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Case Report

Limited ilioinguinal approach for unstable pelvic fractures in children aged <3 years

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ABSTRACT

Background: Pelvic fractures in pediatric trauma account for 0.5–1 % of total hospital admissions, whereas acetabular fracture occurs at a rate of one case per 100,000 children; the low presentation rate is due to its unique characteristics. Standardized management for this age group is impossible. Conservative treatment has been commonly used but surgical correction has gained popularity. The purpose of this study was to report the authors' experience using a limited ilioinguinal approach for unstable pelvic fracture in two toddlers.
Methods: Description of case studies.
Results: Herein, we describe the treatment of two patients: a male patient struck by a vehicle (aged 1 year and 7 months) and a female patient ejected from a motor vehicle (aged 2 years and 1 month). They sustained an unstable type IV fracture in the modified Torode and Zieg classification. Surgical treatment was performed using a limited ilioinguinal approach, and stabilization was achieved using 3.5-mm reconstruction plate. There were no iatrogenic nerve injuries or infection. The female patient had left hip dislocation 2 months post-surgery and was unfortunately lost to follow-up. The male patient achieved radiological bone union without discrepancy, with no loss of reduction or evidence of pain during the mean follow-up period of 18 months.
Conclusion: Pelvic fracture in children is rare. Based on fracture patterns, surgical stabilization may be necessary to prevent major complications in the short, medium, or long term. The limited ilioinguinal approach was proven to be a viable alternative for managing unstable pelvic fracture in children aged <3 years with minimal blood lo and shorter operative time, allowing more anatomical and stable reduction.

Introduction

Fractures of the pelvic ring and acetabulum constitute 0.5–1 % of total pediatric trauma hospital admissions. The average age is 11.8 years (range 3–16) years old, with a sex distribution of 46 % females and 54 % males [1].

The rarity of pelvic and acetabular fractures in pediatric patients is due to a large amount of cartilage, strong ligamentous structure, and considerable elasticity in the pelvic and hip joints. This allows the pelvis to absorb a substantial amount of energy without fracturing [2,3].

Recent studies have show that the remodeling ability of children after fracture is suboptimal [4]. Fortunately, <10 % of pediatric

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Fig. 1. Clinical presentation of abrasions in the pelvic area.

patients with pelvic injury require surgical management [5]. Complication after conservative treatment in unstable pelvic fracture, such as pelvic asymmetry, non-structural scoliosis, lower back pain, discrepancy in length of the limbs, and claudication when walking, seriously affect the quality of life of these children.

Complex pelvic ring injuries can be difficult to treat, especially at a young age. Although there is no consensus on the best approach or fixation methods, surgically repairing unstable or displaced pelvic fractures is beneficial regardless of patient age or skeletal maturity [6].

Herein, we present two patients under the age of 3 years with complex pelvic ring fractures. We used only the first and third windows of the ilioinguinal approach originally described by Letournel to stabilize the pelvic fractures. To our knowledge, this technique has not been extensively studied in these rare pediatric cases.

Case reports

Case 1

A 1-year-and-7-month-old male patient was struck by a vehicle and presented with left-sided injuries, including abrasions on the abdomen, left iliac fossa, and iliac crest; external rotation of the left leg; and deformity with swelling of the left arm. There were no circulatory or alertness alterations. Placement of a Foley catheter revealed hematuria. Negative Focused Assessment with Sonography in Trauma (FAST) was reported (Fig. 1).

Plain radiography of the pelvis showed loss of bone continuity at the non-displaced right superior pubic and ischiopubic ramus and

Fig. 2. Anteroposterior radiograph of the pelvis with considerable displacement of the left superior pubic ramus.

the left superior pubic ramus with superior displacement of 2 cm (Fig. 2), and radiography of the humerus revealed a humeral shaft fracture (Fig. 3). Computed tomography (CT) confirmed pelvic ring injuries with complete avulsion of the superior pubic ramus on the left side, which included injury to the growth cartilage of the ipsilateral hip with considerable rotation (Fig. 4).

Surgical technique

An anterior ilioinguinal approach was conducted using the first and third windows. The first incision of approximately 3 cm was made over the palpable left anterior superior iliac spine (Fig. 5). Another horizontal Pfannenstiel-type incision was made above the symphysis. The avulsion and displacement of the left iliopubic ramus was reduced with a spike ball and stabilization was achieved using a 3.5-mm six-hole reconstruction plate along with three cortical screws. The length of the plate allowed the right iliopubic ramus to be fixed, resulting in a satisfactory reduction and stabilization (Fig. 6). During the intervention, the urology service repaired an injury to the bladder. A Foley catheter was left in place for 21 days. The humeral shaft fracture was treated conservatively with a cast for eight weeks (Fig. 7). The patient was encouraged to perform functional exercise of both lower limbs without weight-bearing for eight weeks, after which progressive and complete weight-bearing was allowed. The fractures healed without complications and the patient's evolution was satisfactory. The osteosynthesis material was removed after 8 months (Fig. 8) and follow-up continued for 18 months after discharge (Fig. 9).

