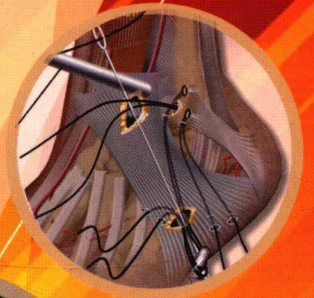
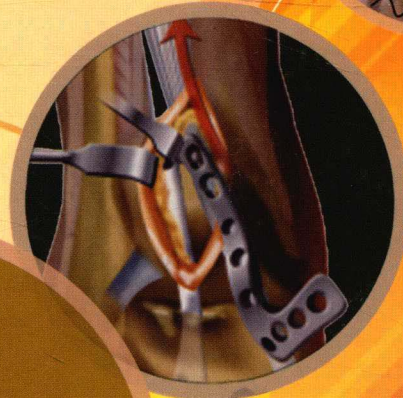


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# **Minimally Invasive Foot and Ankle Surgery**



**Eric M. Bluman  
Christopher P. Chiodo**

# Minimally Invasive Foot and Ankle Surgery

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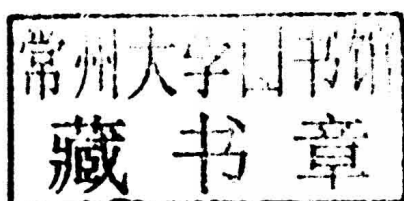
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To my mother, Phyllis, who found the best in people, had compassion for all, and whose insight, guidance, and love have always made me believe that anything is possible.

**Paul Tornetta, III, MD**

To my parents, whom I cannot thank enough for giving me all of the opportunities  
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Also to my wife Trimble Augur, MD and our children Adair, Tenney, and Everett who allow  
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to complete projects such as these.

**Eric M. Bluman, MD, PhD**

To my family, colleagues, and patients. Thank you for your love, wisdom, and inspiration.

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## Series Preface

It is my pleasure to introduce the second volume of the series, *Minimally Invasive Orthopaedic Surgery*. This book builds on the tradition of advances that orthopaedic surgery has made and captures the exciting methods being introduced by current innovators. Obtaining faster recovery while minimizing risk is the goal of minimally invasive procedures.

This volume, edited by Chris Chiodo, will focus on minimally invasive foot and ankle surgery. Over the past 15 years, the advent of better instrumentation and

innovations in technique has allowed previously done open procedures to be performed with soft tissue-sparing methods. The editor has gathered experts in minimally invasive procedures and has presented them in a uniform way including the indications, setup, technical aspects of surgery, and the problem areas.

I am proud to see this series advance with this volume on foot and ankle surgery.

*Paul Tornetta, III, MD*

# Preface

Minimally invasive surgery has not had a static definition. Procedures evolve such that clinical efficacy increases while tissue insult decreases. This process is ongoing; as technology advances, surgeries that are minimally invasive in the current era will be modified so that they become even less invasive. These different stages of evolution are illustrated within this text. Indeed, the chapters we have included range from treatments that do not breach the skin to those using incisions previously described in non-MIS texts.

Currently, there are procedures which may be considered less invasive than some featured here. As editors we included procedures that would be of maximal benefit to patients while maintaining an adequate safety profile. In this vein, an important safety concern is the significant training challenges in performing some of these techniques. We leave it to the reader to determine whether each described technique is appropriate for their individual practice.

This text is targeted to the practicing orthopedic foot and ankle surgeon. However, it will be of value to all health care providers who participate in the care of orthopedic foot and ankle patients. Specifically, we expect surgical residents, fellows, and allied health providers to benefit from this book.

In preparing this book, we assembled an internationally diverse cadre of experts considered as authoritative surgeons on the cutting edge of minimally invasive orthopedic foot and ankle surgery. Many of them have been on the forefront of developing and teaching the methods described herein. We are indebted to them for the time and effort they put in preparing their chapters. We hope that the techniques detailed herein aid the clinician, the health care system and most importantly patients.

*Eric M. Bluman, MD, PhD*  
*Christopher P. Chiodo, MD*

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This project really has been a family affair on many levels. As such, we would like to thank several groups of individuals:

This book would not have been possible without the significant and sustained contributions of the authors. All of them are accomplished orthopedic surgeons and part of the Orthopedic Foot & Ankle family. Their patients are fortunate to have them as physicians.

