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Management of femoral cervical fractures in children at the Mathlaboul Fawzaini national hospital of Touba: About 16 cases

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Abstract
Introduction: Fractures of the femoral neck in children are rare. They are secondary to high kinetic energy trauma and are associated with serious complications. The aim of this study was to report epidemiological, diagnostic, therapeutic and evolutionary aspects of femoral cervical fractures in children.
Patients and Methods: This is a retrospective and descriptive study that collected over a period of 5 years, 16 cases of children treated for a femoral neck fracture at the Orthopedic-Traumatology Department of the Mathlaboul Fawzaïni Hospital in Touba from January 1st, 2015 to December 31, 2019.
Results: The relative annual frequency was 3.2 cases. The mean age of our patients was 10.9 years and the most represented age group was 10 to 15 years. Our study included 13 boys and 3 girls with a sex ratio of 4.33. Falls from an elevated location and MVAs were the main etiologies. Associated injuries were found in 3 cases. According to Delbet's classification, type III femoral neck fracture was the most frequent with a percentage of 81.2% (13 cases).
All our patients had undergone surgical treatment. The approach was closed in 13 cases and open in other cases. The type of osteosynthesis used was screw fixation in 14 cases and a combination of screw and Kirschner wire in 2 cases. According to Ratliff criteria, at the last review (24 months with extremes of 3 and 60 months), we had 13 good results and 3 average results. Three complications on three different patients were found: epiphysiodesis, malunion, and femoral head necrosis.
Conclusion: Fractures of the femoral neck in children are rare, especially in children under 10 years of age. Delbet type III is the most frequent injury. Surgical treatment remains the leading indication for the management of these fractures in older children. Treatment results are satisfactory.

Keywords: fracture-femoral, neck-childhood-osteosynthesis-osteonecrosis

Introduction
Fractures of the femoral neck in children include all traumatic situations where there is a bony or osteocartilaginous continuity solution involving the neck before spontaneous closure of the growth plate [1, 2, 3, 4]. They are very rare in children and account for about 1% of all pediatric fractures [1, 5, 6]. They are secondary to high kinetic energy trauma and are associated with serious complications. The aim of this study is to report epidemiological, diagnostic, therapeutic and evolutionary aspects of cervical femoral fractures in children through a retrospective and descriptive study from January 2015 to December 2019 at the Orthopedic and Traumatic Surgery Department of the Mathlaboul Fawzaïni Hospital in Touba.

Patients and Methods
Patients
All patients aged 0 to 15 years who were managed from January 2015 to December 2019 for a femoral neck fracture in the Orthopedics-Traumatology Department of the Mathlaboul Fawzaïni Hospital were included in the study.
Not included in this work were any patient discharged against medical advice or referred to another structure and/or any incomplete or unusable medical records. Thus a file was not included in this work.

During our study period, sixteen (16) children met our selection criteria.

Methods

This was a retrospective and descriptive single-centre study. Data were collected from patient records and operating protocol registers. Data entry was performed using SPSS 20.0 software. Graphs were generated in Microsoft Excel 2013. Tables as well as texts of our work were entered using Microsoft Word 2013 software. Epidemiological, diagnostic, therapeutic and evolutionary aspects were listed on an exploitation sheet.

Epidemiological aspects were studied: frequency, age ranged 5 to 9 years old and 10 to 15 years old, sex, delay of consultation time subdivided into three categories within the first 24 hours, between 24 and 72 hours and more than 72 hours and circumstances of occurrence.

Diagnostic aspects concerned: clinically (pain, absolute or relative functional impotence, attitude of the traumatized limb (shortening, external rotation, deformity...), skin lesions and other associated lesions) and at radiography, we used Delbet's classification [7] of the femoral neck fractures in children.

Treatment was evaluated in several aspects: type of treatment (orthopedic or surgical), surgical approach (open or closed), type of anesthesia (general or spinal anesthesia) and type of osteosynthesis (isolated screwing or pinning or combination screw and pin).

Rehabilitation was assessed in terms of number of sessions and results. The average length of hospitalization was noted as well as its extremes.

Anatomical evaluation, at the last review, was made by radiographic control searching the existence of: good consolidation or malunion or nonunion.

The overall evolution of the pediatric femoral neck fracture was evaluated according to the RATLIFF criteria [8].

Results

During the study period, we observed 16 cases of femoral neck fractures in children, i.e. a relative frequency of 3.2 per year.

The mean age of our patients was 10.9 years with extremes of 5 and 15 years. The most represented age group was 10 to 15 years with a percentage of 68.8%. Our series included 13 boys and 3 girls with a sex ratio of 4.33.

