Diagnosis, treatment and prevention of ankle sprains: an evidence-based clinical guideline

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ABSTRACT

Ankle injuries are a huge medical and socioeconomic problem. Many people have a traumatic injury of the ankle, most of which are a result of sports. Total costs of treatment and work absenteeism due to ankle injuries are high. The prevention of recurrences can result in large savings on medical costs. A multidisciplinary clinical practice guideline was developed with the aim to prevent further health impairment of patients with acute lateral ankle ligament injuries by giving recommendations with respect to improved diagnostic and therapeutic opportunities. The recommendations are based on evidence from published scientific research, which was extensively discussed by the guideline committee. This clinical guideline is helpful for healthcare providers who are involved in the management of patients with ankle injuries.

INTRODUCTION

In the Netherlands, about 520 000 persons annually have a traumatic injury of the ankle of which about 200 000 are a result of sports.[1] Around half of the injuries receive medical treatment and 40% results in chronic instability.[1] The average work absenteeism of patients with a functional-treated ligament rupture is two and a half weeks and after six weeks, 90% has returned to work.[1] Of the patients who perform sports, around 60–90% resume sports after 12 weeks at the same level as before the trauma.[1] About one-third of the total costs due to sport injuries are caused by ankle injuries.[1] The prevention of recurrence can result in substantial cost savings. An example from a Dutch study showed mean total costs of one ankle sprain to be about E360.[2] With the abovementioned 520 000 persons with an ankle sprain, Dutch annual sports-related ankle sprain costs can roughly be estimated at E187.2 million. Productivity loss due to absence from paid and unpaid work was responsible for up to 80% of these costs.[2 3] Despite the growing body of evidence, international debate shows controversy for best treatment strategies after ankle injuries.[4 5] Till date, no international guidelines have been published for the management of acute ankle injuries (International Guideline Library (www.g-i-n.net); US National Guideline Clearinghouse (www.guideline.gov).

Recently, in the Netherlands, a clinical guideline for acute lateral ankle ligament injury was developed under the auspices of the Royal Dutch Society for Physical Therapy in cooperation with many medical professional associations and patients, following the AGREE criteria.[6] Specific goal of this clinical guideline is the prevention of further health impairment of patients (ie, recurrences) by providing recommendations for improved diagnostic and therapeutic opportunities. Other goals are to obtain uniformity of diagnostics, treatment and guidance of doctors and physical therapists and other involved professional groups and to define the framework within which the multidisciplinary care of patients with ankle injuries has to take place. This guideline will also contribute to improved communication between healthcare professionals.

Target group

The guideline is meant for all care providers who are involved in the treatment and guidance of patients with ankle injuries: family physicians, physical therapists, orthopaedic surgeons, trauma surgeons, rehabilitation physicians, radiologists, occupational physicians, sports physicians and professionals involved in sport massage.

MATERIALS AND METHODS

The recommendations set in this guideline are, if available, based on evidence from published scientific research. Relevant articles were searched in the Cochrane Library, Medline and Embase. The full search strategy is available upon request. The language was limited to Dutch, English, German, French, Danish, Norwegian and Swedish. In search for additional information, all reference lists of the included articles were checked manually. Articles published between January 1996 and March 2009 were enclosed. The quality of included articles was assessed by epidemiologists on the basis of 'evidence-based guideline development' – assessment forms and classified in various levels in order of probative and scientific value (tables 1 and 2). The results based on the evidence from literature are presented in categories with levels of evidence of the conclusions included. In formulating the final recommendations, the guideline committee also took other aspects into account, such as potential harm of the interventions, patients' perspective, costs and organisational aspects. If the guideline committee decided that based on current evidence a positive recommendation was not opportune, this was stated as well. So, recommendations were evidence-based and consensus-based. Below, the evidence and discussion among the committee members are summarised, and the final recommendations presented in *italics*.

