

DZIEDZIC, Mariola Maria, PACH, Magdalena, NOWAK, Agnieszka, DOBRZAŃSKA, Justyna, PARTYKA, Alicja, MICHALCZEWSKA, Aneta, FUGAS, Agnieszka, WIERZEJSKA, Natalia, CHMIELOWIEC, Zuzanna and SMYKIEWICZ, Karolina. 47-Year-Old Man with Quadriplegia Following Traumatic Spinal Cord Injury in the Cervical Spine: A Case Report. *Journal of Education, Health and Sport*. 2024;66:50662. eISSN 2391-8306.  
<https://dx.doi.org/10.12775/JEHS.2024.66.009>  
<https://apcz.umk.pl/JEHS/article/view/50662>

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences). Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu). © The Authors 2024; This article is published with open access at License Open Journal Systems of Nicolaus Copernicus University in Torun, Poland  
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The authors declare that there is no conflict of interests regarding the publication of this paper.  
Received: 26.04.2024. Revised: 26.04.2024. Accepted: 05.05.2024. Published: 06.05.2024.

## **47-Year-Old Man with Quadriplegia Following Traumatic Spinal Cord Injury in the Cervical Spine: A Case Report**

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**Abstract:** Spinal cord injuries (SCIs) typically affect young, healthy males, with the cervical spine being the most frequently injured area. These injuries are devastating and have a lifelong impact on a person's health and well-being. While uncommon, SCIs can occur during sports participation, as seen in this case study. This case examines a 47-year-old male skier who sustained a skiing accident and presented with quadriplegia upon arrival at the trauma centre. It highlights the critical role of readily available diagnostic imaging and efficient teamwork within trauma centres in managing such complex injuries.

**KEYWORDS:** spinal cord injuries, spine, spinal fractures, quadriplegia, neurologic examination, internal hernia

**Introduction:** The majority of the SCI (spinal cord injuries) (60 %) affect young, healthy males between the ages of 15 and 35 years. Cervical spine injuries are most common. The prevailing cause is blunt trauma, most often caused by car accidents (48%), falls (21%) and sports injuries (14.6%) (1,2,3). The most frequent result of a cervical or dorsal spinal cord injury is a transverse lesion with quadriplegia or paraplegia, total loss of bladder and bowel control, breakdown of

sympathetic function and complete loss of sensory function (4). However, when it comes to sports-related spinal cord injuries, the most common diagnoses at discharge are incomplete tetraplegia (46.9%), followed by complete tetraplegia (37.4%), incomplete paraplegia (5.9%) and total paraplegia (5.7%). Fewer than 1% of persons experienced complete neurologic recovery by hospital discharge (5,6).

Rapid diagnosis is essential in spinal cord injuries to differentiate between cases requiring surgery and those managed conservatively. This can significantly impact treatment decisions and potentially improve long-term outcomes for patients.

Imaging techniques play a vital role in this process:

- \* CT scans: These scans are excellent for visualizing bone abnormalities, such as fractures or dislocations in the spine, that might necessitate surgery.

- \* MRI scans: MRI is the preferred method for examining soft tissues like ligaments, discs, and the spinal cord itself. MRI can also distinguish between swelling (oedema) and bleeding (haemorrhage) in the spinal cord, which is crucial for predicting the patient's potential for recovery (prognosis) (7,8).

A 2016 review paper by Christie WL Chan et al. examined the prevalence of SCIs in various sports. The study found that skiing carries a high risk of spinal cord injuries, with Norway (48.3%) and Germany (10.9%) reporting the highest proportions of sport-related SCIs attributed to skiing. This information highlights the potential dangers associated with skiing, especially for those at a higher risk of SCIs based on age and gender demographics (5).

The case involves a 47-year-old male skier who sustained quadriplegia (paralysis of all four limbs) after a skiing accident. He was promptly brought to a trauma centre for evaluation. Immediate diagnostic imaging studies were performed, followed by surgery aimed at restoring function in his limbs.

