Surgical Treatment in Unstable Fractures of the Pelvis and Acetabulum in Children under 3 years

Dr. Cesar Othoniel Gonzalez Cancino

ABSTRACT

The incidence of pelvic fracture represents between 0.5 to 1% of the total hospital admissions for pediatric trauma, in turn the acetabular fracture corresponds to one case per 100,000 children. This low presentation is due to the very special characteristics that this presents. bone segment that allows it to have great elasticity and great tolerance to trauma. We present two patients under three years of age with unstable type IV lesions in the modified classification of Torode and Zieg, who were managed surgically through open reductions and placement of osteosynthesis material. It is impossible to standardize management protocols in this age group, therefore the most appropriate thing is to adhere to pre-established treatment guidelines for skeletally mature people. Our objective is to highlight this type of high-energy injuries that occur with increasing frequency. regularity in very young patients and that on some occasions there will be the need, according to the fracture patterns, to perform the corresponding surgical stabilization to avoid major complications in the short, medium or long term.

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SUMMARY

The incidence of pelvic fracture represents between 0.5 to 1% of the total hospital admissions for pediatric trauma, in turn the acetabular fracture corresponds to one case per 100,000 children. This low presentation is due to the very special characteristics that this presents. bone segment that allows it to have great elasticity and great tolerance to trauma. We present two patients under three years of age with unstable type IV lesions in the modified classification of Torode and Zieg, who were managed surgically through open reductions and placement of osteosynthesis material. It is impossible to standardize management protocols in this age group, therefore the most appropriate thing is to adhere to pre-established treatment guidelines for skeletally mature people. Our objective is to highlight this type of high-energy injuries that occur with increasing frequency. regularity in very young patients and that on some occasions there will be the need, according to the fracture patterns, to perform the corresponding surgical stabilization to avoid major complications in the short, medium or long term.

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I. INTRODUCTION

The incidence of pelvic fracture represents between 0.5 to 1% of total hospital admissions for pediatric trauma, while acetabular fracture corresponds to one case per 100,000 children. The average age of presentation is 11.8 years, with a sex distribution of 46% in girls and 54% in boys. [1-5]

Pelvic fracture, in children with polytrauma, significantly increases morbidity and mortality in them, although pelvic fractures are not common at this age, they are placed second, after traumatic brain injury (TBI), in order of complications. [6]

The rarity of pelvic and acetabular fractures in pediatric patients is often a consequence of the following factors: a large amount of cartilage, a strong ligamentous structure and, above all, significant joint elasticity, which means that the pelvis can absorb a large amount of energy without fracturing. [7-14]

A biomechanical study, presented by Stuhler, shows that forces above 10,000 N in a one-year-old pelvis do not cause fractures, but do cause plastic deformity; In the same way, it has been shown that at ages above 14 years, a force of 3,000-6,000 N is necessary to cause fractures, disruption of the sacroiliac joint or the pubic symphysis. [15]

The most used classifications in pelvic injuries in children are the one modified by Torode and Zieg [16], (Fig. 1) being exclusive for this age group, the Tile classification modified by the AO group and that of Young and Burguess. , while for acetabular fractures there is no one designed for pediatric patients, in this way we can handle the proposal by Judet and Letournel modified by the AO group, but the presence of triradiate cartilage in this area even allows us to use the classification of physeal injuries proposed by Salter and Harris (Fig.2) [17].

Nowadays, fixation of unstable pelvic and acetabular fractures in pediatric patients is widely recommended. Less than 10% of pediatric patients with pelvic injury require surgical management [18-19], even though there is no general consensus on approaches and fixation methods to be used; In the end, the objective will always be to restore pelvic symmetry and periarticular anatomy in the hip, in order to avoid chronic pain, dysmetria in the extremities or gait alterations. [20]

Case 1:

Male patient, 1 year and 7 months old, who entered the pediatric emergency service after being hit by a reversing motor vehicle, presenting injuries on the left side of the body. At the time of evaluation by our service, the presence of abrasive injuries was found. in the abdomen, as well as in the left iliac fossa and crest, Foley catheter with hematuria, and external rotation of the affected pelvic extremity, as well as presence of deformity and increased volume of the left arm, there were no circulatory or alertness alterations (Fig . 3).

