

Reinforcing a Spica Cast With a Fiberglass Bar

Sonia Chaudhry, MD, Kevin Kang, MD, and Mark C. Lee, MD

Abstract

Hip spica casting is used in the treatment of femur fractures and hip dysplasia in children 1 to 6 years old. A bar connecting the legs of the cast has been shown to improve cast integrity and assist in patient transport. We present a simple and low-cost technique that can be used to create a connecting bar and that can be performed with readily available casting materials.

Femur fractures (Orthopaedic Trauma Association classes 31, 32, 33)¹ are common childhood injuries, occurring at a rate of 19 per 100,000 children in the United States.² Peak occurrence is bimodal at ages 2 and 17 years. The most common mechanism of injury in children under 6 years is a fall, and hip spica casting is the preferred treatment modality in this group.³⁻⁵

A bar connecting the legs of the spica cast has been shown to facilitate patient transport⁵ and significantly decrease mechanical failure of the spica cast.⁶ This bar often consists of a broom handle or pipe that must be cut to size during the case and subsequently incorporated into the cast—tasks that are often inconvenient and time-consuming for on-call or emergency department staff unfamiliar with orthopedic tools.

In this article, we review a spica cast application that incorporates a low-cost, lightweight technique for fabricating a connecting bar from existing fiberglass casting material. The Institutional Review Board at Connecticut Children’s Medical Center approved this work.

Technique of Double-Leg Spica Casting With Fiberglass Bar

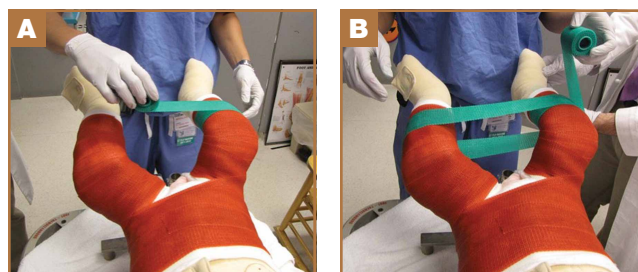
A spica casting table (Orthopedic Systems) with a well-padded post is placed on the operating room table and adjusted to the length of the patient from perineum to just below the shoulders. With the patient under general anesthesia, folded towels are used to provide 2 to 4 cm of padding on the anterior torso, atop which a waterproof pantaloon is applied. The patient is transferred to the spica table, and the patient’s arms are gently secured to the casting table with cast padding or tape in an abducted position at the shoulders. A surgeon

controls the legs by holding the feet with the long fingers just above the heels, the index fingers on the anterior ankle, and the thumbs on the soles of the feet. Cast padding is wrapped from the nipple line to the supramalleolar region on each leg. The bony prominences of the malleoli, patella, fibular head, femoral condyles, iliac crests, and coccyx are well padded.

Fiberglass is then rolled without compression onto the patient, beginning with the torso and perineal areas. The injured leg is wrapped to its final length above the malleoli while the uninjured leg is kept free. Maintaining the position of the injured leg with simultaneous molding at the fracture site, typically to promote valgus, allows fracture reduction. The fracture position is then checked under image intensification. For femur fractures, hip abduction and flexion are set to 45° and 90°, respectively, while knee flexion is between 50° and 90°. The uninjured leg is then wrapped with fiberglass. Additional strips of fiberglass can be used to reinforce weak junctional regions between the torso and the legs, posteriorly over the “intern’s triangle” and anteriorly along the hip crease.

A connecting fiberglass bar is then created using a fiberglass roll once the cast is hardened. A 2-inch fiberglass roll is wrapped around one leg to secure its position (Figure 1A) and then rolled around the second limb (Figure 1B). Fiberglass is then pulled taut and rolled around the bridge that has been created in order to thicken the bar (Figure 2). The roll is again brought around the closest limb, wrapped back across the bridge to the other limb, and rolled out to its full length. Last, the legs are abducted 1 to 2 cm to tension the bar (Figure 3). Although this does not produce enough movement to cause a crease and a resultant ulcer, careful inspection of

Figure 1. Double leg spica cast with initial placement of fiberglass (A) around one leg (B) followed by the other leg.



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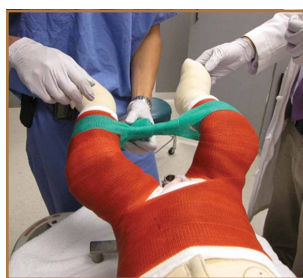


Figure 2. Bridge formed by fiberglass across legs is then wrapped circumferentially.