**Case report:** The 47-year-old male skier was brought to the trauma centre by emergency medical services following a skiing accident. The accident occurred around 1:00 PM. The skier was wearing a ski helmet and secured in a cervical collar upon arrival at the trauma centre approximately 75 minutes later at 2:15 pm. Basic vital signs were examined on admission. The patient was in stable condition: his blood pressure was 140/80 mmHg, heart rate 85/minute, and saturation 97%. The main symptoms reported by the patient were pain in the cervical spine radiating to the right upper and lower extremities, along with significant weakness in all four limbs (tetraparesis). He had no previous chronic medical conditions or drug allergies. He was awaiting upcoming prostatectomy surgery for benign prostatic hyperplasia.

The patient reported severe pain in his right arm (shooting pain in the areas served by the C4 and C5 nerves) and general pain throughout both arms and legs. Although he had some sensitivity to touch everywhere, he felt a heightened sensitivity in the areas served by the C5 and C6 nerves. He also had normal deep sensation in all his limbs. There was a difference in muscle tone between the upper and lower body. His arms were very weak (flaccid muscles), with some remaining weak movement possible only at the elbows. In contrast, his legs had increased muscle tone (spasticity). While he could move his hips and knees slightly, movement in his feet was significantly impaired, with near-complete paralysis in the right foot. Deep tendon reflexes, which test muscle response, were absent in the arms but exaggerated in the legs. Additionally, there wasn't found abnormal joint mobility that could explain the patient's symptoms. Overall, these findings suggest quadriplegia with some remaining weakness patterns (9).

Laboratory tests were performed to assess the patient's overall health. Imaging studies included a CT scan of the head, cervical, and thoracic spine. The CT scan revealed a rare finding of bony growths (osteophyte inclusions) within the spinal cord itself. More importantly, it showed a narrowing of the spinal canal (bore stenosis) at the C5/C6/C7 vertebrae. This narrowing could be compressing the spinal cord and potentially causing the patient's symptoms. Due to these concerning findings, consultations with a neurologist and a neurosurgeon were requested. To get a clearer picture of the spinal cord and nerve roots, an MRI scan of the cervical spine was ordered.

The MRI scan revealed a large disc herniation at the C3/C4 level, mostly on the right side. This bulging disc, along with bone spurs (osteophytes), was severely narrowing the space available for the spinal cord in the front-to-back direction (complete blockage) at this level. Additionally, the scan showed narrowing on both sides of the spinal canal at the C5-C7 level (bilateral stenosis), which might be compressing nerves. These findings, particularly the disc pressing on the spinal cord (compression) at C3/C4, could explain the patient's pain, weakness, and sensory changes.

Taking into account the patient's history, physical examination, and the MRI scan findings, the doctor diagnosed a spinal cord contusion at the C3/C4 level, along with quadriparesis (paralysis of all four limbs). The MRI scan, particularly the visualization of severe narrowing (absolute stenosis) at C3/C4, prompted the decision for emergency surgery to decompress the spinal cord and alleviate the pressure.

The surgical team performed a minimally invasive procedure called a microdiscectomy at the C3/C4 level in the patient's neck. This procedure aimed to remove part of the herniated disc material compressing the spinal cord. Additionally, they used a small titanium spacer (CeSpace 3D cage) to promote healing and create stability between the vertebrae at that level.

On the first day after surgery, the patient's cervical spine was immobilized with a Schantz collar to aid healing. A follow-up X-ray confirmed the correct positioning of the implanted titanium cage. A neurologist re-evaluated the patient and, based on the clinical picture suggesting potential for improvement, recommended transferring the patient to a specialized neurological rehabilitation unit for further treatment. During his hospital stay, the patient received various medications, including pain medication (analgesics) and medications to prevent blood clots (anticoagulants).

On the third day post-surgery, the patient was transferred to the neurological rehabilitation unit to begin a program focused on regaining lost neurological function.

