

Managing ankle sprains in primary care: what is best practice? A systematic review of the last 10 years of evidence

Richard Seah*, and **Sivanadian Mani-Babu**

Imperial College Healthcare NHS Trust, London, UK

To summarize the best available evidence in the last decade for managing ankle sprains in the community, data were collected using MEDLINE database from January 2000 to December 2009. Terms utilized: 'ankle injury primary care' (102 articles were found), 'ankle sprain primary care' (34 articles), 'ankle guidelines primary care' (25 articles), 'ankle pathways primary care' (2 articles), 'ankle sprain community' (18 articles), 'ankle sprain general practice' (22 articles), 'Cochrane review ankle' (58 articles). Of these, only 33 satisfied the inclusion criteria. The search terms identified many of the same studies. Two independent reviewers reviewed the articles. The study results and generated conclusions were extracted, discussed and finally agreed on. Ankle sprains occur commonly but their management is not always readily agreed. The Ottawa Ankle Rules are ubiquitous in the clinical pathway and can be reliably applied by emergency care physicians, primary care physicians and triage nurses. For mild-to-moderate ankle sprains, functional treatment options (which can consist of elastic bandaging, soft casting, taping or orthoses with associated coordination training) were found to be statistically better than immobilization for multiple outcome measures. For severe ankle sprains, a short period of immobilization in a below-knee cast or pneumatic brace results in a quicker recovery than tubular compression bandage alone. Lace-up supports are a more effective functional treatment than elastic bandaging and result in less persistent swelling in the short term when compared with semi-rigid ankle supports, elastic bandaging and tape. Semi-rigid orthoses and pneumatic braces provide beneficial ankle support and may prevent subsequent sprains during high-risk sporting activity. Supervised rehabilitation training in combination with conventional treatment for acute lateral ankle sprains can be beneficial, although some of the studies reviewed gave conflicting outcomes. Therapeutic hyaluronic acid injections in the ankle are a relatively novel non-surgical treatment but may have a role in expediting return to sport after ankle sprain. There is a role for surgical intervention in severe acute and chronic ankle injuries, but the evidence is limited.

**Correspondence address.
Sport and Exercise
Medicine,
c/o Department of
Orthopaedics, Charing
Cross Hospital, Floor 7
East, Fulham Palace Road,
London W6 8RF, UK.
E-mail: rick.semforum@
gmail.com*

Keywords: ankle/injury/sprain/primary care/review

Accepted: July 22, 2010

Introduction

Ankle sprains are common musculoskeletal injuries, which can present to medical practitioners via different routes. They may require assessment by an emergency department clinician (doctor, nurse, physiotherapist or other extended scope practitioners), sports physician in a sports injury clinic or general practitioner in primary care and can often be treated non-surgically.

The scope of this review article is to address the management of ankle injuries (most commonly ankle sprains) in the community setting. Evidence from the last 10 years was evaluated. The following key questions were considered: What are the best clinical decision rules and assessment instruments available for managing ankle sprains? What is the evidence for the use of conservative treatment? What is the evidence for the use of interventional treatment? Is there any evidence from the literature reviewed to suggest that ankle sprains are preventable?

The definition of an 'ankle sprain' is an ankle injury that occurs when a person stumbles and the supporting foot twists, resulting in damage to the ligaments.¹ The commonest mechanism of injury is a combination of inversion and adduction of the foot in plantar flexion, resulting in an 'inversion sprain',² with subsequent damage to the lateral ligament complex of the ankle joint. It is worth noting that eversion sprains (with subsequent damage to the deltoid ligament) and 'high' ankle sprains (with subsequent damage to the ankle syndesmosis and tibiofibular ligaments) can also occur.

Ankle ligament sprains are usually graded on the basis of severity. Grade I is a mild stretching of the ligament complex without joint instability, Grade II, a partial rupture of the ligament complex with mild instability; Grade III, a complete rupture of the ligament complex with joint instability. Clinically, this grading can be subjective, especially in the acute stage and if there are no radiological modalities (such as diagnostic ultrasound or magnetic resonance imaging) to confirm the diagnosis. Predisposing factors for ankle sprains include a previous history of ankle sprain (giving rise to subsequent recurrent sprains), ligament hyperlaxity, poor sensorimotor control and various foot and ankle biomechanical abnormalities. The incidence of ankle sprains was estimated to occur at a rate of approximately one injury per 10 000 people per day.³ Lateral ligament complex injuries comprised about a quarter of all sporting injuries.³ In certain populations

(for example, the US military service personnel), the incidence rate was reported to be as high as 35%.⁴

Methods

Two reviewers conducted a comprehensive literature search using the MEDLINE database, utilizing different combinations of keywords as listed in the Results section. Time limits were applied and only contemporary articles published within the last 10 years (from 1 January 2000) were considered as we were only interested in seeing what the scientific literature said about current management of these ankle injuries. The date of the most recent search was 31 December 2009.

We used the following inclusion criteria: ankle sprains—acute and/or chronic (greater than 6 weeks) occurring within the primary care/community/general practice or urgent/emergency care settings; only English language articles less than 10 years old (in effect published after 1 January 2000), published in peer-reviewed medical or physiotherapy journals, listed within MEDLINE and available to download as full versions electronically were considered.

Patient selection was also limited to adults equal to or greater than 18 years of age. We only considered articles with higher levels of evidence (1–5) where level 1 = systematic review or meta-analysis, level 2 = randomized controlled trial (RCT), level 3 = cohort studies, level 4 = case control studies and level 5 = cross-sectional studies. Case reports, expert opinion and anecdotal evidence were not considered. The hierarchy of evidence was taken from Sheffield University School of Health and Related Research.⁵ We excluded articles which considered management of ankle fractures or dislocations.

Different primary and secondary outcomes from each paper are listed in Table 1. The major outcomes associated with patient-orientated evidence included length of stay, recurrence and time of return to work or sport.

Results

The different searches described within the Methods section yielded the following results: ‘ankle injury primary care’ (102 articles were found), ‘ankle sprain primary care’ (34 articles), ‘ankle guidelines primary care’ (25 articles), ‘ankle pathways primary care’ (2 articles), ‘ankle sprain community’ (18 articles), ‘ankle sprain general practice’ (22 articles) and ‘Cochrane review ankle’ (58 articles). Of these, only 33 satisfied the inclusion criteria. It was noted that the search terms

Table 1 Systematic review demographics and methods (full version).

Study, country of origin	Level of evidence and study type	Objective	Population	Method	Primary outcomes (and secondary outcomes where stated)
De Vries <i>et al.</i> , ²¹ The Netherlands	Level 1, systematic review	To compare different treatments, both conservative and surgical, for chronic lateral ankle instability	7 randomized trials were considered A total of 308 participants were evaluated Mean/median age 24–27 years, range 17–40 years	The authors searched the following databases: Cochrane Bone, Joint and Muscle Trauma Group Specialized Register, the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL and reference lists of articles All RCTs and quasi-RCTs of interventions for chronic lateral ankle instability were included	<p><i>Primary outcomes</i></p> <p>Patient derived:</p> <ol style="list-style-type: none"> 1. Subjective stability or instability 2. Recurrent injury 3. Use of external support 4. Pain 5. Swelling 6. Time to return to work/sports 7. Patient satisfaction <p>Physical examination:</p> <ol style="list-style-type: none"> 1. Mechanical laxity (manual) 2. Range of motion (ROM) 3. Swelling 4. Muscle atrophy or objective muscle weakness <p><i>Secondary outcomes</i></p> <ol style="list-style-type: none"> 1. Mechanical laxity (radiological) 2. Complications of surgical interventions 3. Re-operation 4. Functional outcome

