

# Unit 7B:

## Short Leg Cast



# Fracture Type(s) for Short Leg Cast

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Short leg casts (SLCs) are widely used in orthopedic practice for immobilizing fractures of the distal tibia, fibula, ankle, and foot. These fractures often occur due to trauma, falls, or sports-related injuries and require precise diagnosis and management to ensure proper healing. This section explores distal tibia fractures, isolated fibular fractures, ankle fractures, metatarsal fractures, and Lisfranc injuries, detailing their clinical anatomy, epidemiology, mechanism of injury, clinical characteristics, diagnostic process, differential diagnoses, and treatment considerations.

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## Distal Tibia Fractures

- ✓ **Clinical Relevant Anatomy:** The tibia, or shinbone, is the primary weight-bearing bone of the lower leg and plays a crucial role in lower extremity biomechanics. The distal tibial metaphysis transitions from the dense cortical bone of the shaft to the more porous cancellous bone near the ankle joint, making it more susceptible to fractures. The medial malleolus, which extends from the distal tibia, forms a critical stabilizing component of the ankle joint. Additionally, the posterior tibial artery and nerve pass closely along the posterior aspect of the tibia, making vascular and neurological compromise a concern in tibial fractures (Moore et al., 2020).
- ✓ **Epidemiology / Etiology / Mechanism of Injury:** Distal tibial fractures comprise approximately 7-10% of all tibial fractures, with a bimodal age distribution. Younger individuals commonly sustain these fractures through high-energy trauma, such as motor vehicle accidents, sports injuries, or falls from height. In contrast, older adults often experience low-energy fragility fractures due to osteoporosis and falls (Court-Brown et al., 2021). The mechanism of injury varies but often involves axial loading, torsional forces, or direct impact. High-energy fractures are frequently comminuted or intra-articular, while low-energy fractures tend to be simple transverse or oblique fractures.
- ✓ **Clinical Characteristics / Presentation:** Patients with distal tibial fractures typically present with significant localized pain, swelling, and bruising over the lower leg and ankle. Depending on the severity, they may have an obvious deformity in displaced fractures or minimal swelling in hairline fractures. Weight-bearing is often painful or impossible, and patients may report numbness or tingling if neurovascular structures are affected. Compartment syndrome is a rare but critical complication in high-impact fractures, requiring immediate assessment.
- ✓ **Fracture Diagnosis Process:** Assess for tenderness along the tibia, particularly near the medial malleolus; Evaluate skin integrity to rule out open fractures; Perform a neurovascular examination, checking for capillary refill, dorsalis pedis and posterior tibial pulses, and sensation in the foot.
- ✓ **Imaging Studies:** (1) X-ray (AP, lateral, oblique views) is the first-line imaging modality to confirm the fracture pattern; (2) CT scan may be necessary for complex fractures with suspected intra-articular extension.
- ✓ **Differential Diagnosis / Associated Injuries:** Ankle sprains (can mimic pain at the distal tibia); Stress fractures (particularly in athletes with chronic lower leg pain); Talus fractures (can coexist with distal tibial fractures); Maisonneuve fractures (high fibular fractures associated with syndesmosis injuries)
- ✓ **Treatment / Management Considerations:** For nondisplaced fractures, an SLC is applied for 6–8 weeks, with non-weight-bearing status for the first few weeks, followed by progressive weight-bearing. If the fracture is displaced, closed reduction is performed before casting. Surgical fixation (intramedullary nailing or plating) is considered for unstable fractures, open fractures, or those involving the articular surface (Bucholz et al., 2021).

