Perinatal Femur Fracture Following Difficult Cesarean Delivery: A Case Report

Sarthak Aggarwal, BS; Sudhish Chandra, MD

ABSTRACT

Introduction: Neonatal femur fractures from birth trauma are rare, occurring in 0.1 to 2 per 1000 live births, with unclear associations with cesarean delivery. Limited literature leaves gaps in early detection, injury mechanisms, and management.

Case Presentation: This is the case of a full-term female neonate with a femur fracture following a cesarean delivery for breech presentation. The delivery involved a difficult extraction, and the fracture was diagnosed immediately due to crepitus and a "popping" sound. Treatment was complicated by insurance. The patient received a Pavlik harness with good healing.

Discussion: In the literature, diagnosis averages 4 days, relying on late-arising classic signs. The literature is mixed on risks associated with mode of delivery.

Conclusions: Challenging cesarean extractions pose a risk for femur fractures. Early diagnosis is essential and may be expedited by comprehensive screening and early physical exam findings, such as crepitus, a "popping" sound, or decreased limb mobility. Poor access to pediatric orthopedic clinicians may complicate treatment.

INTRODUCTION

Neonatal femur fractures in the setting of birth trauma are exceedingly rare. The estimated incidence of perinatal femur fracture has been reported to be roughly 0.1-2 per 1000 live births.[1-3] Clavicle and humerus fractures from birth trauma are relatively more common, though still infrequent.[4,5] Long bone fractures may occur during both vaginal delivery or cesarean delivery and, while cesarean deliveries have long been thought of as protective against birth trauma, literature has not been definitive on which mode of delivery purports greater risk for femoral fracture. Some studies have posited that most birth-related femur fractures occur in vaginal breech deliveries,[6-9] whereas other studies report a greater incidence with cesarean delivery.[2,3,10] More established risk factors for femoral fracture at delivery include malpresentation, low birth weight, macrosomia, prematurity, osteogenesis imperfecta, fetal osteoporosis, and difficult extraction.[9,11] Given limited literature on these fractures, information on their early clinical detection, mechanism of injury, and preferred management is lacking, and current practices on identifying such fractures partly rely on the extrapolation of practices from other contexts. Further elucidating the epidemiology and risk factors associated with neonatal femur fractures can inform clinical decision-making and contribute to improved outcomes for affected infants. We report the case of a full-term neonate found to have a closed fracture of the femoral shaft following cesarean delivery for breech presentation.

CASE REPORT

This is the case of a female neonate born at 39 weeks 0 days via cesarean section to a gravida 1 para 1 (G1P1) mother in a community hospital. The mother's prenatal course was uncomplicated, and she received routine care throughout her pregnancy. She did not have a history of diabetes or drug use, nor was there any family history of musculoskeletal diseases, such as osteogenesis imperfecta. Cesarean delivery was ultimately indicated due to breech presentation, and the neonate was born via a low transverse incision with Apgar scores of 7 and 9 at 1 and 5 minutes, respectively. Delivery was complicated by a difficult extraction, in which the leg was internally rotated to deliver the infant through the hysterotomy. Given the challenging positioning of the neonate and relatively limited space provided by the hysterotomy, additional

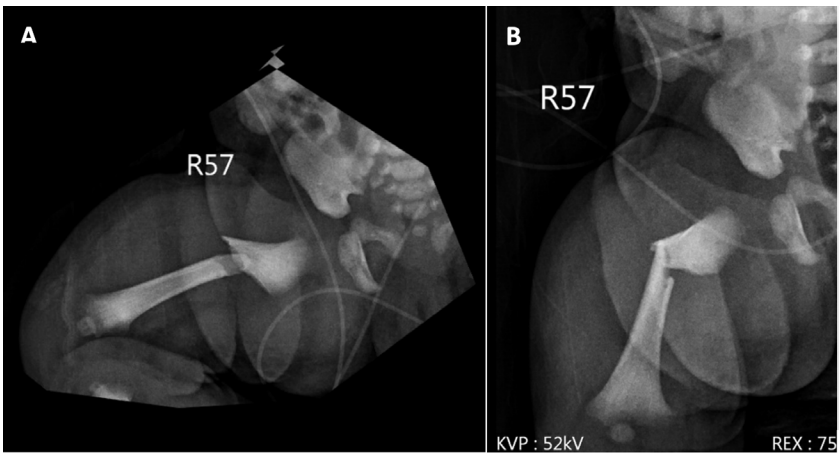
Author Affiliations: University of Chicago Pritzker School of Medicine, Chicago, Illinois (Aggarwal); Department of Pediatrics, St. Mary Medical Center, Hobart, Indiana (Chandra).

