

Long-term revision-free survival after unaugmented modified Broström repair for chronic lateral ankle instability: A single tertiary-centre series of 110 ankles

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Abstract

Introduction.

Chronic lateral ankle instability failing non-operative treatment is commonly managed with the modified Broström anatomic repair. Whether the unaugmented repair remains durable long-term is unclear, as most published evidence is short- to mid-term. We report long-term survivorship of a consecutive series.

Materials and Methods.

We retrospectively reviewed consecutive modified Broström procedures without augmentation for chronic lateral ankle instability at a tertiary centre (May 2013–January 2025). The primary endpoint was revision for recurrent instability; the secondary endpoint was any further ipsilateral ankle surgery. Survivorship was estimated by the Kaplan–Meier method with complementary log–log 95% confidence intervals (CI).

Results.

110 ankles were included (mean age 37.3 years; 52 [47%] with a concomitant procedure). Median follow-up was 7.4 years (maximum 13.2). Four ankles underwent revision for instability, none beyond 3.3 years. Instability-free survival was 96.1% (95% CI 89.8–98.5) at 5 and 10 years. Freedom from further ankle surgery was 87.4% (79.2–92.5) at 5 years and 80.8% (69.0–88.4) at 10 years, later procedures being predominantly degenerative or adjacent-joint pathology.

Conclusions.

The un-augmented modified Broström repair provided durable freedom from revision for instability to 10 years. Most subsequent surgery reflected degenerative or adjacent-joint disease rather than repair failure, supporting long-term durability of the technique.

Introduction

Lateral ankle sprains are among the most common musculoskeletal injuries, and a substantial minority of patients develop chronic lateral ankle instability characterised by recurrent giving-way, apprehension and functional limitation [1, 2]. When a structured programme of physiotherapy and bracing fails, anatomic repair of the anterior talofibular and calcaneofibular ligaments—the Broström procedure, most often performed with the Gould modification—is widely regarded as the reference standard operation [3, 4, 10].

There is continued debate about whether the repair should be reinforced. Proponents of augmentation (for example with suture tape) argue that it permits accelerated rehabilitation and may protect against recurrence, particularly in higher-demand patients, those with generalised hypermobility, or a malaligned hindfoot [5, 6, 11–13]. Others contend that a well-performed un-augmented anatomic repair is durable and avoids the cost and potential complications of implants [7, 8, 14]. Resolving this debate requires long-term data on how often the un-augmented repair actually fails.

Most published series report short- to mid-term, patient-reported outcomes rather than long-term survivorship [15, 16]. We therefore examined a consecutive, single-procedure cohort of un-augmented modified Broström repairs performed at a tertiary centre, with follow-up extending beyond a decade. Our aim was to estimate survivorship using two clinically distinct endpoints: revision for recurrent instability (failure of the repair itself) and any further ipsilateral ankle surgery (which additionally captures degenerative and adjacent-joint disease).

Materials and Methods

Study design and setting

We performed a retrospective review of a consecutive cohort at a single tertiary referral centre. Reporting follows the STROBE recommendations for observational studies [9] with institutional Audit approval number 2226.

Participants

All consecutive patients who underwent a modified Broström repair without augmentation for chronic lateral ankle instability between May 2013 and January 2025 were identified. Repairs performed with suture-tape or other ligamentous augmentation were not part of this series. Concomitant procedures (for example arthroscopic assessment, cheilectomy, osteophyte excision, calcaneal or other osteotomy, or adjacent-joint procedures) were permitted and recorded.

Surgical technique

All procedures comprised an anatomic repair of the anterior talofibular (ATFL) and, where indicated, calcaneofibular ligament (CFL) with the Gould modification, without augmentation. All patients had a general anaesthetic and were positioned supine with a sand-bag under the ipsilateral hip to internally rotate the limb, and the foot at the end of the bed. Examination under anaesthetic was performed before making the incision for the Brostrom. An oblique skin incision (5–6 cm) was made about 1 cm superior to the tip of the fibula, extending from the posterior border of the fibula towards the sinus tarsi. Care was taken to preserve the extensor retinaculum as a separate layer for later repair (Gould modification of Brostrom). The ATFL/CFL was divided close to the distal fibula and separated as a cuff off from the

