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How to implement NIV in the ICU?

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NIV is widely used in the ICU for different types of respiratory failure. However, there is no recommendation on the method to implement successfully the NIV program in the ICU. The three keys are equipment, caregiver's education and training, and organisation. Equipment should be considered purchasing the appropriate ventilators according to the number of patients and the type of patients admitted. Interface selection is very important and should not be neglected. Humidification devices should also be appropriate. Physician, nurses and respiratory therapist have to get education, practical training and a continuous training program. Organisation of NIV in the ICU is improved if there is a local developed protocol with precise indication criteria, initiation method, mask selection, ventilator settings, NIV session duration and monitoring.

Key words: non-invasive ventilation, acute respiratory failure, mechanical ventilation

INTRODUCTION

Non-invasive ventilation is a daily procedure in the ICU concerning around 25% of ICU patients as the only mechanical support or used after extubation (1). NIV can be an alternative to invasive mechanical ventilation in some cases, but it should not be considered a replacement for invasive mechanical ventilation. Indications are well defined (2). NIV is strongly recommended in acute decompensation of COPD and cardiac pulmonary edema. NIV is recommended in hypoxemic respiratory failure in immunocompromized patients, lung contusion, post-surgery respiratory failure, chest wall stiffness and neuromuscular disorders, and after extubation to prevent a new respiratory failure in selected patients. NIV is not recommended in community-acquired pneumonia, ARDS, post-extubation respiratory failure, and Guillain Barré syndrome. There is no recommendation in acute decompensation of the obesity hypoventilation syndrome because of lack of clinical studies. However, NIV is also very efficient in this condition which is more and more frequently admitted in the ICU. In a mixed population of adult ICU patients, NIV is mainly used for COPD exacerbation, obesity hypoventilation syndrome and to prevent respiratory failure after extubation. The main contra-indications are any kind of extra-respiratory failure (coma, hemodynamic instability, severe arrhythmia…), swallowing disorders, obstruction of upper airways, gastric hemorrhage, and the inexperience of the caregivers. Thus, as NIV is daily

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used and is strongly recommended for the management of some patients, each unit should be prepared to perform NIV. There is no evidence regarding the method to perform and implement NIV in the ICU. This discussion is mainly based on the author's experience. The main reason for low use of NIV is lack of physician knowledge, inappropriate NIV equipment, poor previous experience, and inadequately trained respiratory staff (3). In that scenario, education of physicians, respiratory therapists (RTs), and nurses should be paramount for success. Thus, there are three important components to implement NIV: equipment, caregiver's training and organization.

EQUIPMENT

To perform NIV properly, caregivers have to select the adequate ventilator, interface and ventilator circuit. NIV ventilator should be connected to high pressure oxygen network in order to be able to provide 100% oxygen in some cases. Monitoring should have waveforms which are very useful to assess patient-ventilator synchronization. In addition, a ventilator should be able to measure and adjust the output to leaks (increase the pressure delivered to compensate leaks and adjust inspiratory and expiratory triggers sensitivity to prevent patient-ventilator asynchrony due to leaks). Up to now, transport ventilators were not able to provide correctly NIV. A new generation of a transport ventilator with a turbine and waveforms is emerging which allows clinicians to perform NIV in good conditions during transport. Home design ventilators are suited for NIV in home care. Usually, they cannot be connected to high pressure oxygen and they do not display waveforms. However, some of them offer bi-level ventilation (or ventilation with calibrated leak) which is very comfortable for the patient. Home design ventilators can be used in the ICU for hypercapnic respiratory failure. In case of hypoxemic respiratory failure, FiO_2 and the flow delivered by the ventilator may not be sufficient in regard to patient's need. ICU ventilators usually have a NIV mode. However, the characteristic of these modes is variable among different manufacturers (4). Some offer real benefits in case of leaks while others are just marketing features. Clinician should be careful when purchasing an ICU ventilator to know the characteristics of the NIV mode. Finally, some NIV ventilators designed for ICU have been developed which provide all the advantages: turbine ventilators, high pressure oxygen, waveforms, and good adjustment to leaks. These ventilators are probably more suitable for units that use a lot of NIV.

The interface used for NIV in the ICU is usually a mask although a helmet or a mouth piece can be used in a particular situation. An oronasal mask is usually preferred to a nasal mask because patients in acute respiratory failure breathe through the mouth. There is a large choice of oronasal masks available today with different characteristics and prices. None is better than the other. The most important is to select a single-use oronasal mask dedicated for NIV (as opposed to anesthesia facial masks) and to have different types of masks available. Full face masks without any pressure on the nose are also available. They are sometimes difficult to adjust because there are not a lot of sizes but can be useful in case of skin lesions on the nose. A procedure specified as first-line, second-line… is very useful for the caregivers. Once the type of the mask has been determined, selection of the appropriate size, setting and adjustment of the headgear are also very important and require caregiver's training.

