

Cast application (Advanced practice)



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■ Introduction

A cast is a hard mold that encases a patient's body part (usually an extremity) to immobilize the bones and surrounding tissue. It can be used to treat injuries such as fractures, correct orthopedic conditions such as deformities, and promote healing after surgery, amputation, or nerve or vascular repair. A cast also helps to reduce pain, swelling, and muscle spasms and provides protection from further injury.^[1] It usually remains in place until bone healing occurs, typically in about 4 to 8 weeks.^[2] (See [Types of casts.](#))

A cast may be constructed of plaster, fiberglass, or another synthetic material. Plaster, a commonly used casting material, is inexpensive, nontoxic, nonflammable, and easy to mold and rarely causes allergic reactions or skin irritation. Fiberglass is lighter, stronger, and more resilient than plaster.^[3] It dries rapidly and is more difficult to mold, but it can bear body weight immediately if necessary and is water-resistant.^[4]

An orthopedist typically applies a cast, and a nurse prepares the patient and equipment and assists during the procedure. With special training, a nurse practitioner or physician assistant can apply or change a cast and set a fracture under the direction of an orthopedist.^[5]^[6]



EQUIPMENT

TYPES OF CASTS

Various types of casts are used to protect and immobilize the body. Common cast types and their uses are described below.^[4]^[7]

Long arm cast

A long arm cast (shown below) is applied from the upper arm to the hand. It treats upper arm, elbow, and forearm fractures and holds the arm or elbow muscles and tendons in place after surgery.



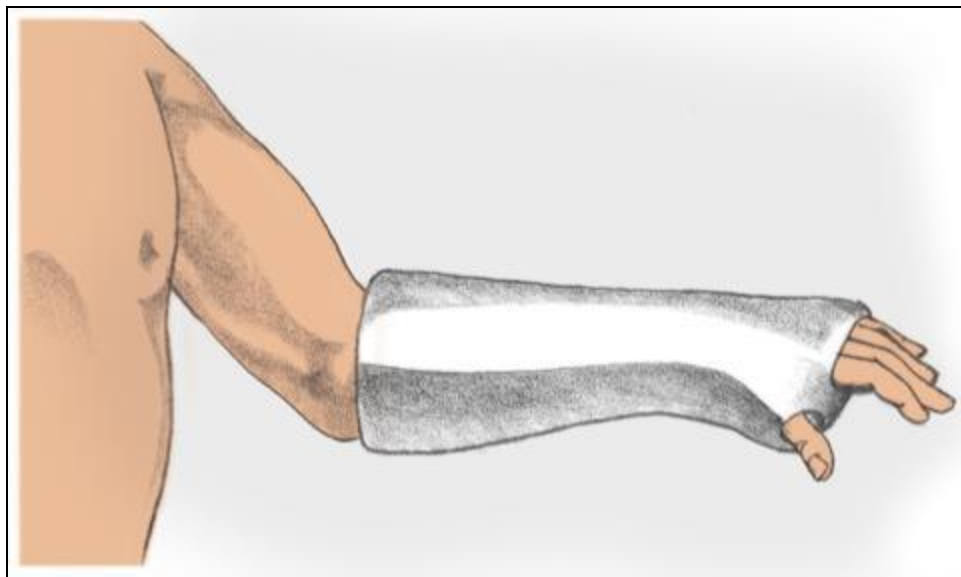
Shoulder spica cast

A shoulder spica cast (shown below) is applied around the trunk of the body to the shoulder, arm, and hand. It treats shoulder dislocations and soft tissue injuries and holds the shoulder muscles and tendons in place after surgery.



