ORIGINAL ARTICLE

Fractures in Children before 1-Year: Place Abuse

Caryne Mboutol-Mandavo[1,2,3], S. F. Ouedraogo[3], O. Ndour[3,4], A. Dramé[3], S. P. Karume[3], G. Ngom[3,4]

[1]Department of Surgery and Maternity, Faculty of Health Sciences, Brazzaville Marien Ngouabi University, Congo, [2]Department of Paediatric Surgery, University Hospital of Brazzaville, Congo, [3]Department of Pediatric Surgery, University Hospital Aristide Le Dantec of Dakar, Senegal, [4]Department of Surgery, Faculty of Medicine, Pharmacy and Dentistry of Cheikh Anta DIOP, Universty of Dakar, Senegal

Abstract

Aim: To study the epidemiological and diagnostic aspects of fractures in children before the age of 1 year and identify the place of abuse. **Materiel and methods:** we conducted a retrospective study in the Pediatric Surgery over a period of 2-year. We got 40 cases of fractures occurred before the age of 1 year. **Results and Discussion:** The main causes are the fall with 45% of cases, followed by the receipt of a load with 20% of cases, and traditional massage with 12.5% of cases. The main locations of these fractures are the femur (31.1%), humerus (20%) and the clavicle (17.8%). In applying the criteria Bayreuther, a likely accidental is retained in 67.5% of cases and abuse is suspected in 25% of cases, 7.5% of cases were not classified due to lack of clinical data and/or radiological fracture for linking to an accident or abuse. Fractures of the child before the 1st year of life are, in general, due to domestic accidents. However, a number of them may be due to intentional injuries or non-accidental injury. **Conclusion:** Abuse is a possible cause of fractures in children under 1-year should be systematically sought to the recurrences.

Keywords: abuse, domestic accident, fracture, infant.

Key words: Abuse, domestic accidents, fractures, infants, newborns

INTRODUCTION

Pediatric trauma, disability and child deaths that result are a major public health problem.[1] Fractures in infants are due, mostly, to accidental trauma mainly domestic accidents.[2] A domestic accident is unintentional injuries that occur at home or in its immediate vicinity (yard, garage, or other outbuildings).[2] However, it is very likely that some children are called accidental, in fact, trauma due to child abuse: "Child or young person is the one who is abused victim from his parents or adults in authority on him with physical violence, psychological abuse, gross negligence (or lack of care), sexual abuse can have serious consequences on their physical or mental development."[3] It is, therefore, the duty of the pediatrician and pediatric surgeon to know differentiating accidental trauma intentional injuries related to abuse, particularly among infants whose injuries are often trivialized as attached to the normal events of daily life peppering learning motor acquisition and development of the child.[4]

Very few studies have been conducted in Africa on this subject that is still taboo because it conflicted with educational practices and socio-cultural resorting to violence more or less tolerated.[5]

The aim of our study was to investigate epidemiological and diagnostic aspects of fractures in children before the age of 1 year (before the acquisition of walking) and perform a literature review to identify elements that distinguish accidental fractures because those due to abuse at that age.

Address for correspondence:
Dr. Caryne Mboutol-Mandavo, Service de Chirurgie Pédiatrique, 13 Avenue Auxence IKONGA,
BP 32, CHU de Brazzaville, Brazzaville, Congo.
E-mail: carynemboutol@yahoo.fr

Received: 10-11-2013
Revised: 15-10-2014
Accepted: 29-10-2014

PATIENTS AND METHODS

We conducted a retrospective descriptive study of the fractures occurred in children aged <1 year, admitted to the Pediatric Surgery Department of National University Hospital during a period of 2-year from 01 July, 2010, to 30 June, 2012. The cases of obstetric fractures, pathological as well as cases where the files were incomplete fractures were not included in our study. Variables, in our study, were epidemiological (age, sex, circumstances of occurrence of the injury), diagnosis (fracture type, line, seat, and topography), we also studied the consultation period and the notion of hospitalization cases of traumatic fractures observed at this age. We then classified patients into three groups according to the classification used by Bayreuther *et al*.[6]

- Patients with a probably accidental cause of the fracture are successful, this before a match between the child's age (psychomotor development level), circumstances of the occurrence of the accident reported by the surroundings and the elements clinical and radiological diagnosis, with a consultation period <48 h.
- Patients in whom suspicion of abuse were referred to a mismatch between the above elements, the physical signs and/or radiological previous trauma, with a consultation period longer than 48 h.
- Patients not classified, it is those the evidence does not allow us to move toward a trauma cause accidental or intentional.

