

Outcomes of Open Versus Arthroscopic Broström Surgery for Chronic Lateral Ankle Instability

A Systematic Review and Meta-analysis of Comparative Studies

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Background: Nearly 20% of acute ankle sprains progress to chronic lateral ankle instability that requires surgical intervention. In recent years, there has been a growing interest in arthroscopic Broström techniques as an alternative to open surgery.

Purpose: To review the most up-to-date evidence comparing the outcomes of open and arthroscopic Broström procedures for chronic lateral ankle instability.

Study Design: Systematic review; Level of evidence, 3.

Methods: This review was performed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Relevant comparative studies in English up to May 2020 were identified. The primary outcomes were (1) functional scores (Karlsson Ankle Function Score and American Orthopaedic Foot & Ankle Society [AOFAS] score) and (2) the 10-point visual analog scale (VAS) score for pain. The secondary outcomes were differences in (1) postoperative anterior drawer and talar tilt, (2) surgical time and complication rate, and (3) time to return to sports and weightbearing.

Results: A total of 408 patients in 8 studies met the inclusion criteria. Of these, 193 (47.3%) patients underwent open surgery, while 215 (52.7%) patients underwent arthroscopic surgery. There were significant differences between the open and arthroscopic repair groups in mean 6-month AOFAS scores (82.4 vs 92.25, respectively; mean difference [MD], 11.36; 95% CI, 0.14-2.56; $I^2 = 90\%$; $P = .03$), 1-year AOFAS scores (80.05 vs 88.6; MD, -11.96; 95% CI, -21.26 to -2.76; $I^2 = 82\%$; $P = .01$), 6-month VAS scores (1.7 vs 1.4; MD, -0.38; 95% CI, -0.54 to -0.21; $I^2 = 78\%$; $P < .001$), and 1-year VAS scores (2.05 vs 1.45; MD, 0.31; 95% CI, 0.09-0.54; $I^2 = 0\%$; $P < .001$). The mean time to weightbearing was 14.25 and 9.0 weeks in the open and arthroscopic repair groups, respectively (MD, 1.89; 95% CI, 1.24-2.54; $I^2 = 99\%$; $P < .001$). There were no statistically significant differences in the remaining outcomes evaluated.

Conclusion: While technically more demanding, arthroscopic Broström was superior to open Broström-Gould surgery in post-operative AOFAS scores, VAS pain scores, and time to return to weightbearing. The operative time, complication rate, talar tilt, and anterior drawer tests were excellent and statistically comparable. Long-term clinical trials are required before recommending arthroscopic Broström as the new gold standard.

Keywords: lateral ankle instability; open; arthroscopic; Broström-Gould; repair

Ankle sprains are the most common ankle injury, accounting for up to 85% of all ankle injuries, with lateral inversion sprains constituting the majority of those sprains.²⁸ The injury mainly compromises the anterior talofibular ligament (ATFL), ranging from stretching to complete

tears.²⁵ Most cases require a brief period of immobilization and functional rehabilitation and have excellent outcomes. Nevertheless, up to 20% of acute ankle sprains progress to mechanical or functional chronic lateral ankle instability (LAI) and may require surgical intervention.^{7,30} Patients are typically evaluated with persistent tenderness over the lateral gutter accompanied by episodes of instability. Clinically, they have abnormal findings on the talar tilt test, anterior drawer tests, and stress radiographs.²⁹

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In 1966, Broström published his technique: anatomical reconstruction of the ATFL and calcaneofibular ligament (CFL) by imbricating the remnants of these ligaments along with the lateral capsule.⁴ Gould et al¹⁰ later modified the technique in 1980 by adding augmentation of the repair with fibers from the inferior extensor retinaculum. While many techniques have been described over the following decades, the Broström-Gould open surgery has remained the gold standard treatment for primary chronic LAI even more than 50 years after the technique was first described.¹¹ In cases without sufficient remnant tissue or failed Broström-Gould procedure, reconstruction of the ATFL can be performed using autologous or synthetic grafts.²⁷

In recent years, there has been a growing interest in arthroscopic Broström techniques as an alternative to open Broström-Gould surgery. Using suture anchors to the fibula, surgeons can arthroscopically repair the ATFL and augment it with the inferior extensor retinaculum. The Gould modifications can be performed through an accessory anterolateral portal/incision^{25,34} or endoscopically (all-inside).^{12,36} This technique offers an additional diagnostic and therapeutic opportunity for concomitant intra-articular pathologies in the same setting.^{5,11,14} Recent case series and cohort studies show reliable improvement in clinical and radiographic outcomes of LAI after arthroscopic surgery.^{16,31} Few studies have compared the clinical outcomes of arthroscopic versus open Broström-Gould procedures. In the past 2 years alone, 4 comparative studies have been published,^{8,32,33,37} which highlights the importance of reaching a bottom line as to whether to recommend the arthroscopic Broström procedure as a worthy alternative to the gold standard Broström-Gould.

The current study aimed to provide the foot and ankle surgery community with the most updated evidence comparing outcomes of open with arthroscopic Broström procedures for chronic LAI.

METHODS

Literature Search

This meta-analysis was performed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.²⁴ An electronic-based search of the MEDLINE (PubMed), EMBASE, Google Scholar, and

Cochrane databases was conducted using the following keywords with their synonyms: (“open Broström-Gould” AND “arthroscopic Broström” AND “lateral ankle instability” AND “ATFL reconstruction”). Relevant comparative studies in the English literature were identified between inception of databases and May 2020. In addition, the reference lists from previous review articles were searched manually for eligible studies.

Two investigators (A.K.A., K.M.) independently reviewed all titles, abstracts, and the full text of articles that were potentially eligible based on the abstract review. The eligible studies were selected according to the inclusion and exclusion criteria. Any disagreement was resolved by discussion, and all decisions were unanimous. If further conflict remained, it was resolved by the senior author (P.D.).

Study Eligibility Criteria

The research team systematically reviewed published studies according to the following inclusion criteria: comparative studies on open versus arthroscopic Broström procedures for chronic ankle instability reporting at least 1 of the following desirable outcomes: American Orthopaedic Foot & Ankle Society (AOFAS) score, Karlsson Ankle Function Score (KAFFS), 10-point visual analog scale (VAS) for pain, talar tilt, anterior drawer, complications, and time to return to activities/sport. Studies not reporting any of the outcomes of interest or not having the full text available in English were excluded. Noncomparative studies, as well as studies reporting on acute ankle instability, were excluded.

