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Surgical Versus Conservative Intervention for Acute Achilles Tendon Rupture

A PRISMA-Compliant Systematic Review of Overlapping Meta-Analyses

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Abstract: Although many meta-analyses comparing surgical intervention with conservative treatment have been conducted for acute Achilles tendon rupture, discordant conclusions are shown. This study systematically reviewed the overlapping meta-analyses relating to surgical versus conservative intervention of acute Achilles tendon rupture to assist decision makers select among conflicting meta-analyses, and to offer intervention recommendations based on the currently best evidence.

Multiple databases were comprehensively searched for meta-analyses comparing surgical with conservative treatment of acute Achilles tendon rupture. Meta-analyses only comprising randomized controlled trials (RCTs) were included. Two authors independently evaluated the meta-analysis quality and extracted data. The Jadad decision algorithm was applied to ascertain which meta-analysis offered the best evidence.

A total of 9 meta-analyses were included. Only RCTs were determined as Level-II evidence. The scores of Assessment of Multiple Systematic Reviews (AMSTAR) ranged from 5 to 10 (median 7). A high-quality meta-analysis with more RCTs was selected according to the Jadad decision algorithm. This study found that when functional rehabilitation was used, conservative intervention was equal to surgical treatment regarding the incidence of rerupture, range of motion, calf circumference, and functional outcomes, while reducing the incidence of other complications. Where functional rehabilitation was not performed, conservative intervention could significantly increase rerupture rate.

Conservative intervention may be preferred for acute Achilles tendon rupture at centers offering functional rehabilitation, because it shows a similar rerupture rate with a lower risk of other complications when compared with surgical treatment. However, surgical treatment should be considered at centers without functional rehabilitation as this can reduce the incidence of rerupture.

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Abbreviations: AMSTAR = Assessment of Multiple Systematic Reviews, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analysis, RCTs = randomized clinical trials.

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INTRODUCTION

Achilles tendon rupture is a common and potentially disabling injury, largely influencing young male adults who participate in sports, such as racket games, soccer, and basketball.[1,2] The incidence of Achilles tendon rupture is up to 18 per 100,000 per year and is still increasing.[2] In general, interventions for acute Achilles tendon rupture could be classified as surgical and conservative.[3,4] In recent years, significant progress has been observed for the treatment of acute Achilles tendon rupture. However, the optimal intervention for acute Achilles tendon rupture is still uncertain.[5–17]

Multiple randomized clinical trials (RCTs) comparing surgical with conservative treatment have been reported for acute Achilles tendon ruptures, but their findings are conflicting regarding which procedure is better.[5–17] In light of this, many meta-analyses of RCTs, representing the highest level of evidence, have been published to compare these 2 procedures for treating acute Achilles tendon rupture. However, these overlapping meta-analyses also showed discordant findings.[18–26] Some articles suggested that surgical intervention for acute Achilles tendon rupture was associated with a significant increase with respect to the incidence of rerupture when comparing with conservative treatment;[19] the others found no significant difference between surgical and conservative intervention.[21] These inconsistent findings have resulted in uncertainty for decision makers with respect to the intervention of acute Achilles tendon rupture.

In recent years, systematic reviews of overlapping meta-analyses have been reported in many medical fields.[27–30] These studies help to select the highest-quality level of evidence for decision making by evaluating the overlapping meta-analyses with the discordant findings on certain topic.[27–30] However, to our knowledge, there is no systematic review of overlapping meta-analyses investigating the relative effects between surgical and conservative intervention for acute Achilles tendon rupture. The objective of the present study was to perform a systematic review of overlapping meta-analyses regarding surgical versus conservative treatment of acute Achilles tendon rupture, to assist decision makers in selection among conflicting meta-analyses, and to offer intervention recommendations by the best available evidence.

MATERIALS AND METHODS

This study was approved by the Research Ethics Committee of Changhai Hospital of Second Military Medical University, and conducted following the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement.[31] The design of this study was based on previous similar publications.[27-30]

Literature Search

On July 20, 2015, the databases of PubMed, EMBASE, and Cochrane Library were systematically retrieved. The keywords were used, including achilles, tendoachilles, calcaneal, calcanean, calcaneus, rupture, ruptures, ruptured, lesion, lesions, tear, tears, systematic review, and meta-analysis. The search was independently conducted by 2 authors, with the restriction of English language. The references of the included studies were also checked to find possible meta-analyses on this topic. The titles and abstracts were first reviewed, and the full texts were acquired if the information was not enough. Disagreements were settled by discussion, and a third author was consulted when necessary.

