

# Henry Ricardo Handoyo

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# Comparison of Arthroscopic and Open Repair Outcomes for Lateral Ankle Ligament Injuries: A Literature Review

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## Keywords:

Arthroscopy, open surgery, ankle ligament injury.

## Abstract

Lateral ankle ligament injury is one of the most common musculoskeletal injuries, especially in athletes and physically active individuals. If not treated properly, these injuries can lead to chronic instability that impacts the biomechanics of the ankle as well as increasing the risk of recurrent injuries. The two main methods used in the repair of these injuries are arthroscopic procedures and open surgery. Although both techniques have been widely used, there is still debate about their effectiveness in the long term. This study aims to compare the clinical outcomes between arthroscopic procedures and open surgery in the repair of lateral ankle ligament injuries, by analyzing the biomechanical and functional factors that influence the success of both methods. The study also evaluated the advantages and limitations of each technique in terms of patient recovery, postoperative pain levels, and the risk of long-term complications. The method used in this study is a literature review from various academic sources, including medical journals and scientific articles from leading databases in the last ten years. The results of the study showed that the arthroscopy procedure has advantages in faster recovery, lower postoperative pain, and fewer complications compared to the open method. However, open surgery remains the top choice for complex instability cases that require more extensive structural reconstruction. Based on the results of this study, the selection of the method of repairing lateral ankle ligament injury should be adjusted to the patient's clinical condition and expected functional goals.



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## INTRODUCTION

Lateral ankle ligament injuries are one of the most common musculoskeletal injuries, especially in athletes and physically active individuals (Yao et al., 2024). The anterior talofibular ligaments (ATFL) and kalkaneofibular (CFL) are often injured due to excessive inversion movement, which can lead to ankle joint instability as well as an increased risk of recurrent injury (Hong et al., 2024). If not treated properly, these injuries can have an impact on biomechanical impairment and decreased ankle function in the long term (Lee & Lim, 2024).

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14 The ankle ligament is a connective tissue structure that serves as the main stabilizer of the ankle joint as well as maintaining balance when walking or running. There are several important ligaments in the ankle, including the anterior talofibular ligament (ATFL), posterior talofibular ligament (PTFL), calcaneofibular ligament (CFL), as well as the deltoid ligament complex that supports the medial side of the ankle. According to He et al. (2024), ATFL is the ligament that most often suffers from injuries due to excessive inversion movements, which often occurs in ankle sprains. In addition, research by Rougereau et al. (2025) shows that ankle ligament reconstruction with arthroscopic techniques has undergone significant progress in improving ankle joint stability after serious injury (He et al., 2024; Rougereau et al., 2025).

15 Ankle ligament injuries can vary from mild to severe, with impacts that can affect daily activities as well as athletic performance. A study conducted by Dalmau-Pastor et al. (2024) found that post-injury ankle instability can lead to biomechanical disturbances that affect load distribution while walking. In addition, research by Liu et al. (2025) discusses how minimally invasive treatment methods can accelerate recovery from deltoid ligament injuries, which are often combined with tibiofibular syndesmosis injuries. For a more accurate diagnosis, the use of imaging such as MRI and ultrasound is increasingly used to assess the structural condition of the ligaments and determine the optimal treatment approach (Dallaudière et al., 2024; Liu et al., 2025).

The main method for treating chronic or severe lateral ankle ligament injuries is through repair procedures, which can be performed with arthroscopic techniques or open surgery (Hong et al., 2024). Arthroscopic repair has come a long way in recent years with a minimally invasive approach that provides benefits in the form of faster recovery, lower postoperative pain, and a reduced risk of soft tissue complications (Sethi et al., 2024). On the other hand, open surgical techniques, such as the modified Broström-Gould procedure, have long been the standard in dealing with ankle instability, with results that have proven effective in restoring joint stability (Yao et al., 2024).

