ORIGINAL CONTRIBUTION

Effects of Ankle Sprain in a General Clinic Population 6 to 18 Months After Medical Evaluation

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Objective: To assess the 1-year outcome of standard medical care of acute ankle sprains in a general clinic-based population.

Design: A self-administered survey was mailed to all adult patients who presented to a health system provider for evaluation of ankle sprain.

Setting: A regional primary care health system.

Participants: Four hundred sixty-seven (66.5%) of 702 patients with ankle sprains evaluated by a system physician from April 1, 1995, to March 31, 1996.

Main Outcome Measures: Prevalence and severity of self-reported ankle pain, swelling, perceived instability, and perceived weakness 6 to 18 months after medical evaluation.

Results: Most patients sought medical evaluation shortly after injury and were immobilized or braced; 32.7% reported formal or home-based physical therapy. Six to 18 months after injury, 72.6% reported residual symptoms. Of these, 40.4% reported at least 1 moderate to severe symptom, most commonly perceived ankle weakness; 40.3% were unable to walk 1 mile; and 43.3% were unable to jump or pivot on the ankle without symptoms. Factors associated with moderate to severe residual symptoms were reinjury of the ankle (odds ratio [OR], 7.21; 95% confidence interval [CI], 4.14-12.68), activity restriction longer than 1 week (OR, 2.04; 95% CI, 1.25-3.32), and limited weight bearing longer than 28 days (OR, 2.16; 95% CI, 1.28-3.63).

Conclusions: Residual lifestyle-limiting symptoms are common 6 to 18 months after an ankle sprain. Ankle sprains may be more problematic than generally thought, or standard medical treatment may be inadequate. Further studies evaluating treatment regimens are needed to identify effective methods to reduce the long-term functional limitations of ankle sprain in general clinic populations.

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ANKLE SPRAINS, typically ankle inversion injuries,[1] are common orthopedic conditions frequently evaluated and treated by health care providers. More than 23 000 people per day, including athletes and nonathletes, require medical care for ankle sprains in the United States,[2] although incident cases have been estimated at 1 per 10 000 persons per day.[3] Despite the estimated level of follow-up medical care, ankle sprains are considered undertreated by the medical community.[1]

Physiological characteristics influence the likelihood of ankle sprain. In military recruits, ankle sprains were more likely among those with a history of ankle sprain and those with a higher body mass index.[4] In athletes, muscle strength imbalance across the ankle joint, such as an elevated eversion-to-inversion strength ratio or low ratio of dorsiflexion to plantar flexion strength, was associated with increased incidence of ankle sprain injury during the next athletic season.[5] Additional characteristics implicated in ankle sprain among athletes include an imbalance in weight distribution during standing or an abnormal Q-angle of the knee.[6]

Although some individuals return to normal function in a short time after an ankle sprain, previous studies suggest that residual signs and symptoms may be expected. Among young military recruits sustaining a moderate or severe ankle sprain, 44% reported pain or giving way 1 year after injury, regardless of management technique.[7,8] Among Chinese athletes, residual ankle pain, instability, and

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SUBJECTS, MATERIALS, AND METHODS

The St Mary's–Duluth Clinic Health System (SMDC) is a comprehensive regional health care system serving northeastern Minnesota and northwestern Wisconsin, a service area of 450 000 people. Health care financing among SMDC patients is approximately 33% government programs and 67% third-party payers or self-pay. A small percentage of patients participate in a health maintenance organization. Employing 300 physicians, the SMDC includes neighborhood primary care clinics, a multispecialty secondary care clinic, and a tertiary care hospital in the city of Duluth, Minn.

STUDY SAMPLE

Patients with ankle sprains were identified from the computerized record system. All adult patients residing in the cities of Duluth (population, 85 000) or Superior, Wis (population, 20 000), and having at least 1 appointment with an SMDC physician for evaluation of an ankle sprain (*International Classification of Diseases, Ninth Revision,* codes 845.0-845.09) from April 1, 1995, to March 31, 1996, were eligible for inclusion (n = 778). Children were excluded due to the necessity and difficulty of obtaining parental consent before surveying minors. Patients were excluded from all analyses if they were noncontactable (n = 38) or reported never seeing a physician for an ankle sprain (n = 38). Four hundred sixty-seven of the remaining 702 patients completed the survey (response rate, 66.5%) and are the focus of this report. The study was approved by the institutional review board of the SMDC.

