

Lateral Ankle Sprain: Epidemiology, Prevention, Treatment, and Group-specified Guidelines

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Abstract. Lateral ankle sprains are a prevalent and diverse injury, but unfortunately, in previous studies, there are few clear guidelines for categorized patient groups to face it. So, this article aims to present a comprehensive guide for specific patient groups to make right the decisions when facing the problem of lateral ankle sprain by comparing and analyzing epidemiology, prevention, and treatment strategies of lateral ankle sprain. Risking factors are revealed in Epidemiological studies. The advantages and disadvantages of prevention strategies including taping & bracing, shoe design, and exercise programs are discussed. And surgical and conservative treatments are compared. For suggestions, athletes should apply a balanced approach involving taping, bracing, exercise programs, and surgical options. Non-athlete individuals engaging in sports activities should make their prevention and treatment choices based on their functional demands. Those less sport-inclined can employ few preventions and choose more conservative treatments.

Keywords: Lateral ankle sprain; epidemiology; prevention; treatment; individual guideline.

1. Introduction

Lateral ankle sprain, which is the most occurred acute ankle sprain, involves the tear of three ligaments (anterior talofibular, calcaneofibular, and posterior talofibular ligament) at the outer ankle, usually caused by inward rolling of the foot [1]. The patient population of this injury is so broad that it can be found from young to old, male to female, athletes to normal people, etc. And there are a lot of prevention and treatment options. Because of this broadness and diversity, it would be hard for individuals to identify the risk factors in life and find which prevention and treatment strategy works best for them specifically. Although there were a lot of previous articles studied the epidemiology of the lateral ankle sprain and compared the effectiveness of different prevention and treatment options, few of them had fused all these contents and given clear suggestions to specific patient groups. So, the goal of this article is to give individuals an overall guideline for lateral ankle sprain by addressing the following questions as a whole:

1. What factors make an individual at high risk of a lateral ankle sprain?
2. Which prevention strategy for lateral ankle sprain works best for a specific individual?
3. Which treatment strategy should a specific individual choose if he unfortunately sprains his lateral ankle?

In this article, the epidemiology of ankle sprain will be listed to identify factors that would cause a higher rate of sprain. Next, some major prevention and treatment strategies will be given, with their advantages and disadvantages. Finally, patient groups with different needs would be categorized, and suggestions would be given to each of them through analyzing and discussing contents in all previous sections.

2. Epidemiology

In this section, patient populations are divided into two parts, general public and athletes, as athletes have a much more intensive workload than normal people, so it's better to discuss separately.

2.1. The Population of General Public

There are many previous studies on the epidemiology of lateral ankle sprain to the public and four studies with comprehensive details are selected in this article. Those studies had study periods varied from 1980 to 2014 and were based on different nation's populations (US, Bulgaria, and Denmark) and various databases (US National Electronic Injury Surveillance System, US National Emergency Department Sample, Varna Emergency Trauma Center, and Hillerød County Hospital) [2-5]. The summarized information of those studies is shown below:

2.1.1 Overall Incidence Rate

The overall incidence rate of lateral ankle ligament sprain is within the range of 2~3 per 1000 person-year [2-4].

2.1.2 Sex

Males and females do not have significant differences in the incidence rate (RR 1.04) [2].

2.1.3 Age

The mean patient age is around 25~26 years old [2, 4, 5]. The highest incidence rate is about the age range from 15~20 years old [2-4].

2.1.4 Mechanism/Location

Major activities that cause the sprain are athletic activity (45%), play (20%), and work (16%) [5]. Most injuries happened at home (47.9%) and then recreation or sports spaces (28.5%) [2]. Patients younger than 25 years old have more injuries on sports grounds, and patients over 50 have more in-house injuries [5].

2.2. Population of Athletes

Some epidemiology studies on lateral ankle sprain are conducted on athlete population NCAA league. Two conclusive research based on US college athletes in about 20 sports are selected [6, 7], and below is some summarized information about those studies.

