Original Article

Simultaneous Bilateral Femoral Fracture in Children

Somkieta Francis Modeste Ouédraogo, Malick Diallo[1], W. Toussaint Tapsoba, Koundja Thiombiano, Isso Ouedraogo, Albert Wandaogo

Departments of Pediatric Surgery and Hospital Center and University Charles de Gaulle, Ouagadougou, [1]Department of Trauma and Orthopaedics, Hospital Center End University Souro Sanou of Bobo Dioulasso, Burkina Faso

Abstract

Introduction: Bilateral femoral fractures in children (BFFC) are an uncommon condition. Only a few cases were reported in the literature. The frequency and outcome in low-setting facilities are unknown. This study aims to describe our experience in managing BFFC. **Patients and Methods:** A 10-year ongoing study spanning from 2010 to 2020 was held in a level-1 paediatric facility. We included all cases of BFFC on a bone-free disease with at least 10 months of follow-up time. Data were collected and analysed with statistical software. **Results:** A total of eight patients with ten BFFC were collected. It involved mainly boys (n = 7/8) with median age of 8 years. Mechanism of injury were a road traffic accident (n = 4), a fall from height (n = 3), and been crushed by a falling wall (n = 1). Associated injuries were frequent (n = 6/8). Patients were managed nonoperatively with spica cast (n = 5) and by elastic intramedullary nails (n = 3). After 6.11 years of mean follow-up time, all fractures healed. The outcome was excellent and good in 7 cases. One patient sustained knees stiffness. **Conclusion:** Non-operative management of BFFC showed satisfactory outcomes. Early surgical care must be developed in our low-income settings to reduce in-hospital stay and encourage early weight-bearing.

Keywords: Bilateral femoral fracture, children, elastic intramedullary nail, high-energy trauma, low-income setting, spica cast

Introduction

Bilateral femoral fractures in children (BFFC) is an uncommon condition.[1,2] The literature review shows mainly a few reports.[1-5] According to our knowledge, only three short case series were reported.[1-3] At walking age, high-energy trauma like traffic accidents[2] and fall from height[2,5] is usually the mechanism of injury (MOI). Due to the MOI, it is mainly polytrauma patients with associated injuries from head to toes.[2] Early surgical management which is widely reported, is not easily available in low-income settings.[5]

The study aims to describe our experience in managing eight cases of BFFC in 10 years.

Patients and Methods

Study area

The study setting was a paediatrics surgery department in a paediatric hospital in West Africa. This hospital is the only level-3 dedicated paediatric facility in the country.

Study design

This study was an ongoing 10 years retrospective series cases study from 2010 to 2020.

Study population, sample size estimation and sampling technique

The study included all BFFC cases in children under 15 years with a bone-free disease with at least 10 months of follow-up time. We excluded incomplete file records of 2 cases.

Data collection tools

The survey collected socio-demographic characteristics, MOI, clinical presentation, associated injuries, treatment patterns, in-hospital stay and outcome patterns data [Table 1].

Data analysis

The data were recorded on statistical software (MS Excel®, Microsoft Corporation, Redmon WA United States) with a

Received: 04-06-2021 **Revised:** 12-06-2022 **Accepted:** 29-06-2022 **Available Online:** 04-01-2023

Access this article online

Quick Response Code:

Website: www.afrjpaedsurg.org

DOI: 10.4103/ajps.ajps_91_21

Address for correspondence: Dr. Somkieta Francis Modeste Ouédraogo, Service de Chirurgie Pédiatrique, CHUP Charles de Gaule, Ouagadougou, Burkina Faso.
E-mail: somkieta@yahoo.fr

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How to cite this article: Ouédraogo SF, Diallo M, Tapsoba WT, Thiombiano K, Ouedraogo I, Wandaogo A. Simultaneous bilateral femoral fracture in children. Afr J Paediatr Surg 2023;20:120-3.

double-checking of the data before data analysis. We used a squatting test to evaluate the adjacent joint's range of motion (ROM). The mean (with 95% confidence interval [CI] or with standard deviation) and the median for each quantitative variable were calculated; the results by category of the percentage of the qualitative variable were fit.

Ethical considerations

The study matches Helsinki's declaration.[6] Patients and their parents were informed that data would be submitted for publication, and they provided consent.

Results

Epidemiological patterns

A total of ten BFFC were collected among 413 femoral fracture cases in 403 children. Two cases were excluded due to missing data in medical records. The BFFC rate among femoral fractures in children was 0.02 (1/year). The mean age was 8.625 years (11.55–5.69 95% CI). The youngest child was 3-years old and the oldest 14. There were seven boys and one girl.

Mechanism of injury

A road traffic injury was the main MOI. It was pedestrians stuck by a fast motorcycle (n = 3) or by a car (n = 1). In one case, the boy fell from a cart that rolled over him. Fall from the fruit tree was found in three cases. In another case, the young girl was crushed by a falling wall.

Clinical presentation

Patients sustained Gustilo Anderson Type I open fractures in three cases. Fractures type were diversified, including bilateral diaphyseal fractures (n = 6) and associated proximal end and diaphyseal fractures (n = 2) [Table 1 and Figures 1-3].