RESULTS

Predisposing factors

Intrinsic and extrinsic risk factors may increase the chance of acute lateral ankle ligament injury or in short lateral ankle injury (LAI). In order to unravel the

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Table 1 Classification of methodological quality of individual studies

	Intervention	Diagnostic accuracy of research	Damage or side effects, aetiology, prognosis*
A1	Systematic review of at least two independently conducted studies of A2 level		
A2	Randomised double-blind comparative clinical research of good quality of sufficient size	Research relative to a reference test (a 'golden standard') with predefined cut-off points and independent assessment of the results of a test and golden standard, on a sufficiently large series of consecutive patients who all have had the index and reference test	Prospective cohort study of sufficient size and follow-up, at which adequately controlled for 'confounding' and selective follow-up sufficient is excluded.
B	Comparative research, but not with all the features as mentioned under A2 (this includes patient–control research, cohort study)	Research relative to a reference test, but not with all the attributes that are listed under A2	Prospective cohort study, but not with all the features as mentioned under A2 or retrospective cohort study or patient-monitoring research
C	Not comparative research		
D	Opinion of experts		

*This classification only applies to situations in which due to ethical or other reasons controlled trials are not possible to perform. If these are possible, then the classification applies to interventions.

importance of extrinsic risk factors for athletes, a specific search was performed for risk factors relating to the type of surface on which to play and the player position during the game.

Intrinsic risk factors

Four risk factors are important: strength, propriocepsis, range of motion and balance of patients older than 15 years with a primary or recurrent lateral ankle ligament injury. The definition of LAI, ADL (activities of daily living) in the literature varied widely.[7] There are indications that limited dorsal flexion[8] and reduced propriocepsis[9] lead to an increased risk of sustaining an LAI (Level 3). It is plausible that an ankle distortion in the past[10 11] and reduced balance predispose for LAI, ADL.[9 12–17]

Extrinsic risk factors

Among a group of 2 016 000 players of all kind of sports, 14 098 patients with LAI were selected of whom the medical files were available. The highest incidence of ankle injuries was reported due to playing aero ball, in wall climbing, indoor volleyball, rock climbing, basketball and field sports.[18] The incidence is dependent on the type of sport, the total number of players and whether a competition is involved (Level 2).[18] Among soccer players, playing on artificial grass seems to slightly increase the incidence (Level 2)[19 20] and defenders and attackers have a higher risk due to contact with opponents (Level 2).[21–23] In volleyball players, landing after a jump seems to be the most important risk factor (Level 2).[24 25]

Based on current research data, no recommendations concerning predisposing factors for LAI, ADL can be made for daily practice.

Prognostic factors

Research of high quality concerning the relationship between prognostic factors and LAI is lacking. The natural course is good; most patients with LAI show complete recovery over time. Pain decreases rapidly in the first 2 weeks after an ankle distortion (Level 1).[26] After 1 year, 5% to 33% of the patients with LAI still have pain and have complaints of instability (Level 1)[26] and 3% to 34% has a recurrent distortion (Level 1).[26] Sports performed at high level is possibly an unfavourable prognostic factor for the development of residual complaints (Level 3).[27] Increased ligament laxity after an ankle distortion might also be an unfavourable prognostic factor for the development of chronic instability (Level 3).[28]

Based on current research data, no recommendations concerning neither prognostic factors nor natural course of LAI can be made for daily practice.

Ottawa ankle rules

In LAI, ADL, the existence of a fracture is the main red flag. The ability to walk again within 48 h after trauma is an auspicious sign and indicates a good prognosis.[29] The Ottawa Ankle Rules have been developed to rule out fractures after acute ankle injuries.[30] Most patients who visit the emergency room are examined using radiographs to rule out fractures despite the fact that the prevalence of ankle fractures is less than 15%.[30] The Ottawa Ankle Rules consists of a questionnaire and research protocol for examination of ankle and foot. X-ray diagnostics is only indicated in case of pain in the malleoli or middle foot, combined with one of the following findings: palpation pain on the dorsal side of one or both of the malleoli, palpation pain at the bases of the metatarsal bone V, palpation pain of the navicular bone and finally if the patient is unable to walk at least four steps. Among 73 studies concerning Ottawa Ankle Rules, four review studies of importance were identified.[30–33] Ottawa Ankle Rules seems to be an accurate tool to exclude fractures in the emergency room within the first week after acute ankle injury (Level 1).[30] This finding was acknowledged by results of research from the Netherlands (Level 2).[34] Studies about the use of Ottawa Ankle Rules outside the hospital are missing. (Level 4) It seems plausible that the predictive value of the Ottawa Ankle Rules when used in a general practice is reduced due to the lower incidence of serious ankle injuries or ruptures of ligaments of the ankle.[35 36]

The use of the Ottawa Ankle Rules is strongly recommended in the emergency room of hospitals and in general practice in order to exclude fractures.