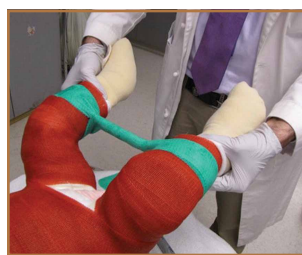


Figure 3. After rewrapping until length of 1 roll is used, legs are abducted to tension fiberglass bar while bar dries.

common pressure points (eg, popliteal fossa) should be performed after the cast is complete.

The chest towels are removed, and the final cast is inspected clinically and fluoroscopically at the fracture site before extubation. The cast is trimmed as needed to ensure room for perineal care, as well as full ankle flexion and extension without impingement. Cast edges are further petaled with plastic tape (Hy-Tape International) to provide padding and prevent the waterproof lining from tearing.

Postoperative care involves overnight observation and caregiver practice in perineal care. Frequent rotation from supine to prone is encouraged. Nurses confirm car-seat fit before dis-

charge. If needed, radiographs are obtained 7 to 10 days later to help with wedging adjustment. The cast is removed in the clinic when adequate callus is appreciated on subsequent radiographs.

Case Series

Our experience with this technique in 16 unilateral femur fractures has been favorable (Table). Patient age ranged from 5 months to 3 years. Mean pretreatment angulation was 13° varus and 11° procurvatum. The majority of fractures were femoral shaft fractures; 1 was proximal, 2 distal.

All fractures united without cast revision. Mean cast time was 4.5 weeks (range, 16 days–6 weeks). Immediate postoperative alignment was 2.5° varus (range, 11° valgus to 16° varus) and 7° procurvatum (range, 1° recurvatum to 22° procurvatum). Mean shortening was 1.5 cm (range, 0–2.7 cm). Final alignment was 1° valgus (range, 9° valgus to 12° varus) and 5° procurvatum (range, 0° to 22°). Mean follow-up was 8 months. There were no cases of skin maceration or cast failure. No casts precluded use of a spica car-seat. Figure 4 shows a typical case with a midshaft fracture treated with closed reduction and casting for 4 weeks with good remodeling at final follow-up, 19 months after injury.

Discussion

Although single-leg walking spica casts have been shown to safely treat low-energy femur fractures in children 1 to 6 years

Table. Patient Data

Patient No.	Age at Injury, mo	Side	Location	Cast Duration, wk	Follow-Up, mo	Preoperative Radiographs		Postoperative Radiographs		Shortening, mm	Final Radiographs	
						AP ^a	Lateral ^b	AP ^{a,c}	Lateral ^b		AP ^a	Lateral ^b
1	32	R	Middle	5	19	-10	10	5	3	17	7	0
2	27	R	Middle	5	1	-28	16	-3	-1	20	-3	1
3	29	R	Proximal	5	1	20	0	11	0	15	9	0
4	10	L	Distal	2	2	0	0	0	0	0	-5	0
5	18	L	Middle	4	12	-15	10	-8	10	6	0	0
6	5	L	Distal	3	4	-18	25	-16	22	0	0	22
7	39	L	Middle	5	14	-20	10	-6	0	20	1	0
8	24	R	Middle	5	13	-21	17	0	7	24	5	0
9	23	R	Middle	5	8	-20	15	0	10	25	0	0
10	30	L	Middle	6	1	-24	24	-12	18	16	-12	17
11	38	L	Middle	6	12	-20	15	0	8	20	6	2
12	39	R	Middle	5	12	-25	15	-7	7	27	1	10
13	23	R	Middle	4	4	2	12	0	8	15	0	5
14	22	R	Middle	4	19	2	6	2	12	7	0	10
15	42	L	Middle	5	4	-24	0	-6	10	25	1	8
16	11	L	Middle	5	5	0	0	0	0	0	0	0

Abbreviation: AP, anteroposterior.

^aDegrees of varus (negative) or valgus (positive).

^bDegrees of extension (negative) or flexion (positive).

^cImmediate postoperative values based on intraoperative imaging or on imaging performed within 1 week after cast application.

