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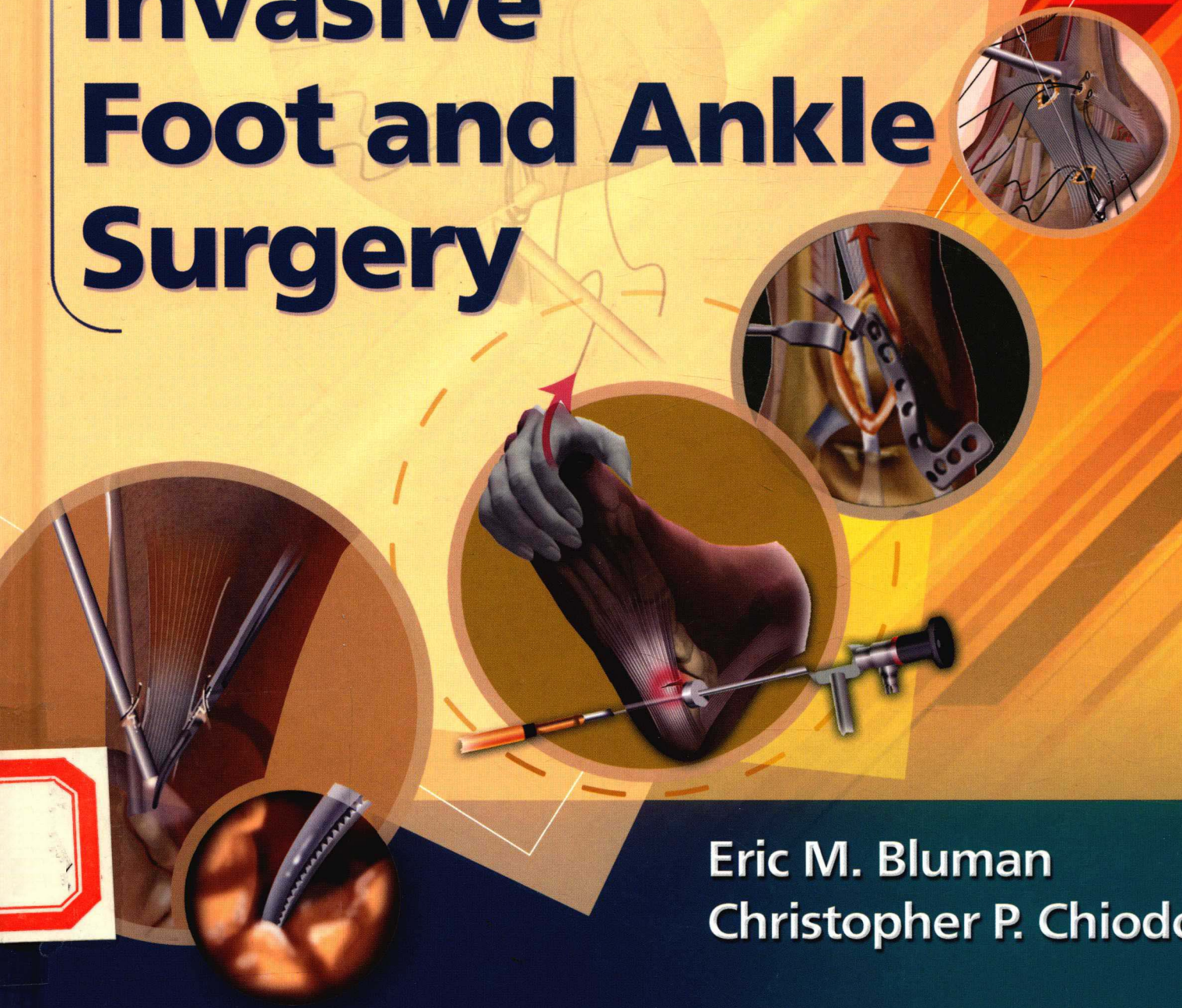
Minimally Invasive Foot and Ankle Surgery



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Minimally Invasive Foot and Ankle Surgery

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Manufacturing Coordinator: Beth Welsh
Prepress Vendor: Aptara, Inc.

9 8 7 6 5 4 3 2 1

Printed in China

978-1-45113-161-1

Library of Congress Cataloging-in-Publication Data
available upon request

LWW.com

RRS1509

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 I had growing up and are greatly responsible for where I am today.