In the training of healthcare professionals, sufficient attention should be paid to proper application of the Ottawa Ankle Rules.

Table 2 Level of conclusions

	Conclusions based on
1	Research of level A1 or at least two examinations of level A2 performed independently of each other, with consistent results
2	One examination of level A2 or at least two examinations of level B, performed independently of each other
3	One examination of level B or C
4	Opinion of experts

Diagnostics

If a haematoma is present accompanied by local pressure pain at palpation or a positive anterior drawer test is present or both, it is most likely that a (partial) lateral ankle ligament rupture exists. Delayed physical diagnostic examination (4 to 5 days) gives a better diagnostic result than research within 48 h. The sensitivity of delayed physical examination is 96% and the specificity 84% (Level 2).[35] Knowledge about the

Table 3* Effects in favour of functional treatment compared with immobilisation in the event of acute ankle injury[46]

Short-term (0 to 6 weeks)	
Return to work	2 RCTs; n=150; RR 5.75 (95% CI 1.01 to 32.71)
Swelling	3 RCTs; n=260; RR 1.74 (95% CI 1.17 to 2.59)
Medium term (6 weeks–1 year)	
Patient satisfaction	2 RCTs; n=123; RR 4.25 (95% CI 1.12 to 16.09)
Long term (>1 year)	
Return to sports	5 RCTs; n=360; RR 1.86 (95% CI 1.22 to 2.86)
Resuming sport activity (number of days)	3 RCTs n=195; MD 4.88 (95% CI 1.50 to 8.25)
Return to work (number of days)	6 RCTs n=604; MD 8.23 (95% CI: 6.31 to 10.16)

*The effects per comparison are in favour of the former interventions.
MD, mean difference; RCT, randomised controlled trials.

Table 4 Results* of functional treatments for acute ankle injury[48]

Short-term (0–6 weeks)	
Swelling	
Semirigid brace vs lace-up brace	1 RCT; n=122: RR 4.19, 95% CI 1.26 to 13.98
Elastic bandage vs lace-up brace	1 RCT; n=122: RR 5.48, 95% CI 1.69 to 17.76
Tape vs lace-up brace	1 RCT; n=119; RR 4.07 (95% CI 1.21 to 13.68)
Return to work (number of days)	
Elastic bandage vs semirigid brace	2 RCTs; n=157: WMD 4.24, 95% CI 2.42 to 6.06
Resuming sport activity	
Elastic bandage vs semirigid brace (subjective) Instability	1 RCT; n=84: RR 9.60, 95% CI 6.34 to 12.86
Semirigid brace vs elastic bandage	1 RCT; n=104: RR 8.00, 95% CI 1.03 to 62.07
Complications (ie, skin irritations)	
Elastic bandage vs tape	2 RCT; n=208: RR 0.11, 95% CI 0.01 to 0.86

*The effects per comparison are in favour of the former interventions.
RCT, randomised controlled trials; WMD, weighted mean difference.

use of ultrasound and MRI examination and their diagnostic performance is hampered by lack of research (Level 4). Arthrography within 48 h after an inversion trauma is highly sensitive but not recommended (Level 2).[36–39]

For a solid diagnosis of an ankle ligament rupture, patients must be re-examined 4 to 5 days after the trauma.

If a haematoma develops and patients experience local pressure pain at palpation or a positive anterior drawer test is present or both, it is very likely that a ligament rupture exists.

Treatment

The use of ice and compression in the inflammatory phase after acute ankle injuries

In the event of an acute ankle injury, the effect of ice (cryotherapy) is unclear.[40] Ice combined with exercise therapy has a positive effect on the swelling in comparison with heat application.[41] The effectiveness of compression shows conflicting results (Level 2).[42–44] Intermittent application of ice has a significant effect on short-term pain reduction (difference ± 1 cm in a visual analogue scale) in comparison with standard application of ice. There are no indications that the use of ice only is effective to reduce swelling, increase function and reduce pain at rest in the event of an acute ankle injury (Level 2).[40 45]

The use of ice and compression, in combination with rest and elevation, is an important aspect of treatment in the acute phase of LAI.

