On radiography and MRI, the presence of soft tissue calcification was assessed in the region of the medial malleolus, lateral malleolus, talus, and navicular bone. All possible structural abnormalities on radiography and MRI were scored from 0 to 2: 0 = absent, 1 = possibly present, and 2 = evidently present. The talocrural joint, subtalar joint, and talonavicular joint were scored for signs of osteoarthritis using the 0–4 point Kellgren and Lawrence (KL) score (0 = absent, 1 = doubtful, 2 = mild, 4 = severe),[14] and bone marrow oedema was scored as absent, subchondral present, and bone bruise volume <25%, 25–50%, 50–75%, and >75%. Tendons (peroneus longus and brevis tendon) and ligaments were scored as normal, thickened, partial tear, total tear, and (in the case of the peroneus brevis tendon) split tendon. The large numbers of radiography and MRI item scores were reduced by clustering the osseous structures into talocrural joint, subtalar joint, talonavicular joint, and talus.

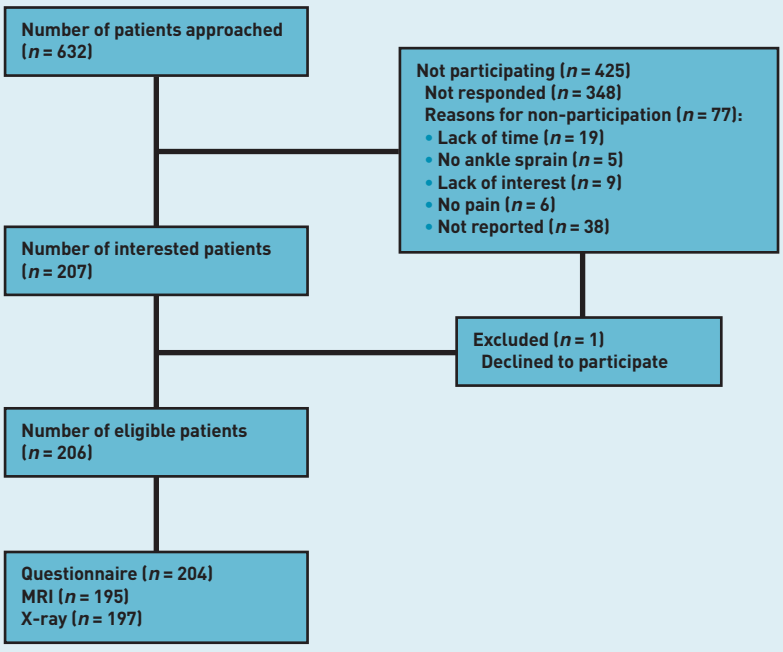
Statistics

To compare characteristics of patients with and without persistent complaints, differences between both groups were tested with an independent sample *t*-test for continuous variables and a χ^2 test for dichotomous variables.

Logistic regression was applied to determine the association between radiography and MRI findings and persistent complaints. All analyses were adjusted for potential confounders age, sex, and BMI.

All data were analysed using SPSS (version 20.0). For all analyses, $P<0.05$ was defined as statistically significant.

Figure 1. Flowchart of the study.



RESULTS

A total of 632 patients were selected from the medical files of 84 GPs; these patients were approached and asked to participate in the study. Finally, 206 patients were included in the study: 98 patients reported persistent complaints and 108 patients reported no persistent complaints (Figure 1). From this total, 204 patients completed the questionnaire, radiography was performed in 197 patients, and MRI was performed in 195 patients (Figure 1). The time between inclusion and the physical examination, radiography, and MRI ranged from 2–77 (median 7) days.

Baseline characteristics

The mean age of the total study population was 37 (SD 14.7) years and consisted of 87 males (42.2%) (Table 1). The right ankle was the most frequently injured ankle (55.8%). Of the participants, 6% had a previous ankle sprain in their former history but with no significant difference between the two groups. Patients with persistent complaints had a significantly higher BMI (26.9 kg/m^2) than the control group (24.9 kg/m^2).

Patients with persistent complaints had higher pain scores both in rest and during exercise (1.9 and 3.6, respectively) and the Ankle Function Score was significantly lower ($P<0.001$) compared with patients without complaints (0.4 and 1.25, respectively).