2.2.1 Overall rate

The overall lateral ankle sprain rate was 4.95 per 10,000 AEs during the NCAA academic year 2009-2010 to 2014-2015 [6] and 4.61 per 10,000 AEs during 2014-2015 to 2018-2019 [7]. It was estimated that 16022 lateral ankle sprains happened nationally in a year, and this means there would be at least 1 in 28 collegiate student-athletes suffering from sprains in each academic year [6].

2.2.2 Sex

With man's sports total rate of 4.88 and women's sports total rate of 4.22 (RR 1.16) [7], there is no significant overall rate overlap between the two sexes.

2.2.3 Highest Rate Sports

The sports with the highest LLC sprain are basketball, with men's rate of 11.82~11.96 per 10,000 AEs and women's rate of 9.50~10.03 per 10,000 AEs; then the second highest would be soccer, with men's rate of 7.43 per 10,000 AEs and women rate of 8.36 per 10000 AEs. Also, men's football and women's volleyball are at high risk too, with rates of 6.43~6.87 and 6.92~7.48 per 10,000 AEs [6, 7].

2.2.4 Mechanism/Situation

The top 3 injury mechanisms would be player contact, non-contact, and surface contact, with 41.4%, 27.4%, and 22.2% of reported cases respectively. The sprain rate is higher in competitions than in practice (with RR 3.24~3.29), though more cases happened during practices with a rate of 57.3% [6, 7].

2.2.5 Time Loss

44.4% of injured athletes come back within 24 hours, and another half (49.7%) would be one week or over a week. And in a very small proportion, it takes more than 21 days to return (3.6%) [6, 7].

3. Prevention

There are several options to prevent lateral ankle sprain, but they can be mainly divided into two genres: external support and exercise programs.

3.1. External Support

3.1.1 Taping & Bracing

The goal of external support is to restrict the movement of the ankle. Common types of external support involve taping and bracing. According to R Zwiers et al's review on the taping & bracing, those two techniques are concluded effective to the prevent lateral ankle sprain through three aspects: mechanical support, neuromuscular effect, and psychological benefit [8]. Mechanical support includes the effective restriction of range of motion [9] and reduction of inversion velocity [10]. The neuromuscular effect indicates that using tape and brace can improve proprioception, peroneal muscle reflex, and postural control, which all decrease the risk of sprain, but this part is inconclusive [11]. Psychological effect means people increase perceived stability and confidence when they think their ankles are protected, which would be effective in preventing injury [12].

The advantages of taping and bracing are that they are easily accessible and have been proven to be effective for the prevention of later ankle sprain. However, taping and bracing may undermine athletes' performance by hindering their abilities to jump, run, and change direction [11]. Also, tape and brace need extra time and money to employ: comparatively, tape use for an athlete in one season costs about \$40 but a reusable brace costs \$28 on average. Taping is usually more time-consuming than bracing. In addition, tape and brace would get loose during exercise, meaning the loss of protection to the ankle (15 mins for tape and 45 mins for brace) [8].

3.1.2 Choice of Shoes

Based on common knowledge, a well-designed sneaker like a high-top basketball sneaker can provide ankle protection. But do high-top shoes have better ankle protection than low-top shoes? Or does shoe design influence sprain incidence? The answer is speculative. According to James R. Barrett et al's research on high-top and low-top shoes, high-top and low-top shoes have no difference in the prevention of sprain; he estimated that maybe the newness of the shoe is a more vital factor [13].

3.2. Exercise Program

Exercise program to prevent lateral ankle sprain often involves stretching, strengthening, and balancing & proprioceptive training. Stretching to the triceps surae increases the dorsiflexion range of motion of the ankle. Strengthening the hip and knee joint helps to decrease the risk of lower extremity injury. Neuromuscular control of the proximal musculature, which helps people to adapt to unstable surfaces, can also be improved through Lateral hip strengthening exercises. Balancing & proprioceptive training enhance static and dynamic postural control, which helps the body manage joint motions, so there would be lower possibility of ankle sprain [14, 15]. A typical example of balancing & proprioceptive training includes maintaining single-leg balance on the ankle disk or wobble, with sports-related tasks like dribbling or catching a ball [16].

