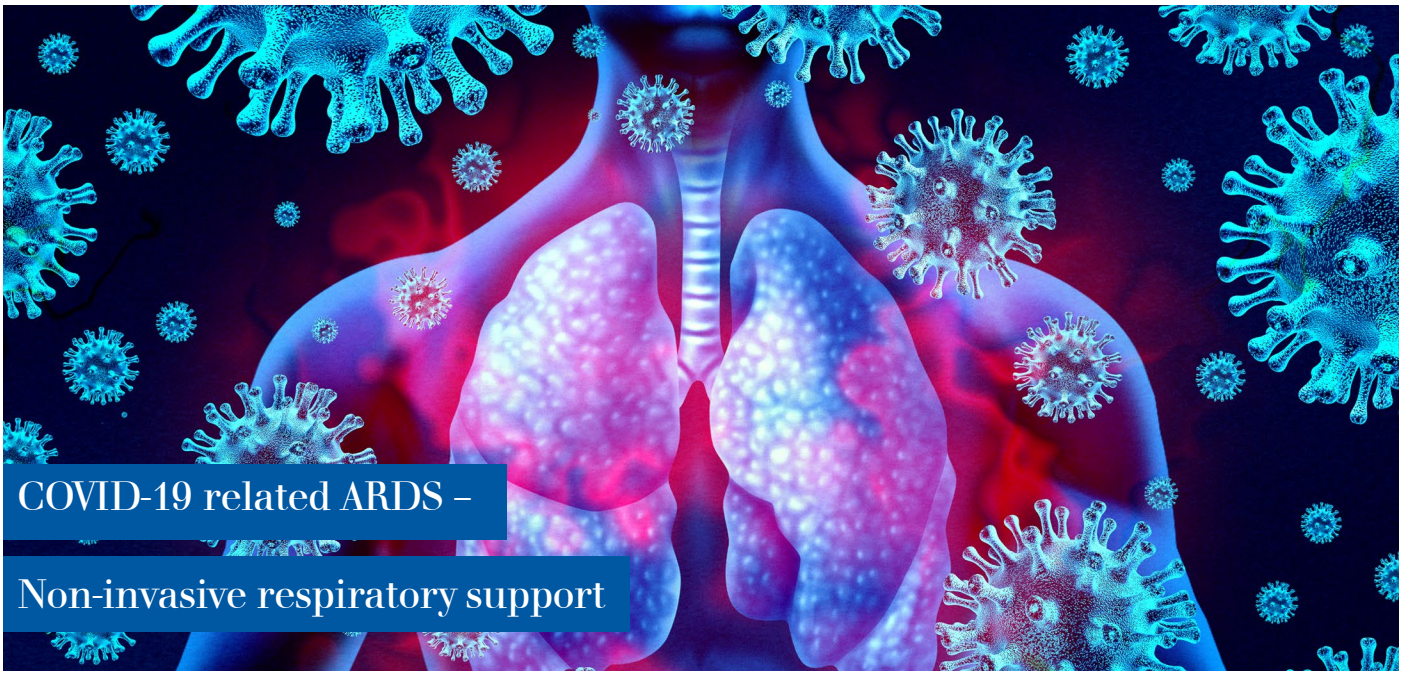

COVID-19 related ARDS –

Non-invasive respiratory support

DL-45340-2021

The development of clinical data on COVID-19 has been very rapid, resulting in a large amount of data being generated in a very short time. However, hard evidence still appears to be scarce. This article has been written to the best of our knowledge based on selected literature and opinions of clinical experts. It does not represent a summary of all available literature and therefore does not claim to be exhaustive. As COVID-19 is a very complex disease, you should always refer to the original literature mentioned in this article, other relevant literature and the circumstances of the individual case when deciding on the right ventilation strategy for your patients. It is also strongly advised to follow your national/local guidelines and standards.

There seem to be high hopes that non-invasive respiratory support would prevent the need for endotracheal intubation (ETI) and invasive ventilation. However, there is also the fear of missing the right point for ETI in the individual patient. There is not much evidence specifically for COVID-19 patients, therefore recommendations are not available on all aspects on non-invasive respiratory support and the question of when to decide for ETI. In the following we will take a practical approach: We compiled the recommendations of 4 different guidelines and complemented this with information from recent publications. This is not to be seen as a review reflecting all currently available data, but more as a practical approach to get at least some guidance.

Reviewed Guidelines:

- German S3 Guideline – Recommendations for the therapy of hospitalised patients with COVID-19, Version 4.1, February 2021 [referred to as **GS3**)[34]
- Surviving Sepsis Guidelines on the Management of Adults with Coronavirus Disease 2019 (COVID-19) in the ICU: First Update; March 2021 [referred to as **SSC**)[35]
- ERS Guideline for the Management of hospitalized adults with coronavirus disease 2019 (COVID-19): A European Respiratory Society living guideline, January 2021 [referred to as **ERS**][36]
- Australian guideline for clinical care of people with COVID-19, National COVID-19 Clinical Evidence Taskforce [referred to as **NCCET**][37]

Recommendations for non-invasive respiratory support

Conventional Oxygenation:

The SSC Guideline is the only reviewed guideline to specifically comment on conventional oxygen therapy: The guideline suggests to start supplemental oxygen if peripheral SaO_2 is <92% (strong), but recommends it at an SaO_2 <90% (strong). The guideline recommends to maintain SaO_2 no higher than 96% in patients with acute hypoxemic respiratory failure (AHRF).

HFNC AND CPAP/NIV:

Treatment with High Flow Nasal Cannula (HFCN) or CPAP/NIV is either suggested or (conditionally) recommended by all guidelines, in part with specific additional information.