Although these two methods have been widely used, there are still differences of opinion regarding the effectiveness and advantages of each technique in the long term (Hong et al., 2024). Several studies have shown that arthroscopic techniques provide clinical outcomes that are equal to or better than open surgery, especially in terms of mobility and reduction of postoperative complications (Lee & Lim, 2024). However, other studies have stated that open repair is still superior in cases of ankle instability that is complex or involves more than one ligament (Sethi et al., 2024).

2 With the development of arthroscopy techniques and the use of open methods as the gold standard, the comparison between these two methods is important to determine the best approach in dealing with lateral ankle ligament injuries (Feng et al., 2021). This literature review aims to evaluate the clinical, biomechanical, and long-term outcome differences of these two improvement methods, as well as identify the factors that affect the success of the procedure.

As the incidence of ankle injuries due to sports activities and active lifestyles increases, the need for more effective and efficient repair procedures is increasing. This research is important because it provides a more comprehensive understanding of the advantages and limitations of each repair method, so that it can assist doctors and orthopedists in determining the best approach for patients with lateral ankle ligament injuries.

Several previous studies have compared the results of arthroscopic techniques and open repair for lateral ankle ligament injuries. Yao et al. (2024) in their study showed that the arthroscopy approach provides better clinical outcomes in terms of functional recovery and postoperative pain reduction compared to open methods. Meanwhile, research by Hong et al. (2024) found that open techniques are more effective in dealing with complex chronic instability with a lower risk of re-injury. Lee and Lim (2024) mentioned that there is no significant difference between the two methods



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in the long term, but patients who undergo arthroscopy recover faster than those who undergo open surgery.

This study aims to compare the clinical outcomes between arthroscopic procedures and open surgery in the repair of lateral ankle ligament injuries, by analyzing the biomechanical and functional factors that affect the success of both methods. In addition, this study identified the advantages and limitations of each technique in terms of patient recovery, postoperative pain level, and risk of long-term complications. Based on a recent literature review, this study also aims to provide evidence-based recommendations regarding the best approach in managing lateral ankle ligament injuries.

### METHOD

This study uses a qualitative approach with the literature study method as the main technique in collecting and analyzing data. The literature study was selected to explore and compare the outcomes of lateral ankle ligament injury repair through arthroscopic procedures and open surgery based on the findings of previous research. This method allows researchers to identify clinical trends, evaluate the effectiveness of procedures, and highlight biomechanical and functional factors that influence the success of both techniques (Snyder, 2019).

The data sources in this study come from scientific journals, medical articles, and relevant academic publications, obtained through PubMed, Google Scholar, ScienceDirect, and SpringerLink databases in the last 10 years (2014-2024). Inclusion criteria included research that addressed clinical outcomes, biomechanics, patient recovery, postoperative pain levels, as well as the risk of long-term complications from arthroscopic procedures and open surgery. Meanwhile, exclusion criteria are applied to studies that do not provide sufficient empirical data or are only opinion-based without in-depth clinical analysis (Moher et al., 2009).

Data collection techniques are carried out through identification, selection, and synthesis of literature in accordance with the research topic (Page et al., 2021). Articles that met the criteria were then analyzed in depth to identify patterns and relationships between variables in the published study.

The data analysis methods used were content analysis and comparative analysis to compare the clinical results of the two surgical methods. The thematic analysis approach is applied to group findings based on aspects of repair effectiveness, functional recovery, postoperative pain, and complications (Braun & Clarke, 2021). The results of this analysis are then summarized in the form of a critical synthesis to provide evidence-based recommendations on the best approach to repair lateral ankle ligament injuries.

### RESULT AND DISCUSSION

The table below presents the results of a selection of 5 journal articles that discuss the comparison between arthroscopic repair and open repair for lateral ankle ligament injuries. These articles were selected based on the relevance, methodological quality, and focus of the study on the clinical, biomechanical, and functional outcomes of the two techniques.

