

Pelvic Fractures in Children: About 30 Cases Observed at University Hospital of Brazzaville

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Abstract

Introduction: Trauma in children is a major public health problem. Pelvic fractures involve all fractures of the pelvic girdle: iliac bone, sacrum, and coccyx. It is uncommon in children. Their seriousness is due to the traumatic injuries that are often associated with them, because of the violence of the trauma. **Patients and Methods:** We performed a descriptive study conducted from 2012 to 2022 (10 years) in the pediatric surgery department of Brazzaville University Hospital. Data collection was retrospective. We studied the records of all children aged 0 - 16 years hospitalized for pelvic fracture in order to determine their diagnostic and therapeutic aspects in Brazzaville. **Results:** Our study included 30 cases of pelvic fractures. There was a male predominance, with 20 boys (66.7%) and 10 girls (33.3%). The average age was 8.5 years (extremes 2 and 15 years), with a peak between the ages of 6 and 10. Road traffic accidents were the most common cause, accounting for 21 cases (70%). Inguinal pain and functional impotence of the pelvic limb were the symptoms consistently found. All patients had a pelvic X-ray. Fractures occurred in 24 cases (80%) on the obturator frame. Il s'agissait le plus souvent des fractures de type 3 de Torode et Zeig. Five (16.6%) patients had polytrauma. Almost all patients had received orthopedic treatment, and all had a favorable outcome. **Conclusion:** Pelvic fractures are rare in children, and are often caused by road accidents. They are most often associated with other injuries, sometimes in the context of polytrauma. Treatment is usually functional and/or orthopedic, with good functional results.

Keywords

Fractures, Pelvis, Child, Brazzaville

1. Introduction

Childhood trauma is a major public health problem [1]. Trauma and violence are among the leading causes of death in children worldwide. They are the cause of more than 950,000 deaths in children and young people under the age of 18 each year worldwide [1]. Trauma to the pelvis is often the result of high-energy trauma and occurs in the context of polytrauma [2]. Pelvic ring fractures are bone continuity solutions and ligament ruptures located on the posterior arch (iliac wing, sacrum, coccyx) and/or on the anterior arch (obturator frame and pubis) [3]. In the literature, the incidence of these injuries in children is low, ranging from 2.4% to 7.5% [4]. Similarly, pelvic fractures are rare in children, accounting for between 0.3% and 4% of all pediatric traumatic injuries [5]. Apart from the management of associated injuries, orthopedic treatment of pelvic fractures is the treatment of choice because they heal rapidly [6].

2. Patients and Methods

This was a descriptive cross-sectional study with retrospective data collection, carried out over a 10-year period from 1 January 2012 to 31 December 2022, in the pediatric surgery department of the Brazzaville University Hospital. It included all children aged 0 to 16 years hospitalized for pelvic fractures. A parental assent form had been signed to include a child in the study. As our system is not computerized; 18 cases recorded as pelvic fractures, but lacking medical records, were initially included in the frequency calculation but subsequently excluded from the study due to a lack of usable data.

We studied:

- epidemiological: frequency, sex, age divided into 3 groups (0 - 5 years, 6 - 10 years, 11 - 16 years), origin, cause of trauma, mode of transport, admission time;
- diagnostic: reason of consultation, general condition, physical signs, radiographic lesions, type and location of fracture, Torode and Zeig classification [7], associated lesions;
- therapeutic: treatment period, type of treatment;
- outcome: complications, sequelae, notion of death.

The outcome was considered favorable when the child exhibited no residual pain, limping, or deformity, and radiographs showed bone consolidation.

The data were analyzed using Epi Info software version 7.2.4.0 and Excel.

3. Results

- **Epidemiological aspects:** during the study period, 9000 patients were hospitalized in the pediatric surgery department, 48 of them for pelvic fractures, representing a hospital frequency of 0.5%. Of the 48 cases, we selected and analyzed 30 (62.5%). The average annual incidence was 3 cases per year (extremes of 2 and 6 cases). There was a male predominance, with 20 males (66.7%) and 10 females (33.3%), giving a sex ratio of 2. The mean age was 8.5 years (range 2 - 16 years).

The most common age group was 6 - 10 years, accounting for 43.4% of cases (**Figure 1** and **Table 1**).