DATA COLLECTION

A self-administered survey was mailed to all eligible patients in mid-October 1996. Nonrespondents were resurveyed 2 weeks later; persistent nonrespondents were resurveyed 2 weeks after the second mailing. Data collection closed February 28, 1997.

VARIABLES OF INTEREST

Sociodemographic and Initial Injury Characteristics

The first medical visit for an ankle sprain during the study period was considered the index visit. The index visit date was included on the survey as a reference for the study participant. Participants were asked to provide their age at the time the survey was completed, their sex, and whether the index visit was for an initial injury to the ankle. They were also asked to identify the mechanism of injury as a fall, slipping or tripping, competitive or recreational sports participation, or a motor vehicle crash.

Acute Management and Functional Limitations

The type of immobilization was categorized as an elastic wrap, an air splint, a laced brace, or casting. The 7 categories available for describing duration of immobilization and duration of restricted activity ranged from 0 to more than 29 days.

Prevalence of any ankle-restricted activity such as job tasks, classroom participation, housekeeping, social events, and recreational or competitive sports was evaluated immediately after injury.

Medical Care and Management

Physician utilization was assessed as time from the injury to the first physician appointment, the number of ankle-related physician appointments, and the type of physician specialty involved in the management of the ankle injury.

Treatment options evaluated included physical therapy, chiropractic, and acupuncture and the number of visits for each. For patients reporting physical therapy, the type of treatment was assessed, including therapeutic exercise; home exercise prescription; modalities such as heat, cold, and electrical stimulation; crutch training; and taping or splinting.

Reinjury and Other Residual Signs and Symptoms of Ankle Sprain

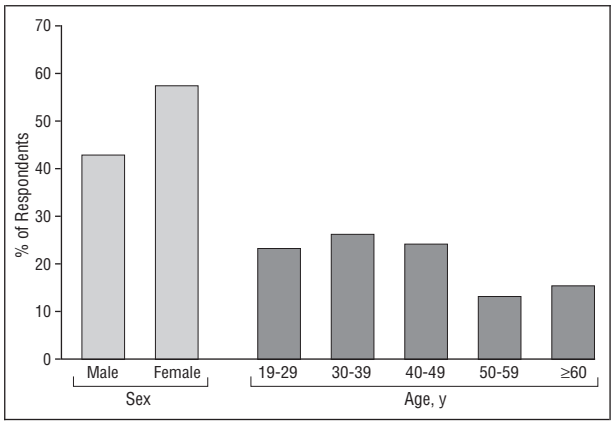
Reinjury of the ankle during the study period and the number of reinjuries were assessed. Presence and severity of ankle pain, ankle swelling, ankle instability (ie, giving way), and ankle weakness were classified as none, mild, moderate, or severe. Signs and symptoms were the patient's self-reported perception and subjective assessment of ankle status. Symptoms were collapsed into 3 categories: none, mild, and moderate to severe due to the clinical relevance of moderate symptoms and the lower prevalence of severe symptoms. The presence of any 1 of the 4 symptoms at a moderate to severe level was noted.

Mobility was determined by assessing the participant's ambulation ability without assistive devices, pain, or limping. In addition, subjects reported their ability to turn or jump on their ankle without symptoms. Self-reported use of pain medication was documented.

STATISTICAL ANALYSIS

Prevalence estimates and χ^2 analyses were computed using SAS PROC FREQ.[13] The bivariate relationship between sociodemographic and injury characteristics, medical experience, postinjury immobilization or bracing, functional limitations, and presence of moderate to severe residual signs and symptoms were evaluated using SAS PROC LOGISTIC.[13] Stepwise logistic regression was used to evaluate the multivariate relationship of significant bivariate factors with moderate to severe residual symptoms; final estimates were determined using a non–stepwise logistic regression model. Surgical cases were excluded from analyses of residual symptoms due to marked differences in injury severity and case management.

weakness were reported by 30%, 20%, and 17%, respectively, although time since injury was not presented.[9] In nonathletic patients treated in an orthopedic surgery department, 39% reported pain 6.5 years after injury, regardless of the grade of ankle sprain.[10,11] Ankle instability 11 years after injury was evident in 6% of patients experiencing a grade 3 ankle sprain, regardless of surgical or conservative management.[12]



Age and sex distribution of respondents with ankle sprains.

