

T9 Fracture-Dislocation in an Eight-Month Old Infant -11-year follow-up of neurologic recovery and related spinal deformity-

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ABSTRACT. Spinal column injuries are relatively infrequent in children, representing only 2% to 3% of all spinal injuries¹⁾. More than 60% of major spinal injuries in children occur in the cervical spine, and compression fractures due to hyperflexion are the most common injuries. We present a rare T9 fracture-dislocation in an eight-month old infant with incomplete neurologic injury and an 11-year follow-up.

Key words ① spinal fractures ② infant

CASE REPORT

An eight-month-old infant was being held face to face in his mother's arms in a car when they were hit head-on by another car. He was caught between the shoulder harness his mother was using and her body. In the emergency room, ecchymosis was observed obliquely on his back in the harness belt distribution. He had an associated liver injury and right hemothorax. Neurologically, he showed incomplete paraplegia. Radiologic examination revealed a ninth thoracic fracture-dislocation (Fig. 1). A T2-weighted magnetic resonance image revealed a mosaic high-intensity area in the spinal cord at T9 (Fig. 2). After the liver and lung injuries were managed conservatively, bedrest was prescribed for the infant for four weeks during which time his trunk was to be supported by a soft brace and two pillows on each side. Four weeks after the injury, callus formation around the fractured vertebra could be seen on computed tomography (Fig. 3), and the patient was allowed to sit and be held by his mother. Six months after the injury, he could stand up with support, and a somatosensory-evoked potential (SEP) wave could be observed in his left tibial nerve for the first time. Two years after the injury, at the age of 31 months, he could urinate by himself and walk independently, although his gait was spastic. The spasticity in his legs gradually decreased, and his ankle clonus disappeared. At the time of this writing, the patient was twelve years old and could walk with an almost normal gait. Roentgenography demonstrated remodeling of the fractured vertebra with a slight scoliotic deformity (Fig. 4). Magnetic resonance imaging showed no abnormal intensity of the T9 vertebra or adjacent discs. In the spinal cord, no abnormal intensity area was observed at the level of the injury (Fig. 5). Post-traumatic syringomyelia was not observed during the follow-up period.

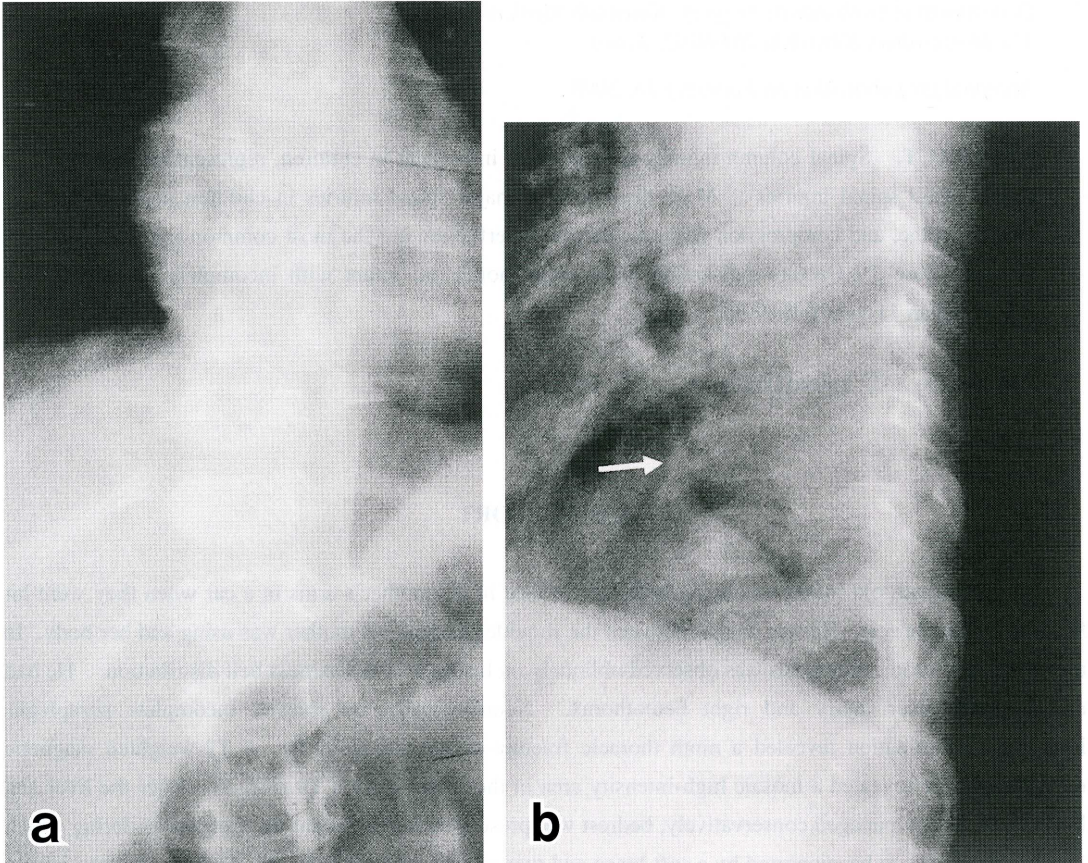


Fig. 1. A, Anteroposterior radiograph showing the T9 vertebra displaced to the left.
B, Lateral radiograph showing slight loss of height in the anterior and posterior aspects of T9 (arrow). Anterior and posterior notching of the anterior wall of T10 and T11 were caused by normal vascular channels.