Eligibility Criteria

The inclusion criteria of this systematic review were: comparing surgical with conservative intervention for acute Achilles tendon rupture; meta-analysis only comprising RCTs; at least 1 outcome, such as rerupture rate and functional outcome. The narrative review, meetings abstract, correspondence, meta-analysis comprising non-RCTs, and systematic review without meta-analysis conducted were excluded.

Data Extraction

The following data were independently extracted by 2 authors from the included meta-analyses: first author, year of publications, databases for search, primary study design, the number of RCTs included, heterogeneity or subgroup analysis of primary study, and meta-analysis results. When disagreements between the 2 authors could not be resolved by discussion, a third author was consulted.

Quality Evaluation

The meta-analysis quality was evaluated by the Oxford Levels of Evidence[32] and the Assessment of Multiple Systematic Reviews (AMSTAR) instrument.[33] AMSTAR has been proven as a methodological assessment tool with good reliability, validity, and responsibility.[34,35] It is widely used to evaluate the quality of systematic reviews.[27–30] Meta-analyses quality was independently evaluated by 2 authors. Disagreements between authors were settled by discussion, and a third author was consulted if necessary.

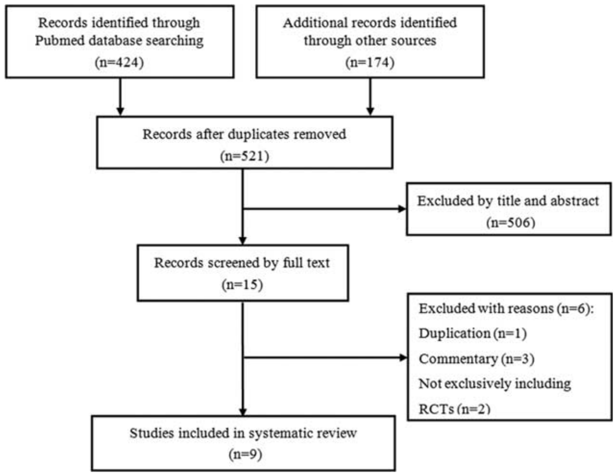

FIGURE 1. The flowchart of study selection.

Application of Jadad Decision Algorithm

The Jadad decision algorithm was conducted to investigate the source of inconsistency among systematic reviews, comprising differences in clinical question, inclusion and exclusion criteria, data extraction, quality assessment, data pooling, and statistical analysis.[36] It has been widely conducted to offer treatment recommendations among meta-analyses with discordant conclusions.[27–30,36] This algorithm was independently applied by 3 authors, who reached a consensus regarding which meta-analysis offered the best available evidence.

RESULTS

Literature Search

A flowchart of the study selection is depicted in Figure 1. A total of 521 titles were found from the literature source. Nine meta-analyses met the inclusion criteria.[18–26] The characteristics of these included meta-analyses are listed in Table 1.

TABLE 1. The Characteristics of the Included Studies

First Author	Year	Journal	Date of Last Literature Search	No. of Included RCTs
Bhandari M	2002	Clinical Orthopaedics and Related Research	August 2001	6
Khan RJ	2005	The Journal of Bone and Joint Surgery American Volume	NA	4
Khan RJ	2010	Cochrane Database of Systematic Reviews	July 2009	6
Zhao HM	2011	Chinese Medicine Journal	July 2011	8
Jones MP	2012	The Journal of Bone and Joint Surgery American Volume	NA	8
Wilkins R	2012	The American Journal of Sports Medicine	NA	7
Jiang N	2012	International Orthopaedics	September 2011	10
Soroceanu A	2012	The Journal of Bone and Joint Surgery American Volume	December 2011	10
van der Eng DM	2013	The Journal of Foot and Ankle Surgery	December 2012	7

NA = not available; RCTs = randomized clinical trials.

These studies were published between 2002 and 2013. The primary studies of included meta-analyses were published between 1981 and 2011, and the number of primary trials ranged from 4 to 10 (Table 2).

Search Methodology

Three of the included meta-analyses only included English literature,[18,19,21] and the others had no language restriction.[20,22–26] The databases of Medline were searched in all included meta-analyses, whether PubMed, Cochrane Library, Embase, OVID, and BIOSIS were included in search strategy was inconsistent among the studies. Search methodology used in the included meta-analyses is shown in Table 3.

