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CASE REPORT

A Case Report of Spino-Pelvic Dissociation with Neurological Deficit in Pediatric Age Group

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Abstract

Transverse sacral fracture is a rare entity in the pediatric age group, primarily resulting from a fall from height. This case report stresses the importance of proper neurological assessment, adequate imaging and highlights different modalities of management of this fracture. We report a case of a 13-year-old child with type III Roy-Camille sacral fracture with associated bladder and bowel dysfunction. The patient underwent spinopelvic fixation and decompression of the sacral canal. The patient partially regained bowel and urinary function and had improved motor function after three months of follow-up. Operative management is generally advocated for such fractures.

Keywords: Decompression; Bone fractures; Neural tube; Pediatrics; Sacrum

Introduction

Literature review suggests that transverse sacral fractures are rare in children, while longitudinal fractures are more common. Hart et al. reviewed 4,876 cases of pediatric trauma, where eight children had documented sacral fractures.[1] Transverse sacral fractures commonly result from falls from heights and are frequently associated with neurological deficits.[2] We report a case of transverse sacral fracture in a young adolescent to stress the importance of proper neurological assessment, adequate imaging and to highlight different management modalities of this fracture.

Case Presentation

A 13-year-old girl was brought to the accident and emergency department of Salmaniya Medical Complex, the largest tertiary care trauma center in Bahrain, after falling from a 3-story building. The primary survey showed deformity of both arms and a swollen left heel. The patient's neurological status was difficult to assess as the patient was irritable and uncooperative during the examination. Radiographs and full computed tomography (CT) scan showed a sacral fracture (Figure 1), bilateral humeri fracture, and left calcaneus fracture.

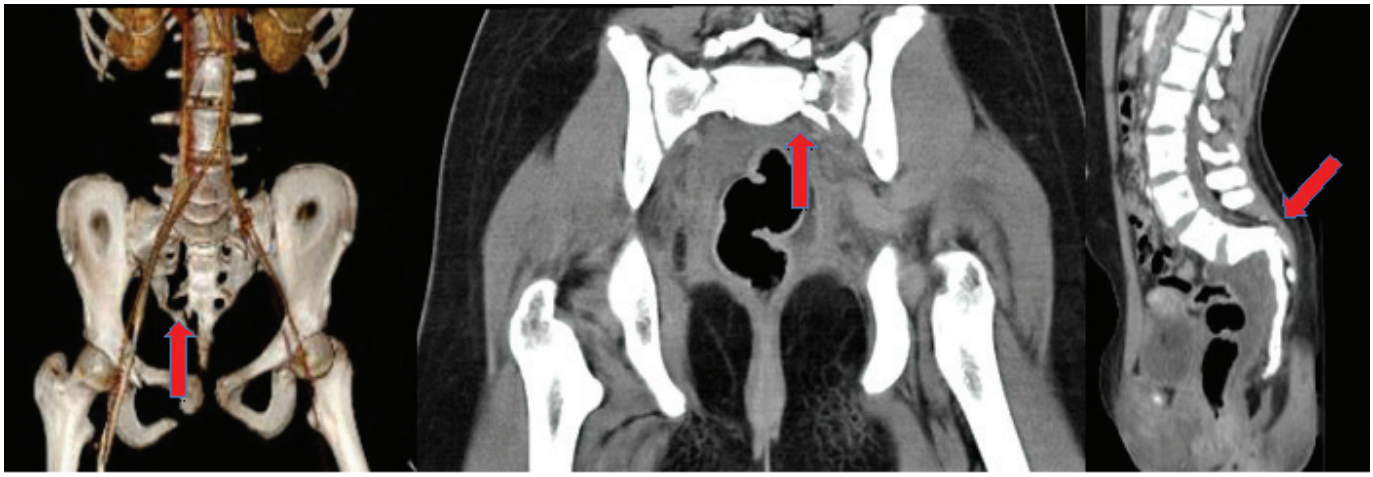

Figure 1: CT scan is a significant tool to assess the orientation of the sacrum specially the transverse element shown in 3D reconstruction, coronal & sagittal views (red arrows indicates the extent of sacral fractures in these views)

The patient was admitted to the pediatric intensive care unit (ICU) for stabilization and resuscitation.

A follow-up assessment was conducted later, which showed a right lower limb power of 3/5 and a left lower limb power of 4/5 with loss of anal tone and loss of urinary control along with a deficient sensory dermatome of L5-1.

