Med Intensiva. 2017;41(5):306–315

medicina intensiva

www.elsevier.es/medintensiva

SERIES IN INTENSIVE CARE MEDICINE: TRAUMATIC ACUTE SPINAL CORD INJURY

Update on traumatic acute spinal cord injury. Part 2[☆]

M. Mourelo Fariña[a], S. Salvador de la Barrera[b], A. Montoto Marqués[b,c], M.E. Ferreiro Velasco[b], R. Galeiras Vázquez[a,*]

[a] *Unidad de Cuidados Intensivos, Complexo Hospitalario Universitario de A Coruña, A Coruña, Spain*
[b] *Unidad de Lesionados Medulares, Complexo Hospitalario Universitario de A Coruña, A Coruña, Spain*
[c] *Departamento de Medicina, Universidad de A Coruña, A Coruña, Spain*

Received 30 July 2016; accepted 31 October 2016

KEYWORDS
Spinal cord injuries/surgery;
Spinal cord injury/pain;
Tracheostomy;
Prolonged mechanical ventilation

Abstract The aim of treatment in acute traumatic spinal cord injury is to preserve residual neurologic function, avoid secondary injury, and restore spinal alignment and stability. In this second part of the review, we describe the management of spinal cord injury focusing on issues related to short-term respiratory management, where the preservation of diaphragmatic function is a priority, with prediction of the duration of mechanical ventilation and the need for tracheostomy. Surgical assessment of spinal injuries based on updated criteria is discussed, taking into account that although the type of intervention depends on the surgical team, nowadays treatment should afford early spinal decompression and stabilization. Within a comprehensive strategy in spinal cord injury, it is essential to identify and properly treat patient anxiety and pain associated to spinal cord injury, as well as to prevent and ensure the early diagnosis of complications secondary to spinal cord injury (thromboembolic disease, gastrointestinal and urinary disorders, pressure ulcers).

PALABRAS CLAVE
Lesión medular/cirugía;
Lesión medular/dolor;
Traqueostomía;
Ventilación mecánica prolongada

Actualización en lesión medular aguda postraumática. Parte 2

Resumen El objetivo en el tratamiento de la lesión medular aguda traumática es preservar la función neurológica residual, evitar el daño secundario, y restaurar la alineación y la estabilidad de la columna. En esta segunda parte proporcionaremos un enfoque en el tratamiento de la lesión medular en cuestiones relativas al manejo respiratorio a corto plazo, donde es prioritaria la preservación de la función diafragmática, así como la posibilidad de predecir la duración de la ventilación mecánica y la necesidad de traqueostomía. Abordaremos la valoración quirúrgica de las lesiones de columna en función de unos criterios de tratamiento actualizados, teniendo

☆ Please cite this article as: Mourelo Fariña M, Salvador de la Barrera S, Montoto Marqués A, Ferreiro Velasco ME, Galeiras Vázquez R. Actualización en lesión medular aguda postraumática. Parte 2. Med Intensiva. 2017;41:306–315.

* Corresponding author.
E-mail address: ritagaleiras@hotmail.es (R. Galeiras Vázquez).

en cuenta que, aunque el tipo de intervención depende del equipo quirúrgico, en el momento actual el tratamiento implica descompresión y estabilización precoz. En el tratamiento integral del paciente con lesión medular es fundamental identificar y tratar adecuadamente el dolor asociado a la lesión medular, así como la ansiedad, al igual que prevenir y diagnosticar precozmente complicaciones secundarias a la afectación que la lesión medular ocasiona en todos los sistemas del organismo (enfermedad tromboembólica, alteraciones gastrointestinales, afectación del sistema urinario, úlceras por presión).

Respiratory support. Prolonged mechanical ventilation

The need for respiratory support in the acute phase of a spinal cord injury has a variable incidence. The two most important markers used to predict the need for intubation are the level at which the injury occurs and the score shown on the ASIA impairment motor score.