Immobilisation after acute ankle injuries

Research from a systematic review (21 randomised controlled trials (RCTs), N=2184) showed that a longer period of immobilisation in a lower leg cast (minimum of 4 weeks) is less effective compared with different functional treatments (Level 2) (see table 3).[46] However, due to great variation in methodological quality, the conclusions from this review should be interpreted with some caution (Level 2).[46] Recent evidence from 1 RCT (N=584) states that a short period of plaster immobilisation (10 days) or rigid support for reduction of pain and swelling can still be considered of help in the treatment of LAI.[47]

A short period of plaster immobilisation or similar rigid support facilitating a rapid decrease of pain and swelling can be helpful in the acute phase of the treatment of LAI.

Functional treatment for 4 to 6 weeks is preferable to immobilisation in a cast.

Optimal functional treatment after acute ankle injuries

A systematic review (9 RCTs, N=892) investigated the effect of different functional treatments for acute ankle injuries such as exercise therapy and immobilisation by means of tape or brace (Level 2) (see table 4).[48] Elastic bandages gave fewer complications than tape, but was associated with a delayed return to work and sports. Instability was reported more frequently compared with a semirigid ankle brace. A lace-up brace or a semirigid brace seems preferable to the use of an elastic bandage (Level 2).[48] However, in this review, insufficient data were present to draw definite conclusions from literature.

A lace-up brace or a semirigid brace is preferable and recommended.

Based on consensus in the committee in (professional) sports also the use of tape can be considered.

Exercise therapy after acute inversion injury

Besides three recent RCTs,[49–51] four systematic reviews of sufficient quality were found on this subject.[52–55] Exercise therapy seems to prevent a recurrence in patients with LAI (2 RCTs, n=130) (RR 0.37; 95% 0.18 to 0.74) on the long term (8 to 12 months) (Level 2).[54] Exercise therapy seems to have no (significant) effect on balance on the medium term (6 to 9 months) (2 RCTs, n=78) (SMD 0.38; 95% –0.15 to 0.91) (Level 2).[54]

Exercise therapy should be used in the treatment of LAI.

Exercise therapy can also be applied at home.

Manual mobilisation after acute ankle injuries

Three systematic reviews were identified,[52–54] the most recent review included all trials from the other two reviews.[54] There are limited positive (very) short-term effects (dorsalflexion, ROM, propriocepsis) in favour of manual mobilisation of the ankle (6 RCTs, N=224) (Level 2).[52–54] However, the clinical relevance of these findings is limited since the effects had disappeared 2 weeks after injury.

Manual mobilisation of the ankle has limited added value and is not recommended.

Other therapies after acute ankle injuries

In literature, no effect was found of ultrasound, laser therapy[56] and electrotherapy in the treatment of acute ankle injuries[57–59] (Level 1). Short-wave therapy also seems ineffective (Level 2).[60–64]

Ultrasound, laser and electrotherapy have no added value and are not recommended.

Table 5 Checklist. Essential information for healthcare professionals during referral of patient with LAI, ADL

Medical discipline	Diagnostic phase	Acute treatment phase	Guidance phase
Emergency physician	Time of accident Trauma mechanism	(Differential) diagnosis	
	Age, profession, hobby	Time schedule and treatment plan	
	Man, woman	Advise follow-up visit Duration of rest	
	Ability to walk after trauma	When normal weight-bearing allowed	
	Therapy until visit Concomitant symptoms	Thrombosis prophylaxis yes/no What to do with deviant drift of symptoms	
Sports masseur, physical therapist	Time of accident	(Differential) diagnosis	Diagnosis
	Trauma mechanism	Time schedule and treatment plan	Result of treatment
	Age, profession, hobby	Advise follow-up visit	Advise on ADL and sports participation
	Man, woman	Duration of rest	
	Ability to walk after trauma	When normal weight-bearing allowed	
	Therapy until visit	Thrombosis prophylaxis yes/no	
	Concomitant symptoms	What to do with deviant drift of symptoms	
Sports physician, general practitioner	Time of accident	(Differential) diagnosis	Diagnosis
	Trauma mechanism		Result of treatment
		Time schedule and treatment plan	Advise on ADL and sports participation
	Age, profession, hobby	Advise follow-up visit	Medication
	Man, woman	Duration of rest	
	Ability to walk after trauma	When normal weight-bearing allowed	
	Therapy until visit Concomitant symptoms	Thrombosis prophylaxis yes/no What to do with deviant drift of symptoms	
Orthopaedic and trauma surgeon	Time of accident	Fracture yes/no	
	Trauma mechanism	Treatment options	
	Age, profession, hobby		
	Man, woman		
	Ability to walk after trauma		
	Therapy until visit		
	Concomitant symptoms		
Radiologist	Time of accident	Fracture yes/no	
	Trauma mechanism	Concomitant pathology	
	Age, profession, hobby		
	Man, woman		
	Ability to walk after trauma		
	Therapy until visit		
	Concomitant symptoms		
Medical officer, insurance medical officer, rehabilitation physician			Diagnosis
			Therapy
			Time schedule and treatment plan/ result
			Advise on ADL and sports participation
			Advise follow-up visit
			Medication
			Prognosis
			Reintegration protocol

