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T8 spinal cord transection in a 6-year-old child

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ABSTRACT

Study design: Case report.

Objective: To describe a case of spinal cord transection in a 6-year-old child.

Background information: Non-missile injury of the spinal cord is not common and its incidence varies according to the country. In addition, to our knowledge, there are no published reports of spinal cord injury (SCI) from a penetrating nail. Here, we report the case of a child who developed complete SCI because of cord transection by a nail.

Methods: A detailed history and physical examination were performed along with careful review of the patient's medical records. In addition, a review of the literature was conducted to assess the incidence and treatment of similar injuries.

Case description: A 6-year-old boy was admitted to the hospital after falling from a tree and landing on a nail. His physical examination revealed an emaciated child with multiple decubitus ulcers, lying on his side in bed. Visible was a well-healed posterior puncture wound at the T8 vertebral level. On neurological examination, the patient had 0/5 muscle strength in his lower extremities, symmetrical areflexia, and hypoaesthesia below the T8 level. Plain x-ray of the thoracolumbar spine was normal. Magnetic resonance imaging revealed a transected spinal cord at the T8 vertebra, consistent with his nail puncture wound.

Discussion: This report describes an unusual case of a complete SCI in a pediatric patient caused by penetrating trauma from a nail. To our knowledge, this is the first case to report on complete SCI due to trauma from a nail.

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INTRODUCTION

While violence remains the third most common cause of spinal cord injury (SCI) in the United States, only 1% of SCIs occurs from stab wounds [1]. Non-missile injuries, namely stabbings, are more common in developing countries where access to firearms is limited [2, 3]. In a large series from South Africa, 25% of SCIs were reported to result from penetrating injuries not due to firearms, of which 84.2% were caused by stabbing [4]. Commonly used weapons include knives, ice picks, screwdrivers, and bicycle spokes. To our knowledge, no case of SCI caused by a fall onto a nail has been reported in the English-language literature.

Here we present a patient who developed complete SCI after his thoracic spinal cord was transected by a nail. The causative mechanism, diagnostic tools, and review of the literature on non-missile SCI are discussed.

METHODS

A detailed history and physical examination were performed along with a careful review of the patient's medical records. Plain x-rays and magnetic resonance imaging (MRI) were performed to help determine the etiology of the patient's injury. A literature review was also conducted to assess the incidence of similar mechanism of SCI.

REPORT OF A CASE

A 6-year-old boy was initially evaluated in the emergency department in Mulago Hospital, Kampala, Uganda, after he fell from a tree. At the scene of the fall, he was unable to independently ambulate. It was then discovered that he had landed on a nail, which was upright in a piece of wood. The nail penetrated his body at about the T8 vertebra and was found buried in the soft tissue; it was removed shortly after. Plain x-rays of the thoracolumbar spine were normal (**Fig 1**). The patient was then admitted to the spine ward at Mulago Hospital where he was examined 12 days later by a team of visiting surgeons.

Fig 1 AP x-rays of the thoracic spine. T8 vertebra (arrow).



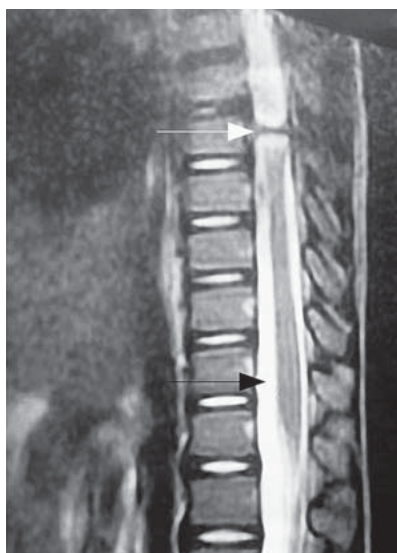
Fig 2 Digital photograph of the patient back highlighting the healed nail puncture wound. T8 vertebra (arrow).



On examination, he was emaciated and was lying on his side in bed. Clearly visible was his healed nail puncture wound (**Fig 2**). On neurological examination, the patient had 0/5 motor strength in the lower extremities, symmetrical areflexia, and hypoesthesia below the T8 level. He had diminished anal tone and required intermittent catheterization for urination. Clinically, his American Spinal Injury Association (ASIA) score was “A” with a T8 level.

After the initial neurological assessment, the team believed further imaging to evaluate the cord integrity and rule out a surgically correctable cause of paralysis would be in order. An MRI scan of the thoracic spine revealed a complete transection of the spinal cord at the T8 vertebra (**Fig 3**). There was no evidence of infection, tumor, or epidural abnormalities that could have otherwise accounted for the patient’s symptoms. The MRI confirmed the diagnosis that the boy suffered a spinal cord transection from the penetrating injury, namely the nail. A detailed discussion was conducted with the patient and his family concerning the prognosis and the fact that it would be unlikely for him to independently walk again. Also discussed was the role of nonoperative management, namely aggressive rehabilitation, bowel, and bladder care.

Fig 3 A T2 MRI scan of the thoracic spine. The white arrow indicates the nail tract and the resultant spinal cord (black arrow) transection.