The search strategy according to the PICO framework² was as follows:

Population: chronic LAI

Intervention: arthroscopic Broström procedure

Control: open Broström procedure

Outcomes: *primary*: functional scores (KAFFS, AOFAS), VAS pain score; *secondary*: differences in anterior drawer and talar tilt, complication rate, time to return to sport, and weightbearing

Risk-of-Bias Assessment

Using the Newcastle-Ottawa Scale, 2 independent investigators (A.K.A. and T.T.) rated each study for quality and

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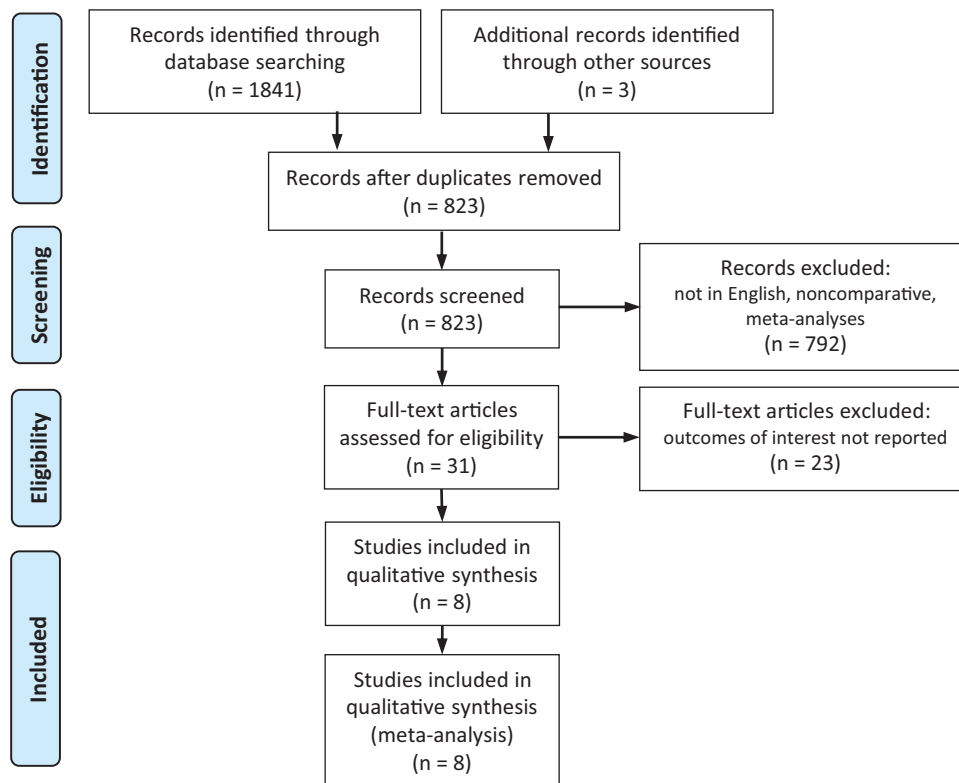


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart.

bias assessment.³² The Newcastle-Ottawa Scale evaluates the quality of a study from 3 categories: selection of study groups, comparability of groups, and ascertainment of outcomes/exposure. The level of evidence was assigned according to the Cochrane Book Review Group.¹⁴ Additionally, Review Manager (RevMan, Version 5.4; The Cochrane Collaboration, 2020) was used for the risk-of-bias assessment. To assess the risk of publication bias, a funnel plot of the most reported outcome measure (preoperative AOFAS score) was charted.

Data Collection

The data retrieved included study characteristics (name, year, level of evidence), patient characteristics (sample size, age, sex, associated ankle pathology), management characteristics, and outcome measures.

Data Analysis

Statistical analysis was carried out by an independent statistician. The data analysis was performed by comprehensive meta-analysis software using a random-effects model and SPSS Version 22 (IBM Corp). For continuous variables, the standardized mean difference (MD) and 95% CI were calculated. Heterogeneity was evaluated using the Higgins I^2 methods. According to the *Cochrane Handbook for Systematic Reviews of Interventions*, the interpretation of I^2 was as follows: heterogeneity not important, 0% to 40%;

moderate, 30% to 60%; substantial, 50% to 90%; and considerable, 75% to 100%.¹³

RESULTS

After removal of duplicates, a total of 823 studies were identified. After screening those records, 31 studies remained for full-text assessment. Eight studies qualified for the meta-analysis (Figure 1). A total of 408 patients in 8 studies met the inclusion criteria and were subjected to analysis. Out of those patients, 193 (47.3%) underwent open repair, while arthroscopic repair was performed in 215 (52.7%). Out of enrolled patients in different studies, 234 (57.4%) patients were male (117 patients in each group). There were 6 retrospective comparative studies, 1 prospective cohort study, and 1 randomized controlled trial (Table 1).

Risk-of-Bias Assessment

The results of the quality assessment according to the Newcastle-Ottawa Scale are shown in Table 2, and the results of the risk-of-bias assessment are shown in Figure 2. The funnel plot confirmed a low risk of publication bias of the studies reviewed.

Patient and Study Characteristics

Patient Age. Mean age was reported in 5 studies, with 120 patients treated with open repair and 141 patients

TABLE 1
Characteristics of Included Studies^a

Lead Author (Year)	Country	Study Design	Sample Size	Intervention	n	Age, y ^b	M/F, n	F/U, y ^b
Xu (2020) ³⁴	China	RCC	67	Open	35	35.8 ± 8.5	25/10	3.3 ± 0.8
				Arthroscopic	32	33.7 ± 7.0	24/8	3.0 ± 1.1
Woo (2020) ³³	Singapore	RCC	52	Open	26	31.5 ± 10.3	16/10	1
				Arthroscopic	26	33.4 ± 10.6	16/10	1
Zeng (2020) ³⁷	China	RCC	27	Open	10	27.7 ± 9.7	7/3	3
				Arthroscopic	17	30.9 ± 6.0	15/2	3
DeVries (2019) ⁸	USA	RCC	55	Open	12	39.5 ± 16.0	6/6	1.8 ± 0.6
				Arthroscopic	43	44.7 ± 13.2	16/27	2.0 ± 0.6
Li (2017) ¹⁸	China	PCS	60	Open	37	28.7 ± 8.7	29/8	3.0 ± 0.8
				Arthroscopic	23	30.3 ± 10.1	18/5	3.3 ± 0.9
Rigby (2019) ²⁸	USA	RCC	62	Open	32	37.73 (9-72)	14/18	3.7 (1.3-5.3)
				Arthroscopic	30	47.89 (14-83)	9/21	1.3 (0.7 -1.7)
Yeo (2016) ³⁶	Korea	RCT	48	Open	23	34.4 (17-52)	12/11	1
				Arthroscopic	25	35.2 (19-54)	7/18	1
Matsui (2016) ²³	Japan	RCC	37	Open	18	24 (13-56)	8/10	1
				Arthroscopic	19	28 (8-59)	12/7	1

^aF/U, follow-up; LOE, level of evidence; M/F, male/female; PCS, prospective cohort study; RCC, retrospective case-control study; RCT, randomized controlled trial.