Radiological findings

Radiography. In the talocrural joint, possible and evident osteophytes were seen in 47.9% of the patients with persistent complaints compared with 46.6% in the control group. Moreover, 44.7% of the patients with persistent complaints and 45.7% of the patients without persistent complaints had a KL grade of at least 1, with no significant difference between the groups (Table 2).

At the talonavicular joint, a prevalence of possible and evident osteophytes of 41.5% and 46.6%, respectively, was found in patients with and without persistent complaints and 39.4% and 46.6% of the patients, respectively, had a KL grade of at least 1. In addition, 30.9% of the cases and 41.7% of the control participants had sclerosis.

After adjustment for age, sex, and BMI, no

Table 1. Patient characteristics, *n* (%) (unless otherwise stated)

	Total (*n* = 206)	Persistent symptoms (*n* = 98)	No symptoms (*n* = 108)	*P*-value
Mean age (SD), years	37.33 (14.67)	36.14 (14.51)	38.41 (14.80)	0.270
Sex, male	87 (42.2)	36 (36.7)	51 (47.2)	0.128
BMI (SD), kg/m^2	25.77 (4.80)	26.92 (5.51)	24.94 (4.04)	0.006[a]
Education level				0.056
Lower	124 (60.2)	65 (66.3)	59 (54.6)	
Higher	80 (38.8)	31 (31.6)	49 (45.4)	
Sport participation, yes	119 (57.8)	35 (35.7)	84 (77.8)	
Side of ankle sprain, right	115 (55.8)	59 (60.2)	56 (51.9)	0.228
Previous ankle sprain	96 (46.6)	49 (50.0)	47 (43.5)	0.277
Ankle sprain during:				0.926
Sport	75 (36.4)	36 (36.7)	39 (36.1)	
Work	26 (12.6)	13 (13.3)	13 (12.0)	
Hobby	14 (6.8)	5 (5.1)	9 (8.3)	
Task around the house	10 (4.9)	4 (4.1)	6 (5.6)	
Traffic participation	21 (10.2)	9 (9.2)	12 (11.1)	
Other	56 (27.2)	28 (28.6)	28 (25.9)	
Ankle swollen after sprain				0.373
No	13 (6.3)	7 (7.1)	6 (5.6)	
Slight	47 (22.8)	18 (18.4)	29 (26.9)	
Serious	142 (68.9)	70 (71.4)	72 (66.7)	
Unknown	4 (1.9)	3 (3.1)	1 (0.9)	
Place swelling after sprain				0.080
Medial side	20 (9.7)	13 (13.3)	7 (6.5)	
Lateral side	169 (82)	75 (76.5)	94 (87.0)	
Other place	17 (8.3)	10 (10.2)	7 (6.5)	
Most pain after sprain				0.113
Medial side	25 (12.1)	12 (12.2)	13 (12.0)	
Lateral side	109 (52.9)	42 (42.9)	67 (62.0)	
Frontal side	14 (6.8)	9 (9.2)	5 (4.6)	
Caudal side	7 (3.4)	5 (5.1)	2 (1.9)	
Other place	51 (24.8)	30 (30.6)	21 (19.4)	
Instability after sprain				0.020[a]
Yes	170 (82.5)	86 (87.8)	84 (77.8)	
Pain score at baseline (SD)				
In rest, VAS 0–10	1.11 (1.83)	1.87 (2.20)	0.44 (1.03)	<0.001[a]
During exercise, VAS 0–10	2.37 (2.46)	3.62 (2.62)	1.25 (1.64)	<0.001[a]
Ankle Function Score at baseline, AFS 0–100[a]	73.45 (20.50)	62.47 (20.24)	82.90 (15.44)	<0.001[a]
Baseline recovery score				na
Completely recovered	36 (17.5)	-	36 (33.3)	
Greatly improved	72 (35.0)	-	72 (66.7)	
Slightly improved	52 (25.2)	52 (53.1)	-	
The same	17 (8.3)	17 (17.3)	-	
Slightly deteriorated	21 (10.2)	21 (21.4)	-	
Sharply deteriorated	6 (2.9)	6 (6.1)	-	
Worse than ever	2 (1.0)	2 (2.0)	-	

BMI = body mass index. VAS = visual analogue scale. [a]Statistically significant difference. na = not applicable.

significant differences were found for any of the radiographic scores between the patients with and without persistent complaints.

