An unusual case of burst cervical spinal fracture of a 15-year-old boy complicated by venous thrombosis and neurogenic heterotopic ossification

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ABSTRACT

The authors report an unusual case of a 15-year-old boy who dove into a shallow lake and suffered a cervical fracture of C5 affecting the spinal cord. This resulted in tetraplegia. Vitamin D3 deficiency and a history of several bone fractures supported an idea that the patient's bone structure had been weakened. The deep vein thrombosis of lower limb and neurogenic heterotopic ossification of a hip limited the effectiveness of physical therapy.

Key words: cervical fracture, spinal cord injury, tetraplegia, male

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INTRODUCTION

Cervical spine injury occurs in less than 1% of children presented for trauma evaluation [1]. According to epidemiologic data, half of the traumatic spinal injuries are caused by traffic accidents, while 10% of spinal injuries are usually the result of sports, falls or other accidents [1,2]. Diving carelessly into shallow water is the cause of 5% of the spinal cord injuries reported. To date, no exact data on traumatic spinal injuries in Poland are available; there are an estimated 800 cases yearly [2]. Traumatic spinal injury causes paraplegia or tetraplegia. There are many potential complications that the individual with spinal cord injury must face and the professional must have adequate knowledge about to provide the best care. The most frequent complication is related to the skin; though, pulmonary and urologic complications are often more threatening and serious for the individual with spinal cord injury [3-5]. In spinal cord injury, the neurogenic heterotopic ossification varies from 5% to 60%. [6-7]. Clinically apparent deep vein thrombosis occurs in approximately 15% of patients with acute spinal cord injury. Rarely it is described in children. The risk of deep vein thrombosis is highest within the first two weeks following injury, with peak occurrence between days 7 and 10 [8]. It is a real challenge for the patient, especially the young, due to a significant reduction of the quality of life, emotional state, and social life. The patient's disability has also a great impact on the family and society.

Case report

A 15-year-old male in May 2011 experienced a cervical spine fracture after diving into the shallow area of a lake. This was not a typical jump “on the head” from a great height. He dove into the water standing at his feet. The patient was admitted to Pediatric Orthopedic Surgery. A neurological examination revealed a severe motor weakness in the lower and moderate weakness in the upper limbs (C5 level tetraplegia). A systematic sensory examination detected loss of sensation, including the ability to feel heat, cold and touch below a nipple line. A cervical computer tomography (CT) showed C5 lower cervical burst fractures (Fig.1a,b). An application of cervical tongs and traction with 7kg load was used in the first day of hospitalization. Next, a standard anterior approach to the spine was used to allow anterior decompression C5 and reconstruction with autograft iliac crest, followed by stabilization with anterior locking plates. No postoperative complications were observed. Physical therapy was then initiated. Within 15 days after the accident, the patient was transferred to the Department of Pediatric Rehabilitation to continue therapy. His medical history revealed several bone fractures: the right metacarpal, the left forearm, the right fifth metatarsal fracture, right metatarsal, and crushing of the left fifth finger.

At the admission, neurological examination showed paresis of the upper limbs with a predominance of right-hand side with preserved a deep surface sensation and tetraplegia at C5 level, lack of the surface sensation below Th5 levels (according to the American Spinal Injury Association (ASIA) classification level A), the lack of the abdominal reflexes, and a positive Babinski’s sign.

At the fourth day of hospitalization, the patient showed enlargement of the left thigh circumference with increased warmth. Doppler ultrasound examination revealed the presence of venous thrombosis within the femoral vein, external iliac, and left tibia. Laboratory studies have confirmed the existing pathology revealing a deficiency of vitamin D3. The anticoagulant therapy has been introduced by giving the patient Clexane. Urodynamic examination revealed the presence of neurogenic bladder: low pressure bladder, the lack of sensation, detrusor areflexia and control of urination. He was managing his bladder by assisted intermittent catheterization 4–5 times a day. The patient underwent physical therapy (passive exercises of the upper and lower limbs, isometric, assisted, and unloaded-active exercises) in the form of massages, phototherapy, laser therapy, and electrostimulation. He remained dependent on the help of other people. He felt sensation at the Th10/Th11 levels. After three months, he developed heterotopic ossification of the left hip as a late complication of the spinal cord injury. The patient received psychological assistance at the Foundation for Active Rehabilitation due to emotional and behavioral problems. He was equipped with orthopedic supplies including a pillow and anti-pressure sore mattress, orthoses of the lower limb and foot, a standing device, and a wheelchair.

The patient is still undergoing rehabilitation for his spinal cord injury. He is wheelchair-dependent person.

DISCUSSION

In this case, the patient experienced spinal cord injury at C5 of the complex pathogenesis**.** There are six types of injury mechanisms that can appear in combination: compression flexion (the most frequent type in cervical spine injuries caused by diving into shallow water), flexion disruption, compressive hyperextension, disruptive hyperextension, rotation and axial compression [3,6].

