The Journal of Foot & Ankle Surgery 55 (2016) 125–128

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Effect of Preoperative Stress Radiographic Findings on Radiographic and Clinical Outcomes of the Modified Broström Procedure for Chronic Ankle Instability

Bi O Jeong, MD, PhD [1], Tae Yong Kim, MD [2], Wook Jae Song, MD [2]

[1] Associate Professor, Department of Orthopaedic Surgery, Kyung Hee University College of Medicine, Seoul, Korea
[2] Orthopedic Doctor, Department of Orthopaedic Surgery, Kyung Hee University College of Medicine, Seoul, Korea

ARTICLE INFO

Level of Clinical Evidence: 3

Keywords:
chronic ankle instability
modified Broström procedure
stress radiography

ABSTRACT

The purpose of the present study is to evaluate whether findings of instability on preoperative stress radiographs of patients with chronic ankle instability affects the radiographic and clinical outcomes after a modified Broström procedure. A total of 45 consecutive patients (45 ankles) who had undergone the modified Broström procedure for unilateral ankle joint instability and were followed up for ≥2 years were selected. The patients were classified into 2 groups according to the results of the preoperative stress radiographs: 1 group with positive findings (35 [77.8%] patients; stress-positive group) and 1 group with negative findings (10 [22.2%] patients; stress-negative group). The radiographic and clinical outcomes were compared between the 2 groups. The mean preoperative talar tilt measured on the stress radiograph was 14.4° ± 4.2° and 4.8° ± 2.6° in the stress-positive and stress-negative groups, respectively, a statistically significant difference. Postoperative talar tilt improved in both groups, with a mean final talar tilt of 5.4° ± 3.4° in the stress-positive group ($p < .001$) and 3.0° ± 1.5° in the stress-negative group ($p = .038$). The average American Orthopaedic Foot and Ankle Society ankle-hindfoot score in the stress-positive and stress-negative groups improved from 65.1 ± 14.6 to 90.0 ± 6.3 ($p < .001$) and 72.5 ± 9.3 to 92.6 ± 7.8 ($p = .007$), respectively. The mean postoperative satisfaction rate was 83.9 ± 11.9 and 85.0 ± 11.8 in the 2 groups. No statistically significant differences were seen in the preoperative and postoperative American Orthopaedic Foot and Ankle Society ankle-hindfoot scores or in postoperative satisfaction rates between the 2 groups.

Although chronic ankle instability occurring after ankle sprains is usually treated nonoperatively, operative treatment is considered when sufficient conservative treatment has failed to improve symptoms (1–7). Stress radiographs can be used in this process for a more accurate diagnosis or to determine the need for operative treatment (8,9). However, the appropriate role of stress radiography is controversial (10–12). Specifically, chronic ankle instability is often diagnosed from the patient history and physical examination findings in patients in whom stress radiographs do not show instability. The appropriate indication for surgical reconstruction in such patients has not been well-defined. No studies have reported on how the findings from preoperative stress radiographs might affect the postoperative outcomes in patients with chronic ankle instability.

The purpose of the present study was to examine whether the presence or absence of instability on preoperative stress radiographs affected radiographic and clinical outcomes after the modified Broström procedure. Specifically, we compared the results of patients undergoing modified Broström reconstruction of the lateral ankle ligaments with and without increased talar tilt found on the preoperative stress radiograph.

Patients and Methods

Our institutional review board approved the present study, and all patients provided informed consent. A total of 45 consecutive patients (45 ankles) who had been diagnosed with chronic ankle instability and had undergone the modified Broström procedure from September 2007 to January 2011, with a minimum follow-up period of ≥2 years, were included in our retrospective study. Of the 45 patients, 19 (42.2%) were male and 26 (57.8%) were female. The mean patient age was 31 (range 17 to 75) years at surgery. The mean follow-up period was 3 years, 5 months (range 2 years to 5 years, 9 months). The indication for surgery was clinically determined by a confirmed history of repeated sprain injuries and pain and marked ankle instability confirmed by physical examination compared with the contralateral ankle despite >6 months of conservative treatment. The study exclusion criteria were previous fractures, concomitant lesions of the affected ankle, previous surgery, injuries to both left and right ankles, joint hyperlaxity, a malaligned foot, and neuromuscular disorders. The anterior drawer test was used in the

Financial Disclosure: None reported.
Conflict of Interest: None reported.