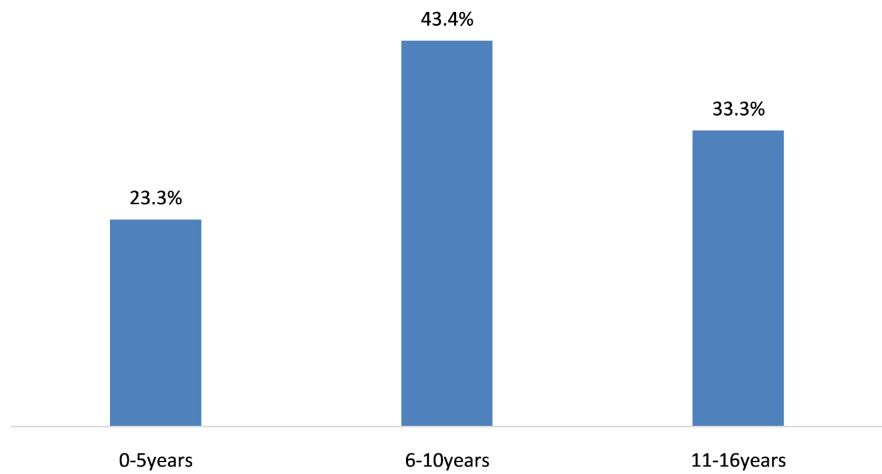


Figure 1. Distribution of patients by age.

Table 1. Distribution of patients by time to admission.

Hours	N	%
0 - 12	19	63.3
12 - 24	2	6.7
≥24	9	30

The patients lived in urban areas in 26 cases (86.7%) and in rural areas in 4 cases (13.3%).

Road traffic accidents were the main cause of pelvic fractures, accounting for 70% of cases (**Figure 2**).

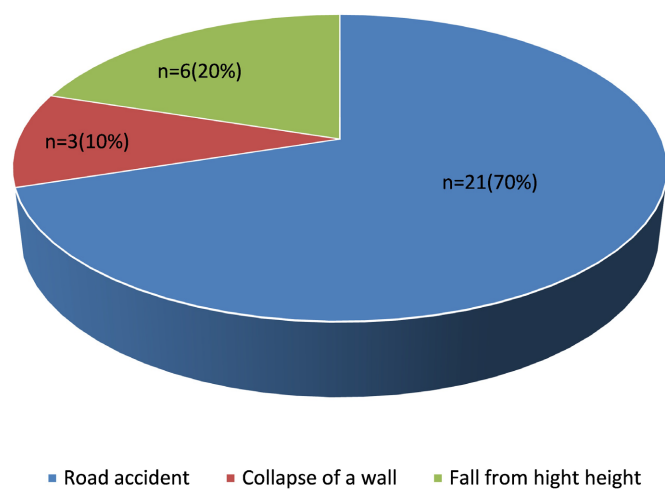


Figure 2. Distribution of patients by cause of injury.

As regards MVAs, 18 cases (60%) involved pedestrians hit by a car, 2 cases

(6.7%) involved pedestrians hit by a motorbike and one case (3.3%) involved a car passenger. Falls were represented by one case of a fall from the top of a roof and 5 cases of a fall from the top of a tree.

Patients were transported to the hospital by taxi in 26 cases (90%), by private vehicle in 2 cases (6.7%) and by the fire brigade in 1 case (3.3%).

Most patients were admitted within the first 12 hours following the trauma.

The mechanism of injury was specified in only 8 cases (26.7%). It was vertical shearing in 3 cases, lateral compression in 3 cases and 2 cases of antero-posterior compression.

- Diagnostic aspects

Pelvic pain and functional impotence of the traumatized limb were the reasons for consultation in all patients; we found 2 cases of urethrorrhagia.

Pain in the inguinal fold was the most common physical sign in 86.7% of cases (**Table 2**).

Table 2. Distribution of patients according to physical examination signs.

Signes	N	%
Inguinal pain	26	86.7
Pain during manoeuvres	16	53.3
Pubic pain	4	13.3
Bladder Globe	2	6.7
Asymmetry of the pelvis	2	6.7
Perineal haematoma	2	6.7
Damage to the perineum	2	6.7
Shortening of the pelvic limb	2	6.7
Perineal irritation syndrome	1	3.4

Morphological examinations All our patients had undergone a standard X-ray of the pelvis, which systematically included a frontal view in all patients and a lateral view in 5 cases.

