

# THE RESPIRATORY APPROACH TO THE MEDULLARY PATIENT IN THE ACUTE STAGE, FROM LITERATURE TO EXPERIENCE.

## A RETROSPECTIVE STUDY IN OUR INTENSIVE CARE UNIT

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### ABSTRACT

*In spinal cord injury in the acute phase, pulmonary complications are the most common cause of death and often affect the outcome even during the chronic phase.*

*In the initial acute phase, the person is assisted in ICU and the management of the airways can be guaranteed in two ways: invasive by subjecting the patient to tracheotomy and invasive ventilation, non-invasive by extubating the patient early, supporting him with Non-Invasive Ventilation (NIV).*

*Both approaches have their advantages and disadvantages.*

*For about 6 years in the Intensive Therapy of the Neuromotor Pole (Sod neuroanesthesia and Reanimation) Careggi hospital in Florence has been strengthened 54 patients with complete or incomplete spinal cord injury, resulting from trauma, have been hospitalized only 23 patients (less than 43%) have needed tracheostomy. Those who did not have the tracheostomy performed NIV in the early stages, and then moved on to more autonomous ventilatory modes. All patients were treated with a mechanical cough assistant.*

*From the retrospective investigation it appears that NIV can be considered a valid alternative to invasive ventilation in the bone marrow patient. However, it is necessary to specify that the desired objectives can only be achieved with solid knowledge of the health professionals involved and above all by close collaboration within the multidisciplinary team.*

*The non-invasive approach has reduced complications for the patient, hospitalization times with a consequent reduction in treatment costs.*

*In light of the data that emerged and the considerations made, we can think that this is only the beginning of a multidisciplinary path that reduces the invasive approach on our clients as much as possible.*

### INTRODUCTION

#### Background on spinal cord injury

Spinal cord injury involves both motor and sensory alterations, with psychological consequences, and influence interpersonal relationships and daily life activities. Depending on the damage reported, there may also be vegetative alterations.

Complete and optimal management of spinal cord injury requires a coordinated and interdisciplinary approach.

Spinal cord injury affects mostly adults over the age of 60 and is prevalent in males. The cervical localization is found more frequently than the dorso-lumbar one.

Spinal cord injuries can be divided into two major etiological groups:

- Traumatic spinal cord injuries, resulting from an acute damage due to an extrinsic force;
- Non-traumatic spinal cord injuries, as a result of a vascular, tumor, dysplastic, inflammatory and

iatrogenic pathology

- They are also divided according to the level of lesion and the degree of damage, in particular:
- Complete spinal cord injury with absence of any neurological activity below of the injury level;
- Incomplete spinal cord lesions with varying degrees of motor, sensory and autonomic activity below of the injury level.

The incidence of traumatic origin was is estimated in 23 cases per million (179,312 cases per year worldwide).

Pulmonary complications (respiratory failure, lung infections and atelectasis ) are the most common cause of death in the acute phase but also occur during the post acute and chronic phase.

The same pulmonary complications more frequently affect patients with complete high cervical lesions in the chronic face.

Impairment of respiratory functions is dictated by the

characteristics of the injury, such as complete or incomplete damage.

In high cervical lesions (C), from C1 to C3 level, the activities of the thoracic diaphragm, the use of the thoracic muscles and the abdominal muscles are compromised, even if these patients have normal function of the accessory respiratory muscles in the neck; so it is often compromise spontaneous breathing. Some authors say that there is an increase in post-traumatic survival with high cervical lesion, and that part of these patients can be weaned from mechanical ventilation.

In the lower cervical lesions, from C4 to 8, the activity of the thoracic diaphragm and accessory muscles of the neck is preserved; depending on the level, even the clavicular portion of the pectoralis major muscle is preserved; In these lesion, the thoracic and abdominal muscles are absent, and therefore the effectiveness of the cough.

In high dorsal injuries (D) from D1 to D6 level, the activity of the intrinsic muscles of the first seven segments of the rib cage is preserved, so it begins to move more synchronously with the thoracic diaphragm. However, the abdominal muscles are not yet active.

In the lower lesions, from D7 to the second lumbar level, the full activity of the muscles of the thoracic cage is completed and the progressive activity of the abdominal muscles is acquired, with the full effectiveness of the cough.

The cervical spinal cord patient will certainly present a reduction in both static and dynamic lung volumes based on the different level of lesion and the postures; he is a restrictive patient.

