

ANESTHETIC MANAGEMENT OF ACUTE CERVICAL SPINAL CORD INJURY IN PREGNANCY

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SUMMARY – The incidence of traumatic spinal cord injury is 11,000 *per* year, with 55% of the injuries occurring between the age of 16 and 33, 18% of these in women of reproductive age. Diagnostic and early spinal decompression along with maintaining the mean arterial pressure to improve spinal cord perfusion and a high progesterone level in pregnancy for its neuroprotective and anti-inflammatory effect have the leading role in neurological recovery and clinical outcome. We present a case of a patient in the 17th week of pregnancy who sustained luxation fracture of the C5 and C6 vertebrae and tetraplegia as passenger in a road accident. The early operative treatment and appropriate anesthetic procedure resulted in good clinical outcome with complete neurological recovery.

Key words: *Spinal cord injuries; Pregnancy; Acute disease; Arterial pressure; Decompression, surgical*

Introduction

The incidence of traumatic spinal cord injury (SCI) is 11,000 *per* year; 55% of the injuries occur between the age of 16 and 33, with 18% of patients being women of reproductive age^{1,2}. Acute injuries sustained in pregnancy produce immediate changes in the maternal neurogenic and hemodynamic physiology, which may profoundly affect the fetus³. The rate of fetal malformations in acutely acquired SCI in pregnancy is as high as 11%³⁻⁵. The patient with traumatic SCI, therefore, presents specific challenges requiring a multidisciplinary approach for maternal and fetal health^{2,6,10}.

Evaluation of a pregnant patient with acute SCI does not greatly differ from the non pregnant patient with similar injury^{2,11}. Spinal shock may develop in

approximately half of SCIs occurring at any level. Neurogenic shock, which causes hemodynamic perturbations in addition to sensorimotor effects, generally lasts from 1 to 3 weeks and results in peripheral vasodilation that leads to profound hypotension^{11,12}.

Positive inotropic support with dopamine or dobutamine may also be necessary and is not contraindicated in pregnancy^{11,12}, but the use of noradrenaline is still unclear. Methylprednisolone has been recommended after an acute injury by the American Association of Neurological Surgeons and the Congress of Neurologic Surgeons^{11,14}. As thought before, when administered within 6-8 hours of the initial insult, methylprednisolone may significantly improve motor and sensory function 6 months postinjury^{11,12,14-16}; however, this year some new and revised guidelines have arisen¹⁷⁻¹⁹. The new guidelines do not recommend administration of methylprednisolone for the treatment of acute SCI. In our case, we used methylprednisolone despite more than 8 hours after injury, based on our good clinical experience with steroid therapy after acute spinal trauma.

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Case Report

We present a case of a patient in her 17th week of pregnancy who sustained luxation fracture of the C5 and C6 vertebrae and tetraplegia as passenger in a road accident. The patient was primarily treated in a secondary surgical facility, where radiology diagnostics of the spine was not performed due to pregnancy. At the first clinical evaluation in the emergency department, the patient complained of tingling sensation in her arms with movement preserved in all extremities. The patient was referred for emergency gynecologic assessment, where she developed tetraplegia during transportation (American Spinal Injury Association, ASIA B). She arrived at the SCI unit 16 hours after the accident.

Magnetic resonance imaging (MRI) is recommended for identifying the level of injury. MRI of the spine showed luxation fracture C5 and C6 (Fig. 1); upon MRI, she was submitted to an emergency surgical procedure of disk extirpation and anterior spondylodesis (Fig. 2). The patient was assessed as the American Society of Anesthesiologists classification (ASA) III. Following the spinal injuries protocol, methylprednisolone (National Acute Spinal Cord Injury Study NASCIS III, 30 mg/kg loading dose followed by a maintenance infusion at 5.4 mg/kg for 23 hours) was administered and invasive hemodynamic

monitoring was set (central venous catheter with ultrasound control and invasive arterial pressure). During the surgical procedure and due to hemodynamic instability (spinal and neurogenic shock), low dosage of noradrenaline (0.05 µg/kg/min) was administered until the mean arterial pressure of 85-90 mm Hg with volume replacement (central venous pressure was between 6 and 11 mm Hg). Blood loss during the procedure was insignificant. The patient was stable during the procedure and was extubated two hours postoperatively.

The patient achieved complete recovery of the neurological deficit within few days of the surgery. She was verticalized with the help of physiotherapist 48 hours after the procedure. She was kept in the intensive care unit until complete hemodynamic normalization 48 hours postoperatively. Fetal and hemodynamic monitoring was sustained during intensive care with preservation of pregnancy without complications. She delivered a healthy baby at term.

Discussion

Acute traumatic SCI is frequently associated with systemic hypotension¹. Hypotension may be attributable to associated traumatic injuries with hypovolemia, direct severe spinal cord trauma itself, or a combination². The occurrence of hypotension has been shown



Fig. 1. Magnetic resonance imaging before operation.