Corresponding Author: Sarthak Aggarwal, email sarthak.aggarwal@uchicagomedicine.org; ORCID ID 0000-0001-9887-1223

traction and rotation was deemed necessary to successfully extract the neonate. Upon this internal rotation, a "pop" was felt at the level of the hip, and this exam finding was noted by the obstetrician.

The attending obstetrician communicated this finding with the attending neonatologist, who promptly examined the infant. The infant was found to have crepitus upon palpation of the right thigh, with only slight swelling of the area. The circumference of the right thigh was noted be 1 centimeter greater than that of the left thigh. Neurovascular exam was intact, with distal pulses, sensation, and motor tone intact immediately following delivery. The infant was noted to be irritable, though this observation was largely nonspecific. Laboratory workup was also unremarkable at the time. Anterior posterior and lateral view x-rays were obtained given the high index of suspicion for fracture, and imaging demonstrated an oblique fracture of the proximal femoral diaphysis with a rotational component (Figure). Of note, there was no dislocation at the hip noted on radiographic imaging, and gentle manipulation while holding proximal to the fracture site produced no frank dislocation. The infant was admitted to the neonatal intensive care unit for perinatal femur fracture and remained stable. Given the rare nature of this pathology and the lack of pediatric orthopedic specialists in the area, she was transferred to a tertiary medical center in a nearby city for further care.

Figure. Anterior Posterior View (A) and Lateral View (B)



At the tertiary center, a pediatric orthopedic surgeon and resident on call performed a physical exam. The exam ultimately revealed no gross deformity or skin changes over the extremity, and the patient continued to be neurovascularly intact; however, she cried upon manipulation of the affected extremity. Given the clinical context and imaging studies, as well as the lack of significant neurovascular compromise, she received a Pavlik harness for right lower extremity fracture immobilization and was discharged with plans for outpatient follow-up. The chest strap of the Pavlik harness was applied allowing space for respiration, the anterior leg strap was fastened to maintain hip flexion of roughly 90 degrees, and the posterior leg strap was fastened to produce roughly 45 degrees of abduction. It was advised that the harness be worn at all times with the exception of brief removal for bathing and sanitation. Follow-up was complicated by the tertiary center's specialists being out of network given the patient's insurance, and she was unable to return for follow-up. Instead, specialist follow-up with pediatric orthopedic surgery was pursued at another tertiary center. Healthy callus formation was noted at 3 weeks, and improved alignment and excellent healing were seen at subsequent follow-up visits. There were no complications during the follow-up period, and the patient's parents strictly adhered to immobilization recommendations and appropriate harness usage. She ultimately demonstrated a full recovery with complete healing of the femur and return to age-appropriate activity and function.

DISCUSSION

We observed a perinatal femur fracture in a full-term neonate following cesarean delivery for breech presentation. Cesarean delivery is recommended for breech delivery, but its role in reducing risk of birth trauma is a matter of debate. Even so, femur fractures related to delivery are exceptionally rare.[2,7]

A case series by Kancherla et al found the mean time to diagnosis to be 4 days for perinatal femur fractures, similar to prior studies.[7] While some femur fractures may be diagnosed soon after delivery due to more dramatic presentations, other cases may not be identified until much later due to a lack of symptoms or poor access to care.[2] In our case, the fracture was diagnosed immediately following delivery due to collaboration between the attending obstetrician and neonatologist, as well as identification of key physical exam findings. Close observation of neonates with risk factors for perinatal femur fracture—especially breech presentation or difficult extraction—also may help with early detection. A screening protocol may best address this, in which neonatologists examine such high-risk neonates to detect the aforementioned early physical exam signs.[7] Parents of at-risk neonates also should be educated on classic symptoms, as this may reduce delays in care after discharge.

Common presentations of perinatal femur fractures include thigh swelling, decreased mobility of the affected leg, focal tenderness, and irritability.[2,5,11] In the case presented here, a sound was heard during delivery, which prompted further examination by the neonatologist. Many of the classic symptoms noted above, such as soft tissue swelling, focal tenderness, and irritability, may present late and thus were not prominent on initial examination in our case.[2] However, the presence of crepitus was a key early exam finding in our case, even though it is one that may not be checked for

routinely. In the timeframe immediately following delivery, careful clinical examination for crepitus and decreased mobility may quicken diagnosis of perinatal femur fracture, as opposed to waiting for the emergence of other classic physical findings and may avoid unnecessary investigation for nonaccidental trauma associated with delayed discovery.