MRI. Bone oedema was most frequently seen in the talocrural and subtalar joints in patients with and without persistent complaints (26.6% versus 40.6% and 28.7% versus 31.7%, respectively) (Table 3). Osteophytes were most frequently seen in the talonavicular joint in patients with and without persistent complaints (48.9% and 59.4%, respectively).

A KL grade of at least 1 was present most frequently in the talocrural and talonavicular joints in patients with and without persistent complaints (40.4% versus 42.5% and 49% versus 61.3%, respectively). In the talocrural joint, 13.8% of the participants with persistent complaints and 5.9% of the participants without persistent complaints had a KL grade of at least 2. Nearly half of the patients (44.7% of cases and 49.5% of controls) had sclerosis in the talonavicular joint on MRI. In both groups, the two ligaments most often affected were the ATFL and the calcaneofibular ligament.

After adjustment for age, sex, and BMI, no significant differences were found in any of the MRI items between the patients with and without persistent complaints.

DISCUSSION

Summary

Overall, on radiography as well as on MRI, a large percentage of structural abnormalities were found in patients with and patients without persistent complaints after a sustained ankle sprain. These structural abnormalities were predominantly present in the talocrural and talonavicular joint. No differences were found, however, between patients with and patients without persistent complaints in the prevalence of structural abnormalities.

Strength and limitations

This is the first study in general practice, including patients with and without complaints after a lateral ankle sprain, to compare associations with structural abnormalities on radiography and MRI. It was not possible, unfortunately, to make a comparison with a control group without a history of a lateral ankle sprain.

Based on the literature, it was expected that a 1:3 ratio of patients with and without persistent complaints would be found.[8] As 47.5% of the study population consisted of patients with persistent complaints, however, this suggests a possible selection bias. This may be caused by the willingness of patients with persistent complaints to participate in a study. However, despite the possible selection bias, a representative control group was included from general practice without persistent complaints, and the study was sufficiently powered to demonstrate potential differences between the two study groups.

Table 2. Prevalence of abnormalities on radiography in patients with and without persistent symptoms

		Total (*n* = 197)		Persistent symptoms (*n* = 94)		No symptoms (*n* = 103)		
		n	%	*n*	%	*n*	%	*P*-value[a]
Talocrural joint								
Fracture:[b]	• Present	6	3.0	3	3.2	3	2.9	0.98
Osteophyte:[b]	• Possibly	63	32.0	33	35.1	30	29.1	0.73
	• Evident	30	15.2	12	12.8	18	17.5	
Subchondral cyst:[b]	• Present	1	0.5	1	1.1	0	0.0	0.98
Sclerosis:[b]	• Present	3	1.5	2	2.1	1	1.0	0.54
Osteochondral lesion:[b]	• Present	3	1.5	1	1.1	2	1.9	0.98
Cartilage loss:[b]	• Present	2	1.0	2	2.1	0	0.0	0.97
Joint space narrowing:[c]	• Present	17	8.6	8	8.5	9	8.7	0.89
Kellgren and Lawrence score:[b]	• Normal	106	53.8	51	54.3	55	53.4	0.82
	• Grade 1	70	35.5	31	33.0	39	37.9	
	• ≥ Grade 2	19	9.6	11	11.7	8	7.8	
Subtalar joint								
Fracture:[c]	• Present	0	0.0	0	0.0	0	0.0	0.81
Osteophyte:[c]	• Possibly	3	1.5	0	0.0	3	2.9	0.99
	• Evident	3	1.5	0	0.0	3	2.9	
Subchondral cyst:[c]	• Present	0	0.0	0	0.0	0	0.0	0.81
Sclerosis:[c]	• Present	11	5.6	4	4.3	7	6.8	0.96
Joint space narrowing:[c]	• Present	1	0.5	0	0.0	1	1.0	0.97
Kellgren and Lawrence score:[c]	• Normal	188	95.4	93	98.9	95	92.2	0.96
	• Grade 1	6	3.0	0	0.0	6	5.8	
Talonavicular joint								
Fracture:[d]	• Present	0	0.0	0	0.0	0	0.0	0.31
Osteophyte:[d]	• Possibly	67	34.0	30	31.9	37	35.9	0.72
	• Evident	20	10.2	9	9.6	11	10.7	
Subchondral cyst:[d]	• Present	0	0.0	0	0.0	0	0.0	0.31
Sclerosis:[d]	• Present	72	36.5	29	30.9	43	41.7	0.35
Joint space narrowing:[d]	• Present	17	8.6	8	8.5	9	8.7	0.58
Kellgren and Lawrence score:[d]	• Normal	107	54.3	56	59.6	51	49.5	0.56
	• Grade 1	74	37.6	33	35.1	41	39.8	
	• ≥ Grade 2	11	5.6	4	4.3	7	6.8	
Calcification								
Medial malleolus:[b]	• Present	14	7.1	6	6.4	8	7.8	0.98
Lateral malleolus:[b]	• Present	24	12.2	9	9.6	15	14.6	0.65
Talus:[c]	• Present	10	5.1	3	3.2	7	6.8	0.56
Navicular bone:[c]	• Present	19	9.6	7	7.4	12	11.7	0.50
Other								
Joint effusion:[c]	• Present	5	2.5	0	0.0	5	4.9	0.96
Loose body:[c]	• Present	6	3.0	2	2.1	4	3.9	0.93
Soft tissue swelling:[b]	• Present	2	1.0	1	1.1	1	1.0	0.93