DISCUSSION

The mechanism of SCI differs between developed and developing countries. In the United States SCIs are typically due to motor vehicle injuries (42.1%), falls (26.7%), violence (15.1%), sporting injuries (7.6%), and unknown events (8.6%) [1]. The latter is more common in the pediatric population and when this occurs it is called SCI without radiographic abnormality (SCIWORA) [5]. In addition, SCIs in juvenile patients are most often a result of motor vehicle injuries and falls from heights [6]. In developing countries, including South Africa, where there is a lack of access to firearms, the primary cause of SCI was a penetrating injury from a sharp object of which 84.2% resulted from stabbing. Most injuries caused hemi-section of the spinal cord with incomplete neurological deficits [4].

There are numerous case reports of SCI caused by nonviolent penetrating injuries. A recent case described SCI as a result of penetration from an epidural needle [7]. Another case report documented SCI from a glass fragment [8]. Most pencil injuries have been reported to occur in or around the orbital region [9, 10], with the exception of one report of SCI from pencil impalement [11]. Although craniofacial and both upper and lower extremities injury caused by nail impalement have been reported [12], to the best of our knowledge, no case of SCI, especially complete transection has been described in the English-language literature.

In this case the MRI suggests penetrating trauma to the cord. The SCI was believed to occur in the following manner: the nail transected the spinal cord via a path through skin, thoracolumbar fascia, either lateral to the spinal process or directly through the T8/T9 interspinous ligaments; then through the lamina or interlaminar space, and finally through the spinal cord. It is also postulated that the nail interrupted the posterior blood supply to the cord as well as damaging the artery of Adamkiewicz, which generally enters the spinal cord through T8 and T12 levels to supply the anterior part of the spinal cord [13]. In cases with suspected SCI due to impalement, plain x-rays are recommended to detect the level of lesion and penetration into the spinal canal. An MRI is recommended for further evaluation of the spinal cord and surrounding soft tissue and the relation between the object and the spinal cord. The surprising aspect of this case was the absence of any other morbidity, such as infection or cerebrospinal fluid leak.

In summary, we report a rare case of a complete SCI caused by cord transection by a nail. To our knowledge, this is the first report of SCI by this mechanism.

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EDITORIAL PERSPECTIVE

The editors have selected this case to continue the discussion on spinal cord injury (SCI) in emerging countries with limited medical infrastructure. We have received diverse opinions on our question of how much and what type of spine reconstructive surgery to do in developing countries as delivered by short-term visiting surgeons. So many opinions, in fact, that we have collected these and plan to create a special focus issue on this topic in the future.

There is little doubt about the acute care needs of this patient, both the commentator and the presenting authors agree. The much bigger questions arise regarding the long-term prospects of this T8 ASIA A paraplegic boy.

- What form of rehabilitation support is the patient receiving, what bowel/bladder care program—what mobility aids?
- Will he be a candidate for fusion surgery when he develops the expected neuromuscular paralytic curve?
- What does his decubitus prophylaxis look like?
- What is he doing scholastically and what is his eventual life expectancy?

In developed countries, patients with mid-thoracic SCI can achieve near normal life expectancy at reasonable annual healthcare costs. Societal protections, such as afforded by the Americans with Disabilities Act, are priceless for the life quality of many patients, especially those with SCI. This again raises the question of the responsibility of visiting surgeons. Aside from bringing surgical expertise to the developing countries—are they engaged in creating a rehabilitation medicine community or knowledge transfer, for instance, through the use of Internet communications? Should this be part of a visiting spine surgeon's portfolio, or should this be left to others to care for?

Again, the EBSJ editors invite your comments.

COMMENTARY

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The authors present a case in which a 6-year-old child in Uganda fell from a tree and suffered a complete spinal cord injury (SCI). A nail was found embedded in the soft tissue directly over the T8 midline and had been removed before presentation. The MRI showed complete cord transection at the T8 level, which was believed to have occurred from penetrating injury at this level from the nail. The MRI is consistent with the proposed mechanism, and not with a transection due to SCIWORA, fracture, or dislocation from the fall. The combination of lack of soft-tissue coverage in this child, and larger interlaminar space in children may have contributed to this occurrence.

In developed countries, pediatric SCIs are most commonly caused by motor vehicle injuries, falls, sports injuries, or penetrating trauma from firearms. In developing countries where firearms are less readily available, penetrating injuries from stabbings with sharp instruments are more common causes, and they most often result in incomplete SCI syndromes, such as Brown-Sequard [1]. Neither the authors nor this reviewer could find a report of SCI caused by nail penetration in the English-language literature. Although many other implements have been reported including acupuncture needles, broken glass fragments, chopsticks, migrated K-wires from clavicle fracture fixation, Stingray spine, and a Senegalese Tiger Tooth.

Penetrating trauma to the thoracolumbar spine usually does not require surgery. Local wound debridement and prophylactic antibiotics for 24 hours are appropriate [2]. Indications for surgery from a non-missile penetrating injury include evidence of progressive neurological deficit, spinal cord compression from hematoma or bony fragment, or persistent spinal fluid leak. Steroids should not be given. This patient's recovery after non-surgical management without the development of infection is typical. Late instability is rare, and treatment should focus as it did on appropriate rehabilitation.

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