The patient initially underwent open reduction internal fixation of both humerus fractures and left calcaneus on the 4th day of admission. On the 5th day, magnetic resonance imaging (MRI) of the lumbosacral region showed complete disruption of the neural canal (Figure 2).

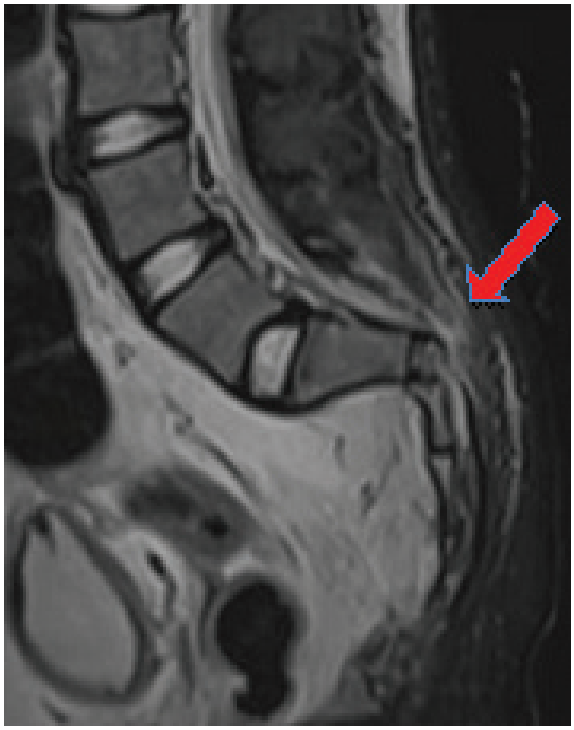

Figure 2: Preoperative MRI shows compression of the sacral plexus at S1-2 level (Red arrow)

Full detailed consent and advantages & disadvantages of both conservative and operative management were explained to both parents with probability and degree of recovery of neural function. On the 7th day of admission, the patient underwent spino-pelvic fixation (posterior instrumentation L4-L5 with bilateral sacroiliac screw), decompression of the sacral canal with the release

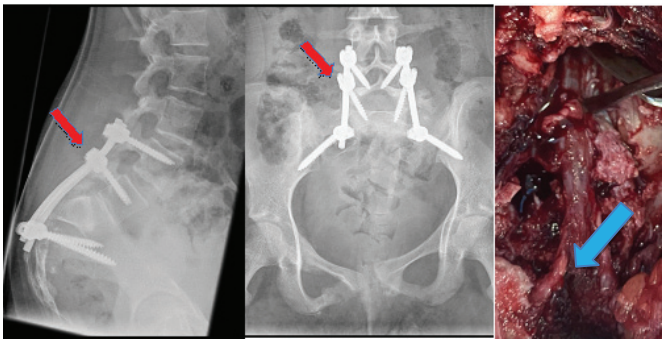

Figure 3: Anteroposterior & lateral views of post spino-pelvic fixation (Red arrows), Sacral plexus post decompression (Blue arrow)

of nerve roots (Figure 3). The neural tube in the sacrum was damaged with cerebrospinal fluid (CSF) leak and compressed and avulsed sacral roots. The repair was done and augmented with haemopatch and duraceal.

The postoperative course was uneventful, and the stitches were removed on the thirteenth day following surgery with no noted CSF leak. Mobilization to a wheelchair was started in the third week.

The patient was last seen three months post-operatively and reported partial recovery of bowel and bladder function with improved motor power of

both lower limbs. Follow-up MRI showed adequate decompression of the sacral canal. (Figure 4).

Figure 4: MRI show adequate sacral canal decompression

Discussion

Sacral fractures are a rare entity in the pediatric age group. A majority of the cases result from high kinetic energy, mainly due to falls from height or involvement in motor vehicle accidents.[1,3] Diagnosis of these fractures requires a high index of suspicion, especially in the case of subtle neurological deficits, as a simple anteroposterior (AP) pelvis is usually insufficient to diagnose sacral fractures.[1] This is especially true in emergency settings as a lateral view of the sacrum is needed for diagnosis, and this can be obstructed by both iliac bones.[4,5] Findings that could suggest an occult sacral fracture include fractures of the transverse process of the L5 vertebra, which has been highly associated with sacral fractures and warrants further imaging of the sacrum.[6] A sacral fracture should also be suspected whenever there is a displaced anterior pelvic fracture with an intact sacroiliac joint.[6] The rate of diagnosis of sacral fractures is highly dependent on the presence of neurological deficits. According to Denis and associates, diagnosis of sacral fractures was made in 49% of patients

with neurological deficits, while the diagnosis was made in only 5% of patients who were neurologically intact.[7]

