COVID-19 and NHF

At the beginning of the pandemic, a low threshold for early intubation and mechanical ventilation was recommended to protect HCWs. NHF has emerged as a mode of respiratory support favored for its role in reducing the need for tracheal intubation. Initial concerns over NHF are being reconsidered in light of the requirement for NHF as a mode of respiratory support.1

Evidence Based Guidelines

Use of NHF features in guidelines for the clinical management of COVID-19 from the World Health Organization (WHO)7, the National Institutes of Health (NIH)8, the European Society of Intensive Care Medicine (ESICM)*, the Society of Critical Care Medicine (SCCM)*9 and the Australia and New Zealand Intensive Care Society (ANZICS)10.

<table>
<thead>
<tr>
<th>Guideline</th>
<th>NHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO7</td>
<td>May be used in patients with mild ARDS**</td>
</tr>
<tr>
<td>NIH8</td>
<td>Recommended over NIV† in patients with AHRF† despite COT§</td>
</tr>
<tr>
<td>SSC9</td>
<td>Suggest use over COT§ and NIV† in patients with AHRF†</td>
</tr>
<tr>
<td>ANZICS10</td>
<td>Considered for patients with hypoxemia</td>
</tr>
</tbody>
</table>

Table 1. Guideline recommendations for use of NHF on COVID-19 patients.

Summary

The dual primary objectives for clinical management of patients with COVID-19 are:

- Improving patient outcomes e.g. by avoiding the need for tracheal intubation.
- Maintaining health care worker (HCW) safety e.g. by avoiding an increase in widespread nosocomial transmission.

Collectively, evidence based guidelines for COVID-19, published clinical observations of NHF use and HCW infections, investigational research on dispersion of exhaled particles, and expert recommendations indicate that:

- NHF is recommended as respiratory support for patients with hypoxemia caused by viral pneumonia, such as COVID-19.2-5
- NHF is currently not considered to represent an increased risk of HCW infection via contact, droplet or airborne transmission routes.2-6
- Advocation for NHF is called for in recommendations for hospital preparedness.1

New evidence continues to emerge showing how Optiflow™ Nasal High Flow contributes to improved patient care and outcomes.

COVID-19 Edition

The outbreak of COVID-19 has impacted healthcare services around the world. Optiflow™ Nasal High Flow (NHF) therapy is being used to treat patients in affected hospitals, while the awareness of NHF continues to grow as countries manage waves of the pandemic.

“Administrators and policymakers both nationally and at the individual hospital level should focus efforts on increasing the availability of [NHF] and on advocating for its use for COVID-19-associated respiratory failure.”

Publications on NHF therapy in COVID-19

As NHF has been adopted for use in COVID-19, observational research on its clinical application has been peer reviewed and published.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Title</th>
<th>Journal</th>
<th>From Conclusion/Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duan et al. 2020.2 (Pre-pub)</td>
<td>Use of high-flow nasal cannula and noninvasive ventilation in patients with COVID-19: A multicenter observational study.</td>
<td>American Journal of Emergency Medicine</td>
<td>“... no medical staff got nosocomial infection during this study.”</td>
</tr>
<tr>
<td>Guy et al. 2020.3</td>
<td>High-flow nasal oxygen: a safe, efficient treatment for COVID-19 patients not in an ICU.</td>
<td>European Respiratory Journal</td>
<td>“... The technique appears to be safe for HCWs and could well liberate critical ICU resources.”</td>
</tr>
<tr>
<td>Patel et al. 2020.4</td>
<td>Retrospective analysis of high flow nasal therapy in COVID-19-related moderate-to-severe hypoxaemic respiratory failure.</td>
<td>BMJ Open Respiratory Research</td>
<td>“In our department of 80 members... we had only two members who developed COVID-19 infection during the pandemic.”</td>
</tr>
<tr>
<td>Vianello et al. 2020.5</td>
<td>High-flow nasal cannula oxygen therapy to treat patients with hypoxemic acute respiratory failure consequent to SARS-CoV-2 infection.</td>
<td>Thorax</td>
<td>“... None of the staff had a positive swab testing during the study period and the following 14 days...”</td>
</tr>
<tr>
<td>Westafer et al. 2020.6</td>
<td>No evidence of increasing COVID-19 in health care workers after implementation of high flow nasal cannula: A safety evaluation.</td>
<td>American Journal of Emergency Medicine</td>
<td>“Despite initial concerns for increased transmission of [COVID-19] in patients using [NHF]/NIV, we did not find evidence of an increase in employee infection rates... Rather, clinical and non-clinical employee infection rates appeared to parallel the community transmission of COVID-19.”</td>
</tr>
</tbody>
</table>