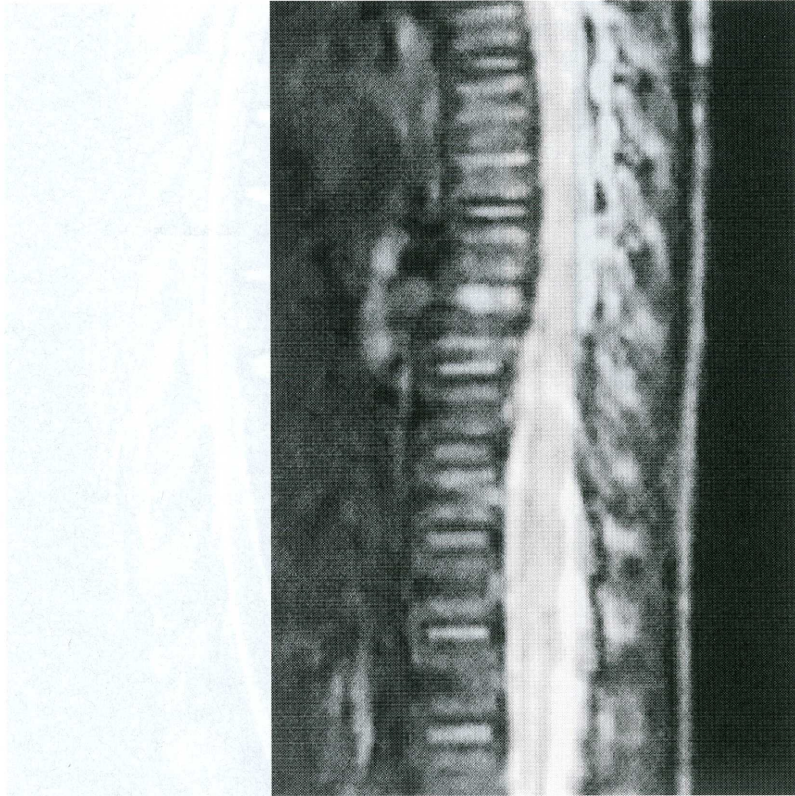


Fig. 2. T2-weighted magnetic resonance image made on the day of injury, showing a high intensity area at the T9 spinal cord level with no spinal canal compromise.

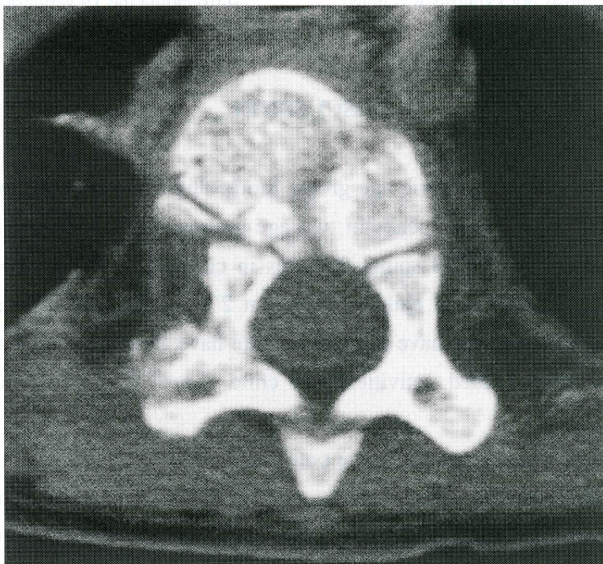


Fig. 3. Computed tomography scan taken four weeks after the injury, demonstrating callus formation.