bone. Peroneus Longus and Peroneus Brevis tendons were inspected and debrided if necessary. The distal end of the fibula was curetted to get bleeding cancellous bone. The fibular periosteum was divided in line with the skin incision making sure that there was reasonable tissue on either side for later repair. Two parallel drill holes were made from the posterior border of the fibula towards the sinus tarsi in line with the anatomical position of the ATFL. Care was taken to ensure that the holes were not too close to the tip of the fibula to prevent cut-out. Using a straight needle suture loop through the proximal of the two holes, passing from proximal posterior border of fibula to distal at the tip of the fibula, Fiberwire 1 suture was pulled out to the posterior border of fibula using this loop. The cuff of ATFL/CFL was repaired using the Fiberwire 1 needle and the needle then passed through the distal hole from distal to proximal, again to end up at the posterior border of the fibula. Holding the foot in dorsiflexion and eversion the suture knot was applied at the posterior border of the fibula, leaving the cut ends slightly longer to ensure that they rest against the bone and do not stick up against the wound. The fibular periosteum was then repaired over this knot to further bury the knot. The extensor retinaculum was repaired over the repair for reinforcement. Skin was closed with absorbable suture and the leg was immobilised in a boot. Patient was allowed to weight-bear as tolerated with crutches immediately after surgery but advised to keep the boot on all day and night until wound check at two weeks. Subsequently the patient was allowed to sleep without the boot at night. Patient was referred to the physiotherapist at 6 weeks with an established protocol, and was to avoid inversion for 3 months after surgery.

Outcome measures

The primary endpoint was revision surgery for recurrent instability. The secondary endpoint was any further ipsilateral ankle surgery, capturing both revision for instability and later procedures for other ankle or adjacent-joint pathology. A metatarsal osteotomy procedure in one patient was classified as foot rather than ankle surgery and was not counted as an event.

Follow-up and ascertainment

Time zero was the date of the index procedure. Events were dated from the first subsequent operation; where a patient underwent several later procedures, the date of the first was used. Patients without an event were censored at the date of last known follow-up. Because patients remaining in Scotland are traceable through the shared national health record, ascertainment of reoperation was considered complete for that group; one patient known to have relocated to England represents the principal source of potential under-ascertainment.

Statistical analysis

Survivorship was estimated using the Kaplan–Meier method, with 95% confidence intervals derived from the complementary log–log transformation, and numbers at risk reported at each interval. Survival according to hindfoot alignment (varus versus non-varus) was compared using the log-rank test.

Continuous variables are summarised as mean ± standard deviation or median with interquartile range (IQR). Analyses were performed using SPSS version 25.

Results

Cohort

One patient whose primary repair was later revised appeared twice in the records; these entries were merged so that the patient was counted once, with the revision recorded as an instability (hence n = 110 rather than 111). Demographic and clinical characteristics are shown in Table 1. The mean age was 37.3 years, and 52 ankles (47%) underwent a concomitant procedure at the time of the index repair.

Table 1
Baseline characteristics of the cohort (n = 110).

Variable	Value
Ankles (patients)	110
Age, years (mean ± SD, range)	37.3 ± 13.7 (16–76)
Sex	59 male / 51 female
BMI, kg/m ² (mean ± SD)	28.4 ± 4.8
Side	61 right / 49 left
Hindfoot alignment	80 neutral / 28 varus / 2 valgus
Positive anterior drawer	80 (73%)
Pre-operative MRI performed	85 (77%)
Isolated repair vs concomitant procedure	58 vs 52 (47%)
Surgical period	May 2013 – January 2025
Median follow-up, years (IQR; max)	7.4 (4.4–9.4; 13.2)

Survivorship:

Median follow-up was 7.4 years (IQR 4.4–9.4; maximum 13.2). Four ankles underwent revision for recurrent instability, the latest at 3.3 years; no instability revision occurred thereafter. Instability-free survival was 99.1% at 1 year, 96.1% (95% CI 89.8–98.5) at 5 years and unchanged at 10 years (Table 2, Fig. 1). Sixteen ankles underwent some further ankle surgery: freedom from any further ankle surgery was 98.2% at 1 year, 87.4% (79.2–92.5) at 5 years and 80.8% (69.0–88.4) at 10 years. The divergence between the two curves reflects that most later surgery was undertaken for degenerative or adjacent-joint pathology—including subtalar, talonavicular and tibiotalar fusion, cheilectomy or osteophyte excision, osteochondral and nerve procedures—rather than for failure of the lateral repair. Survivorship

did not differ between varus and non-varus hindfeet for either endpoint (log-rank $p = 0.99$), although instability events were too few for a powered comparison.

Table 2
Kaplan–Meier survival estimates.