Perinatal femur fractures tend to be spiral fractures of the proximal femur, suggesting a torsional mechanism of injury in the delivery process.[1,7] In the case of a cesarean delivery, this may be due to poor maneuverability of the fetus given anatomic challenges (eg, uterine anatomy, small incision, fetal positioning) or poor delivery technique. In our case, a difficult extraction with torsion of the leg likely contributed to the fracture.[7,8] In vaginal deliveries, breech fixation at the pelvis may lead to excessive leg traction.[7] Unanticipated fracture patterns in the absence of excessive traction may necessitate further workup for other causes of fracture, including metabolic and musculoskeletal disorders. Nonaccidental trauma is another important consideration in fractures discovered after discharge. Notably, any forceful traction may result in long bone injury, and our case highlights the definite risk for femur fracture with cesarean delivery.[10]

Prognosis of birth-related femur fracture is generally excellent with appropriate diagnosis and treatment, and treatment is mostly nonoperative.[1,12] Given the superior healing capacity of infants and children relative to adults, surgical intervention is very rarely indicated. Furthermore, fractures generally heal well through secondary bone healing without any long-term sequelae, such as deformity, neurologic deficit, or limb-length discrepancy.[1] However, early diagnosis and treatment limits prolonged distress for both the infant and family and may avoid the need for nonaccidental trauma investigation. A variety of treatment options exist, all of which ultimately aim to immobilize the femur. Pavlik harness, splint, spica cast, and Bryant traction are all acceptable treatment methods that have been shown to be effective.[7,12]

A Pavlik harness was used in the present case, as it is inexpensive, simple to use, and allows for quick discharge. Though treatment with these harnesses is generally uncomplicated, Pavlik harnesses should still be monitored for possible complications, most notably femoral nerve palsy, avascular necrosis of the femoral head, and skin breakdown.[5,9] Femoral nerve palsy may result from excessive hip flexion, and patient families must be vigilant for leg weakness—particularly with knee extension. In contrast, avascular necrosis may occur with excessive abduction or otherwise improper positioning and is often accompanied by increasingly limited, painful hip movement that families may notice during diaper changes. Finally, skin irritation may occur due to excess tightness or poor positioning of harness straps, which should be checked regularly for underlying irritation. If symptoms arise, patient families should consult their care provider, who may then adjust the harness and perform a careful physical exam.

Given the necessity for such close follow-up and monitoring, a study by Givon et al posited that Pavlik harnesses may cause unnecessary distress to new parents versus inpatient care with Bryant traction, allowing for continuous professional nursing care.[12] However, in addition to Bryant traction being logistically challenging, the efficacy of this method may be rooted in the increased frequency and quality of communication between clinicians and family. Thus, while the ability of caretakers to closely provide care at home for their infant should be considered when weighing treatment options, high-quality communication with families and convenient follow-up should be prioritized when caring for such fractures.

In our case, a lack of orthopedic specialists comfortable with Pavlik harness application in the community required the patient to be transferred to a tertiary care facility in an adjacent state for Pavlik harness placement, and insurance issues necessitated follow-ups at a separate facility located significantly farther away. Thus, the present case not only highlights hurdles to timely and effective care but also underscores the logistical challenges of outpatient management and need for pediatric orthopedic care that is easily accessible. This is particularly relevant to socioeconomically disadvantaged families, who may not have the resources to travel hours for care and follow-up. Even in the absence of orthopedic specialist care, training in the basics of fracture care and immobilization techniques could allow for improved care in community settings. Such training may be directed towards neonatologists, pediatricians, and family medicine clinicians and may include training on reduction techniques, Pavlik harness and spica cast application, and general cast application workshops and principles. In the case presented here, a lack of local treatment options required the patient to seek regular care hours from home, contributing unnecessary stress to an already distressing situation.

Thus, despite advances in perinatal care, challenges persist in the timely diagnosis and management of perinatal femur fractures—particularly in regions with limited access to pediatric orthopedic expertise. Developing standardized protocols for the screening and management of neonates at risk for birth-related fractures could enhance early detection, decrease family distress, and expedite timely treatment and should be achieved through multidisciplinary efforts by obstetricians, pediatricians, and orthopedists. Such screening ideally would allow for pediatricians and obstetricians to identify key risk factors related to prenatal history and delivery method to stratify patients at high risk for such fractures and prompt further workup. Similar efforts to create screening guidelines have begun at our own institution to guide the identification and care of these fractures.