Methodologic Quality

All meta-analyses included RCTs or quasi-RCT, and were determined as Level-II evidence according to Oxford Levels of Evidence (Table 4). The results of AMSTAR scores for the included meta-analyses are listed in Table 5, ranging from 5 to 10 (median 7). Two Cochrane reviews with 10 scores of AMSTAR were the highest-quality studies.[22,23]

Heterogeneity Assessment

The I^2 statistic value, as a measurement tool for investigating the interstudy variability, was used to evaluate the heterogeneity of study in each meta-analysis (Table 6).[18–26] Only 1 study performed sensitivity analyses according to methodological quality (Table 4).[19] A total of 3 meta-analyses did not conduct sensitivity or subgroup analysis (Table 6).[18,25,26]

Results of Jadad Decision Algorithm

Which meta-analysis offered the best available evidence among the 9 included meta-analyses was investigated following the Jadad decision algorithm.[36] The meta-analysis result of the each study is depicted in Figure 2. Based on that the included studies investigated the same question, did not comprise the same trials, and the selection criteria were discordant, the Jadad decision algorithm indicated that the best available evidence should be chosen according to the publication status and the methodological quality of primary trials, language restrictions, and analysis of data on individual patients (Fig. 3). Hence, a high-quality study with more RCTs was selected.[24] This study demonstrated that when conservative intervention included early range of motion protocol, it was equal to surgical treatment with respect to rerupture rate, range of motion, calf circumference, and functional outcomes, while it decreased the risk of other complications. If functional rehabilitation was not performed, conservative intervention shows a significant increase with respect to the incidence of rerupture.

DISCUSSION

Meta-analysis of RCTs, representing the highest level of evidence, helps clinicians, patients, and policy-makers to make decisions.[37] Although many meta-analyses regarding the same topic have been conducted to assess some intervention methods, they have resulted in discordant conclusions.[36] Such conflict findings complicate decision makers, who make choices among alternative interventions based on these best available evidence. Multiple meta-analyses have found that both conservative and surgical intervention could improve the preoperative clinical status, but the relative effects between these 2 procedures are still uncertain.[18–26]

TABLE 2. Primary Studies Included in Meta-Analyses

First author (Year)	Nistor L (1981)	Coombs R (1981)	Cetti R (1993)	Thermann H (1995)	Schroeder D (1997)	Majewski M (2000)	Moller M (2001)	Costa ML (2006)	Twaddle BC (2007)	Metzn R (2008)	Willits K (2010)	Nillsson-Helander K (2010)	Keating JF (2011)
Bhandari M (2002)	+	+	+	+		+	+						
Khan RJ (2005)	+		+		+		+						
Khan RJ (2010)	+		+		+		+		+	+			
Zhao HM(2011)	+		+				+		+	+	+	+	+
Jones MP (2012)	+		+		+		+		+	+	+	+	
Wilkins R (2012)	+		+				+		+	+	+	+	
Jiang N (2012)	+		+		+		+	+	+	+	+	+	+
Soroceanu A (2012)	+		+	+	+	+	+		+	+	+	+	
van der Eng DM(2013)							+	+	+	+	+	+	+

TABLE 3. Search Methodology of the Included Studies

First Author (Year)	Restriction of Publication Language	Restriction of Publication Status	Search database						
			PubMed	Medline	Embase	Cochrane Library	OVID	BIOSIS	Others
Bhandari M (2002)	No	NA		+		+			+
Khan RJ (2005)	No	NA		+	+	+			+
Khan RJ (2010)	No	No		+	+	+			+
Zhao HM (2011)	No	NA	+	+	+		+		+
Jones MP (2012)	No	No		+	+	+			+
Wilkins R (2012)	Yes	NA	+	+		+			+
Jiang N (2012)	Yes	Yes		+	+	+	+	+	+
Soroceanu A (2012)	No	No		+	+	+			+
van der Eng DM (2013)	Yes	Yes		+		+			+

NA = not available.