Address correspondence to: Bi O Jeong, MD, PhD, Department of Orthopaedic Surgery, Kyung Hee University College of Medicine, 1 Hoegi-dong, Dongdaemun-gu, Seoul 130-702, Korea.
E-mail address: biojeong@khmc.or.kr (B.O. Jeong).

1067-2516/$ - see front matter © 2016 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2015.08.010

physical examination of the patients. The physical examination was performed in all cases solely by the senior author (J.B.O.), who had >5 years of clinical experience.

All patients underwent preoperative and postoperative stress radiographs (150 N; Telos, Weiterstadt, Germany), with talar tilt and talar anterior translation measured by 2 orthopedic surgeons (K.T.Y., S.W.J.), who were unaware of the clinical details. The average of these 2 observers was used as the final measurement value. Positive stress test results were defined as either a talar tilt angle >10° or a discrepancy of >5° compared with the unaffected side or a talar anterior translation >10 mm or a discrepancy of >3 mm compared with the unaffected side on the preoperative stress radiograph. Patients not meeting these criteria were classified as having negative stress test results. The 45 patients were divided into a stress-positive group and stress-negative group according to these results: 35 were in the stress-positive group and 10 in the stress-negative group. The radiographic outcomes were assessed by comparing the talar tilt and talar anterior translation measured preoperatively and at the last follow-up examination.

The clinical outcomes were assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scores measured preoperatively and at the last follow-up examination. Postoperative satisfaction was rated by patients on a scale from 0 (not satisfied at all) to 100 (fully satisfied) according to the presence of subjective instability after surgery.

Statistical Analysis

Fisher's exact test and the Mann-Whitney *U* test were used to evaluate differences in gender, age, and follow-up duration between the groups and for comparisons of the preoperative and postoperative radiographic and clinical findings between the stress-positive and stress-negative groups. The Wilcoxon signed rank test was used to identify the presence of significant radiographic and clinical improvements within the 2 groups. A p value < .05 was considered statistically significant. All statistical analysis was performed by a statistician using SPSS statistical software, version 13.0 (IBM Corp, Armonk, NY).

Surgical Method

All procedures were performed by a single surgeon (J.B.O.) with the patient under general or spinal anesthesia. Diagnostic arthroscopy was performed in all cases, and no lesion was newly found that had been undetected before arthroscopy. No patient required a change of the surgical plan from the results of the diagnostic arthroscopy. With the patient in the supine position and the ankle under tourniquet control, a pillow was placed under the hip to rotate the ankle internally. After arthroscopy, a 5-cm curvilinear incision was made from 2 cm proximally to the fibular tip directed toward the fifth metatarsal base. The inferior extensor retinaculum was identified and fully mobilized. The anterior talofibular ligament and calcaneofibular ligament were detached from their fibular attachment site. Next, the anterior talofibular ligament and calcaneofibular ligament were reattached to the fibula by inserting a single suture anchor (Bio Mini-Revo™; Conmed Linvatec, Largo, FL) between the anatomic footprints of the anterior talofibular ligament and calcaneofibular ligament. The fully mobilized inferior extensor retinaculum was then reinforced and sutured to the periosteum over the fibula using the "pants over the vest" technique described by Gould et al (13). All patients underwent a standardized rehabilitation program. Non-weightbearing was maintained for 6 weeks after surgery. Short leg cast immobilization was maintained for 4 weeks after surgery. Gentle ankle range of motion exercise was allowed for 2 weeks with the patients in a protective ankle foot orthosis after cast removal. At 6 weeks after surgery, the patients were instructed to begin partial weightbearing, along with proprioception and peroneal muscle strengthening exercises. Light exercises began after 3 months, and the patients gradually returned to their normal sports activities.

