

A Meta-analysis of treatment methods for acute ankle sprain

Lihua Han¹, Chaoyue Zhang¹, Bo Liu³, Hao Ting⁴, Wang Jihong⁵

ABSTRACT

Objectives: To conduct a Meta analysis with 12 related published studies to compare the effect of operative and conventional treatment for acute ankle sprain.

Methodology: A systematic research on the published paper was conducted for randomized controlled trial studies. Three data bases were searched, including Pubmed, EMBase and ISI web of Knowledge, and we compared the efficacy of two treatment methods, operative treatment and functional treatment, for acute ruptures of lateral ankle. A total of 15 related RCT studies were included in our study. RevMan software was taken to analyze the data.

Results: The 15 studies involved 1413 mostly young adults, 665 of them received surgical treatment, while 748 received conventional treatment. The results showed surgical treatment is more beneficial as compared to conventional treatment in terms of ankle activity and instability, with the OR(95%CI) of 5.15 (1.06-25.03) and 1.72 (1.31-2.26), respectively. However, the surgical treatment was accompanied with great risk of complication, including DVT, tenderness of scar, sensory loss and wound infection or necrosis.

Conclusion: Surgical treatment is better than the conventional treatment alone, especially for the outcome of the ankle activity and instability. Further high quality randomized controlled trials are required.

KEY WORDS: Acute ruptures, Lateral ankle ligament, Ankle sprain, Surgical treatment, Conventional treatment.

Pak J Med Sci October - December 2012 Vol. 28 No. 5 895-899

How to cite this article:

Han L, Zhang C, Liu B, Ting H, Jihong W. A Meta-analysis of treatment methods for acute ankle sprain. Pak J Med Sci 2012;28(5):895-899

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- * Received for Publication: February 7, 2012
- * Revision Received: June 19, 2012
- * Revision Accepted: July 20, 2012

INTRODUCTION

Lateral ankle sprains are the most common ankle injuries, especially for athletic or recreational activities. In the American and British, about 23,000 and 5,000 ankle injuries occurred per day, respectively.¹⁻³ Above 70% of patients with initial ankle sprain may be recurrence and become chronic ankle instability if given inappropriate treatment.⁴ Furthermore, the chronic ankle instability could limit physical activity and increase the risk of degeneration of the joint as well as increase the risk of osteoarthritis.⁵

Currently, there are two strategies for the acute ankle sprains, including operative treatment and conventional treatment. The choice of treatment for this injury remains controversial. In previous studies, the operative treatment could

gain more efficacy rate for acute ankle sprains, but this method may bring more complications such as tenderness of scar, sensory loss, infection or wound necrosis.⁶⁻⁸ Therefore, a systematic review was used in our study to compare the effectiveness of operative and conventional treatment for acute ankle sprains.

METHODOLOGY

Study selection: The criteria of the study selection were randomized controlled trials (RCT) comparing the effectiveness between operative procedure and functional treatment for acute ankle sprains. Three databases were searched including Ovid (Ovid Technologies, Inc., New York, 1980- May 1th, 2011), EMBase (Elsevier, Amsterdam, the Netherlands, 1980 to May 1th, 2011), and ISI Web of Knowledge (Thomson Scientific Technical Support, New York, 1980 to May 1th, 2011). The relevant terms for searching studies included 'ligment', 'ankle', 'Sprains or Strains or rupture or injury', 'treatment', 'conventional' and 'surgical' and 'randomized controlled trial'. If one study was published more than twice, only one study was included. Each title and abstract of the searched study was reviewed by two reviewers, and they would decide which one would be selected. The full text was reviewed if the abstract and title was in line with the included criteria. We extracted the authors, publication years, study site, study type, sample size, duration of follow-up, the ankle activity, subjective instability and complication. If there was any initial disagreement, it was resolved by discussion in our group.

Assessment of risk of bias: The risk of bias was independently assessed by two reviewers in our group, and the risk of bias was assessed according to the criteria by Cochrane Collaboration.⁹ The criteria used in our study included five domains (11 items). Each item would be decided by yes, no, or unsure. If there was disagreement, it was resolved by discussion. Studies with more than 6 'yes' items were regarded as low risk of bias.