The big advantage of exercise programs to prevent sprain is have nearly no cost [16]. Also, the exercise program can be blended into athletes' schedules like warmup or conditioning sessions, and it can improve the athletes' performance on the court [17], but the program might be time-consuming—it takes up to 30 mins for several times a week, so people's compliance might be bad

[17]. In addition, the program's prevention effect on lateral ankle sprain can take up to 3 months to develop [16].

4. Treatment

There are two main categories of treatment of lateral ankle sprain, which are conservative treatment and surgical treatment. And which of them is better is always debated. In the next part, some details and pros/cons of those two categories will be listed, so it would establish great references for comparison.

4.1. Conservative

There are three phases after the lateral ankle sprain: Acute phase (0~4 days), subacute phase (5~14 days), and post-acute phase (after 14 days). During the acute phase, treatment often includes RICE (Rest, Ice, Compression, Elevation), and short-term or complete immobilization using a rigid or semi-rigid ankle brace. Other treatments may include, non-steroidal anti-inflammatory drugs (NSAID), electrical stimulation, and manual therapy. During the subacute phase, some ROM, balancing stretching exercises can be applied. During the post-acute phase, some weight-bearing and sports-specific exercises can be included. Noticed that treatment in the acute phase should be also used combinedly during the subacute and post-acute phases [18].

Several articles recommend conservative treatment over surgical treatment. According to Niedermann B et al's 1-year follow-up research on patients who underwent ankle sprain and were treated with either a plaster cast or surgery, there is no significant difference between the recovery results of conservative and surgical treatment (76% good results from conservative and 81% good results from surgical). So, he concluded that considering the risk of infection and the complexity of the surgical approach, conservative treatment is more recommended [19]. Also, Povacz P et al found out that patients in the conservative treatment group returned to normal work activity much sooner than those in the surgical treatment group (Mean 1.6 weeks for conservative and 7.0 weeks for surgical), indicating that conservative treatment is a much more time-saving option [20]. In the systematic review of D. Altomare et al., he concluded that most lateral ankle sprain can be treated with non-surgical methods, and conservative treatment would be a better option when taking into account of cost and risk of surgery [21].

4.2. Surgical

There are generally two techniques in lateral ankle ligament reconstruction surgery, which are the Brostrom-Gould technique and tendon transfer. The Brostrom-Gould technique tightens the torn ligament (like ATFL) and cleaves it. The tendon transfer means replacing the ligament with a tendon originating from other parts of the body or another cadaver. The replacement tendon is secured in place using sutures and pins. An 8~12-week recovery program with physical therapy would follow up after the surgery [22].

Several articles recommend surgical treatment over conservative treatment. According to O. Korkala et al, under-40-year-old patients with severe ankle sprains, who are physically active, like athletes, should better choose surgical repair. This is because surgical treatment may yield a better recovery of proprioceptive ability compared to conservative treatment. However, he also stated that patients over 40 should choose conservative treatment because they have worse ligamentous regeneration capacity [23]. Also, according to A.C.M. Pijnenburg et al, surgical treatment has long-term benefits on residual pain, recurrent pain, and stability. He recommends surgical treatment for patients with higher functional demand as primary repair to the ligament guarantees some resistance to extra stresses imposed by competitive sports activities. However, he also concluded some drawbacks of surgical treatment include non-treatment due to delayed surgery, high cost in money and time, and risk of infection, surgical failure, or nerve damage [24].

