

Femoral Neck Fractures in Children a Review of Five Patients Managed at an Orthopaedic Referral Centre in Nigeria

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Abstract

Background: Femoral neck fractures are rare conditions in children and their complications are associated with serious long-term morbidities. In this study, our aim was to evaluate the pattern of presentation, clinical outcome and complications associated with the management of these fractures.

Method: The study was a review of case series on five patients who presented with femoral neck fractures, or its complications managed at the National Orthopaedic Hospital, Dala-Kano, Nigeria between June 2008 and June 2013. The outcome of treatment was evaluated using the Ratliff criteria after a follow-up period of at least one year.

Results: The mean age of patients included was 10.8 ± 3.3 years (range, 6 to 15 years), while the male to female ratio was 4:1. The mean duration of follow-up was 2.6 ± 1.1 years (range, 1 to 4 years). There were 3 cases of Delbet type III and 2 cases of Delbet type II. The duration of injury prior to presentation range from 10 days to 9 months post-injury. Painful limp, malunion and coxa vara deformity were the common mode of presentation. According to Ratliff criteria, 3 patients had good outcome while 2 patients had fair outcome. Avascular necrosis occurred in one patient and there were 2 cases of residual coxa vara after treatment.

Conclusion: The clinical outcome was influenced by late presentation, and this probably contributed to the complications recorded.

Keywords: Nigeria; Femoral Neck Fractures; Children

Femoral neck fractures are rare in children accounting for <1% of all paediatric fractures [1-4]. They do not constitute a large burden in terms of incidence but the frequency of associated complications make them an important clinical entity [5].

Fractures of the femoral neck in children result commonly from high-energy injuries making the risk of associated injuries very high [5-7]. Due to the peculiarity of vascular anatomy of

the proximal femoral physis, these fractures are prone to serious complications like avascular necrosis, coxa vara, malunion and premature physeal closure [2,8,9]. These complications may or may not be treatment-related.

The most frequently used classification system for these fractures is Delbet classification as it helps to predict the risk of complications as well as help determine the appropriate treatment method [1,2,9].

Our study was a combined retrospective and prospective study which reviewed case series on five patients in order to evaluate the pattern of presentation, clinical outcome and complications associated with the management of these patients.

Patients and Methods

The National Orthopaedic Hospital, Dala-Kano, Nigeria is a tertiary orthopaedic-based referral centre located in the Northwest region of the Country. The hospital manages a wide range of orthopaedic conditions largely referred from peripheral hospitals in and around the Northern region as well as other parts of the country.

In this study, we reviewed the clinical records of paediatric patients who presented with femoral neck fractures or its complications and were managed at the hospital between June 2008 and June 2013. Eight patients were managed during this period but only five met our criteria for analysis. The inclusion criteria included age <16 years at the time of injury, complete radiographic record and patients who have completed at least one year follow-up period. Of the three cases excluded, one was a case of sickle cell disease, the second had incomplete radiographic records while the third had inconclusive diagnosis.

Delbet classification, which is well-documented in the literature [1,2,9], was used to categorize the fractures seen. All the patients

had operative treatment with either cannulated screw fixation or primary osteotomy (to correct malunion or coxa vara), which was subsequently stabilized with paediatric osteotomy plate. All the surgery was performed by consultant orthopaedic surgeons based in the hospital. The Ratliff criteria [3,5,9] was used for final outcome analysis in all the patients reviewed.

Results

Over the five-year period reviewed, we included five patients in the series. The mean age was 10.8 ± 3.3 years (range 6 to 15 years). There were four males and a female, giving male-to-female ratio of 4:1. All the fractures studied occurred on the left side. The mechanism of injury revealed that 3 cases were due to falls from height while the remaining 2 resulted from road-traffic accident. The associated injuries were as depicted in Table I. The mean duration of follow-up was 2.6 ± 1.1 (range 1 to 4 years).

According to Delbet classification, 3 cases were type III (cervico-trochanteric fractures), while 2 cases were type II (transcervical fractures). The mean duration of injury prior to presentation was 4.2 ± 3.8 (range 10 days to 9 months). The mode of presentation and treatment offered are as shown in table II. All patients had operative treatment and choice of implant was determined by Surgeon’s preference and availability.

Case No	Age at injury	Gender	Mechanism of injury	Associated Injury
1	11 years	M	Fall from height	-
2	6 years	M	Fall from height	Facial Injury
3	15 years	M	RTA	Blunt chest injury
4	10 years	F	RTA	Blunt chest injury
5	12 years	M	Fall from height	-

Table 1: Demographics and mechanism of injury.

