

Distal Femoral Physeal Fractures and Peroneal Nerve Palsy: Outcome and Review of the Literature

John F. Sloboda, MD, Paul L. Benfanti, MD, John J. McGuigan, MD, and Edward D. Arrington, MD

Distal femoral physeal injuries commonly result in growth disturbance. Leg length discrepancy or angular deformities occur in approximately 40% to 50% of patients.¹ The mechanism of the physeal injury usually involves a varus or valgus force with resultant medial or lateral displacement of the epiphysis.² Injury to popliteal neurovascular structures has been less commonly associated with distal femoral physeal fractures. The mechanism of neurovascular injury is a hyperextension force with anterior displacement of the epiphysis resulting in traction injury.¹

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Peroneal nerve injury in association with distal femoral physeal injury has been described in 6 patients.³⁻⁷ Four of 6 patients had complete return of peroneal nerve function by 6 months.^{4,6,7} Two of 6 patients had described peroneal nerve injuries, although the functional outcome was not reported.^{3,5} We describe an additional patient who sustained a distal femoral physeal fracture with concomitant peroneal nerve palsy.

MAJ Sloboda is Staff Orthopaedic Surgeon, Guthrie Ambulatory Clinic, Fort Drum, New York.

LTC(P) Benfanti is Staff Orthopaedic Surgeon, Madigan Army Medical Center, Fort Lewis, Washington.

MAJ McGuigan is Staff Orthopaedic Surgeon, Martin Army Community Hospital, Fort Benning, Georgia.

COL Arrington is Staff Orthopaedic Surgeon, Madigan Army Medical Center, Fort Lewis, Washington.

Requests for reprints: Paul Benfanti, MD, MCHJ-SOP, Madigan Army Medical Center, Tacoma, WA 98431 (tel, 253-968-3180; fax, 253-968-1586; e-mail, paul.benfanti@nw.amedd.army.mil).

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CASE REPORT

A 9-year-old girl sustained a right knee injury while jumping on a trampoline. The patient complained of immediate knee pain, swelling, and inability to ambulate. Physical examination demonstrated intact skin, moderate right knee effusion, and intact pedal pulses. Neurologic examination revealed absent tibialis anterior, extensor hallucis longus, and extensor digitorum longus function with loss of light touch sensation in the superficial and deep peroneal nerve sensory distributions. Initial radiographs demonstrated a Salter-Harris II pattern distal femoral physeal fracture with complete anterior and mild medial displacement of the epiphysis (Figure 1).

Closed reduction and percutaneous pinning were performed (Figure 2). Exploration of the peroneal nerve was not performed at the time of surgery. Neurologic status improved slowly. Tibialis anterior and extensor hallucis longus function improved to 2/5 by 6 weeks. At 4 months, the patient had regained normal motor strength and light touch sensation in the peroneal nerve distribution and full active range of motion of the knee. Radiographs demonstrated complete healing at 6-month follow-up with probable physeal bar formation (Figure 3).

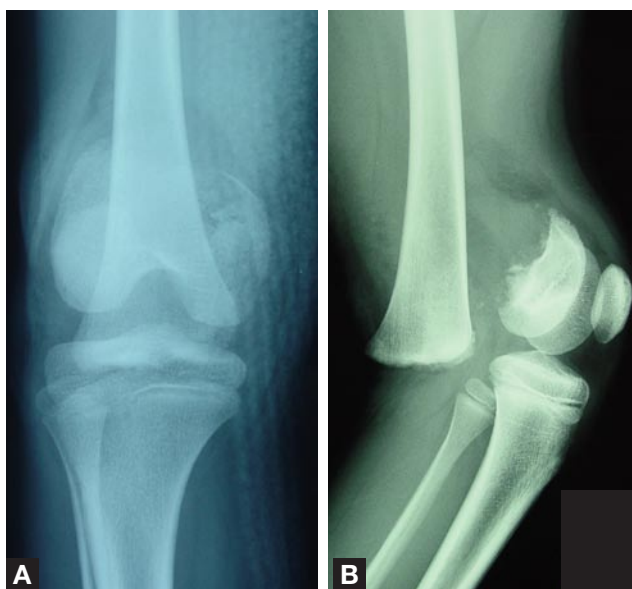


Figure 1. Distal femoral physeal fracture, Salter-Harris II pattern. (A) Anteroposterior view showing mild medial displacement. (B) Lateral view showing complete anterior epiphyseal displacement.