Previous studies, however, may not reflect the full range and impact of residual symptoms in the general clinic population. Samples limited to patients with the most severe cases,[12] patients treated in an orthopedic surgery department,[10] younger people,[7,8] or sports participants[9] may not reflect the experience and outcome of patients treated in a general medical clinic.

This study evaluates the outcome of ankle sprain treatment in a community health care system by answering the following questions: (1) How are ankle sprains treated initially? (2) What type of follow-up treatment is implemented? (3) How common are residual signs and symptoms 6 to 18 months later? and (4) Are patients with ankle sprains limited by residual ankle symptoms 6 to 18 months later?

RESULTS

CHARACTERISTICS OF THE STUDY SAMPLE

Respondents were 57.3% female; mean (SE) age was 38.2 (0.9) years (range, 19-91 years). Whereas most patients were younger than 50 years, a substantial proportion was older than 50 years (**Figure**).

Most of the index ankle sprain visits were the first injury to the ankle (61.3%), not reinjuries. Falls, slipping, or tripping accounted for 73.8% of ankle sprains, with 24.4% due to motor vehicle crashes and 1.8% sports related. Respondents reporting a sports-related ankle injury were younger compared with those reporting a motor vehicle–related mechanism of injury or a fall (mean ages, 33.1, 36.4, and 39.5 years, respectively). Mean (SE) duration of time between the index appointment and survey was 12.8 (0.3) months (range, 6-18 months).

ACUTE MANAGEMENT OF ANKLE SPRAIN

Most patients reported seeking medical evaluation during the acute phase of the ankle sprain, although 9.5% delayed initial medical evaluation by more than 2 weeks (**Table 1**). Virtually all patients reported some type of immobilization or bracing, usually an air splint and an elastic wrap. Duration of immobilization typically exceeded 1 week.

Table 1. Characteristics of the Early Management of Ankle Sprain

Characteristics	% of Respondents
Days from injury to initial physician visit	
<1	40.8
1-2	30.2
3-7	14.0
8-14	5.4
15-28	5.0
>28	4.5
Immobilization or bracing	
Any technique used	92.0
Method	
Air splint	44.0
Elastic wrap*	43.4
Lace-up brace	25.0
Walking cast	23.1
Duration of immobilization, d	
<1	3.2
1-2	6.5
3-7	24.2
8-14	20.3
15-28	18.0
>28	27.7
Duration of restricted weight bearing, d	
Never	8.1
<1	4.4
1-2	11.8
3-7	22.3
8-14	14.0
15-28	16.4
>28	23.0
Duration of activity restriction, d	
Never	5.4
<1	2.0
1-2	8.3
3-7	21.7
8-14	13.9
15-28	13.6
>28	35.1

**Includes bracing held in place with an elastic wrap.*

Restricted weight bearing after injury was common; most participants reported more than 1 week of restricted weight bearing. Activity restriction for more than 28 days was reported by 35.1% of the respondents.

USE OF MEDICAL SERVICES

Most patients were treated by their family physician or emergency department physician; few reported seeing a sports medicine physician (**Table 2**). Most patients reported 1 ankle sprain–related physician visit; however, 3 or more physician visits were reported by almost a third of all patients, and 11.6% reported at least 5 visits.

Treatment with chiropractic and acupuncture was rare, although physical therapy was reported by almost a third of the patients. Therapeutic exercise and home exercise prescription were the most common treatment procedures. Of those reporting physical therapy, a single visit was reported by 31.5%; more than 6 visits were reported by 28.2%.

Table 2. Self-Reported Medical Service Utilization by Patients With Ankle Sprain

Services	% of Respondents
Physician utilization	
Medical specialties included in management	
Family practitioners	51.4
Emergency department physicians	44.4
Orthopedic surgeons	24.7
Sports medicine physicians	12.5
Internal medicine practitioners	7.4
No. of ankle-related physician visits since the injury	
Index visit only	55.9
2	13.2
3-5	19.2
>5	11.6
Treatment during the study	
Acupuncture	2.1
Surgery	3.5
Chiropractic	4.1
Physical therapy	32.7
Characteristics of physical therapy	
No. of physical therapy visits	
1	31.5
2	10.7
3-6	29.5
7-12	12.1
>12	16.1
Physical therapy type	
Therapeutic exercise	76.7
Home exercise prescribed	75.3
Modalities (heat, cold)	46.6
Crutch training	30.2

Table 3. Signs and Symptoms of Ankle Sprain 6 to 18 Months After Medical Evaluation