Due to the reported damage, the expiratory reserve volume, the maximum expiratory pressure generated and the flows are severely reduced. For these reasons the patient has an altered cough and is unable to “clean” the airways from secretions.

It is important to clarify that an inadequate cough mechanism is the major cause of pulmonary complications that cause death in the 12 weeks following the traumatic event.

#### ***Problem: How to ventilate a patient with spinal cord injury***

In a traumatic event the medical assistance is carried out mostly in intensive care settings, generally immediately after the surgery to stabilize the spine. In the acute phase it is possible to adopt two different respiratory sistem to ventilate the patient:

- Invasive ventilation, with oro thracheal tube or tracheostomy.
- Non Invasive Ventilation (NIV), with different kind of mask.

In the first approach, the patients usually undergoes an early tracheotomy (less than 10 days afeter the injury) and the management of secretions takes place through bronchoaspiration with direct access of the tracheotomy. These patients will have to rehabilitate swallowing to weaning not only from mechanical ventilation but even from tracheostomy tube. The bronchial clearing with the use of the cough assistant can be done directly through the tracheostomy.

In the second approach, with NIV, it is possible to avoid tracheotomy. In these cases the intubation period can be longer than 72 hours to allow a complete recovery of consciousness and adequate respiratory exchange, to improve chance of success with NIV. To ensure the

bronchial clearing and good oxygenation, the support of the cough assistant accompanied by manual maneuvers becomes essential. In these subjects, the multidisciplinary team must work together as best as possible to guarantee assistance to the respiratory functions during the 24 hours.

#### ***Advantages of tracheostomy***

The tracheostomy allows a better management of secretions, for this reason it can be considered advantageous for the prevention of pneumonia associated with mechanical ventilation.

One other advantage of the tracheotomy is the time factor, because it reduces the days of mechanical ventilation and reduces the time in intensive unit permanence. This is a safe method because it allows immediate access to the airways to ensure ventilation and bronchial clearing; it allows a quick possibility of sedation and does not require the patient’s collaboration; side effects are contained.

#### ***Disadvantages of tracheostomy***

Studies have shown that the risks associated with tracheostomy, such as haemorrhage, dislocation or occlusion of the cannula, are considered early complications. On the other hand, late complications can be: dysphagia, tracheal stenosis, pneumothorax and pneumomediastinum, tracheoesophageal fistula, infections and granulomas.

Klotz says that 12.9% of patients with tracheostomy undergo inflammation of the stoma.

Romero in 2009 says that 30% of patients who perform early tracheostomy and 51% of those who perform late tracheotomy experience complications.

Invasive ventilation bypasses the physiological filters of the upper airways, and this condition is capable of generating infections, especially in the lungs.

A study shows that 87% of early tracheostomized patients have pneumonia and 92.7% in late tracheostomized patients. In conclusion, early tracheostomy would reduce the incidence of pneumonia compared to that performed late.

#### ***Advantages of the NIV***

NIV should be applied in day and night for the previous days. Nursing care is essential for the effective management of this ventilatory support; in the acute phase, the human resources involved make this treatment approach very expensive. With the improvement of the clinical conditions of the subjects, the need of assistance decreases and the costs of assistance are reduced; for this reason the final management costs are lower than those of the invasive approach.

The wheight of assistance is dictated not only by ventilatory management, but also by the characteristics of medullary patients, such as the presence of ineffective cough. Due to the lack of the tracheostomy tube, manual or mechanical cough assistance maneuvers are less effective.

According to Bach, NIV if managed safely and efficiently, may be preferred. As early as 1990, the same author says that NIV can be the effective alternative to tracheotomy.

In one of his publications, he claims to have extubated 100% of patients with cervical spinal cord injury using NIV. The subjects in this group were cooperative, had no associated severe head trauma, rarely had bulbar

