

## Case Report

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# Spinal Cord Reperfusion Injury Syndrome: A Rare Post-Surgical Complication after Spinal Cord Decompression that Makes the Surgeon Doubtful about his Surgical Skills

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### Abstract

**Background:** Spinal cord reperfusion injury syndrome (SCRIS) is a very rare pathology with little literature on the subject. The pathophysiology of SCRIS/WCS is poorly understood to date but the most widely accepted is that the sudden increase in blood flow at the level of the medullary compression area would cause the release of free radicals, causing damage to the axonal membrane. Severe or post-surgical tetraplegia together with an emergency magnetic resonance imaging (MRI) in which spinal cord hyperintensity is observed on T2 will make us suspect the diagnosis once the most frequent complications of spinal cord decompression have been ruled out.

**Purpose:** Understand and evaluate decision-making when facing a case of SCRIS/WCS.

**Study Setting:** Case report.

**Objective:** Evaluate the appropriate approach to SCRIS/WCS and review the literature.

**Clinical Observation:** we report a rare case of spinal cord reperfusion injury in a 65-year-old female. The first case reported in Ecuador.

**Conclusion:** The SCRIS/WCS is a rare pathology with little literature reported so far. The most accepted physiopathology is the sudden increase in blood flow over a chronically compressed spinal cord with the consequent increase in free radicals which lead to neural membrane injury. A very important risk factor to consider is hypertension as a history of the patient. Sudden quadriplegia or immediate post-surgical spinal cord decompression will make us request a follow-up magnetic resonance imaging to evaluate the possible most frequent complications, once each of them has been ruled out and with an increase in T2-weighted intensity, it will guide us towards the diagnosis. The skill and training of the surgeon is important when making decisions because the cause of this syndrome is not of mechanical origin.

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### Introduction

Spinal cord reperfusion injury syndrome (SCRIS), or also called white cord syndrome (WCS), is a very rare pathology with little literature on the subject. It is a spinal cord ischemic injury that occurs suddenly after spinal decompressive surgery, presenting with a picture of immediate post-surgical quadriplegia and slowly progressive improvement [1].

The pathophysiology of SCRIS/WCS is poorly understood to date, numerous hypotheses have been proposed including post-decompression increased spinal cord blood flow, post-decompression spinal cord remodeling or micro emboli that could cause spinal cord ischemia. The most widely accepted is that the sudden increase in blood flow at the level of the medullary

compression area would cause the release of free radicals, causing damage to the axonal membrane [2].

A case of a patient with cervical neural canal stenosis who after decompressive surgery + posterior instrumentation presents sudden and progressive quadriplegia is reported. Considering that the diagnosis is by exclusion, it is imperative that the specialist knows how to handle the condition and make the appropriate decision when addressing this problem.

### Case Report

A 65-year-old female patient, with a history of arterial hypertension, breast cancer in remission five years ago, and residual juvenile schizophrenia. With progressive stoppage gait alteration for 20 years without a reliable diagnosis, so she mobilizes with the support of a walking frame. She presents cervical pain of approximately one year of evolution with irradiation to the upper

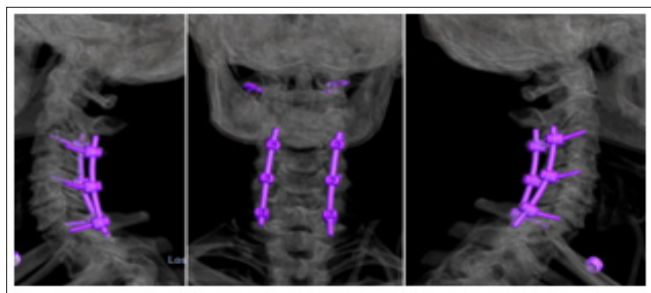
extremities and loss of strength. On physical examination, she presented bilateral cervical paravertebral contracture, negative Spurling test, negative Lhermitte, bilateral M4 C5 C6 force, bilateral M3 L4 force, left M3 L5, S1, M2 L5 and right S1. An MRI imaging of the lumbar spine was performed, which revealed degenerative disc disease with severe spinal stenosis with signs of myelopathy (Figure 1). In MRI at the level of the cervical spine, C4-C5 and C5-C6 spinal stenosis is observed (Figure 2), causing narrowing of the spinal cord. Surgical resolution was decided by total decompressive laminectomy C4, C5 and C6 + bilateral C3-C4 C4-C5 C5-C6 foraminotomy + bilateral C4-T1 posterior instrumentation and arthrodesis (Figure 3). Procedure performed with motor and sensory intraoperative monitoring which did not report conduction disturbances. Patient goes to the recovery room and later to hospitalization zone with force M4 C4 C5 C6 L4 bilateral M3 L5-S1 left and M2 L5-S1 right.