Years	Instability-free survival, % (95% CI)	Any-further-ankle-surgery-free survival, % (95% CI)	No. at risk
1	99.1 (93.6–99.9)	98.2 (92.9–99.5)	107
3	97.2 (91.6–99.1)	89.6 (82.0–94.1)	87
5	96.1 (89.8–98.5)	87.4 (79.2–92.5)	66
10	96.1 (89.8–98.5)	80.8 (69.0–88.4)	13

Complications

A complication of any kind was recorded in 36 ankles (33%); the majority were minor. Neuritic symptoms were the most frequent (12 ankles), followed by wound problems (6) and complex regional pain syndrome (4). Deep infection (1), permanent nerve palsy (1) and venous thromboembolism (1) were rare. Seven patients were readmitted within one year.

Table 3
Complications by type (n = 110 ankles).

Complication	n (%)
Neuritic symptoms	12 (10.9%)
Wound problems	6 (5.5%)
Complex regional pain syndrome	4 (3.6%)
Deep infection	1 (0.9%)
Permanent nerve palsy	1 (0.9%)
Venous thromboembolism	1 (0.9%)
Minor complications* <i>[e.g. superficial wound irritation, transient swelling]</i>	11 (10.0%)
Total	36 (32.7%)

Discussion

The principal finding of this study is that the un-augmented modified Broström repair provides durable control of lateral ankle instability: only four of 110 ankles were revised for recurrent instability, none beyond 3.3 years, giving an instability-free survival of approximately 96% that was maintained to 10

years. This directly addresses the clinical question of whether augmentation is required for durability, and suggests that, across an unselected tertiary-centre cohort, a well-performed anatomic repair remains reliable in the long term [7, 8, 17–20].

The contrast between our two endpoints is clinically instructive. Whereas revision for instability was rare and confined to the early years, freedom from any further ankle surgery declined more steadily, to approximately 81% at 10 years. These later procedures were dominated by degenerative and adjacent-joint pathology rather than recurrent laxity [21, 22]. For patient counselling this distinction matters: the repair itself seldom fails, but an ankle that has sustained sufficient instability to warrant surgery may still require later intervention as pre-existing or progressive joint disease declares itself [7].

Our complication profile was consistent with the anatomic repair being a low-morbidity procedure, with predominantly minor and neuritic events and few serious complications [8, 23]. Whether concomitant calcaneofibular ligament repair confers additional benefit over isolated anterior talofibular ligament repair also remains debated; a randomised comparison found no difference in clinical or radiographic outcomes between the two approaches, consistent with our practice of repairing the calcaneofibular ligament only where clinically indicated [24].

Strengths of this study include a consecutive, single-technique cohort, long follow-up extending beyond a decade, a survivorship framework using clinically meaningful endpoints, and near-complete reoperation ascertainment through a robust shared national health record system within Scotland.

Limitations

This was a retrospective study without serial patient-reported outcome measures, and radiographic outcomes were not analysed; the survivorship endpoints therefore capture reoperation rather than symptomatic function. The cohort was heterogeneous, with almost half undergoing a concomitant procedure, which may influence the secondary endpoint. The number of instability revisions was small, so the confidence intervals are wide and the 10-year estimates rest on relatively few ankles remaining at risk (13 at 10 years); late estimates should be interpreted cautiously. Finally, although ascertainment within Scotland is robust, a patient who relocated outside Scotland and underwent surgery elsewhere could be misclassified as event-free, which would modestly overestimate survival. Findings from a single surgeon/centre may not generalise to all settings. Subgroup comparisons by hindfoot alignment were underpowered, with few events in the varus group, and should be regarded as hypothesis-generating. Xu et al in their study suggested that generalised joint laxity, rather than static hindfoot alignment, may be the more relevant predictor of failure after un-augmented repair, a factor we did not systematically record [13].

Conclusion

In this consecutive single-centre series with follow-up to 13 years, the un-augmented modified Broström repair delivered durable freedom from revision for instability at a median of 7 years, with trends

maintained at approximately 96% up to 10 years. Later surgery was largely attributable to degenerative or adjacent-joint disease rather than failure of the repair, supporting the long-term durability of the un-augmented technique.

Declarations

Author Contribution

1. CBS Literature search, data analysis, statistical analysis, Manuscript preparation
2. KW Design Study, Data acquisition, Data analysis,
3. KS Concept of study, design of study, manuscript review, and manuscript editing.