Regarding the ventilator circuit, humidifying the inspiratory gas is usually required in NIV because gas coming from the high pressure network is dry and the inspiratory flow is higher than normal. Inappropriate humidification induces discomfort which can decrease tolerance. In addition, bronchial mucosa may be injured by dry gas with dry secretions difficult to cough. Heated humidifiers are usually preferred to HMI that offer more inspiratory resistances and dead space in NIV (5, 6).

EDUCATION

NIV is a particular type of a ventilator support that needs appropriate training for the caregivers. Physicians need to be educated regarding indications and criteria to start NIV, monitoring and management of failure. The most important is the practical training of caregivers, namely nurses and respiratory therapist. This training should include the rationale to use NIV in the different conditions, the mask selection, setting, and adjustments, the initiation method and monitoring. Patients that need NIV are usually anxious, therefore caregivers should be trained to encourage them and offer the maximum of comfort.

NIV training is not provided in nursing school, so a short training is required for every new nurse coming in the ICU. A two-hour session that focuses on the mask selection and setting may be organized. In addition, a full day NIV workshop is useful to address the rationale, monitoring and simulate initiation of NIV.

Ongoing education is also vital and should be based on need, outcomes, and emerging trends in the literature. The ongoing education should apply to all members of the health-care team. Ongoing education is especially important in acute-care centers because of annual resident physician turnover.

ORGANIZATION

NIV is a treatment daily provided in the ICU, therefore it should be organized. Developing a medical and paramedical protocol is helpful to increase caregiver's efficiency at the bedside. However, protocols should not take the place of clinical judgment. Implementing a specific NIV protocol could help facilitate therapy standardization and help identify appropriate patients. Important considerations concerning protocol implementation include interactive education, timely and specific feedback, physician participation, administration interventions, and adequate staffing. The most important aspects of implementing an NIV protocol relate to its initiation and the recognition of its successes and failures.

Nurses and respiratory therapist protocol should specify mask selection and setting, initiation method, session duration and monitoring. Initiation of NIV is an important time. Usually, initiation is performed by a physician and a nurse to optimize in the same time the mask and the ventilator settings. Ventilator settings use low pressures at the beginning which are increased progressively. Synchronization parameters, namely inspiratory and expiratory triggers sensitivity and rise time are very important to adjust carefully in order to provide the maximum of comfort. The first NIV session duration is usually around 4 hours. Monitoring is based on clinical evaluation, namely, the respiratory rate and respiratory muscle effort, in addition to SpO_2 for hypoxemic patients. For hypoxemic patients, a blood gas measurement may be checked after one hour but for hypercapnic patients, the first blood gas evaluation should be at least three hours after starting NIV. The subsequent NIV sessions are organized to allow patient's rest, family visit and mobilization. On the first day of NIV, the patient may get two hours of NIV every four hours and full night with NIV. Sleep quality is better if NIV support is provided with adequate mask and ventilator settings in order to be comfortable.

CONCLUSIONS

NIV is now a daily treatment provided in the ICU. Implementing NIV in the ICU requires selecting the appropriate equipment (ventilators, interfaces and humidification method), training the caregivers and designing medical and nurse's protocols. Among these three keys for success, training of caregivers is probably the most important.

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KAIP ĮDIEGTI NIV Į ITS?

Santrauka

Nors NIV yra plačiai taikoma ITS įvairiems kvėpavimo nepakankamumo tipams, tačiau nėra jokių rekomendacijų, kaip sėkmingai NIV programą įdiegti į ITS. Išskiriami trys pagrindiniai aspektai: įranga, slaugytojų išsilavinimas bei parengimas ir organizuotumas. Įrangą sudaro pagal guldomų pacientų skaičių ir tipus tinkami ventiliatoriai ir drėkinimo prietaisai. Gydytojai ir bendros praktikos slaugytojos turi įgyti praktinį parengimą, nuolat kelti kvalifikaciją. NIV įdiegimo į ITS organizavimą pagerina vietinis protokolas, kuris apibrėžia indikacijų kriterijus, iniciacijos metodą, kaukių parinkimą, ventiliatoriaus nustatymus, NIV sesijos trukmę ir stebėseną.

Raktažodžiai: neinvazinė ventiliacija, ūminis kvėpavimo nepakankamumas, mechaninė ventiliacija