**Figure 1:** Degenerative Disc Disease with Severe Spinal Stenosis with Signs of Myelopathy



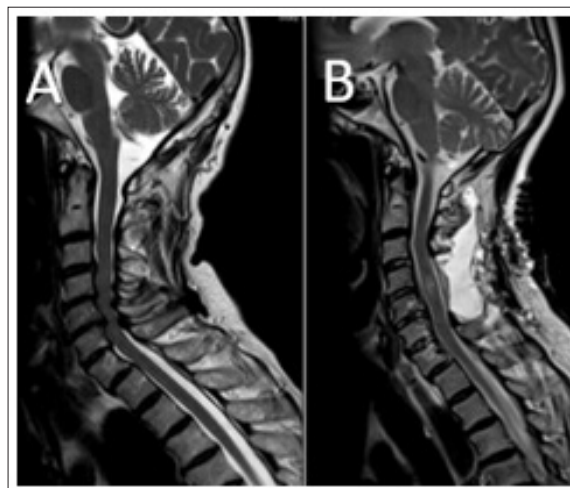
**Figure 2:** C4-C5 and C5-C6 Spinal Stenosis with Spinal Cord Compression



**Figure 3:** Total Decompressive Laminectomy C4, C5 and C6 + Bilateral C3-C4 C4-C5 C5-C6 Foraminotomy + Bilateral C4-T1 Posterior Instrumentation and Arthrodesis

One day after surgery, the patient presented a picture of M1 tetraplegia in all the myotomes from C5 towards the bilateral caudal on physical examination. It was decided to perform an emergent MRI (Figure 4) in which extensive decompression was observed, the presence of epidural hematomas and insufficient spinal cord decompression were ruled out, but T2-weighted signal hyperintensity was observed at the level of the spinal cord. Once the most frequent causes of post-surgical neurological deficits have been ruled out and with the characteristic T2-weighted image, the condition is classified as MRLS. For this reason, the decision was made not to perform a second surgical intervention because a mechanical cause for the neurological deficit was not appreciated. Corticosteroids are administered for 24 hours. The patient remains hospitalized for 5 days with evidence of improvement in her

clinical picture. At medical discharge, clinical improvement of his bilateral M3 neurological deficit was documented in C4, C5 and C6. Therefore, continuous physiotherapy sessions are planned as a long-standing treatment.



**Figure 4:** Pre and Post-Surgical MRI. A. Cervical Cord without Signs of Myelopathy. B. T2-Weighted Spinal Cord Hyperintensity

### Discussion

Spinal cord reperfusion injury syndrome is a very rare complication and at the same time very devastating for the patient. Its diagnosis usually occurs after spinal cord decompression surgery for chronic severe stenosis [3]. Few cases of sudden quadriplegia have been reported in the literature in the context of anterior or posterior decompression of the cervical spine. The abrupt increase in blood flow in the territory of a chronically compressed medulla triggers the activation of the inflammatory cascade with elevation of free radicals, mitochondria-dependent apoptosis, increased production of TNF alpha, and phospholipid cascades that lead to neuronal membrane damage [4,5]. It is characterized by presenting an increase in T2 signal in the magnetic resonance appreciated at the level of the decompression performed [6]. In most cases the tendency is to show a progressive but slow recovery of motor function, but in certain cases the evolution of the picture is refractory. It is estimated that the estimated average age is 65 years. The risk factors have not been established so far, but Fathalla et al, in a retrospective study between 2017 and 2019 of 150 patients who underwent medullary decompressive surgery with instrumentation, showed that 7 patients presented SCRIS of all of whom were hypertensive, which would explain that persistent oxidative stress over time would cause elevation of free radicals, generating a dysfunction of the neural membrane [7,8].

