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High Flow Nasal Oxygen Therapy in Severe Pneumonia of COVID-19

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Abstract **Original Research Article**

Coronavirus disease 2019 (COVID-19) has quickly spread across the world and is currently a real public health problem. It is the cause of severe respiratory failure which has caused many deaths. Many therapies aimed at correcting respiratory failure have been used, and it appears that hight flow nasal oxygen (HFNO) therapy has gained space compared to other means of ventilator support. We report in this work our experience with the HFNO in our hospital located in Morocco.

Keywords: COVID-19, (HFNO), Coronavirus disease, Oxygen Therapy.

INTRODUCTION

Coronavirus disease 2019 is a potentially fatal infection caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-COV 2) [1].

A high number of patients with COVID-19 develop severe bilateral viral pneumonia. Many COVID-19 patients evolve to acute respiratory distress syndrome (ARDS), characterized by profound hypoxemia and an associated high mortality rate [2].

High flow nasal oxygen therapy is effective in decreasing the need for endotracheal intubation in patients with acute hypoxemic respiratory failure [3].

METHODS

Our study is a prospective study spanning four months from the 1st September to the 30th December, involving 64 patients who meet the following criteria:

- Age > 30 years old.
- Confirmed SARS-COV-2 infection of an airway sample using polymerase chain reaction (PCR).
- No previous invasive ventilation or no invasive ventilation use before starting HFNO.
- Peripheral oxyhemoglobin saturation (spo2) < 90% with a face mask at 15l/min.
- Respiratory rate > 30 cycles per minute.
- Pao2/fio2 < 150.

HFNO was administrated by an optiflow. The flow was started at 60l/min with fio2 at 0,8 titrated to aim for oxygen saturation at 95%.

The primary endpoint was the proportion of patients with results (weaned from HFNO).

Failure was defined as composite the need for intubation or death on HFNO. Monitoring elements: C reactive protein, spo2, respiratory rate, thoracic chest computed tomography, the need for invasive mechanical ventilation (MV), the length of Intensive Care Unit (ICU) stay and mortality.

Decision to initiate the HFNO is acute no-hypercapnic respiratory failure.

RESULTS

Sixty-four patients were enrolled between September 1st and December 30th 2020, admitted to ICU for HFNO.

The median age was 63 years (40-86), 79% were men (men 51/ women 13). Each patient was under face mask at 15L/min before initiating HFNO.

The ratio of pao2/fio2 was 97 (74-120). Co-morbidities were very common: 49/64 (76%) patients were diabetic, 45/64 (70%) were hypertensive, 10/64 (16%) were obese (body mass index > 30).

All patients were on curative anticoagulation with enoxaparin 1mg/kg every 12 hours and received corticosteroids (prednisolone).

Success with HFNO treatment was achieved in 33/64 (51%) of patients and who are released from hospital. The mean duration of HFNO was 15 (8-22) days in people treated successfully versus 9 (2-16) days for the rest. The switchover rate to invasive or no-invasive ventilation was 5/64 and 19/64 (8%, 29%) respectively, while the mortality rate for HFNO was 7/64 (11%) Fig-1.

Patients who tested positive on HFNO had oxygen saturation greater than 95%, respiratory rate less than 20 cycles per minute, heart rate less than 90 beats per minute and pao2/fio2 > 300 after day 4 of HFNO.

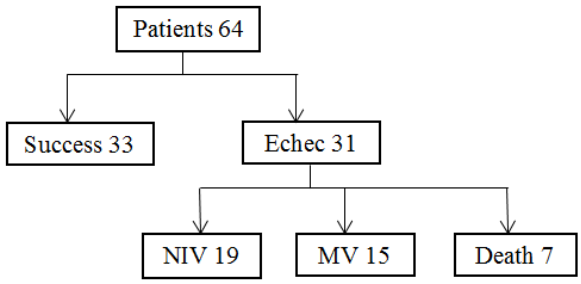

Fig-1: Results of the effect of using HFNO

DISCUSSION

Optiflow is a high flow nasal oxygen therapy device. Its operation consists on an air-oxygen mixer making it possible to control the Fio2 (up to 100%) and to generate high flow rates (up to 60l/min), to deliver controlled oxygen therapy in flow and in inspired fraction, in humidity and heat (via the humidification system of the inspired air as well as a heating base allowing a temperature adjustment to 37° C).

Air and oxygen are thus mixed, warmed, humidified and delivered to the patient via a single branch inspiratory heating circuit through large diameter nasal cannulas.

The physiological effects attributed to the use of this device are numerous:

- Washing of the nasopharyngeal dead space. This results in an increase in the alveolar ventilation to minute ventilation ratio. Several studies performed in mechanical ventilation have shown this effect through the administration of a low flow of oxygen at the end of an intubation tube. Interestingly, high flow oxygen delivery through the nasal cannulas achieves the same effect. Washing the dead space could also have an impact on oxygenation. Chatila and al showed that at equal fio2, high flow versus low flow oxygen therapy allowed COPD (chronic obstructive pulmonary disease) patients to maintain higher oxygenation during exercise. The PH and the pco2 remained stable with a decrease in the respiratory rate of the patients [4].
- A decrease in inspiratory resistance: the increase in respiratory resistance linked to the retraction of the nasopharynx is attenuated during high flow oxygen therapy
- Respiratory work in spontaneous ventilation is reduced [5].
- Humidification and warming of the inspired gases.
- Improvement of thoraco-abdominal synchronization.
- A positive expiratory pressure (PEP) effect of 1 to 5 cmH2o: few studies have sought to highlights this effect [6, 7]. The two points raised by these studies were that PEP was only present with the mouth closed and that it depended on the speed used. In healthy volunteers, it increased from 2,9 cmH2o to 7,4 cmH2o between 20 and 60 l/min. the creation of the PEP allows an increase in lung volumes and the functional residual capacity of patients. These different effects are linked to the high flow oxygen rate and the control of fio2. Therefore, the inspiratory flow must be set to the maximum initially and then adjusted secondarily.

The arrival of the OPTIFLOW in our hospital coincided with an increase in the mortality rate in patients with COVID-19 pneumonia, which was around 65%. In fact, the rate of mortality and recourse to no-invasive and mechanical ventilation has considerably decreased.

A study which was published in September 2020 [8] and which was the most important carried out so far on the interest of HFNO and showed that this device can be used successfully to provide respiratory support to these patients with COVID-19 pneumonia and avoid mechanical ventilation even in patients with severe hypoxemia. In addition, the HFNO failed in more than half of the patients (47% of success against 53% of failure). This result attached it to the consequences of a population suffering from socio-economic difficulties and multiple comorbidities such as tuberculosis.

A second retrospective study [9] carried out in China on the combination of prone position (PP) with HFNO has been published and has objectified that early awakened PP associated with HFNO therapy was the most important strategy to avoid intubation and reduce the need for medical personnel. Early application of PP with HFNO especially in patients with moderate ARDS may help to avoid intubation. The main reasons for complications were: PP intolerance, anxiety and difficulty to change position. Their strategy was psychological by change of position every 2 hours. Compared to NIV, patients felt more comfortable using HFNO therapy and the demand for medical personnel has been reduced. Awake PP combined with HFNO could be used safely and effective in patients with

severe COVID-19, and it may reduce conversion to serious illness and the need to tracheal intubation.

CONCLUSION

COVID-19 acute respiratory distress syndrome has become a very common resuscitation problem around the world. The HFNO has earned its place in the treatment of severe case of this pandemic by reducing the need for NIV and MV.

Competing interests: The authors declare no competing interest.

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