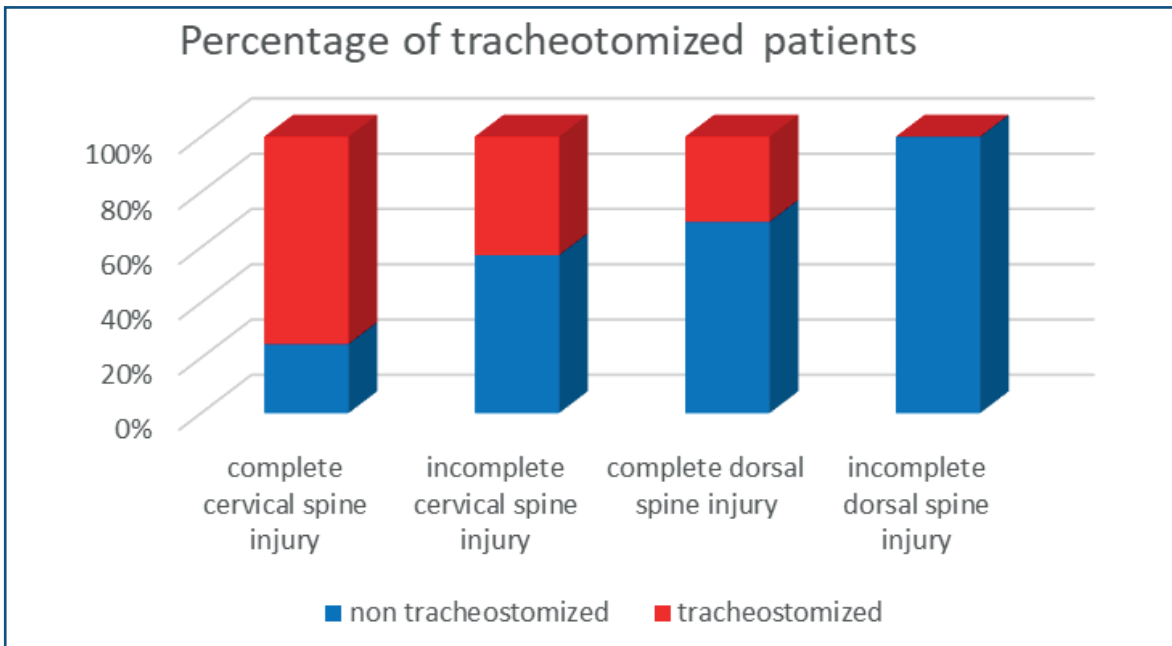


Fig. 1

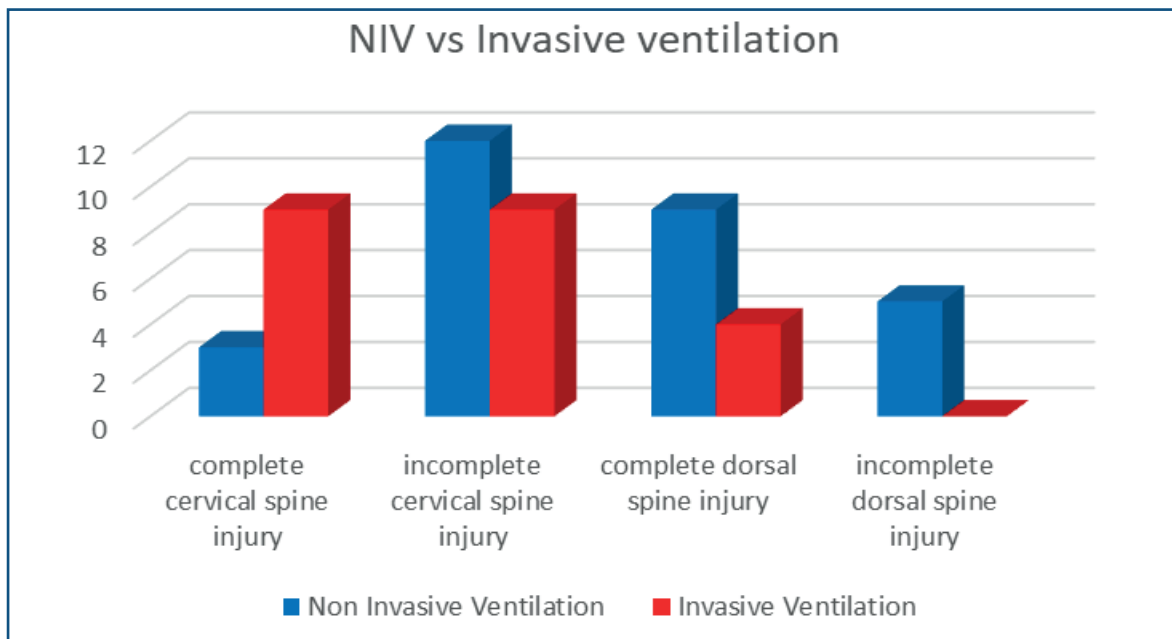


Fig. 2

deficits that cause speech and swallowing disorders, so they have adequate protection of the airways and they were the ideal candidates to be managed in NIV.