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## Isolated Fibular Fractures

- ✓ Clinical Relevant Anatomy: The fibula is a non-weight-bearing bone, running parallel to the tibia and playing a key role in ankle stability and lateral leg muscle attachment. It provides attachment for the peroneus longus and brevis muscles, which contribute to ankle eversion. Additionally, the interosseous membrane connects the fibula to the tibia, offering further support (Moore et al., 2020).
- ✓ Epidemiology / Etiology / Mechanism of Injury: Fibular fractures account for 15% of lower extremity fractures, commonly occurring due to inversion injuries, direct trauma, or rotational forces. These injuries are frequently seen in athletes, particularly runners and soccer players, due to repetitive stress on the fibula.
- ✓ Clinical Characteristics / Presentation: Localized pain and swelling over the lateral lower leg; Possible ecchymosis and tenderness along the fibula; Intact weight-bearing ability if isolated; Minimal deformity unless displaced
- ✓ Fracture Diagnosis Process: (1) X-ray (AP, lateral, and mortise views) to confirm the location and pattern; (2) MRI if syndesmotic injury or ligamentous instability is suspected.
- ✓ Differential Diagnosis / Associated Injuries: High-grade ankle sprains (lateral ligament damage mimicking fibular fractures); Syndesmotic injuries (damage to the tibiofibular syndesmosis); Maisonneuve fractures (proximal fibula fracture with syndesmotic disruption)
- ✓ Treatment / Management Considerations: For nondisplaced fractures, an SLC is applied for 4–6 weeks, allowing early weight-bearing. Displaced fractures may require closed reduction or surgical fixation, particularly if ankle stability is compromised (Bucholz et al., 2021).

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## Ankle Fractures

- ✓ Clinical Relevant Anatomy: The ankle joint consists of the tibia, fibula, and talus, with stabilizing ligaments including the anterior talofibular, calcaneofibular, and deltoid ligaments. The syndesmosis, a fibrous joint between the tibia and fibula, is critical for stability (Moore et al., 2020).
- ✓ Epidemiology / Etiology / Mechanism of Injury: Ankle fractures represent 9% of all fractures, affecting young athletes and elderly individuals. Common mechanisms include: (1) Inversion injuries → Lateral malleolus fractures; (2) Eversion injuries → Medial malleolus fractures; (3) Torsional forces → Bimalleolar fractures
- ✓ Clinical Characteristics / Presentation: Pain, swelling, and bruising localized at the ankle; Difficulty bearing weight; Instability in ligamentous injuries
- ✓ Fracture Diagnosis Process: (1) X-ray (AP, lateral, mortise views) for fracture classification; (2) Ottawa Ankle Rules to determine imaging necessity
- ✓ Treatment / Management Considerations: Stable fractures are treated with SLC for 6 weeks, while unstable fractures require ORIF (Bucholz et al., 2021).