Most of our patients consulted within the first 24 hours with a percentage of 43.8%. Fractures were mainly secondary to violent trauma represented by falls from a high place with a rate of 43.8% (7 cases), MVAs with a rate of 25% (4 cases), recreational accidents 18.7% (3 cases) and domestic accidents 12.5% (2 cases). The mechanism frequently found was direct.

In our study, the fracture occurred on the left side as on the right in 8 cases. No bilateral fracture was found.

Clinically, all patients had pain, functional impotence, eight (8) absolute and eight (8) relative, shortening and external rotation. Swelling and deformation was found in two of our patients. We noted associated lesions in three of our patients with a fracture of the two bones of the left leg, fracture of the olecranon and abdominal contusion. Dermabrasion-type skin lesions, superficial and deep wounds were noted in three other patients.

Radiologically, according to the Delbet classification, type III femoral neck fracture was the most frequent (Figure 1) with a percentage of 81.2% (13 cases) followed by type II (3 cases) (Figure 2). None of our patients had a Delbet type I or Delbet type IV femoral neck fracture. All of our patients had undergone surgical treatment preceded by medical treatment.

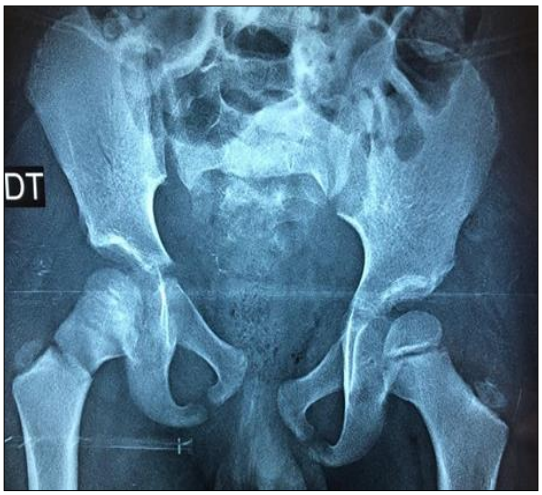

Fig 1: Basicervical fracture of Delbet's right femoral neck type III in a 6-year-old boy

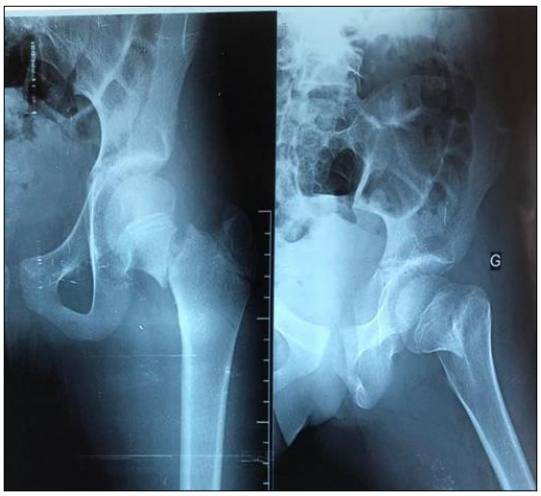

Fig 2: Transcervical fracture of Delbet's left femoral neck type II in a 12-year-old girl

On admission, patients were put under analgesics with immobilization by bone traction. The duration of immobilization varied from one patient to another with an average of 3 days depending on the availability of the operating room. General anesthesia was performed in 7 patients and spinal one in 9 patients. The installation was performed in supine position on an orthopedic table under radiographic control. The approach was in 13 cases and open in 3 cases. Osteosynthesis by screw fixation was performed in 14 patients (Figure 3) and a combination of screw and Kirschner ® wire in 2 patients (Figure 4).

Rehabilitation was prescribed for all patients after the operative act. The average length of hospitalization was 8 days with extremes of 3 and 22 days.

At an average retreat of 24 months with extremes of 3 and 60 months, according to Ratliff's criteria, we recorded 13 good results and 3 average results. The average consolidation period was 4 months with extremes of 3 to 7 months. We noted 3 complications in 3 different patients: an epiphysiodesis on a transcervical fracture (type II) treated in a closed approach by screw fixation, a malunion (Figure 5 A-B) in a displaced type III fracture treated in an open approach by screwing and a femoral head necrosis in a displaced type III fracture treated in a closed approach by screwing.