^bData are reported as means. SD and ranges in parentheses are presented if reported in the included studies.

TABLE 2
Quality Assessment of Included Studies per
Newcastle-Ottawa Scale^a

Lead Author (Year)	LOE	Selection	Comparability	Outcome/Exposure
Xu (2020) ³⁴	3	****	*	**
Woo (2020) ³³	3	****	**	***
Zeng (2020) ³⁷	3	****	*	**
DeVries (2019) ⁸	3	****	*	**
Li (2017) ¹⁸	3	****	*	***
Rigby (2019) ²⁸	3	****	*	***
Yeo (2016) ³⁶	1	****	**	**
Matsui (2016) ²³	3	****	*	***

^aEach asterisk represents 1 point scored. The possible total points are 4 for selection, 2 for comparability, and 3 for outcomes. LOE, level of evidence.

treated with arthroscopic repair. The mean ages were 32.5 and 34.8 years for open and arthroscopic repairs, respectively, with no statistically significant difference (MD, -0.54; 95% CI, -2.93 to 1.85; $I^2 = 0\%$; $P = .66$).

Follow-up Duration. The duration of follow-up was reported in 3 studies, with 84 patients treated with open repair and 98 treated with arthroscopic repair. The mean follow-up was 2.7 years in the case of open repair and 2.8 years in the arthroscopic group, with no statistically significant difference (MD, 0; 95% CI, -0.29 to 0.30; $I^2 = 62\%$; $P = .98$).

AOFAS Score

Preoperative AOFAS Score. The mean preoperative AOFAS score was reported in 5 studies, with 131 patients

treated with open repair and 123 treated with arthroscopic repair. The average scores were 67.12 and 65.94 in the open and arthroscopic repairs, respectively, which was a statistically significant difference (MD, 2.24; 95% CI, 1.14-3.35; $I^2 = 0\%$; $P < .001$) (Figure 3).

Perioperative AOFAS Score. The mean perioperative AOFAS score was reported in 3 studies, with 82 patients treated with open repair and 72 treated with arthroscopic repair. The average postoperative AOFAS score was 91.2 in both groups of repair. There was no statistically significant difference between the repair types (MD, -1; 95% CI, -3.43 to 1.42; $I^2 = 0\%$; $P = .42$) (Figure 3).

Postoperative AOFAS Score. The mean 6-month AOFAS was reported in 2 studies, with 49 patients treated with open repair and 51 treated with arthroscopic repair. The average postoperative AOFAS scores were 82.4 and 92.25 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, 11.36; 95% CI, 0.14-2.56; $I^2 = 90\%$; $P = .03$) (Figure 3).

The 1-year-AOFAS score was reported in 2 studies, with 49 patients treated with open repair and 51 treated with arthroscopic repair. The average postoperative AOFAS scores were 80.05 and 88.6 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, -11.96; 95% CI, -21.26 to -2.76; $I^2 = 82\%$; $P = .01$) (Figure 3).

VAS Pain Score

Baseline VAS Score. The preoperative VAS score was reported in 3 studies, with 84 patients treated with open repair and 83 treated with arthroscopic repair. The average preoperative VAS scores were 5.77 and 5.40 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, -0.75; 95% CI, -0.91 to -0.58; $I^2 = 86\%$; $P < .001$) (Figure 4).

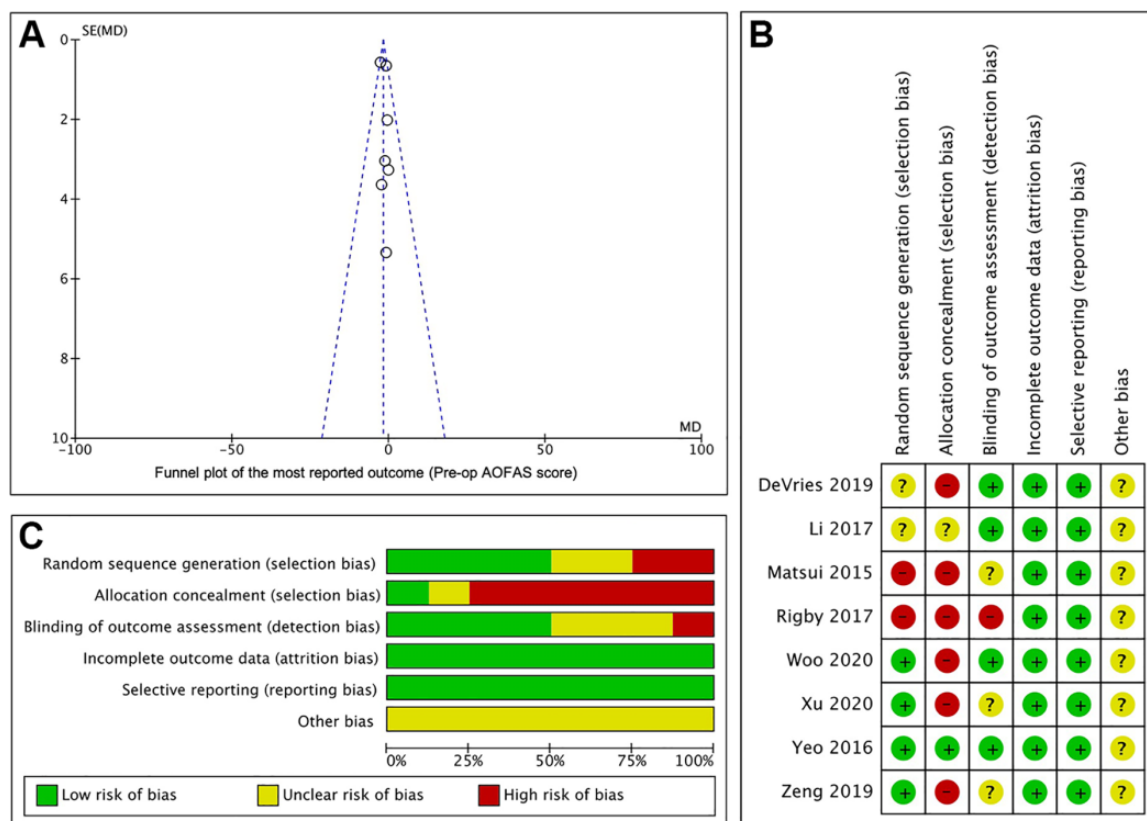


Figure 2. (A) Funnel plot of the most reported outcome measure (preoperative [Pre-op] American Orthopaedic Foot & Ankle Society [AOFAS] score), where each circle represents a study. All of the values are narrow to the no-effect line (vertical dashed line), and none of the studies were outside the range of acceptability (diagonal dashed lines). (B and C) Risk-of-bias assessment summary in the included studies using RevMan software. MD, mean difference.