Case 2

A 2-year-and-1-month old female patient was ejected from a motor vehicle and presented with a left lower-extremity deformity and severe suprapubic pain without loss of alertness. Evaluation revealed dysmetria in the lower extremities, abrasions on the left hemipelvis, and swelling of the genitalia (Fig. 10).

A pelvic radiograph revealed a pubic symphysis diastasis, left hip joint incongruity with femoral head displacement, and a widening at the ipsilateral sacroiliac joint (Fig. 11). CT showed a crescent fracture at the left sacroiliac joint (Figs. 12 and 13).

Surgical technique

Surgical stabilization was performed through an anterior ilioinguinal approach using the first and third windows, mirroring the approach in the previous case (Fig. 14). The pubis was reduced with a field-type clamp and secured with a 3.5-mm four-hole plate. Plates and screws, including two 3.5 mm two-hole reconstruction plates in the sacroiliac lesion and a 4.0-mm cannulated screw to fix the femoral epiphysiolysis, were used (Figs. 15 and 16). A plaster device immobilized the affected hip, and the recovery was satisfactory until left hip dislocation occurred 2 months later (Fig. 17). While a new surgical approach was proposed, it was rejected by the patient's family due to their desire to avoid surgical management. Unfortunately, the patient was lost to follow-up.

Fig. 3. Anteroposterior radiograph of the humerus with humeral shaft fracture.

Discussion

Unstable pelvic fractures are uncommon, especially in pediatric patients, and frequently occur with other life-threatening injuries. The traditional management is not to carry out any surgical procedure, but evidence shows that non-surgical treatment can lead to poor long-term prognosis in children, especially with unstable fractures. For this reason, anatomic reduction is essential in some cases.

In pediatric pelvic fractures, the approach generally follows adult management methods. The initial focus is on maintaining hemodynamic stability, and then the biomechanical stability of the injury is assessed. Tile and Pennal type A injuries are typically managed conservatively, whereas type B or C injuries (III B with a displacement >2 mm and unstable IV as per the modified Torode and Zieg classification) require surgical treatment [7].

Determining acetabular injury is challenging. Salter and Harris type I and II injuries with minimal displacement can be conservatively managed, as there is no evidence of growth alteration. However, injuries resulting in incongruity between the femoral head and acetabulum require surgical treatment [8].

The literature is limited regarding the management of patients aged <3 years with unstable pelvic fractures. In a series of four patients, Zhang et al. [9] treated with two patients under 3 years of age, one 3-year-old patient managed with external fixation, and one 2-year-old patient managed with traction for three weeks. Sangasoongsong et al. [10] treated a 2-year-old patient with a novel spinal pedicle screw plate system. In a study similar to ours, Liu et al. [11] treated two patients under 3 years old with the lateral-rectus approach and external and sacroiliac screw fixation and reported excellent final outcomes in both cases.

The classic ilioinguinal approach provides access to the anterior column from the sacroiliac joint to the pubic symphysis and provide excellent results in complex pelvic fractures. While this approach involves mainly the lateral cutaneous nerve or neurovascular injuries, we know that sometimes anatomical reductions are needed in these injuries to avoid compromising the coxofemoral joint when the percutaneous fixation method is not appropriate.

Performing a limited approach using only the first and third Letournel windows allowed us to have satisfactory reductions with good results, less blood loss, and fewer complications. This technique is not as technically demanding as percutaneous fixation, and it

Fig. 4. Computed tomography reveals the rotation of the superior pubic ramus fragment and the involvement of the triradiate cartilage.

Fig. 5. Limited ilioinguinal approach using the first and third Letournel windows.

was less invasive compared with the classic ilioinguinal approach.

This study describes the open surgical technique for fixation through the first and third windows of the ilioinguinal approach in pediatric pelvic fractures with acceptable results after a follow-up period of up to 2 years. We are encouraged by the satisfactory efficacy provided. However, he present study is limited by the small number of cases and the final evaluation of this technique needs further investigation.

Conclusion

The limited ilioinguinal approach is a safe and effective alternative to treat certain patterns of pelvic and acetabular fractures, allowing more anatomical and stable reductions. The main advantages of this approach are reduced blood loss and a shorter operative time with less soft tissue dissection.

Fig. 6. Anteroposterior radiograph of the pelvis showing adequate reduction of the acetabular lesion.