Statistics: The main outcome measures were assessed by the odds risks and 95% confidence interval (OR, 95% CI) for comparison of operative procedure and functional treatment for acute lateral ankle sprains.¹⁰ The pooled OR was estimated using fixed effects models or random effects models. If there was heterogeneity between studies, random effect model would be chosen, otherwise, the fixed effect model was included. The significant of odds ratio was decided by Z test, and the significant level was determined at 0.05. The heterogeneity was analyzed by chi-square-based Q statistic test¹¹ and an I² test¹², and the significant level was determined at 0.1. We also assessed the publication bias of this systematic review, which was analyzed by funnel plot. If an asymmetric plot was showed, the publication bias might be existed.¹³

RESULTS

A total of 192 articles were searched according to our search items, and 177 were excluded due to duplication, non-randomized controlled trials and unrelated articles. Finally, a total of 15 studies were related to the inclusion criteria, and included in our systematic review. The authors, publication

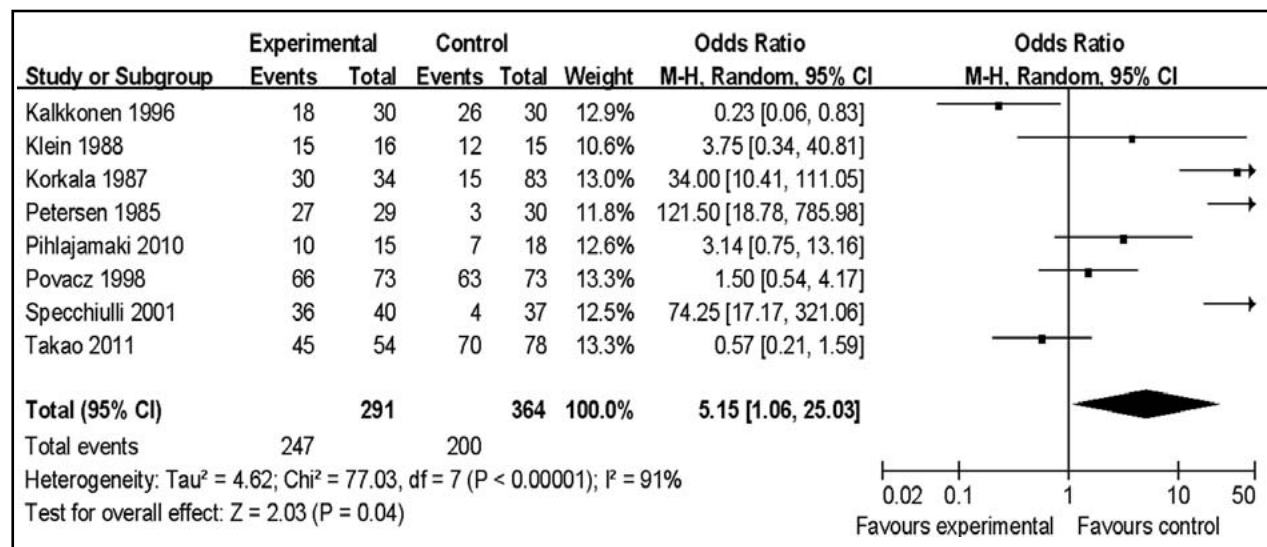


Fig.1: Comparison of recovery to preinjury activity by surgical treatment and functional treatment in acute ruptures of lateral ankle ligament.

years, study site, study type, sample size, duration of follow-up, the ankle activity, subjective instability and complication were extracted and summarized in Table-I. The effectiveness of the operative procedure and functional treatment for acute lateral ankle sprains was compared and pooled. All the articles were from 1981 to 2011. All the trials were conducted from United Kingdom, Germany, Finland, Denmark, Netherlands and Australia. The 15 studies involved 1413 mostly young adults, 665 of them received surgical treatment, while 748 received conventional treatment.

The conventional treatment were regarded as ice application, partial immobilization with tap, brace, or bandage, complete immobilization with plaster cast, a home exercise, instructions for early ankle mobilization, or a combination of the above treatments. The surgical treatment included ligament repair or reconstruction followed by conventional modalities. The mean age of the included studies were at the range of 16 to 45 years. After assessing the total risk of bias, five studies were classified as low risk of bias. The main biases were blinding, allocation concealment, and similarity of treatment groups at baseline.