Postoperative VAS Score. The 6-month VAS score was reported in 2 studies, with 49 patients treated with open repair and 51 treated with arthroscopic repair. The average 6-month VAS scores were 1.7 and 1.4 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, -0.38; 95% CI, -0.54 to -0.21; $I^2 = 78\%$; $P < .001$) (Figure 4).

The 1-year VAS score was reported in 2 studies, with 49 patients treated with open repair and 51 treated with arthroscopic repair. The average 1-year VAS scores were 2.05 and 1.45 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, 0.31; 95% CI, 0.09-0.54; $I^2 = 0\%$; $P < .001$) (Figure 4).

Karlsson Ankle Function Score

Preoperative KAFS. The preoperative KAFS was reported in 4 studies, with 105 patients treated with open repair and 97 treated with arthroscopic repair. The average preoperative KAFSs were 57 and 55.7 in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, 3.34; 95% CI, 2.08-4.60; $I^2 = 0\%$; $P < .001$) (Figure 5).

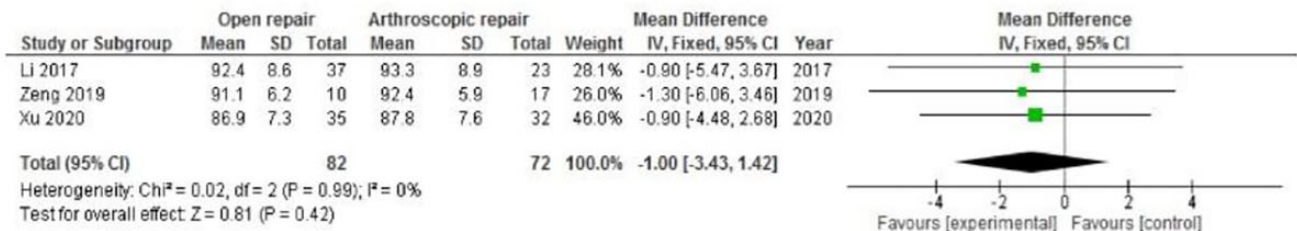
Postoperative KAFS. The postoperative KAFS was reported in 3 studies, with 82 patients treated with open repair and 72 treated with arthroscopic repair. The average postoperative KAFS results were 82.7 and 87.5 in the open and arthroscopic repairs, respectively. There was no statistically significant difference (MD, -0.73; 95% CI, -3.70 to 2.24; $I^2 = 0\%$; $P = .63$) (Figure 5).

Time to Weightbearing and Return to Sport

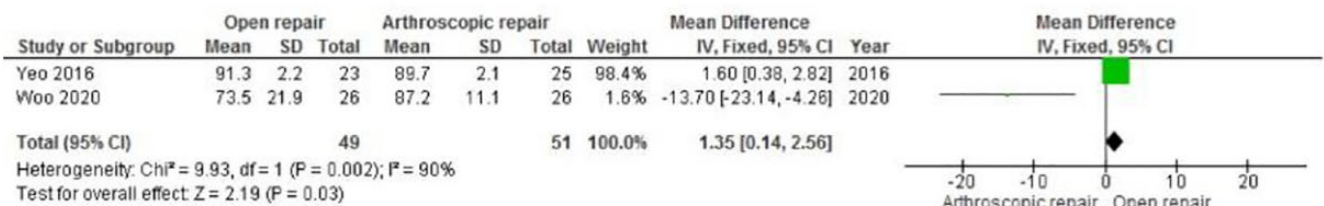
Time to return to weightbearing was reported in 2 studies, with 44 patients treated with open repair and 73 treated with arthroscopic repair. The average times to weightbearing were 14.25 weeks and 9.0 weeks in the open and arthroscopic repairs, respectively. This was a statistically significant difference (MD, 1.89; 95% CI, 1.24-2.54; $I^2 = 99\%$; $P < .001$) (Figure 6).

Time to return to sports was reported in 2 studies, with 30 patients treated with open repair and 62 treated with arthroscopic repair. The average times to return to sport were 18.7 weeks and 15.1 weeks in the open and arthroscopic repairs, respectively. There was no statistically significant difference (MD, -1.63; 95% CI, -0.73 to 3.99; $I^2 = 50\%$; $P = .18$) (Figure 6).

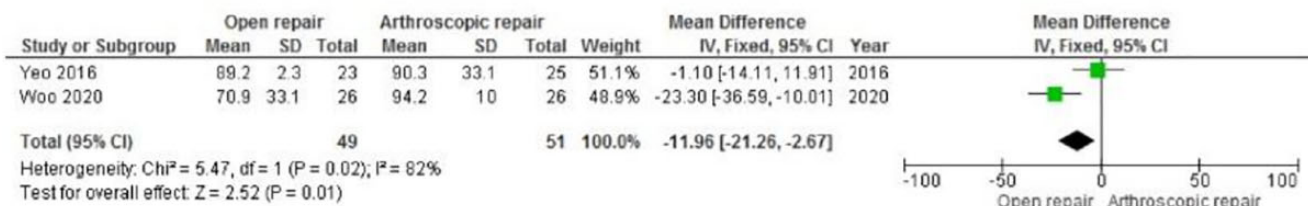
POSTOPERATIVE AOFAS SCALE SCORE



6 MONTHS POSTOPERATIVE AOFAS SCALE SCORE



1 YEAR POSTOPERATIVE AOFAS SCALE SCORE



Baseline preoperative AOFAS SCALE SCORE

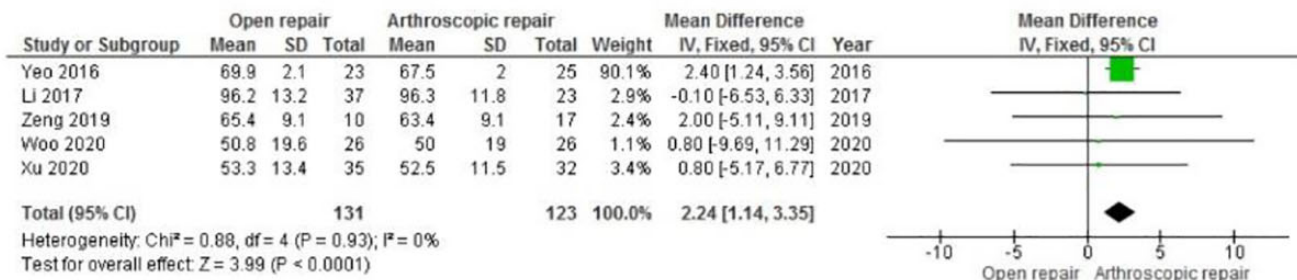


Figure 3. Forest plots comparing American Orthopaedic Foot & Ankle Society (AOFAS) scale score in arthroscopic versus open surgery. IV, inverse variance.