Eechaute <i>et al.</i> , ⁷ Belgium	Level 1, systematic review	To systematically review the clinimetric qualities of patient-assessed instruments designed for patients with chronic ankle instability	—	A computerized literature search of MEDLINE, EMBASE, CINAHL, WEB OF SCIENCE, SPORT DISCUS and the Cochrane Controlled Trial Register was performed to identify eligible instruments Two reviewers independently evaluated the clinimetric qualities of the selected instruments, using a criteria list	1. The clinimetric qualities of patient-assessed instruments or rating scales
Handoll <i>et al.</i> , ²³ UK	Level 1, systematic review	To assess the effects of interventions used for the prevention of ankle ligament injuries or sprains in physically active individuals from adolescence to middle age	14 randomized trials with data for 8279 participants were included	The authors searched the Cochrane Bone, Joint and Muscle Trauma Group's specialized register, MEDLINE, PUBMED, EMBASE, CINAHL, the National Research Register and bibliographies of study reports	<ol style="list-style-type: none"> 1. Incidence of ankle ligament injury 2. Severity of ligament injuries to the ankle (grade, surgery considered) 3. Incidence of other lower limb injuries 4. Complications (e.g. fitness deficit, skin abrasions, other injuries) 5. Measures of service utilization or resource use (e.g. medical centre visits, cost of bracing) 6. Subjective assessment of instability (giving way) 7. Performance inhibition
			Twelve trials involved active, predominantly young, adults participating in organized, generally high-risk, activities The other two trials involved injured patients who had been active in sports before their injury	They also contacted colleagues and some trialists They restricted the scope to randomized and quasi-randomized trials dealing with the prevention of ligament injuries and also applied the method of meta-analysis	

Continued

Table 1 Continued

Study, country of origin	Level of evidence and study type	Objective	Population	Method	Primary outcomes (and secondary outcomes where stated)
Kerkhoffs <i>et al.</i> , ¹⁴ The Netherlands	Level 1, systematic review	To assess the effectiveness of methods of immobilization for acute lateral ankle ligament injuries and to compare immobilization with functional treatment methods	21 randomized and quasi-randomized trials	The authors performed an electronic database search using the Cochrane Bone, Joint and Muscle Trauma Group specialized register, the Cochrane Controlled Trials Register, MEDLINE, EMBASE, reference lists of articles and contacted organizations and researchers in the field	<ol style="list-style-type: none"> 1. Return to pre-injury level of sports 2. Return to pre-injury level of work 3. Pain 4. Swelling 5. Subjective instability 6. Objective instability 7. Recurrent injury 8. Ankle mobility/ROM 9. Complications 10. Patient satisfaction
Kerkhoffs <i>et al.</i> , ¹⁶ The Netherlands	Level 1, systematic review	To assess the effectiveness of various functional treatments for acute ruptures of the lateral ankle ligament in adults	2184 patients Nine randomized controlled trials	The authors performed an electronic database search using MEDLINE, EMBASE, Cochrane Controlled Trial Register and Current Contents	<ol style="list-style-type: none"> 1. Return to sports 2. Return to work 3. Pain 4. Swelling 5. Subjective instability 6. Objective instability 7. Recurrent injury 8. Ankle mobility/ROM 9. Complications 10. Patient satisfaction
			915 patients		

Struijs and Kerkhoffs, ² The Netherlands	Level 1, systematic review	To identify the effects of treatment strategies for acute ankle ligament ruptures	–	The following databases were used: Medline, Embase and the Cochrane Library (all databases) Additional searches were carried out using these websites: NHS centre for reviews and dissemination—all databases, turning research into practice, and National Institute for Health and Clinical Excellence	<ol style="list-style-type: none"> 1. Return to pre-injury level of sports 2. Return to pre-injury level of work 3. Pain 4. Swelling 5. Subjective instability 6. Objective instability 7. Recurrent injury 8. Ankle mobility 9. Complications 10. Patient satisfaction 11. Quality of life 12. Adverse effects of treatment
Van Der Windt <i>et al.</i> , ¹⁵ UK	Level 1, systematic review	To evaluate the effects of ultrasound therapy in the treatment of acute ankle sprains	Five RCTs	<p>Study design criteria for evaluation in this review were: published systematic reviews and RCTs in any language and Healthcare products Regulatory Agency</p> <p>The authors searched the Cochrane Bone, Joint and Muscle Trauma Group Specialized Register, the Cochrane Central Register of Controlled Trials, Cochrane Rehabilitation and Related Therapies Field database, MEDLINE, EMBASE, CINAHL and PEDro databases</p> <p>They also searched the reference lists of articles and contacted colleagues</p>	<ol style="list-style-type: none"> 1. General improvement 2. Improvement of pain 3. Swelling 4. Functional disability 5. ROM
			572 participants		

Continued

Table 1 Continued

Study, country of origin	Level of evidence and study type	Objective	Population	Method	Primary outcomes (and secondary outcomes where stated)
Van Os <i>et al.</i> , ¹⁸ The Netherlands	Level 1, systematic review	To compare the effectiveness of conventional treatment complemented by supervised rehabilitation training (supervised exercises) with conventional treatment alone for the rehabilitation of acute lateral ankle sprains	A total of 714 patients were included in these 7 studies, but data for only 436 patients were used in the separate analysis presented in each study, representing a drop-out rate of 38.9%	<p>The authors searched 5 computerized databases (MEDLINE, CINAHL, PEDro, EMBASE, Cochrane Controlled Trial Register) from 1966 to 2004, checked the reference lists of all studies that fulfilled the eligibility criteria, and searched for non-indexed journals available on the Internet</p> <p>Three reviewers independently selected RCTs, and controlled clinical trials (CCTs), comparing conventional treatment alone with conventional treatment combined with supervised exercises for treating patients with an acute lateral ankle sprain</p>	<ol style="list-style-type: none"> 1. Time to return to sports and work 2. Pain 3. Swelling 4. Subjective instability (giving way) 5. Objective instability (re-injury) 6. Range of motion (ROM) 7. Patient satisfaction <p><i>Additional information</i></p> <p>Follow-up measurements were grouped into the following categories:</p> <ol style="list-style-type: none"> (a) Immediate effects (within 2 weeks of randomization) (b) Short-term effects (2–6 weeks after randomization) (c) Intermediate-term effects (6 weeks to 6 months follow-up) (d) Long-term effects (more than 6 months follow-up)

Van Rijn <i>et al.</i> , ²² The Netherlands	Level 1, systematic review	To perform a systematic review of the literature about the clinical course of conventionally treated acute lateral ankle sprains in adults and its prognostic factors	31 studies were included, of which 24 were considered to be of high quality 4 studies were retrospective and 27 prospective In these studies, the follow-up period ranged from 1 day to 11 years Patients were recruited in various settings, including hospital emergency departments, primary care and military health-care centres	A database search was conducted in MEDLINE, CINAHL, PEDro, EMBASE and the Cochrane Controlled Trial register. Included were observational studies and controlled trials with adult subjects who suffered from an acute lateral ankle sprain that was conventionally treated Two reviewers independently assessed the methodological quality of each included study. One reviewer extracted relevant data	<ol style="list-style-type: none"> 1. Pain 2. Re-sprains 3. Instability 4. Recovery
Fan and Woolfrey, ¹¹ Canada	Level 2, randomized control trial	To determine whether triage nurses ordering ankle or foot radiographs according to the OAR before physician evaluation decreases the length of stay for patients visiting an urgent care department	130 adult patients (age > 18 years) presenting to emergency or urgent care departments with ankle or foot twisting injuries within the last 7 days (mean age in triage-applied OARs group was 34.2 (± 12.6) years versus control group 34.6 (± 14.3) years	Patients were randomly allocated to a radiograph—ordering clinical pathway (intervention) or to standard departmental care (control) Those assigned to the intervention group had triage nurses applying the OAR and those with positive OAR were sent for radiographs before physician evaluation	<ol style="list-style-type: none"> 1. Total mean length of stay (TLOS) in the department 2. Patient satisfaction