TABLE 4. Methodological Information of the Included Studies

First Author (Year)	Design of Included Studies	Level of Evidence	Software	GRADE Use	Sensitivity Analysis
Bhandari M (2002)	RCT or quasi-RCT	Level II	NA	No	No
Khan RJ 2005)	RCT or quasi-RCT	Level II	NA	No	No
Khan RJ (2010)	RCT or quasi-RCT	Level II	NA	No	No
Zhao HM (2011)	RCT or quasi-RCT	Level II	RevMan	No	No
Jones MP (2012)	RCT or quasi-RCT	Level II	NA	No	No
Wilkins R (2012)	RCT or quasi-RCT	Level II	SAS	No	No
Jiang N (2012)	RCT or quasi-RCT	Level II	RevMan	No	Yes
Soroceanu A (2012)	RCT or quasi-RCT	Level II	NA	No	No
van der Eng DM (2013)	RCT or quasi-RCT	Level II	RevMan	No	No

NA = not available; RCT = randomized controlled trial.

TABLE 5. AMSTAR Scores of the Included Studies

Items	Bhandari M (2002)	Khan RJ (2005)	Khan RJ (2010)	Zhao HM (2011)	Jones MP (2012)	Wilkins R (2012)	Jiang N (2012)	Soroceanu A (2012)	van der Eng DM (2013)
1. Was an a priori design provided?	0	0	1	0	1	0	0	0	0
2. Was there duplicate study selection and data extraction?	0	1	1	1	1	0	1	1	1
3. Was a comprehensive literature search performed?	1	1	1	1	1	1	1	1	1
4. Was the status of publication (ie grey literature) used as an inclusion criterion?	0	0	1	0	1	0	0	1	0
5. Was a list of studies (included and excluded) provided?	0	1	1	0	1	0	0	0	0
6. Were the characteristics of the included studies provided?	1	0	1	1	1	1	1	1	1
7. Was the scientific quality of the included studies assessed and documented?	1	1	1	1	1	1	1	1	1
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?	1	1	1	0	1	1	1	1	1
9. Were the methods used to combine the findings of studies appropriate?	1	1	1	1	1	1	1	1	1
10. Was the likelihood of publication bias assessed?	0	0	0	0	0	0	0	1	0
11. Was the conflict of interest stated?	0	1	1	1	1	1	1	1	1
Total scores	5	7	10	6	10	6	7	9	7

TABLE 6. Heterogeneity or Subgroup Analyses of Each Meta-Analyses

Items	Bhandari M (2002)	Khan RJ (2005)	Khan RJ (2010)	Zhao HM (2011)	Jones MP (2012)	Wilkins R (2012)	Jiang N (2012)	Soroceanu A (2012)	van der Eng DM (2013)
Rerupture rate	−	−	−	−	+	−	+	+	+
Complications rate (other than rerupture)		−	+	+	−		+	−	+
Major complication rate				−					+
Moderate complication rate				−					
Minor complication rate	−			−					+
Total infection rate			+						
Incidence of superficial infection			−				−		
Incidence of deep infection			−			−	+		
Incidence of wound infection	−	−			−				
Deep vein thrombosis			−			−	−		
Incidence of scar adhesion			−			−	+		
Incidence of sensibility disturbance			−			−	+		
Complex regional pain syndrome			−						
Delayed wound healing			−						
Skin related complications (other than scar adhesions)			−						
Return to previous level of sporting activity	−		−	−			−		
Time to return to work				−		−	−	−	
Range of motion				−				−	
Strength								−	
Calf circumference								−	
Functional outcome								−	
Excessive tendon lengthening			−				−		

A plus sign indicates formal sensitivity or subgroup analysis was performed. A minus sign indicates formal sensitivity or subgroup analysis was not performed.