Our academic family consisting of mentors, colleagues, fellows, and residents, all of whom ask challenging and critical questions. They continue to inspire us and remain our greatest source of education.

The Wolters-Kluwer family and Brian Brown who agreed with us that this was a needed resource for orthopedic surgeons. We especially want to thank David Murphy who has been with us through multiple staff changes and editorial teams from inception to composition and finally publication.

*Eric M. Bluman, MD, PhD*  
*Christopher P. Chiodo, MD*

# Contents

## SECTION 1 Tendons and Ligaments 1

### 1 Brisement and Related Procedures 1

*Stuart H. Myers, Lew C. Schon*

### 2 Endoscopic Gastrocnemius Recession 5

*Saul G. Trevino, Santaram Vallurupalli, and David Flood*

### 3 Tendoscopy 11

*Markus Knupp, V. James Sammarco*

### 4 Limited Incision Achilles Repair—Two Techniques 19

*Bruce Cohen, Emilio Wagner*

### 5 Arthroscopic Lateral Ankle Ligament Reconstruction 27

*Peter Mangone, Jorge Acevedo*

### 6 Tendon Harvesting 35

*Vinod K. Panchbhavi*

## SECTION 2 Fascial Structures 45

### 7 Extracorporeal Shock Wave Therapy in the Foot and Ankle 45

*John P. Furia, Eric M. Bluman*

### 8 Endoscopic Plantar Fascia Release 52

*Jeremy J. Miles, Michael J. Shereff*

### 9 Endoscopic Compartment Release for Chronic Exertional Compartment Syndrome 60

*Jeremy T. Smith, Eric M. Bluman*

## SECTION 3 Arthrodesis 65

### 10 Mini-Open Ankle Arthrodesis 65

*Christopher P. Chiodo, Eric M. Bluman*

### 11 Arthroscopic Ankle Fusion Methods 68

*Timothy C. Fitzgibbons, David J. Inda*

### 12 Arthroscopic Triple Arthrodesis 79

*Tun Hing Lui, Lung Fung Tse*

### 13 Axial Screw Technique for Charcot Midfoot Neuropathic Dislocation 85

*V. James Sammarco*

## SECTION 4 Arthroscopy 91

### 14 Ankle Arthroscopy—Basics 91

*Marcus P. Coe, Alastair S.E. Younger, and Kevin Wing*

### 15 Arthroscopic Treatment of Osteochondral Lesions of the Talus: Microfracture 101

*Eric Giza, Edward Shin, and Stephanie E. Wong*

### 16 Osteochondral Lesion of the Talus (OLT) Treated by Matrix-Based Techniques (Matrix-Induced Chondrocyte Implantation [MACI] and Autologous Matrix-Induced Chondrogenesis [AMIC]) 109

*Markus Walther*

### 17 Arthroscopic Treatment of Osteochondral Lesions of the Talus: Juvenile Articular Cartilage Allograft 117

*Eric Giza, Edward Shin, and Stephanie E. Wong*

### 18 Arthroscopic Management of Distal Lower Extremity Syndesmosis Injuries 124

*Tun Hing Lui, Lung Fung Tse*

### 19 Posterior Ankle Arthroscopy and Hindfoot Endoscopy/Tendoscopy 131

*Florian Nickisch, Frank R. Avilucea, Phinit Phisitkul, and Brad D. Blankenhorn*

**20 Subtalar Joint Arthroscopy and Arthroscopically Assisted Subtalar Arthrodesis 141**

*Lijkele Beimers, C. Niek van Dijk*

**21 Arthroscopy of the Hallux MTP Joint 149**

*C. Christopher Stroud*

**SECTION 5 Forefoot Deformity 155**

**22 Hallux Valgus Correction with a Suture-Button Construct 155**

*Jeremy T. Smith, Christopher P. Chiodo*

**23 Hallux Valgus Correction—SERI Technique 161**

*Sandro Giannini, Francesca Vannini*

**24 Minimally Invasive Operative Treatment of Bunionette Deformity with Percutaneous Distal Metatarsal Osteotomy 169**

*Jin Woo Lee, Woo Jin Choi*

**SECTION 6 Trauma 175**

**25 The Fibula Nail for the Management of Unstable Ankle Fractures 175**

*Paul Appleton*

**26 Minimally Invasive Surgical Techniques for the Treatment of High-Energy Tibial Pilon Fractures 181**

*John P. Ketzer, Roy Sanders*

**27 Minimally Invasive Operative Treatment of Displaced Intra-Articular Calcaneal Fractures via the Sinus Tarsi Approach 194**