Continued

Table 1 Continued

Study, country of origin	Level of evidence and study type	Objective	Population	Method	Primary outcomes (and secondary outcomes where stated)
Hupperets <i>et al.</i> , ²⁴ The Netherlands	Level 2, randomized control trial	To evaluate the effectiveness of an unsupervised proprioceptive training programme on recurrences of ankle sprain after usual care in athletes who had sustained an acute sports related injury to the lateral ankle ligament	522 Amateur and elite athletes who sustained a lateral ankle sprain up to 2 months before inclusion, age group 12–70 years Mean age of 28.6 years in intervention group, 28.0 years in the control group	Both groups received treatment according to usual care. Athletes allocated to the intervention group additionally received an 8 week home-based proprioceptive training programme	<ol style="list-style-type: none"> 1. Self-reported recurrence of ankle sprain 2. Loss of tie off sport 3. Healthcare costs 4. Lost productivity cost
Lamb <i>et al.</i> , ¹⁷ UK	Level 2, randomized control trial, single-blinded	To assess the effectiveness of three different mechanical supports (Aircast brace, Bledsoe boot or 10-day below-knee cast) compared with that of a double-layer tubular compression bandage in promoting recovery after severe ankle sprains	584 participants recruited from emergency departments, aged over 16 years, with severe ankle sprain. Mean age of 30 years	Participants were provided with a mechanical support within the first 3 days of attendance by a trained health-care professional, and given advice on reducing swelling and pain. Functional outcomes were measured over 9 months	<ol style="list-style-type: none"> 1. Quality of ankle function at 3 months measured using the Foot and Ankle Score 2. Generic health-related quality of life assessment 3. Self-perceived benefits of treatment 4. Health service resources used
Petrella <i>et al.</i> , ²⁰ Canada	Level 2, randomized control trial	To determine the efficacy and safety of periarticular hyaluronic acid injections in acute lateral ankle sprain during 9 months at a sports injuries centre	158 competitive athletes with Grade 1 or 2 lateral ankle sprains, within the last 48 h	Patients were randomized (within 48 h of injury to periarticular injection with hyaluronic acid (HA) + standard of care [rest, ice, compression and elevation (RICE)] or placebo injection (PL) + standard of care (RICE) treatment at baseline assessment and on day 4 after injury	<ol style="list-style-type: none"> 1. VAS of pain on weight bearing at day 8 2. VAS of pain on walking 20 metres 3. Patient's global assessment of ankle injury 4. Patient's assessment of return to normal activity (in sport) 5. Patient's satisfaction assessments

Van Rijn <i>et al.</i> , ¹⁹ The Netherlands	Level 2, randomized control trial, single-blinded	To evaluate the short- and long-term effectiveness of conventional treatment combined with supervised exercises compared with conventional treatment alone in patients with an acute ankle sprain	Average age 26 ± 7 for HA group and 24 ± 8 years for PL group 102 patients recruited from 32 Dutch general practices and the hospital emergency department	Adults with an acute lateral ankle sprain were allocated to either conventional treatment combined with supervised exercises or conventional treatment alone	<ol style="list-style-type: none"> 1. Subjective recovery (0–10 point scale) 2. Occurrence of a re-sprain at 3 months and 1 year follow-up 3. Patient's appreciation of the received treatment 4. Reported instability 5. Range of motion (ROM) of the ankle joint at 3 months' follow-up 6. Reported instability at 1 year of follow-up
Leddy <i>et al.</i> , ⁸ USA	Level 3, prospective cohort study	To implement the OAR, with a modification to improve the specificity for identifying malleolar fractures (the 'Buffalo rule'), in a sports medicine centre and measure impact on physician practice and cost savings	Mean age of 37 ± 11.9 years. Age range 18–60 years	The supervised programme consisted of a maximum of nine half-hour sessions, within a period of 3 months, and included balance exercises, walking, running and jumping Measurements were carried out at intake, 4, 8 weeks, 3 months and 1 year after injury All pediatric and adult patients with acute (10 day old) ankle/ midfoot injury had the rule applied by primary care providers.	<ol style="list-style-type: none"> 1. Performance of OAR in identifying fractures in patients with malleolar and/or midfoot pain 2. Performance of OAR with Buffalo modification in identifying fractures in patients with malleolar pain

Continued

Table 1 Continued

Study, country of origin	Level of evidence and study type	Objective	Population	Method	Primary outcomes (and secondary outcomes where stated)
			Mean age of 23.3 ± 8.5 years. Age range 10–64 years	Exclusion criteria included pregnancy, isolated skin injury, 10 days since injury, second evaluation for same injury, obvious deformity of ankle or foot, or altered sensorium	
Brehaut <i>et al.</i> , ¹⁰ Canada	Level 5, cross-sectional survey, retrospective	To conduct a survey of emergency physicians (EPs) to examine whether they use the OAR consistently, exclusively and accurately	399 EPs, randomly selected from the national membership list of EPs	Pilot interview for 11 practising EPs prior to sending out a postal survey and four-page questionnaire	1. To find out if EPs used OARs some or all of the time
Cooke <i>et al.</i> , ¹³ UK	Level 5, cross-sectional survey, retrospective	To determine consultant practice in larger UK emergency departments in the management of severe ankle sprains	Completed questionnaires were received from 83 lead consultants of Emergency Departments seeing more than 50 000 new patients per year	Questionnaire study to all UK emergency departments with larger patient catchment population (defined as seeing more than 50 000 new patients per year). A 70% response rate was attained	1. To ascertain current methods of treatment used in patients with typical acute Grade III lateral ankle injuries
Leemrijse <i>et al.</i> , ¹² The Netherlands	Level 5, cross-sectional survey	To study the compliance with guidelines for acute ankle sprain for physiotherapists	400 physiotherapists working in extramural health care in the Netherlands	A questionnaire was sent by mail to a random sample of physiotherapists in the Netherlands	1. Attitude towards guidelines in general 2. Familiarity with the guidelines for acute ankle sprain 3. Compliance with the guidelines 4. Advantages and disadvantages of the guidelines 5. Factors relating to compliance with the guidelines
				Questions were presented in a closed format	

Marinos <i>et al.</i> , ⁶ Greece	Level 5, retrospective, observational cross-sectional study	To assess the prevalence of orthopaedic cases that could be managed by primary care	39 172 patients who visited one orthopaedic emergency department over a 5 year period were considered	Physiotherapists who did not return the written questionnaire were briefly interviewed by telephone about sociodemographic information, and their familiarity and compliance with the guidelines The registry of the orthopaedic ED was analysed by age, sex and clinical diagnosis. All patients were evaluated by a specialist	1. To decide how many cases could be dealt with in primary care
Wynn-Thomas <i>et al.</i> , ⁹ New Zealand	Level 5, cross-sectional survey, retrospective	To measure the baseline use of OARs and validate the OARs	410 GPs were surveyed	Classification of the cases was based on the main symptom of those seeking care. Patients were stratified into six major groups of diagnosis GPs were surveyed retrospectively to find their awareness of ankle injury guidelines	1. To establish baseline use of OARs 2. Radiograph utilization and diagnosis of fracture
		Where appropriate, explore the impact of implementing the rules on radiography rates in a primary care, after hours medical centre setting		Data concerning diagnosis and radiograph utilization were collected prospectively for patients presenting with ankle injuries to 2 after hours medical centres The OARs were applied retrospectively and the sensitivity and specificity of the OAR were compared with GPs' clinical judgement in ordering radiographs	

identified many of the same studies. A further 13 articles were excluded for various reasons. These included papers which fell into the category of study design protocol, papers that were not available in their full version electronically or papers that appeared to be duplicates of original articles already cited.

Full text articles were obtained for all studies. Data from each of the articles was gathered and summarized using tables created by the authors. The final 20 articles are presented in Tables 1 and 2. Table 1 describes the demographics and methods of each paper ranking both by level of evidence and in alphabetical order. Table 2 lists the authors' results and conclusions. (For the sake of brevity, abbreviated tables have been included with this article. Full version tables are available as electronic documents, illustrating in greater detail the studies reviewed).

Discussion

In the UK, the term 'hospital care' is often synonymous with 'secondary care'. This can create ambiguity as not all hospital patients may have been referred in by their general practitioners. Notably, exceptions to this rule include patients who present directly to urgent care or emergency care departments located in hospitals without first consulting their general practitioners (GPs). For this reason, the term 'primary care' is used pragmatically within this article to imply patients who are seen with their presenting complaint by a medically qualified doctor without having initially been referred.