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## Metatarsal Fractures

- ✓ Clinical Relevant Anatomy: The metatarsals are five long bones located in the midfoot, connecting the tarsal bones to the phalanges. They play a critical role in weight-bearing, balance, and propulsion during walking and running. The first metatarsal is the thickest and strongest, bearing the most weight, while the fifth metatarsal is more susceptible to avulsion fractures due to its attachment to the peroneus brevis tendon (Moore et al., 2020). Blood supply to the metatarsals is primarily derived from the dorsalis pedis and plantar arteries, with the nutrient arteries supplying the midshaft. Insufficient vascularization, particularly at the proximal fifth metatarsal (Jones fracture site), can impair healing.
- ✓ Epidemiology / Etiology / Mechanism of Injury: Metatarsal fractures are among the most common foot fractures, accounting for approximately 35% of all foot fractures (Court-Brown et al., 2021). The fifth metatarsal is the most frequently fractured, often due to twisting injuries, direct trauma, or stress-related overuse; (1) high-energy trauma (e.g., falls, dropping heavy objects on the foot) can lead to displaced fractures; (2) Repetitive stress in athletes and military personnel causes stress fractures, commonly seen in the second and third metatarsals (March fractures); (3) Twisting or inversion injuries often cause fifth metatarsal avulsion fractures due to the pull of the peroneus brevis tendon.
- ✓ Clinical Characteristics / Presentation: Pain and swelling over the dorsum of the foot; Difficulty walking or bearing weight, especially with first and fifth metatarsal fractures; Localized tenderness, often at the fracture site; Ecchymosis (bruising) around the midfoot or lateral border of the foot (especially in Jones fractures).
- ✓ Fracture Diagnosis Process: Physical Examination: (1) Palpation to localize pain along each metatarsal; (2) Assess for midfoot instability if Lisfranc injury is suspected; (3) Check for capillary refill and sensation to rule out neurovascular compromise.
- ✓ Imaging Studies: (1) X-ray (AP, lateral, oblique views) to assess for fracture type and displacement; (2) MRI or bone scan in suspected stress fractures, where initial X-rays may be negative; (3) CT scan if intra-articular extension is suspected.
- ✓ Differential Diagnosis / Associated Injuries: Lisfranc injury (midfoot instability must be ruled out); Soft tissue injuries or ligamentous sprains mimicking fractures; Sesamoid fractures (common near the first metatarsal head).
- ✓ Treatment / Management Considerations: (1) Nondisplaced fractures: Managed with an SLC or walking boot for 4–6 weeks with progressive weight-bearing; (2) Stress fractures: Require activity modification and protective immobilization for 6–8 weeks; (3) Displaced fractures: May require closed reduction before casting; (4) Jones fractures (proximal fifth metatarsal fractures with high risk of nonunion) may require operative fixation (Bucholz et al., 2021).

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## Lisfranc Fractures

- ✓ Clinical Relevant Anatomy: The Lisfranc joint complex is a critical stabilizing structure of the midfoot, consisting of the tarsometatarsal (TMT) joints, the Lisfranc ligament (between the medial cuneiform and second metatarsal base), and the supporting joint capsule. This structure maintains the medial longitudinal arch and allows for force distribution during ambulation. The Lisfranc ligament is relatively weak, making it susceptible to dislocation or fracture with excessive midfoot stress (Moore et al., 2020).
- ✓ Epidemiology / Etiology / Mechanism of Injury: Lisfranc injuries are relatively rare, occurring in 1 out of 55,000 fractures annually, but they are often missed, leading to chronic instability if untreated (Eiff et al., 2020). These injuries typically occur due to high-energy trauma (e.g., motor vehicle collisions, falls from height, or crush injuries) but can also be seen in low-energy twisting injuries, especially in athletes (e.g., football, gymnastics, horseback riding).
- ✓ Clinical Characteristics / Presentation: (1) Midfoot pain, swelling, and bruising, particularly along the plantar surface; Inability to bear weight due to pain; (2) Pain with passive forefoot abduction or dorsiflexion (Lisfranc stress test); (3) "Fleck sign" on X-ray – a small avulsion fragment at the base of the second metatarsal indicating ligamentous injury.
- ✓ Fracture Diagnosis Process / Physical Examination: Tenderness along the midfoot, especially at the TMT joint complex; Assess for instability by applying dorsal-plantar stress to the forefoot.
- ✓ Imaging Studies: (1) Weight-bearing X-rays (AP, lateral, oblique views) to assess for TMT diastasis >2mm; (2) CT scan if subtle fractures or dislocations are suspected; (3) MRI to evaluate for Lisfranc ligamentous disruption.
- ✓ Differential Diagnosis / Associated Injuries: Metatarsal fractures (isolated vs. Lisfranc instability); Midfoot sprains (without ligamentous rupture); Navicular or cuneiform fractures.
- ✓ Treatment / Management Considerations: (1) Stable Lisfranc injuries (without diastasis): Managed with SLC for 6–8 weeks with non-weight-bearing for 6 weeks; (2) Unstable injuries (>2 mm diastasis): Require surgical fixation with screws or plates to prevent chronic midfoot instability and arthritis; (3) Post-immobilization rehabilitation: Progressive weight-bearing and midfoot strengthening exercises for 3–6 months post-injury (Bucholz et al., 2021).