**Table 1.** Literature Review

No	Author	Title	Research Focus
1	Yao et al., 2024	Simplified arthroscopic anterior talofibular ligament repair with inferior extensor retinaculum reinforcement: technical notes and preliminary results	Arthroscopic repair with reinforcement technique produces better biomechanical stability than open repair, with faster rehabilitation time



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2	Hong et al., 2024	Comparative analysis of arthroscopic technique for anterior talofibular and calcaneofibular ligament reconstruction versus open modified Brostrom-Gould procedure	Arthroscopic techniques show better clinical outcomes in range of motion (ROM) and lower postoperative pain, but long-term stability outcomes are similar to those of open repair
3	Sethi et al., 2024	Isolated Brostrom-Gould (MBG) repair vs. Internal Brace Augmentation (IBA) for chronic lateral ligament injury	Internal Brace Augmentation (IBA) is superior in faster recovery than MBG, with lower complications and fewer recurrence rates
4	Jain et al. 2022	Is Internal brace augmentation a gold standard treatment compared to isolated modified brostrom gould repair for chronic lateral ligament ankle instability? Effect on functional outcome and return to preinjury activity: a retrospective analysis	Internal Brace Augmentation (IBA) as a method of lateral ankle ligament repair provides better functional outcomes and allows patients to return to pre-injury activities more quickly compared to the Modified Broström-Gould (MBG) repair method.
5	Song & Hua (2019)	Similar outcomes at early term after arthroscopic or open repair of chronic ankle instability: a systematic review and meta-analysis	Short-term outcomes of arthroscopic repair and open surgery for chronic ankle instability are relatively similar, with arthroscopy offering advantages in faster recovery and lower postoperative pain, while open surgery remains an effective option in certain cases.
6	Brown et al. (2020)	Arthroscopic versus open repair of lateral ankle ligament for chronic lateral ankle instability: a meta-analysis	Arthroscopic repair and open surgery for chronic lateral ankle instability produce similar clinical outcomes, but arthroscopy offers the advantages of faster recovery, lower postoperative pain, and less risk of complications compared to open methods.
7	Attia et al. (2021)	Outcomes of open versus arthroscopic Broström surgery for chronic lateral ankle instability: a systematic review and meta-analysis of comparative studies	pArthroscopic and open Bloomstrom's treatment yielded comparable clinical outcomes, but arthroscopy had advantages in reducing postoperative pain, speeding recovery, and lowering the risk of complications compared to open methods.
8	Zhi et al. (2020)	Does arthroscopic repair show superiority over open repair of lateral ankle ligament for chronic lateral ankle instability: a systematic review and meta-analysis	Lateral ankle ligament repair with arthroscopy provides results comparable to open surgery in terms of stability and restoration of function, but arthroscopy shows advantages in reducing postoperative pain, speeding



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				recovery, and lowering the risk of complications.
2	9	Guelfi et al. (2018)	Open and arthroscopic lateral ligament repair for treatment of chronic ankle instability: a systematic review	Arthroscopic and open repair of the lateral ankle ligaments provides comparable clinical outcomes, but arthroscopy has the advantage of faster recovery, lower postoperative pain, and fewer complications than open methods.
	10	Xu et al. (2020)	A comparison between arthroscopic and open surgery for treatment outcomes of chronic lateral ankle instability accompanied by osteochondral lesions of the talus	Arthroscopic repair and open surgery for chronic lateral ankle instability with osteochondral talus lesions produce similar clinical outcomes, but arthroscopy offers the advantage of faster recovery, lower postoperative pain, and allows for simultaneous treatment of osteochondral lesions.

1 Lateral ankle ligament injuries are one of the most common musculoskeletal problems, especially among athletes and individuals with high physical activity. Surgical techniques to treat this condition are constantly evolving, with two main approaches being used, namely arthroscopy and open surgery. The debate over the superiority of each technique continues, and research in recent years has sought to evaluate the clinical and biomechanical results of both methods. Of the ten studies that have been analyzed, it was found that each approach has advantages and limitations that need to be considered in the selection of the optimal surgical procedure.