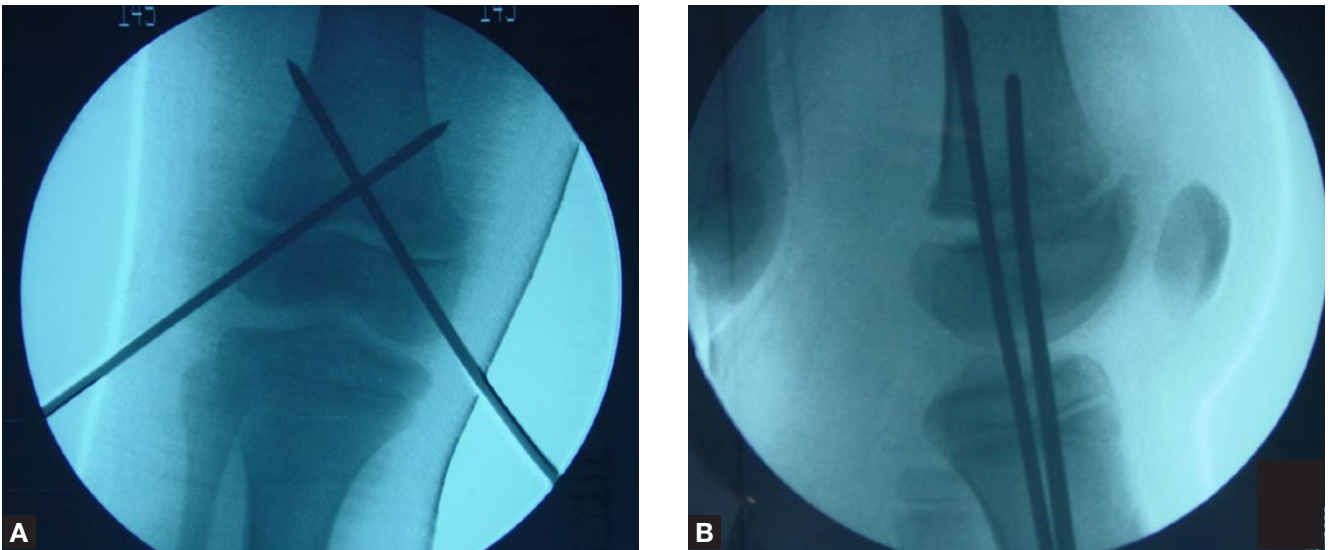


Figure 2. Distal femoral physeal fracture after closed reduction and percutaneous pinning. (A) Anteroposterior view. (B) Lateral view.

DISCUSSION

Distal femoral physeal fracture was originally known as wagon-wheel fracture. Individuals trying to mount moving horse-drawn vehicles entangled their foot in the moving wagon wheel, resulting in a severe hyperextension knee injury; open, contaminated distal femoral physeal fractures with associated popliteal neurovascular embarrassment would often result.⁸ Unfortunately, many of these injuries necessitated amputation.

Peroneal nerve injury has been a rarely described complication of distal femoral physeal fractures in the last 50 years. This combination of injuries has not been reviewed in the English-language literature. In a review of 206 patients with distal femoral physeal fracture, Beaty and Kumar⁹ noted a 2% incidence (4 patients) of neurovascular injury. These injuries were primarily vascular, and no numbers were cited for patients with associated peroneal nerve injury. In our review of 311 patients with distal femoral physeal fracture (Table), we found a total of 6 cases (~2%) with peroneal nerve palsy. This case report adds a seventh case to the literature.

Six cases of distal femoral physeal fracture and peroneal nerve palsy have been described in the literature. In a review of 100 cases of distal femoral physeal fractures, Roberts⁶ documented only 1 case of peroneal nerve palsy, which resolved without operative intervention. Stephens and colleagues⁷ reviewed 20 distal femoral physeal fractures and documented 2 cases of peroneal nerve palsy. Lateral epiphyseal displacement was described in 1 patient and was not commented upon in the second patient. Lombardo and Harvey⁴ noted 1 case of transient peroneal nerve palsy in a review of 34 distal femoral physeal fractures, and the epiphyseal displacement was medial. The peroneal nerve palsy resolved over 6 months. In a review of 10 distal femoral physeal fractures by Graham and Gross,³ 1 patient was noted to have peroneal nerve palsy; return of peroneal nerve function was not addressed. Riseborough and colleagues⁵ reported on 66 patients with distal femoral physeal fractures and noted 1 case of peroneal nerve palsy; peroneal nerve recovery was not mentioned. Peroneal nerve palsy was not reported in other series of distal femoral physeal fractures.^{8,10-12}

TABLE. SUMMARY OF DISTAL FEMORAL PHYSEAL CASES FROM A REVIEW OF THE LITERATURE

Reference	Total Cases	Cases with Peroneal Nerve Injury	Result
Aitken and Magill ⁸	15	0	NA
Neer ¹¹	21	0	NA
Roberts ⁶	100	1	Full recovery
Stephens et al ⁷	20	2	Full recovery
Criswell et al ¹⁰	15	0	NA
Lombardo and Harvey ⁴	34	1	Full recovery
Riseborough et al ⁵	66	1	Unknown
Graham and Gross ³	10	1	Unknown
Thomson et al ¹²	30	0	NA
Total	311	6	

NA indicates not applicable.