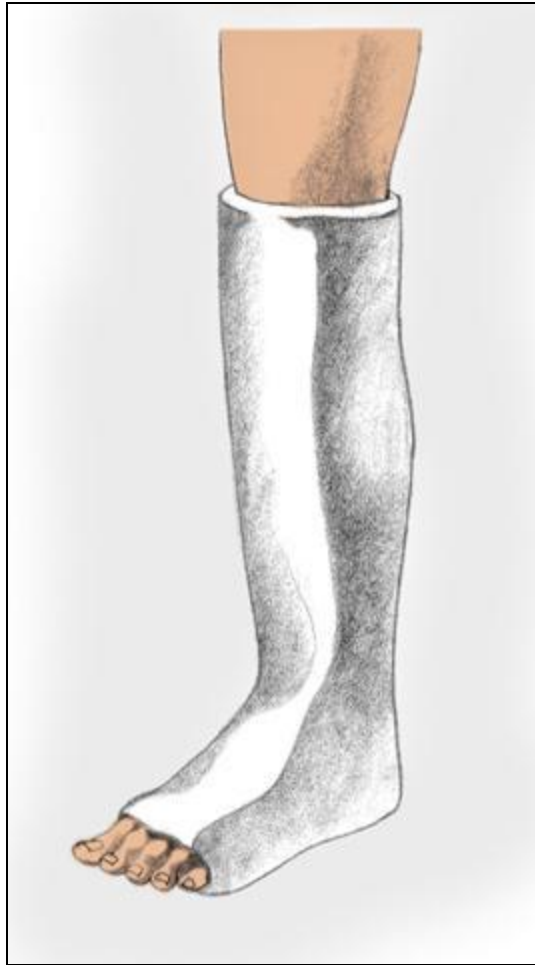
Short arm cast

A short arm cast (shown below) is applied below the elbow to the hand. It treats forearm and wrist fractures and holds the forearm or wrist muscles and tendons in place after surgery.



Long leg cast

A long leg cast (shown below) is applied from the thigh to the foot. It treats knee, lower leg, and ankle fractures and knee dislocations and holds the knee area or leg or foot muscles and tendons in place after surgery.



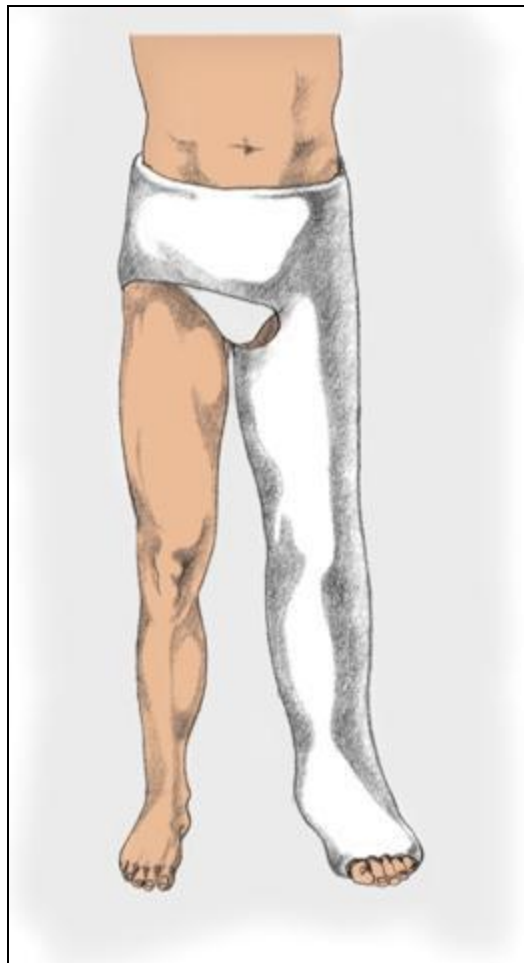
Short leg cast

A short leg cast (shown below) is applied from below the knee to the foot. It treats lower leg fractures, severe ankle sprains and strains, and ankle fractures and holds the leg or foot muscles and tendons in place after surgery.