Data were collected on Excel 2007. Quantitative variables were expressed as a mean ± standard deviation and qualitative variables as percentages.

RESULTS

Epidemiology

Frequency

We had 40 patients who had 45 fractures. They constituted 10.1% of disease in this age group.

Age

The mean age was 5.7 ± 4.1 months (range: 2 weeks-11 months), age of 0-3 months was the most represented with 40% of cases [Table 1].

Sex

There are as many boys as girls (sex ratio = 1).

Consultation period

More than half (57.5%) of our patients consulted in the first 48 h after the trauma and the third within 3-7 days.

Circumstances of occurrence

Place

Injuries occurred at the family home in 38 cases (95%), there was a trauma occurred in a nursery and another occurred in the workplace of the father.

Causes

A main cause reported by the family was as follows: The fall (bed, sofa, arm a third) with 45% of cases was the leading cause, followed by the receipt of a load with 20% of cases and traditional massage with 12.5% of cases [Table 2]. Fall of furniture (bed, couch) concerned especially children over 3 months of receipt of a charge of children of all ages, traditional massage children <3 months and falling escrow children <6 months.

Table 1: Age

Age (months)	Number	Percentage
0-3	16	40
4-6	7	17.5
7-9	9	22.5
10-12	8	20
Total	40	100

Table 2: Causes fractures

Causes	Number	Percentage
Falls	18	45
Receipt of a load	8	20
Massage	5	12,5
Traction	1	2,5
Unknown family	4	10
Not specified in file	4	10
Total	40	100

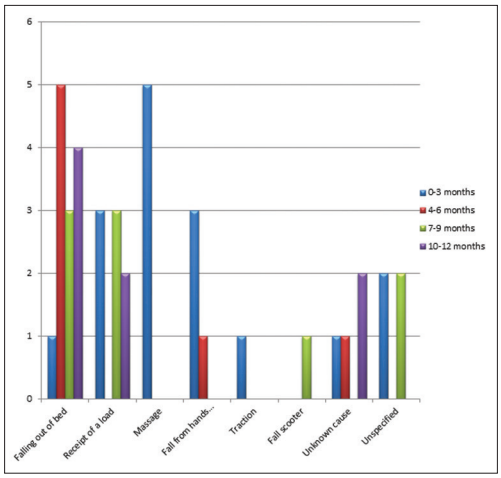

Figure 1: Distribution of cases by age

Main locations of fractures were the femur (31.1%), humerus (20%), and the clavicle (17.8%).

We noted a predominance of fractures of the femur and humerus in children <4 months. Broken collarbone has affected all ages, one of the two bones of the forearm, especially children over 6 months [Figure 1].

We found 77.8% of long bone fractures, 17.8% of clavicle fractures and 4.4% cases of fractures of the phalanges.

For long bones, diaphyseal fractures predominated with 82.9%, followed by metaphyseal fractures with 4 cases (11.4%) and epiphyseal fractures with 2 cases (5.7%).

We attached 27 cases (67.5%) fracture to a probable accident.

We found 10 cases (25%) of suspected abuse, including 7 patients <4 months. The 10 patients had 14 fractures, 6 humerus fractures (with a bilateral fracture), 4 fractures of the femur and a bilateral fracture of both bones of the forearm. Three patients (7.5%) could not be classified [Figure 2].

Notion of hospitalization

Four patients (10%) were hospitalized. There were three cases of patients with a femur fracture who underwent traction stuck before making a pelvis-leg cast, and one patient had multiple metacarpal fractures treated surgically by racking.