Associated injuries

Associated leg fractures and radius fractures were present in two cases each. In two other cases, patients sustained traumatic brain injuries (TBI) and abdominal contusion with hemoperitoneum [Table 1].

Treatment

We used immediate casting (n = 1), skin traction followed by spica casting (n = 4), and open reduction and an elastic stable intramedullary nails (ESIN) (n = 3) to treat our patients. Wound closures were performed by junior surgeons.

Outcome

After 73.375 months of mean follow-up time (range from 10 to 238 months), all fractures healed with minor leg discrepancies. Hips and knees ROM were complete in four cases, slightly limited (l0 and 15°) in three cases, and fair in one case (-30° on stiffness). Due to our hospital limitations, the last patient had an extended long in-hospital stay and delayed surgical management. All patients were able to squat. The three ESIN cases demonstrated hypertrophic scars [Figure 4]. Computed tomography scan was not available to evaluate rotations. Superficial infection of the

Table 1: Summary of cases

Patient	Sex age	Age	MOI	Femurs fractures type right/left	Complication right/left	Associated injuries	Treatment (right/ left femurs)	Other treatment	Inhospital stay (days)	Follow-up (months)	Outcome
1	Male	11	RTA: Motorcycle-pedestrian	Mid-shaft/ mid-shaft	No	Left leg fracture	Cast	-	18	238	Excellent - Full ROM
2	Male	9	RTA: Motorcycle	Mid-shaft/lower third shaft	No/open	-	Skin traction+cast	Debridement	18	98	Good - Full ROM
3	Male	14	RTA: Motorcycle-pedestrian	Upper third shaft/ lower third shaft	No	-	OR+ESIN	-	37	78	Fair - 30 degrees stiffness
4	Female	3	Crush by a walling wall	Trochanteric/lower third shaft	No	Left leg fracture +abdominal contusion	Skin traction+cast	-	5	66	Excellent - Full ROM
5	Male	10	Fall from height (tree)	Mid-shaft/ mid-shaft	Open/no	-	Skin traction + cast	Debridement	24	60	Excellent - Full ROM
6	Male	5	RTA: Vehicle-pedestrian	Mid-shaft/upper third shaft	No	TBI + closed right radius fracture open foot phalanx fracture	Skin traction + cast	Monitoring+ above elbow cast	15	20	Excellent - Full ROM+TBI sequelae
7	Male	10	Fall from height (tree)	Sub-trochanteric/ mid-shaft	No/open	TBI + fracture of distal extremity of left radius	OR + ESIN	Debridement + above elbow cast	32	17	Good - Full ROM+ Intermittent pain (nails)
8	Male	7	Fall from a cart	Mid-shaft/lower third shaft	No	-	OR+ESIN	-	10	10	Good - Full ROM

MOI: Mechanism of injury, RTA: Road traffic accident, TBI: Traumatic brain injury, OR: Open reduction, ESIN: Elastic stable intramedullary Nail, ROM: Range of motion

nail track was noted in one ESIN case with adequate healing at the last follow-up. We did not encounter any refracture. Seven children returned to school. The eighth child was out of school due to neurological sequelae after his TBI. Five among the seven school children recovered good hip and knee functions, allowing them to squat and regularly perform sports activities. The other two had knee stiffness [Table 1]. Only one of them had two school years lag.

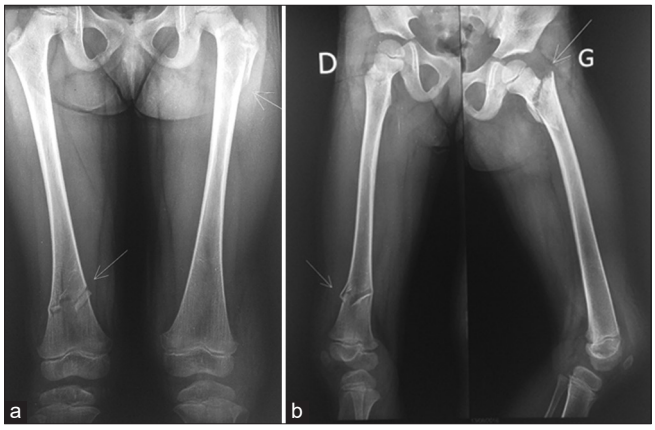


Figure 1: Femur AP: (a) and lateral; (b) radiographs views showing a simultaneous bilateral femoral diaphysis fracture



Figure 2: Immediate post-operative femurs AP radiographs showing bilateral diaphyseal femurs fractures reduction and internal fixation with elastic stable intramedullary nails. ESIN: elastic stable intramedullary nails

Discussion

Frequency

Femoral fractures in children represent >2% of all paediatric fractures.[2,7] BFFC rates are fewer.[8] 10-year spanning studies by Shah *et al.*[1] and Scherl *et al.*[2] reported, respectively, eight and seven cases. Scherl *et al.* rate was 0.03% among 207 children with a femoral fracture.[2] The Swedish fracture registry showed six BFFC among 724 femoral fractures.[8] The mean age for femoral fracture is around 7 years with two peaks at 2–3 years and 14–15 years with the boy: girl ratio of 1.8: 1.[8]