#### **Discussion and conclusions:**

This case involves a 47-year-old patient, which falls outside the most common age group (15-35 years old) for spinal cord injuries (SCIs). While the majority of SCIs affect young adults, understanding and treating SCIs in older individuals is becoming increasingly important (1). However, he is a healthy male who sustained a spinal cord injury in the cervical region during a sporting activity. This case highlights the fact that although uncommon, spinal cord injuries can occur during sports, accounting for approximately 14.6% of all SCIs (1). Upon admission to the trauma centre, the patient presented with quadriplegia, a paralysis of all four limbs. This aligns with the fact that quadriplegia is the most common consequence of sports-related SCIs, as exemplified by this skiing accident case (5). A cervical spine CT scan was performed to identify potential injuries. While no bony fractures were detected, the scan showed a suspicion of a herniated disc at the C3-C4 level. To further evaluate these findings, an MRI of the cervical spine was performed. Thanks to the rapid imaging studies, particularly the MRI scan revealing significant spinal cord compression due to the herniated disc, a swift decision for immediate surgery could be made (7). The MRI scan revealed a herniated disc at the C3/C4 level. It is unclear whether this was a new injury (de novo) or a worsening of a pre-existing condition.

To address the spinal cord compression, the patient underwent surgical decompression of a herniated disc between the C3 and C4 vertebrae. This procedure, known as Anterior Cervical Discectomy and Fusion (ACDF), involves removing the herniated disc material and fusing the vertebral bodies to create stability and relieve pressure on the spinal cord (10–13). In this case,

an implant with a titanium coating was used for the spinal fusion. Titanium-coated implants have been shown to have a very good record of promoting bone growth and achieving successful fusion (14,15). The choice of a titanium implant here might be due to the severity of the patient's injury and the need for strong fusion.

For individuals with complete spinal cord injuries, regaining lost motor or sensory function is uncommon. Research suggests that most patients with incomplete injuries, like some regaining movement from a C5 to C6 level, experience some level of spontaneous neurological improvement (1,4). This case exemplifies the critical role of readily available diagnostic imaging and efficient trauma centre teams. The prompt identification of the herniated disc through imaging, coupled with the swift surgical intervention by the trauma centre team, minimized further damage to the patient's spinal cord. This allowed for continued treatment in the neurological rehabilitation unit, offering the best chance for recovery.