ADL, activities of daily living; LAI, lateral ankle injury.

Surgical therapy after acute lateral ankle ligament injury

A systematic review concluded that there was some limited evidence for longer recovery times, and higher incidences of ankle stiffness, impaired ankle mobility and complications after surgical treatment (20 RCTs, N=2562) (Level 2).[65] However, final conclusion from this review was that there are insufficient high-quality RCTs available to give a final judgement on the effectiveness of surgery compared with conservative treatment in LAI (20 RCTs, N=2562) (Level 2).[65]

Functional treatment is preferred over surgical therapy.

Based on consensus in the committee, it is recommended that in (top-professional) sports surgical treatment can be considered on an individual basis.

Communication between healthcare professionals

In order to be able to effectively refine communication between healthcare professionals during referral of patients with LAI, the essential information has been inventoried by consensus of the guideline committee. A distinction was made between the diagnostic phase, the treatment phase and the guidance phase. The

Table 6 Return to work[75]

Degree of inversion injury	Return to light work	Restrictions	Full return to former work
Distortion	2 Weeks	Mostly sitting work Not exceeding 10 kg of lifting Limit standing and walking position on uneven surfaces	3–4 Weeks depending on the task requirements
Partial or total rupture of ligaments	3–6 Weeks	Mostly sitting work Not exceeding 10 kg of lifting Limit standing and walking position on uneven surfaces	6–8 Weeks depending on the task requirements and the result of physiotherapy

different disciplines involved in communication are emergency physician, sports masseur and physical therapist, sports physician and general practitioner, orthopaedic and trauma surgeon, radiologist, medical officer for occupational medicine and rehabilitation physicians.

Communication between healthcare professionals involved in the treatment of LAI can be short and effective, if the referring professional takes care to exactly provide the correct information.

The use of the information checklist will refine communication between healthcare professionals involved in the treatment of patients with LAI (table 5) and is recommended.

Prevention

Exercise therapy

Besides one recent RCT,[66] one systematic review reports that exercise therapy shows no significant beneficial effect on balance on midterm (6 to 9 months) follow-up in patients with LAI (Level 2) (2 RCTs, N=1577) (SMD 0.38; 95% −0.15 to 0.91). Also training coordination and balance have no effect on the prevention of primary (first) inversion injuries of the ankle in athletes (Level 2).[11 67 68] However, the results of two RCTs and two systematic reviews suggest that training coordination and balance does prevent recurrence of ankle injuries in athletes up to 12 months postinjury (Level 2).[1 3 54 69]

After LAI, it is recommended to train balance and coordination, especially among athletes, starting within 12 months after the occurrence of the injury.

Exercise therapy should be included as much as possible into regular training activities or at home to prevent recurrences or both.

Tape or brace to prevent inversion injury

The results from three systematic reviews suggest that the use of a brace and tape reduces the risk of recurrent inversion injuries in those who are active in sports (Level 2) (5 RCTs, N=2858) (RR 0.53, 95% CI 0.40 to 0.69).[1 70 71] However, it is unclear whether a brace is more effective than a tape (Level 2).[1 48 72] The preference for the choice of a brace or a tape depends on the individual situation. Due to considerations about practical usability and evaluation of costs, a brace is initially preferable to a tape.

