Unit 8A: Long Leg Cast Technique

A long leg cylinder cast (LLCC) is a circumferential immobilization device extending from the **proximal thigh to just above the ankle**, leaving the foot free. It is used primarily to stabilize injuries that require immobilization of the knee joint while allowing some degree of ankle mobility. Common indications include:

- **Patella fractures** (nondisplaced or minimally displaced fractures requiring immobilization)
- **Tibial plateau fractures** (stable fractures that do not require surgical fixation)
- **Quadriceps tendon ruptures** (postoperative immobilization following repair)
- P**atellar tendon ruptures** (postoperative management)
- **Severe knee ligament injuries** requiring prolonged immobilization (e.g., high-grade medial collateral ligament (MCL) injuries)

Anatomical and Injury Considerations

Clinically Relevant Anatomy:

The knee joint is a complex hinge joint involving the **distal femur, proximal tibia, and patella**, stabilized by **ligaments, cartilage, and surrounding musculature**. The patella functions as a mechanical pulley for the **quadriceps muscle**, allowing efficient knee extension. The **quadriceps and patellar tendons** play a crucial role in stabilizing the knee joint. Additionally, the **tibial plateau serves as the weight-bearing surface**, and fractures in this region can significantly impact **knee stability and mobility**. Neurovascular structures, including the **popliteal artery, peroneal nerve, and tibial nerve**, must be assessed when managing knee fractures to prevent complications such as **vascular injury or nerve damage** (Moore et al., 2020).

Epidemiology / Etiology / Mechanism of Injury

- *Patella Fractures:* Account for 1% of all skeletal fractures and are commonly seen in direct impact trauma (e.g., falls, dashboard injuries in motor vehicle accidents) (Court-Brown et al., 2021).
- *Tibial Plateau Fractures:* Represent 1% of all fractures but make up 55% of all tibial fractures, often occurring due to axial loading with valgus or varus forces, commonly seen in pedestrian vs. car accidents, skiing injuries, or high-energy falls.
- *Quadriceps/Patellar Tendon Ruptures:* These injuries frequently occur in middle-aged males engaging in sports and are associated with sudden eccentric contraction of the quadriceps (e.g., landing from a jump or a forceful knee extension) (Bucholz et al., 2021).
- *Severe Knee Ligament Injuries:* High-grade MCL and multi-ligamentous injuries often result from sports-related trauma, valgus stress, or hyperextension forces.

Clinical Characteristics

Clinical Characteristics / Presentation

Patella Fractures

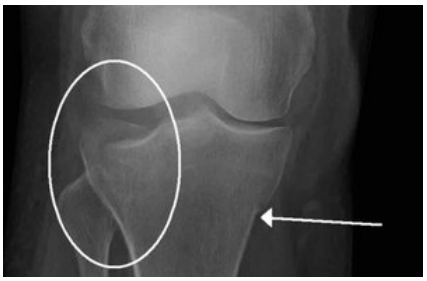
- ✓ Pain and swelling over the anterior knee
- ✓ Inability to actively extend the knee if extensor mechanism is disrupted
- ✓ Palpable gap in displaced fractures
- ✓ Hemarthrosis (knee effusion)

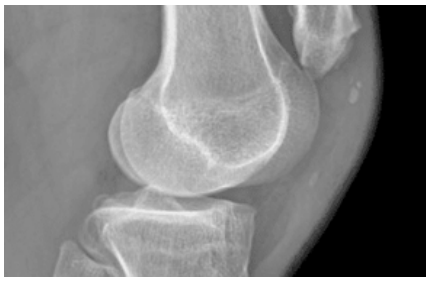
Tibial Plateau Fractures

- ✓ Pain and swelling localized to the proximal tibia
- ✓ Inability to bear weight
- ✓ Joint effusion and possible valgus/varus deformity
- ✓ Possible ligamentous instability if associated soft tissue injury

Quadriceps / Patellar Tendon Ruptures

- ✓ Inability to extend the knee actively
- ✓ Patella alta (high-riding patella) in patellar tendon rupture
- ✓ Palpable defect above or below the patella
- ✓ Significant pain with attempted knee extension





Clinical Diagnosis Review ...

Fracture Diagnosis Process

1. Physical Examination

- Palpation for tenderness, deformity, and effusion
- Assess knee extension function (critical for determining extensor mechanism integrity)
- Check neurovascular status, particularly for popliteal artery injury in tibial plateau fractures

2. Imaging Studies

- X-ray (AP, lateral, sunrise views for patella fractures; AP, lateral, oblique views for tibial plateau fractures)
- CT scan for complex tibial plateau fractures
- MRI for suspected ligamentous injuries or occult tendon ruptures

Differential Diagnosis / Associated Injuries

- Knee dislocations (can be mistaken for tibial plateau fractures)
- Meniscal tears (often co-exist with tibial plateau fractures)
- Femoral condyle fractures (may present similarly to tibial plateau injuries)
- Severe patellofemoral osteoarthritis (mimicking pain from patellar fractures)

Treatment / Management Considerations

Non-Surgical Management (Long Leg Cylinder Cast Indications)

- Stable, nondisplaced patella fractures → LLCC for 4–6 weeks with gradual range of motion exercises after 3–4 weeks.
- Minimally displaced tibial plateau fractures → LLCC for 6 weeks, followed by partial weight-bearing with a hinged knee brace.
- Postoperative care for tendon repairs (quadriceps/patellar tendon ruptures) → LLCC in extension for 4–6 weeks, with progressive mobilization.
- Severe ligamentous injuries (high-grade MCL injuries requiring immobilization) → LLCC with restricted weight-bearing until ligamentous healing occurs.

