Management of Acute Ankle Sprain: A Literature Review
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ABSTRACT
Among musculoskeletal injuries, the incidence of ankle sprains is between 15% and 20% of sports injuries. The ankle is supported laterally by the anterior talofibular ligament, calcaneofibular ligament and posterior talofibular ligament, whilst the medial aspect is supported by the deltoid ligament. Ankle sprains can be either acute sprains, which can be further classified into three grades depending on the severity of the injury, or chronic instability. Acute ankle sprain is usually managed conservatively and functional rehabilitation failure by conservative treatment leads to development of chronic ankle instability, which most often requires surgical intervention. Successful treatment of acute ankle sprain can be achieved with individualized, aggressive and non-operative measures. Surgery should always be indicated on an individual basis.

Keywords: acute ankle sprain, management.

INTRODUCTION
A history of a twisting injury followed by pain and swelling could suggest anything from a minor sprain to a fracture. If the patient is able to walk, and bruising is only faint and slow to appear, it is probably a sprain; if bruising is marked and the patient unable to put any weight on the foot, this suggests a more severe injury.1,2,3,4 Ankle sprain is an injury that occurs in the ankle as a result of trauma to the soft tissue structures of the ankle resulting in painful wrenching of soft tissue. The common ‘twisted ankle’ is due to unbalanced loading with the ankle inverted and plantarflexed. First the anterior talofibular and then the calcaneofibular ligament is strained; sometimes the talocalcaneal ligaments also are injured.5-10 Among all ankle injuries, ankle sprains are the most common and account for approximately 80%, of which 77% are lateral sprains. 73% of lateral ankle sprains are due to rupture or tear of the ATFL. Ankle sprain incidence rates range from to 5.3-7.0 sprained ankles per 1000 person-years in Europe.11 The ankle sprain incidence rate in the United States is 2.15 per 1000 person-years with no significant differences in gender. Furthermore, acute ankle sprains account for between 3% and 10% of all emergency department attendances in the United Kingdom.12 According to secondary data obtained Polyclinic KONI Jakarta in September-October 2012 with secondary data, the population in this study are all athletes of PON XVIII / 2012 DKI Jakarta. Results obtained are 85 injuries in 2009, 146 injuries in 2010, 353 injuries in 2011, and 419 injuries in 2012. Prevalence of injuries continues to rise, the most injuries that found in the observation is ankle sprains (ligament injury) as much as 41.1%, the most injured body part is the lower limb as much as 60%. Acute injuries are 64.4% of cases and 35.6% is chronic injury of all cases.13

Acute ankle sprain is usually managed conservatively and functional rehabilitation failure by conservative treatment leads to development of chronic ankle instability, which most often requires surgical intervention.14-15 Successful treatment of acute ankle sprain can be achieved with individualized, aggressive and non-operative measures. Surgery should always be indicated on an individual basis. Therefore, the author considers that it is necessary to discuss about appropriate management of acute ankle sprain to prevent chronic ankle instability thus no need for a surgical treatment.

FUNCTIONAL ANATOMY
Ligaments are elastic structure and a passive stabilization of the ankle and foot joints. Part of ligaments that frequently injured are ligament complex lateral legs include: anterior talofibular ligament which serves to resist movement in the direction of plantar flexion, posterior talofibular ligaments which serves to resist movement toward inverse, ligaments calcaneocuboideum ligaments which serves to resist the push for plantar flexion, the talocalcaneus ligaments which serves to resist...
movement toward inversion and calcaneofibular ligaments that serves to resist movement toward inversion makes leg joints locked to a certain extent so that there is stability in the legs and cervical ligament. There is also plantar cuneonavicular ligament, plantar cuboidenucular ligament, plantar intercuneiform ligament, plantar cuneocuboid ligaments and also interrosoe ligaments such as interrosoe intercuneiform ligaments and interrosoe cuneocuboideum ligaments. In between the tarsal and metatarsal ligaments are dorsal tarsometatarso ligaments, plantar tarsometatarso ligaments and interrosoe cuneometatarsal ligaments. Among osteum metatarsal there are dorsal interrosoa metatarsal ligaments that located at the base of the metatarsal.