[a]Analyses adjusted for age, sex, and BMI. [b]Missing data: Total/Persistent symptoms/Without persistent symptoms = 2 (1.0%)/1 (1.1%)/1 (1.0%). [c]Missing data: Total/Persistent symptoms/Without persistent symptoms = 3 (1.5%)/1 (1.1%)/2 (1.9%). [d]Missing data: Total/Persistent symptoms/Without persistent symptoms = 5 (2.5%)/1 (1.1%)/4 (3.9%).

Although the chosen definition for persistent complaints based on the outcome measure 'recovery' is debatable, it is frequently applied in other studies.[15,16] Consequently, 47.5% of the study population were defined as patients with persistent complaints; however, only half of these were completely recovered according to the Likert scale.

Comparison with existing literature

To the authors' knowledge, this is the first study to compare patients from primary care with and without complaints persisting at least 6 months after an ankle injury, regarding structural abnormalities on MRI and radiography. It is difficult, therefore, to compare the study outcomes with previous reports.

A relatively high prevalence of structural abnormalities was found in both study groups. Several studies in secondary care investigated pathologies in patients with persistent complaints after an ankle sprain.[17] Based on arthroscopic findings of patients undergoing lateral ankle stabilisation surgery, synovitis (100%),

Table 3. Prevalence of abnormalities on MRI in patients with and without persistent symptoms