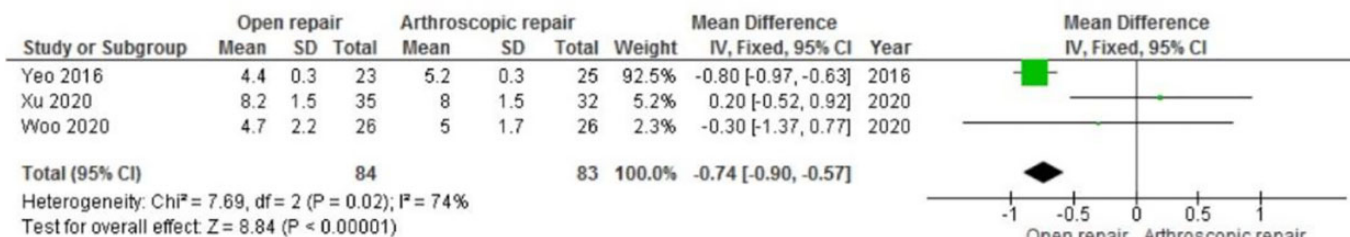
Postoperative Anterior Drawer and Talar Tilt

The postoperative anterior drawer was reported in 2 studies, with 33 patients treated with open repair and 42 treated with arthroscopic repair. The average postoperative anterior drawer values were 8.55 and 8.4 mm in the open

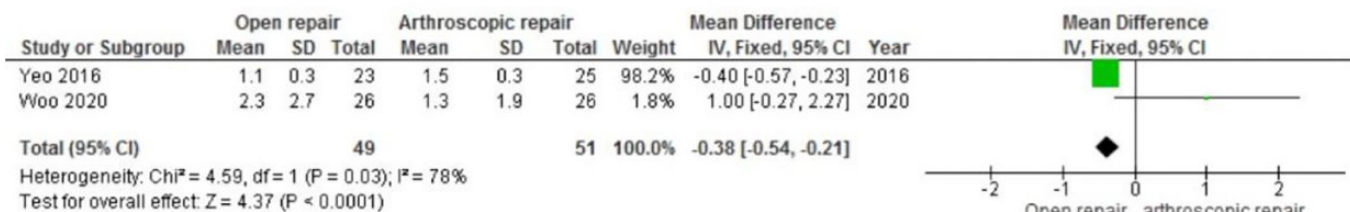
and arthroscopic repairs, respectively. There was no statistically significant difference (MD, 0.11; 95% CI, -0.83 to 1.05; I² = 0%; P = .82) (Figure 7).

Postoperative talar tilt was reported in 2 studies, with 33 patients treated with open repair and 42 treated with arthroscopic repair. The average postoperative talar tilts

PREOPERATIVE BASELINE VAS PAIN SCORE



6 MONTHS POSTOPERATIVE VAS PAIN SCORE



1 YEAR POSTOPERATIVE VAS PAIN SCORE

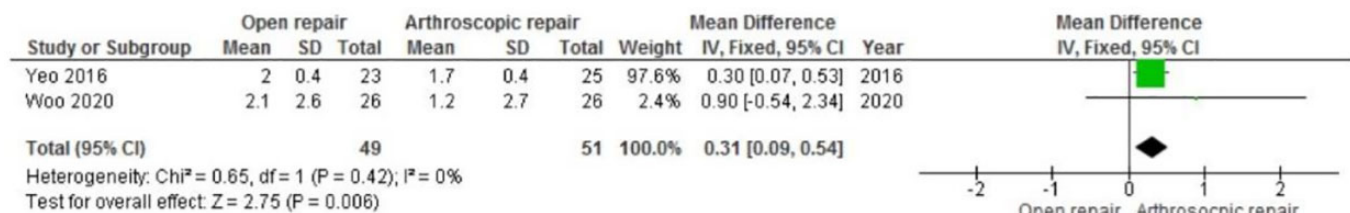


Figure 4. Forest plots comparing visual analog scale (VAS) score in arthroscopic versus open surgery. IV, inverse variance.

were 5.75° and 6.35° in the open and arthroscopic repairs, respectively. There was no statistically significant difference (MD, -0.41; 95% CI, -1.73 to 0.91; I² = 0%; P = .54) (Figure 7).

Operative Time and Complications

Operative time was reported in 2 studies, with 28 patients treated with open repair and 36 treated with arthroscopic repair. The average operative times were 37.95 and 46.1 minutes in the open and arthroscopic repairs, respectively. There was no statistically significant difference (MD, -4.62; 95% CI, -9.57 to 0.33; I² = 96%; P = .07) (Figure 8).

The total complication rate was reported in 7 studies, with 189 patients in each group. The open repair complication rate was 21.3%, while that for arthroscopic repair was 10%. There was no statistically significant difference (odds ratio [OR], 0.73; 95% CI, 0.39-1.38; I² = 0%; P = .34) (Figure 8).

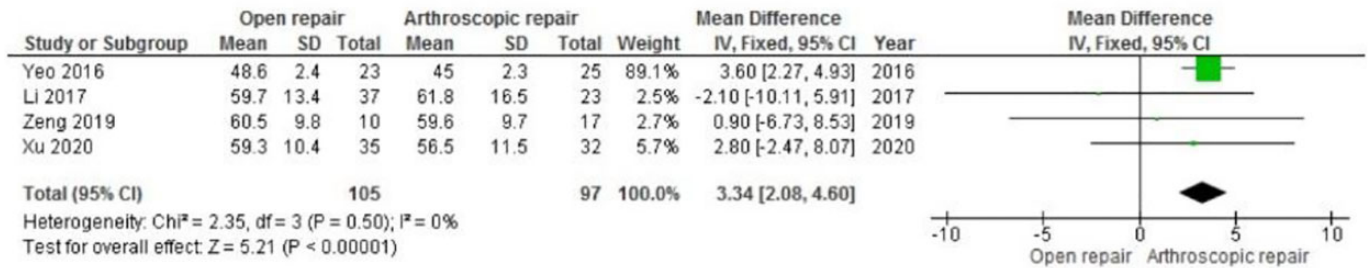
The nerve complication rate was reported in 6 studies, with 130 patients treated with open repair and 166 patients treated with arthroscopic repair. The open repair complication rate was 6.2%, while the arthroscopic repair rate was 6%. There was no statistically significant difference (OR, 0.95; 95% CI, 0.38-2.38; I² = 0%; P = .91) (Figure 8).