After conducting pooling analysis, significant heterogeneity was found in studies on results

of ankle activity and instability (both $p < 0.05$) (Fig.1). Seven studies demonstrated a significant difference in the recovery of ankle activity, surgical treatment was more effective than the conventional treatment (OR=5.15, 95% CI=1.06-25.03), and a heavy heterogeneous was found between studies. Among the 7 studies, 5 studies showed a high risk of bias, and two showed low risk of bias. The great heterogeneity may be due to the great bias during studies. Fig.2 shows the stability after treatment, and surgical treatment could gain more people with ankle function stability than the functional treatment, with the OR and 95% CI of 1.72 (1.31-2.26). Also, great heterogeneity was found in studies ($p < 0.05$). All studies in analysis showed high risk of bias.

Table-II shows the complication of the two methods for treatment with acute ruptures of lateral ankle ligament. We found the surgical treatment was accompanied with greater risk of complication (OR=4.49, 95%CI=2.15-9.36), including DVT, tenderness of scar, sensory loss and wound infection or necrosis. No heterogeneity was found in these studies.

For the sensitivity analysis, the results still showed robust after removing studies with risk of bias lower than 3 points. Moreover, we did not find an

Table-I: Characteristics of included studies.

Study ID	Country	Follow up (months)	Intervention group / control group	Age (years)	Score of risk of bias	Outcome
Evans 1984 ⁶	United Kingdom	24	50/50	16-35	2	Ankle activity, subjective instability, complication
Klein 1988 ⁷	Germany	24	30/30	16-40	3	Ankle activity, subjective instability, complication
Korkala 1987 ¹⁴	Finland	24	50/100	15-50	3	Ankle activity, subjective instability, complication
Moller-Larsen 1988 ¹⁵	Denmark	12	55/120	15-47	3	Ankle activity, complication
Petersen 1985 ¹⁶	Denmark	12	29/30	15-50	2	Ankle activity, complication
Pijnenburg 2003 ¹⁷	Netherlands	72	159/158	18-45	5	Ankle activity, complication
Specchiulli 2001 ¹⁸	Italy	27	50/50	Average 25	4	Subjective instability, complication
Povacz 1998 ¹⁹	Australia	6	73/73	16-39	4	Ankle activity, subjective instability, complication
Kalkkonen 1996 ²⁰	Finland	9	30/30	15-55	3	Ankle activity, subjective instability, complication
Sommer 1987 ²¹	Germany	6	36/27	18-45	3	Subjective instability
Pihlajamaki 2010 ²²	Finland	168	25/26	Average 20.4	6	Subjective instability
Takao 2011 ²³	Japan	12	78/54	18-32	4	Ankle activity; subjective instability