Data Availability

Anonymised Research Data Available on Request

References

1. Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont PJ Jr (2010) The epidemiology of ankle sprains in the United States. *J Bone Joint Surg Am* 92:2279–2284
2. Ferran NA, Maffulli N (2006) Epidemiology of sprains of the lateral ankle ligament complex. *Foot Ankle Clin* 11:659–662
3. Broström L (1966) Sprained ankles. VI. Surgical treatment of chronic ligament ruptures. *Acta Chir Scand* 132:551–565
4. Gould N, Seligson D, Gassman J (1980) Early and late repair of lateral ligament of the ankle. *Foot Ankle* 1:84–89
5. Cho BK, Kim YM, Choi SM et al (2017) Revision anatomical reconstruction of the lateral ligaments of the ankle augmented with suture tape for patients with a failed Broström procedure. *Bone Joint J* 99–B:1183–1189
6. Ulku TK, Kocaoglu B, Tok O, Irgit K, Nalbantoglu U (2020) Arthroscopic suture-tape internal bracing is safe as arthroscopic modified Broström repair in the treatment of chronic ankle instability. *Knee Surg Sports Traumatol Arthrosc* 28:227–232
7. Maffulli N, Del Buono A, Maffulli GD, Oliva F, Testa V, Capasso G, Denaro V (2013) Isolated anterior talofibular ligament Broström repair for chronic lateral ankle instability: 9-year follow-up. *Am J Sports Med* 41:858–864
8. Nery C, Raduan F, Del Buono A, Asaumi ID, Cohen M, Maffulli N (2011) Arthroscopic-assisted Broström-Gould for chronic ankle instability: a long-term follow-up. *Am J Sports Med* 39:2381–2388
9. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, STROBE Initiative (2007) The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)

statement: guidelines for reporting observational studies. *Lancet* 370:1453–1457

10. [Author(s) to be confirmed] (2024) Treatment of chronic instability of the ankle joint caused by lateral ligament complex trauma: review. *Medalliance* 12:66–74
11. Hadley SM, Bergman R, Westvold SJ, Kukreja T, Hu CJ, Filler R, Mutawakkil MY, Patel M, Kadakia AR (2025) Augmented Bröström is associated with improved functional outcomes as measured by PROMIS scores compared to Bröström without augmentation. *Foot Ankle Orthop* 10:2473011425S00138
12. Porter M, Shadbolt B, Ye X, Stuart R (2019) Ankle lateral ligament augmentation versus the modified Bröström-Gould procedure: a 5-year randomized controlled trial. *Am J Sports Med* 47:659–666
13. Xu HX, Lee KB (2016) Modified Bröström procedure for chronic lateral ankle instability in patients with generalized joint laxity. *Am J Sports Med* 44:3152–3157
14. Waggett RM, Hoch CP, Ottofaro TD, Scott DJ, Gross CE (2022) Effect of internal bracing on Bröström operation clinical outcomes. *Foot Ankle Orthop* 7:2473011421S00990
15. Weng PW, Chen CY, Tsuang YH, Sun JS, Lee CH, Cheng CK (2018) A modified Bröström repair with transosseous fixation for chronic ankle instability: a midterm followup study in soldiers. *Indian J Orthop* 52:315–321
16. Ahn JH, Lee YG, Jung SH, Choy WS (2007) Treatment of chronic ankle lateral instability using modified Brostrom procedure. *J Korean Orthop Assoc* 42:91–97
17. Bell SJ, Mologne TS, Sitler DF, Cox JS (2006) Twenty-six-year results after Bröström procedure for chronic lateral ankle instability. *Am J Sports Med* 34:975–978
18. Lee KT, Park YU, Kim JS, Kim JB, Kim KC, Kang SK (2011) Long-term results after modified Bröström procedure without calcaneo-fibular ligament reconstruction. *Foot Ankle Int* 32:153–157
19. Ferkel RD, Chams RN (2007) Chronic lateral instability: arthroscopic findings and long-term results. *Foot Ankle Int* 28:24–31
20. Hsu AR, Ardoin GT, Davis WH, Anderson RB (2016) Intermediate and long-term outcomes of the modified Bröström-Evans procedure for lateral ankle ligament reconstruction. *Foot Ankle Spec* 9:131–139
21. Cho BK, Shin YD, Park HW (2018) Outcome following a modified Bröström procedure and arthroscopic debridement of medial gutter osteoarthritis combined with chronic ankle instability. *Foot Ankle Int* 39:1473–1480
22. Cho BK, Choi SM (2019) Outcomes following a modified Bröström procedure and arthroscopic debridement of medial gutter osteoarthritis combined with chronic lateral ankle instability. *Foot Ankle Orthop* 4:2473011419S00140
23. Comfort SM, Marchetti DC, Duncan PP, Dornan GJ, Haytmanek CT, Clanton TO (2023) Bröström repair with and without augmentation: comparison of outcomes at median follow-up of 5 years. *Foot Ankle Int* 44:691–701

