



Case report

Particular precautions and the role of intraoperative neuromonitoring in cervical cord injury in elder recreational cyclist: A case report

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ABSTRACT

Introduction and importance: The trend in cycling nowadays affects all age groups. However, special precautions must be considered in the elderly group. Minor trauma to the cervical region can cause severe neurological deterioration, leading to fatality because of the pre-existing degenerative process.

Case presentation: We present a case of a 61-year-old male recreational cyclist with acute onset of tetraplegia following a minor fall. The radiological result revealed a long-standing degenerative process. Unfortunately, the patient deceased due to the sequelae of the paralysis and cardiac event despite our prompt surgical decompression and the improvement shown on intraoperative neuromonitoring.

Clinical discussion: The degenerative process can aggravate cervical cord injury even in its mildest form of injury. In this study, immediate improvement was detected by the intraoperative neuromonitoring (IONM) - although the clinical improvement had not improved yet as the general condition is poor.

Conclusion: The elder cycling population is increasing. Safety measures and injury avoidance are advisable along with expert consultation before the exercise. In a pre-existing degenerative condition of the cervical, a special precaution is also needed during the exercise. If the surgery has been indicated, the use of intraoperative neuromonitoring is found to be useful to guide the decompression and potentially beneficial as a predictive value for the clinical outcome.

1. Introduction

The great bicycle boom during the COVID-19 pandemic is involving all age groups, including the elderly population [1]. Despite the good health impact, this also correlates with the spike in bicycle accidents worldwide [2]. Generally, cervical cord injury (CCI) is reported in 10 to 50 % of traumatic cervical fractures [3]. The incidence of CCI might further increase in the current aging society even in a mild cervical trauma without necessarily the evidence of fracture due to the pre-existing degenerative structural abnormality which may lead to devastating complications [4–6].

However, CCI following minor trauma in the pre-existing degenerative condition is rarely reported in the literature. It can further lead to a fatal condition even with appropriate treatment. We present a case of an elderly man with a multilevel cervical disc degeneration and stenosis that develop acute tetraplegia after a simple fall during cycling. This

work has been reported in line with the SCARE 2020 criteria and the consent was obtained from the patient for publication of this report [7].

2. Case presentation

A 61-year-old male was admitted to the casualty with three days onset of tetraplegia following a cycling accident. The patient hit the back of another bike during road cycling at 40 km/h speed. He fell sideways off the bike with his side body bumping the road. No direct injury to the head and neck region. The patient was fully alert but there was a progressive muscle weakness in all four extremities along with the loss of bladder and bowel control. He had a history of 5 years of cervical radicular pain to the right upper extremity and mild axial neck pain. He had never sought medical treatment for those symptoms.

On the physical examination, there was hypoesthesia below the C3 dermatome and the muscle strength was grade 0/0 below C5. The

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American Spinal Injury Association score was A. There was no fracture in the neck region which was confirmed on the computed tomography (CT) scan (Fig. 1). On the CT scan, there was ossification of the posterior longitudinal ligament (OPLL) on the level of C2. The magnetic resonance imaging (MRI) revealed multiple canal stenosis and disc degenerations on C3–4, C4–5, C5–6, and C6–7 with calcification on C5–6 and C6–7 discs. Despite those degenerative changes, there was a hyperintensity signal suggesting spinal cord edema on the level of C3–5, and a hypointensity signal on the T2-weighted image of the C4–5 spinal cord suggesting a blood product or calcification. The degree of preexisting cervical spinal cord compression was evaluated by calculating maximum spinal cord compression (MSCC) using mid-sagittal T2-weighted MRI [6]. In our patient, the MSCC was 38.33 % which represented a preexisting moderate compression.

The patient had undergone an anterior cervical corpectomy and fusion (ACCF) on the level of C4–5 by an orthopedic spine surgeon (D.L). A complete corpectomy and discectomy were performed and a cage with graft was placed into the empty space. Lastly, a titanium plate was fixed to the segments to provide direct stability to the construct.