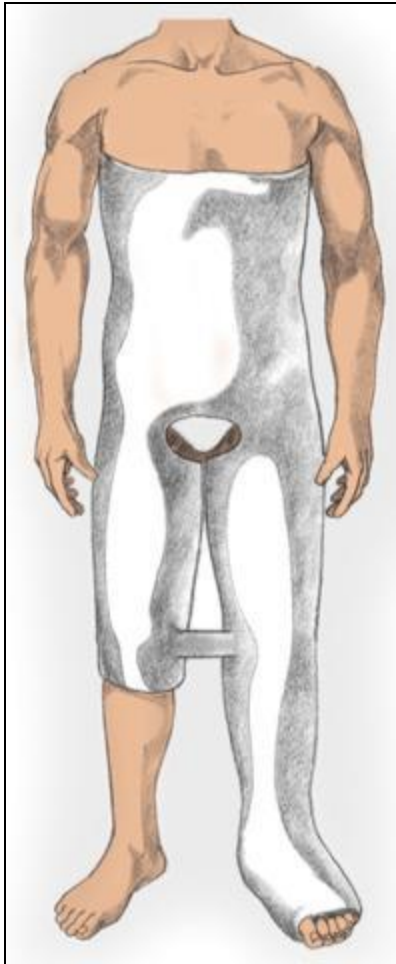
Unilateral hip spica cast

A unilateral hip spica cast (shown below) is applied from the waist or nipple line on the chest to the foot on one leg. It treats femur fractures and holds the hip or thigh muscles and tendons in place after surgery.



One and one-half hip spica cast

A one and one-half hip spica cast (shown below) is applied from the waist or nipple line on the chest to the foot on one leg and the knee on the other leg. A bar placed between the legs helps to keep the hips and legs immobilized. This cast treats femur fractures and holds the hip or thigh muscles and tendons in place after surgery.



■ Equipment

- Bucket of water for dipping the casting material
- Casting material (2" to 6" [5- to 15-cm] wide plaster or fiberglass rolls, based on extremity size)
- Cotton or synthetic undercast padding
- Facility-approved pain assessment tool
- Fluid-impermeable pads
- Pillows or blankets
- Scissors
- Tubular stockinette (2" to 12" [5 to 30 cm] wide, based on extremity size)
- Vital signs monitoring equipment
- Optional: adhesive tape, cast removal safety strip, cast stand, fan, gloves, moleskin, pain medication, plaster splints, sink equipped with a plaster trap, supplies for cleaning the extremity (soap, washcloth, water, towels), supplies for fall precautions, surgical marking pen

■ Preparation of Equipment

Inspect all equipment and supplies. If a product is expired, is defective, or has compromised integrity, remove it from patient use, label it as expired or defective, and report the expiration or defect as directed by your facility.

Ensure that the packages of casting material don't have air leaks by squeezing the packages gently; *humid air penetrating the packaging may cause the casting material to fail*. Verify that the water temperature conforms to the casting material manufacturer's directions *because water that's too warm may cause skin burns as the casting material sets*. Use tepid or slightly warmer water for plaster casting material, and use room temperature or slightly cooler water for fiberglass casting material that's water-activated.^{[2][8]} Wear gloves when preparing fiberglass casting material *because fiberglass is a skin irritant*.^{[2][8]}

◆ **Clinical alert:** Cool dipping water slows the setting rate of the casting material, *which can be helpful when molding difficult casts*. It also reduces the risk of thermal injury. Warm dipping water speeds the setting rate but also raises the temperature under the cast, *increasing the risk of thermal injury*.^{[2][8]} ◆