**ETIOLOGY AND CLASSIFICATION**

Ankle sprain caused by inversion injury that can cause injury to the lateral ligament complex, sometimes followed by tendon injury. The things that facilitate the occurrence of sprains ankle chronic are intrinsic and extrinsic factors. Extrinsic factors including the training errors, poor performance, the wrong technique and tread on uneven surfaces, intrinsic factors including damage of soft tissue, the instability of the active foot and ankle muscles (muscle weakness), poor proprioceptive, hypermobile foot and ankle. The risk factors of chronic ankle sprain injury can be caused abnormal foot posture, such as: dynamic pes planus, pes cavus and flat foot. Classification helps in identifying the damage level and correct treatment. Table 1 shows the three grades of acute ankle sprain. Practically, acute ankle sprain can be classified as stable or unstable according to the findings on physical examination.

The Ottawa Ankle Rules (OAR) were developed to reduce the unnecessary radiographs and decide when radiographic studies are indicated in patients who undergo ankle trauma. X-ray examination is called for if there is: (1) pain around the malleolus; (2) inability to take weight on the ankle immediately after the injury; (3) inability to take four steps in the Emergency Department; (4) bone tenderness at the posterior edge or tip of the medial or lateral malleolus or the base of the fifth metatarsal bone. The OAR were first tested on adult patients with ankle sprains from acute injuries, revealing almost perfect results for adult and young populations. A previous study revealed that the OAR were significantly sensitive in excluding ankle fractures. As such, the OAR reduced unnecessary radiographs by 30-40%. For patients who have had persistent pain, swelling, instability and impaired function over 6 weeks or longer, despite appropriate early treatment, magnetic resonance imaging (MRI) or computed tomography (CT) will be required to assess the extent of soft tissue injury or subtle bony changes.

**MANAGEMENT**

**Conservative Treatment**

Conservative treatment is very important in the early weeks after the injury. In the conservative treatment known as RICE (Rest, Ice, Compression and Elevation). However, some articles add "protection" and "rehabilitation" in the initial treatment and make the acronym became PRICE (Protection, Rest, Ice, Compression, Elevation and Rehabilitation). Term “protection” means to immobilize ankle to reduce any future damage by using some tools. Grade 1 of ankle sprain doesn’t need serious immobilisation, it can be treated well by flexible or elastic wrap. Grade II ankle injuries are

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### Table 1. Classification of acute ankle sprain according to its grade, severity, pathophysiology and clinical findings.8

<table>
<thead>
<tr>
<th>Grade</th>
<th>Severity</th>
<th>Pathophysiology</th>
<th>Clinical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>Mild</td>
<td>Stretch of the Anterior Talofibular ligament (ATFL), causing tear of the ligament fibers</td>
<td>Mild swelling, no laxity, little ecchymosis, and difficulty in full weight bearing.</td>
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<tr>
<td>Grade 2</td>
<td>Moderate</td>
<td>Moderate injury to the lateral ligamentous complex with a complete tear of the ATFL</td>
<td>Localized swelling, hemorrhage ecchymosis, and anterolateral tenderness. Abnormal laxity may be mild or absent.</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Severe</td>
<td>Complete disruption of the ATFL along with CFL and Posterior Talofibular ligaments (PTFL).</td>
<td>Tenderness, swelling and ecchymosis on the lateral ankle and heel side with marked laxity.</td>
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likely to require support by using a flexible wrap and a splint for the first few days until they are pain-free. The use of ankle braces has been shown to be superior to an elastic support or compression bandages. Patients treated with an elastic support bandage took longer to return to work and reported increased subjective instability. In Grade III, controlling the range of the patient’s motion is recommended. The four main procedural methods of treatment of the ankle: Rest, Ice, Compression and Elevation, which can be performed in the first 2-3 days. Patients are provided with crutches to help them walk until they can walk normally. They must take a rest to give time for injury to heal themselves. Weight-bearing is limited to light weight-bearing. As part of cryotherapy, ice immersion is recommended for up to 20 minutes every 2-3 hours. To apply compression, the patient is provided with a flexible bandage to reduce swelling, but some articles recommend add splint instead the flexible bandage alone to reduce the swelling. To facilitate a reduction in swelling and for better venous and lymphatic drainage, the injured ankle should be elevated at a level higher than the heart.

