

Cesarean Section and the Risk of Fractured Femur

Asaf Toker MD MHA¹, Zvi H. Perry MD MA², Eugen Cohen MD³ and Hanna Krymko MD⁴

¹Central Administration, Hadassah Medical Organization, Jerusalem, Israel

²Department of Epidemiology and Health Services Evaluation, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer Sheva, Israel

³Pediatric Orthopedics Unit and ⁴Pediatric Division, Soroka University Medical Center, Beer Sheva, Israel

ABSTRACT: **Background:** The rate of cesarean section is increasing and in the United States recently exceeded 30% of all deliveries. Birth injuries during CS are relatively rare. Femur fractures have a very low incidence during both vaginal delivery and CS.

Objectives: To assess our 10 year experience (2008–1997) in managing fractured femur during CS, including a typical case.

Methods: We reviewed the prevalence of femur fractures in two tertiary, academic, level one trauma center hospitals in Israel (Hadassah in Jerusalem and Soroka in Beer Sheva).

Results: During the study period 221,939 deliveries occurred in both hospitals. Of these, 17.6% were cesarean sections (38,990 CS). Of the total number of deliveries, the incidence of femur fracture was 0.077 per 1000 deliveries (17 fractures), and the incidence of femur fracture during CS was 0.308 per 1000 CS (12 fractures).

Conclusions: Cesarean section increases the risk of femur fractures ($P < 0.001$) with an odds ratio of 11.26 (confidence interval 3.97–31.97).

IMAJ 2009;11:416–418

KEY WORDS: fractured femur, cesarean section, risk, birth associated injury

Birth injuries during vaginal delivery are uncommon [1]. The most common fractures during vaginal delivery occur in the clavicle, humerus and femur [2]. Cesarean section has been reported to reduce the incidence of birth-associated injuries to nearly zero [3]. Femoral fracture during delivery is a rare complication [4]. We report a typical case and review all cases of birth-associated femoral fractures during 10 years in two tertiary, academic, level one trauma center hospitals in Israel (Hadassah in Jerusalem and Soroka in Beer Sheva).

PATIENTS AND METHODS

We performed a retrospective study that included all the data on newborns who were hospitalized with a femur fracture

during their first month of life at the Hadassah University Hospital in Jerusalem and the Soroka University Medical Center in Beer Sheva between 1 January 1998 and 31 December 2007. All information on the patients was obtained from the two hospitals' medical files. Recorded data included demographic details such as gender, ethnicity, week of delivery, mode of delivery, relevant medical history, treatment and follow-up. All babies who were hospitalized with a fractured femur due to another medical condition that was not birth related (such as a fall) were excluded from the study. Our study design was approved by the Helsinki Subcommittee for trials in human subjects at Hadassah Medical Center (Research No. 2939).

STATISTICAL ANALYSIS

The data were gathered from the patients' records and from the hospitals' records. Statistical analysis was performed using SPSS (Statistical Package for Social Sciences) for Windows 14.0. We first analyzed the data by using descriptive statistics (mean \pm SD, graphs), followed by statistical analysis using independent parametric (unpaired *t*-test) and a-parametric tests. Comparison of the two hospitals' rates and categorical data (demographics, etc.) was conducted using chi-square tests for categorical variables.

RESULTS

A TYPICAL CASE

A 10 day old baby was admitted to our emergency room due to swelling of his left thigh, local redness and local fever. The baby had been delivered by cesarean section due to a footling breach presentation; it was the mother's seventh pregnancy after six normal deliveries. The infant's birth weight was 3735 g. After delivery the baby cried spontaneously and Apgar scores were 9 and 10 at 1 and 5 minutes respectively. Physical examinations following delivery and prior to release from the hospital at the age of 4 days were normal.

At home the mother noticed redness on the infant's left thigh but she did not seek immediate medical attention. Six days later, while bathing the baby the mother noticed that the area of the left thigh was tender, warm and firm. Due to the above complaints the child was referred to the Soroka

CS = cesarean section

University Medical Center and admitted to the pediatric ward with the presumptive diagnosis of left thigh cellulites. Upon admission the child was afebrile, hemodynamically stable and without signs of distress. Apart from local tenderness, redness and a well-defined induration of his left thigh, the physical examination was normal.