Spinal cord injuries (SCI) at cervical or thoracic levels affect the spinal nerves innervating the respiratory muscles. The diaphragm, the main muscle involved in breathing, is innervated from the third, fourth, and fifth cervical spinal segments. Injuries above C5 level cause paralysis of the diaphragm, the intercostal and abdominal muscles and without the appropriate respiratory support they are incompatible with life and they require intubation in almost 100 per cent of the cases. In incomplete upper cervical injuries (C2–C4) or lower injuries (C5–T5) spontaneous ventilation may be feasible. However, the respiratory function is substantially compromised and ventilation failure can be due to fatigue.[1]

Respiratory dysfunction in patients with acute SCIs is associated with three factors: muscle strength, secretion retention, and anatomic dysfunction. The first 24 h after the occurrence of the SCI predispose to the development of complications (atelectasis, pneumonia, thromboembolism, and pulmonary oedema) that are the main cause of morbimortality. In respiratory failure, the associated traumatic injuries and the patient's basal situation (age, comorbidity, and genetic predisposition)[2,3] can also play a significant role.

The need for respiratory support occurs more commonly four days after the lesion of muscle fatigue so if conservative management is required, a close monitoring of respiratory function will be required too. What we will have to do is monitor the levels of pCO_2 (capnography/arterial blood gas) and perform one spirometry, while measuring the vital capacity (excellent correlation with pulmonary function test) and the maximum respiratory pressure (estimating the strength of respiratory musculature). These are the indicators of respiratory failure: vital capacity < 15 ml/kg, maximum respiratory pressure $<-20\,cmH_2O$, and increased levels of carbonic dioxide.[1,4] Recent studies show that, on the MRI, the mere presence of injury or swelling at C3 level predicts the occurrence of respiratory failure.[5]

Patients with injuries above T5 level, serious associated injuries or patients requiring respiratory monitorization should be admitted in intensive care units in order to minimize damage secondary to hypoxia. We should remember that if the patient needs respiratory support, then the intubation will have to be planned, since urgent intubations in situations of respiratory failure increase the risk of neurological damage.[3]

When it comes to applying ventilation to these patients, the special characteristics of SCI should be observed. Even though it has been reported that patients have ''healthy'' lungs, up to 60 per cent show associated thoracic traumatisms. In these cases, we will need to implement a strategy of protective ventilation.

Preserving the diaphragmatic function needs to be a primary goal since it is a key goal in respiratory function. The ventilator-induced diaphragmatic dysfunction occurs early with the diaphragmatic inactivity in any of the modalities of controlled ventilation. In order to avoid it, the goal with these patients should be keeping the total support provided by the ventilator in order to avoid fatigue, thus allowing the patient's initiation of most of the cycles (certain level of diaphragmatic contraction) and the adjustment of breathing time (while avoiding autotrigger, and auto-PEEP).[6]

The practices of setting breathing patterns like the tidal volume and the PEEP have evolved during the last years. The practice of ventilating with high tidal volumes has been abandoned after different studies showed that ventilating with volumes of 10–15 ml/kg, and volumes of 10 ml/kg makes no difference at all. It has been confirmed that keeping plateau-pressures $<30\,cmH_2O$ affects the prognosis.[7] When it comes to PEEP, the theory was using $0\,cmH_2O$ to avoid air entrapment in patients with impaired breathing out muscles. If we have in mind that breathing out is a passive phenomenon the aforementioned argument simply does not stand. Also, the use of PEEP increases residual functional capacity and avoids the cyclic alveolar collapse, while avoiding the pulmonary lesion associated with mechanical ventilation (MV). This is why PEEP zero is not recommended, at least in the acute phase, instead PEEP levels capable of minimizing the atelectrauma with the adequate plateau-pressure ($PEEP \geq 5\,cmH_2O$ and plateau-pressures $< 30\,cmH_2O$)[8] are recommended.

Prolonged mechanical ventilation

When it comes to defining the concept of prolonged MV there is a great variability in the actual medical literature. In general, when the patient is ventilated for over 21 days during, at least, 6 h/day we usually talk about prolonged MV. The possibility of predicting the duration of MV facilitates