Admission laboratories: Hemoglobin 8 gr/dl, Leukocytes 6,180, neutrophils 43.6, platelets 178,000, Creatinine 0.32, Uric acid 5.9.

Negative FAST was reported, left pleural effusion, left peritoneal slide with little 2.1cc fluid, bladder with regular edges and contours, thin wall 1.5mm, semi-solid hyperechoic image floating inside suggestive of a clot.

The plain x-ray of the pelvis showed: loss of bone continuity at the level of the undisplaced right ileopubic and ischiopubic ramus, and left iliopubic ramus with superior displacement of 2cm (Fig. 4). The computed axial tomography (CT) confirmed pelvic ring injuries with complete avulsion of the iliopubic ramus on the left side, which involved injury to the growth cartilage of the ipsilateral hip with significant rotation thereof. (Fig. 5)

Based on the modified classification of Torode and Zieg, this pelvic injury corresponds to type III A, but the involvement of the triradiate cartilage involves the acetabulum, therefore, we consider this fracture as a combined injury of the pelvis and acetabulum. Now classified as a type IV; For this reason, surgical stabilization was proposed, and an anterior Ilioinguinal approach was performed with the use of the first and third windows only, where we reduced the avulsion and displacement of the iliopubic ramus with a spike ball, and stabilized with a 3.5 reconstruction plate. millimeters of 6 holes and three cortical screws of 3.5 millimeters, we obtained a satisfactory reduction and stabilization (Fig. 6); During the intervention we detected a bladder injury which was repaired primarily by the urology service and managed with the use of a Foley catheter for a couple of weeks. This was resolved without any problem, the patient's evolution was satisfactory, there were no complications. some, started ambulation at eight weeks without restrictions, the osteosynthesis material was removed at eight months, the punctual follow-up was until 18 months, after this time he was discharged from the service (Fig. 7).

Case 2:

Female patient, 2 years and 1 month old, who entered the pediatric emergency service after being run over and ejected by a motor vehicle, presenting after the event deformity in the left pelvic extremity and severe pain in the suprapubic region, without loss of alertness. She is referred to the hospital for emergency care.

Clinically, in the evaluation carried out by our service, we observed dysmetria in the lower extremities at the expense of the left side, as well as some dermabrasions in the left hemipelvis and a slight increase in volume in the genitals (Fig.8).

Admission laboratories: Hemoglobin 10.1 gr/dl, Leukocytes 12,440, neutrophils 52.9, platelets 240,000, Glucose 103 Urea 34.67 Creatinine 0.39.

The simple x-ray of the pelvis showed: significant opening at the level of the pubic symphysis, loss of joint congruity of the left hip with displacement of the femoral head and apparently opening at the level of the ipsilateral sacroiliac joint (Fig. 9). In the computed axial tomography (CAT) we observed in detail the injury at the level of the left sacroiliac joint which corresponds to a crescent fracture injury. (Fig. 10 and 11).

In the modified classification of Torode and Zieg, the pelvic injury corresponds to a III B injury, but with accompanying hip dislocation it becomes a type IV injury according to the proposed criteria. For this reason, surgical stabilization was carried out through an anterior ilioinguinal approach using the first and third windows in the same way as in the previous case, reducing the pubis with a field-type clamp and fixing it with a 3.5 4-hole plate. millimeters with the corresponding screws, in the same way two 3.5 millimeter 2-hole

reconstruction plates were placed in the sacroiliac lesion, ending with the open reduction of the femoral head and fixation of the femoral epiphysisolisthesis, with a 4.0 cannulated screw. millimeters (Fig. 12 and 13), a plaster device was placed to keep the affected hip immobilized, the evolution was satisfactory until two months when dislocation of the left hip occurred (Fig. 14), which is why it was proposed new surgical management, which was not accepted by the patient's relatives due to the idiosyncrasy of those who decided on empiric management and unfortunately we lost follow-up despite multiple attempts to contact them and we do not know the current status of the patient .

