Delayed treatment of cervical fracture. *Dislocation in a 4-year-old*

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Trauma to the vertebral column is relatively uncommon in the pediatric patient population. It accounts for approximately 5% of all spinal cord and vertebral column injuries.[1] In the patient with an immature spine (0-9 years) the majority of spinal injuries occur at the cervical (C) spine, especially between the occiput and C2.[2,3] When diagnosed and managed properly, most of these injuries can be treated non-operatively. We present a case of inadequately treated injury of the immature cervical spine and review the available literature regarding these injuries.

A 4-year-old girl presented to our hospital 4 months after an injury to her neck. She had a history of an isolated trauma to the neck after falling from a height of 6 meters. At the time of initial trauma, there was no history of loss of consciousness and no other injuries. She had no neurological deficit. Radiographs of the cervical spine on the day of trauma were interpreted as normal and the patient was discharged home on simple painkillers. Repeat radiographs were carried out 3 days latter due to persistent complaints of neck pain. The new set of radiographs revealed a compression fracture of C6 vertebral body as well as bilateral facet dislocation at the C5-C6 level with 50% forward shift of C5 on C6. Magnetic resonance images (MRI) of the cervical spine carried out at that time revealed the same findings as the plain radiographs. There was no significant compression to the cord at the level of injury. The patient was admitted to a local hospital at that time and skull traction was applied for one day after which she was discharged in a rigid cervical collar. When she presented to our hospital 4 months after the initial trauma, she was wearing the cervical collar continually. Her neurological examination was within normal limits. Upon removal of the collar, examination of her neck showed a mildly tender range of motion. She did not have any neurological deficit. All radiographic investigations were repeated, including plain radiographs, computerized axial tomogram (CAT) and MRI. They revealed the fracture of C6 vertebral body with dislocation at the C5-C6 level. The vertebral body of C6 is severely wedged and compressed with anterolisthesis of C5 on C6 of approximately 50%. There were bilateral locked facets at C5-C6 and because the fracture was 4 months old and had united, there was no joint seen between the inferior facet of C5 and the superior facet of C6. The cord was displaced posteriorly at the fracture site but without any evidence of compression (**Figure 1**).

When she presented to us, the posterior elements were fused while the anterior part of the injured vertebra was compromised and unable to support the spine. Progressive deformity and mechanical instability are likely to occur as this patient grows. To reconstruct the anterior part of the injured vertebra, an anterior approach to the cervical spine was used in this patient. Somatosensory evoked potential monitoring was utilized

Figure 1 - Magnetic resonance image of the cervical spine.

Figure 2 - Postoperative lateral radiograph of the cervical spine.

during the procedure. The fractured C6 vertebral body was completely removed along with the adjacent intervertebral disks. Skull traction was used intraoperatively to realign the cervical spine as close as possible to normal, especially maintaining the cervical lordosis and sagittal alignment. An appropriate sized iliac crest autograft was harvested using a subcrestal window. The bone graft was applied to replace the C6 vertebral body and was fixed using an anterior cervical plate between C5 and C7. Post operatively the patient was placed in a rigid collar for 6 weeks. A repeat cervical plain radiograph then showed healing of the bone graft, and the patient was started on physiotherapy (**Figure 2**). She had a complete pain-free range of motion of her cervical spine.

Spinal column trauma is relatively uncommon in the pediatric population. The immature spine has more physiologic mobility compared to the adult spine. This is because of the ligamentous laxity, underdevelopment of the neck and paraspinal muscles, incompletely ossified wedge-shaped vertebra, and a shallow horizontal orientation of the facet joints. The strength of the ligaments and muscles increases with age, and the geometry of the vertebral bodies and facet joints changes with maturation. These factors explain the relative resistance of the immature spine to spinal column trauma. The laxity and elasticity of the immature spine affords some protection against spinal trauma that might result in fracture or fracture-subluxation in the more mature rigid spine.[4]

Four patterns of injury in the pediatric cervical spine have been described.[2] They include fractures of the vertebral body or posterior elements without subluxation (41%), fractures with subluxation (33%), subluxation without fracture (10%), and spinal cord injury without radiographic evidence of fracture or subluxation (16%). Generally, pediatric patients have a good prognosis after such injury.[4] The majority of these patients can be treated by non-operative means. This is due to the rapid healing properties of bone and ligament injuries in children. Despite the relative infrequency of pediatric spinal injuries, it is essential to have a high level of suspicion and carry out a thorough evaluation on each child with suspected spinal trauma. Radiographic evaluation including plain roentgenograms of the area(s) of suspected injury as well as the entire spine is indicated. Computerized axial tomography scan and MRI are extremely helpful in evaluating these injuries. Patients with acute traumatic cervical spine subluxation as determined by the standard lateral and swimmer radiographs are placed in Gardner-Wells tongs for rapid reduction and realignment. Dynamic flexion and extension radiographs are helpful. They are obtained after CAT scan in patients without evidence of fracture or obvious subluxation. The treatment of each patient is individualized. After initial immobilization and reduction (when possible), early surgical intervention is infrequently required. Hadley et al[2] in their series showed that only 19 (16%) of 122 patients required primary surgery. The indications for surgery in the pediatric population include non-reducible and markedly unstable injuries, significant subluxation without fracture, spinal cord compression in patients with incomplete neurological deficit, and injuries that remain unstable after non-operative therapy.[4] Hamilton et al[3] showed that in patients with fracture and subluxation or subluxation alone, surgery was needed in 57% and 50%, compared with only 13% of those with fracture alone. When surgical treatment is used in such injuries, careful planning and consideration must be given regarding the size and immaturity of the spine and the size of the required implants.

In conclusion, pediatric spinal injuries are infrequent. They should be approached with a high level of suspicion. With early diagnoses and proper management, the majority of these injuries can be treated non-operatively. Missed diagnosis and delayed treatment may lead to the need for more aggressive surgical treatment in these injuries.

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