5. Discussion

From the epidemiology part, it can be concluded that for the population of the public, young people are more likely to get lateral ankle sprain, and although most of the people in the general public are not athletes, sports activities and play cause a large proportion of sprain cases. But there is still quite a proportion of sprains caused by work or at home. For the population of athletes, it is concluded that compared to the general public, athletes do have a higher risk of lateral ankle sprain, proving the high risk of sports activities on lateral ankle sprain. (National estimates of 1 in 28 athletes having a sprain in each academic year would be equal to about 36 per 1000 person-year, which is times greater than 2~3 person-year in public)

So, based on the information above, patient populations are divided into three main groups: athletes, the non-athlete public who attend sports in daily life, and the public who don't usually attend sports in daily life. And some suggestions to face lateral ankle sprain for those different groups would be given below.

5.1. Athletes

Athletes attend the most vigorous sports activities and require the highest body functional demands. They need to be particularly careful about lateral ankle sprain because half of the sprain cases take over one week to return, which might influence their achievement in a season. Those athletes of sports like basketball, soccer, volleyball, and football, need to be even more careful because their sports involve frequent jumps, direction changes, or contact, which makes them have the highest incidence rate of sprain. Athletes also need to pay attention to possible sprain during competition as it has a higher sprain rate, and they need to be aware of the situation of player contacts as this accounts for most sprain cases.

Regarding the prevention strategy, it would be best for athletes to apply more of them: they can use taping & bracing and exercise programs simultaneously. Since this might make them less likely to injure. However, the money and time cost, as well as the possible hindering of athletic performance might come up. So, it depends on the preference of the athlete and coach to decide which combination of strategies should be used.

For the treatment of athletes' lateral ankle sprain, especially for severe ones, surgical treatments are suggested. As stated before, surgical treatment would have better recovery on stability and fewer residual problems, which would be ideal for athletes who need good body functions. In addition, athletes would have medical teams and sponsors, which would be enough to cancel out the risk and cost of surgical treatment.

5.2. Non-athlete Public Who Attend Sports in Daily Life

Suggestions to this group would have some similarities with those of athletes because sports activity accounts for most sprain cases in the general public. People should also pay more attention to sports with a high risk of sprain. But luckily, this group would have a generally lower incidence rate than athletes because of lower intensity.

The prevention and treatment strategy for this group highly depends on personal preference because people in this group generally don't have such high function demand compared to athletes and the sport's intensity is lower. For prevention, the principle "more the better" still works here, but people might only play sports for fun; they might find wearing a brace troublesome and costly and conducting an exercise program tiring. It might be a good option for those "lazy" people to get a fitting sneaker—although there is no conclusive evidence on the protective function of shoe design, ill-fitting shoes are just not appropriate for sports. For treatment, conservative treatment can provide enough functional recovery for this group for most of the time, people within this group may find surgical treatment expensive, risky, and time-consuming. So, if people within this group personally have higher body functional demands, they can choose to employ more prevention methods and choose surgical treatment after a severe sprain, and vice versa.

5.3. Public Who Don'T Usually Attend Sports in Daily Life

For this group, prevention strategies on purpose don't seem to be necessary, people can save time, effort, and money by skipping them. But because some cases still happen at home and during work, they can still consider buying a cheap, reusable, and convenient brace.

This group also has few needs for surgical treatment because people usually have lower body functional demand—by applying conservative treatment, people can ensure a level of recovery capable of maintaining a normal life and save a lot of money. Also, they can avoid the risks of surgery and return to their pre-injury life much sooner.

6. Conclusion

To conclude, the whole patient population of a lateral ankle sprain can be divided into athletes, the public who attend sports, and the public who don't attend sports. Athletes need to pay more attention to the sprain during competition and player contact situations; choose prevention options involving taping, bracing, and exercise programs; and consider surgical treatment for severe cases. But the choice-making would depend on the athlete and his team's preference. The public who attends sports and have higher functional demand can apply prevention and treatment options closer to those of athletes, but the public who attend sports and have lower functional demands can do fewer prevention programs and consider conservative treatments. Both athletes and the public who attend sports need to pay extra attention to high-risk sports like basketball, soccer, volleyball, and football. Finally, the public who don't attend sports can apply few prevention programs and use conservative treatment to save time and money. They may find cost-effective ankle braces ideal.

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