NIV also has advantages in daily life activities that affect the quality of life, such as the possibility of speak and eat, also the person assumes a high level of collaboration during the interventions. This methodology has a positive impact on the social and psychological aspects of the person.

**Disadvantages of NIV**

NIV requires patient collaboration. It is necessary to split to tracheostomy when the patient is not cooperating, when severe head trauma coexists, when there is no adequate protection of the airways and when neck movement is limited (such as in the presence of a collar and before surgical stabilization). In these cases and in the event that the team is not experienced in NIV, tracheostomy remains the best alternative.

NIV often fails in emergency-urgency due to the staff rarely trained and the limited specific material available, so many centers prefer to ventilate the patient invasively to have a greater guarantee of success. Furthermore, few intensive unit care have the respiratory physiotherapist available in a constant way who can collaborate in the management of NIV and cough assistant.

**DISCUSSION: THE MULTIDISCIPLINARY TEAM, OUR EXPERIENCE**

As Yuguè says, in the multidisciplinary team the nurses together with the respiratory physiotherapist play a crucial role in reducing the incidences of tracheotomies. To ensure that the subject derives real benefit from NIV, the training of health personnel and shared experience are essential. The respiratory rehabilitation carried out by the nursing team and the physiotherapist presence

in the ward allow to quickly identify cases in which it is necessary to clear the airways caused by ineffective cough.

Bach and Goncalves in 2009 affirm the importance of the multidisciplinary team for patient management in NIV. Their protocol include: mechanical cough assistance every thirty minutes in the first 2 days after extubation or during lung infections; the use of NIV for many hours a day. Bronchial clearance will then be the first therapeutic choice in case of desaturation. In consideration of this protocol, Vianello argues that physiotherapy and nursing staff are not always able to apply the protocol perfectly, especially at night or during days with a high care load.

In the last six years, 54 patients with complete or incomplete spinal cord injury resulting from trauma have been admitted to the Intensive Therapy of the Neuro-motor Center (department of Anesthesia and Intensive Care) hospital of Careggi, Florence. As can be seen from the graph (fig.1), after extubation most patients with complete dorsal spinal injury (60%) avoided tracheotomy. People who reported an incomplete spinal cord injury avoided tracheotomy in more than 95% of cases.

In the complete cervical lesions, less than 20% have avoided tracheostomy, a percentage that rises to almost 50% when the lesion is incomplete. Those who did not have the tracheostomy performed NIV in the early stages, and then switched to more autonomous ventilation modes such as high-flow and then low-flow oxygen shows ventilatory interventions for the various disease (fig.2)

All patients were treated with a mechanical cough assistant, in tracheotomy tube or in mask if they were ventilated in NIV.

In this article we have mentioned some of the advantages and disadvantages of these two treatment methodologies for patients with spinal cord injury, and the results obtained in our ward over the past six years.

Until now the literature leaves an open choice between early tracheostomy and non-invasive ventilation. Very often the choice of methodology, when it is possible to choose between the two approaches, also depends on the level of specialization of the healthcare staff.

In some studies the patient NIV seems in fact more easily manageable in the control of secretions and therefore in the management of infections, while advocates for tracheostomy claim that this type of surgery is fast, safe, with few side effects, and without patient cooperation.

The complications of tracheostomy are well known but still many intensive care units prefer it to NIV because the latter is considered too impacting on the care load and often of little success.

However, from the data that emerged, we can say that it is possible to manage most patients with acute spinal injury with NIV and cough assistance thanks to the close collaboration between the nurse staff, the doctor and the respiratory physiotherapist.

The difficulties encountered in our reality are the lack of knowledge homogeneity in the staff and the presence of the respiratory physiotherapist only during the day on weekdays.

## CONCLUSIONS

Our experience agrees with the literature in confirming that the NIV approach may be the best solution, with better cost benefits, and it can reduce complications and improve patient comfort.

The obstacles to the NIV approach are: the difficulty of ventilation, especially in patients with complete cervical injury, the preparation of the multidisciplinary team and the availability of all professional figures, such as the respiratory physiotherapist 24 hours a day.

The NIV approach is still to be considered the best choice in terms of cost-benefits for the health system and for the user, even if today in so many ward have to be improved.

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