II. DISCUSSION

The multiple classifications of pelvic fractures still have biases today, for example, the original classification of Torode and Zieg, divides fractures into stable and unstable, but makes no difference between the type of fracture and degree of instability, which with the The most recent modification has tried to correct this problem, Tile and Pennal (AO), combine mechanism of injury and degree of pelvic instability, but it is difficult to adapt them to the pediatric age. At the same time, there is no specific classification for acetabular fractures in children, and it is most common to use the Salter and Harris classification for this purpose. Bucholz in 1982 [17] presented a work with a series of cases of patients with acetabular fractures and observed The most frequent lesions of the triradiate cartilage would be type II and V of Salter and Harris, with type V being the most severe, due to the closure of the physis that it can cause.

Generally, in pelvic fractures in children, the idea is to adhere to the management algorithms established for adults, although in reality they behave like different entities; where always initially, efforts are made to maintain hemodynamic stability to preserve life and once this situation is resolved, proceed to assess the biomechanical stability of the injury. The Tile and Pennal type A injury is normally managed conservatively and in type B or C (III B with displacement greater than 2 millimeters and unstable IV by definition in the modified classification of Tored and Zieg) must be surgical. [21-22]

With regard to acetabular injury, this is even more difficult to rule; Salter and Harris type I and II injuries, with minimal displacement, can be managed conservatively, since there is no evidence that they alter growth, on the other hand. On the other hand, acetabular injuries that result from an incongruity between the femoral head and the acetabulum must be surgical.

Anterior ring injuries can normally be treated with external fixation, or direct repair of the injured bone using nonabsorbable sutures, as well as with the use of plates and screws. [23-24] The standard approach for this type of repair is the ilionguinal approach, proposed by Letournel; Likewise, on some occasions depending on the personality of the fracture, the Smith Petersen approach can be used.

Posterior arch injuries normally involve the sacroiliac joint and in this sense we can use iliosacral screws, bone sutures and in very rare cases lumbopelvic fixation systems that have been modified to treat young patients with immature skeletons. [25] Fixation is normally carried out through the traditional ilionguinal approach or in one of its windows or in the case of iliosacral screws, the technique widely described for this purpose.

In acetabular fractures, there are priority management options, such as keeping the head reduced or reducing it as soon as possible if it is dislocated and the management of injuries to the triradiate cartilage; If these are not displaced, they can be managed conservatively as the case may be, but injuries with significant displacement must be reduced as anatomically possible. The surgical indications for acetabular fractures in children are[26]: the inability to maintain the congruity of the femoral head, joint displacements greater than 2 millimeters, joint fragments trapped in the joint, open fractures, and fractures associated with an unstable pelvis, the commonly used surgical approaches are the Kocher Lagenbeck type approach for the posterior approach and the Ilioinguinal approach for the

anterior approach, The use of a modified stoppa approach has been reported casually[7].

Large series with acetabular fractures practically do not exist. Bucholz's case series [17] consisted of 9 cases, only one of which was surgical. Letournel published a series of 5 cases of triradiate cartilage injury managed with internal fixation [27]. Slongo published a series of only 19 cases. [28]

Trousdale and Ganz [29] found that injuries at a young age, 5 years or younger, with closure of the physis are more likely to result in posttraumatic dysplasia, whereas injuries in adolescence tend not to develop acetabular dysplasia. Although premature arthritis is unlikely in a child, it is possible that traumatic dysplasia or other bone growth abnormalities could develop a propensity for early post-traumatic arthritis in a young adult. [1]

In pelvic injury, normal function is expected to be recovered within 6 months, understanding that an anatomical reduction will lead to excellent results, unlike an unstable pelvis fused in an incorrect position with lifelong functional problems.