■ Implementation

- Review the patient's medical record for a history of any medical conditions that would impede fracture healing and any allergies to the materials used in cast application.
- Conduct a preprocedure verification *to make sure that all relevant documentation, related information, and equipment are available and correctly identified to the patient's identifiers*.^{[9][10]}
- Verify that laboratory and imaging studies have been completed as ordered and that the results are in the patient's medical record.
- Perform hand hygiene.^{[11][12][13][14][15][16]}
- Confirm the patient's identity using at least two patient identifiers.^[17]
- Provide privacy.^{[18][19][20][21]}
- Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding, allay their fears, and enhance cooperation*.^[22]
- If required by your facility, obtain informed consent and place the signed consent form in the patient's medical record.^{[23][24][25][26]}
- Screen for and assess the patient's pain using facility-defined criteria that are consistent with the patient's age, condition, and ability to understand.^[27] (See the "[Pain assessment](#)" procedure.)
- Treat the patient's pain, as needed, using nonpharmacologic, pharmacologic, or a combination of approaches. Base the treatment plan on evidence-based practices and the patient's clinical condition, past medical history, and pain management goals.^[27]
- Monitor closely if the patient is at high risk for adverse outcomes related to opioid treatment, if prescribed.^[27]
- Gather and prepare the necessary equipment and supplies.
- Raise the bed to waist level before providing care *to prevent caregiver back strain*.^[28]
- Perform hand hygiene.^{[11][12][13][14][15][16]}
- Obtain the patient's vital signs *for baseline comparison*.
- Cover appropriate parts of the patient's bedding with fluid-impermeable pads.

- Perform hand hygiene. [11](#) [12](#) [13](#) [14](#) [15](#) [16](#)
- Put on gloves, as needed, *to comply with standard precautions*. [29](#) [30](#) [31](#)
- Assess the condition of the skin of the affected extremity and note areas of abnormal color, ecchymosis, open wounds, rashes, or irritation. *This assessment will make it easier to evaluate patient complaints after cast application.*
- Assess the patient's baseline neurovascular status. Palpate the patient's pulses and assess the temperature, color, capillary refill time, motion, sensation, and pain in the patient's affected and unaffected extremities. [3](#) [4](#)
- Make sure that the patient's extremity to be casted is clean and dry. If it isn't, clean and dry it. [3](#) [4](#)
- Remove jewelry from the patient's extremity to be casted. *Jewelry may interfere with circulation to the extremity.*
- Mark the procedure site, if indicated, using a surgical marking pen *to ensure that you cast the correct site*. [9](#) [32](#)
- Remove and discard your gloves, if worn. [30](#)
- Perform hand hygiene. [11](#) [12](#) [13](#) [14](#) [15](#) [16](#)
- Conduct a time-out immediately before starting the procedure *to perform a final assessment, ensuring that the correct patient, site, positioning, and procedure are identified and, as applicable, that all relevant information and necessary equipment are available*. [9](#) [33](#)
- Tell the patient to report pain or the sensation of excessive warmth during the procedure.
- Measure the tubular stockinette to a length approximately 4" (10 cm) longer than the cast on both the distal and proximal ends *to allow it to be rolled back before applying the last layer of casting material to create a smooth edge*. Consider omitting the stockinette in the presence of an open wound or a severe contusion. [2](#)
- Cut the stockinette with scissors to the appropriate length. If you're applying the cast over the patient's hand, cut a slit for the thumb.
- Roll the stockinette over the area to be casted, ensuring that it's smooth and wrinkle-free.
- With the help of the assisting nurse, position the patient's extremity in a neutral position with the affected joint in its functional position. [2](#) [8](#)
- While the assisting nurse supports the patient's affected extremity, apply the undercast padding:
 - Beginning at the distal end of the extremity, wrap the undercast padding circumferentially around the extremity, starting $\frac{3}{4}$ " to $1\frac{1}{4}$ " (2 to 3 cm) beyond the expected edge of the cast. [2](#) [8](#)
 - Continue to wrap the undercast padding in a proximal direction, overlapping the previous layer by one-half. [2](#) [8](#)
 - Leave an additional $\frac{3}{4}$ " to $1\frac{1}{4}$ " (2 to 3 cm) of undercast padding beyond the expected proximal end of the cast. [2](#)
 - If you're applying the cast over the hand, cut a small hole in the undercast padding for the thumb.
 - Avoid wrapping the undercast padding too tightly *to reduce the risk of impaired circulation and skin breakdown*. Avoid wrapping the undercast padding too loosely *to reduce the risk of friction injuries*. [2](#) [8](#)
 - Apply multiple (two to four) layers of undercast padding *to reduce the risk of cast saw burns during cast removal*. Avoid wrinkles and overpadding *to prevent pressure points*. [2](#) [3](#) [8](#)
- Apply a cast removal safety strip (if available) according to the manufacturer's instructions; *use of a protective strip beneath the casting material can mitigate risks associated with cast*