*Lew C. Schon, Samuel B. Adams, and Alan Yan*

**28 Minimally Invasive Operative Treatment of Proximal Fifth Metatarsal Fractures 201**

*Kathryn L. Williams, Robert B. Anderson*

**Index 211**

# Tendons and Ligaments

## Brisement and Related Procedures

Stuart H. Myers    Lew C. Schon

### BACKGROUND

Brisement (French: “breaking”) is the lysis of adhesions around a tendon by high-pressure fluid injection. It is distinct from brisement forcé (French: “forced breaking”), which is the lysis of intra-articular adhesions by joint manipulation.

Achilles tendon brisement, the most studied form of brisement in the foot and ankle, is performed by a wide variety of healthcare providers. Orthopedic surgeons, podiatrists, and interventional radiologists have described and validated a variety of techniques. The greatest variation among the different techniques is the composition of the injection. A second distinction is the presence or absence of ultrasound guidance. Despite these differences, all Achilles brisement is directed toward distention of the paratenon–tendon interface.<sup>1</sup>

The mechanism by which brisement is thought to work is the arresting or reversing of the process of tendon neovascularization. Zanetti et al.<sup>2</sup> showed that neovascularization is associated with painful Achilles tendinopathy. Humphrey et al.<sup>3</sup> further showed that brisement reverses this process while reducing tendon thickness, with decreased pain scores.

In dry needling, tissue is stimulated and blood flow is promoted through repeated needle puncture. The reparative process may be further stimulated with injection of platelet-rich plasma (PRP) during needling.

The addition of a steroid to the brisement cocktail is controversial. In a review article, Schepesis et al.<sup>1</sup> recommended against the use of an injectable steroid solution except in the case of retrocalcaneal bursitis. Although Read showed that peritendinous steroid injections in

patients with achillodynia did not increase the risk of rupture,<sup>4</sup> most protocols do not include a steroid in their injection.<sup>5,6</sup> However, steroids are used by some investigators for peritendinous injections.<sup>3,7</sup>

### INDICATIONS

The syndrome of Achilles tendon pain, inflammation, and degeneration is not completely understood. A distinction is often made between peritendinitis (paratenon disease) and tendinosis (tendon disease). Peritendinitis—possibly caused by repetitive injury to the paratenon—has an acute inflammatory phase and a chronic fibrotic stage. Tendinosis has an acute inflammatory stage and a chronic degenerative stage. These processes can coexist. Jones suggests that refractory peritendinitis can be successfully treated with brisement, whereas symptomatic tendinosis requires debridement.<sup>6</sup>

In our experience, peritendinitis tends to occur in younger patients and is often accompanied by squeaking and palpable nodules. Tendinosis tends to occur in older patients and is often associated with a more focal distribution of pain.

Investigations of brisement tend to group these entities together because of the difficulty in distinguishing them or the high rate of concurrence. Indications in the literature for brisement include insertional Achilles tendinitis,<sup>1</sup> chronic Achilles tendinopathy,<sup>7</sup> chronic resistant Achilles tendinopathy,<sup>3</sup> refractory mid-Achilles tendinosis,<sup>5</sup> achillodynia,<sup>4</sup> Achilles peritendinitis,<sup>6</sup> and Achilles tenosynovitis.<sup>8</sup> It is difficult to review the literature on this subject because the diagnostic language for Achilles

tendon disease is heterogeneous and the understanding of its pathophysiology is incomplete.

We perform brisement for chronic Achilles peritendinitis and for Achilles tendinosis if there is substantial concomitant peritendinitis and only after nonoperative measures have failed. Our initial treatment program consists of relative rest, stretching, and anti-inflammatory medication. If this is unsuccessful, we immobilize the patient with a boot brace. Brisement is considered if there is failure to achieve symptom control along this pathway.

Brisement can also be used to treat peritendinous adhesions of the Achilles tendon, posterior tibialis tendon, peroneal tendons, long toe extensors, tibialis anterior, and flexor hallucis longus. This procedure can be especially useful in the treatment of postsurgical peritendinitis of the peroneal and extensor tendons. We consider one-time addition of a steroid to the brisement solution in the brisement treatment of flexor hallucis longus tendinitis.