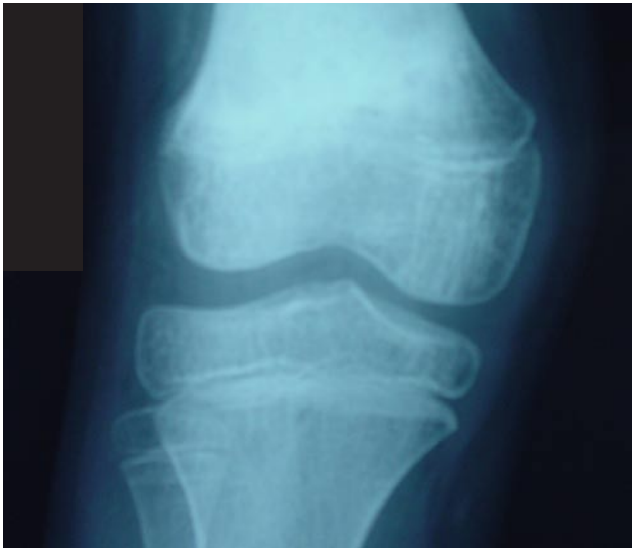


Figure 3. Complete healing of physal fracture at 6 months with lateral physal bar.

In our patient the epiphyseal displacement was anterior and medial. Full recovery of the peroneal nerve was evident by 4 months. Previous discussions of causative factors for neurovascular injuries associated with distal femoral physal fractures have focused on anterior epiphyseal displacement as the primary risk factor.¹ Peroneal nerve palsy may also occur with isolated medial or lateral epiphyseal displacement, as discussed previously.

“Peroneal nerve palsy may also occur with isolated medial or lateral epiphyseal displacement...”

Given that recovery of peroneal nerve function occurs spontaneously without intervention, peroneal nerve palsy associated with closed distal femoral physal fracture appears to be a neuropraxia or an axonotmesis type of injury. In our review of closed distal femoral physal fracture and concomitant peroneal nerve palsy, including our case, we found that 5 of 7 peroneal nerve palsies resolved spontaneously without intervention. This would indicate that distal femoral physal fracture with associated peroneal nerve palsy may be managed expectantly. Operative

indications for the distal femoral physal fracture itself do not change. Open fractures with complete nerve transection should be managed operatively.²

CONCLUSIONS

Peroneal nerve palsy rarely accompanies distal femoral physal fracture. A comprehensive review of the English-language literature has shown a total of 7 cases with an incidence of approximately 2%. Peroneal nerve palsy may occur with any pattern of epiphyseal displacement. Spontaneous recovery of peroneal nerve function has occurred in the majority of reported cases. Peroneal nerve palsy in association with distal femoral physal fracture appears to be a neuropraxia or an axonotmesis type of injury that may be managed expectantly.

AUTHOR'S DISCLOSURE STATEMENT AND ACKNOWLEDGEMENTS

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REFERENCES

1. Devito DP. Management of fractures and their complications. In: Morrissy RT, Weinstein SL, eds. *Lovell and Winter's Pediatric Orthopaedics*. Philadelphia: Lippincott-Raven; 1996:1229-1313.
2. Sponseller PD, Stanitski CL. Fractures and dislocations about the knee. In: Beaty JH, Kasser JR, eds. *Fractures in Children*. Philadelphia: Lippincott Williams & Wilkins; 2001:981-1076.
3. Graham JM, Gross RH. Distal femoral physal problem fractures. *Clin Orthop Relat Res*. 1990;255:51-53.
4. Lombardo S, Harvey JP. Fractures of the distal femoral epiphysis: factors influencing prognosis; a review of thirty-four cases. *J Bone Joint Surg Am*. 1977;59:742-751.
5. Riseborough EJ, Barrett IR, Shapiro F. Growth disturbances following distal femoral physal fracture-separations. *J Bone Joint Surg Am*. 1983;65:885-893.
6. Roberts JM. Fracture separation of the distal femoral epiphysis. *J Bone Joint Surg Am*. 1973;55:1324.
7. Stephens DC, Louis E, Louis DS. Traumatic separation of the distal femoral epiphyseal cartilage plate. *J Bone Joint Surg Am*. 1974;56:1383-1390.
8. Aitken AP, Magill HK. Fractures involving the distal femoral epiphyseal cartilage. *J Bone Joint Surg Am*. 1952;34:96-108.
9. Beaty JH, Kumar A. Current concepts review: fractures about the knee in children. *J Bone Joint Surg Am*. 1994;76:1870-1880.
10. Criswell AR, Hand WL, Butler JE. Abduction injuries to the distal femoral epiphysis. *Clin Orthop Relat Res*. 1976;115:189-194.
11. Neer CS II. Separation of the lower femoral epiphysis. *Am J Surg*. 1960;99:756-761.
12. Thomson JD, Stricker SJ, Williams MM. Fractures of the distal femoral epiphyseal plate. *J Pediatr Orthop*. 1995;15:474-478.