A radiograph of the thigh revealed a closed midshaft fracture of the left femur [Figure 1A] and initial callus formation [Figure 1B]. The left thigh was casted and the orthopedic follow-up was normal. A Technetium bone scan did not reveal additional fractures. Eye funduscopy was normal and a social evaluation did not support the possibility of child abuse. Laboratory analysis including serum levels of calcium, phosphorus and alkaline phosphatase was normal. The working diagnosis was fracture of the left femur as a result of birth injury. The baby was released from the ward 2 days later in good condition.

A follow-up 10 days after his release showed a good callus response, and a fine healing fracture was observed on X-ray [Figure 2]. Physical examination at the age of 2 months was normal.

We searched for all cases of birth-associated femoral fractures during cesarean section and vaginal delivery in two tertiary, academic, level one trauma centers in Israel (Hadassah in Jerusalem and Soroka in Beer Sheva) during a 10 year period. From January 1998 to December 2007 a total of 221,939 deliveries took place at our hospitals; 38,990 (17.6%) of them were performed by cesarean section. Seventeen cases of birth-associated femoral fractures were documented during the first month after the delivery (incidence rate 0.077 per 1000 deliveries). Twelve of the cases occurred during a cesarean section (incidence rate 0.308 per 1000 CS deliveries) [Table 1]. Using these data, we calculated the odds ratio for CS, which was 11.26 (confidence interval 97–31.97). Chi-square analysis revealed a significant difference between the two groups ($P < 0.001$) in the same direction.

DISCUSSION

Three-quarters of all birth-associated fractures to long bones occur during vaginal breech deliveries [5]. During cesarean section, fractures occurred following difficult deliveries where considerable traction was involved. Maneuvers employed during CS, poor delivery techniques, uterine incision and inadequate relaxation may cause these injuries. The typical situation is when the breech is well engaged in the pelvis or when a footling has descended into the vagina [6]. Research has shown that risk factors speculated to be associated with femoral fractures during CS are large fetuses, breech presentation, difficult delivery, inadequate uterine relaxation, small incision, twin pregnancies, osteogenesis imperfecta, prematurity and osteoporosis [7]. It is no surprise that CS

Figure 1. Radiograph of the thigh revealed [A] a closed midshaft of the left femur and [B] initial callus formation

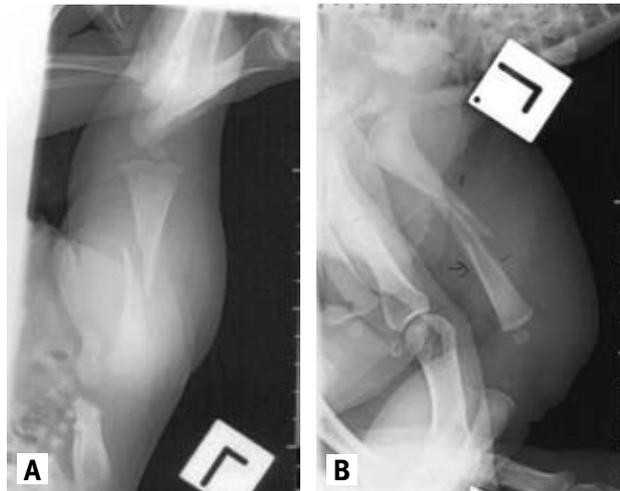


Figure 2. A good callus response and a healing fracture



Table 1. Incidence of femoral fractures during delivery

	Hadassah	Soroka	Total
No. of total deliveries	97,952	123,987	221,939
No. of vaginal deliveries	78,443	104,506	182,949
No. of cesarean sections	19,509	19,481	38,990
CS percentage	15.7%	19.9%	17.6%
Total no. of fractures	8	9	17
Fractures during CS	6	6	12
Incidence per 1000 total deliveries	0.082	0.073	0.077
Incidence per 1000 vaginal deliveries	0.025	0.029	0.027
Incidence per 1000 CS	0.308	0.308	0.308
Average birth weight (g)	2830	2541	
SD	875	725	
Range	1840-3970	1645-3700	
Average gestational age	38	36.4	
SD	1.15	3.32	
Range	37-39	32-40	