The outcome analysis was done after a minimum of one year follow-up period using the Ratliff criteria⁹ as shown in Table III. We recorded a case complicated by avascular necrosis in a Delbet type II fracture. Residual coxa vara was the commonest complication recorded during the follow-up analysis, probably due to incomplete correction of the deformity. There was a case

of superficial incisional surgical site infection and another case of peri-implant fracture which occurred 4 weeks after the outcome analysis was done. The patient was said to have sustained a fall while ambulating freely at home. Table IV shows the outcome of treatment and complications recorded.

	Good	Fair	Poor
Pain	None or Patient ignores it	Occasional	Disabling
Movement	Full or Terminal Restriction	Greater than 50%	Less than 50%
Activity	Normal or avoid games	Normal or avoid games	Restricted
Radiographic findings	Normal or Some deformity of the neck	Severe deformity of the femoral neck or mild avascular necrosis	Severe avascular necrosis, Degenerative arthritis, Arthrodesis

Table 3: Ratliff Criteria.

Case No	Delbet Type	Complications observed	Ratliff Outcome
1	III	Residual coxa vara	Good
2	III	Residual coxa vara	Fair
3	II	Avascular necrosis	Fair
4	II	Surgical site infection	Good
5	III	Peri-implant fracture	Good

Table 4: Outcome of Treatment.

Discussion

Paediatric femoral neck fractures are rare with an average incidence <1% of all paediatric fractures, worldwide [1-4]. The incidence may however be higher in Nigeria ¹⁰. most cases result from high-energy trauma, particularly motor-vehicle accidents and falls from height.

The fact that the osseous anatomy of the proximal femur in children is characterized by the presence of proximal femoral physis, dense bone, thick periosteum, small neck and immature vascular anatomy, increase the risk of complications in these fractures [1,5,11]. In addition, the statement by Canale [12] that “Hip fractures in children are of interest because of the frequency of complications rather than the frequency of fractures” summarizes this important clinical entity. Prompt reduction and stabilization of these fractures therefore is a priority.

In our series, 3 patients presented with Delbet type III fractures while 2 patients presented with type II fractures. Late presentation, as often experienced in our setting, was recorded in 3 patients. These patients presented with malunion, nonunion and coxa vara (a neck-shaft angle of <120° as seen on plain radiographs). Initial

involvement of Traditional Bone Setters (TBS) accounted for the late presentation. The remaining 2 patients in our series were referred cases from nearby peripheral hospitals and presented relatively early. We therefore offered 4 of our patients primary osteotomy due to the mode of presentation (Figure 2 and 3), while the only patient who presented 10 days after injury had threaded cannulated screw fixation (Figure 4).

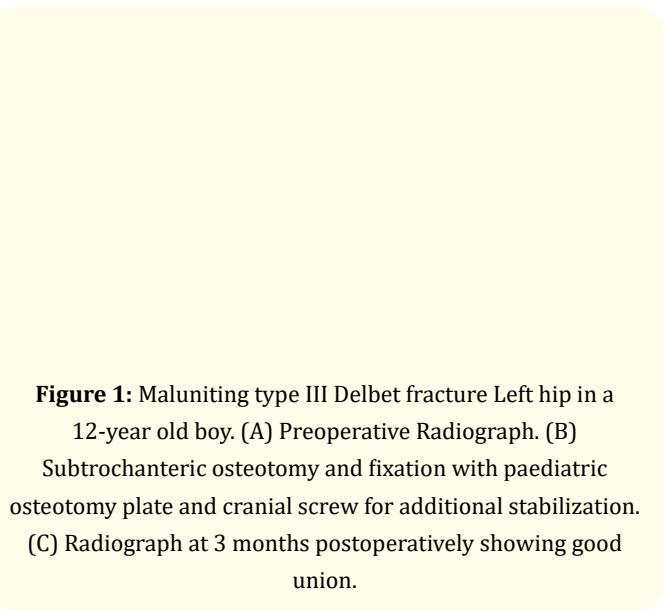


Figure 1: Maluniting type III Delbet fracture Left hip in a 12-year old boy. (A) Preoperative Radiograph. (B) Subtrochanteric osteotomy and fixation with paediatric osteotomy plate and cranial screw for additional stabilization. (C) Radiograph at 3 months postoperatively showing good union.