In our series, 5 patients (16.7%) had undergone a pelvic CT scan.

Other morphological examinations were ordered according to the clinical picture and associated lesions.

Location of pelvic injuries

In our series, traumatic pelvic injuries consisted of fractures (32 cases) and disruptions (5 cases). The obturator ring was the most frequently affected site, involving 16 patients (86.7%) (**Table 3**). We did not find any cases of isolated diastasis; these consisted of 4 cases of pubic symphyseal diastasis associated with an obturator ring fracture (**Figure 3(a)**), and 1 case of sacroiliac diastasis associated with a fracture of obturator ring. Thus, we recorded 26 cases (86.7%) of stable lésions and 4 cases (13.3%) of unstable lésions. The classification of the observed injuries according to Torode and Zied is presented in **Table 4**.

Extrapelvic Injuries

Pelvic trauma was isolated in 12 cases (40%), while 18 patients (60%) presented two or more traumas (**Table 5**), including 5 cases (16.7%) of polytrauma.

- Therapeutic aspects

All patients had received analgesics.

Strict bed rest on a firm surface without traction was prescribed in 24 cases, glued traction in 5 cases for 12 days (extremes of 10 and 60 days), and discharge was authorized with a pelvi-pedal castor plastered Bermuda shorts to impose continued rest at home.

Table 3. Distribution of patients according to the topography of the pelvic fracture.

Topography	N	%
Shutter frame	27	90
▪ 2 branches	16	53.3
▪ Branche Ischio-Pubic	6	20
▪ Branche ilio-pubic	5	16.7
Pubis	2	6.7
Iliac wing	1	3.3

Table 4. Distribution of patients according to the classification of Torode and Zieg.

Type	n	%
1	-	-
2	1	3.3
3	25	83.4
4	4	13.3
Total	30	100

Table 5. Distribution of patients by associated lesions (N = 30).

Associated lesions	n	%
Cranioencephalic trauma	5	16.6
Fracture of the humerus	3	10
Femur fracture	3	10
Rupture of the urethra	2	6.6
Damage to the perineum	2	6.6
Intraperitoneal bladder rupture	1	3.3
Hemothorax	1	3.3
Forearm bone fractures	1	3.3

One patient had undergone surgery, including double osteosynthesis of the pelvis and femur using a screw plate (**Figure 3**).

Appropriate management of the associated lesions was instituted:

- cystorraphy with abdominal cleansing by laparotomy: 1 case
- suprapubic catheterism for cases of traumatic urethral rupture, followed by urethrorraphy 3 months after the trauma;
- plaster cast immobilization for humerus fractures and 1 case of femur fractures after bonded traction;
- osteosynthesis in 2 cases of femoral shaft fracture;
- thoracic drainage for 1 case of hemothorax;
- offloading colostomy and directed healing for 2 cases of perineal dislocation.