removal.³⁴

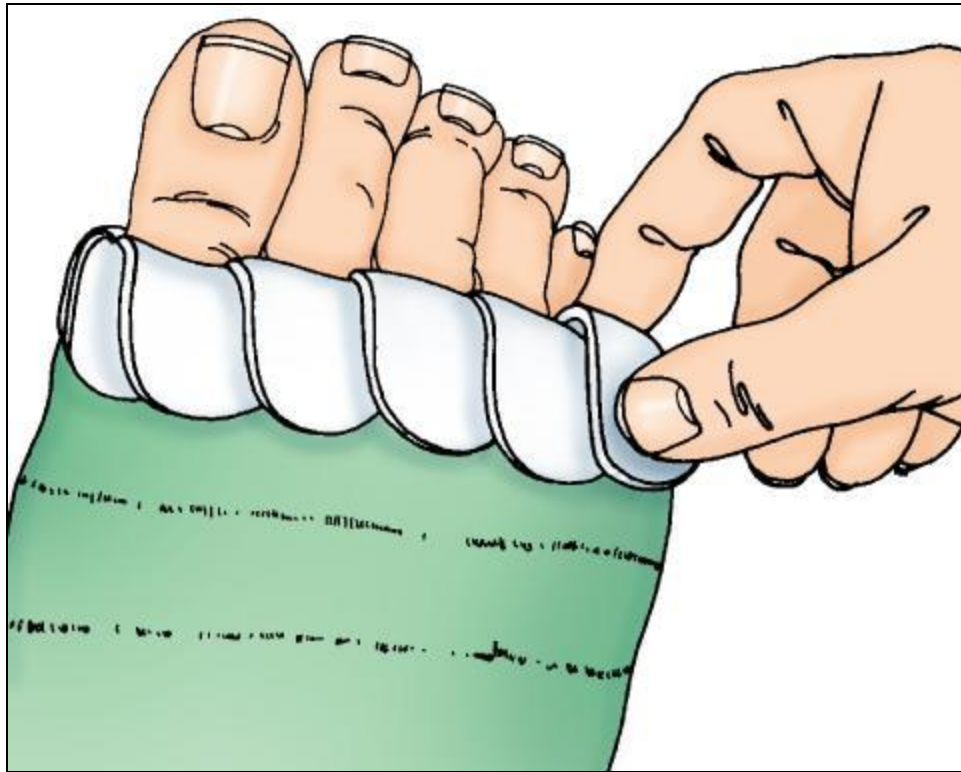
- Perform hand hygiene.^{11 12 13 14 15 16}
- Put on gloves if you're using fiberglass casting material.^{2 8}
- Prepare each roll of casting material. Alternatively, the assisting nurse can perform this function.
 - For plaster, submerge the roll of casting material in a bucket of water. When air bubbles stop rising from the roll, remove it and gently squeeze out the excess water.
 - For fiberglass, open one roll at a time *to prevent the opened rolls from being activated before use*. If you're using water-activated fiberglass casting material, add a minimal amount of water *to initiate the chemical reaction that causes the cast to harden*. Using too much water makes cast application difficult. If you're using light-cured fiberglass casting material, you can unroll the material more slowly *because this material remains soft and malleable until it's exposed to ultraviolet light, which sets it*.