Fig 3: Delbet type II fracture treated by double screwing with a coxa-valga

Fig 4: Delbet Type III fracture treated with screws and pins

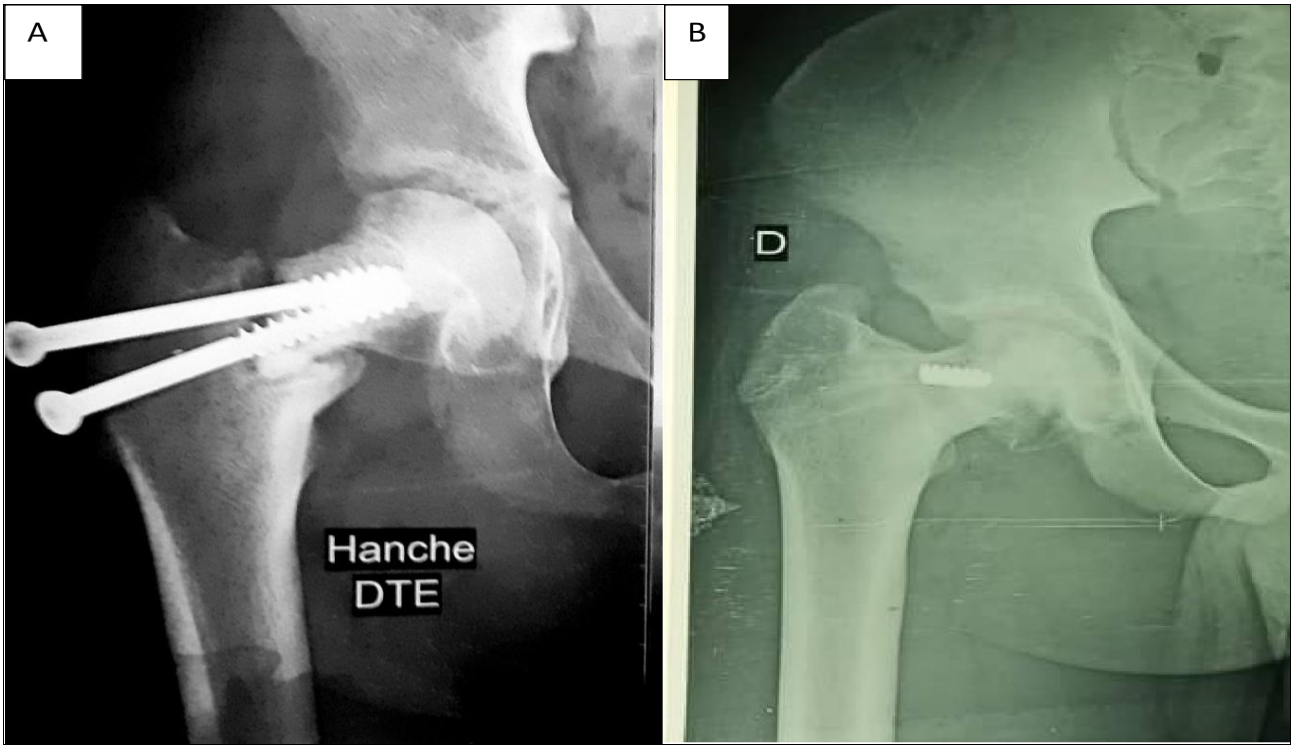

Fig 5: A: Open reduction and fixation in coxa-vara with 2 short-threaded sponge screws, B: Vicious callus evolution in varus at the 24th month post-op with screw breakage

Discussion

It will focus on the epidemiological, diagnostic, therapeutic and evolutionary aspects of femoral neck fractures in children.

Fractures of the femoral neck are rare in children and represent about 1% of the traumatic pathology [1]. Our study confirms the rarity of this type of fracture in children with a number of 16 cases over a 5-year period, i.e. an annual frequency of 3.2 cases. Their rarity is confirmed in the African and Western series [3, 4, 5, 9].

The low number of femoral neck fractures in our series and in the literature could be explained on the one hand by the particular mechanism of occurrence of these lesions, and on the other hand by the almost always high-energy nature of the causal trauma (fall from a high place, MVA). However, in our study, the increase in incidence is explained by the frequency of trauma-related trauma during religious events organized throughout the year in this holy city, which represents the second largest conurbation in the country in terms of population.

In our series, the average age of occurrence of femoral neck fractures was 10.9 years, which is close to that found in most of the literature [10, 11]. This is the age when children begin to free themselves and play with their friends away from parental supervision. Our study is consistent with most published series regarding the rarity of fractures occurring before the age of 10 [3, 9]. Only 5 of our patients (31.24%) were less than 10 years old at the time of the trauma.

