

KEY PROCEDURES

SUBMUSCULAR PLATE FOR PEDIATRIC FEMORAL FRACTURES

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Published outcomes of this procedure can be found at: *J Am Acad Orthop Surg.* 2012 Sep;20(9):596-603

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Abstract

Management of pediatric femoral fractures is dependent on patient age and injury pattern. For length-stable femoral shaft fractures in school-age children (5 to 11 years of age), flexible intramedullary nailing (IMN) is a popular treatment method. However, for fracture patterns that are length-unstable or involve the proximal or distal third of the femur, flexible IMN has a higher rate of postoperative complications. Use of a submuscular bridge plate has been shown to be an effective alternative to IMN for these injuries. Because this long plate is inserted with a minimally invasive technique and indirect reduction, it acts as an internal type of “external fixator,” thereby avoiding soft-tissue stripping at the fracture site and decreasing strain across the fracture site.

- Step 1: Position the patient supine on a radiolucent table with a bump under the ipsilateral hip.
- Step 2: Lay a 4.5-mm narrow stainless-steel plate over the injured thigh and use fluoroscopy to determine the appropriate length for this plate. Contour the plate as needed.
- Step 3: Make a lateral, longitudinal incision of 2 to 3 cm at the proximal or distal part of the femur through the iliotibial band. Elevate the vastus lateralis extraperiosteally from the femur using a Cobb elevator. Pass the plate through this plane proximally or distally while maintaining contact between the plate and the femur.
- Step 4: Adjust the plate position using fluoroscopy. Obtain fracture reduction using closed techniques and secure the plate temporarily with Kirschner wires through the most proximal and distal holes.
- Step 5: Place the first screw near the end of the plate under direct visualization. Place the second screw using a percutaneous technique and insert it immediately proximal or distal to the fracture site where the femur is farthest from the plate. The drilling and length measurement of this screw are fluoroscopically aided and will bring the plate down into contact with the femoral cortex.

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- Step 6: Place the remaining screws in a similar fashion; 3 screws proximal and distal to the fracture site provide adequate stability. Locking screws or lag screws are typically not necessary in this construct. Obtain final radiographs to ensure appropriate reduction length, alignment, and rotation.

Postoperatively, patients begin hip and knee range-of-motion exercises without immobilization. Touch-down weight-bearing with crutches is used until callus formation is seen on radiographs, usually in 6 to 8 weeks. The plate can be removed 6 months after the index surgery.

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References

1. Abdelgawad AA, Sieg RN, Laughlin MD, Shunia J, Kanlic EM. Submuscular bridge plating for complex pediatric femur fractures is reliable. *Clin Orthop Relat Res.* 2013 Sep;471(9):2797-807.
2. Eidelman M, Ghayeb N, Katzman A, Keren Y. Submuscular plating of femoral fractures in children: the importance of anatomic plate precontouring. *J Pediatr Orthop B.* 2010 Sep;19(5):424-7.
3. Hoffmann MF, Gburek J, Jones CB. A novel technique for pediatric femoral locked submuscular plate removal: the 'push-pull' technique. *J Orthop Surg Res.* 2013 Jul 11;8:21.
4. Kanlic EM, Anglen JO, Smith DG, Morgan SJ, Pesántez RF. Advantages of submuscular bridge plating for complex pediatric femur fractures. *Clin Orthop Relat Res.* 2004 Sep;426:244-51.
5. Li Y, Hedequist DJ. Submuscular plating of pediatric femur fracture. *J Am Acad Orthop Surg.* 2012 Sep;20(9):596-603.
6. May C, Yen YM, Nasreddine AY, Hedequist D, Hresko MT, Heyworth BE. Complications of plate fixation of femoral shaft fractures in children and adolescents. *J Child Orthop.* 2013 Jun;7(3):235-43. Epub 2013 Apr 11.
7. Pate O, Hedequist D, Leong N, Hresko T. Implant removal after submuscular plating for pediatric femur fractures. *J Pediatr Orthop.* 2009 Oct-Nov;29(7):709-12.
8. Samora WP, Guerriero M, Willis L, Klingele KE. Submuscular bridge plating for length-unstable, pediatric femur fractures. *J Pediatr Orthop.* 2013 Dec;33(8):797-802.
9. Sink EL, Hedequist D, Morgan SJ, Hresko T. Results and technique of unstable pediatric femoral fractures treated with submuscular bridge plating. *J Pediatr Orthop.* 2006 Mar-Apr;26(2):177-81.
10. Stoneback JW, Carry PM, Flynn K, Pan Z, Sink EL, Miller NH. Clinical and radiographic outcomes after submuscular plating (smp) of pediatric femoral shaft fractures. *J Pediatr Orthop.* 2016 Jun 2. [Epub ahead of print].