After an ankle injury, functional rehabilitation provides a very significant positive effect, and in addition to helping patients to get their normal daily activity back and prevent the possibility of chronic instability of the ankle. Semi-rigid ankle braces used to support the position of the feet perfectly. Movement exercises such as leg circles, mild tendon stretching, exercise alphabet, dorsiflexion, eversion, inversion, taking marbles with toes, and toe curling and walking are encouraged to assist lymphatic drainage. It is also recommended to wrap the ankle with elastic bandage to control the edema. Patients can use crutches to help patients when walking when sprain ankle still painful. Weight-bearing is possible when it’s tolerated. Ankle-foot orthoses can be used along with ankle braces filled with water or gel to facilitate the rehabilitation, which can be used to limit plantarflexion-dorsiflexion. Patients typically require a proprioceptive training program where proprioceptive patients are often affected. Work activities and sports that require strenuous physical movement should be reduced when the initial period of post-injury to prevent pain and further complications. Ankle injury to Grade I and II, the patient should immediately perform functional rehabilitation when the swelling and pain is reduced. Patient can begin to practice simple movements when patients feel the ankle has been pain-free. To prevent recurrence, rehabilitation programs should be conducted at least between 3 and 6 weeks. During the functional rehabilitation program, braces, elastic bandages, taping or splints are recommended in order to decrease ankle instability and control swelling.

Pharmacological treatment

Non-Steroidal Anti Inflammatory Drugs (NSAIDs)

Non-steroidal anti-inflammatory drugs (NSAIDs) in acute phase of ankle sprain may useful. A clinical trial demonstrated that NSAIDs could reduce symptom and inflammation effect and enhance the recovery in sports-related injuries. The NSAIDs reduce pain and inflammation by inhibit cyclo-oxgenase (COX), COX-1 isoform found in many tissues and it’s essential for homeostatic functions, such as gastric mucosal protection and normal platelet aggregation. COX-2 isoform is mostly expressed locally on tissue inflammation. Non-selective NSAIDs such as diclofenac, piroxicam and naproxen become a common adjuvant therapy for acute ankle sprain. They reduce the inflammatory reaction by inhibit both COX-1 and COX-2 while selective COX-2 inhibitors only inhibit COX-2. Therefore, non-selective NSAIDs have side effects that interfere with disorders of the gastrointestinal tract caused by non-selective NSAIDs inhibit COX-1 isoform, which play a role in gastric mucosal protection. Clinical trials had proof that celecoxib (400 mg loading dose followed by 200 mg twice daily for 7 days) and valdecoxib (40 mg twice daily on day 1 followed by 40 mg once daily on days 2 – 7) was as efficacious as non-selective NSAIDs in treating acute pain due to ankle sprain from as early as 24 h after the start of treatment.

Using standard efficacy measures, patients in both treatment groups demonstrated a clinically significant reduction in pain from baseline and a rapid return to normal function. With its platelet-sparing properties and improved GI tolerability profile, celecoxib may offer advantages over conventional non-selective NSAIDs in the treatment of acute ankle sprain. In accordance with current treatment recommendations, patients requiring non-selective NSAIDs, who are at an increased GI risk, should be co-prescribed a gastroprotective agent such as a proton pump inhibitor (PPI). There is evidence that in acute injuries topical non-steroidal anti-inflammatory (NSAI) gels or creams might be as beneficial as oral preparations, probably.