Signs and Symptoms	% of Respondents
Reinjury during the study period	
Any reinjury to the index ankle	19.4
No. of reinjuries among the reinjured	
1	34.8
2	33.7
3-5	17.4
>5	14.1
Residual symptoms	
Mild, moderate, or severe	
Any	72.6
Ankle instability	40.4
Ankle weakness	59.6
Pain	51.1
Swelling	36.3
Moderate or severe only	
Any	40.4
Ankle instability	23.3
Ankle weakness	33.8
Pain	23.2
Swelling	15.9
Physical signs	
Unable to turn or jump on ankle without symptoms	43.3
Unable to ambulate a mile without pain or limping	40.3
Taking medications for ankle symptoms	11.4

RESIDUAL SIGNS AND SYMPTOMS

Reinjury of the ankle during the study period was reported by 19.4% of respondents, primarily younger participants. Most of these patients reported more than 1 reinjury (**Table 3**).

Residual symptoms 6 to 18 months after injury were reported by most respondents, although about half reported mild symptoms only. At least 1 moderate to severe symptom, most commonly perceived ankle weakness, was reported by 40.4% of the respondents (Table 3). Other symptoms were more likely to be mild.

Functional limitations were common. Ambulation was markedly compromised, as was the ability to jump, turn, or pivot on the ankle without symptoms. Slightly more than thirty-eight percent (38.4%) of patients reported current activity limitations as a result of their previous ankle sprain. Medication use to manage ankle pain persisted 6 to 18 months later.

CLINICAL FACTORS ASSOCIATED WITH MODERATE TO SEVERE RESIDUAL SIGNS AND SYMPTOMS

Multivariate analysis revealed moderate to severe residual symptoms were related to reinjury of the ankle during the study period, postinjury activity restriction of greater than 1 week, and limited weight bearing for more than 1 month after injury (**Table 4**). In addition to the clinical factors associated with any moderate or severe ankle symptom, moderate to severe pain or instability was associated with more than 12 physical therapy visits (Table 4), and moderate to severe swelling was associated with having an orthopedic consultation.

FUNCTIONAL IMPACT OF RESIDUAL SIGNS AND SYMPTOMS

Moderate to severe residual symptoms limited patients' ability to walk or run comfortably or to pivot or jump on their ankle ($P<.001$). Daily activities in all areas, including sports participation, attending school, social activities, and tasks around the house, were limited by moderate to severe residual symptoms ($P<.001$).

COMMENT

Results of our study, the first evaluation of all medically attended ankle sprains in a general clinic population, indicated a remarkably high rate of disabling residual signs and symptoms 6 to 18 months later. Acute management, implemented primarily by primary care or emergency department physicians, appears consistent with documented treatment recommendations. However, rehabilitation utilization was limited, physician utilization was high, and the prevalence of residual signs and symptoms was higher than previously reported. Importantly, this study identified a group of patients at risk for development of moderate to severe residual symptoms, assisting application and development of more effective treatment protocols.

These results suggest that most patients seek care in a timely manner. Most presented for evaluation dur-

Table 4. Factors Associated With Moderate or Severe Residual Symptoms 6 to 18 Months After an Ankle Sprain

Factors	Odds Ratio (95% Confidence Interval)*				
	Any Moderate or Severe Symptom	Moderate or Severe Instability	Moderate or Severe Weakness	Moderate or Severe Pain	Moderate or Severe Swelling
Reinjury to the index ankle during the study period	7.21 (4.14-12.68)	7.37 (4.22-12.94)	6.09 (3.56-10.49)	3.78 (2.18-6.55)	3.60 (1.92-6.75)
Weight bearing limited for more than 1 mo after injury	2.16 (1.28-3.63)	2.94 (1.67-5.21)	2.03 (1.19-3.49)	2.49 (1.40-4.39)	NS
Activity restricted for more than 1 wk after injury	2.04 (1.25-3.32)	NS	2.29 (1.35-3.90)	2.48 (1.32-4.66)	2.76 (1.30-5.93)
Injury severe enough to have seen an orthopedic physician	NS	NS	NS	NS	2.33 (1.23-4.44)
More than 12 physical therapy visits	NS	3.09 (1.20-8.00)	NS	3.05 (1.19-7.77)	NS

**NS indicates not significant at* $P<.05$.

ing the acute phase of the ankle sprain, and time from the injury to initial medical evaluation was not related to the presence of residual symptoms 6 to 18 months later. These results are in contrast to previous hypotheses suggesting nonathletes avoid seeking treatment unless severe symptoms persist, thereby compromising recovery.[14,15]