		Total (*n* = 195)		Persistent symptoms (*n* = 94)		No symptoms (*n* = 101)		
		n	%	*n*	%	*n*	%	*P*-value[a]
Talocrural joint								
Fracture:	• Present	8		4		4		0.46
Bone oedema:	• Subchondral	17	8.7	8	8.5	9	8.9	0.25
	• <25%	33	16.9	11	11.7	22	21.8	
	• >25	16	8.2	6	6.4	10	9.9	
Osteochondral lesion:	• Present	11	5.6	6	6.4	5	5.0	0.61
Osteophyte:	• Slightly	57	29.2	24	25.5	33	32.7	0.37
	• Evident	20	10.3	11	11.7	9	8.9	
Subchondral cyst:	• Present	4	2.1	3	3.2	1	1.0	0.16
Cartilage loss:	• Present	20	0.3	8	8.5	12	11.9	0.60
Sclerosis:	• Present	4	2.1	1	1.1	3	3.0	0.48
Kellgren and Lawrence score:	• Normal	114	58.5	56	59.6	58	57.4	0.16
	• Grade 1	62	31.8	25	26.6	37	36.6	
	• ≥ Grade 2	19	9.7	13	13.8	6	5.9	
Subtalar joint								
Fracture:	• Present	0	0.0	0	0.0	0	0.0	0.15
Bone oedema:	• Subchondral	11	5.6	6	6.4	5	5.0	0.83
	• <25%	39	20.0	18	19.1	21	20.8	
	• >25	9	4.6	3	3.2	6	5.9	
Osteochondral lesion:	• Present	1	0.5	1	1.1	0	0.0	1.00
Osteophyte:	• Slightly	12	6.2	3	3.2	9	8.9	0.18
	• Evident	5	2.6	1	1.1	4	4.0	
Subchondral cyst:	• Present	5	2.6	3	3.2	2	2.0	0.29
Cartilage loss:	• Present	5	2.6	1	1.1	4	4.0	0.35
Sclerosis:	• Present	15	7.7	3	3.2	12	11.9	0.05
Kellgren and Lawrence score:	• Normal	178	91.3	90	95.7	88	87.1	0.67
	• Grade 1	17	8.7	4	4.3	13	12.9	
Talonavicular joint								
Fracture:	• Present	2	1.0	2	2.1	0	0.0	1.00
Bone oedema:	• Subchondral	3	1.5	2	2.1	1	1.0	0.76
	• <25%	15	7.7	8	8.5	7	6.9	
	• >25	8	4.1	5	5.3	3	3.0	
Osteochondral lesion:	• Present	0	0.0	0	0.0	0	0.0	0.15
Osteophyte:	• Slightly	84	43.1	36	38.3	48	47.5	0.59
	• Evident	22	11.3	10	10.6	12	11.9	
Subchondral cyst:	• Present	1	0.5	0	0.0	1	1.0	1.00
Cartilage loss:	• Present	39	20.0	17	18.1	22	21.8	0.59
Sclerosis:	• Present	92	47.2	42	44.7	50	49.5	0.39
Kellgren and Lawrence score:	• Normal	87	44.6	48	51.1	39	38.6	0.45
	• Grade 1	80	41.0	34	36.2	46	45.5	
	• ≥ Grade 2	28	14.4	12	12.8	16	15.8	
Calcification								
Medial malleolus:	• Present	12	6.2	5	5.3	7	6.9	0.77
Lateral malleolus:	• Present	21	10.8	7	7.4	14	13.9	0.33
Talus:	• Present	9	4.6	2	2.1	7	6.9	0.14
Os naviculare:	• Present	19	9.7	8	8.5	11	10.9	0.61
Other								
Hydrops:	• Present	68	34.9	33	35.1	35	34.7	0.99
Anterolateral impingement:	• Present	22	11.3	10	10.6	12	11.9	0.73
	• Missing	2	1.0	1	1.1	1	1.0	
Synovitis:	• Present	1	0.5	0	0.0	1	1.0	1.00
Corpus liberum:	• Present	2	1.0	1	1.1	1	1.0	0.83
Soft tissue swelling:	• Present	20	10.3	8	8.5	12	11.9	0.57
	• Missing	5	2.6	3	3.2	2	2.0	
Tendons of muscles								
Peroneus longus[b]:	• Affected	1	0.5	0	0.0	1	1.0	1.00
Peroneus brevis[b]:	• Affected	2	1.0	1	1.1	1	1.0	1.00

continued ...

Table 3 Continued. Prevalence of abnormalities on MRI in patients with and without persistent symptoms

		Total (*n* = 195)		Persistent symptoms (*n* = 94)		No symptoms (*n* = 101)		
		n	%	*n*	%	*n*	%	*P*-value[a]
Ligaments								
Anterior tibiofibular:[c]	• Normal	170	87.2	83	88.3	87	86.1	0.97
	• Thickened	20	10.3	9	9.6	11	10.9	
	• Partial tear	1	0.5	0	0.0	1	1.0	
	• Total tear	1	0.5	1	1.1	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	
Posterior tibiofibular:[c]	• Normal	187	95.9	89	94.7	98	97.0	0.80
	• Thickened	4	2.1	3	3.2	1	1.0	
	• Partial tear	0	0.0	0	0.0	0	0.0	
	• Total tear	1	0.5	1	1.1	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	
Anterior talofibular:[d]	• Normal	85	43.6	43	45.7	42	41.6	0.44
	• Thickened	77	39.5	37	39.4	40	39.6	
	• Partial tear	22	11.3	11	11.7	11	10.9	
	• Total tear	10	5.1	3	3.2	7	6.9	
	• Oedema	0	0.0	0	0.0	0	0.0	
Posterior talofibular:[d]	• Normal	193	99.0	94	100.0	99	98.0	1.00
	• Thickened	1	0.5	0	0.0	1	1.0	
	• Partial tear	0	0.0	0	0.0	0	0.0	
	• Total tear	0	0.0	0	0.0	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	
Calcaneofibular:[d]	• Normal	121	62.1	59	62.8	62	61.4	0.97
	• Thickened	72	36.9	35	37.2	37	36.6	
	• Partial tear	1	0.5	0	0.0	1	1.0	
	• Total tear	0	0.0	0	0.0	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	
Deltoid:[d]	• Normal	173	88.7	85	90.4	88	87.1	0.94
	• Thickened	19	9.7	8	8.5	11	10.9	
	• Partial tear	2	1.0	1	1.1	1	1.0	
	• Total tear	0	0.0	0	0.0	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	
Plantar calcaneonavicular (Spring):	• Normal	195	100.0	94	100.0	101	100.0	na
	• Thickened	0	0.0	0	0.0	0	0.0	
	• Partial tear	0	0.0	0	0.0	0	0.0	
	• Total tear	0	0.0	0	0.0	0	0.0	
	• Oedema	0	0.0	0	0.0	0	0.0	