Also to my wife Trimble Augur, MD and our children Adair, Tenney, and Everett who allow me to take time away from them more often than they would like 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

Acknowledgments

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

CHAPTER 1

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.[1]

The mechanism by which brisement is thought to work is the arresting or reversing of the process of tendon neovascularization. Zanetti et al.[2] showed that neovascularization is associated with painful Achilles tendinopathy. Humphrey et al.[3] 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, Schepsis et al.[1] 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,[4] most protocols do not include a steroid in their injection.[5,6] However, steroids are used by some investigators for peritendinous injections.[3,7]

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.[6]

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,[1] chronic Achilles tendinopathy,[7] chronic resistant Achilles tendinopathy,[3] refractory mid-Achilles tendinosis,[5] achillodynia,[4] Achilles peritendinitis,[6] and Achilles tenosynovitis.[8] It is difficult to review the literature on this subject because the diagnostic language for Achilles

tendon disease is heterogenous 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.

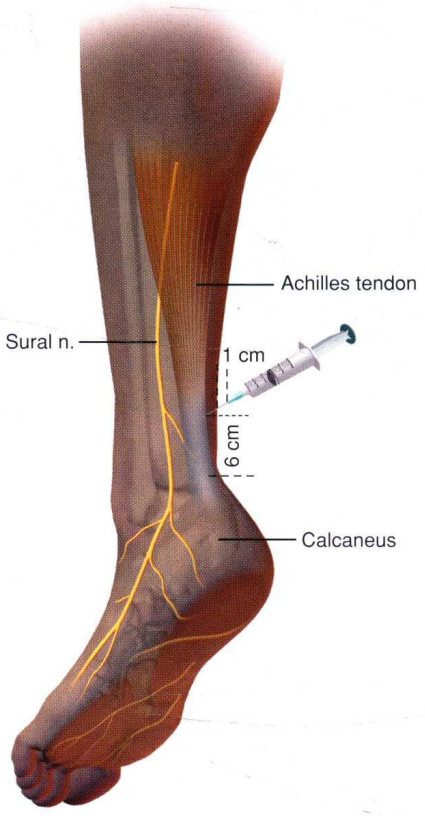

Figure 1–1. Illustration shows placement of needle 1 cm medial to the border of the Achilles tendon and 6 cm from the Achilles insertion.

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.[3,5,7]

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.[5]

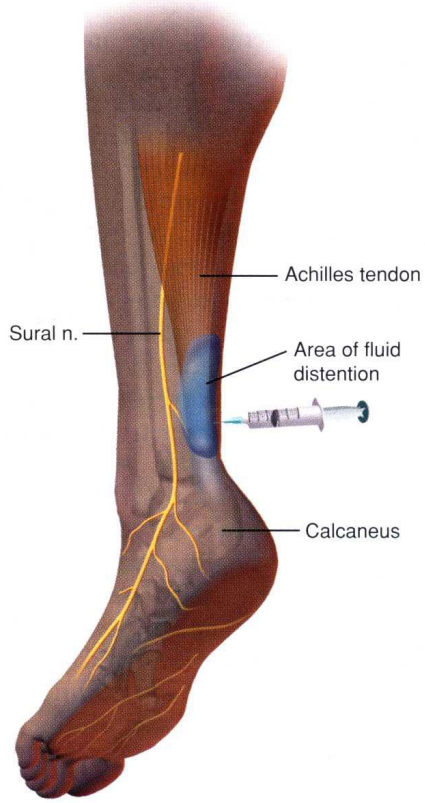

Figure 1–2. Illustration shows distention of paratenon after injection.

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 sterilely 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 1–4. Ethyl chloride spray is used to anesthetize the skin.

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 1–7. 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 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.

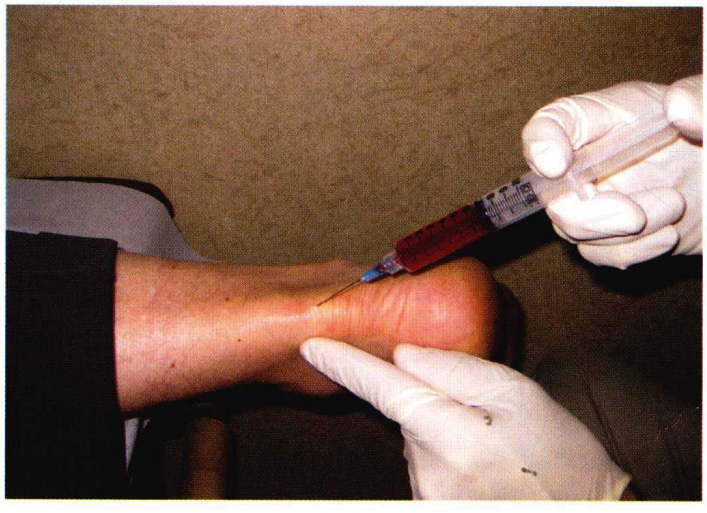

Figure 1–8. Injection of PRP in and around midsubstance (noninsertional) Achilles tendinopathy.

OUTCOME

Chan et al.[7] 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.[3] 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.[8] 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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