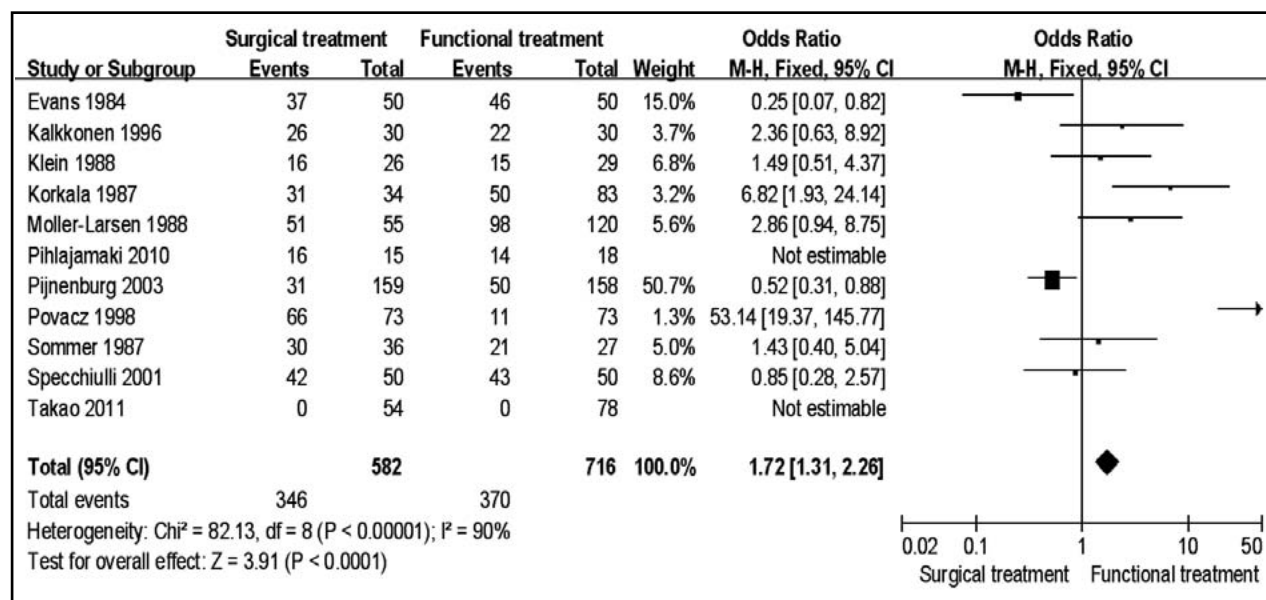


Fig.2: Comparison of ankle function stability by surgical treatment and functional treatment in acute ruptures of lateral ankle ligament.

obvious publication bias by Egger test ($p=0.09$ and $p=0.61$ for studies on ankle activity and instability, respectively).

DISCUSSION

In this present study, we compared the efficacy of surgical procedure and conventional treatment for patients with acute ankle sprains, and the results showed effect of surgical treatment was better than that of the conventional treatment in terms of ankle activity and instability during a short term period after treatment. However, operative treatment had more complication than that of the conventional treatment. The evidence for the comparison of efficacy of operative procedure and conventional treatment for acute ankle sprains was based on 15 published studies, and the limited sample size might lower the statistical power. Because there was several conventional treatments, and treatment effect might vary due

to different methods, a subgroup analysis was conducted according to the different treatment. However, we did not conduct this analysis because of limited number of published studies and unavailable data. There was great heterogeneity between studies, and the reasons might be the ethnicities, risk of bias, duration of follow-up, and outcome indexes. Most of the included studies were assessed with high risk bias. Therefore, a sensitivity analysis was conducted. After excluding high risk studies, the results showed robust. The reasons might be several studies have significant treatment allocation concealment, and they do not include all data of the enrolled patients. This allocation concealment could result in great selection bias, and induce overestimation of the treatment efficacy.^{6,16} Also, the different outcomes, including recovery to pre-injury activity and ankle function stability as well as recurrent ankle injury may restrain to conduct a best evidence synthesis.

Table-II: Comparison of complication by surgical treatment and functional treatment in acute ruptures of lateral ankle ligament.

Variables	Surgery treatment	Conventional treatment	Odds Ratio(95% CI)	P value
	Events/Total	Events/Total		
DVT	7/138	4/189	2.56(0.77-8.59)	0.13
Tenderness of scar	9/260	0/264	5.57(1.18-26.37)	<0.05
Sensory loss	18/361	0/358	8.01(2.08-30.82)	<0.05
Wound infection or necrosis	3/346	0/400	3.98(0.44-36.34)	0.22
Pooled results	37/1105	4/1211	4.49(2.15-9.36)	<0.05

The limited evidence found the effectiveness of surgical treatment is more favourable than the conventional treatment. Previously, another meta-analysis reported that surgical treatment is benefits for patients with acute ruptures of lateral ankle ligament with low quality and potentially biased evidence.²⁴ A recent study concluded that a surgery combined with conventional treatment is beneficial to the grade III ankle sprain, and conventional treatment, such as immobilization with tape or brace, weight-bearing ambulation, motion exercises could result a quickly recovery to ankle sprain below than II grade.²⁵

In summary, the recovery of the ankle activity and instability of surgical procedure is significantly better than conventional treatment alone for acute ankle sprain. However, due to the limited number of published studies, we did not find significant improvement in other outcomes. Therefore, there is a strong need for high quality RCTs regarding the effectiveness of surgical procedure in comparison to conventional treatment in populations with different stage of injuries.

ACKNOWLEDGEMENT

We acknowledge the help from the Third Xiangya Hospital of Central South University for our study.