[a]Analyses adjusted for age, sex, and BMI. na = not applicable. [b]Missing data: Total/ Persistent symptoms/ Without persistent symptoms = 2 (1.0%)/0 (0.0%)/2 (2.0%). [c]Missing data: Total/ Persistent symptoms/ Without persistent symptoms = 3 (1.5%)/1 (1.1%)/2 (2.0%). [d]Missing data: Total/ Persistent symptoms/ Without persistent symptoms = 1 (0.5%)/0 (0.0%)/1 (1.0%).

osteochondral defects (7%), loose bodies (11%), anterolateral impingement (14%), and anterior tibial osteophytosis (14%) were frequently reported.[17,18] Other studies found intra-articular lesions on arthroscopy in 90–97% of the patients seen in secondary care.[19,20] The percentages of abnormalities found in these latter studies are much higher compared with those of the present study. Although this difference could be attributed to the techniques applied, it is most likely caused by the different study populations.[20]

In addition to the frequent abnormalities found in the ligaments, structural damage was also frequently seen in the bone and cartilage. Most apparent are the findings in the talocrural and talonavicular joints. Early signs of osteoarthritis, manifested as osteophytes, cartilage loss, and a KL grade of at least 1, were frequently seen in this relatively young and healthy patient population. This might imply that an injury in primary care, often regarded as self-limiting, could result in significant structural damage; however, it is unknown whether such damage can lead to serious problems at a later age.

In the present study, a 7-point Likert scale was used to classify patients into the two study groups. Van Rijn *et al* (2011) investigated the explanatory variables for reported recovery according to this scale in patients with acute ankle sprains, and found an association between differences in pain intensity and a feeling of 'giving way' during high ankle load activities and

reported recovery.[21] Analyses of the present study were replicated, therefore, according to a classification based on pain (NRS ≤2) and instability (yes or no) outcomes (data not presented). These analyses showed similar findings: no differences were found between patients with or without pain, and with or without instability, regarding the structural abnormalities. This might be related to the relatively large percentage of patients with combined persistent complaints expressed in pain, function, and instability. When classifications of persistent complaints and pain were compared, 75% of patients with persistent complaints reported pain. Comparing patients on the classification of persistent complaints and instability showed that 65% of patients without persistent complaints still reported instability; however, 80% of patients with persistent complaints also reported complaints of instability. This indicates the variety of persistent complaints in patients after a lateral ankle sprain and suggests that the terminology often applied for persistent complaints, that is chronic instability, may not be appropriate for this total group.

Implications for research and practice

Persistent complaints are frequently seen after a lateral ankle sprain. When patients consult their GP, however, further examination with imaging will not assist in diagnosing the explicit reason for the persistent complaints. It is doubtful whether structural abnormalities seen on radiography or MRI are associated with the persisting complaints for which the patient consults the GP.

Structural abnormalities on radiography and MRI are very common after a lateral ankle sprain in patients presenting in general practice within 6–12 months after an ankle sprain. These structural abnormalities are not associated with persistent complaints, however. These findings are important for clinical practice, as the current concept of an ankle sprain is that it is associated with a greater risk of structural damage in the ankle. Investigation of other potential associations with persistent complaints is needed for targeting better diagnosis and treatment of lateral ankle sprains.

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Competing interests

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