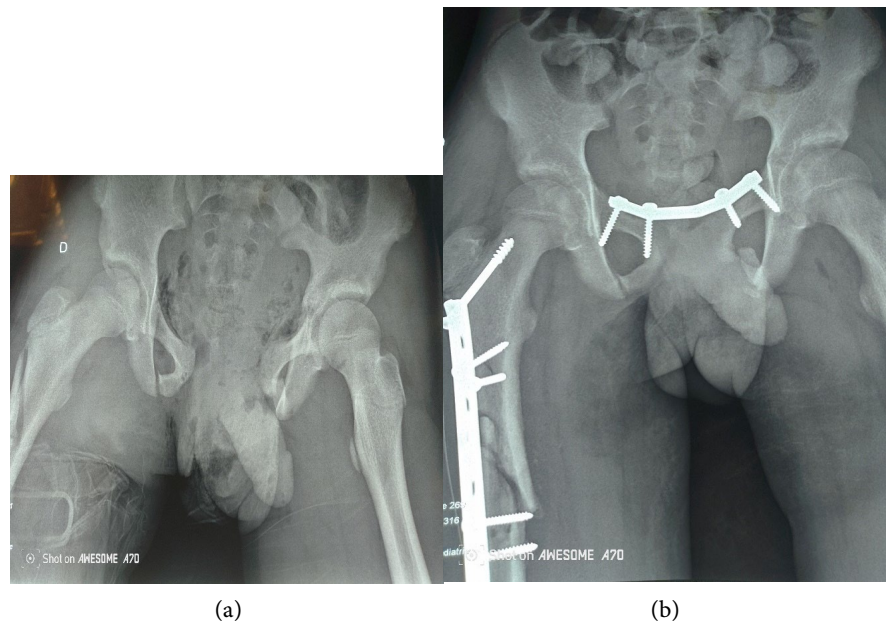


Figure 3. (a) Unstable pelvic fracture Torod and Zied type IV with symphyseal diastasis and comminuted femoral fracture in a 13-year-old adolescent following a traffic accident; (b) Double osteosynthesis of the pelvis and femur using screwed plates.

Outcome

The average hospital stay was 14.2 days (range 10 and 61 days).

Ten patients were reviewed with a mean follow-up of 36.8 months (range 5 months to 48 months).

The clinical examination of these patients was normal. No morphological examinations were requested. No deaths were observed.

4. Discussion

1) Epidemiological aspects

Pelvic fractures are rare in children, with a reported incidence of 1/100,000 children per year in developed countries [8]. In our study, the hospital incidence was 0.5%, with a mean annual incidence of 3 cases/year. This result is close to that reported by De la Calva *et al.* [5] and Banerjee *et al.* [9], with 3.8 and 4.4 cases/year respectively, while Tuovinen *et al.* [10] reported an incidence of 7.1 cases/year. The hospital frequency of pelvic fractures in our series is 0.5%, which is in line

with the literature, where it varies between 0.02% - 5% [11] [12]. The male predominance found in our series has already been reported by other authors such as Shaath *et al.* [13], De la Calva *et al.* [5], Saglam *et al.* [4] with 2.1 - 1.6 and 1.5 respectively.

The mean age was 8.5 years, similar to that reported by Shaath *et al.* [13] at 8.3 years, while Yaokreh *et al.* [14], De la Cava *et al.* [5] and Tuovinen *et al.* [10] found a higher mean age of 9.5, 9.9 and 11 years respectively. The urban population is the most affected, which may be explained by the increase in the number of cars and the failure to comply with traffic regulations, resulting in exposure to public road accidents, whereas falls from great heights by falling from a fruit tree are found in patients from rural areas in Africa [13]. In the literature, road traffic accidents are the main cause of pelvic fractures in children, followed by falls from a great height [5] [9] [10] [14]-[16]; car or motorcycle/pedestrian conflicts are more frequent, accounting for 66.7% of cases. This result corroborates the data in African and Western literature reported by Gobba *et al.* [17], Pietrzak *et al.* [18], and Lopreiato and Ramalingam [19], with 50%, 70% and 75% respectively. While in developed countries, falls from a great height in children are most often caused by defenestration [20], in Africa they often occur from a tree, often a fruit tree [15] [21].

2) Diagnostic aspects

Trauma to the pelvis is often the result of high-energy trauma requiring a full work-up to detect concomitant life-threatening injuries. Anteroposterior radiographs and rapid sequence CT scans are the reference diagnostic tests for identifying the fracture and associated lesions [22]. In our practice, CT scans are not always available due to the low socio-economic status of families. Although CT of the pelvis is the most complete and effective means of assessing the total extent of lesions, it must be used judiciously, as it increases time, cost and exposure to radiation. It produces 100 to 500 times more ionizing radiation than plain X-rays, which increases the risk of solid organ cancer and leukemia [23]. In most cases, X-rays alone can reliably predict the need for and type of surgical intervention in children with pelvic ring fractures [24]. However, CT scans of the pelvis can be useful in complex lesions and for preoperative planning and should be considered to assess instability, large anterior ruptures, posterior ring ruptures and acetabulum fractures [8].

The predominance of type 3 pelvic fractures according to the classification of Torode and Zeig [7] is consistent with the data in the literature [5] [14] [24] [25]. However, Guerra *et al.* [26] found as many type 3 as type 4 fractures, Hasan *et al.* [27] reported a predominance of type 4.