Yao et al. (2024) highlighted a simplified arthroscopic technique to repair the anterior talofibular ligament (ATFL) with reinforcement of the inferior extensor retinacular. The study showed that patients who underwent this procedure had a faster recovery than those who underwent the open technique. In addition, patients who undergo arthroscopy experience less postoperative pain and have good clinical outcomes in terms of ankle stability in the short term (Yao et al., 2024). Similar findings were also confirmed by Hong et al. (2024), who compared arthroscopic reconstruction of ATFL and calcaneopububular ligament (CFL) with an open Broström-Gould procedure. The results of their study showed that the arthroscopic procedure resulted in faster recovery and lower levels of postoperative pain, although in the long term ankle stability did not differ significantly compared to the open method (Hong et al., 2024).

5 Furthermore, the study by Sethi et al. (2024) focused on the comparison of open Broström-Gould repair with internal brace augmentation (IBA) for chronic lateral ligament injuries. This study shows that internal brace augmentation can improve stability and reduce the risk of re-injury compared to traditional Broström-Gould procedures. However, this technique is also associated with increased joint stiffness in some patients, which is a consideration in the selection of the most suitable procedure for individuals with high functional needs, such as professional athletes (Sethi et al., 2024).

11 Meanwhile, Jain et al. (2022) conducted a retrospective analysis to assess the effect of internal brace augmentation compared to the Broström-Gould procedure on functional outcomes and recovery of pre-injury activity. The study found that patients who underwent internal brace augmentation tended to return to sports activity more quickly than those who underwent the conventional Broström-Gould procedure. However, the study also highlights the need for further



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evaluation of the long-term impact of augmentation braces on ankle stability and the risk of secondary complications (Jain et al., 2022).

Several meta-analysis studies have also been conducted to compare the clinical outcomes of arthroscopic and open methods. Song & Hua (2019) found that both methods provide nearly equal results in the short term, but arthroscopy has an advantage in terms of lower postoperative pain and faster recovery of function (Song & Hua, 2019). Another meta-analysis study by Brown et al. (2020) confirms that although arthroscopy is preferred in the aspect of early recovery, open procedures are still the main choice in more complex cases of ankle instability. They noted that arthroscopy was more effective in reducing soft tissue complications, but open procedures were more reliable in dealing with more complicated structural reconstructions (Brown et al., 2020).

Attia et al. (2021) in their systematic analysis found that patients who underwent open and arthroscopy had an equivalent success rate in terms of ankle stability improvement, but arthroscopy was preferred due to fewer surgical wound complications and faster recovery (Attia et al., 2021). On the other hand, Zhi et al. (2020) discuss whether arthroscopy shows an advantage compared to open procedures in chronic ankle lateral ligament repair. They concluded that arthroscopy does provide an advantage in terms of short-term recovery and reduction of soft tissue complications, but there is no significant difference in long-term clinical outcomes (Zhi et al., 2020).

Guelfi et al. (2018) reviewed various studies on lateral ligament repair using arthroscopic and open methods, and they found that the arthroscopic approach is more commonly used in cases of mild to moderate instability, while open techniques are more commonly used in more complex cases. The study also showed that although arthroscopy provides better results in terms of scar aesthetics and faster recovery, open techniques are still more reliable in handling more extensive reconstructions (Guelfi et al., 2018).

Xu et al. (2020) in their study compared surgical outcomes between arthroscopic and open methods in patients with chronic lateral instability accompanied by osteochondral lesions in the talus. They found that arthroscopy has the advantage of treating osteochondral lesions simultaneously without the need for additional procedures, thereby improving the efficiency of surgery. However, in cases of very severe instability, the open technique is still more effective in repairing ligament structures that have undergone significant degeneration (Xu et al., 2020).

From the results of this literature review, it can be concluded that both surgical methods have their own advantages depending on the specific condition of the patient. Arthroscopic techniques provide advantages in terms of faster recovery, lower postoperative pain, as well as reduced soft tissue complications. Therefore, this technique is preferred in cases of not very complex ankle instability and in patients who want to return to sports activity quickly. In contrast, open techniques are still the primary choice in cases of more complex lateral ligament injuries or in patients with significant tissue degeneration, as they provide stronger stability and more consistent results over the long term.