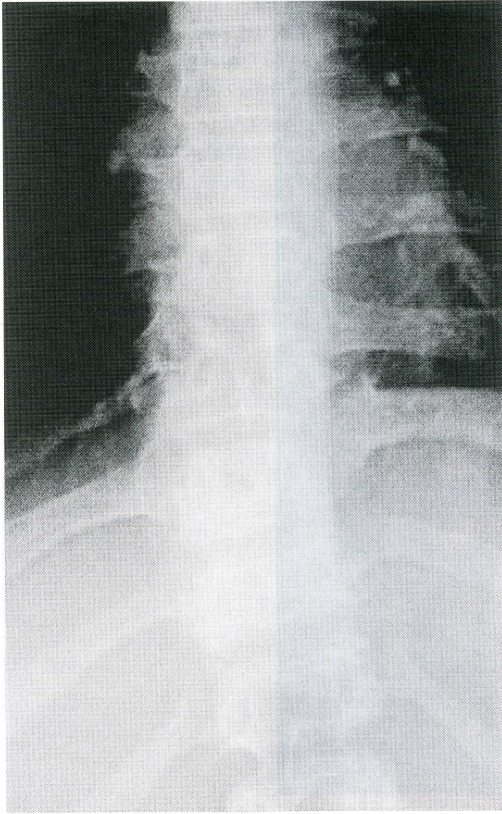


Fig. 4. Anteroposterior radiograph made 11 years after the injury, showing depression in the center of the vertebral body which suggests a delayed remodeling of this region. Neither severe scoliosis nor kyphosis was noted.



Fig. 5. T2-weighted magnetic resonance image taken 11 years after the injury, showing no abnormal intensity in the spinal cord at the level of the injury or of the discs surrounding the T9 vertebra.

DISCUSSION

Among all spinal injuries in the pediatric age group, thoracolumbar spine fractures are rare (2% to 3%). The incidence of pediatric spine injuries peaks in two age groups; children five years old or younger and children older than ten years¹⁾⁻³⁾. Of all spinal fractures in children, 26% to 75% are in the thoracic or lumbar spine^{1),4)}. Spinal cord injuries in children represent 2% to 4% of all admissions to spinal trauma centers. Twenty percent of children who have a spinal fracture have an associated neurologic injury⁵⁾. Motor vehicle accidents, falls⁶⁾, sports-related activities, and child abuse⁷⁾⁻⁹⁾ are the most common causes of pediatric spinal fractures.

Children have more elastic soft tissue and more potential for remodeling than adults. Certain injuries are unique to children, including posterior limbus injuries, most cases of spinal cord injury without radiographic abnormalities (SCIWORA), and spinal trauma in child abuse. Spinal column injuries are infrequent in children, constituting 2% to 3% of all spinal injuries^{7),10)}. Approximately 20% of children incur spinal cord injury without radiographic abnormality (SCIWORA). Approximately 33% to 60% of the cases involve the cervical spine^{7),10)} due to the relatively large cranial size of a child, which exposes the cervical spine to

different forces. Ruge et al. reported that children aged three years or younger represent only 0.3% of all spinal injuries and the most frequent level of spinal injury is C2¹⁰.

Spinal fractures associated with wearing a seat belt have been documented in adults. These injuries generally involve distraction of the posterior and middle columns as a result of flexion and distraction. Approximately 50% of injuries are classified as one-level lesions through bone, described by Chance. The introduction of the shoulder harness in the front seat has decreased the incidence of this fracture in adults. However, mandatory seatbelt restraining devices for children in rear seats use only lap belts. Thus, in children, injury is more likely to occur in the midlumbar spine than at the thoracolumbar junction as in adults, which may be related to the higher center of gravity of the children¹¹. Such uncommon fractures in children are mostly Chance-type fractures¹².

In the present case, the level of injury was midthoracic. The infant was sitting on his mother's lap and was trapped between the shoulder harness and his mother's body at the time of the accident. The level of injury was higher than that typically seen in children. The cause of this fracture-dislocation was axial loading resulting from hyperextension with rotation forces.

In spinal injuries with a malalignment of the vertebral column and neurologic deficit, immediate realignment, decompression, and stabilization are required, particularly when the neurological deficit is incomplete^{13,14}. Two recent reports on infants discussed surgical management for the dislocation of T12-L1 and L1-L2^{8,15}.

The present report presents a very rare case of a fracture-dislocation at the midthoracic spine in an infant. In addition, this study followed the recovery of the fractured vertebra by magnetic resonance imaging, despite the well-known efficacy of such imaging primarily in the identification of the site and extent of injury. In adult cases, the narrowing of the spinal canal is relieved by the natural and slow course of remodeling^{16,17}. In this case, the remodeling of the spinal alignment has not occurred on the coronal plane in terms of the scoliosis angle, which was 15° on one postinjury radiograph and 15° on the latest radiograph. The immature spine of infants has a greater capacity to remodel¹⁸⁻²⁰, and restoration of the height of the compressed vertebra can be attributed in part to the reparative response and stimulation of the apophysis. The vertebral body is supplied by segmental arteries, with the core of the vertebra being most vulnerable to ischemia. The depression in the center of the vertebra is probably a result of the delayed remodeling of this ischemic area.

The patient described here should have been seated in a proper child seat at the age of eight months and not in his mother's lap. Although laws mandate seatbelt use in Japan, child car seats did not become mandatory until April 2000.

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