There is a uniform recommendation not to delay intubation.

Close monitoring important. All guidelines call for close monitoring of patients for improvement or further deterioration to avoid the delay of intubation, as this may be associated with poor outcomes.

GS3:

- Recommendation to carry out a trial of HighFlow or CPAP/NIV for patients with hypoxemic resp. failure (P/F=100-300) under permanent monitoring and intubation readiness. Few direct comparisons of HFNC, CPAP and NIV are currently available. Therefore, evidence for non-COVID Patients needs to be evaluated.

SSC:

- Suggests using HFNC over NIPPV (weak); if HFNC is not available and absence of urgent indication for ETI, the guideline suggests NIPPV trial with close monitoring and short-interval assessment for worsening.
- If HFNC is not available and absence of urgent indication for ETI, the guideline suggests NIPPV trial with close monitoring and short-interval assessment for worsening.

ERS:

- Conditionally recommends that hospitalized patients with COVID-19 should receive HFNC or CPAP. The authors urge to not delay intubation if patients fail to respond to this measure.

NCCET:

- Conditional recommendation for HFNC to be considered in patients unable to maintain SaO_2 of ≥92% despite conventional oxygen delivery at >6l/min or an FiO_2 = 0,4.
- Consider using NIV therapy for patients with hypoxemia associated with COVID-19.
- Generally, the guideline recommends strict attention to staff safety (unconditional use of PPE) and the use of single rooms or negative pressure rooms wherever possible.
- Contact, droplet and airborne precautions are to be in place.
- The guidelines recommends against the usage of HFNC and NIV in COVID-19 patients in shared wards, emergency department cubicles or during interhospital patient transfer/retrieval.

HFNC OR CPAP/NIV AND THE QUESTION ON WHAT WORKS BETTER FOR NIV: HELMET OR MASK

HFNC OR CPAP/NIV is a matter of uncertainty. There is one recent larger study in which 2 approaches were tested on 100 COVID-19 patients[38]:

1. Helmet for 48h followed by HFNC
2. HFNC only.

RESULT: There was no difference with respect to primary outcome (respiratory support-free days). However, significantly fewer patients with helmet + highflow were intubated.
A large NHS study, the RECOVERY trial, is ongoing, randomizing COVID-19 patients with acute respiratory failure to receive HFNC, CPAP, NIV or conventional oxygen therapy.[39] Primary outcome parameters are intubation rate and 30-day mortality. At the time of writing, already more than 1,000 patients were recruited, and the results are urgently awaited.[38]

CPAP/NIV – helmet or mask. Not much evidence is available with regards to COVID-19, data from non-COVID trials therefore need to be taken into account. One example is an RCT from 2016 comparing NIV with helmet and mask.[40] This trial demonstrated that the helmet may be superior to the mask: More than 60% of patients receiving NIV by mask required secondary intubation, quite a high NIV failure rate; only 18% of the helmet group required intubation. This led to a significantly reduced 90-day mortality. As reason for the good result favoring the helmet, the authors discussed the applicability of a higher PEEP in helmets.[38]

RELEVANT IN DAILY CLINICAL PRACTICE? But is the information of which non-invasive way of support is chosen really that clinically relevant? Maybe not. The choice depends on the acceptance of the individual patient. Not every method is equally suited for all patients. Furthermore, in daily clinical practice the mentioned methods are frequently used in parallel: HFNC during meals, helmet during proning, and mask-CPAP in a rehab chair. Future research needs to deliver evidence on any significant advantage of one over the other and for or against combinations.[38]

(AWAKE) PRONE POSITIONING is not explicitly recommended in all guidelines. The Australian guideline recommends considering prone positioning for at least 3 hours per day if tolerated. The ERS conditionally recommends delivering non-invasive respiratory support with or without adjunct strategies, such as prone positioning, if no immediate indications for invasive mechanical ventilation are present. Furthermore, the ERS states that prone positioning of non-intubated patients with acute hypoxemic respiratory failure due to COVID-19 pneumonia has been recently tested across different settings, wards, or in ICUs as an adjunct to conventional oxygen therapies. Large heterogeneity across these experiences can be recognised. They differ in terms of patient selection, type of oxygen therapy support used, setting, timing and duration of the intervention, and therefore provide variable results. Despite this heterogeneity, reports document a significant improvement in oxygenation and respiratory rate upon prone positioning, and the majority were able to tolerate the procedure.

In a recent publication, Leasa et al. declare that after initiation of HFNO or CPAP, patients may be encouraged to assume the prone position, particularly if the PaO_2/FiO_2 ratio is below 200.[41]

REMEMBER: Awake prone positioning requires the maintenance of close monitoring and the presence of well-skilled health care staff.

IMPORTANT PRECAUTIONS

Precautions. All reviewed guidelines call for the strict use of appropriate PPE to protect clinical staff, while some provide recommendations for the environment, in which non-invasive respiratory support is provided.

Consider available precautions to limit aerosol spread at patient side, such as surgical masks over HFNC interface. In case of NIV, independent of patient interface (mask or helmet), check if your ventilator offers an Anti-Air Shower functionality. In case of hose disconnection from the patient interface, the ventilator detects the disconnection and reduces the device-given high flow (e.g. for leakage compensation) to a minimum level. This may help to reduce a possible spread of droplets and aerosols in the room exposing clinical staff to a higher risk of infection. Accordingly, reconnection is detected, and ventilation will continue automatically with the previous settings.

In our article on ventilating patients with COVID-19-associated ARDS, we reviewed relevant literature and four current guidelines to provide a practical overview. For references and details, please visit our website: **www.draeger.com/covid-ventilation**

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Moislinger Allee 53–55
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DMC-100018

Editing status: 2021-08-12