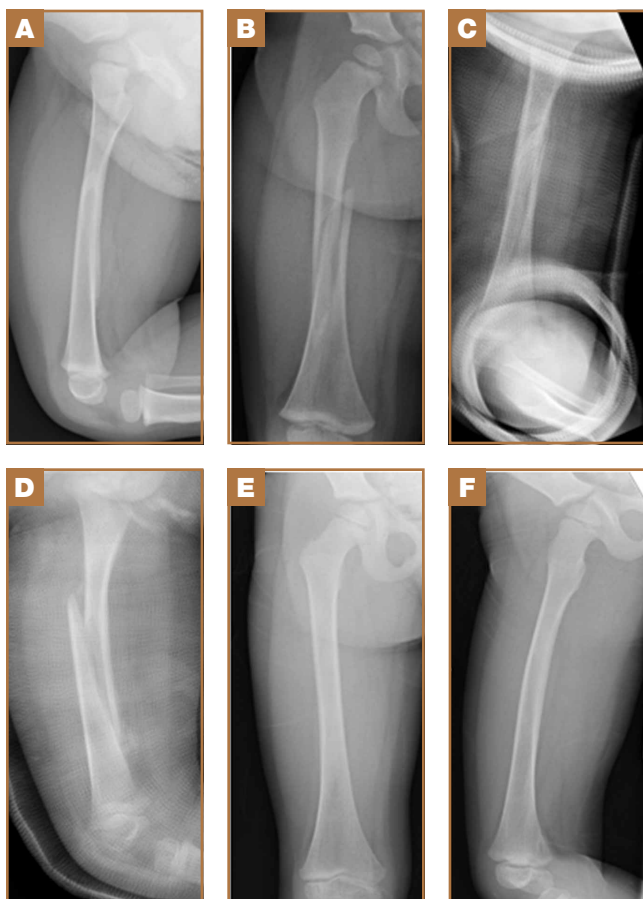


Figure 4. (A, B) Typical radiographic appearance of midshaft femur fracture in a 21-month-old boy (C, D) treated with closed reduction and casting under general anesthesia, (E, F) with healing and remodeling at 19-month follow-up.

old,⁷ length-unstable femur fractures, bilateral femur fractures, and patients with hip dysplasia continue to be managed with a double-leg hip spica construct. Cast integrity remains fundamental to the control of most fractures and prevention of cast-related complications, such as skin maceration and ulceration. Surgeons typically use spica cast reinforcement schemes—such as cast augments of the torso–limb junction, with multiple layers of casting material or incorporation of a connecting bar between the legs, typically constructed by overwrapping a wooden dowel in casting material—to improve the mechanical stability of casts.⁶ The present technique of creating a connecting bar from fiberglass casting material significantly simplifies the standard wooden dowel approach and provided excellent results in our treatment group in terms of cast integrity and fracture alignment. In addition, at our institution, a roll of fiberglass costs \$2.10, whereas a wooden dowel costs \$3 to \$10 and can be difficult to locate if not frequently used. Other tube-shaped materials, such as the disposable material used to package implants and tubes, carry an even lower cost. However, we have found that a single fiberglass roll is most readily available and easiest to apply.

Although proper spica cast application remains important

in managing pediatric trauma, it lacks a good technical description in the literature. In this technical report, we have presented our standard spica cast application method, which minimizes the range of cast complications that have been reported, from minor skin irritation to superior mesenteric artery syndrome. Two salient technical highlights are use of waterproof pantaloon liners and cast petaling, which we have found almost eliminate the morbidity of potential skin complications, reported to occur at a rate of 28%.⁸ In addition, we forgo applying the cast on the injured leg in segments. Application of a short-leg cast on the injured leg to allow traction on the leg during cast application is of dubious utility and may be potentially harmful, with described complications of peroneal nerve palsy and compartment syndrome.⁹⁻¹¹ Further, it is important to use an abdominal spacer (eg, a stack of towels) under the cast padding to create room for abdominal expansion and minimize pressure thought to induce superior mesenteric artery syndrome. Plastic or rubber abdominal spacers have also been described.^{12,13} Last, leg position is important for reduction and maintenance of the fracture, as well as patient care. Literature advocates minimizing hip abduction to just that needed for perineal care and maximizing hip flexion and knee extension to optimize car-seat fit and safety.¹⁴

Conclusion

Construction of a spica cast lower limb connecting bar from readily available fiberglass casting material allows a facile and rapid addition to the mechanical stability of a spica cast in the treatment of pediatric femur fractures. The technique is low-cost and obviates the need for additional extraneous materials.

Dr. Chaudhry is Assistant Professor, Department of Orthopaedic Surgery, Connecticut Children's Medical Center, University of Connecticut, Hartford, Connecticut. Dr. Kang is Orthopedic Trauma Surgeon, Maimonides Bone & Joint Center, Brooklyn, New York. Dr. Lee is Assistant Professor, Connecticut Children's Medical Center, University of Connecticut, Hartford, Connecticut.

Address correspondence to: Sonia Chaudhry, MD, Department of Orthopaedic Surgery, Connecticut Children's Medical Center, University of Connecticut, Suite 1H, 282 Washington St, Hartford, CT 06106 (tel, 860-545-8654; fax, 860-545-8650; email, schaudhry02@connecticutchildrens.org).

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