In acetabular injury, obviously the injury to the triradiate cartilage can have serious consequences, such as a dysplastic acetabulum with an unstable hip and the consequent early osteoarthritis as mentioned previously.

III. CONCLUSION

The rarity of this type of injuries in the pediatric population, coupled with not being able to have a clear vision of the real limits between conservative or surgical management and the multiple pathologies that may be associated, make it very difficult to standardize management guidelines.

Hence the importance of individualizing each case, assessing and defining the stability or instability in pelvic injuries or the degree of involvement or deformity of the acetabular anatomy with or without injury to the growth cartilage.

In this pair of cases that we present, they were severe injuries that undoubtedly warranted surgical management, we did not find any literature, there is practically no information on the surgical management of patients with injuries to the pelvis and acetabulum at ages younger than 3 years, since Normally, these types of injuries, which are initially rare in pediatric patients, tend to occur in much older children.

In the first case the evolution so far has been excellent without complications; Unfortunately, in the second of them we had a coxofemoral dislocation two months later and we did not have the opportunity to correct this situation or have the patient follow up.

The final objective of this article is to emphasize the correct identification and diagnosis of pelvic instability or acetabular injury in the pediatric patient with polytrauma and from theremake use of the various therapeutic tools available to try to obtain the best possible results and avoid future consequences.

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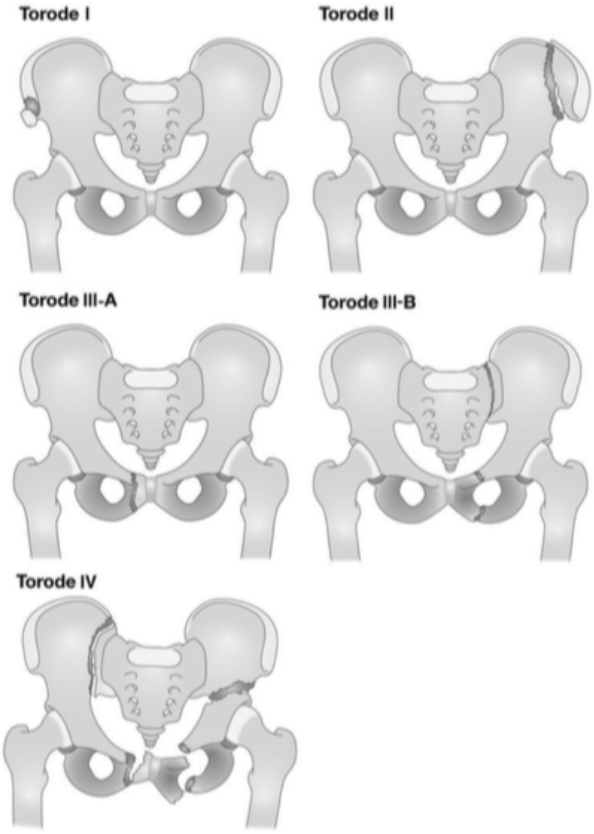

Fig. 1: Modified Torode and Zieg classification: Torode I (avulsion fractures): avulsion of the bony elements of the pelvis, invariably a separation through or adjacent to the cartilaginous growth plate. Torode II (iliac wing fractures): resulting from a direct lateral force against the pelvis, causing a rupture of the iliac process or an inwardly folded fracture of the ilium wing. Torode III-A (simple anterior ring fractures): This group included only children with stable anterior fractures involving the pubic rami or pubic symphysis. Torode III-B (stable anterior and posterior annulus fractures): This new group involved children with stable anterior and posterior annulus fractures. Torode IV (unstable annular rupture fractures): This group of children had unstable pelvic fractures, including annulus ruptures, hip dislocations, and combined pelvic and acetabular fractures.