Fig. 7. Humeral shaft fracture healing.

Fig. 8. Anteroposterior radiograph of the pelvis without osteosynthesis material.

Fig. 9. Patient status after 1 year of follow-up.

Fig. 10. Clinical presentation of pelvic lesions with shortening of the left pelvic extremity.

Fig. 11. Anteroposterior radiograph of the pelvis showing pubic diastasis, coxofemoral dislocation with epiphysiolysis of the femoral head.

Fig. 12. Pelvic computed tomography reveals details of the crescent fracture type lesion at the sacroiliac level.

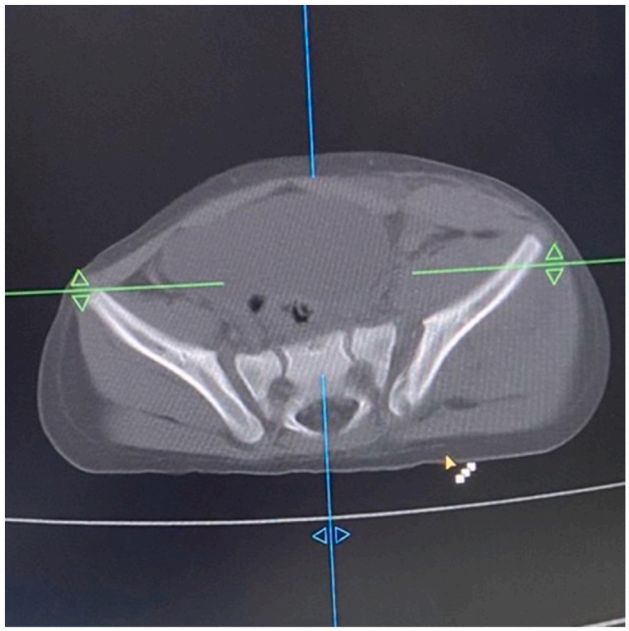

Fig. 13. Coronal computed tomography displays diastasis at the sacroiliac joint level, with a segment of the iliac crest still attached to the joint.

Fig. 14. Limited ilioinguinal approach to fix pelvic disruption.

CRediT authorship contribution statement

C. Gonzalez-Cancino: Writing – original draft. **M. Gonzalez:** Visualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: CESAR OTHONIEL GONZALEZ CANCINO reports a relationship with Health Institute of Chiapas that includes: employment. CESAR OTHONIEL GONZALEZ CANCINO has patent pending to PENDING. none If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

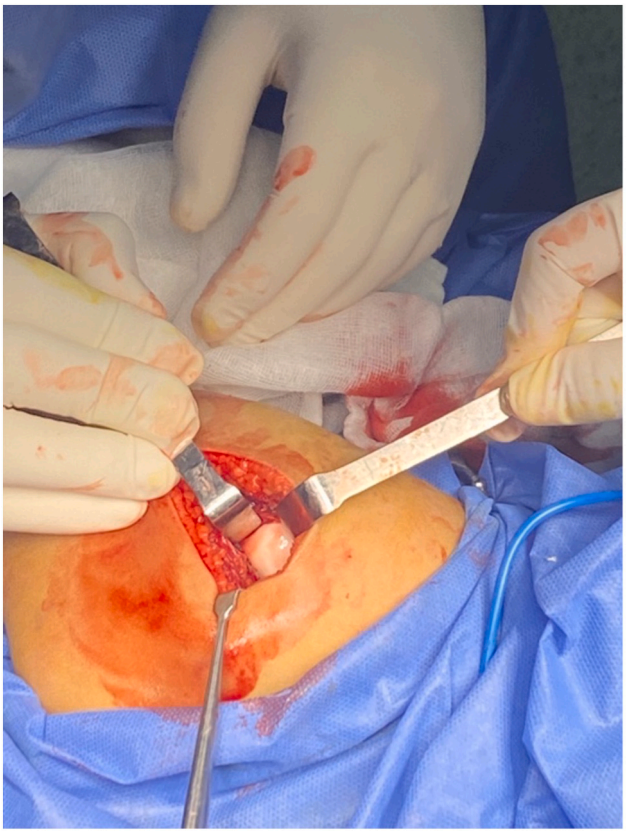

Fig. 15. Hip approach for reducing femoral epiphysiolysis and coxofemoral dislocation.