Initial care of an ankle sprain appears appropriate. Physician specialty was not strongly associated with the likelihood of residual symptoms, suggesting adequate referral and management across specialty types. Almost all patients reported use of immobilization or bracing techniques after injury, and no differences in residual symptoms across immobilization or bracing techniques were noted, suggesting adequate early use of individual immobilization and bracing techniques.[16-18]

Although recommended duration of immobilization varies across studies,[16] early mobilization of the ankle is associated with improved functional outcome.[14,18-20] In our study, more than 28 days of immobilization or bracing doubled the risk for moderate to severe residual symptoms 6 to 18 months later. Although this may represent necessary treatment of more severe injury, it may indicate inappropriate self-limiting behavior on the part of the patient or inadequate medical management, as well.

The unsatisfactory results of conservative care have been attributed to inadequate or incomplete rehabilitation[14,15,21]; exercise prescription, in particular, tends to be overlooked by primary care providers.[20] However, rehabilitation techniques, including progressive exercise, neuromuscular training, and functional activity training,[2,19,22-30] have demonstrated effectiveness among young athletes.[14,18] These methods were inconsistently used in this clinic sample and may have affected ankle sprain recovery.

The results of this study must be interpreted with the following considerations. First, although this study included the full spectrum of adult patients using medical services, respondents may differ from nonrespondents. Time between the first physician appointment and the survey date was similar between groups, suggesting adequate representation across the time span of the project. However, nonrespondents were more likely to be male and younger, suggesting that our data may overrepresent women and older patients, previously understudied demographic groups. Injury severity or the presence and severity of residual symptoms may have differed between respondents and nonrespondents, affecting the results of this study.

Second, case identification may be incomplete. Preliminary study revealed an ankle sprain visit miscoding rate of 5%, a rate considered acceptable. In the present study, the miscoding rate was at least 4.9% (38/778). Although it is unlikely that patients without ankle sprains returned the survey, it is difficult to know how many true ankle sprain cases were inaccurately coded and, therefore, missed by the case identification method.

Third, ankle sprain severity was not graded due to reliance on a self-administered survey. Although ankle sprains can range from stretching (grade 1) to partial rupture (grade 2) to complete rupture of the ligament (grade 3),[31] previous studies have not documented severity[7-9] or have failed to find differences in residual signs and symptoms based on severity.[10,11] Future studies may benefit from including severity of the sprain in evaluating residual signs and symptoms.

Finally, self-reported historical data may be unreliable. Since patients were free to seek care from providers outside the SMDC, verification of self-reported utilization was not feasible. Available responses to the survey items, however, were not open-ended but rather broad, general categories that may minimize poor recall. Nevertheless, inaccurate recall may have affected these data.

Several characteristics of this study strengthen the validity of the results, however. All adult patients with ankle sprains undergoing assessment during the designated time were invited to participate. Athletes and nonathletes of both sexes and across all ages were included, providing information across the full spectrum of clinically evaluated ankle sprains. Our response rate of 66.5% suggests adequate representation of the patient population and a significant level of patient concern regarding long-term functional ankle status.

Family practice and emergency department physicians are important primary providers of health care for patients with ankle sprains, hence positioned to affect the long-term outcome of ankle sprain injuries. The following are key points to consider:

1. A large percentage of patients (40.4%) perceive they are not doing well 6 to 18 months after medical evaluation and are probably dissatisfied with the outcome of standard medical care for ankle sprains.

2. Patients should be advised at the initial visit that there is no such thing as a minor ankle sprain. There are

potential complications, and close follow-up is warranted. Monitoring the duration of immobilization and activity limitation is necessary to optimize functional gain. Continued bracing rather than immobilization may be helpful.

3. More extensive rehabilitation, particularly during the subacute or later phases of ankle sprain recovery, may be recommended for patients at risk for residual symptoms. Physical therapy exercise programs, including activities to enhance proprioceptive response to displacement and to strengthen muscles (including the peroneal muscle), and modalities to maximize exercise gains may help reduce the likelihood of significant residual symptoms and may prevent reinjury.

4. Studies evaluating treatment regimens for an older, less active general clinic population are warranted to identify the most effective methods for treating a prevalent medical condition associated with significant use of medical services and significant risk for long-term functional limitations.

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