REFERENCES

- Pijnenburg AC, Van Dijk CN, Bossuyt PM, Marti RK. Treatment of ruptures of the lateral ankle ligaments: a meta-analysis. *J Bone Joint Surg Am.* 2000;82:761-773.
- Ferran NA, Maffulli N. Epidemiology of sprains of the lateral ankle ligament complex. *Foot Ankle Clin.* 2006;11:659-662.
- Parkkari J, Kannus P, Natri A, Lapinleimu I, Palvanen M, Heiskanen M, et al. Active living and injury risk. *Int J Sports Med.* 2004;25:209-216.
- Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. *J Athl Train.* 2002;37(4):364-375.
- Harrington KD. Degenerative arthritis of the ankle secondary to long-standing lateral ligament instability. *J Bone Joint Surg Am.* 1979;61(3):354-361.
- Evans GA, Hardcastle P, Frenyo AD. Acute rupture of the lateral ligament of the ankle. To suture or not to suture? *J Bone Joint Surg.* 1984;66(2):209-212.
- Klein J, Schreckenberger C, Roddecker K, Tiling T. Is the operative treatment of a fresh rupture of the outer tendon of the upper ankle necessary. *Zentralblatt fur Chirurgie.* 1988;13(11):737.
- Pihlajamäki H, Hietaniemi K, Paavola M, Visuri T, Mattila VM. Surgical versus functional treatment for acute ruptures of the lateral ligament complex of the ankle in young men: a randomized controlled trial. *J Bone Joint Surg Am.* 2010;92(14):2367-2374.
- Higgins JPT, Green S, eds. *Cochrane handbook for systematic reviews of interventions.* Version 5.0.1 [updated September 2008]. Cochrane Collaboration 2008. www.cochrane-handbook.org.
- Woolf B. On estimating the relation between blood group and disease. *Ann Hum Genet.* 1955;19:251-253.
- Lau J, Ioannidis JP, Schmid CH. Quantitative synthesis in systematic reviews. *Ann Intern Med.* 1997;127:820-826.
- Higgins JPT, Thompson SG, Deek JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ.* 2003;327:557-560.
- Egger M, Davey SG, Schneider M, Minder. Bias in metaanalysis detected by a simple, graphical test. *BMJ.* 1997;315:629-634.
- Korkala O, Rusanen M, Jokipii P, Kytomaa J, Avikainen V. A prospective study of the treatment of severe tears of the lateral ligament of the ankle. *Int Orthop.* 1987;11(1):13-17.
- Moller-Larsen F, Wethelund JO, Jurik AG, de Carvalho A, Lucht U. Comparison of three different treatments for ruptured lateral ankle ligaments. *Acta Orthopaedica Scandinavica.* 1988;59(5):564-566.
- Petersen AO. Treatment of rupture of the lateral ligament of the ankle. Prospective comparison of surgical and conservative treatment. *Ugeskrift for Laeger.* 1985;147(2):93-95.
- Pijnenburg AC, Bogaard K, Krips R, Marti RK, Bossuyt PM, van Dijk CN. Operative and functional treatment of rupture of the lateral ligament of the ankle. A randomised, prospective trial. *J Bone Joint Surg.* 2003;85(4):525-530.
- Specchiulli F, Cofano RE. A comparison of surgical and conservative treatment in ankle ligament tears. *Orthop.* 2001;24(7):686-688.
- Povacz P, Unger SF, Miller WK, Tockner R, Resch H. A randomized, prospective study of operative and non-operative treatment of injuries of the fibular collateral ligaments of the ankle. *J Bone Joint Surg.* 1998;80:345-351.
- Kaikkonen A, Kannus P, Jarvinen M. Surgery versus functional treatment in ankle ligament tears: A prospective study. *Clin Orthop Relat Res.* 1996;(326):194-202.
- Sommer HM, Arza D. Conservative functional treatment of fibular capsule ligament rupture even in the performance athlete? *Sportverletz Sportschaden.* 1987;1:25-29. (German).
- Pihlajamäki H, Hietaniemi K, Paavola M, Visuri T, Mattila VM. Surgical versus functional treatment for acute ruptures of the lateral ligament complex of the ankle in young men: a randomized controlled trial. *J Bone Joint Surg Am.* 2010;92(14):2367-2374.
- Takao M, Miyamoto W, Matsui K, Sasahara J, Matsushita T. Functional Treatment After Surgical Repair for Acute Lateral Ligament Disruption of the Ankle in Athletes. *Am J Sports Med.* 2012;40(2):447-451.
- Kerkhoffs GM, Handoll HH, de Bie R, Rowe BH, Struijs PA. Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. *Cochrane Database Syst Rev.* 2007;(2):CD000380.
- Kannus P, Renstrom P. Treatment for acute tears of the lateral ligaments of the ankle. Operation, cast or early controlled mobilization. *J Bone Joint Surg Am.* 1991;73:305-312.