Particle dispersion investigative research

The potential risk posed to HCWs by infectious patients has heightened research interest in the dispersion of exhaled particles which may increase risk of nosocomial infection.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Title</th>
<th>Journal</th>
<th>From Conclusion/Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaecelle et al. 2020.2</td>
<td>Aerosol Generation from the Respiratory Tract with Various Modes of Oxygen Delivery.</td>
<td>American Journal of Respiratory and Critical Care Medicine</td>
<td>“…in healthy individuals, [NIV] or HFNC did not produce higher-concentration aerosol from the respiratory tract than room air or nonhumidified oxygen conditions. In fact, in some instances HFNC and [NIV] might decrease aerosol.”</td>
</tr>
<tr>
<td>Iwashyna et al. 2020.3</td>
<td>Variation in Aerosol Production Across Oxygen Delivery Devices in Spontaneously Breathing Human Subjects.</td>
<td>medRxiv Pre-print</td>
<td>“… there was no evidence of increased [particles such as aerosols and droplets] with nasal cannula, non-rebreather mask, or heated high flow nasal cannula...”</td>
</tr>
<tr>
<td>Jermy et al. 2020.4</td>
<td>Assessment of dispersion of airborne particles of oral/nasal fluid by high flow nasal cannula therapy.</td>
<td>medRxiv Pre-print</td>
<td>“NHF use does not increase the risk of dispersing infectious aerosols above the risk of unsupported vigorous breathing.”</td>
</tr>
<tr>
<td>Kotoda et al. 2020.5</td>
<td>Assessment of the potential for pathogen dispersal during high-flow nasal therapy.</td>
<td>Journal of Hospital Infection</td>
<td>“… it is likely that high-flow nasal therapy does not increase the potential risk of droplet and contact infection.”</td>
</tr>
<tr>
<td>Leung et al. 2019.6</td>
<td>Comparison of high-flow nasal cannula versus oxygen face mask for environmental bacterial contamination in critically ill pneumonia patients: a randomized controlled crossover trial.</td>
<td>Journal of Hospital Infection</td>
<td>“HFNC use in patients with Gram-negative pneumonia did not increase airborne and surface [Gram-negative bacterial] contamination compared to an oxygen mask, suggesting that additional infection control measures are not required when using HFNC...”</td>
</tr>
<tr>
<td>Kaur et al. 2020.7</td>
<td>Practical strategies to reduce nosocomial transmission to healthcare professionals providing respiratory care to patients with COVID-19.</td>
<td>Journal of Hospital Infection</td>
<td>“… it is suggested that a surgical or procedure mask be worn by patients receiving HFNC.”</td>
</tr>
</tbody>
</table>

Table 2. Healthcare worker outcomes in use of NHF on COVID-19 patients.

Table 3. Particle dispersion from use of NHF on COVID-19 patients.
In addition to the data from publications on dispersion in Table 3, Hui et al. 2019 and Hui et al. 2014 compared a range of respiratory therapies and interfaces with a method for evaluating the dispersion of exhaled air using smoke and lasers to trace air movement from a human patient simulator. Collated air dispersion results from the two studies conducted by Hui et al. are illustrated in the chart below.

**Changes in Exhaled Air Dispersion**

![Chart showing changes in exhaled air dispersion](image)

- **Human patient simulator setting:** Normal, Mild lung injury, Severe lung injury

*Dispersion distance data shown on the chart is combined from two studies conducted by the same authors. The experiments were conducted in rooms with different configurations. Not all of the interfaces depicted were directly compared.*

**Expert recommendations**

In recent publications by experts associated with leading international societies such as the International Society of Aerosols in Medicine (ISAM), opinions have been expressed about the use (or non-use) of NHF and other forms of noninvasive respiratory support.

*We must make every practicable effort to protect both ourselves from infection and our patients from dogma.*

*Clinicians should consider moving away from the dogma refraining the use of HFNC among COVID-19 patients.*
- Li et al. 2020.

*Abandoning [NHF] to use other oxygen devices for the uncertain risks of virus transmission is unnecessary and ill advised.*
- Li et al. 2020.

A recent publication made recommendations for hospital preparedness based on mathematical modelling of COVID-19 pandemic scenarios:

*... administrators and policymakers must consider amending protocols to not only allow, but actually advocate for, the use of [NHF] for COVID-19 patients with significant hypoxemia who, without this option, would be placed on [mechanical ventilation].*


For further information, please visit the F&P webpage: www.fphcare.com/COVID-19 or click on the hyperlinked reference below.

For further information, please visit the F&P webpage: www.fphcare.com/COVID-19 or click on the hyperlinked reference below.

Common terms  

Particle: Matter with physical dimensions such as a water vapor molecule, a pathogen (virus or bacteria), an aerosol or a droplet.  

Water vapor molecule: Gas particle of H2O. Size: < 0.001 microns.  

Virus: Infectious agent replicating only in living cells. Size: 0.017 to 0.3 microns.  

Bacteria: Infectious organism. Size: 0.2 to 10 microns.  

Aerosol: Very small liquid particle, suspended in the air. Size: < 5 microns.  

Droplet: Larger liquid particle, falling to the ground. Size: > 5 microns.  

Medical-particle: Aerosol or droplet including a suspended pharmaceutical agent such as salbutomol, for delivery to a patient.  

Medical-aerosol: Medical particle small enough to be delivered to a patient’s lower airway or lungs.  

Bio-particle: Aerosol or droplet expelled by a patient during exhalation which includes biological material (e.g. a suspended pathogen).  


Bio-droplet: Larger bio-particle, falling to the ground. Size: > 5 microns.  

Bio-aerosol generating procedure: A procedure which includes the type of patient airway interaction known to break fluids into aerosol sized particles.  

Bio-aerosol dispersing procedure: A procedure which doesn’t break fluids into aerosols but may disperse bio-aerosols generated by normal airway functions.

* ESICM and SCCM collaborated to form the Surviving Sepsis Campaign.  
** Acute Respiratory Distress Syndrome.  
† Noninvasive ventilation.  
‡ Conventional oxygen therapy.

Dispersion distance data shown on the chart is combined from two studies conducted by the same authors.