Intraoperatively, the neurological recording was made from C3–4 to C6–7 at the trapezius, Deltoid, APB, and AH muscles. Although the clinical manifestation was tetraplegia, some of the baseline MEP still existed. Baseline MEP was identified at the C3–4, C4–5 and C5–6 of left upper extremities, and at the C3–4, C4–5, C5–6, and C6–7 of right upper extremities. The upper right extremities motor unit action potential (MUAP) amplitude was 226,30 μ V while the left MUAP amplitude was 170,89 μ V. However, in both lower extremities, MUAP did not appear. The baseline SSEP of both upper extremities that was recorded through the median nerves was not identified. Right after the ACCF procedure, MEP of both APB muscles showed up consistently until the end of the surgery. The MEP of C3–4, C4–5, and C5–6 were all preserved.

Post operatively the patient was sent to the intensive care unit because of the paralysis. On the third post-operative day, the patient started to have autonomic dysreflexia, including bradycardia and asystole. He suffered three cardiac arrest episodes and survived. However, on the 8th day, the patient had pneumonia and deceased on the 14th day due to respiratory failure.

3. Discussion

The increase of spinal cord injury in bike road traffic accidents might

increase in the current elderly society. In this population, CCI occurs as a result of both dynamic (external force) and static factors (preexisting cord compression). It does not necessarily correlate with bony injuries such as fractures or dislocation. Interestingly, the degree of soft tissue damage on MRI is associated with clinical neurological deterioration. This is probably reflecting the amount of external force applied to the cervical region [6,8,9]. Our patient had signs of soft tissue contusion over the posterior elements of the C-spine. There was also bone marrow edema anteriorly over the C5 and C6 vertebrae.

The other radiological findings such as bony spur, multilevel disc herniations, and OPLL were signs of a long-term degenerative process. This patient had symptomatic cervical radiculopathy without myelopathic symptoms for the past 5 years. However, in the absence of pre-injury data due to neglect, one way to prove the preexisting spinal cord compression is by measuring the MSCC as described by Fehling in 1999 [10]. The degree of preexisting spinal cord compression was divided into three categories: Minor compression (MSCC <20 %), moderate compression (MSCC 20–40 %), and severe compression (MSCC >40 %) [6,10]. According to this method, the patient already had an underlying moderate cervical canal compression.

In Oichi et al. [6] study, in a mild or moderate compression, severe paralysis is less likely. They speculate that the spinal cord becomes more vulnerable to external forces when the degree of cord compression exceeds a certain threshold [6]. However, the moderate pre-existing compression combined with the severe external force as suggested by the amount of injury encircling the cord on MRI possibly cause the severe neurological symptom in our patient.

Excessive traction or pinching during the traumatic accident can damage the neural structures in an already narrowed canal due to OPLL, protruded disc, and hypertrophied flavum. Moreover, aging compromises axonal plasticity towards external assault. The contused nerve underwent edema and initiated the micro de-arrangement that represents an abnormal signal in MRI. Although the intramedullary signal changes of the spinal cord are frequently observed in the degenerative cervical spine, the presence of acute myelopathy along with this abnormal signal may reflect edema or blood-spinal cord barrier breakdown [11,12].

The evidence of cord edema is one of the reasons for the early surgical decompression in this patient. A motor recovery can be expected in 72 % of cases with focal cord edema involving only one spinal segment or less. However, only 42 % of patients with more than one segment