is a risk factor for femoral fractures. Eherenfest, in 1922 [7], was the first to report a femoral fracture during cesarean section. He described a midshaft fracture during CS delivery in a mother with diabetes and a uterine myoma. Similarly, Denes and Weil [9] reported three infants with femoral fractures during cesarean section due to traumatic separation of the proximal femoral epiphyses. Kellner [10] claimed that large or very small babies are predisposing factors for such a fracture. Morris et al. [7], reporting in 2001 on their experience with femoral fractures occurring during delivery, found an incidence of 7 infants/52,296 deliveries, or 0.13 per 1000. In our study the incidence of femoral fractures was 0.077 per 1000 in a large population in two medical centers. All patients in the study by Morris and co-authors weighed > 2600 g and were delivered not before 37 weeks gestation. Five of the 7 (71.4%) were born during cesarean section and 3 of the 7 (42.8%) following a twin breech presentation. Similarly, in our study 12/17 (70%) were born during cesarean section, strengthening our suggestion that CS is a risk factor for femoral fractures. In the study by Morris and team, the diagnosis was not readily made: the time from delivery to diagnosis averaged 6.3 days, and in 6 of the 7 cases (85.7%) no evidence of femoral injury was evident on the immediate postnatal examination. The same was shown in our case report and in most of the children admitted. In their report published a year ago in this journal, Givon and collaborators [11] assessed the treatment of neonates with femoral fractures. They too noted the increased risk for femoral fracture during CS (73% of fractures occurred during CS).

The differential diagnosis of femoral fracture in a newborn includes osteomyelitis, osteogenesis imperfecta, child abuse, and metabolic bone diseases. The prognosis of diaphyseal fractures of the femur is good. Such fractures usually heal within 2–3 weeks. Rigid immobilization in a long leg or spica cast is recommended. It reduces pain and maintains bony alignment.

The study had several limitations. Firstly, a causal relationship between femur fracture and cesarean section might exist, but because our study was retrospective in nature we cannot be sure of a real cause-and-effect relationship. Secondly, since most fractures were diagnosed a few days after delivery, it is possible that healing of a femoral fracture after cesarean section occurs spontaneously without a diagnosis, and the incidence appears more frequently than isolated case reports. Thirdly, since the Hadassah University Hospital is located in

Jerusalem it is possible that some cases were diagnosed with femoral fracture in other hospitals in Jerusalem, suggesting an artificial decrease in the frequency of this entity. Finally, our data did not include confounding variables known to be associated with a higher risk of femur fracture during birth, including large for gestational age babies, gestational diabetes, myomatous uterus and breech presentation.

In conclusion, the data reported here emphasize the notion that cesarean section markedly increases the risk for a long bone fracture during birth. When encountering a difficult labor, which started as a breech and ended as a CS, obstetricians should bear in mind that the risk for femoral fractures is higher than in vaginal delivery and a more thorough follow-up by a pediatrician is recommended.

Correspondence:

Dr. A. Toker

Central Administration, Hadassah Medical Organization, P.O. Box 12000, Jerusalem 91120, Israel

Phone: (972-2) 677-8935

Fax: (972-2) 677-8900

email: asaftoker@hadassah.org.il

References

1. Cunningham FG, Leveno KL, Bloom SL, Hauth JC, Gilstrap LC III, Wenstrom KD, eds. Section IV. Labor and Delivery, Chapter 25: Cesarean Delivery and Peripartum Hysterectomy. In: Williams Obstetrics. 22nd edn. New York: McGraw-Hill, 2005: 589-99.
2. Gordon AB, Fletcher MA, MacDonald GM. Neonatology, Pathophysiology and Management of the Newborn. 5th edn. Philadelphia: Lippincott Williams & Wilkins, 1999: 1280-1.
3. Bistoletti P, Nisell H, Palme C, Lagercrantz H. Term breech delivery. Early and late complications. *Acta Obstet Gynecol Scand* 1981; 60: 165-71.
4. Bangale RC. Neonatal fracture and cesarean section. *Am J Dis Child* 1983; 137: 505.
5. Curran JS. Birth associated injury. *Clin Perinatol* 1981; 8: 111-29.
6. Awwad JT. Femur fracture during cesarean breech delivery [Letter]. *Int J Gynecol Obstet* 1993; 43: 324-6.
7. Morris S, Cassidy N, Stephens M, McCormack D, McManus F. Birth associated femoral fractures: incidence and outcome. *J Pediatr Orthop* 2002; 22: 27-30.
8. Eherenfest H. Birth Injuries of the Child. New York: Appleton-Century-Crofts, 1922.
9. Denes J, Weil S. Proximal epiphysiolysis of the femur during cesarean section. *Lancet* 1964; i: 906.
10. Kellner KR. Neonatal fractures and cesarean section [Letter]. *Am J Dis Child* 1982; 136: 865.
11. Givon U, Sherr-Lurie N, Schindler A, Blankstein A, Ganel A. Treatment of femoral fractures in neonates. *Isr Med Assoc J* 2007; 9: 28-9.