### Discossion

#### Comparison of Clinical Outcomes between Arthroscopy and Open Surgery Procedures

Several studies have evaluated the clinical outcomes between arthroscopic and open surgery methods in the repair of lateral ankle ligament injuries. A meta-analysis by Hurley et al. (2020) found that the arthroscopic procedure provides clinical outcomes comparable to open surgery in terms of ankle stability and functional recovery. The study also noted that the complication rate tends to be lower on arthroscopy compared to the open method due to the smaller invasion of the surrounding tissue (Hurley et al., 2020).



On the other hand, the study of Attia et al. (2021) showed that patients who underwent open repair tended to have a more stable recovery in the long term, especially in cases with more severe instability. Although arthroscopy offers faster recovery times, open methods are superior in correcting the complexity of ligament injuries (Attia et al., 2021).

### Biomechanical and Functional Factors Influencing Success

Biomechanical factors are an important aspect in the successful repair of ligament injuries. The study of Nery et al. (2018) found that arthroscopic repair is superior in maintaining ankle biomechanics, especially in maintaining ligament flexibility and strength after surgery. However, the study also noted that patients with more complex injuries benefited more from the open method (Nery et al., 2018).

On the functional side, the study of Matheny et al. (2016) showed that the level of muscle strength and postoperative ankle stability was similar in both methods, but patients who underwent arthroscopy reported higher satisfaction in terms of mobility recovery (Matheny et al., 2016).

**Table 2.** Advantages and Limitations

Technical	Advantages	Limitations
Arthroscopy	Minimally invasive, causing less tissue trauma and faster recovery time	May be less effective in the case of more complex injuries, due to limited access to the entire ligament structure.
	Reduced risk of infection and complications of surgical wounds compared to open methods	The risk of iatrogenic injuries (injuries caused by medical procedures) is higher due to the use of small-sized instruments.
	More effective for patients with mild to moderate instability	
Open Surgery	Provides better long-term stability in cases of chronic instability	The level of postoperative pain is higher compared to the arthroscopic method, leading to a longer rehabilitation period
	Allows wider access to damaged ligament structures, allowing for more thorough correction	The risk of complications such as infection and scarring is greater due to larger incisions

### Recommendations

For mild to moderate instability:

- Arthroscopy is more recommended because it offers faster recovery, less pain, and a lower risk of complications (Saliba et al., 2024).
- Suitable for patients with fast mobility needs such as athletes and active workers.

For severe or chronic instability cases:

- Open surgery is more recommended because it provides better long-term stability (Hassan et al., 2018).
- Suitable for patients with a history of recurrent injuries and patients with ankle deformities.

The patient's age and activity level factors should be considered:

- Younger patients with high activity needs benefit more from arthroscopy.



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- b. Patients with chronic conditions and greater instability are better off undergoing open methods for long-term stability.

The role of postoperative rehabilitation is very important:

- a. Regardless of the method used, an optimal functional rehabilitation program is indispensable to ensure the best results and prevent recurrence

### CONCLUSION

Based on the literature review that has been conducted, it can be concluded that arthroscopy and open surgery procedures each have advantages and limitations in repairing lateral ankle ligament injuries. Arthroscopy is superior in terms of faster recovery, lower postoperative pain, as well as a smaller risk of complications. Therefore, this method is more recommended for patients with mild to moderate instability as well as for those who need quick rehabilitation to return to physical activity, such as athletes.

On the other hand, open surgery remains the top choice in cases of more complex lateral ankle ligament injuries. This technique is more effective in dealing with chronic instability and more extensive structural reconstruction. Although this procedure has a higher level of postoperative pain as well as a longer recovery time, open surgery provides better long-term stability compared to arthroscopy.

As a suggestion for further research, more comprehensive long-term studies are needed to evaluate the differences in the effectiveness of these two methods in different patient groups, including age factors, physical activity levels, as well as specific types of ligament injuries. In addition, innovations in arthroscopy and ligament reconstruction techniques can continue to be developed to improve long-term stability and accelerate patient recovery. The combination of arthroscopic methods and biologically-based reconstructive procedures could also be an interesting area of research to explore more optimal ligament injury repair strategies in the future.

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