In response to the four key questions asked, we have organized our findings into the following sections in order to discuss them in greater detail.

Clinical decision rules and assessment instruments

The level of evidence surrounding clinical decision rules and assessment instruments ranged from level 1 to level 5. We identified one systematic review, one randomized control trial, one prospective cohort study and four cross-sectional surveys to support our conclusions.

In a retrospective observational cross-sectional study, Marinos *et al.*⁶ assessed the prevalence of orthopaedic cases that could be managed by primary care. After back pain, ankle injuries were the second most common injury to occur, accounting for approximately 10% that could have been managed in primary care. Overall, 43.5% of all musculoskeletal injuries presenting to their orthopaedic emergency department over a 5 year period could have been by their primary care physician.

Table 2 Systematic review results and conclusions (full version).

Study, country of origin	Results (RR: relative risk; CI: 95% confidence interval)	Conclusions	Additional information
De Vries <i>et al.</i> , ²¹ The Netherlands	<p>Surgical interventions (four studies): one study showed more complications after the Chrisman-Snook procedure compared with an anatomical reconstruction, whereas another study showed greater mean talar tilt after an anatomical reconstruction</p> <p>Subjective instability and hindfoot inversion was greater after a dynamic than after a static tenodesis in a third study</p> <p>The fourth study showed that the operating time for anatomical reconstructions was shorter for the reinsertion technique than for the imbrication method</p> <p>Rehabilitation after surgical interventions (two studies): both studies provided evidence that early functional mobilization leads to an earlier return to work and sports than immobilization</p> <p>Conservative interventions: the only study in this group showed better proprioception and functional outcome with the bi-directional than with the uni-directional pedal technique on a cyclo-ergometer</p>	<p>The authors concluded that in view of the low-quality methodology of almost all the studies, this review did not provide sufficient evidence to support any specific surgical or conservative intervention for chronic ankle instability</p> <p>However, after surgical reconstruction, early functional rehabilitation was shown to be superior to 6 weeks immobilization regarding time to return to work and sports</p>	Trials were included and divided into three groups: (a) surgical interventions, (b) rehabilitation programs after surgical interventions and (c) conservative interventions
Eechaute <i>et al.</i> , ⁷ Belgium	<p>Four instruments met the eligibility criteria: the Ankle Joint Functional Assessment Tool (AJFAT), the Functional Ankle Outcome Score (FAOS), the FADI and the FAAM</p> <p>Test–retest reliability was demonstrated for the FAOS, the FADI and the FAAM but not for the AJFAT</p> <p>The FAOS and the FAAM met the criteria for content validity and construct validity</p> <p>Responsiveness was demonstrated for the AJFAT, FADI and the FAAM</p> <p>Only for the FAAM, a minimal clinical important difference was presented</p>	<p>The authors concluded that FADI and the FAAM can be considered as the most appropriate, patient-assessed tools to quantify functional disabilities in patients with chronic ankle instability</p> <p>The clinimetric qualities of the FAAM would need to be further demonstrated in a specific population of patients with chronic ankle instability</p>	This was a review comparing ankle assessment scores, not patients

Continued

Table 2 Continued

Study, country of origin	Results (RR: relative risk; CI: 95% confidence interval)	Conclusions	Additional information
Handoll <i>et al.</i> , ²³ UK	<p>The main finding was a significant reduction in the number of ankle sprains in people allocated external ankle support (RR: 0.53, 95% CI: 0.40–0.69)</p> <p>This reduction was greater for those with a previous history of ankle sprain, but still possible for those without prior sprain</p> <p>There was no apparent difference in the severity of ankle sprains or any change to the incidence of other leg injuries</p> <p>The protective effect of 'high-top' shoes remains to be established</p> <p>There was limited evidence for reduction in ankle sprain for those with previous ankle sprains who did ankle disk training exercises</p> <p>Various problems with data reporting limited the interpretation of the results for many of the other interventions</p>	<p>The authors conclude there is good evidence for the beneficial effect of ankle supports in the form of semi-rigid orthoses or Aircast braces to prevent ankle sprains during high-risk sporting activities (e.g. soccer, basketball)</p> <p>Participants with a history of previous sprain can be advised that wearing such supports may reduce the risk of incurring a future sprain. However, any potential prophylactic effect should be balanced against the baseline risk of the activity, the supply and cost of the particular device, and for some, the possible or perceived loss of performance</p> <p>Further research is indicated principally to investigate other prophylactic interventions, their cost-effectiveness and general applicability</p>	<p>The prophylactic interventions under test included the application of an external ankle support in the form of a semi-rigid orthosis (three trials), Aircast brace (one trial) or high-top shoes (one trial); ankle disk training; taping; muscle stretching; boot inserts; health education programme and controlled rehabilitation</p>
Kerkhoffs <i>et al.</i> , ¹⁴ The Netherlands	<p>Statistically significant differences in favour of functional treatment when compared with immobilization were found for seven outcome measures</p> <p>More patients returned to sport in the long term (RR: 1.86, 95% CI: 1.22–2.86)</p> <p>The time taken to return to sport was shorter (Weighted Mean Difference (WMD) 4.88 days, 95% CI: 1.50–8.25)</p> <p>More patients had returned to work at short-term follow-up (RR: 5.75, 95% CI: 1.01–32.71)</p>	<p>The authors concluded that functional treatment appears to be the favourable strategy for treating acute ankle sprains when compared with immobilization</p>	<p>Immobilization included plaster cast or special boots</p> <p>Functional interventions included elastic bandaging, softcast, tape or orthosis with associated coordination training</p> <p>These results should be interpreted with caution, as most of the differences are not significant after exclusion of the low-quality trials</p>

Kerkhoffs <i>et al.</i> , ¹⁶ The Netherlands	<p>The time taken to return to work was shorter (WMD 8.23 days, 95% CI: 6.31–10.16)</p> <p>Fewer patients suffered from persistent swelling at short-term follow-up (RR: 1.74, 95% CI: 1.17–2.59)</p> <p>Fewer patients suffered from objective instability as tested by stress X-ray (WMD 2.60, 95% CI: 1.24–3.96)</p> <p>Patients treated functionally were more satisfied with their treatment (RR: 1.83, 95% CI: 1.09–3.07)</p> <p>No significant differences between varying types of immobilization, immobilization and physiotherapy or no treatment were found, apart from one trial where patients returned to work sooner after treatment with a soft cast</p> <p>In all analyses performed, no results were significantly in favour of immobilization</p> <p>Persistent swelling at short-term follow-up was less with lace-up ankle support than with semi-rigid ankle support (RR: 4.2, 95% CI: 1.3–14), an elastic bandage (RR: 5.5, 95% CI: 1.7–18) and tape (RR: 4.1, 95% CI: 1.2–14)</p> <p>A semi-rigid ankle support required a shorter period for return to work than an elastic bandage (WMD 4.2, 95% CI: 2.4–6.1) ($P = 0.7$)</p> <p>One trial reported better results for subjective instability using the semi-rigid ankle support than the elastic bandage (RR: 8.0, 95% CI: 1.0–62)</p> <p>Treatment with tape resulted in more complications, mostly skin problems, than that with an elastic bandage (RR: 0.1, 95% CI: 0.0–0.8)</p>	The authors concluded that an elastic bandage is a less effective functional treatment. Lace-up supports seem better, but the data are insufficient as a basis for definite conclusions	Short-term follow-up was defined as follow-up within 6 weeks of randomization, intermediate-term from 6 weeks to 1 year and more than 1 year
Struijs and Kerkhoffs, ² The Netherlands	<p>The authors were able to produce detailed results for each of the interventions.</p> <p>Unfortunately, due to limitations of space, we are not able to list them all individually</p>	Despite consensus views that immobilization is more effective than no treatment, studies have shown that immobilization worsens function and symptoms in the short- and long term compared with functional treatment	The authors could not say with certainty as to which is the most effective functional treatment, or how functional treatments compare with surgery