# Conclusion

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Short leg casts (SLCs) remain a fundamental treatment modality for managing stable fractures of the distal tibia, fibula, ankle, and foot, providing essential immobilization to promote optimal healing while minimizing complications. Their application is particularly beneficial for non-displaced fractures and fractures with minimal instability, where external support is sufficient to allow the natural bone remodeling process to occur without the need for surgical fixation. In addition to immobilization, SLCs help to reduce pain, swelling, and movement-related discomfort, facilitating early recovery and functional rehabilitation.

Fracture management is not solely dependent on casting, as accurate diagnosis, classification, and patient-specific considerations play a critical role in determining treatment outcomes. Understanding the biomechanics and anatomical significance of the affected bones is crucial in selecting the appropriate immobilization strategy. For example, metatarsal stress fractures require modified weight-bearing approaches, while fifth metatarsal Jones fractures often require closer monitoring due to poor vascular supply and the potential risk of nonunion. Similarly, Lisfranc injuries, although potentially treated conservatively in stable cases, may lead to chronic midfoot instability and post-traumatic arthritis if misdiagnosed or inadequately managed.

Moreover, the role of early detection and proper imaging cannot be overstated in fracture management. Conventional X-ray imaging remains the first-line diagnostic tool, but in cases of subtle fractures or suspected ligamentous injuries (e.g., Lisfranc sprains or occult fractures), additional imaging modalities such as CT scans and MRIs are invaluable in determining the extent of the injury and guiding treatment decisions. Failure to accurately diagnose and classify fractures may lead to prolonged disability, malunion, or functional impairments, which can significantly impact an individual's mobility and quality of life.

The physician's decision to treat a fracture conservatively or surgically is guided by several factors, including fracture displacement, stability, alignment, and soft tissue involvement. While SLCs provide sufficient stabilization for many injuries, they are not suitable for all fracture types, particularly those with significant displacement, intra-articular extension, or syndesmotic disruption. In these cases, surgical intervention with open reduction and internal fixation (ORIF) may be necessary to restore anatomic alignment and joint stability, preventing long-term complications such as post-traumatic osteoarthritis, chronic pain, and functional limitations.

Beyond immobilization, rehabilitation and post-cast care are essential components of the recovery process. Prolonged immobilization can lead to muscle atrophy, joint stiffness, and decreased range of motion, necessitating progressive rehabilitation protocols focusing on strength restoration, proprioceptive training, and gradual weight-bearing progression. Patient education is also vital, emphasizing proper cast care, monitoring for complications (e.g., swelling, numbness, or skin irritation), and adherence to weight-bearing restrictions to ensure optimal healing.

In conclusion, short leg casts play a pivotal role in orthopedic fracture management, but their effectiveness depends on appropriate patient selection, accurate diagnosis, and comprehensive follow-up care. As advancements in fracture treatment and imaging techniques continue to evolve, the focus remains on optimizing outcomes through evidence-based clinical decision-making. A multidisciplinary approach, incorporating orthopedic specialists, athletic trainers, physical therapists, and patient-centered rehabilitation strategies, is key to ensuring that individuals with lower extremity fractures regain full functional mobility and long-term musculoskeletal health.

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# Short Leg Cast: Overview

## Application Steps:

1. Patient preparation – skin assessment / examination
2. Begin by applying a stockinette and padding to protect the skin and provide comfort.
3. Position the hip / ankle 90/90 on cast stand.
4. Apply the casting material (fiberglass or plaster) in layers, starting from the distal end toes and moving proximally.
5. Mold the cast carefully over bony prominences, such as the medial / lateral malleolus, Achilles and tibial tubercle.
6. Allow the cast to set fully before providing patient education on care and monitoring.