Surgical Considerations (Cases Not Suitable for LLCC Alone)

- Displaced fractures of the patella or tibial plateau require open reduction and internal fixation (ORIF).
- Complex tibial plateau fractures involving joint depression may require surgical elevation and fixation.
- Complete extensor mechanism disruption (patellar/quad tendon rupture with retraction) mandates surgical repair with early immobilization in LLCC.

Conclusion

Fracture Diagnosis Process

A long leg cylinder cast plays an essential role in stabilizing knee and proximal tibia fractures that do not require immediate surgical intervention. By maintaining knee extension and limiting motion, an LLCC facilitates healing while reducing pain, preventing deformity, and minimizing complications. Proper patient selection, early imaging, and rehabilitation planning are critical in ensuring optimal recovery and functional outcomes. While LLCC remains a mainstay in conservative orthopedic management, it is imperative to monitor fracture stability, assess for associated ligamentous or vascular injuries, and ensure gradual return to mobility post-immobilization. As advancements in orthopedic surgery and rehabilitation continue to evolve, the role of early functional movement post-casting is becoming increasingly recognized in achieving the best possible outcomes.

References

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- Court-Brown, C. M., Rimmer, S., Prakash, U., & McQueen, M. M. (2021). *Epidemiology of adult fractures* (2nd ed.). Elsevier.
- Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2020). *Clinically oriented anatomy* (8th ed.). Wolters Kluwer.

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Long Leg Cast Application

Patient Preparation

Preparing a patient's skin prior to the application of an orthopedic fracture cast is crucial to ensure proper hygiene, reduce the risk of infection, and provide a comfortable fit. Here are the general steps to prepare the skin before applying a cast:

- **Removing jewelry from the affected limb prior to the application of a fiberglass cast for the lower extremity helps to ensure patient comfort, proper cast fitting, and effective healing while reducing the risk of complications during the treatment and recovery process.**
- **Clean the skin: Gently clean the area around the fracture site using mild soap and water or an antiseptic solution. This step helps to remove dirt, debris, and bacteria from the skin, reducing the risk of infection.**
- **Dry the skin: Pat the skin dry with a clean towel or gauze. Make sure the skin is completely dry before proceeding, as moisture can interfere with the adhesion of the cast materials and promote the growth of bacteria.**
- **Assess the skin: Examine the skin for any signs of infection, open wounds, or skin irritation. If there are any concerns, consult with the healthcare professional responsible for the patient's care.**
- **Apply a skin barrier (if necessary): In some cases, a skin barrier may be used to protect the skin from irritation or maceration. This could be a moisture barrier cream or spray, which can help prevent skin breakdown caused by prolonged exposure to moisture.**
- **If the patient has excessive hair, trim lightly with clippers (avoid shaving, as micro-abrasions can lead to irritation or infection).Be sure to get the patient's consent before doing so.**
- **Position the limb: Properly position the patient's limb in the desired position for casting: (1)Place the patient in a supine position on an examination table or specialized casting table; (2) Ensure the injured leg is fully supported on a padded surface, with the knee in slight flexion (~5-10 degrees). This helps maintain joint positioning and prevents undue stiffness after cast removal; (3) the ankle should be in a neutral position (to prevent foot drop).**
- **Once the patient's skin is clean, dry, and properly assessed, you can proceed with applying the stockinette, padding, and casting material according to the healthcare professional's instructions.**

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

Long Leg Cast cont ...

Stockinette Application

Applying a stockinette and padding correctly is crucial for patient comfort and protection. Here is a step-by-step guide on how to apply both the stockinette and padding:

- Prepare the materials: Gather the necessary materials, including a stockinette, scissors, and cast padding.
- Choose a 4 inch wide stockinette, ensuring it is wide enough to cover the entire leg without excessive bunching.
- Measure the stockinette: Measure a length of stockinette that extends at least 2-3 inches beyond the anticipated proximal (thigh) and distal (lower leg) cast edges. Cut the stockinette to the appropriate length.
- Position the stockinette: Slide the stockinette over the leg, making sure it reaches from just below the groin to just above the ankle joint.
- Smooth out any wrinkles or folds to avoid pressure points inside the cast.
- Leave extra length at both the proximal and distal ends to be folded over after padding and fiberglass application.