♦ **Clinical alert:** When applying a plaster cast, the chemical reaction that occurs between water and the casting material produces heat, which may cause thermal injury; take extra care with older adults *because their skin is more temperature sensitive than younger adults*. Fiberglass casts also produce heat, but the risk is lower because they produce less heat than plaster casts.^{4 35} ♦

- Begin rolling the casting material, starting at the distal end and wrapping circumferentially in a proximal direction, overlapping the previous layer by one-half.^{2 8} If you're using plaster splints, apply them to the middle layers of the cast.
- Mold and smooth the cast using the palms and heels of your hands rather than your fingers *to avoid indentations that may compromise tissue integrity*.⁸
- Before wrapping the last casting material roll, pull the ends of the tubular stockinette over the cast edges, creating a padded end, *which prevents cast crumbling and reduces skin irritation*. Then wrap the final roll of casting material over the ends of the stockinette *to keep it in place*.^{2 3 8}
- Remove and discard your gloves, if worn.³⁰
- Perform hand hygiene.^{11 12 13 14 15 16}
- Petal the edges of the cast as needed using adhesive tape or moleskin *to reduce roughness and cushion pressure points*. (See [How to petal a cast](#).)⁴

HOW TO PETAL A CAST

Rough cast edges can be cushioned by petaling them using adhesive tape or moleskin. To do so, first cut several 4" × 2" (10- × 5-cm) strips of tape or moleskin. Round off one end of each strip *to keep it from curling*, and then tuck the straight end of the strip just inside the cast edge and bring the rounded end of the strip over the edge of the cast to the outside (as shown below).



Smooth the adhesive tape or moleskin with your finger until you're sure it's secured inside and out. Repeat the procedure, overlapping the adhesive tape or moleskin strips until you've gone all the way around the cast edge (as shown below).



- Use a cast stand or your palm to support the cast in a therapeutic position until it becomes firm to the touch (usually within minutes) *to prevent indentation in the cast.*^{[3][4]}
- Place the cast on a firm, smooth surface to continue drying. Promote drying by leaving the cast uncovered and exposed to the air. If permitted by your facility, use a fan *to increase airflow and facilitate the drying process.*^{[3][4]}
- *To facilitate venous return and reduce edema,* elevate the patient's casted extremity above the level of the heart using pillows or blankets.^[1] Make sure the cast has matured and hardened before placing the extremity on a pillow or blanket *because, when a cast is allowed to mature on a pillow or blanket, temperatures beneath the cast can rise to dangerous levels, placing the patient at risk for thermal injury.*^[36]
- Explain to the patient the need to limit activity while the cast dries *because the angles of the cast must be maintained during the drying process to prevent pressure on bony prominences.* As appropriate, explain that fiberglass casts harden within about 30 minutes and plaster casts require at least 24 hours to harden.^{[3][4]}
- Assess the neurovascular status of the patient's casted extremity, including pulses, temperature, color, capillary refill time, motion, sensation, and pain; compare your findings with the extremity on the unaffected side and with baseline assessment findings.^{[3][4]}
- Return the bed to the lowest level *to prevent falls and maintain the patient's safety.*^[37]
- Institute fall precautions as needed *because a cast impairs mobility, increasing the risk of falls.*^{[37][38]} (See the "[Fall prevention](#)" procedure.)

♦ **Hospital-acquired condition alert:** Keep in mind that the Centers for Medicare and Medicaid Services considers an injury from a fall a hospital-acquired condition *because it can be reasonably prevented using a variety of best practices.* Make sure to follow evidence-based fall prevention practices, such as performing a fall risk assessment and instituting fall precautions, *to reduce the risk of injury from a fall.*^{[37][38][39]} ♦

- Discard used supplies in appropriate receptacles.^[30]
- Discard the water from the bucket. If you applied a plaster cast, discard the water into a sink that contains a plaster trap. Don't use a regular sink *because plaster in the water will damage the plumbing.*
- Perform hand hygiene.^{[11][12][13][14][15][16]}
- Reassess and respond to the patient's pain by evaluating the response to treatment and progress toward pain management goals. Assess for adverse reactions and risk factors for adverse events that may result from treatment.^[27]
- Perform hand hygiene.^{[11][12][13][14][15][16]}
- Order an X-ray of the extremity if appropriate *to ensure proper positioning.*
- Document the procedure.^{[40][41][42][43]}

■ Special Considerations

- A cast may need to be opened *to assess underlying skin or pulses or to relieve pressure in a specific area.* In a windowed cast, a specific area is cut out *to allow inspection of the underlying skin or relieve pressure.* A bivalved cast is split medially and laterally, creating anterior and posterior sections. One of the sections can be removed *to prevent pressure* while the remaining section maintains the immobilization.