Our patient had injury and compression of the spinal cord with vascular changes (hemorrhagic, ischemic, and necrotic spots) and axonal changes

(edema, destruction of myelin) [1,2,3]. The mechanism of fracture in this case is likely to be vertical compression of the spine at C5 level.

Between 80% and 90% of patients suffering spinal cord lesions caused by diving are between 15 and 25 years old and four out of five are males. Our patient is in this range of age. Patients with spinal cord injury at C4 diaphragm are paralyzed, have respiratory insufficiency, complete paralysis of body and legs, and no sensory function. [3]. Our patient had preserved muscle function of the shoulders, diaphragm, and accessory respiratory muscles. He had paresis of the upper limbs and preserved the respiratory function.

However, in laboratory test vitamin D3 deficiency was found. He had several bone fractures. These data support the idea that the patient's bone structure has been weakened. Thus, a small force trauma caused the burst fracture of the vertebra. On the other hand, at three weeks of the hospitalization, he developed vascular thrombosis within the left lower limb. Pathophysiological factors of venous thrombosis were described by Virchov. His triad describes the three broad categories of factors that are thought to contribute to thrombosis: 1) Endothelial injury or dysfunction; 2) Hypercoagulability, and 3) Hemodynamic changes (stasis, turbulence). It is well known that thrombosis in spinal cord injury is an important clinical issue and common complication. However, according to Medical Standards of 2010, an age over 40 years is another risk factor for venous thrombosis [4,7]. The case report of the 15-year-old boy draws attention to the younger population threatened by the abovementioned pathology. The deep vein thrombosis of the left lower limb limited the effectiveness of physical therapy and could cause the development of heterotopic ossification of the left hip.

This emphasizes the need for thrombo-prophylaxis in this age group of patients. Thromboprophylaxis should include the following modalities: avoiding of patients' immobilization, early physical therapy, providing of adequate quantities of fluids, anticoagulation therapy (unfractionated heparin, low-molecular-weight heparin, Fondaparinux a synthetic pentasaccharide Factor Xa inhibitor), and mechanical modalities (e.g., external pneumatic devices). The rehabilitation goal of a patient with the spinal cord injury is to resume independent, productive activities of daily living, and minimize the irreversible sequels of trauma [5].

The incidence of heterotopic ossification in spinal cord injury is between 16% and 53%, depending on the incidence reports from various institutions [8,9]. Once present, neurogenic heterotopic ossification is clinically significant in 18–27% of cases. Both the venous thrombosis and neurogenic heterotopic ossification limit effective physical therapy, standing and functional recovery. The psychological service and support should be extended to spinal cord injury patients and their family members patients and family members [9-11].

This complicated case raises issues regarding early diagnosis and aggressive treatment of neurogenic heterotopic ossification and the need for thromboprophylaxis.

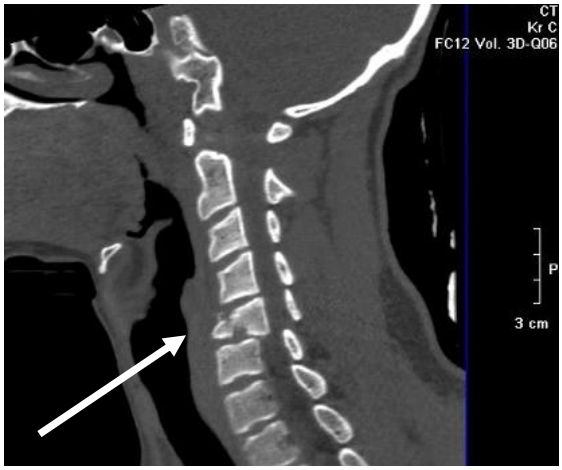

Figure 1a. Sagital CT showing C5 lower cervical burst fractures.

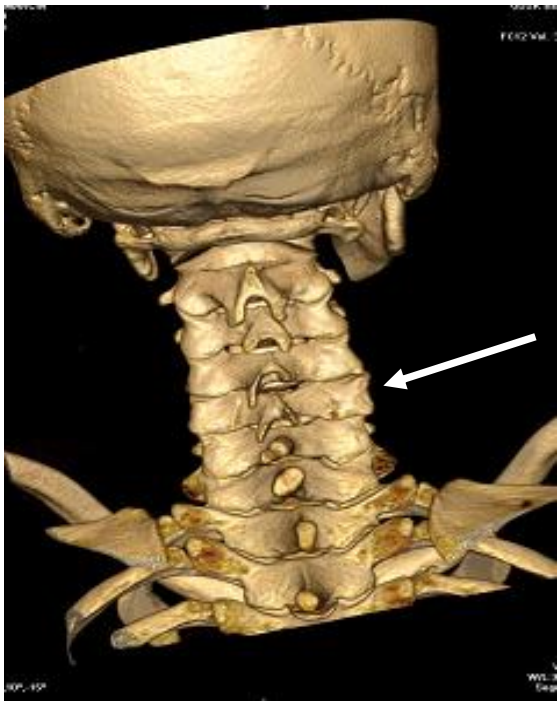

Figure 1b. Coronal three-dimensional (3D) CT scan showing C5 lower cervical burst fractures.

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