Additionally, efforts to improve access to specialized care, such as telemedicine consultations or regional referral networks, may mitigate the logistical barriers faced by families and clinicians in underserved areas. These relationships may begin through networking with local orthopedists as well as through the creation of formalized procedures for referrals and transfers to tertiary centers, as has recently begun in our institution. Further research is warranted to

explore the long-term implications of perinatal femur fractures and evaluate the effectiveness of different treatment modalities in optimizing outcomes for affected infants. Collaboration among perinatal and orthopedic specialists is essential to ensure comprehensive and coordinated care for these vulnerable patients. Ultimately, while the need for pediatric orthopedic specialists in the community may not be fixable immediately, mitigating patient and family distress is a critical part of improving care. Providing educational materials and clear communication about the excellent outcomes of these fractures, maintaining frequent follow-up with pediatric specialists and care coordinators, and building relationships with academic centers for smoother transitions of care are key strategies to make a meaningful impact.

CONCLUSIONS

We present a case of perinatal femur fracture following cesarean delivery for breech presentation. Perinatal femur fracture is a rare but distressing complication and should be diagnosed promptly with appropriate screening and exam. Cesarean delivery—especially difficult extractions with rotation of the leg—carries a definite risk for such fractures, and excessive traction should be avoided when possible. Early diagnosis is important and may be quickened by comprehensive screening and demonstration of early physical exam findings, such as crepitus—a "popping" sound upon delivery—and decreased limb mobility. These signs may emerge before other classic physical exam findings characteristic of fractures. Poor access to pediatric orthopedic providers may complicate the treatment course and be a source of additional distress for patients and their families. However, access to such care may be improved by educating local clinicians on the application of Pavlik harnesses, utilizing local orthopedists as immediate resources, and fostering robust partnerships with tertiary care centers for telemedicine consultations and clinical outreach.

Funding/Support: None declared.

Financial Disclosures: None declared.

Acknowledgements: Written and signed informed consent was provided by the patient's guardian for patient information and images to be published (in print and online).

REFERENCES

1. Morris S, Cassidy N, Stephens M, McCormack D, McManus F. Birth-associated femoral fractures: incidence and outcome. *J Pediatr Orthop.* 2002;22(1):27-30. doi:10.1097/01241398-200201000-00007

2. Kanai Y, Honda Y, Honda T, Sanpei M. Delayed birth-related femur fracture after cesarean section: a case report. *AJP Rep*. 2018;8(3):e158-e160. doi:10.1055/s-0038-1667190

3. Curtelin C, Delille E, Bailly C, et al. Femoral fracture during breech vaginal delivery: a case report. *J Gynecol Obstet Hum Reprod.* 2022;51(3):102310. doi:10.1016/j.jogoh.2022.102310

4. von Heideken J, Thiblin I, Högberg U. The epidemiology of infant shaft fractures of femur or humerus by incidence, birth, accidents, and other causes. *BMC Musculoskelet Disord.* 2020;21(1):840. doi:10.1186/s12891-020-03856-4

5. Pavone V, Vescio A, Montemagno M, et al. Perinatal femoral fracture: a ten-year observational case series study. *Children*. 2020;7(10):156. doi:10.3390/children7100156

6. Bombah FM, Ngalame AN, René E, et al. Obstetric fracture of the femur during cesarean section in a preterm baby: a case report. *J Orthop Orthop Surg.* 2021;2(3):22-24. doi: 10.29245/2767-5130/2021/3.1150

7. Kancherla R, Sankineani SR, Naranje S, et al. Birth-related femoral fracture in newborns: risk factors and management. *J Child Orthop*. 2012;6(3):177-180. doi:10.1007/s11832-012-0412-4

8. Rijal L, Ansari T, Trikha V, Yadhav CS. Birth injuries in caesarian sections: cases of fracture femur and humerus following caesarian section. *Nepal Med Coll J.* 2009;11(3):207-208.

9. Awariwar MD, Iqbal MS, Jayamol MK, Bhat V. Management of a neonatal femoral shaft fracture following breech presentation: a case report. *J Mar Med Soc*. 2022;24(3) S104-S106. doi:10.4103/jmms.jmms_193_20

10. Vellingiri K, Venkataraman S, Shanthappa AH, Seenappa H. Femur shaft fracture in newborns: a report of two cases. *Cureus*. 2021;13(1):e12504. doi:10.7759/cureus.12504

11. Moore MK, Zwemer E, Lohr JA. Femur fracture in a newborn. *Consultant*. 2018;58(11):316-317.

12. Givon U, Sherr-Lurie N, Schindler A, Blankstein A, Ganel A. Treatment of femoral fractures in neonates. *Isr Med Assoc J.* 2007;9(1):28-29.

advancing the art & science of medicine in the midwest

WMJ

WMJ (ISSN 1098-1861) is published through a collaboration between The Medical College of Wisconsin and The University of Wisconsin School of Medicine and Public Health. The mission of *WMJ* is to provide an opportunity to publish original research, case reports, review articles, and essays about current medical and public health issues.

Visit www.wmjonline.org to learn more.