Wound infection was reported in 5 studies, with 98 patients treated with open repair and 136 patients treated with arthroscopic repair. The open repair group had a wound complication rate of 9.2%, while the arthroscopic repair group had a wound complication rate of 1.5%. There was a statistically significant difference in favor of arthroscopic repair (OR, 4.32; 95% CI, 1.30-14.30; I² = 0%; P = .02) (Figure 8).

DISCUSSION

A relatively recent and well-conducted meta-analysis comparing open and arthroscopic Broström-Gould

PREOPERATIVE BASELINE KAFS



POSTOPERATIVE KAFS

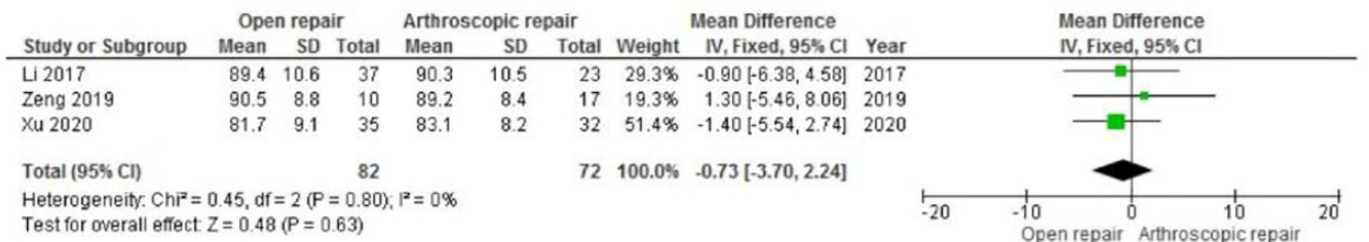
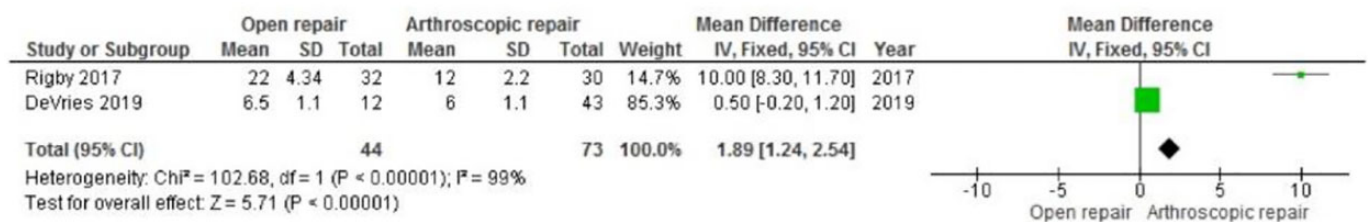


Figure 5. Forest plots comparing Karlsson Ankle Function Score (KAFS) in arthroscopic versus open surgery. IV, inverse variance.

TIME TO WEIGHT BEARING (weeks)



TIME TO RETURN TO SPORT (weeks)

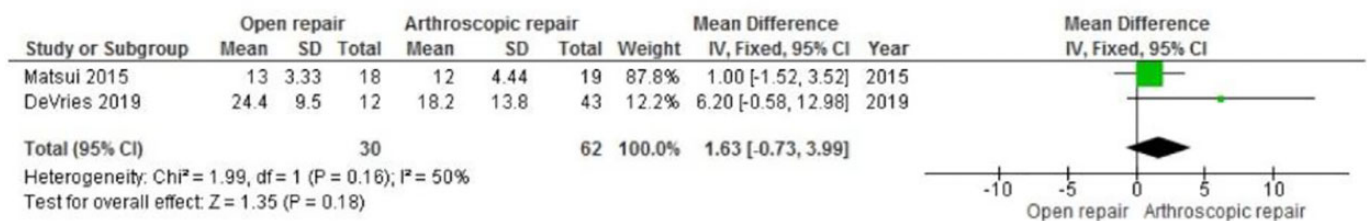
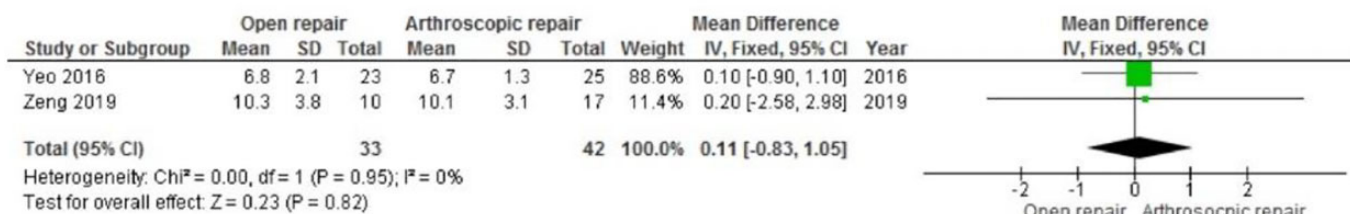


Figure 6. Forest plots comparing time to weightbearing and time to return to sport in arthroscopic versus open surgery. IV, inverse variance.

procedures has been published⁵; however, it included a small number of patients because of the limited number of published comparative studies at that time. The current meta-analysis included twice the number of studies

and 408 patients versus 207 in the previous one. Moreover, we analyzed variables not previously addressed, such as pain, operative time, time to return to sport, and weightbearing.

POSTOPERATIVE ANTERIOR DRAWER TEST



POSTOPERATIVE TALAR TILT TEST

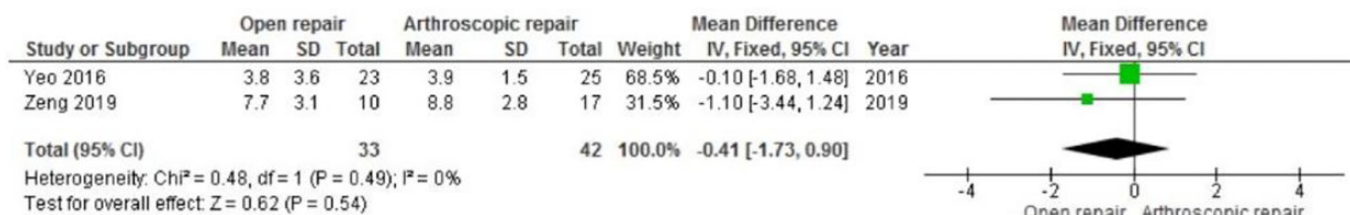


Figure 7. Forest plots comparing anterior drawer test and talar tilt in arthroscopic versus open surgery. IV, inverse variance.

