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Mini Review

Non-Invasive Ventilation in COVID-19 Patients: A Debate to Continue

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Abstract

The use of Non-Invasive Ventilation (NIV) in patients with acute hypoxemic respiratory failure and specifically in Corona Virus Disease 2019 (COVID-19) that causes by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been a matter for discussion since the current COVID 19 pandemic started. The limited available data led to conflicting opinions and variable recommendations and suggestions by the different health care professional bodies. Trends toward early intubation and avoiding NIV justified by the rapid deterioration of patients and the risk of disease transmission to the health care workers were prevalent mainly in the early stages of the pandemic. The limited available medical resources to provide invasive ventilation and subsequent anecdotal evidence suggestive of NIV success in patients with COVID 19 respiratory failure led to a change in the practice in different medical institutions around the world. Despite the absence of strong evidence, NIV probably has a role in the management of COVID 19 respiratory failure in a selected group of patients especially in the early stages of the disease via Continuous Positive Airway Pressure. Close monitoring and strict infection control precautions are required whilst providing NIV to avoid any possible complications.

Keywords: SARS-CoV-2: seververe acute respiratory syndrome coronavirus 2, NIV: Non-Invasive Ventilation, CPAP: Continuous Positive Airway Pressure

Non Invasive Ventilation (NIV) is an umbrella term used to describe mechanical ventilatory support which does not require invasive airway access to for example endotracheal tube or tracheostomy. Two main modalities fall under this definition. Continuous positive Airway Pressure (CPAP), where a constant positive airway pressure is maintained during the whole respiratory cycle and Bilevel Positive Airway Pressure (BIPAP) where a high inspiratory pressure is provided in addition to the constant expiratory pressure.[1]

The use of NIV in patients with acute hypoxemic respiratory failure has been subjected to debate for a long time. Although NIV is known to improve oxygenation and reduce the work of breathing, the high failure rate with the associated mortality and the risk of delaying intubation when needed[2] made the European Respiratory Society (ERS) and the American Thoracic Society (ATS) short of offering a clear recommendation on its use in the novo acute respiratory failure patients.[3]

The Severe Acute Respiratory Syndrome (SARS) epidemic in 2003 raised the question of using NIV in these situations. At that time, experts had strongly advised against the use of NIV in patients with SARS-related acute respiratory failure as it increased the viral load in the room.[4] Despite these risks, it has been reported in multiple studies that NIV is effective in the management of SARS acute respiratory failure without an increasing risk of disease transmission to the medical staff.[5] It's difficult to be certain if the absence or presence of disease transmission with the use of NIV is related to how strict infection control precautions were followed by the medical staff or because of the level of disease transmission risk imposed by the use of NIV itself.

During the current COVID-19 pandemic, the debate about using NIV was raised again and a variety of clinical opinions arose. Early messages from China, the country which was hit first by the virus were supportive of early intubation when oxygen requirements are around 5-6 litres/ min via nasal prongs. The rationale behind these recommendations was mainly the rapid deterioration in patients with COVID 19 respiratory failure and the risk of crash intubations with its infectious hazards.[6] This was also supported by the observation in Wuhan that delayed intubation was associated with higher mortality rates.[7]

The early concerns about NIV causing delayed and emergency intubations with increased risks of improper Personal Protective Equipment (PPE) donning leading to infection transmission risk made some medical societies and medical professionals wary of using it in patients with COVID-19 respiratory failure.[8]

The Australian and New Zealand Intensive Care Society (ANZICS) recommended against routine use of NIV in patients with COVID-19 respiratory failure and suggested early intubation should be considered for deteriorating patients. This was justified by the high failure rate, delayed intubation and the risk of aerosolization, especially with poor mask fit. Along the same lines, German recommendations advised a restrictive strategy with NIV in the context of COVID-19 and recommended early intubation PaO2/FiO2 ratio is ≤200 mmHg.[9] Similarly, and with the same justifications, the American Society of Anaesthesiologists (ASA) recommended to proceed directly to invasive ventilation avoiding the NIV-associated potential infection transmission.[10]

Despite all these recommendations and for various reasons including the limited medical resources, NIV continued to be used in different institutions to support patients with respiratory failure secondary to COVID-19.

Anecdotal evidence of NIV success in managing patients with COVID-19 led to a change in the advice and recommendations provided by some societies. This was best evidenced by the letter released by the Faculty of Intensive Care Medicine in the United Kingdom which pointed out to the growing evidence favouring the use of CPAP as a form of NIV in the early course of the disease as it may prevent further deterioration and invasive ventilation.[11]

Analysis of data from Italy and china revealed that around one-third of their patients required NIV. If Invasive ventilation was to be offered in these situations, the capacity of most health institutions would be overwhelmed.[12] Furthermore, the practice of early Intubation of COVID-19 patients was challenged as it exposed a specific set of patients to unnecessary risks of ventilation associated complications which could have been avoided if other forms of respiratory support including NIV were used.[13]

The risk of disease transmission to health care workers with the use of NIV was one of the reasons behind early intubation practice in some institutions. Nevertheless, there is no complete agreement on the risk of disease transmission with the use of NIV. In 2007, the World Health Organization (WHO) published a guideline on the prevention and control of acute respiratory diseases in healthcare. Interestingly, NIV was included among the aerosol-generating procedures in which the risk of pathogen transmission was still "controversial/possible" but not documented.

More interestingly, Simonds concluded after testing the size of droplets generated by different procedures including chest physiotherapy and NIV are in fact droplets (not aerosol)-generating procedures, producing droplets larger than 10 µm in size. This suggests that infection control precautions designed to limit aerosol spread may have less relevance during these procedures.[14] Furthermore, and in favour of the use of NIV, it could be argued that the use of NIV obviates the need for endotracheal intubation which is a procedure with a documented increased risk of respiratory pathogen transmission to health care workers.

In summary, despite the scarcity of strong evidence, there is probably a role for the use of NIV in a selected group of patients with respiratory failure secondary to COVID-19 especially in the early stages of the disease. During NIV trial, close monitoring and frequent clinical assessments will be vital to facilitate escalation to invasive ventilation if needed in a timely fashion. To avoid the possible risks of disease transmission, functional expiratory valves and personal protective equipment should be used by the health care workers. This is while managing patients with COVID 19 and the NIV service should be delivered ideally in a negative pressure room. In case of not being available, a neutral pressure room or a single side room would be an alternative option. Notwithstanding, further research is needed to bring more evidence into light and to assess the efficacy and safety of NIV use in patients with COIVD-19-related respiratory failure.

Authors' Contributions

All authors contributed equally to this study.

Conflicts of Interests

The authors declare no potential conflict of interest with respect to the authorship and/or publication of this study.

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