Denis *et al*. classified sacral fracture into three types: Zone I occur in the sacral ala region, Zone II fractures involve sacral foramina, while zone III fractures occur medial to sacral foramina.[7] The reported case represents a Zone III fracture associated with neurological deficits in about 45% of cases.[7] Roy-Camille has further classified Zone III fractures into four types: Type 1, simple anterior flexion fracture; type 2, flexion injury with posterior displacement of upper sacral fragment which lies more or less horizontally; type 3, extension injury with upper sacral fragment slip anterior relative to the lower fragment; type 4, axial loading and fragment comminution.[2] The reported case represents type 2 fracture in which there is a posterior displacement of the upper sacral fragment (Figure 2).

Neurological deficits in the case of sacral fractures can result from compression or transection of nerve roots at the site of fracture displacement.[6]

The neurological recovery of patients with Zone III fractures usually starts at six weeks in most patients and plateaus at around six months, as reported by Ebraheim *et al*., with a few adult patients regaining complete urinary and bowel function.[6]

Management of sacral fracture requires an initial proper neurological assessment, especially evaluation of bladder and bowel function. It is vital to get adequate imaging of the fracture, including AP, lateral, inlet, and outlet views of the pelvis. The widespread availability of CT scanning has made the diagnosis and classification of sacral fractures easier, especially with a 3D reconstruction of images.

Due to the rarity of this condition, the management of these fractures represents a dilemma. Some evidence was suggesting conservative management with or without traction for 6-8 weeks.[8] A study was conducted comparing operative, and non-operative management of sacral fractures showed a better functional outcome in non-operative management.[9] Moreover, Dussa and Soni reported no statistical difference between surgical and conservative management regarding the outcome of bladder and bowel function. [10]

Satisfactory results can especially be achieved in the case of pediatric or adolescent age. Novkov *et al*.

reported a recovered motor function and restoration of sagittal alignment at lumbosacral junction in a 12-year-old boy with severe fracture-dislocation of S1 who was treated with closed reduction and skeletal traction for 60 days.[11]

However, conservative management carries several disadvantages. Reduction requires the use of heavy two-pole traction of both femur and counter-traction from both axilla and the use of fulcrum to tilt the pelvis anteriorly. Additionally, maintaining reduction is usually difficult. Healing will occur after three months of bed rest, which causes a great deal of discomfort to the patient.[7] Moreover, the suboptimal reduction will lead to disturbance of sagittal balance (C7-posterior superior corner of S1), this will cause great discomfort.[7]

Several surgical techniques have been proposed; lumbopelvic fixation with laminectomy goes in agreement with the most extensive series of transverse sacral fractures. Schildhauer *et al*. reported that lumbo-pelvic fixation provided reliable fracture stability without loss of alignment.[12]

The goal of surgical intervention is to provide surgical decompression allowing the viable compressed nerves to recover.[4] The surgical management of these fractures poses several challenges; firstly, the spino-pelvic dissociation should be considered. According to Isler classification, involvement of lumbosacral facets will dissociate the spine from the pelvis, so the spine and S1 are dissociated from the remaining sacrum and pelvis.[13] Secondly, it is vital to appreciate the difficulty in obtaining reduction with an acceptable sagittal balance. The third and most crucial intraoperative complication that the surgeon must be prepared for is the possibility of CSF leakage.

The advantages of operative management include early decompression of the compressed nerve roots, lysis of adhesions, repair of ruptured dura mater, and reduction and stabilization of fractures.[14,15]

Conclusion

Transverse sacral fractures are an uncommon injury in pediatrics that warrants adequate imaging and a proper neurological assessment.

Operative management (lumbo-pelvic fixation and decompression of the sacrum) is often explicitly preferred when neurological deficits are present.

Potential Conflicts of Interest

None.

Competing Interest

None.

Sponsorship

None.

Ethical Approval

The study was approved by the Department of Orthopedics, Salmaniya Medical Complex, Bahrain.

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