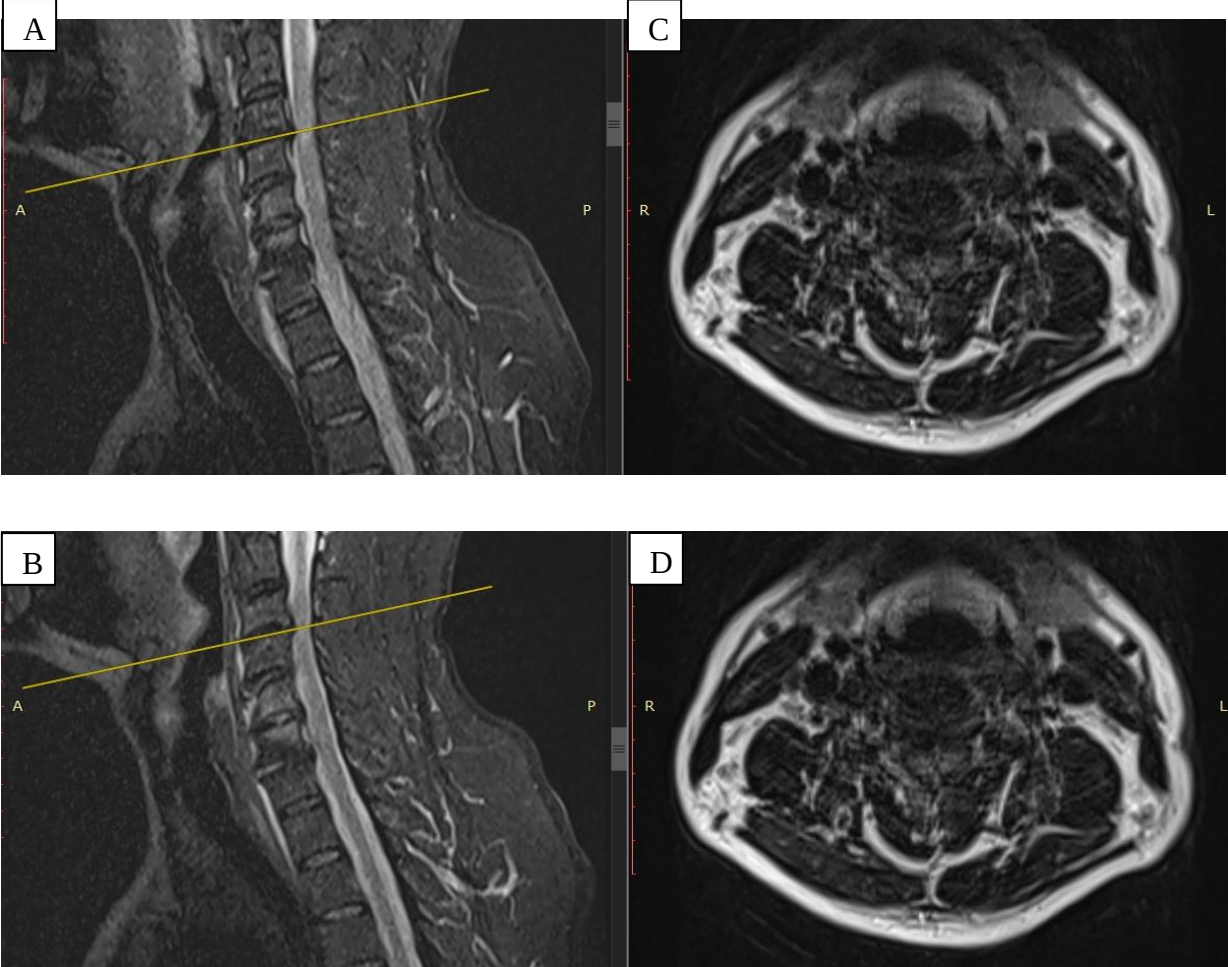


Figure 1,2. Magnetic resonance images at first presentation to trauma centre. A and B sagittal T2-weighted image of the cervical spine shows a wide-basal central-right herniation at the height of C3/C4 protruding to a depth of about 2.5mm and osteophytes causing absolute stenosis in the sagittal dimension up to 5mm and modelling of the anterior surface of the spinal cord. C and D axial T2 weighted image of C3-C4 shows central-right disc extrusion compressing spinal cord.

## **Disclosure**

### **Author's contribution**

Conceptualization: Mariola Dziedzic and Magdalena Pach; Methodology: Justyna Dobrzańska; Software: Mariola Dziedzic; Check: Zuzanna Chmielowiec and Agnieszka Fugas; Formal analysis: Karolina Smykiewicz and Magdalena Pach; Investigation: Aneta Michalczywska and Natalia Wierzejska; Resources: Mariola Dziedzic; Data curation: Karolina Smykiewicz; Writing - rough preparation: Mariola Dziedzic and Alicja Partyka; Writing - review and editing: Agnieszka Nowak and Justyna Dobrzańska; Visualization: Mariola Dziedzic; Supervision: Natalia Wierzejska; Project administration: Aneta Michalczywska and Agnieszka Nowak; Receiving funding - no specific funding.

All authors have read and agreed with the published version of the manuscript.

### **Financing statement**

This research received no external funding.

### **Institutional Review Board Statement**

Not applicable. The study was conducted in accordance with the Declaration of Helsinki. In accordance with the law in force in the Republic of Poland, case report retrospective studies do not require the opinion of consent of the Board of Bioethics Committee, as they are not a medical experiment in which human organisms would be interfered with. For this reason, we did not seek the consent of the Commission. What is more, the results of the study did not affect the management of patients at any stage, so the above-mentioned procedure was followed.

### **Informed Consent Statement**

Not applicable.

### **Data Availability Statement**

Not applicable.

### **Conflict of interest**

The authors deny any conflict of interest.

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