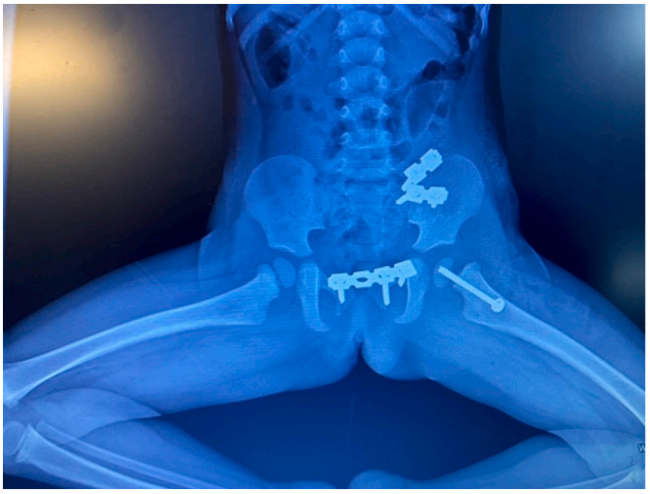

Fig. 16. Anteroposterior radiography of the pelvis after surgical stabilization.

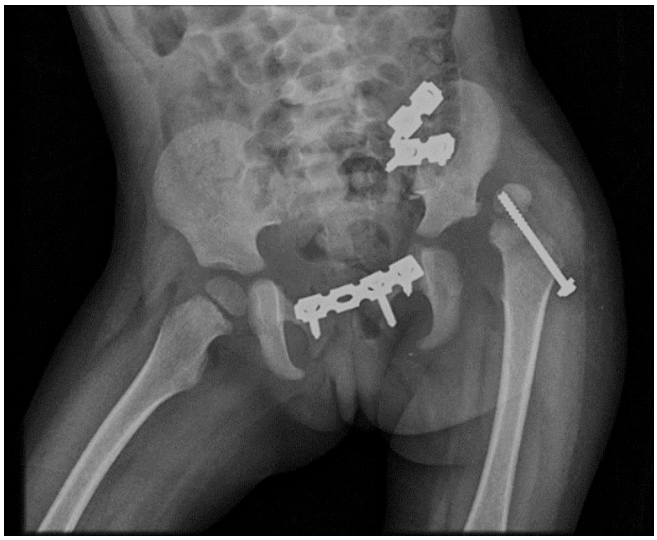

Fig. 17. Anteroposterior radiograph of the pelvis after 2 months of follow-up, showing left hip dislocation.

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References

[1] V.A. de Ridder, S.A. Olson, Operative treatment of pediatric pelvic and acetabulum fractures, J. Orthop. Trauma 33 (2019) S33–S37.
[2] M. Arafa, A.A. Khalifa, A. Fergany, et al., Surgical management of pediatrics pelvic fractures: a prospective case series and early experience from a level one Egyptian trauma centre, Int. Orthop. 46 (2022) 2315–2328.
[3] E. Hermans, S.T. Cornelisse, J. Biert, E.C.T.H. Tan, M.J.R. Edwards, Paediatric pelvic fractures: how do they differ from adults? J. Child. Orthop. 11 (2017) 49–56.
[4] R. Pascarella, C. Betuzzi, V. Digennaro, Surgical treatment for pelvic ring fracture in pediatric and adolescence age, Musculoskelet. Surg. 97 (2013) 217–222.
[5] S.S. Sridharan, D. You, B. Ponich, D. Parsons, P. Schneider, Outcomes following pelvic ring fractures in the pediatrics population: a systematic review, J. Clin. Orthop. Trauma 11 (2020) 963–969.
[6] J.A. Guimaraes, P.H. Mendes, F.C. Vallim, et al., Surgical treatment for unstable pelvic fractures in skeletally immature patients, Injury 45 (2014) S40–S45.
[7] J.M. Guillaume, S. Pesenti, J.L. Jouve, F. Launay, Pelvic fractures in children (pelvic ring and acetabulum), Orthop. Traumatol. Surg. Res. 106 (2020) S125–S133.
[8] D. Galos, T.A. Doering, High-energy fractures of the pelvis and acetabulum in pediatric patients, J. Am. Acad. Orthop. Surg. 28 (2020) 353–362.
[9] Q. Zhang, W. Chen, H. Liu, Y. Su, J. Pang, Y. Zhang, The anterior dislocation of the sacroiliac joint: a report of four cases and review of the literature and treatment algorism, Arch. Orthop. Trauma Surg. 129 (2009) 941–947.
[10] P. Sangasoongsong, N. Sirisreetreerux, P. Chanplakorn, P. Woratanarat, C. Suphachatwong, P. Mulpruek, Modification of spinal pedicle screw-plate fixation for bilateral pediatric pelvic ring injury in 2-year-old girl, J. Orthop. Sci. 20 (2015) 795–801.
[11] Y. Liu, X. Zhan, F. Huang, et al., The application of lateral-rectus approach on toddlers' unstable pelvic fractures, BMC Musculoskelet. Disord. 21 (2020) 147.