Mechanism of injury and injury patterns

Before walking age, femur fracture in children is high positive suspicion of child abuse even if there is no specific fracture pattern.[2] After 3 years old, high-energy trauma is mandatory in bone-free disease.[2,5] Mainly boys are exposed in our setting. They climb tall trees to pick fruits or leaves, ride carts and animals, and play on the road.[9] The only girl in our study was crushed by a falling wall at home when sleeping. In our opinion, BFFC might be considered polytrauma patients as associated injuries are common.[1] TBI and abdominal contusion are frequently associated.[1] Our study showed associated TBI in one-quarter of cases and associated long bone fractures in half of the cases.

Treatment and outcome

Femoral fractures in children under 6 years old are managed mainly by immediate casting or traction, followed by spica casting.[2] This treatment method is widespread because it is reliable, cost-limited with a short traction time and good results.[10] Surgical treatment mainly includes external fixation[4,11] and elastic intramedullary nailing.[11]

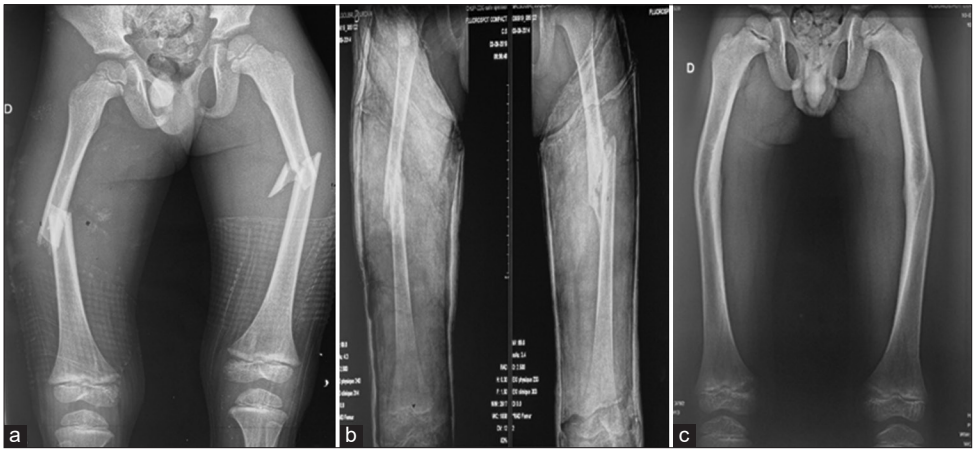


Figure 3: Femurs AP radiographs of bilateral diaphyseal femurs fractures. Immediate post-traumatic: (a), after bilateral casting; (b) and late (20 months) radiographs; (c)



Figure 4: Photographs of functional outcome of bilateral diaphyseal femurs fractures managed by open reduction and ESIN demonstrating knee stiffness. ESIN: Elastic stable intramedullary nails

External fixation for uncomplicated femoral fractures gave satisfactory results but seemed to induce a high refracture rate in BFFC.[4,11,12] BFFC is statistically linked to long in-hospital stay compared to unilateral femoral fractures.[1] The in-hospital stay is expanded by the management of frequent severe associated injuries and the long rehabilitation process.[1,4]

Complications such as hypertrophic scars, hardware failure, pins track infection, hip and or knee stiffness, malunion, nonunion, overgrowth, refractures have been reported in femoral fractures in children.[10,13-15] Many studies highlighted the high rate of refracture in BFFC.[2-4,11] Early cast or external fixation removal might explain that.[4,10] In fact, a weaker callus union bridging <3 corticles and early external fixation removal demonstrated a statistically significant risk of refracture.[4,12] The recommended condition to cast or implant removal is the presence of bridging callus on at least three cortices on AP and lateral radiographs.[11,12]

Surgery tends to be routinely performed to reduce in-hospital stay and allow early weight-bearing. Due to our setting conditions and patients' families' poverty, we largely performed non-operative care with 16 days of mean skin traction, followed by spica cast. This procedure gave excellent and good results without or with minor legs discrepancy, and a complete or a slightly limited ROM at hips and knees. For only three patients with 10 years of mean age, we performed open reduction and retrograded ESIN after 26.33 days. These patients encountered hypertrophic skin scars ($n = 3$), nail track infection ($n = 1$) and knees stiffness ($n = 1$). We think that the closure quality might increase the hypertrophic skin scars rate. Furthermore, colored skin and age over 10 years are known risk factors for hypertrophic skin scarring.[16] The learning curve for ESIN and lack of rehabilitation programmes might explain the stiff knees we got.

Conclusion

BFFC is an uncommon condition related to high-energy trauma. In a low-resource setting, non-operative management of BFFC by spica cast gives good results. Early surgical management and appropriate rehabilitation programme must be developed to reduce in-hospital stay.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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