DISCUSSION

Our work has allowed us to report the descriptive epidemiology and clinical aspects of fractures in children <1 year. However, this work has some limitations, including the retrospective nature and probably selective recruitment bias because it took place in a specialized service. The small size of our sample does not constitute a limitation that the majority of studies on the subject have also focused on small numbers.[6-9] This study allows a preliminary comparison with literature data.

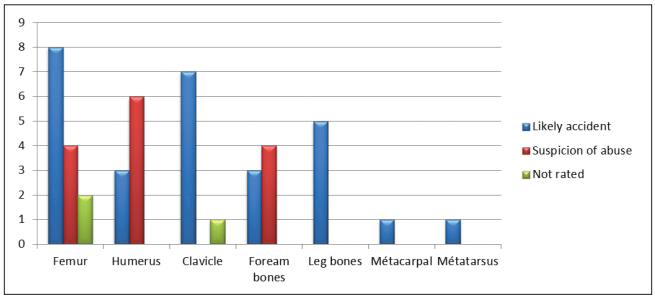

Figure 2: Distribution of the topography of fractures according to the probable origin of the trauma

Epidemiological aspects

Fractures represent 10.1% of disease in children under 1 year received during the study period. Bayreuther *et al*.,[6] found 0.2%. This difference can be explained by the fact that their sample was larger (20,497 against 445 patients in our series) with many admissions for mild injuries that are not often the subject of consultation in our environment, more work was conducted in a pediatric emergency department could explain recruitment bias relative to our study which was conducted in a pediatric surgery.

Mean age was 5.7 months with a range of 2 weeks and 11 months, our results are similar to those reported in the literature.[6-8] In our series, the age of 0-3 months is the most represented.

Literature is not unanimous on this issue. Bayreuther *et al*.,[6] with a series of 36 cases, noted an increase in frequency with age: 8.3% for children aged 0-3 months against 50% for children aged 9-12 months.

McClelland and Heiple[7] in a series of 34 children, found many cases (29.4%) in the age of 0-3 months, 4-6 months and 7-9 months, while the age 9-12 months is the least represented with 11.8%.

These differences are likely due to chance, and a randomized study is needed to assess the true distribution of these fractures by age groups.

Like us, McClelland and Heiple[7] found no difference in gender distribution within a year. However Macgregor,[9] and Skellern *et al*.,[10] reported a male predominance with 56% and 64.6% respectively without explanation.

Consultation period

More than half of our patients presented within the first 48 h.

The consultation period is important because most authors place him among the predictors of abuse. Indeed, a period of use of more than 48 h medical care in a severely injured child is considered suspect abuse.[7,11,12]

However, we believe that this factor must be qualified in our conditions where parents consult later for various socio-economic and cultural reasons.

Niney-five percent (95%) of injuries in our series occurred in the family home. The literature is unanimous on the fact that infants, because of their low mobility, are mostly victims of domestic accidents in 75-80% of cases.[7,13,14]

Falling is the leading cause of fracture in our series which is consistent with data from the literature.[15-17] This is especially

the fall of furniture (bed or couch) or a third arm. Warrington *et al*.,[18] in a study of accidents and injuries in infants before the march, noted that falls due in 53% of cases falls to the bed or couch followed falls of the third arm 12% of cases.

Fall of a cabinet especially for children older than 3 months in our series. Receiving a load with 20% of cases is the second leading cause of fractures in our series; it is an older child who fell on the infant laid on the floor, on the bed or chair. In other studies, we note the rather objects falling on the child, become mobile and curious "key to everything," explores its environment and draws objects in its path with fall risk.[7,17] Traditional massage is the third leading cause of fractures in our series with 12.5% and for the age of 0-3 months. This is a practice that is very common in Africa,[19-21] but also in other regions of the world.[22-24] Beyond its benefits certainly recognized the traditional massage is not without danger.

Diagnostic aspects

Fractures have served mainly to the femur, humerus and clavicle.