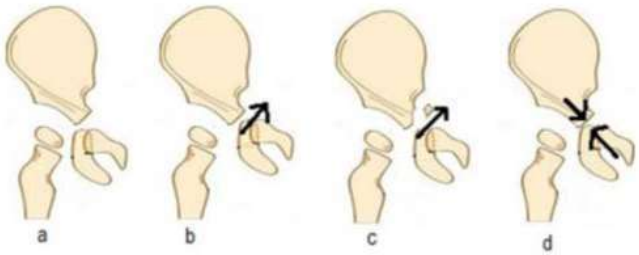

Fig. 2: Classification of acetabulum fractures based on the Salter and Harris classification. a) normal acetabulum, b) type I injury, c) type II injury d) type V injury

Fig. 3: Clinical presentation of dermoepidermal lesions in the pelvic area

Fig. 4: Anteroposterior radiograph of the pelvis with significant displacement of the left iliopubic ramus

Fig. 5: Computed axial tomography (TAC), where we appreciate the rotation of the fragment of the iliopubic ramus and the involvement of the triradiate cartilage

Fig. 6: Anteroposterior radiograph of the pelvis, where we can see the adequate reduction of the acetabular lesion

Fig. 7: Patient status after one year of follow-up

Fig. 8: Clinical presentation of pelvic lesions with shortening of the left pelvic extremity

Fig. 9: Anteroposterior radiograph of the pelvis showing pubic diastasis, coxofemoral dislocation with epiphysiolisthesis of the femoral head

Fig.10: Computed axial tomography of the pelvis (TAC), where the crescent fracture type lesion at the sacroiliac level can be seen in detail

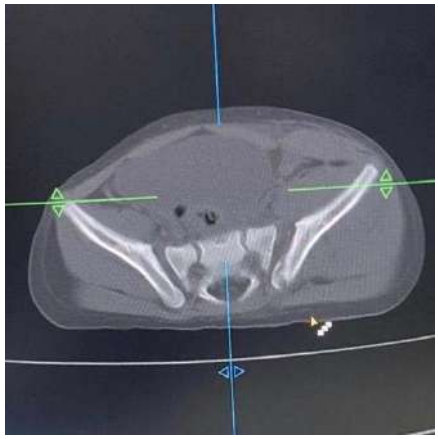

Fig. 11: Coronal section of computed axial tomography, where we can see the diastasis at the level of the sacroiliac joint and a segment of the iliac joint still attached to the joint

Fig. 12: Approach to the hip to reduce femoral epiphysiolisthesis and coxofemoral dislocation

Fig.13: Anteroposterior radiography of the pelvis after surgical stabilization

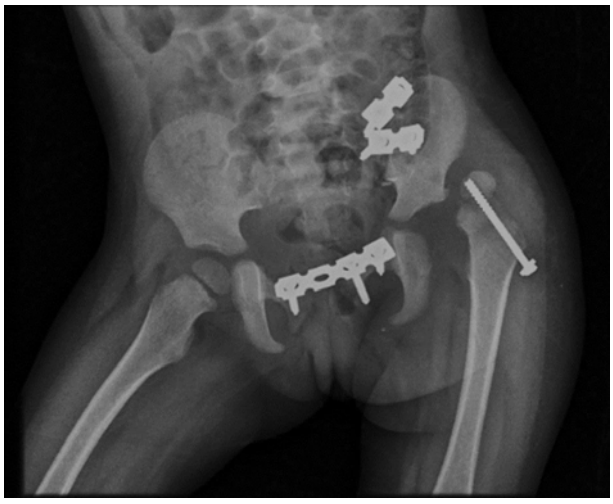

Fig. 14: Anteroposterior radiograph of the pelvis after two months of follow-up with hip dislocation on the left side