Chin et al, reported the first documented case of SCRIS in 2013, after cervical decompressive surgery by anterior approach and referring to the increase in T2-weighted intramedullary signal in an immediate post-surgical magnetic resonance imaging in a patient with abnormal evoked potentials. sudden trans-surgery [9]. One of the main post-surgical complications of cervical decompression is the presence of motor deficit. Which makes the surgeon raise questions about his surgical planning, his training and experience in the field of spinal surgery. The cause of said sudden quadriplegia should always be documented by means of magnetic resonance imaging, considering that SCRIS is a diagnosis by exclusion since the main cause of postoperative paralysis is epidural hematoma followed by inadequate decompression, iatrogenic spinal cord injuries with online 5% of all the cases reported by Petrucci et al, intraoperative hypotension or dislocations of the implants placed during the surgical procedure [10,11].

The case presented is somewhat peculiar because the patient had underlying signs of myelopathy at the level of the lumbar spine for a long time due to severe spinal stenosis at two levels, for which reason the patient, before presenting symptoms in the upper extremities, was already using a walking frame device for mobility. The symptoms of paresthesia's, cervical pain and its irradiation to the upper extremities with M4 motor deficit in C5 and C6 bilaterally occurred a year ago prior to admission, so when she goes for evaluation, an MRI of the cervical spine is requested, in which spinal stenosis can be seen at the level of C4-C5 and C5-C6 without signs of myelopathy. Due to the neurological deficit presented and without improvement with physiotherapy and evidence of spinal cord compression, spinal cord decompression surgery was decided using a posterior approach with arthrodesis and C4-T1 posterior instrumentation. 24 hours post-surgery, the patient presented sudden neurological deficit, evidencing on physical examination M1 motor deficit (fasciculations) in bilateral C5 C6 C7 L4 L5 S1 myotomes, for which it was decided to perform a follow-up MRI immediately, which ruled out the most frequent causes of this complication. However, an increase in intramedullary signal intensity is observed on T2, which is why it is classified as a SCRIS. During her hospitalization, slow but progressive improvement in the clinical picture began to show. After medical discharge, Serial check-ups were carried out by outpatient clinic, appreciating progressive motor recovery. 6 months after surgery, the patient has motor recovery M4 at bilateral C5 C6 C7 level and M3 at bilateral L4 level, M2 L5 S1 right (due to chronic myelopathy prior to admission).

Considering that it is a very rare pathology. There is currently no evidence-based management guide for its treatment. However, the use of high-dose corticosteroids according to the NASCIS-2 protocol as well as maintaining intraoperative mean arterial pressure above 85 mmHg have been described as beneficial in reducing edema and maintaining adequate marrow perfusion [12,13].

This is the first reported case of SCRIS/WCS in Ecuador. Reaching its diagnosis by first excluding the main causes of motor deficit during or after a spinal cord decompression and showing T2-weighted hyperintensity at the spinal level in magnetic resonance images. Until now, it has not been determined that a second reoperation (extending the decompression zone) has benefits because the cause of this syndrome is not of mechanical origin. The training of the spine surgeon, his surgical planning and his skill are essential to be able to correctly face decision-making.

### Conclusion

The SCRIS/WCS is a rare pathology with little literature reported so far. There are several theories about its cause and to date the most accepted is the sudden increase in blood flow over a chronically compressed spinal cord with the consequent increase in free radicals which lead to neural membrane injury. A very important risk factor to consider is hypertension as a history of the patient. Sudden quadriplegia or immediate post-surgical spinal cord decompression will make us request a follow-up magnetic resonance imaging to evaluate the possible most frequent complications, once each of them has been ruled out and with an increase in T2-weighted intensity, it will guide us towards the diagnosis. The skill and training of the surgeon is important when making decisions because the cause of this syndrome is not of mechanical origin. In most cases, a progressive improvement in strength is expected that does not usually reach a complete recovery, so physiotherapy is a necessary tool to optimize the condition. We also believe it is important that before undergoing

chronic spinal cord decompression surgery, the patient and their relatives should be explained that the risk of this complication is very low but that it could occur.

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The authors declare no conflicts of interest.

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