Results

Of the 35 patients in the stress-positive group, 14 (40%) were male and 21 (60%) were female. Their average age was 32 (range 17 to 75) years, and the mean follow-up period was 3 years, 5 months (range 2 years to 5 years, 9 months). Of the 10 patients in the stress-negative group, 5 each were male and female. Their mean age was 29 (range 17 to 53) years. The mean follow-up period was 3 years, 6 months (range 2 years, 1 month to 4 years, 11 months). No statistically significant difference was found in the gender ratio, age, or follow-up period between the 2 groups ($p = .720$, $p = .638$, and $p = .764$, respectively; Table 1).

Radiographic Results

The average preoperative talar tilt on the stress radiograph was significantly different statistically at 14.4° ± 4.2° and 4.8° ± 2.6° in the stress-positive and stress-negative groups, respectively ($p < .001$).

Table 1
Comparison of stress-positive and stress-negative groups

Variable	Stress-Positive Group (n = 35)	Stress-Negative Group (n = 10)	p value
Gender (n)			.720*
Male	14 (40%)	5 (50%)	
Female	21 (60%)	5 (50%)	
Age (y)			.638†
Mean	31.5	28.5	
Range	17 to 75	17 to 53	
Follow-up duration (mo)			.764†
Mean	41.4	42.6	
Range	24 to 70.3	24 to 59.3	

* Fisher's exact test; p values from intergroup comparisons; significance accepted at $p < .05$.
† Mann-Whitney *U* test; p values from intergroup comparisons; significance accepted at $p < .05$.

However, no significant difference was seen in the average preoperative talar anterior translation (mean 7.0 ± 2.2 mm and 6.6 ± 1.4 mm in the stress-positive and stress-negative group, respectively; $p = .672$). The average talar tilt after the modified Broström procedure was 5.4° ± 3.4° in the stress-positive group, with significant improvement compared with the preoperative measurements ($p < .001$). Significant improvement was also seen in the stress-negative group, with average postoperative talar tilt of 3.0° ± 1.5° ($p = .038$). The difference in the postoperative talar tilt in the 2 groups was statistically significant ($p = .014$). The average postoperative talar anterior translation had improved significantly to 5.1 ± 1.7 mm and 4.7 ± 2.7 mm in the stress-positive and stress-negative groups, respectively ($p < .001$ and $p = .037$, respectively). However, in contrast to the talar tilt, no significant difference was seen between the 2 groups postoperatively in the talar anterior translation ($p = .268$; Table 2). Neither group developed intraoperative or postoperative complications.

Clinical Results

For the 35 patients in the stress-positive group, the AOFAS ankle-hindfoot score increased significantly from a preoperative mean of 65.1 ± 14.6 to a postoperative mean of 90.0 ± 6.3 ($p < .001$). The postoperative satisfaction rate was 83.9 ± 11.9 on a 100-point scale. No patient complained of subjective instability after surgery. For the 10 patients in the stress-negative group, the AOFAS ankle-hindfoot score increased significantly from 72.5 ± 9.3 to 92.6 ± 7.8 ($p = .007$). The postoperative satisfaction rate was 85.0 ± 11.8 on a 100-point scale. Again, no patient complained of subjective instability after surgery. No statistically significant difference was found in the preoperative and postoperative AOFAS ankle-hindfoot scores or satisfaction rates of the 2 groups ($p = .125$, $p = .299$, and $p = .813$, respectively, Table 3).

Table 2
Ankle stress radiographic measures of stress-positive and stress-negative groups

	Stress-Positive Group (n = 35)	Stress-Negative Group (n = 10)	p Value*
Talar tilt (°)			
Preoperatively	14.4 ± 4.2	4.8 ± 2.6	<.001
Final follow-up	5.4 ± 3.4	3.0 ± 1.5	.014
Talar anterior translation (mm)			
Preoperatively	7.0 ± 2.2	6.6 ± 1.4	.672
Final follow-up	5.1 ± 1.7	4.7 ± 2.7	.268

Data presented as mean ± standard deviation.
* Mann-Whitney *U* test; p values from intergroup comparisons; significance accepted at $p < .05$.