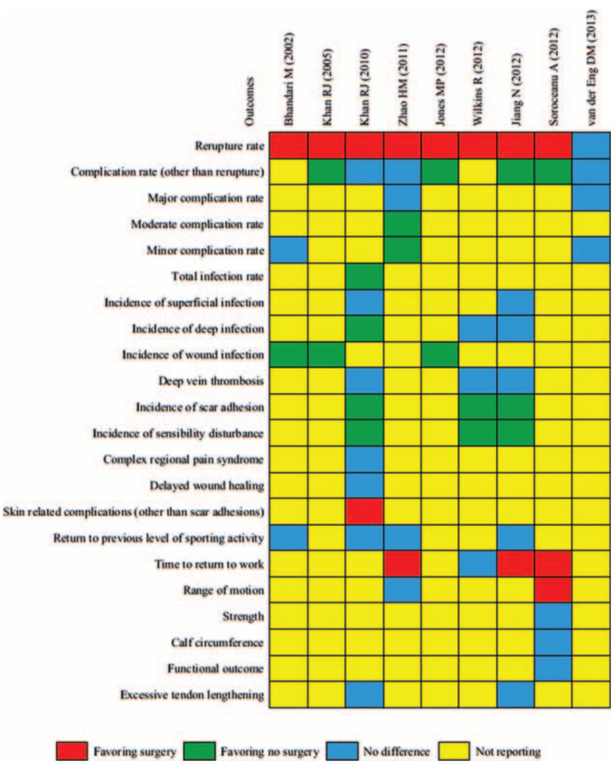

FIGURE 2. Results of the included meta-analyses.

Most of meta-analyses included in this systematic review comprehensively conducted the literature search within similar period, but they did not comprise the same primary trials, and not provide the same conclusions for the intervention of acute Achilles tendon rupture.[18–26] The possible sources of inconsistence among meta-analyses have been analyzed and reported by Jadad et al,[36] including the clinical question, study selection and inclusion, data extraction, assessment of study quality, assessment of the ability to combine studies, and statistical methods for data synthesis. Moreover, a decision algorithm was

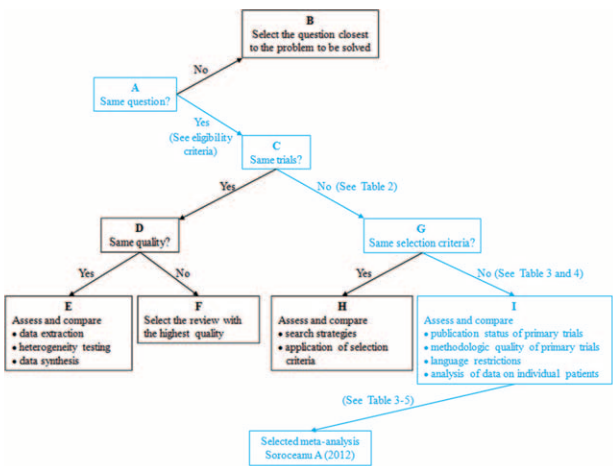

FIGURE 3. The flowchart of Jadad decision algorithm.

also designed to choose the high-quality level of evidence from currently discordant systematic reviews.[36] This decision tool adopted in this study was widely used to find the best available evidence among overlapping systematic reviews.[27–30]

The meta-analysis by Soroceanu et al[24] was selected in terms of the Jadad decision algorithm. This study demonstrated that surgical treatment was superior to conservative treatment with respect to rerupture rate, range of motion, and time to return to work. However, the improvement of range of motion in surgical group was not beyond clinically important difference. There was no difference between surgical and conservative intervention in strength, calf circumference, and functional outcome. The functional outcome was expressed with use of different scales in each RCT, including Functional Index for the Lower Leg and Ankle,[11] the Musculoskeletal Functional Assessment Instrument,[13] Leppilahti score.[14,16] Conservative intervention was superior to surgical treatment regarding the rate of complications. However, when conservative intervention included functional rehabilitation, it was equal to surgical treatment with regard to the incidence of rerupture. Therefore, Soroceanu et al[24] concluded that conservative intervention should be a reasonable choice at centers offering functional rehabilitation with early range of motion, because surgical intervention did not show a significant decrease in the incidence of rerupture while a higher incidence of other complications. Surgical intervention could be preferred at centers that do not perform early range of motion. It showed a higher risk of other complications, but it decreased the incidence of rerupture.

There are several limitations in the present study. First, the literature search was limited to articles published in English. Non-English literature could not be included in this systematic review despite multiple databases being searched. Second, to get the highest level of evidence, meta-analyses only comprising RCTs were included in this study. However, all the included studies were Level-II evidence. Therefore, this systematic review could not offer treatment recommendations based on Level-I evidence.

CONCLUSION

Based on the present systematic review of overlapping meta-analyses that compared surgical with conservative intervention for acute Achilles tendon rupture, the best available evidence indicated that conservative intervention for acute Achilles tendon rupture may be preferred at centers offering functional rehabilitation, because it shows similar rerupture rate when comparing with surgical treatment while low risk of other complications. However, surgical treatment should be considered at centers without functional rehabilitation because it could reduce the incidence of rerupture.

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