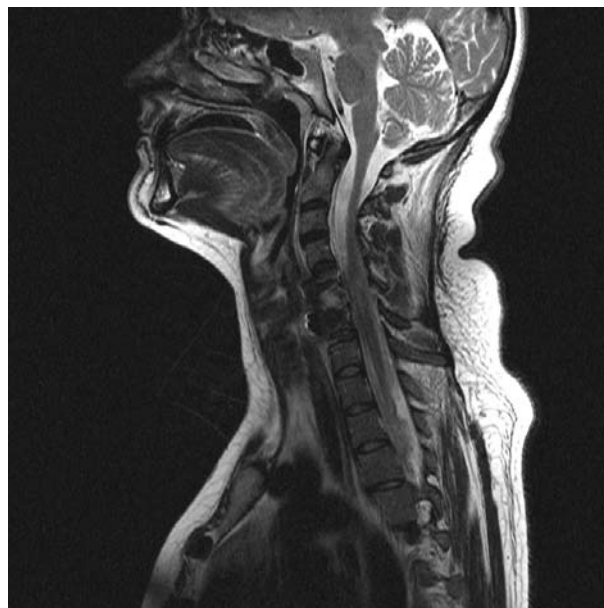


Fig. 2. Magnetic resonance imaging after operation.

to be associated with worse outcomes after traumatic injury^{1,2,8,11,16}. The principal anesthetic concern was to avoid secondary (irreversible) cord damage¹¹ in the mother. Ischemia of the spinal cord is thought to be one of the most important contributors to neuronal injury and neurological deficit after acute SCI¹¹. Both local and systemic vascular alterations can contribute to ischemia after acute SCI by further reducing spinal cord blood flow that can exacerbate and extend the principal spinal cord insult^{1,6,8,16}.

Several reports of case series suggest that treatment of hypotension and resuscitation to maintain the mean arterial pressure at high-normal levels, 85 to 90 mm Hg, for the first 7 days following an SCI is recommended^{18,19}, and may enhance neurological outcome after acute SCI^{1,2,5,7}. A protocol of aggressive, early medical and surgical management of patients with acute SCI may improve neurological outcome after injury^{15,16}. Treatment in the intensive care unit setting, hemodynamic monitoring with maintenance of the mean arterial pressure above 85 mm Hg¹, and early decompression of the spinal cord seemed to reduce secondary complications after acute SCI^{3,4,15}. The use of vasoconstrictive drugs for raising and maintenance of the mean arterial pressure and perfusion pressure in the placenta is not yet fully understood, but there are no clear contraindications for the use of these drugs in pregnancy^{2,10,11}.

During pregnancy, progesterone secretion has a protective effect on myelin and also increases myelination^{5,6,14}. Progesterone exerts strong stimulatory effects upon the oligodendrocyte progenitors and mature oligodendrocytes, and inhibitory effects upon inflammatory mediators^{8,9,13,14}. In this sense, progesterone is a recognized promyelinating factor for trauma, degeneration and inflammation of the peripheral and central nervous system¹⁷. As mentioned earlier, methylprednisolone should not be routinely used in the treatment of patients with acute SCI, suggesting that high-dose methylprednisolone administration is associated with a variety of complications including infection, respiratory compromise, gastrointestinal hemorrhage, and death^{18,19}.

In conclusion, early spinal decompression^{6,10,20} (within 12-24 hours) and maintaining the mean arterial pressure at 85-90 mm Hg to improve spinal cord perfusion^{1,11,15}, as well as high progesterone level in

pregnancy^{7,21} with its neuroprotective, promyelinating and anti-inflammatory effect^{14,17} play an important role in neurological recovery and clinical outcome in acute SCI. The care of a pregnant patient with acute SCI poses multiple challenges that require a multidisciplinary team approach and individualization of therapy.

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Sažetak

ANESTEZIOLOŠKI PRISTUP KOD AKUTNE OZLJEDE VRATNE KRALJEŽNICE U TRUDNOĆI

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Učestalost traumatskih ozljeda kralježnice je 11.000 na godinu, a 55% ozljeda nastaje u dobi od 16 do 33 godine, od toga 18% u žena reproduktivne dobi. Radiološka dijagnostika, uz ranu kiruršku dekompresiju kralježnice s održavanjem srednjeg arterijskog tlaka za očuvanje perfuzije leđne moždine, uz progesteron kao neuroprotektivni i protuupalni faktor u akutnoj traumi leđne moždine, ima vodeće mjesto u neurološkom oporavku i dobrom kliničkom ishodu. Donosimo prikaz slučaja trudnice u 17. tjednu trudnoće koja je zadobila luksacijsku frakturu petog i šestog vratnog kralješka s razvojem tetraplegije, kod koje su rano operacijsko liječenje i odgovarajući anesteziološki postupak doveli do dobrog kliničkog ishoda.

Ključne riječi: Kralježnična moždina, ozljede; Trudnoća; Akutna bolest; Arterijski tlak; Dekompresija, kirurška