Padding Application

- Choose 4-inch wide padding rolls based on the size of the patient's limb. Apply the first section around the upper thigh - wrap the padding circumferentially from proximal to distal, maintaining a 50% overlap with each pass to ensure uniform coverage.
- For the next roll, continue over the knee joint and provide additional layers around the patella and tibial tuberosity to prevent pressure sores.
- Pad bony prominences thoroughly: (1) Patella: Apply extra padding to distribute pressure; (2) Fibular head: This area is prone to nerve compression (watch for signs of common peroneal nerve compression); (3) Tibial tuberosity & lateral condyles: Reinforce with additional layers to prevent discomfort.
- Extend padding distally to just above the ankle, stopping 2 inches above the malleoli (to prevent excessive bulk near the ankle joint).
- Smooth out any wrinkles: As you apply each layer of cast padding, make sure to smooth out any wrinkles or folds to ensure a comfortable fit. Wrinkles or folds can cause discomfort and may even lead to pressure sores.
- Check for proper fit: After applying the cast padding, check to ensure that it is not too tight or too loose. The padding should provide cushioning and protection for the limb, but should not constrict blood flow or cause discomfort.

Long Leg Cast cont ...

Fiberglass Cast Tape Application

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

- Prepare fiberglass tape: Put on gloves to protect your hands. The exact number of rolls will depend on the size of the patient's arm and the desired thickness of the cast.
- Select 4- or 5-inch fiberglass rolls (typically 3-5 rolls are needed, depending on patient size).
- Dip fiberglass tape: Fully submerge a roll of fiberglass tape in lukewarm water for a few seconds to activate the resin. Squeeze the roll gently to remove excess water.
- Apply fiberglass tape: 1. Begin proximally at the thigh and wrap circumferentially, ensuring even tension without excessive pressure - per video crating the thigh cylinder with first roll; 2.Use a 50% overlap technique to maintain strength and uniformity.
- With the next roll, continue to cover the knee smoothly, avoiding creases. Reinforce by applying 1-2 extra layers over the patella.
- Grab another roll and continue wrapping distally, stopping just above the ankle.
- Mold the cast (per video): As you apply the fiberglass tape, use your hands to mold and shape the cast around the leg. Apply gentle pressure to ensure a snug fit without causing discomfort.
- Final molding: Once you have reached the desired thickness, smooth the outer surface of the cast using your hands or a gloved palm. This will help set the cast and make it more comfortable for the patient. Use the demonstrated molding technique for the upper thigh from the instructional video for upper arm.
- Cast setting: Allow the fiberglass cast to harden, which usually takes around 10-15 minutes. The cast will feel warm as it hardens, which is normal.
- Inspect the cast: Once the cast is set, check for any sharp edges, pressure points, or skin irritation. Trim or smooth any rough edges as necessary. Ensure proper circulation by checking the patient's capillary refill time and ensuring they can move their fingers without difficulty.
- Provide aftercare instructions: Explain to the patient how to care for their cast, including keeping it dry, avoiding direct pressure on the cast, and reporting any signs of infection or discomfort.

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

Long Leg Cast - Removal

Long Arm Cast Removal

Follow these steps to remove a short arm cast using an orthopedic cast cutter:

- Explain the process: Inform the patient about the cast removal process, emphasizing that the cast saw will make noise and may feel warm but will not cut their skin.
- Position the patient: Have the patient lie down in a comfortable position, ensuring their arm is well-supported throughout the process.
- Cast saw safety: Put on protective eyewear and ensure the cast saw is in good working condition before using it. Double-check that the blade is sharp and properly attached.
- Cutting the cast: Begin by cutting the cast longitudinally on each side, taking care to avoid direct contact with the patient's skin. Apply gentle pressure and use a steady, back-and-forth motion. Do not force the blade or attempt to cut through the padding in one pass. The cast saw is designed to cut through the rigid outer layer without cutting the padding underneath.
- Use the cast saw - Apply gentle, controlled pressure and Move the saw in a back-and-forth motion to prevent heat buildup.
- Scissor insertion: Once the cast is cut on both sides, gently insert the blunt-nosed cast scissors or a spreader between the padding and the patient's skin, keeping the blade parallel to the skin. This will protect the patient's skin while you cut through the padding.
- Cut the padding: Carefully cut the padding along the same lines you cut the outer layer of the cast. Be cautious not to nick or cut the patient's skin.
- Cast spreading: Using a cast spreader, gently pry apart the two halves of the cast. If necessary, use additional cutting or spreading to ensure the cast can be removed without causing discomfort to the patient.
- Remove the cast: Carefully lift the two halves of the cast away from the patient's arm, taking care not to cause any sudden movements or excessive pressure on the healing fracture.
- Remove the padding and stockinette: Gently peel back the padding and stockinet, being cautious of any sensitive or tender areas on the patient's skin.
- Skin inspection: Examine the patient's skin for any signs of infection, pressure sores, or other issues that may require medical attention. Look for redness, swelling, discharge, or foul odor. Additionally, assess the patient's range of motion and strength in their arm and fingers.
- Clean the area: Gently cleanse the patient's skin with warm water and mild soap, and pat dry. Apply moisturizing lotion if the skin is dry or irritated.
- Follow-up care: Per MD instructions.