Of all the complications reported in the literature, avascular necrosis (AVN) is the most common and most devastating [2,3,9,12-14]. While Quick, *et al.* [15] reported an average incidence of 6 to 53% for AVN in paediatric femoral neck fractures, other studies reported rates of 10 to 58% [9,12,16,17]. Some of the factors influencing the rate of AVN include; degree of initial displacement of the fracture, timing of reduction and fixation (risk increases significantly if reduction is done after 48 hours of injury), stability of the reduction and fixation, and whether capsular decompression of haematoma was done during fixation, to mention but a few [2,3,14-18].

Avascular necrosis was recorded in one patient in our series, following assessment by the Ratliff criteria (table III). The risk factors identified were the type of fracture (Delbet type II) and fracture displacement. Late presentation was an added risk factor as the patient presented 4 months after injury.

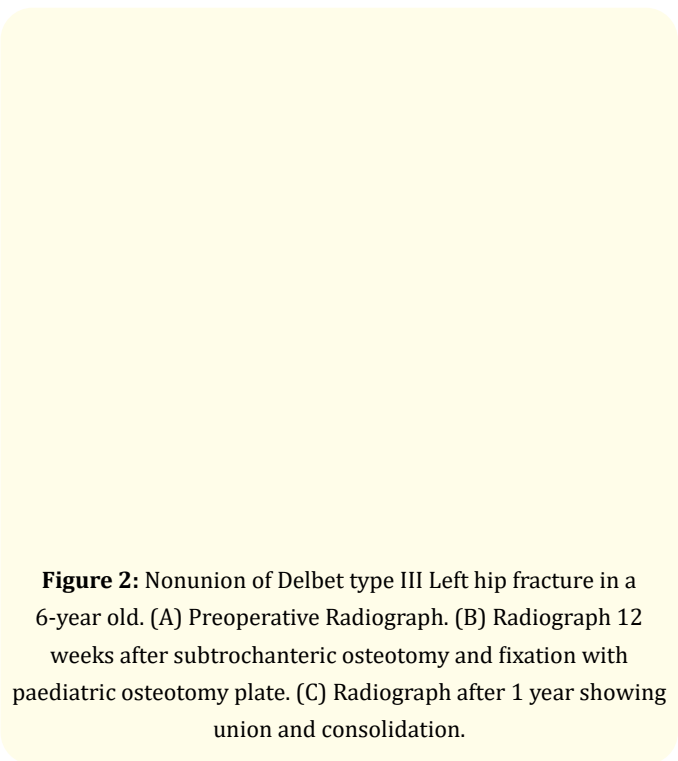


Figure 2: Nonunion of Delbet type III Left hip fracture in a 6-year old. (A) Preoperative Radiograph. (B) Radiograph 12 weeks after subtrochanteric osteotomy and fixation with paediatric osteotomy plate. (C) Radiograph after 1 year showing union and consolidation.

Another complication we recorded was residual coxa vara after operative fixation. Coxa vara has been defined as neck-shaft angle of $<120^\circ$ using radiography [3], and it contributes to significant limb length discrepancy. The prevalence of post-traumatic coxa vara has been reported to be in the range of 20 to 30% of all paediatric hip fractures [1-4,13]. This deformity may be caused by malreduction (varus) of the fracture, loss of reduction, delayed union or nonunion, osteonecrosis, or premature closure of the proximal femoral physis with overgrowth of the greater trochanter [1-4]. In our series, this occurred in 2 patients and giving the fact that these patients presented late with malunion and nonunion, it was thought to be due to incomplete correction of initial deformity and the possibility of premature physal closure in these patients.

Other complication recorded was surgical site infection in 1 patient and peri-implant fracture in another. These complications, however, were promptly addressed and did not affect the outcome.

Figure 4: Delbet type II Left hip fracture in a 10-year old girl. (A) Preoperative Radiograph. (B) Radiographs following fixation with cannulated screws. (C) Radiograph after removal of the cannulated screws.

The overall assessment using Ratliff criteria was good in 3 patients and fair in 2 patients. None of the patients in our series had a chronic disabling pain nor severe restriction of activity after treatment, despite the seemingly unfavourable mode of presentation. Thus, we believe that femoral neck fractures in children should be treated operatively, provide the required expertise is available. In our series, we did not hesitate to perform subtrochanteric valgus osteotomy for malunion, nonunion and coxa vara. Our results using the Ratliff criteria has been good so far.

Conclusion

The clinical outcome of our study was mainly influenced by late presentation. malunion, nonunion and coxa vara were seen as primary complications rather than secondary. Although our experience may be limited to a small number of patients, we believe that primary subtrochanteric valgus osteotomy will benefit patients that present with deformity.

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