Dry needling is performed in the case of intrasubstance tendinopathy (insertional or noninsertional). Tendons most commonly affected include the Achilles, peroneal, and posterior tibialis. Plantar fasciitis is also amenable to this treatment. Mechanical integrity of the tendon is a prerequisite for needling. Tendons that are attenuated or stretched based upon clinical examination are not good candidates for needling. Failure of nonoperative measures similar to those used in tendinitis is required before we recommend dry needling.

## PATIENT POSITIONING

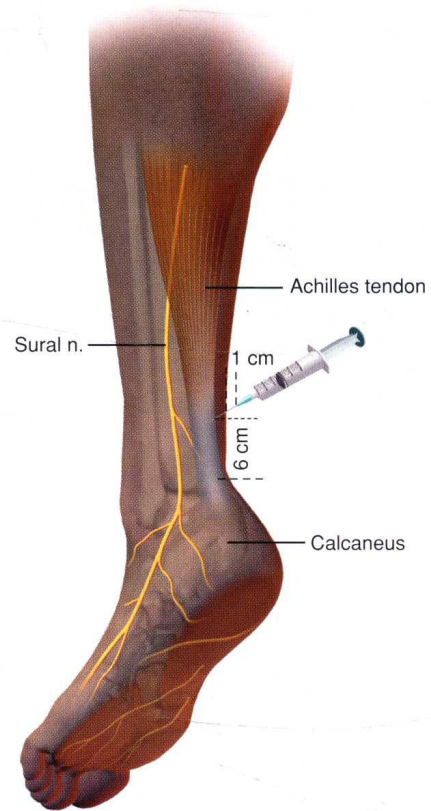
Supine or lateral positioning is used, depending upon the tendon(s) being treated.

## SURGICAL APPROACHES

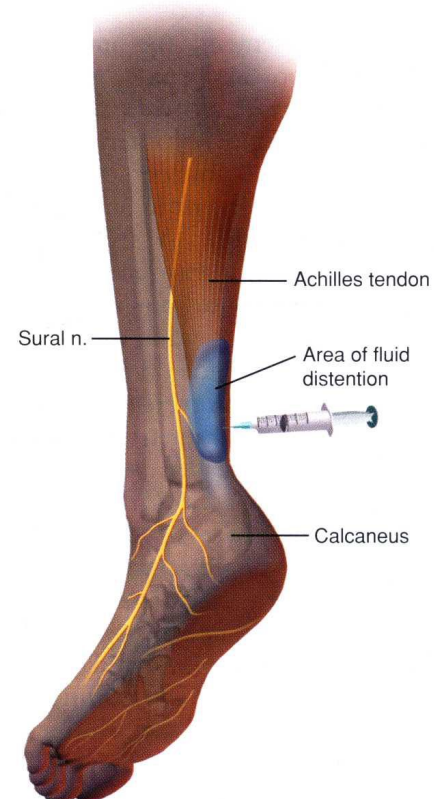
For noninsertional Achilles tendon brisement, the injection is performed medially to avoid the sural nerve. The injection point is 1 cm anterior to medial border of the Achilles tendon and 2 to 6 cm proximal to its insertion (Figs. 1-1 and 1-2). We modify this injection point occasionally depending on the location of tendon nodularity. Our protocol does not include ultrasound guidance, although techniques for use of ultrasound have been described.<sup>3,5,7</sup>

A 10-cc solution consisting of 2.5 cc 1% lidocaine, 2.5 cc 0.25% marcaine, and 5.0 cc normal saline is drawn into a 10-cc syringe. The injection is then done with positive pressure through a 1.5-in 25-gauge needle. The pressure is titrated such that the injection rate is approximately 1 cc per second. Correct injection into the peritendinous space can be confirmed visually based upon circumferential swelling.

Weekly brisement injections (no more than three) can be performed until the patient's symptoms resolve. The utility of repeated injections has not been rigorously studied but has been described in the literature.<sup>5</sup>



**Figure 1-1.** Illustration shows placement of needle 1 cm medial to the border of the Achilles tendon and 6 cm from the Achilles insertion.



**Figure 1-2.** Illustration shows distention of paratenon after injection.



**Figure 1-3.** Creation and injection of platelet-rich plasma in the plantar fascia. Peripheral blood (60 cc) is drawn from a venipuncture in the antecubital fossa using a syringe with anticoagulant. The blood is placed sterily in a specialized chamber, which is inserted into a centrifuge. The chamber allows for separation of the red blood cells from the PRP (red fluid) and platelet-poor plasma (yellow fluid). Long- and short-acting local anesthetics (6 cc) are also prepared.