Continued

Table 2 Continued

Study, country of origin	Results (RR: relative risk; CI: 95% confidence interval)	Conclusions	Additional information
Van Der Windt <i>et al.</i> , ¹⁵ UK	<p data-bbox="362 258 778 307">Instead, we have listed their key findings in the adjacent sections</p> <p data-bbox="362 658 778 786">None of the placebo-controlled trials (sham therapeutic ultrasound) demonstrated statistically significant differences between true and sham ultrasound therapy for any outcome measure at 7 –4 days of follow-up</p> <p data-bbox="362 793 778 892">The pooled relative risk for general improvement was 1.04 (random-effects model, 95% confidence interval: 0.92–1.17) for active versus sham ultrasound</p> <p data-bbox="362 1005 778 1130">The differences between intervention groups were generally small. However, one trial reported relatively large differences for pain-free status (20%) and swelling (25%) in favour of ultrasound</p>	<p data-bbox="809 258 1225 357">Surgery and immobility may have similar outcomes in terms of pain, swelling and recurrence, but surgery may lead to increased joint stability</p> <p data-bbox="809 364 1225 548">Functional treatment, consisting of early mobilization and an external support, improves function and stability of the ankle compared with minimal treatment or immobilization</p> <p data-bbox="809 555 1225 654">Ultrasound has not been shown to improve symptoms or function compared with sham ultrasound</p> <p data-bbox="809 661 1225 759">Cold treatment may reduce oedema compared with heat or a contrast bath, but has not been shown to improve symptoms compared with placebo</p> <p data-bbox="809 766 1225 865">The authors concluded that the results of four placebo-controlled trials do not support the use of ultrasound in the treatment of ankle sprains</p> <p data-bbox="809 872 1225 999">The magnitude of treatment effects are generally small and of limited clinical importance. Only few trials are available and no conclusions can be made regarding any optimal dosage schedule for ultrasound therapy, and whether such a schedule would improve the reported lack of effectiveness of ultrasound for ankle sprains</p>	<p data-bbox="1252 258 1668 357">They were also not certain whether diathermy, homeopathic ointment or physiotherapy (physical therapy) improve function compared with placebo, as few studies have been found</p> <p data-bbox="1252 658 1668 759">The authors commented that the extent and quality of the available evidence for the effects of ultrasound therapy for acute ankle sprains is limited</p>

Van Os <i>et al.</i> , ¹⁸ The Netherlands	Seven RCTs were included. The quality assessment resulted in one high-quality and six low-quality studies. There is limited evidence that the addition of supervised exercises to a conventional treatment approach results in greater reduction in swelling (one study showing significant short-term effect size of 0.64) and faster return to work (one study showing significant immediate term effect size of 0.96)	This review examined the best available evidence for the use of applying supervised rehabilitation training in the management of acute sprains of the lateral ankle ligaments in adolescents and adults	Studies reporting a lack of difference between treatment approach did not report statistical power, making interpretation of those results difficult
Van Rijn <i>et al.</i> , ²² The Netherlands	<p>There was a rapid decrease in pain reporting within the first 2 weeks</p> <p>5–33% of patients still experienced pain after 1 year, while 36–85% reported full recovery within a period of 3 years</p> <p>The risk of re-sprains ranged from 3 to 34% of the patients, and re-sprain was registered in periods ranging from 2 weeks to 96 months post-injury</p> <p>There was a wide variation in subjective instability, ranging from 0 to 33% in the high-quality studies and from 7 to 53% in the low-quality studies</p>	<p>There is limited evidence available from RCTs that conventional treatment combined with supervised rehabilitation training may be superior to conventional treatment alone as a treatment for acute injuries of the lateral ligament complex of the ankle</p> <p>After 1 year of follow-up, a high percentage of patients still experienced pain and subjective instability, while within a period of 3 years, as much as 34% of the patients reported at least 1 re-sprain</p> <p>36% up to 85% of the patients reported full recovery within a period of 3 years</p>	It was noted one study described prognostic factors and indicated that training more than three times a week is a prognostic factor for residual symptoms
Fan and Woolfrey, ¹¹ Canada	<p>The intervention and control groups had mean TLOS of 73.0 and 79.7 min, respectively. There was a statistically non-significant time difference of –6.7 min (95% CI = –20.9–7.4) between groups</p> <p>There were no differences in patient satisfaction ratings (P-value = 0.343) or willingness to return to original site of treatment (3.8%; 95% CI = –3.3–11.0%)</p>	The use of OAR and the ordering of radiographs by triage nurses before physician evaluation for twisting ankle or foot injuries does not decrease the length of stay in an urgent care department	–

Continued

Table 2 Continued

Study, country of origin	Results (RR: relative risk; CI: 95% confidence interval)	Conclusions	Additional information
Hupperets <i>et al.</i> , ²⁴ The Netherlands	Significantly fewer recurrent ankle sprains in the intervention (treatment) than in the control group. Intervention programme was associated with a 35% risk of recurrence. ($P < 0.05$, RR for self-reported ankle sprains 0.63, CI: 0.45–0.88)	The use of a proprioceptive training programme after usual care of an ankle sprain is effective for the prevention of self-reported recurrences. This proprioceptive training was specifically beneficial in athletes whose original sprain was not medically treated	During the 1 year follow-up, 145 athletes reported a recurrent ankle sprain: 56 (22%) in the intervention group and 89 (33%) in the control group. Nine athletes needed to be treated to prevent one recurrence (number needed to treat) The tailored proprioceptive balance board training consisted of three training sessions a week, maximum of 30 min duration per session, for 8 weeks Side-effects were rare with no discernible differences between treatments
Lamb <i>et al.</i> , ¹⁷ UK	Patients who received the below-knee cast had a more rapid recovery than those given the tubular compression bandage. They noted clinically important benefits at 3 months in quality of ankle function with the cast compared with tubular compression bandage (mean difference 9%, CI: 2.4–15.0), as well as in pain, symptoms and activity The mean difference in quality of ankle function between Aircast brace and tubular compression bandage was 8%; CI: 1.8–14.2, but there were little differences for pain, symptoms and activity Bledsoe boots offered no benefit over tubular compression bandage, which was the least effective treatment throughout the recovery period. There were no significant differences between tubular compression bandage and the other treatments at 9 months	A short period of immobilization in a below-knee cast or Aircast results in faster recovery than if the patient is only given tubular compression bandage The authors recommend below-knee casts because that shows the widest range of benefit	Reported events (all treatments combined) were cellulitis (two cases), pulmonary embolus (two cases) and deep-vein thrombosis (three cases)
Petrella <i>et al.</i> , ²⁰ Canada	A significant reduction in VAS pain, on both weight bearing and walking, was observed at day 8 for HA compared with PL ($P < 0.05$)	HA treatment for acute ankle sprain was highly satisfactory in the short-and the long-term versus PL. This was associated with reduced pain and more rapid return to sport, with few associated adverse events An important consideration regarding the potential use of periarticular HA in acute ankle sprains would be the relative cost of this treatment versus the standard of care	The primary criterion was the decrease from baseline to visit 2 (day 8 \pm 1) in weight-bearing pain This and changes in VAS of walking pain were -3.16 ± 1.18 and -1.83 ± 1.1 cm (%) (weight-bearing pain) and -4.99 ± 2.02 and -3.76 ± 2.43 cm (%) (walking pain) in the HA and PL groups, respectively ($P < 0.0001$), giving an intergroup difference of 1.31 and 1.23 cm in favour of treatment