24. Sung KS, Yim HS (2017) Comparison of clinical outcomes after modified Broström procedure with or without calcaneofibular ligament repair for chronic lateral ankle instability. Foot Ankle Orthop 2:2473011417S000383

Figures

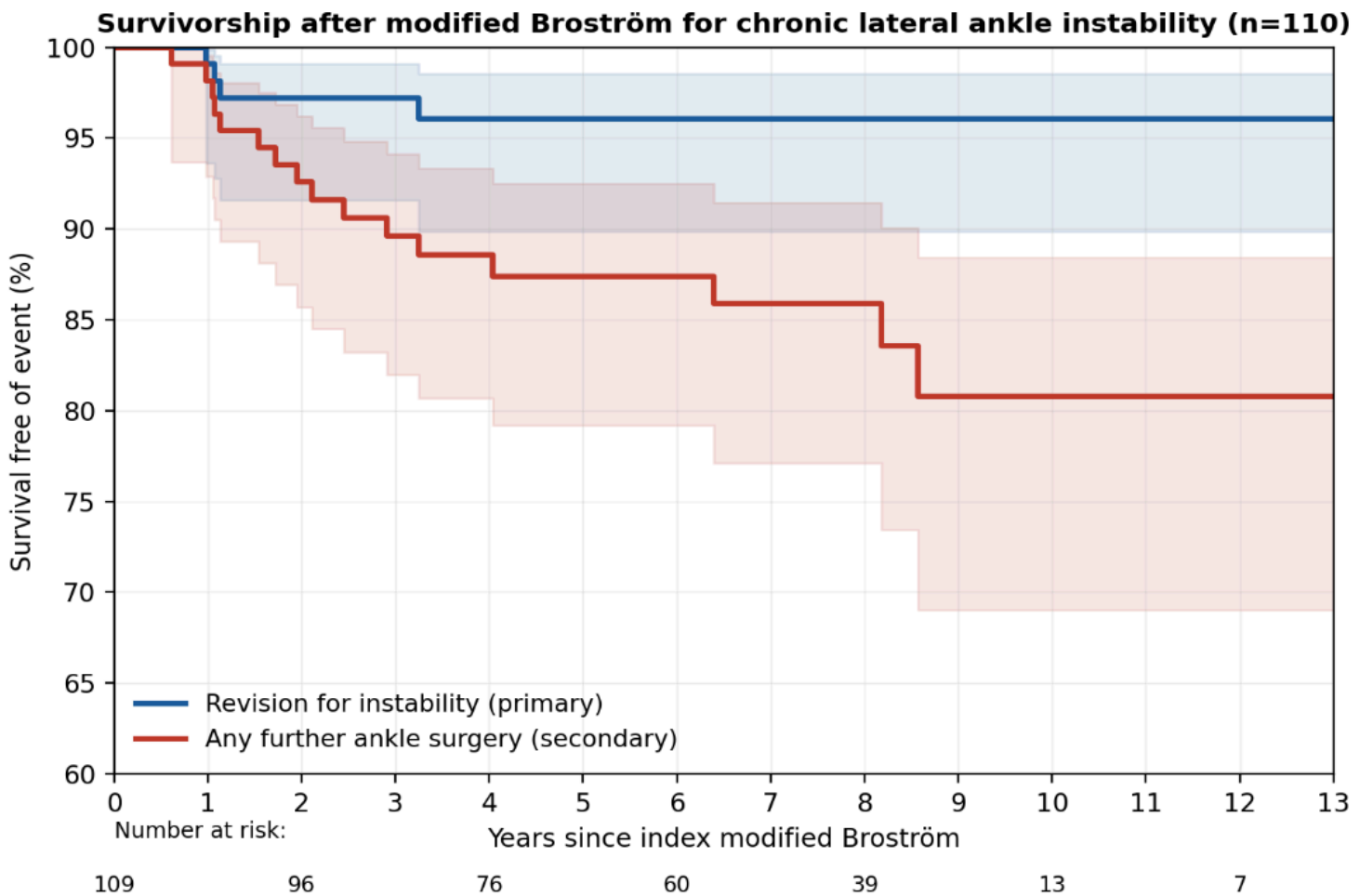


Figure 1

Kaplan–Meier survivorship of the un-augmented modified Broström repair (n = 110). Blue: freedom from revision for instability (primary endpoint). Red: freedom from any further ankle surgery (secondary endpoint). Shaded bands are 95% confidence intervals; numbers at risk are shown beneath the x-axis