Dry needling with PRP augmentation is preferred to brisement in the case of tendinosis and also plantar fasciopathy. We first harvest PRP from the peripheral blood (if the procedure is being done in the clinic) or from the bone marrow (if the procedure is being done in the OR) (Figs. 1-3–1-6). The plasma is then injected via a 25-gauge needle into the degenerated tendon or fascia in 15 to 20 fractionated doses. Skin punctures can be minimized by fanning the needle through the skin to allow several tendon punctures per skin puncture. The goal is to inject the plasma into and around the tendon (Figs. 1-7 and 1-8).



**Figure 1-5.** Local anesthetic is administered with a 25-gauge needle into the tender plantar fascia covering a broad circular area with a diameter of 3 to 4 cm.



**Figure 1-6.** The PRP is then injected with multiple penetrating deep plantar fascia punctures using a 25-gauge needle.



**Figure 1-4.** Ethyl chloride spray is used to anesthetize the skin.



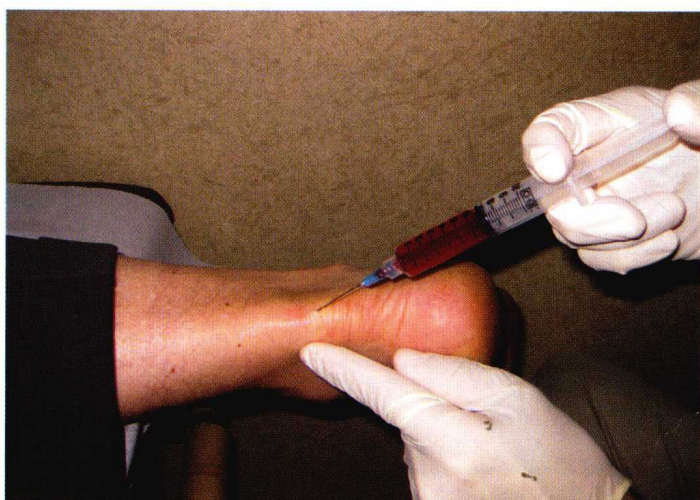
**Figure 1-7.** Injection of PRP into area of residual tendon tear following noninsertional Achilles tendon rupture that extended from midcalf to distal calf. Adjustment of trajectory will increase the zone of treatment.

## COMPLICATIONS

Occasionally patients may experience some mild local irritation from the needle. Some bruising may occur. After the injection, patients may experience a flare of pain, local swelling, and warmth. This is particularly true if needling of the tendon is done. In these cases the flare of symptoms may last for up to 6 weeks. Complications such as infection are very rare. If the tendon is rupturing and this is not recognized, the injection may rarely be blamed for causing the final tearing.

## REHABILITATION PROTOCOL

We keep patients immobilized in a boot brace for 1 week following the procedure. They are instructed to remove



**Figure 1-8.** Injection of PRP in and around midsubstance (noninsertional) Achilles tendinopathy.

the brace for range-of-motion exercises. We ask that patients perform inversion, eversion, and dorsiflexion to avoid stiffness. We will occasionally prescribe theraband exercises. Patients are allowed to walk on the affected leg immediately. Unless the extensor tendons (anterior tibial, extensor hallucis longus, extensor digitorum longus tendons) are injected, we allow the patient to remove the brace at night. For the extensor tendons, it is often useful to use a night splint to minimize stretching of these tendons. We counsel patients that they will have reached 75% healing in 3 months and that we have a 50% to 75% success rate in relieving symptoms.

## OUTCOME

Chan et al.<sup>7</sup> found short-term (4 weeks) and long-term (average of 30 weeks) statistically significant improvement in pain and function scores in reviewing 30 patients with chronic Achilles tendinopathy who had received high-volume steroid/bupivacaine/saline brisement. Using a similar brisement solution, Humphrey et al.<sup>3</sup> showed decreased neovascularization, reduced tendon thickness, and improved function scores in 11 athletes who underwent brisement for Achilles tendinopathy. In a retrospective review of chronic Achilles “tenosynovitis” patients, Johnston et al.<sup>8</sup> found that three of nine who received low-volume (5 cc) bupivacaine brisement had complete resolution of their symptoms.

Our experience is consistent with these findings, suggesting that properly selected patients will derive benefit from brisement and its related procedures.

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