The Broström-Gould open surgery has been the gold standard for decades as a safe, reproducible, and successful procedure to address chronic LAI. However, with the introduction of orthopaedic endoscopy, both surgeons and patients sought a minimally invasive option.⁵ Traditional open surgery requires a long, curved incision and soft tissue trauma. Apart from the cosmetic benefits of the arthroscopic procedure that patients rightfully seek, it provides the added benefit of the diagnosis and treatment of extremely common associated intra-articular pathologies that are better addressed arthroscopically.^{5,11,14} For instance, talar chondral lesions of varying degrees were reported in up to 46% to 75% of cases of chronic LAI,^{14,19,20,36} and anterior impingement and synovitis were reported in up to 63% and 100% of LAI at the time of reconstruction and repair, respectively.^{20,26} As a result, many authors have recommended ankle arthroscopy for all patients before addressing the lateral ankle instability, whether open or arthroscopically.³⁵ After arthroscopy, portals needed for the arthroscopic Broström are established, and soft tissues have been cleared, providing superior visualization of the lateral ankle structures compared with open surgery.¹² However, ankle arthroscopy can be carried out before open Broström to combine the benefits of both procedures.

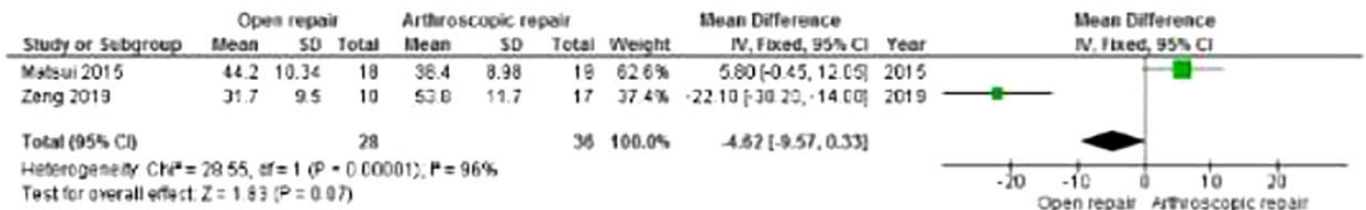
One of the issues that has put the arthroscopic Broström surgery in a bad light is nerve injury or entrapment, which has been reported in earlier literature.¹ While there is a trend for a higher rate of superficial peroneal nerve complications in arthroscopic surgery and a higher rate of wound complications in open surgery, our results showed similar overall complication rates and nerve complication rates in comparative studies. However, wound healing

complications were significantly reduced with arthroscopic surgery (1.5%) compared with open surgery (9.2%). Our findings are in agreement with those of previous reviews.⁵ Moreover, this complication could be avoided by identifying the safe zone 1.5 cm from the tip of the fibula.¹

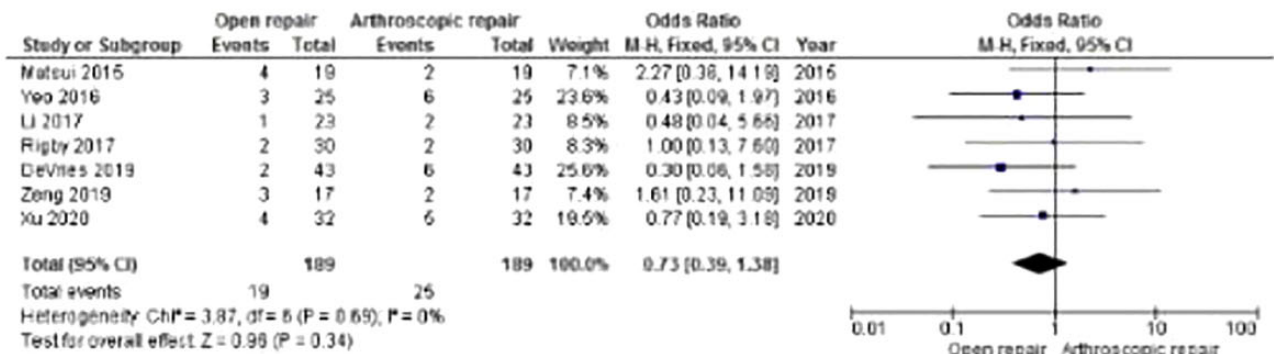
The present study confirms the findings of previous studies that the arthroscopic Broström procedure provides superior functional outcomes in the short term.⁵ In terms of AOFAS hindfoot scale scores, the present study demonstrated an MD of more than 11 points in favor of arthroscopic Broström repair. Such a difference has clinical significance when the specifics of the scale are considered. The score difference between severe limitation of daily activities with a walking aid possibly needed and no limitation is only 10 points. The difference between no difficulty on uneven surfaces and severe difficulty is only 8 points.¹⁷

While this study has shown that the VAS pain scores after arthroscopic Broström were consistently lower than those after open Broström-Gould repair, with statistical significance, the MDs are marginal and do not qualify for clinical relevance. Multiple studies have described the minimum clinically important difference (MCID) of the VAS. The MDs in our study were 0.38 at 6 months and 0.31 at 1 year postoperatively, which fall well below the lowest reported MCID of 0.9.¹⁵ The possible confounding effect of pain on the AOFAS score has been highlighted by Guelfi et al¹¹ and Brown et al⁵ as 40 points of the AOFAS score corresponding to pain. However, based on our results, those differences in pain do not necessarily explain the differences in the AOFAS functional score previously mentioned, pointing toward a high probability of actual superior functional outcomes of the arthroscopic