Hyaluronic Acid Injection

The use of hyaluronic acid injection is associated with increased recovery speed and with fewer side effects were reported. But the cost is relatively expensive compared to the standard treatment should be considered. A study that examines the efficacy and safety of periarticular
Figure 1. Algorithm for diagnosis and treatment of acute ankle injuries.\(^8\)
hyaluronic acid injections in acute lateral ankle sprain showed that there were significant reductions in pain were seen on the visual analogue score (VAS) is low in activity walking and weight bearing 8 day (and weight bearing alone after 90 days) for the group that received injections of hyaluronic acid compared with placebo injections of normal saline.13

Surgical
Most cases of acute ankle sprains can be handled by non-operative methods. A study says that patients with acute ankle sprain given surgical methods have a longer time to return to work compared with patients assigned to conservative treatment. A study also indicates surgery is not helpful in reducing additional complications, cost and risks.5,39 However, for a Grade III ankle sprains or ankle sprain that has not benefited more than 12 weeks need to get surgery intervention.40 Pain and stiffness in the ankle that settled, a sensation of instability or giving way and intermittent swelling are suggestive of cartilage damage or impinging scar tissue within the ankle. Arthroscopic repair or ligament substitution is now effective in many cases, allowing a return to full function and sports. Indications for the surgery are usually associated with unstable ankle fractures, OCD (osteocondral defects), loose bodies, or peroneal tendon tears. Based on the best available literature, the evidence-based algorithm shown in Figure 3 summarizes the diagnosis and treatment of acute ankle injuries.7,8,41,42

CONCLUSION
Ankle sprain caused by inversion injury that can cause injury to the lateral ligament complex, sometimes followed by tendon injury. The things that facilitate the occurrence of sprains ankle chronic are intrinsic and extrinsic factors. Ankle sprain had 3 main grade according to its grade, severity, pathophysiology and clinical findings, grade I, grade II and grade III. Classification helps in identifying the damage level and correct treatment. The Ottawa Ankle Rules (OAR) were developed to reduce the unnecessary radiographs and decide when radiographic studies are indicated in patients who undergo ankle trauma. Most cases of acute ankle sprains can be handled by non-operative methods. Conservative treatment is very important in the early weeks after the injury. Non-steroidal anti-inflammatory drugs (NSAIDs) in acute phase of ankle sprain may useful. The use of hyaluronic acid injection is associated with increased recovery speed and with fewer side effects were reported. Surgery is not helpful in reducing additional complications, cost and risks. However, for a Grade III ankle sprains or ankle sprain that has not benefited more than 12 weeks need to get surgery intervention.

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REFERENCES
Department of Rehabilitation Medicine, Box 356490, University of Washington, Seattle, WA 98195
2. Bonnel,F, Tauler, Tourne. Chronic ankle instability Biomechanics and pathomechanics of ligaments injury and associated lesions. Orthopaedic Surgery and Traumatology Department, Dupuytren Teaching Hospital Center France Accepted: 15 March 2010


15. Bonnel,F, Tauler, Tourne. Chronic ankle instability Biomechanics and pathomechanics of ligaments injury and associated lesions. Orthopaedic Surgery and Traumatology Department, Dupuytreen Teaching Hospital Center, France. 2010. Accepted: 15 March 2010


41. Wees P. Lessen A, Hendriks E, Dekker J, Bie Rob. Effectiveness of exercise therapy and manual mobilisation in acute ankle sprain and functional instability. Department of Epidemiology, Maastricht University, Royal Dutch Society for Physical Therapy (KNGF) 3University Medical Centre Australian Journal of Physiotherapy. 2006 Vol. 52 hal : 27-37
42. Young C,. Clinical Examination of the Foot and Ankle of Sports Medicine, Medical College of Wisconsin, 9200 W Wisconsin Avenue, Milwaukee, WI 53226, USA. 2005.

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