Van Rijn <i>et al.</i> , ¹⁹ The Netherlands	There was no significant difference between treatment groups concerning subjective recovery or occurrence of re-sprains after 3 months and 1-year of follow-up	Conventional treatment combined with supervised exercises compared with conventional treatment alone during the first year after an acute lateral ankle sprain does not lead to differences in the occurrence of re-sprains or in subjective recovery	The authors also noted that after 90 days, there was significant benefit from the HA injection compared with placebo by an improvement in the VAS pain score on weight bearing of -4.07 (SD 1.27) versus -2.67 (SD 1.47), respectively. It is known that the Dutch conventional treatment as defined in the current study (early ankle mobilization, including home exercises and early weight bearing) differs from the conventional treatment in other countries, which can be much less involved. In the current study, the difference in treatment between conventional treatment and intervention is less extreme compared with other studies. This could explain why no difference was found between conventional treatment and intervention, while other studies have found a difference.
Leddy <i>et al.</i> , ⁸ USA	All clinically significant fractures were identified by the OAR rule with Buffalo modifications (100% sensitivity)	The OAR reduced radiography in acute ankle/midfoot injury and saved money in relatively younger patients in the outpatient sports urgent care setting without missing any clinically significant fractures	The Buffalo modification for malleolar tenderness (differs from the OARs in that it moves the area of palpation to over the crests or midportions of the malleoli, away from the ligamentous attachments. The remainder of the rules are the same as the OARs).
	The sensitivity for malleolar fracture (with 95% confidence intervals) was 100% (78–100%) and specificity was 45% (43–46%). In patients with midfoot pain, sensitivity was 100% (65–100%) and specificity was 35% (21–49%). 35% of radiographic series (76 of 217) were foregone for a cost savings of almost USD \$6000. 100% follow-up on those patients for whom X-rays were obtained found no missed fractures and they were subjectively satisfied with their care.	The specificity of the Buffalo malleolar rule was, however, not a significant improvement over the OAR malleolar rule. Widespread application of the OAR could save substantial resources without compromising quality of care.	
Brehaut <i>et al.</i> , ¹⁰ Canada	Most physicians (89.6%) reported using the OAR always or most of the time in appropriate circumstances, while only 42.2% reported basing their decisions to order radiography primarily on the rule.	The authors state most physicians report using and applying the OAR consistently, but most report that the rule is not the primary determinant of their decisions.	Errors in remembering rule components were more common among part-time ($P < 0.05$) and older ($P < 0.05$) physicians, and those who do not apply the rule consistently ($P < 0.05$).

Continued

Table 2 Continued

Study, country of origin	Results (RR: relative risk; CI: 95% confidence interval)	Conclusions	Additional information
Cooke <i>et al.</i> , ¹³ UK	<p>Physicians reported considering non-rule factors that are not related to the presence of a fracture (e.g. swelling: 54%) and factors that add no more predictive value over and above the rule (e.g. age 55 years: 55.2%)</p> <p>While 82.4% reported not having reviewed the rule for months or years, only 30.9% of the respondents were able to correctly remember the components of the rule</p> <p>70% response rate. Most popular treatment was ice, elevation, tubigrip and exercise, each of which was reported as used in most cases by over 70% of respondents</p>	<p>The authors also state that most apply this rule without referring to memory aids, yet their memory for this simple rule is imperfect</p> <p>The authors suggest there is considerable variation in some aspects of the clinical approach (including drug treatment, walking aids, periods of rest) taken to the management of severe ankle sprains in the UK, In some areas however (for example, not routinely immobilizing, early weight bearing as pain permits, use of physiotherapy, use of rest, ice and elevation), there was concordance</p>	<p>Most ED consultants reported that follow-up was only advised for selected cases (Table 3), and when this was offered it was mostly to an emergency department or a physiotherapy clinic (44 and 47%, respondents, respectively)</p> <p>Emergency department clinic follow-up for most cases was reported by 27% respondents. Referral to a general fracture or orthopaedic, sports or specialist ankle clinic was rare, 69% never using or not having access to a sports clinic, and 81% never using or not having access to a specialized ankle clinic</p>
Leemrijse <i>et al.</i> , ¹² The Netherlands	<p>Physiotherapy was usually only used in selected cases. Rest was usually advised for 1 to 3 days (35%). Follow-up was only recommended for selected patients</p> <p>The majority of Dutch physiotherapists were familiar with the content of the Royal Dutch Society for Physiotherapy guidelines for acute ankle sprain to some degree and 66% applied it to more than half of their patients with acute ankle sprain</p> <p>The recommendations to determine both the prognosis and the necessity of treatment by using the function score were the least followed</p>	<p>Although compliance with the guidelines for acute ankle sprain was fair/moderate, compliance may be enhanced by improving clarity of the function score, including it in the short version and improving the attitude of physiotherapists towards guidelines in general</p>	<p>Since this paper was accepted for publication, the Royal Dutch Society for Physiotherapy has initiated revision of the Guidelines for Ankle Sprain</p> <p>An important change is that the guidelines for acute and chronic ankle sprain will be combined. A further change is that the guidelines will reflect the changed conditions for physiotherapy practice now that direct access has been introduced</p>

Marinos <i>et al.</i> , ⁶ Greece	<p>Some physiotherapists thought the function score was not completely clear, which may have been a barrier for implementation</p> <p>Factors relating positively to compliance were a positive attitude towards guidelines in general, and having colleagues who implemented the guidelines for acute ankle sprain</p> <p>39 172 patients who visited the orthopaedic emergency department at one hospital over a 5 year period were considered</p> <p>Of these, 43.5% suffered from orthopaedic problems that could have been managed by their primary care physician</p>	<p>This study confirms that a large proportion of cases attending the orthopaedic emergency department could have been managed by appropriately equipped primary care settings</p>	<p>This study considered all musculoskeletal conditions presenting to a particular emergency department, of which ankle injuries were only a subset</p> <p>In their discussion section, the authors highlighted the fact that despite musculoskeletal problems forming a significant proportion of the general practice workload in the UK (accounting for 9.5% of consultations in males attendees and 8.4% of female attendees), the average UK undergraduate training in trauma and orthopaedics is only 5.6 weeks (range: 3–12 weeks)</p>
Wynn-Thomas <i>et al.</i> , ⁹ New Zealand	<p>Ankle injuries were second most common (after back pain), accounting for 10.3% of those who could have been managed in primary care</p> <p>Awareness of the OAR was low</p> <p>The sensitivity of the OAR for diagnosis of fractures was 100% (CI: 75.3–100) and the specificity was 47% (CI: 40.5–54.5)</p> <p>The sensitivity of GPs' clinical judgement was 100% (CI: 75.3–100) and the specificity was 37% (CI: 30.2–44.2)</p> <p>Implementing the OAR would reduce radiograph utilization by 16% (CI: approximately 10.8–21.3)</p>	<p>The OAR are valid in a primary care setting</p> <p>Further implementation of the rules would result in some reduction of radiographs ordered for ankle injuries, but less than the reduction found in previous studies</p>	<p>This study showed that the OARs are valid in a New Zealand primary care setting</p>

Eechaute *et al.*⁷ systematically reviewed the clinimetric qualities of patient-assessed instruments for patients with chronic ankle instability. They concluded that two instruments—the Foot and Ankle Disability Index (FADI) and the Functional Ankle Ability Measure (FAAM)—were the most appropriate tools to quantify functional disability for chronic ankle instability.⁷

Many of the studies looked at made reference to the Ottawa Ankle Rules (OAR), a well-validated clinical decision aid for suspected ankle fractures. The OAR state that ankle radiographs are only required if there is any pain in the malleolar zone and any one of the following: (i) bone tenderness along the distal 6 cm of the posterior edge of the tibia or tip of the medial malleolus or (ii) bone tenderness along the distal 6 cm of the posterior edge of the fibula or tip of the lateral malleolus or (iii) an inability to bear weight both immediately and in the emergency department for four steps. In addition, a foot radiograph series is indicated if there is any pain in the midfoot zone and any one of the following: (i) bone tenderness at the base of the fifth metatarsal (for foot injuries) or (ii) bone tenderness at the navicular bone (for foot injuries) or (iii) an inability to bear weight both immediately and in the emergency department for four steps.