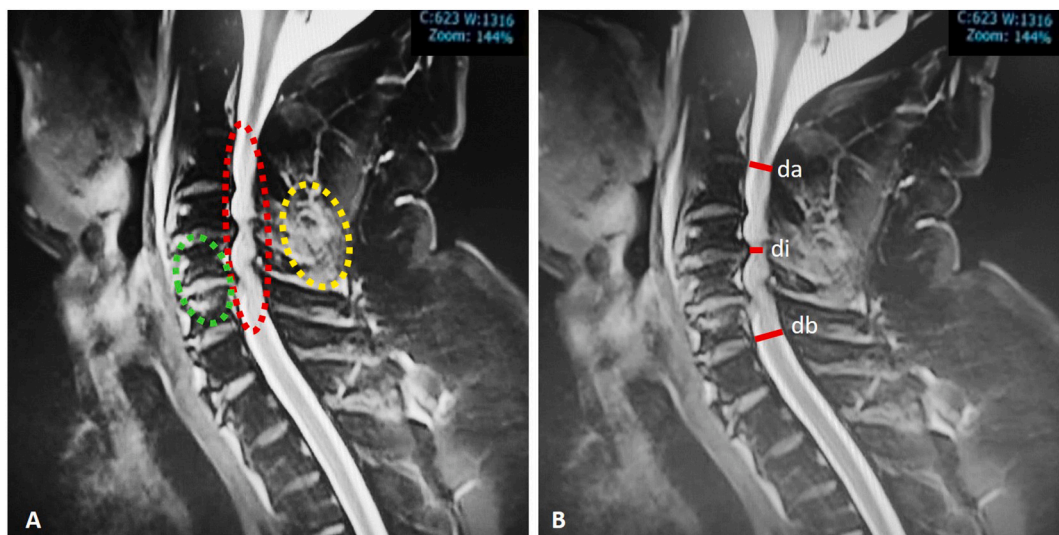


Fig. 1. a) The presence of edema on T2 weighted image. Green circle: bone marrow edema; Red circle: Cord edema; Yellow circle: Posterior interspinous ligament or muscle edema. b) Pre-existing degree of cord compression using MSCC calculation [6]. *di* represents the anteroposterior (AP) cord diameter at the level of injury, *da* is the AP cord diameter at the nearest normal level above the injury level, and *db* is the AP cord diameter at the nearest normal level below the injury level. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

edema can have a motor recovery [12]. In our patient, the edema extended along the C3 to C5 segment. Interestingly, the motoric improvement was detected as early as the decompression achieved by the intraoperative neuro monitoring (IONM).

The IONM has been utilized during spinal surgery to assess the spinal cord function as an effort to prevent iatrogenic injury [13]. Although it is not regularly used in an obvious tetraplegic patient and the benefits of IONM in giving a positive predictive value remains controversial, the experience of using IONM in our center leads us to regularly use this modality in cervical surgery as this modality often give a positive predictive value in our patients. Besides, the evidence of transient tetraplegia following CCI in pre-existing stenosis in literature leads us to detect the improvement as early as possible [12,14].

In our study, immediate improvement was detected by the intraoperative MEP and SSEP signals. However, the clinical improvement had not improved as fast as the signals. It is postulated that the aging process may have a negative impact on axonal repair after spinal cord injury [15]. Unfortunately, during this time gap before the regeneration process can be expected, bradycardia as the most common cardiac arrhythmia following CCI complicates the post-operative period in this patient. Bradycardia and cardiac arrest following CCI have both been described immediately after and in the days following CCI [16]. Although this condition may not directly cause death in our patient, it extended the hospitalization along with the risk of hospital-acquired pneumonia either from the length of stay or from the ventilator device.

4. Conclusion

The elderly group, especially those with symptomatic neck problems, should be aware and consult an expert before doing any exercise. We strongly advised this population to avoid any injury and use all safety measures as a debilitating injury can occur despite a very minimal injury in pre-existing cervical canal stenosis. Moreover, we support the use of IONM to predict the clinical outcome that can be expected after the surgery.

Disclaimer

No patient or author details are included in the figures.

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Ethical approval

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Consent

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Author contribution

Ifiran Saleh: The conception and design of the study.

Didik Librianto: Revising and giving final approval of the version to be published.

Achmad Fauzi Kamal: Acquisition of data.

Fachrisal Ipang: Data analysis and interpretation.

Wahyu Widodo: Acquisition of data.

Dina Aprilya: Drafting and revising the article.

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Not required.

Guarantor

Ifiran Saleh is the sole guarantor of this submitted article.

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