For limb fractures, fractures of the femur and humerus are the most common to McClelland and Heiple[7] while bone fractures of the leg and collarbone predominate for Macgregor.[9]

Long bone fractures are especially diaphyseal, sitting more often in middle 1/3 and transverse line, these observations are similar to those in the literature.[25,26] However, we noted 13 cases of oblique spiral fractures and fractures in our series. This is, in particular, important to emphasize that the fractures spiroid or slash long in infants before the age of walking or a year are found in intentional injuries (abuse) because they are accordingly a leno.[27,28]

Fall of the bed is found in three main locations of fractures (femur, humerus, and clavicle) while receiving a load affected all locations; fractures by traditional massage are only interested in the femur and collarbone. We did not find in the literature studies reporting the location of the fracture relative to the stressor.

Fractures of the clavicle are mainly due to the fall of the bed in our study. This is certainly due to the fact that the fall of the bed is often accompanied by a reception on the top of the shoulder. Humerus fractures have varied causes, and we did not notice the predominance of a question in relation to another.

We did not find any notion of previous trauma, an important element to look at any fracture of the infant to discuss the possibility of non-accidental trauma.[11,12,29] However, it is difficult to confirm the absence of trauma or previous fracture because medical records are based on the elements of the trauma to which the child has consulted. Moreover, no patient received a full body X-ray looking for other old and new fractures. Doutaz and Spalinger[11] point out that in more than 40% of abused children, fractures are not suspected clinically and are only found during a routine X-ray examination. Thus, literature recommends the systematic implementation of whole body X-rays in all infants admitted to a serious skeletal trauma[30,31] or in cases of suspected abuse.[11,29]

Pediatricians and orthopedic surgeons are the first in line to assess the status of these patients, because if not accidental (abuse) of the fracture is not recognized, these children will return to a violent environment with a risk of 50% of relapse and a 10% risk of death.[32,33]

Indeed, the inquiry should be an inconsistency in the story or a story that would be inconsistent with the age of the child (or the level of psychomotor development), and the notion of previous fracture, clinical examination search skin lesions abuse (bruises, multiple scars, etc.), radiography whole body should be systematic in all infants admitted for a fracture in search of a previous fracture or multiple fractures of different ages (Silverman and Tardieu syndrome). It can be complemented by a whole body scintigraphy in infants over 2 years.[28,29,34]

Most authors consider that age is a key element of suspicion of abuse in fractures in infants: Age <1 year (or before walking)[6,7] to 15 months[35,36] or 18 months.[37]

Baldwin *et al*.,[9] in a study of femoral fractures in children, as well as Pandya *et al*.,[37] in a study of fractures of the humerus in children, studied various predictors of abuse and were able to identify three major predictors of differentiation of child abuse from accidental trauma: In <18 months old, physical evidence and/or radiographic previous trauma and a suspected history of abuse. For Baldwin *et al*.,[9] patients without risk factors have a 4% chance of having a fracture of the femur due to abuse, patients with a risk factor have a chance to 24%, those with two factors risk of 87%, and those with three risk factors have a 92% chance of having a fracture of the femur resulting from abuse.[12]

Based on the foregoing and applying the classification arguments Bayreuther *et al*.,[6] we identified 10 patients (25%) in whom we suspected the abuse. This rate is close to those in the literature.[6,10] The lesions are fractures of the femur, humerus and bones of the forearm. The majority of these patients (7 cases/10) were under the age of 4 months. In studies, mainly fractures of children under 1 year of <4-5 months of age is a major element of suspected abuse.[9,12,16] More child is young greater the likelihood that it is indeed a non-accidental fracture.[31] This suggests the need to identify and address the abuse of infants in the perinatal period by detecting the warning signs: Unwanted pregnancy, poorly monitored, maternal depression, precarious social and economic situation, etc.[38]