Bone plasticity and the strength of the periosteum limit the occurrence of unstable lesions, which are more frequent in adults. The pelvic bones of children are less fragile because they are covered by a thick periosteum, which gives them greater elasticity and stability. The pubic symphysis and sacroiliac joints are solid and the immature pelvis is therefore able to dissipate a relatively large amount of energy before giving way. As a result, multifocal ring fractures and pelvic ligament ruptures are relatively rare in children [19].

The frequent association of pelvic fractures with other injuries is reported in the literature and is linked to the violence of the impact [5] [10] [14] [25]. We observed 60% of injuries associated with trauma to the pelvis in our series. In fact, the literature reports that 58% to 100% of injuries associated with pelvic fractures in children [25]-[28]. Cranioencephalic trauma is the most common associated injury, accounting for 16.6% in our series. Lane-O’Kelly *et al.* [29] who found one third of cases of pelvic fractures associated with head trauma also made this observation. In addition to other musculoskeletal injuries, traumatic rupture of the urethra was found in 6.6% of cases. The frequency of traumatic rupture of the urethra in pediatric pelvic fractures has been estimated at between 2.4% and 7.5% [24] [30], but may be as high as 10% - 30% [27] [29] [31].

3) Therapeutic aspects

Management of a pelvic fracture always begins with an assessment of the hemodynamic state, as these are usually serious injuries. Hence the need for hemodynamic stabilization and the implementation of general measures, in particular a stable venous access, analgesics, a blood transfusion if necessary, and urinary drainage using a Foley catheter or suprapubic catheterization if a traumatic rupture of the urethra is suspected.

With regard to pelvic ring injuries, the literature agrees that treatment is most often functional with simple bed rest, orthopedic with glued traction or plaster cast immobilization [32]. After inpatient bed rest until pain subsides, we apply a cast to impose rest until a callus is obtained on radiography.

Surgical treatment is rare; in our series, one patient (3.3%) underwent screw-plate surgery for a large symphyseal disjunction; in the series by Yaokreh *et al.* [14], 4 patients (8.7%) underwent surgery, 2 of whom underwent sacroiliac screw-plate surgery and the other 2 by symphyseal screw-plate surgery (2 cases). Fixation of the anterior ring can be obtained by internal fixation after open reduction, percutaneous fixation or external fixation. Indications for posterior ring fixation include displaced sacral fractures, sacroiliac joint dissociations and crescentic fractures. If the posterior ring is reduced by closed methods, percutaneous screw fixation is preferred [19] [32].

Other surgical procedures may be performed depending on the nature of the associated lesions (Table 5), including urethroplasty, skewering for fracture, bladder suture, trimming of perineal damage with colostomy, etc.

Outcome is often rapid towards bone consolidation, with good functional recovery in our study. Morbidity in our study is mainly related to iterative stenosis of the urethra.

Functional problems are most often seen in unstable displaced fractures. Over 30% of children who survive unstable pelvic fractures have residual pain, lameness, scoliotic attitude or lumbar pain, permanent urological damage, etc. [33].

5. Conclusion

Pelvic fractures are rare in children, often due to a violent trauma such as a car-

pedestrian road accident. They are most often associated with other injuries, sometimes in the context of polytrauma. Treatment is usually functional and/or orthopedic, with good functional results.

Author Contributions

Conceptualization: Caryne Mboutol-Mandavo, Michel Carel Kombila; Methodology: Michel Carel Kombila; Software: Jean-Claude Miérét; Validation: Caryne Mboutol-Mandavo and Jean-Robert Mabiala Babela; Formal analysis: Jean-Claude Miérét; Investigation: Moïse Service Yanguedet, Michel Carel Kombila, Rhodia Bosséba Missengué; Resources: Caryne Mboutol-Mandavo; Data curation: Caryne Mboutol-Mandavo; Writing—original draft preparation: Michel Carel Kombila; Writing—review and editing: Caryne Mboutol-Mandavo; Visualization: Caryne Mboutol-Mandavo; Supervision: Jean-Robert Mabiala Babela; Project administration: Caryne Mboutol-Mandavo; Funding acquisition: Rhodia Bosséba Missengué; All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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