Leddy *et al.*⁸ attempted to implement the OAR, with a modification to improve the specificity of identifying malleolar fractures (the ‘Buffalo Rule’) and measure its impact on physician practice and cost savings. The Buffalo modification for malleolar tenderness differs from the OARs in that it moves the area of palpation to over the crests or midportions of the malleoli, away from the ligamentous attachments. The remainder of the rules is the same as the OARs. In a prospective cohort study, they found that the OAR reduced radiography in acute ankle/midfoot injury and saved money in relatively younger patients in the outpatient sports urgent care setting without missing any clinically significant fractures. The specificity of the Buffalo malleolar rule was, however, not a significant improvement over the OAR malleolar rule.⁸

Wynn-Thomas *et al.*⁹ measured and validated the baseline use of OAR by GPs. They found that the sensitivity of the OAR for the diagnosis of fractures was 100% and the specificity was 47%. The sensitivity of GPs clinical judgement was 100% and the specificity was 37%. In this retrospective cross-sectional survey, implementing the OAR would have reduced radiograph utilization by 16%, suggesting that the OAR is valid for use in a primary care setting.⁹ In Canada, Brehaut *et al.*¹⁰ conducted a survey of emergency medicine physicians to examine their use of the OAR. By carrying out a retrospective cross-sectional survey, they found that most physicians report using the OAR consistently but most report that the rule is not the primary determinant of their decisions. They noted that most emergency medicine

physicians were able to apply this rule adequately without referring to memory aids yet their memory for this simple rule was imperfect.¹⁰ A randomized control trial by Fan and Woolfrey¹¹ looked at whether triage nurses who requested ankle or foot radiographs according to the OAR before physician evaluation altered the length of stay for patients visiting an urgent care department. They found that this did not decrease the length of stay.

In the Netherlands, Leemrijse *et al.*¹² studied physiotherapists' compliance with guidelines for managing acute ankle sprains by means of a cross-sectional survey. Compliance with their national guidelines for managing acute ankle sprain was fair to moderate. A barrier for compliance may have been the original function score which has since been amended.¹²

Although two higher quality studies were identified, most of the studies were between levels 3 and 5 on the hierarchy of evidence. The strength of recommendation for putting the evidence into clinical practice is therefore limited.

Conservative treatment: immobilization, functional interventions and supervised rehabilitation programmes

The level of evidence surrounding conservative treatment options ranged from level 1 to level 5. Five systematic reviews, two single-blinded randomized control trials and one cross-sectional survey were identified to support our conclusions.

In the UK, Cooke *et al.*¹³ carried out a retrospective cross-sectional survey attempting to determine consultant practice in large UK emergency departments for managing severe ankle sprains. The most popular treatments were ice, elevation, application of Tubigrip (a form of compression bandage) and exercise. Crutches, early weight-bearing and non-steroidal anti-inflammatory drugs were each reported as used in most cases, although these were very slightly less popular than the former treatments. Physiotherapy was only used in selected cases. A third of respondents usually advised rest for 1–3 days. Follow-up was only recommended for selected patients. The authors suggested that there is considerable variation in certain aspects of the clinical approach to managing severe ankle sprains in the UK.¹³

A systematic review by Kerkhoffs *et al.*¹⁴ assessed the effectiveness of methods of immobilization for acute lateral ankle ligament injuries and compared immobilization with functional treatment methods. Functional interventions (which included elastic banding, soft cast, taping or orthoses with associated coordination training) were found to be statistically better than immobilization for multiple outcome measures.

Van der Windt *et al.*¹⁵ attempted to evaluate the effects of therapeutic ultrasound in the treatment of acute ankle sprains. Although a systematic review was carried out, they commented that the extent and quality of the available evidence for the effects of therapeutic ultrasound was limited.¹⁵

In a separate article, Kerkhoffs *et al.*¹⁶ systematically assessed the effectiveness of various treatments of acute ruptures of the lateral ankle ligaments in adults. They found that lace-up supports were a more effective functional treatment than elastic bandaging. Lace-up supports resulted in less persistent swelling in the short term when compared with semi-rigid ankle supports, elastic bandaging and tape. Tape resulted in more dermatological complications than elastic bandage. Struijs and Kerkhoffs² could not be certain whether homeopathic ointment or physiotherapy significantly improved function due to a paucity of studies after an extensive review of the evidence.

Lamb *et al.*¹⁷ conducted a single-blinded randomized control trial, assessing the effectiveness of three different mechanical supports (the Aircast brace, the Bledsoe boot or 10-day below-knee cast) against that of a double-layered tubular compression bandage in promoting recovery after severe ankle sprains. They found that a short period of immobilization in a below-knee cast or Aircast brace resulted in faster recovery than if the patient is only given tubular compression bandage. They noted clinically important benefits in terms of ankle function, pain, symptoms and activity at 3 months.¹⁷

Van Os *et al.*¹⁸ looked at the effectiveness of conventional treatment complemented by supervised rehabilitation training (supervised exercises) against conventional treatment alone for the rehabilitation of acute lateral ankle sprains. A systematic review revealed that there was limited evidence available from RCTs that conventional treatment combined with supervised rehabilitation training may be superior to conventional treatment alone. However, studies reporting a lack of difference between treatment approaches did not report statistical power, making interpretation of results difficult. In contrast, Van Rijn *et al.*'s¹⁹ single-blinded randomized control trial reported that conventional treatment combined with supervised exercises, when compared with conventional treatment alone, did not lead to differences in the re-occurrence of ankle sprains during the first year after an acute lateral ankle sprain. They did note however, that Dutch conventional treatment (which consists of early ankle mobilization, home exercise and early weight bearing) can be a much more involved programme than is available in some other countries, accounting for the discrepancy in study findings.^{18,19}

The strength of recommendation for putting the above evidence into clinical practice is good, since the majority of studies identified within this category were of either level 1 or 2 on the hierarchy of evidence.

Interventional treatment: therapeutic injections and surgery

The level of evidence regarding interventional treatment options ranged from levels 1 to 2, though were limited in number. Two systematic reviews and one randomized control trials were scrutinized.

The use of hyaluronic acid injections has been associated with a more rapid return to sport and with only a few associated adverse events, but the relative increased cost of this treatment versus the standard of care has to be considered.²⁰ Petrella *et al.*²⁰ performed a randomized control trial considering the efficacy and safety of periarticular hyaluronic acid injections in acute lateral ankle sprain. They found a significant reduction in pain on the visual analogue score (VAS) on both weight bearing and walking at day 8 (and weight bearing alone after 90 days) for hyaluronic acid compared with placebo injection of normal saline.²⁰

Struijs and Kerkhoffs² attempted to identify the effects of treatment strategies for acute ankle ligament ruptures. Surgery and immobility have similar outcomes in terms of pain, swelling and recurrence but surgery is more likely to lead to increased joint stability.² De Vries *et al.*²¹ compared different treatments (both non-surgical and surgical) for chronic lateral ankle instability and concluded that in view of the low-quality methodology of almost all the studies, there was insufficient evidence to support any specific intervention for chronic ankle instability. They did find, however, that after surgical intervention, early functional mobilization lead to an earlier return to work and sporting activity than immobilization alone.²¹ Both these studies were systematic reviews.

The small numbers of studies accrued, coupled with the fact one of the reviews concluded that the evidence assessed was of low quality, restricts our ability to meaningfully comment on the strength of evidence.

Recurrence prevention

The level of evidence regarding prevention of sprain recurrence ranged from levels 1 to 2, though once again, these were limited in number. In all, two systematic reviews and one randomized control trials were identified.

Van Rijn *et al.*²² carried out a systematic review about the clinical course of conventionally treated acute lateral ankle sprains in adults and their prognostic factors. They noted a rapid decrease in pain reporting within the first 2 weeks. Up to a third of patients still experienced pain after 1 year, but the majority (up to 85%) reported full

recovery within 3 years. The risk of recurrence of sprain ranged from 3 to 34% in studies. One study noted that training more than three times per week is a prognostic factor for residual symptoms.²²

Handoll *et al.*²³ also carried out a systematic review to assess the effects of interventions used for the prevention of ankle ligament injuries in physically active individuals. They concluded there is good evidence for the beneficial effect of ankle support in the form of semi-rigid orthoses or Aircast braces to prevent subsequent ankle sprains during high-risk sporting activity. There was limited evidence for reducing ankle sprains in patients with previous ankle sprains who did ankle disk training exercises.²³ There was no conclusive evidence on the protective effect of 'high-top' shoes.²³ Hupperets *et al.*²⁴ evaluated the effectiveness of an unsupervised proprioceptive training programme on ankle sprain recurrence in athletes by means of a randomized control trial. They found that the use of such a programme is effective for the prevention of self-reported recurrence.²⁴ It was specifically beneficial in athletes whose original sprain had not been medically treated.²⁴

Although studies considered were of higher levels of evidence, small finite numbers once again preclude us from making any meaningful conclusions as to the strength of evidence.