Our results are identical to those of Bayreuther *et al*.,[6] on the topography of fractures. For Gross and Stranger, [39] 80% of fractures of the femur in a child who does not work would be related to the abuse. On the type of fracture, it is essentially diaphyseal fractures in our study. For Pandya *et al*.,[37] the humeral shaft fracture is the result of abuse in 86.7% of cases. Fractures of distal end of humerus are mainly from accidents while those of the proximal end orientate toward more abuse.[10]

Notion of hospitalization

About 10% of our patients were hospitalized. Some authors recommend routine hospitalization of all children under 1 year admitted for fracture,[8,38] while others[12,30] not recommend hospitalization than those in whom it is suspected a non-accidental trauma. In all cases, hospital is required time to conduct a thorough investigation to determine whether accidental fracture.[8,12,30,38]

CONCLUSION

Child abuse is a real problem that we have to realize, especially in Africa where some form of educational violence is tolerated broad, thus endangering the future functional or the lives of many children and more, making services socio-legal management of these patients must revitalize otherwise created to fight against this scourge. To do this, it is essential for pediatrician's surgeons not only treat fractures of these children but also to know and to recognize the characteristics of trauma may suggest abuse.

REFERENCES

1. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AJ, Branche C, Fazlur Rahman AK, *et al*. World Report on Child Injury Prevention. Geneva: WHO and UNICEF; 2008. Available from: http://www.who.int/violence_injury_prevention/child/en/. [Last updated on 2012 Dec 15, Last cited on 2013 Oct 01].
2. Thélot B. Epidemiology of the injuries among children and teenagers. Arch Pediatr 2008;15:758-60.
3. Straus P, Manciaux M, Gabel M, Girodet D, Mignot C, Rouyer M. L'enfant Maltraité. Paris: Fleurus; 1993. p. 1-696.
4. Sebastian AA. Paediatric trauma care. Afr J Paediatr Surg 2010;7:129-33.
5. UNICEF. Violence against Children in West and Central Africa. A Concise Appraisal. Available from: http://www.unicef.org/french/protection/files/violence_ang.pdf. [Last update on 2012 Dec 09, Last cited on 2013 Oct 01].
6. Bayreuther J, Macgregor A, Sajjanhar T. Management of limb fractures in children under 1 year of age in a dedicated paediatric emergency department. Emerg Med J 2009;26:173-6.
7. McClelland CQ, Heiple KG. Fractures in the first year of life. A diagnostic dilemma. Am J Dis Child 1982;136:26-9.
8. Banaszkiewicz PA, Scotland TR, Myerscough EJ. Fractures in children younger than age 1 year: Importance of collaboration with child protection services. J Pediatr Orthop 2002;22:740-4.
9. Macgregor DM. Accident and emergency attendances by children under the age of 1 year as a result of injury. Emerg Med J 2003;20:21-4.
10. Skellern CY, Wood DO, Murphy A, Crawford M. Non-accidental fractures in infants: Risk of further abuse. J Paediatr Child Health 2000;36:590-2.
11. Doutaz M, Spalinger J. Child abuse: Does something escapes me? Swiss Med F 2003;20:469-74.
12. Baldwin K, Pandya NK, Wolfgruber H, Drummond DS, Hosalkar HS. Femur fractures in the pediatric population: Abuse or accidental trauma? Clin Orthop Relat Res 2011;469:798-804.
13. Thélot B. Epidemiology of the home and leisure injuries among children. Arch Pediatr 2010;17:704-5.
14. Institut National de Prévention et d'Éducation pour la Santé (INPES). Protéger vos enfants des accidents domestiques. Available from: http://www.inpes.sante.fr/CFESBases/catalogue/pdf/978.pdf. [Last updated on 2013 Feb 25, Last cited on 2013 Sep 01].
15. Agran PF, Anderson C, Winn D, Trent R, Walton-Haynes L, Thayer S. Rates of pediatric injuries by 3-month intervals for children 0 to 3 years of age. Pediatrics 2003;111:e683-92.
16. Tursz A, Lelong N, Crost M. Home accidents to children under 2 years of age. Paediatr Perinat Epidemiol 1990;4:408-21.
17. Ategbo S, Minto'o S, Koko J, Mba-Meyo SM. Epidemiological aspects of domestics accidents of child in Libreville (Gabon). Clin Mother Child Health 2012;9:1-3.
18. Warrington SA, Wright CM; ALSPAC Study Team. Accidents and resulting injuries in premobile infants: Data from the ALSPAC study. Arch Dis Child 2001;85:104-7.
19. Real I. Traditionnal massage for infants and migration. J Pédiatr Puéricult 1995;2:112-6.
20. Ye D, Nacro N, Koueta F, Dao L, Kabore A, Sawadogo A. Traditional practice of infant care: Investigation of 502 mothers and infants in Ouagadougou (Burkina Faso). Arch Pediatr 2007;14:1112-3.
21. Koffi KS, Balaka B, Agbo A, Agbèrè AD, Gbadoé AD, Atakouma DY. Soins traditionnels donnés aux nouveau-nés et nourrissons dans le district sanitaire de Kloto (Togo): Risques et avantages. J Rech Sci Univ Lomé 2012;14:27-37.
22. Bagna R, Berbotto E, Bevilacqua C, Mandis L, Marencu C, Mosca M, et al. Role of massage of preterm infants in intensive care. Arch Pédiatr 1999;6:573.