■ Patient Teaching

Before discharge, teach the patient and family (if applicable) how to care for the cast. Review skin care, positioning, and activity recommendations, including the appropriate use of assistive devices. Teach the patient the signs and symptoms to report. (See [Teaching about cast care](#).)

Teach the patient and family about pain management strategies during discharge planning. Include information about the patient's pain management plan and adverse effects related to treatment. Discuss activities of daily living and items in the home environment that might exacerbate pain or reduce the effectiveness of the pain management plan, and include strategies to address these issues. Teach about safe use, storage, and disposal of opioids if prescribed.^[27]

Tell the patient that, after cast removal, the casted extremity will appear thinner and have less muscle tone than the contralateral extremity. The underlying skin will also appear yellow or gray from the accumulated dead skin and oils from glands near the skin's surface. If appropriate, reassure the patient that the extremity will return to normal with good care and exercise.^[4]



PATIENT TEACHING

TEACHING ABOUT CAST CARE

When teaching a patient and caregivers how to perform general cast care at home, review these points and provide written instructions.^{[1][2][3][4]}

General cast care

- Keep the cast dry. *Water may cause the cast to soften and lose its shape.* Cover the cast with a plastic bag or commercial cast cover while bathing *to protect the cast.* If an area of the cast becomes wet, use a blow-dryer set on cool *to help dry the cast.* However, if waterproof undercast padding was used with a fiberglass cast, the cast can get wet.
- Cover the edges of the cast with clothing *to prevent crumbs and other articles from getting inside the cast.*
- Don't paint or write over the entire surface of the cast *because it needs to breathe.*
- Take an over-the-counter pain medication as recommended or prescribed pain medication as ordered *to ease discomfort.*

Skin care

- Inspect the skin daily for irritation.
- Don't use lotion or powders on the skin around the cast edges or inside the cast.
- Don't use any object to scratch inside the cast, and don't put items down inside the cast. *Items placed inside the cast may damage the skin and cause infection or pressure injuries.*^[3]
- To relieve itching, use one of these techniques:
 - Blow cool air from a blow-dryer into the cast.^[3]
 - Rub the skin around the cast edges.
 - Rub the opposite arm or leg.
 - Tap gently on the cast over the itchy areas.^[3]
 - For severe itching, take diphenhydramine as recommended.

Positioning

- Elevate the casted extremity elevated above heart level for the first 24 to 72 hours *to minimize swelling.*
 - Raise a casted leg by lying in the supine position with the affected leg on top of a pillow.
 - Prop a casted arm so that the hand and elbow are higher than the shoulder.
 - Use a sling as directed.
- Use an ice pack or place ice in a dry plastic bag and wrap it loosely around the cast at the injury site.
- Change position frequently while awake.

Mobility and exercise

- Don't bear weight on the cast unless directed. If permitted to bear weight, use a walking boot.
- Use assistive devices (such as crutches) as instructed.
- Keep objects, throw rugs, and small pets out of pathways in the environment *to reduce the risk of falling.*
- Maintain muscle strength and flexibility by performing recommended exercises *to prevent disuse syndrome.*

Signs and symptoms to report

Contact the practitioner if you experience:

- an inability to move the digits on the affected extremity^{1 44}
- pale or cool digits on the affected extremity⁴⁴
- decreased capillary refill time of the digits on the affected extremity
- numbness, tingling, burning, or stinging in the casted extremity^{1 44}
- increased pain or swelling above or below the cast that isn't controlled with ice, elevation, or pain medication¹
- warmth over an area of the cast, drainage on the cast, or a foul odor coming from the cast⁴⁴
- raw or red skin around the cast
- fever
- extreme discomfort in one specific spot, such as over a bony prominence, *which may indicate a pressure injury or neurovascular compromise*
- cast loosening, cracking, or breaking⁴⁴
- cast tightness.^{1 44}

