U·P·O·J

Surgical Pearls for Performing a Leg Fasciotomy

Jeffrey A. Fried M.D.

Mercer University,
Macon, Georgia

The treatment of acute compartment syndrome remains a major medical-legal issue for orthopaedic surgeons. Fasciotomy is the best treatment for acute compartment syndrome. In performing fasciotomy of the leg, all four compartments need to be decompressed without causing iatrogenic injury to neurovascular structures. The fasciotomy incisions need to be long enough to fully decompress the skin, subcutaneous tissue, fascia, muscles and neurovascular structures. Dead and non-viable muscle needs to be fully débrided to prevent infection. Muscle stimulation via direct contact or electrocautery may assist in the evaluation of muscle viability. Soft tissue management with skin grafts or negative pressure wound therapy may assist in the later closure of the fasciotomy wound. A single lateral incision fasciotomy may be indicated in some cases. Fasciotomy may not be indicated when there is irreversible ischemia to the leg.

Introduction

Acute compartment syndrome is a surgical emergency in orthopaedic surgery. It should be suspected in orthopaedic patients with excessive pain and tight compartments. It may be difficult to diagnose in obtunded or hypotensive patients. A low threshold for fasciotomy is recommended in patients with signs and symptoms of compartment syndrome and/or compartment pressures within 10-30 mm Hg of diastolic blood pressure or higher[1]. Fasciotomy of the four compartments of the leg remains the definitive treatment for acute compartment syndrome before the onset of irreversible ischemia. Attention to surgical technique can result in decreased morbidity from this surgical emergency. Surgical pearls for performing a leg fasciotomy are reported here.

1. Mark-out incisions, on both the medial and lateral sides prior to performing the fasciotomy. The lateral incision is performed in the mid-lateral axis between the anterior crest of the tibia and the fibula. The medial incision is made about one fingerbreadth posterior to the posteromedial border of the tibia. Mark the incisions first, because the skin shifts after incision due to swelling. This may lead to a narrower skin bridge than expected and increase the risk of skin necrosis.
2. Keep incisions long. Most fasciotomy incisions in the leg are 20-30 centimeters long depending on the length of the leg. A long incision is necessary to fully decompress the muscles, tendons, nerves, subcutaneous tissues, and skin. In addition, it is important to visualize all non-viable tissue for adequate debridement.
3. Identify the superficial peroneal nerve (Figure 1) in the lateral incision before releasing the fascia in both compartments. The course of the superficial nerve can be variable and iatrogenic injury is possible.

Figure 1. Superficial peroneal nerve piercing the crural fascia distal in the lateral incision.

Adkison et al[2] described the variation in superficial peroneal nerve anatomy in 85 limbs. The superficial peroneal nerve exited the lateral compartment and went through the crural fascia in the majority (62) of limbs. However, in 12 legs the nerve crossed from the lateral compartment to the anterior compartment before exiting the fascia. In 10 legs, the superficial nerve was noted to divide into two branches before exiting through the crural fascia in both the anterior and lateral compartments. In one leg, the nerve never lay deep to the peroneal longus and exited distally. There was a variable penetration through the fascia from 3 to 18 centimeters proximal to the lateral malleolus. This nerve supplies sensation to the dorsum of the foot and lateral second toe to the fifth toe. Division of the nerve may result in neurogenic pain, in addition to numbness.

4. Identify the saphenous nerve and vein in the medial incision. These structures are found subcutaneously near the posteromedial border of the tibia. The saphenous vein is the longest vein in the body and empties into the femoral vein near the hip. The saphenous nerve is purely sensory and injury results in decreased sensation distal to the lesion in the medial leg and ankle.

Corresponding Author:
Jeffrey A. Fried, MD
Clinical Assistant Professor of Surgery
Mercer University School of Medicine
6501 Peake Rd. Building #400
Macon, GA 31210
jfjumphigh@aol.com

5. Release the deep posterior compartment. The deep posterior compartment is often not identified or incompletely released. The easiest location to identify the deep posterior compartment is distal in the calf, where the flexor digitorum longus and overlying fascia is identified just posterior to the tibia. The incision is first made distal and the fascia is incised proximally by releasing or retracting the soleus off its insertion at the posteromedial tibia in the middle of the leg. Failure to release this compartment may result in clawed toes.
6. Direct stimulation of the muscle can help with assessment of viability. Commonly used techniques include direct stimulation with an instrument or electrocautery to identify contractility. In addition, color and bleeding are indicators of muscle viability.
7. Débride all nonviable muscle (Figure 2) early. Nonviable muscle increases the risk of infection and rhabdomyolysis. Debridement should include all muscle that does not contract or bleed.
8. Use of a negative pressure wound therapy system (VAC Therapy, Kinetic Concepts Inc., San Antonio,Texas) with vessel loops for dermatotraction (Figure 3) may decrease the need for skin grafting at closure without risking recurrent compartment syndrome[3]. Pressures as low as 50 mm Hg can assure the outflow of edema fluid using negative pressure. Apply a porous dressing such as Xeroform (Kendall) under the sponge connecting the two incisions to prevent skin maceration.

Figure 2. Non-viable muscle that needs debridement. .

Figure 3. Wound VAC with vascular loops used to facilitate early closure without skin graft in this patient with compartment syndrome and rattlesnake bite.

9. Consider no fasciotomy in late cases without rhabdomyolysis. After six to eight hours of ischemia, there is generally irreversible damage to the muscle. Performing a fasciotomy may expose the underlying necrotic muscle and increase the risk of infection and/ or amputation. In addition, Whitesides and Heckman have described scarring of the muscles to leave a checkrein effect to aid in ambulation[4]. Allowing the muscles to scar with the foot in the neutral position may be aided by a spanning external fixator or splint.
10. Consider a one-incision lateral parafibular fasciotomy in tibial plateau and pilon fractures. The one incision leg fasciotomy described by Whitesides and Heckman[4] involves a single lateral incision. However, decompression of the deep posterior compartment is much more difficult using this exposure. Single-incision fasciotomies should be reserved for those with experience in this procedure, either surgically or in the lab.

Conclusion:

Compartment syndrome is a major medico-legal issue for the Orthopaedic Surgeon. A low threshold for fasciotomy is important. Attention to surgical details can prevent iatrogenic neurovascular injury, minimize irreversible nerve and muscle damage, decrease the risk of infection, and allow earlier wound closure.

References

1. **Heckman, Michael M., Whitesides, Thomas E. , Jr., Greene, Scott R., Todd, Randy C., Miller, Marion, Lawrence, John H. III.** Histological Determination of the Ischemic Threshold of Muscle in the Canine Compartment Syndrome Model. *J. Orthop. Trauma* 1993, 7(3):199-210.
2. **Adkison, DP, Bosse, MJ, Gaccione,DR, Gabriel, KR.** Anatomic variations in the course of the superficial peroneal nerve. *J. Bone Joint Surg. Am* 1991, 73:112-114.
3. **Janzing,HM, Broos, PL.** Dermatotraction: an effective technique for the closure of fasciotomy wounds: a preliminary report of fifteen patients.. *J. Orthop. Trauma.* 2001, 15: 438-441.
4. **Whitesides Jr.,TE and Heckman, MM.** Acute Compartment Syndrome: Update on Diagnosis and Treatment. *J. Am. Acad. Ortho. Surg.* 1996,4: 209-218.