Limitations of review

Although every effort was made to obtain high-quality studies, it was clear there was a wide variety in terms of quality of methodology and reported outcomes. Some papers did not originate from the host country and therefore, may not be applicable in every aspect to the local population. It was also noted that by limiting the review to English language articles only, there was the potential for high-quality non-English articles to be excluded. By limiting the articles to those that could be downloaded as full versions electronically, there was also the possibility of excluding high-quality evidence which was not available in such a format.

We attempted to look at studies which recruited only adult patients (i.e. 18 years or older), but some of the studies had age ranges which included adolescents and we have attempted to state this discrepancy when we have encountered it. Even though injection therapy with local anaesthetic and soluble glucocorticoids is a possible treatment option for treating ankle sprains, none of the studies that we retrieved provided any significant evidence for or against its use.

Conclusion

Ankle sprains occur commonly but their management is not always readily agreed. The OARs are ubiquitous in the clinical pathway and can be used in both the primary and secondary care environment. It can be applied by emergency care physicians, primary care physicians and triage nurses but is not the sole determinant of clinicians' decisions on how to investigate and manage ankle sprains. For mild-to-moderate sprains, functional treatment options (which can consist of elastic banding, soft cast, taping or orthoses with associated coordination training) were found to be statistically better than immobilization for multiple outcome measures. Lace-up supports are a more effective functional treatment than elastic bandaging and result in less persistent swelling in the short term when compared with semi-rigid ankle supports, elastic bandaging and tape. Tape resulted in more dermatological complications than elastic bandage.

For severe ankle sprains, a short period of immobilization in a below-knee cast or pneumatic brace results in a quicker recovery than tubular compression bandage alone. There is good evidence that semi-rigid orthoses and pneumatic braces provide beneficial ankle support and also prevent subsequent sprains during high-risk sporting activity. Supervised rehabilitation training in combination with conventional treatment for acute lateral ankle sprains is thought to be beneficial, although some of the studies we reviewed gave conflicting outcomes. Therapeutic hyaluronic acid injections in the ankle are relatively novel but may have a role in expediting return to sport after ankle sprain. There is a role for surgical intervention in severe acute and chronic ankle injuries. However, none of the studies considered showed strong evidence for or against their role, mostly citing methodological issues as the reason.

Only the discussion section on conservative treatments, which consists of immobilization, functional interventions and supervised rehabilitation programmes, currently has a good strength of recommendation for placing the evidence into clinical practice. Potential areas of future in-depth research into therapeutic treatment options and ankle sprain prevention strategies are recommended.

Acknowledgements

We acknowledge Nicola Maffulli for inviting this article. We also acknowledge Somen Banerjee and the Public Health Department at NHS Tower Hamlets for identifying the need for ankle injury clinical

protocols in the community. We wish to thank Alan Rankin for his suggestions and input. Provenance and peer review: commissioned, externally peer reviewed.

References

- 1 Definition of an ankle sprain. *GP Notebook Website*. <http://www.gpnotebook.co.uk> (3 February 2010, date last accessed).
- 2 Struijs P, Kerkhoffs G. Ankle sprain. *Clin Evid (Online)* 2007;12:1115.
- 3 Katcherian DA. Treatment of Freiberg's disease. *Orthop Clin North Am* 1994;25:69–81.
- 4 Cameron KL, Owens BD, DeBerardino TM. Incidence of ankle sprains among active-duty members of the United States Armed Services from 1998 through 2006. *J Athl Train* 2010;45:29–38.
- 5 Systematic Review Hierarchy of Evidence. Sheffield University School of Health and Related Research (ScHARR). <http://www.shef.ac.uk/scharr/ir/units/systrev/hierarchy.htm> (9 April 2010, date last accessed).
- 6 Marinou G, Giannopoulos A, Vlasis K *et al*. Primary care in the management of common orthopaedic problems. *Qual Prim Care* 2008;16:345–9.
- 7 Eecheute C, Vaes P, Van Aerschoot L *et al*. The clinimetric qualities of patient-assessed instruments for measuring chronic ankle instability: a systematic review. *BMC Musculoskeletal Disord* 2007;8:6.
- 8 Leddy JJ, Kesari A, Smolinski RJ. Implementation of the Ottawa ankle rule in a university sports medicine center. *Med Sci Sports Exerc* 2002;34:57–62.
- 9 Wynn-Thomas S, Love T, McLeod D *et al*. The Ottawa ankle rules for the use of diagnostic X-ray in after hours medical centres in New Zealand. *N Z Med J* 2002;115:U184.
- 10 Brehaut JC, Stiell IG, Visentin L *et al*. Clinical decision rules 'in the real world': how a widely disseminated rule is used in everyday practice. *Acad Emerg Med* 2005;12:948–56.
- 11 Fan J, Woolfrey K. The effect of triage-applied Ottawa Ankle Rules on the length of stay in a Canadian urgent care department: a randomized controlled trial. *Acad Emerg Med* 2006;13:153–7.
- 12 Leemrijse CJ, Plas GM, Hofhuis H *et al*. Compliance with the guidelines for acute ankle sprain for physiotherapists is moderate in the Netherlands: an observational study. *Aust J Physiother* 2006;52:293–9.
- 13 Cooke MW, Lamb SE, Marsh J *et al*. A survey of current consultant practice of treatment of severe ankle sprains in emergency departments in the United Kingdom. *Emerg Med J* 2003;20:505–7.
- 14 Kerkhoffs GM, Rowe BH, Assendelft WJ *et al*. Immobilisation and functional treatment for acute lateral ankle ligament injuries in adults. *Cochrane Database Syst Rev* 2002;3:CD003762.
- 15 Van Der Windt DA, Van Der Heijden GJ, Van Den Berg SG *et al*. Ultrasound therapy for acute ankle sprains. *Cochrane Database Syst Rev* 2002;1:CD001250.
- 16 Kerkhoffs GM, Struijs PA, Marti RK *et al*. Functional treatments for acute ruptures of the lateral ankle ligament: a systematic review. *Acta Orthop Scand* 2003;74:69–77.
- 17 Lamb SE, Marsh JL, Hutton JL *et al*. Collaborative Ankle Support Trial (CAST Group). Mechanical supports for acute, severe ankle sprain: a pragmatic, multicentre, randomised controlled trial. *Lancet* 2009;373:575–81.
- 18 Van Os AG, Bierma-Zeinstra SM, Verhagen AP *et al*. Comparison of conventional treatment and supervised rehabilitation for treatment of acute lateral ankle sprains: a systematic review of the literature. *J Orthop Sports Phys Ther* 2005;35:95–105.
- 19 Van Rijn RM, van Os AG, Kleinrensink GJ *et al*. Supervised exercises for adults with acute lateral ankle sprain: a randomised controlled trial. *Br J Gen Pract* 2007;57:793–800.
- 20 Petrella RJ, Petrella MJ, Cogliano A. Periarticular hyaluronic acid in acute ankle sprain. *Clin J Sport Med* 2007;17:251–7.

- 21 De Vries JS, Krips R, Sierevelt IN *et al.* Interventions for treating chronic ankle instability. *Cochrane Database Syst Rev* 2006;4:CD004124.
- 22 Van Rijn RM, van Os AG, Bernsen RM *et al.* What is the clinical course of acute ankle sprains? A systematic literature review. *Am J Med* 2008;121:324–31.
- 23 Handoll HH, Rowe BH, Quinn KM *et al.* Interventions for preventing ankle ligament injuries. *Cochrane Database Syst Rev* 2001;3:CD000018.
- 24 Hupperets MD, Verhagen EA, van Mechelen W. Effect of unsupervised home based proprioceptive training on recurrences of ankle sprain: randomised controlled trial. *BMJ* 2009;339:b2684.