■ Complications

Complications associated with cast application may include:

- compartment syndrome
- vascular compromise
- disuse syndrome
- thrombosis
- compression neuropathy
- infection
- joint stiffness
- muscle atrophy
- skin breakdown

- thermal injury. (See [Recognizing compartment syndrome.](#))²⁸



COMPLICATIONS

RECOGNIZING COMPARTMENT SYNDROME

Compartment syndrome is a rare but serious complication that can occur if a cast is too tight. As the affected extremity swells, the cast acts as a closed compartment, tightly compressing the nerves and blood vessels. The resulting decreased circulation and tissue oxygenation can lead to permanent nerve damage and loss of the affected extremity. Compartment syndrome is most common in the lower leg and forearm, but it may also occur in the hand, foot, thigh, and upper arm. *Because necrosis and nerve injury may occur after 6 hours of ischemia*, perform frequent neurovascular assessments and be alert for complaints of increased pain or decreased effectiveness of analgesics.⁴⁵

Neurologic assessment of the hand is used to evaluate upper extremity injury. Assess the ulnar nerve by flexing the patient's ring and little finger and by instructing the patient to cross the index and middle finger and abduct the fingers. Assess the median nerve by instructing the patient to oppose the thumb to the ring or little finger. Assess the radial nerve using wrist extension, simultaneous extension of all four metacarpophalangeal joints, and thumb abduction and extension.

Assess the lower extremities by observing for loss of dorsiflexion (foot drop), loss of plantar flexion, and loss of toe dorsiflexion and by testing for diminished sensitivity to stimulation in the space between the first and second toes.

Documentation

Documentation associated with cast application includes:

- date and time of cast application
- anatomic location
- type of cast
- casting material used
- location of any special devices applied
 - plaster splints
 - cast removal safety strip
- vital signs
- pain assessment findings
- skin condition
- neurovascular assessment findings before and after cast application
- any medications administered
- postapplication X-ray (if performed)
 - results (if available)
- unexpected outcomes
 - interventions performed
 - response to those interventions
- teaching provided to the patient and family (if applicable)
 - understanding of that teaching
 - follow-up teaching needed.

Related Procedures

- [Cast application, cotton-polyester](#)
- [Cast application, fiberglass](#)
- [Cast application, pediatric](#)

- [Cast application, pediatric \(Advanced practice\)](#)
- [Cast application, plaster](#)
- [Cast assessment and management, pediatric](#)
- [Cast removal \(Advanced practice\)](#)
- [Cast removal, assisting](#)
- [Cast removal, pediatric \(Advanced practice\)](#)
- [Femur traction splint patient care](#)
- [Hip spica cast care, pediatric](#)
- [Internal fixation care and management](#)
- [Neurovascular assessment](#)

■ Related UpToDate Patient Teaching Handouts

- [Cast care – ED discharge instructions](#)
- [Hip Spica Cast, Child](#)
- [How to care for your cast](#)
- [How to care for your child's cast](#)
- [How to Care for Your Child's Hip Spica Cast](#)

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([Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions](#))

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Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions

The following leveling system is adapted from *Evidence-Based practice in nursing & healthcare: A guide to best practice*, Fifth edition, by Bernadette Mazurek Melnyk and Ellen Fineout-Overholt (2023).

Level I	Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCTs)
Level II	Evidence from well-designed single RCTs (experimental)
Level III	Evidence from well-designed nonrandomized controlled trials (quasi-experimental), systematic reviews of a complete body of evidence, and intervention studies using mixed methods

Level IV	Evidence from well-designed case-control and cohort studies (observational)
Level V	Evidence from systematic reviews of qualitative and descriptive studies
Level VI	Evidence from single descriptive and qualitative studies, evidence-based practice implementation, and quality improvement projects
Level VII	Evidence from expert opinion, expert committee reports, and literature reviews

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