In general, male predominance is reported by most authors [3, 12]. This male predominance could be explained by the dangerous games most often played by boys. In fact, boys are more likely to be involved in climbing, which explains the high number of

falls noted in our study. MVAs and falls from a high place remain the most common etiological circumstances [3, 11]. Unlike the circumstances of cervical fractures in adults, in children the causal trauma must be very violent, this is reported by all authors and is explained by the homogeneous and very resistant structure of the cancellous bone at the upper end of the femur of the latter.

No stress fractures were noted. Stress fractures are rare in children and occur more frequently in osteoporotic elderly people and in young adults undergoing sustained physical stress.

Most of our patients were seen within the first 24 hours. This could be explained by the pain and functional impotence that motivate parents to consult in an emergency. Other authors find a delay of more than 24 hours, the explanation found was related to a traditional treatment providing complications in some patients [2, 4, 13].

However, according to some authors, rapid management seems to have a favorable effect on the occurrence of complications [7, 14].

The fracture occurred as many times on the left as on the right, which is not found in the general literature. According to several authors, pediatric femoral neck fractures occur most often on the left [10, 13]. This predominance of the left side could be explained by the relatively high frequency of right-handed people in the general population. In fact, during falls, children try to hold on to something using their dominant limb, exposing the non-dominant limb at the same time to the first impact [3].

All our patients had presented functional impotence, shortening, external rotation and pain. These data are consistent with those in the literature with painful active and passive mobilization [1, 4, 10, 11, 13].

Our series revealed a predominance of type III (81.2%) and II (18.8%) fractures, while types I and IV were absent. Our data are similar to those found in the general literature, which show a predominance of type III followed by type II [11, 12, 13].

In our study, all our patients had undergone surgical treatment. Surgical treatment remains the leading indication in the management of femoral neck fractures in older children, in cases of displacement or unstable fractures [1, 2, 4, 10, 13].

In type I and type II fractures, where the fragment between the fracture and the growth cartilage is too small, non-threaded Kirschner wires can be used through the growth cartilage [15, 16]. The other types can be screwed in using cancellous, cannulated and short-threaded screws that respect the growth cartilage.

However, beyond the age of 12 years, screws through the growth cartilage can be used [15]. It should be remembered, however, that whenever a proper closed reduction is not possible, an open reduction followed by osteo-synthesis should be performed using the same techniques and basic principles as in closed osteosynthesis.

The need to evacuate the intracapsular hematoma remains a point of controversy. The tamponade effect is considered by many authors as a possible cause of avascular necrosis of the femoral head [17]. Nevertheless, there is no absolute proof, and there is some evidence that drainage of the intracapsular hematoma does not decrease the frequency of this complication [18]. However, in our study 3 patients undergoing open surgery had benefited from hematoma drainage. The indication for open reduction was due to logistical concerns (image intensifier not available) and not to the impossibility of correct reduction in closed surgery. The only case of femoral head necrosis in our study was secondary to closed reduction.

The quality of fracture reduction has an influence on the occurrence of necrosis. According to Shrader [12], a good reduction reduces the risk of necrosis, regardless of the type of approach.

In our series, closed reduction was successful in a large majority of cases 81.25% of which (13 cases).

All therapeutic modalities taken together, our results were globally satisfactory. These results are similar to those of Coulibaly, Bali and Senhaji who had respectively 11/13, 27/36 and 26/30 good results [3, 10, 13].

The main complications found in the literature are cephalic necrosis, vicious callus and pseudarthrosis [1, 7, 10, 19].

In our series, the decline ranged from 3 months to 60 months. This short duration of follow-up of some of our patients seems insufficient to judge the rate and finality of complications.

In our study, we nevertheless observed three complications:

- A case of necrosis in a displaced type III fracture: the main factors influencing the occurrence of such a complication are controversial because of vascularization on the one hand and therapeutic modalities on the other. Type III fractures are considered to be of poor prognosis as reported in the literature [1, 7, 10, 19].
- A case of enormous callus with significant inequality in length of the lower limbs. This complication occurred following a reduction defect leading to growth plate lesion as reported by some authors [2, 7, 20].
- A case of epiphysiodesis which caused a growth defect with a shortening of 1cm. This complication is either due to the initial trauma or/and to the multiple manipulations to achieve the reduction during the operation or to the "back and forth" movements of the growth cartilage. Other complications such as migration of the osteosynthesis material, infection, pseudarthrosis, although possible, were not found in our study [1, 7, 21]. This could be explained by the small sample size.

Conclusion

Fractures of the femoral neck in children are rare, especially in children under 10 years of age. Delbet type III is the most frequent injury. Surgical treatment remains the leading indication for the management of these fractures in older children. Treatment results are satisfactory.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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