It is recommended to use a brace or a tape to prevent a relapse.

The use of a brace or a tape is a personal choice. On the basis of practical usability and evaluation of costs, a brace is initially the preferable means of support.

It is recommended to phase out the use of brace or tape in time.

Preventive effect of footwear

Two systematic reviews (3 RCTs, N=3410) found no differences in protective effect of either high-fitted or low-fitted work- or sport shoes to avoid (recurrent) LAI (Level 2).[1 70 73]

No recommendations can be made concerning the type of shoes to prevent recurrence of ankle ligament injury.

Resuming work

One systematic review (2 RCTs, N=159) concluded that workers who use a semi-rigid ankle brace seem to resume work faster than workers who use an elastic bandage (Level 2) (4.2 days; 95% CI 2.4 to 6.1 days).[48] Discrimination between the degrees of injury can support the initial treatment and prognosis in relation to return to work (Level 4).[74] A resumption of work strategy and a return to work schedule, which takes into account the task requirements, can contribute to optimise reintegration towards work (Level 3) (table 6).[75 76]

Workers with LAI should preferably be treated with a brace to speed up work resumption.

Sport resumption

In the Netherlands about 3.5 million athletes annually have a sports injury, of which 1.4 million seek medical treatment. Sixteen per cent of all sports injuries (570 000) are ankle injuries and 26 000 athletes with ankle injuries are treated in the emergency room of a hospital annually.[77] Distortion of the ankle as well as a lateral ankle ligament rupture can lead to a disturbance in propriocepsis through which a functional instability may arise. This disturbance seems to be hosted in the central nervous system above the level of the spinal reflex (Level 2).[21 78 79] A delayed response time of the peroneal muscle may occur as a result of (traction) injury of the peroneal nerve. It seems that motor-unit insufficiencies after a distortion are less long lasting than those after LAI (Level 2).[80–83] Another effect may be strength reduction of extensor muscles (used in eversion) and other muscles around the ankle. These muscles may benefit significantly from a strength training programme (Level 2).[84–88]

Rehabilitation of athletes after LAI must be the result of a variety of exercises in which propriocepsis, strength, coordination and function of the extremity are maintained.

DISCUSSION

A clinical guideline for acute lateral ankle ligament injury was developed under the auspices of the Royal Dutch Society for Physical Therapy by a group including content experts for all specialties involved, methodologists experienced in developing guidelines, health professionals involved in the healthcare process and patients. The idea behind guidelines is to provide a considered, unbiased, evidence-based, accessible, transparent and easy-to-use summary of the implications of current health knowledge for practice, which, if used, should improve the quality of care.[89]

Guideline development is essential in improving 'evidence-based practice', but development is a complex process. Even good guidelines have tended to lie on shelves gathering dust because of the difficulty of distinguishing them from bad ones. At the start of this project, a limited set of relevant questions from daily clinical practice was selected to be answered by the guideline. Consequently, a possible weakness of the guideline is identified in the fact that there are still some issues open for debate. Another possible flaw is that even though the recommendations in this guideline are based on best evidence from literature, ultimately converting the evidence into recommendations was a consensus process among the committee members, leaving room for bias. However, having all relevant health professionals involved in the guideline committee has probably limited this bias.

A definite strength of the current guideline is that essential referral data are now

What is already known?

- The incidence and trauma mechanism of lateral ankle injury (LAI) are known.
- A variety of therapeutic interventions is available for restoring stability and diminishing pain and swelling in patients with LAI.
- There is still no uniform treatment of LAI despite the large number of clinical trials.

What this study adds

- A systematic, evidence-based guideline of the prevention, predictors, diagnosis, operative and conservative treatment and prognosis of lateral ankle injury (LAI) was lacking.
- This guideline incorporates a perspective from several healthcare professionals and patients with the clinical evidence to formulate a guideline concerning LAI.

available for refinement of communication between healthcare professionals, in the Netherlands and all over the world.

Future research is warranted to investigate a number of alternative prophylactic interventions, their cost-effectiveness and general applicability. Additionally, future research requires the design of high-quality randomised controlled trials of the best available conservative treatment for well-defined injuries, with special focus on the benefit of a short period of immobilisation in the treatment of LAI.

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