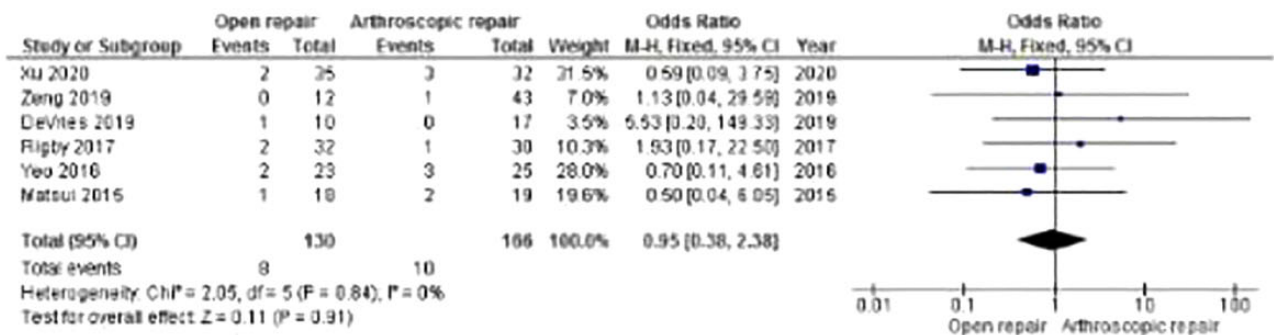
OPERATIVE TIME (mins)



POSTOPERATIVE TOTAL COMPLICATIONS (N)



POSTOPERATIVE NERVE COMPLICATIONS (N)



POSTOPERATIVE WOUND COMPLICATIONS (N)

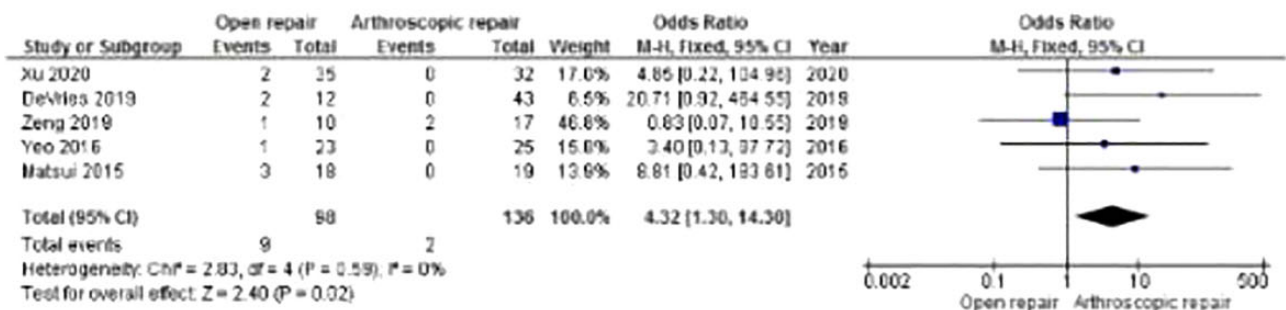


Figure 8. Forest plots comparing operative time and complications in arthroscopic versus open surgery. IV, inverse variance; M-H, Mantel-Haenszel.

Broström procedure rather than a reflection of pain difference.

The results of the present study show that arthroscopic Broström surgery is capable of achieving equivalent results in restoring the stability of the lateral ankle structure, as represented by the talar tilt and anterior drawer test. These results support the findings of the cadaveric study by Giza et al,⁹ which showed equivalent biomechanical results of suture anchors versus open repair of LAI. While arthroscopic Broström does not permit CFL repair without an additional open approach, the literature indicates that repairing the CFL is not necessary for stability. Lee et al²² performed a cadaveric biomechanical study comparing the stability of the modified Broström procedure with combined ATFL and CFL repair versus ATFL alone. They found no significant difference in talar tilt or anterior displacement. Clinically, Lee et al²¹ reported long-term outcomes for the modified Broström procedure with ATFL-only repair. They concluded that the modified Broström procedure without CFL repair had good to excellent subjective, functional, and radiographic outcomes at 10-year follow-up.

Despite the advantages of the arthroscopic Broström procedure, the added cost of arthroscopic implants and equipment remains a drawback. Although a recent study showed the safety and reproducibility of the surgery by young surgeons trained in arthroscopy,²⁵ most studies have highlighted the steep learning curve and less familiarity with the relatively new arthroscopic procedure in comparison with the open procedure, which has been the gold standard for generations.^{1,18,23,35} This, in part, may explain the discrepancy in operative time in the included studies.^{23,37}

Limitations

This study is not without limitations. The limitations of this study are similar to those of all other meta-analyses, including the heterogeneity of the included studies, the unknown bias in the primary studies, and the inclusion of articles published only in English. Furthermore, the number of included studies was limited to only 8 studies. Another fundamental limitation is the indication. Broström procedures are not recommended in the case of a highly attenuated ATFL, which cannot be ruled out before the surgery. A hook can be used to test the ATFL for degeneration and switch to open or arthroscopic reconstruction if necessary.⁹

Second, the length of the follow-up of the arthroscopic procedure in the literature remains limited to 10 years,²⁵ whereas the open procedure has reported excellent long-term outcomes for up to 26 years.³ In comparative studies, the mean follow-up was less than 3 years. As a result, we were unable to provide an answer regarding which procedure has better long-term functional outcomes because of the limited literature on the relatively new arthroscopic technique.

Moreover, in the present meta-analysis we are unable to explain why the arthroscopic procedure had markedly better AOFAS scores that were not reflected in the KAFS. One explanation, presented by Brown et al,⁵ is that AOFAS has a large pain component, and hence less pain after

arthroscopic surgery is a confounder for the AOFAS score. However, our results do not support this explanation, as previously discussed. Our explanation for this discrepancy is that the arthroscopic group had a lower KAFS than the open group preoperatively (MD, 3.34; $P < .001$). Similar postoperative scores mean that the arthroscopic group had more improvement than the open group. Another possibility is that sample size did not allow for detection of a statistical significance of the higher postoperative KAFS results in the arthroscopic group. The preoperative KAFS was reported in more patients than the postoperative KAFS (202 vs 154, respectively). If either of those explanations is true, this can be interpreted in favor of arthroscopic surgery. However, it is noteworthy that the sensitivity of the AOFAS scale in detecting ankle instability has been questioned.^{6,11}

Finally, return-to-play and level of athletic participation data in comparative studies were limited. Although our results show a similar time needed to return to sport, these results are based on only 2 studies with mixed populations. While both procedures provide excellent outcomes, further high-quality comparative studies with a separate analysis for the athletic population are necessary to reach a conclusion.

CONCLUSION

While technically more demanding, arthroscopic Broström was superior to open Broström-Gould surgery in postoperative AOFAS functional scores, time to return to weight-bearing, and minimally in VAS pain scores. Operative time, complication rate, talar tilt, and anterior drawer tests were excellent and statistically comparable. However, long-term outcome data are lacking for arthroscopic Broström repair, and clinical trials with longer follow-up are required before recommending arthroscopic Broström as the new gold standard.

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