# Short Leg Cast: Application

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## Patient Preparation

Proper patient and skin preparation is essential to ensure optimal cast fit, patient comfort, and skin integrity. Here are the general steps to prepare the skin before applying a cast:

- **Verify Physician's Orders:** Confirm the type of cast needed, any special positioning requirements, and whether weight-bearing status is partial, non-weight-bearing, or full weight-bearing.
- **Assess Patient Condition:** Check for contraindications such as open wounds, infections, or significant edema; Evaluate neurovascular status (circulation, sensation, movement) of the affected limb and document findings before cast application.
- **Position the Patient:** Seat the patient comfortably with the affected leg supported at the knee and ankle; Ensure the foot is in a neutral (90-degree) position to prevent equinus deformity.
- **Skin Preparation:** Inspect the skin for abrasions, blisters, or irritation; Clean the skin with an antiseptic solution if necessary; Dry thoroughly before proceeding.
- **Protect Bony Prominences:** Identify pressure-prone areas (e.g., malleoli, Achilles tendon, tibial crest, metatarsal heads); If necessary, apply extra padding (foam or felt) to these areas.

Remember, it's essential to consult with a healthcare professional to ensure proper technique and care for the patient's specific needs.

# Short Leg Cast cont ...

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## Stockinette Application

Applying stockinette and padding correctly is crucial for patient comfort and protection when applying an orthopedic short leg cast. Here is a step-by-step guide on how to apply both the stockinette and padding:

- **Select the Correct Size:** Choose a stockinette size appropriate for the patient's leg circumference.
- **Apply the Stockinette:** Slide the stockinette over the foot and leg, extending approximately 2 inches beyond the intended cast borders (to be folded later).
- **Ensure Smooth Application:** Avoid wrinkles or tight folds to prevent skin irritation.
- **Trim Excess Length:** Ensure 2 inches remain beyond the cast margins to allow for later folding over the padding.

## Padding Application

- **Start Distally (at the Toes):** Begin wrapping just below the metatarsal heads to avoid over-tightening at the toes.
- **Wrap Evenly around ankle complex:** Use the entire roll to cover ankle with 50% overlap to ensure full coverage without excessive bulk.
- **Maintain Neutral Foot Position:** Hold the foot in a 90-degree dorsiflexed position as you wrap.
- **Provide Extra Padding Over Bony Areas:** Add additional layers over the malleoli, tibial crest, heel, and Achilles tendon, as needed.
- **Apply another roll starting at previous layer above malleoli to connect ankle complex with lower leg.** Continue up the lower leg to tibial tubercle and return back down to ankle.
- **The above techniques can be viewed on video at the end of this lesson.**

By carefully applying both the stockinette and padding, you create a comfortable and protective layer between the patient's skin and the fiberglass cast material. This helps to minimize the risk of skin irritation, pressure sores, and other complications during the healing process.

# Short Leg Cast cont ...

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## Fiberglass Cast Tape Application

Applying the fiberglass cast tape correctly is essential for ensuring a strong, durable, and comfortable orthopedic short leg cast. Here are the steps for effectively applying fiberglass cast tape:

- Typically, 3-inch or 4-inch fiberglass rolls are used for short leg casts. Padding technique will be replicated with fiberglass application.
- Prepare the First Roll: Open and submerge the fiberglass roll in room temperature water for 1-2 seconds (excessively wet tape can weaken the cast); Gently squeeze out excess water.
- Apply the First Layer: Begin wrapping distally near the toes, leaving the toes exposed; Maintain 50% overlap, ensuring uniform coverage.
- Mold/Cove Cast While Wrapping: Keep the foot in a neutral position (90 degrees) to prevent plantar flexion deformity; Avoid excessive tension while wrapping to prevent pressure points. Use entire first roll on ankle complex, as indicated above.
- Connect Ankle to Lower Leg: Apply 2nd roll with an anchor turn and connect ankle complex and continue wrapping up to the upper third of the tibia, finishing near tibial tubercle; or as directed by MD/DO; Apply 2-3 layers for adequate support.
- Fold Stockinette Over the Cast Edges: Turn back the excess stockinette over the padding to create smooth, soft edges.
- Final Fiberglass Layer: Apply final layers of fiberglass to secure the folded stockinette and smooth the cast edges.
- Mold and Contour the Cast: Use your hands to mold the cast gently while it sets (approximately 5-7 minutes); Ensure the plantar arch mold, Achilles and tibial molds are applied.
- Monitor Setting Time: The cast will be fully hardened within 20-30 minutes, but weight-bearing (if allowed) should be delayed until full cure (~24 hours).
- Check for Proper Fit: Perform a final neurovascular check: Capillary refill; Sensation; Toe movement
- Ask the patient if they feel any tightness, discomfort, or pressure spots.
- Always have physician review/evaluate cast prior to patient departure from office