23. Stork H. Enfances Indiennes. Paris: Le Centurion; 1988.
24. Darmstadt GL, Saha SK. Traditional practice of oil massage of neonates in Bangladesh. J Health Popul Nutr 2002;20:184-8.
25. Clavert JM, Metaizeau JP. Les Fractures Des Membres de L'enfant. Montpellier: Sauramps Médical; 1990. p. 315-27.
26. Serra C, Bollini G, Jouve JL, Barthelemy R, Versier G. Fractures chez L'enfant. Paris Masson: Programme Officiel d'Internat; 1999. p. 150-72.
27. Durand C, Baudain P, Nugues F, Bessaguet S. Osteoarticular manifestations of battered child syndrome. J Radiol 1999;80:556-8.
28. Adamsbaum C, Cohen PA, Kalifa G. Imaging of children abused. EMC Radiology, update 1999, 31-045-A-10, 10p.
29. Jos J. Abused children. EMC Pédiatrics, Update 2001, 4-126-A-20, 8p.
30. Bader-Meunier B, Nouyrigat V. Prise en charge initiale des enfants victimes de mauvais traitements. Encycl Méd Chir Méd 2004;1:352-64.
31. Nathason M, Oxley J, Rouyer M. Maltraitance envers les enfants et les adolescents. J Pédiatr Puéricult 2011;24:295-305.
32. Grenn M, Haggerty RJ. Enfants maltraités physiquement. Philadelphie, PA: WB Saunders; 1968. p. 285-9.
33. Kocher MS, Kasser JR. Orthopaedic aspects of child abuse. J Am Acad Orthop Surg 2000;8:10-20.
34. Zerah M. Les traumatismes non accidentels du tout-petit. J Pédiatr Puéricult 2001;14:396-8.
35. Richard T, Robert M, Robert A. Humeral fractures without obvious etiologies in children under 3-years : when is it abuse? Pediatrics 1995;96:667-71.
36. Shaw BA, Murphy KM, Shaw A, Oppenheim WL, Myracle MR. Humerus shaft fractures in young children: Accident or abuse? J Pediatr Orthop 1997;17:293-7.
37. Pandya NK, Baldwin KD, Wolfgruber H, Drummond DS, Hosalkar HS. Humerus shaft fractures in young children: Accident or abuse? J Pediatric Orthop 2010;19:535-41.
38. Wilson LM, Reid AJ, Midmer DK, Biringer A, Carroll JC, Stewart DE. Antenatal psychosocial risk factors associated with adverse postpartum family outcomes. Can Assist Med J 1996;154:785-99.41.
39. Gross RH, Stranger M. Causative factors responsible for femoral fractures in infants and young children. J Pediatr Orthop 1983;3:341-3.

Source of Support: Nil. **Conflict of Interest:** None declared.