By following these steps, you can effectively apply fiberglass cast tape for an orthopedic short leg cast, ensuring a strong, stable, and comfortable cast that promotes healing and patient satisfaction.

# Short Leg Cast - Removal

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## Short Arm Cast Removal

Removing a short arm cast with an orthopedic cast cutter requires care and attention to avoid injury. An orthopedic cast cutter, also known as a cast saw, is a specialized tool designed to remove casts by cutting through the hard casting material without injuring the patient's skin. Follow these steps to remove a short arm cast using an orthopedic cast cutter:

- **Prepare the patient and workspace:** Have the patient sit in a comfortable position with their arm supported on a stable surface. Ensure the workspace is well-lit and that you have all the necessary tools, such as the cast cutter, cast spreader, and scissors.
- **Safety measures:** Explain the process to the patient and reassure them that the cast cutter will not harm their skin. The cast cutter works by vibrating at a high frequency, which allows it to cut through the cast material but not the skin. It is normal for the cast cutter to generate some heat and noise during the process, so let the patient know what to expect. Use zip stick if available for additional protection.
- **Begin cutting the cast:** Turn on the cast cutter and start cutting along the length of the cast. Hold the cutter perpendicular to the cast's surface and apply gentle pressure. You can make a cut along the side of the arm, usually following the natural curve between the thumb and the forearm. Be cautious not to press too hard or cut too deep, as this may cause discomfort or injury to the patient.
- **Check for padding:** Periodically stop cutting and check if you've reached the padding layer beneath the cast. The padding will provide an additional layer of protection for the patient's skin.
- **Cut the other side:** Make a similar cut on the opposite side of the cast, ensuring that the two cuts are roughly parallel to one another.
- **Use a cast spreader:** Once both cuts are complete, insert the cast spreader into one of the cuts and gently spread the edges apart. This will help to break any remaining connections between the cast pieces and create enough space to safely remove the cast.
- **Remove the cast:** Carefully lift the cast pieces away from the patient's arm, making sure not to pull or tug on the skin. If needed, use scissors to cut through the padding and stockinette underneath the cast.
- **Inspect the skin:** After the cast is removed, examine the patient's skin for any signs of irritation, infection, or injury. Encourage the patient to gently move their fingers and wrist to regain mobility.

Remember that cast removal should be performed by a healthcare professional or someone trained in cast removal to ensure the safety and well-being of the patient.

# Short Leg Cast - Conclusion

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## **Short Arm Cast Removal**

The Short Leg Cast is an essential orthopedic technique for immobilizing fractures, sprains, and post-surgical conditions of the lower extremity. Ensuring proper application, molding, and patient education is critical for optimal healing and patient comfort.

### Key Takeaways:

- ✅ Maintain proper foot positioning during application.
- ✅ Ensure adequate padding over bony areas.
- ✅ Perform neurovascular checks before and after casting.
- ✅ Provide clear weight-bearing and care instructions.

By following these guidelines, clinicians can ensure safe, effective, and comfortable short leg cast applications for their patients.