Use of High-Flow Nasal Oxygen in adult patients
I. Introduction:

I.1 Background:

Acute respiratory failure is one of the most common causes of Intensive Care Unit (ICU) admission. Mechanical ventilation is a common intervention for 61% of acute respiratory failure. Other common condition that requires mechanical ventilation includes a decreased level of consciousness, respiratory failure, and post-operative failure of extubation. Tracheal intubation and mechanical ventilation are not without risk and adverse outcome as barotrauma, hemodynamic instabilities, ventilator-associated events, and pneumonia. It usually requires an ICU bed and high nurses to patient ratio.

High Flow Nasal Cannula (HFNC) is a noninvasive respiratory support. It can deliver a mix of air and oxygen with an inspired oxygen fraction (FiO2) ranging between 0.21 and 1.0 at a flow rate of up to 60 L/minute. The physiological benefits of HFNC are improved oxygenation, decreased anatomical dead space, decreased metabolic demand of breathing, decreased production of carbon dioxide, superior comfort and improved work of breathing, positive nasopharyngeal and tracheal airway pressure, and better secretion clearance.

HFNC can be used in different clinical settings, including emergency departments, intensive care units, outpatient, and procedural settings (figure1). It has been gaining popularity probably due to how easy it is to use, its high tolerability, and the possibility of applying it outside the ICU setting.

I.1.1 Aim & Scope:

The aim of this guideline is to standardize, optimize the usage and extend the utilization of HFNC among healthcare workers in different clinical departments and for all applicable conditions of adult patients in respiratory distress.

I.1.1.1 Methodology

Systematic searches of scientific literature were undertaken on MEDLINE, PEDro, Cochrane, and CINAHL, for randomized controlled studies, metaanalysis, and systemic reviews to summarize the indications and contraindications of the high-flow nasal cannula in different clinical settings. The guideline was developed by doing a literature review by 3 reviewers and coming up with the written document. The next step was having a meeting with 20 ICU consultants to review the final version. Conflicts were solved by discussion and voting.
I.IV Targeted population:
adult patients requiring high oxygen therapy

I.V Setup:
all clinical departments including general wards, emergency departments, theater rooms, recovery rooms, ICU, and high dependency units (HDU).

I.VI Targeted End User:
- Adult Emergency Medicine physicians and nurses
- Anesthesia technicians, specialists, and physicians
- Critical care physicians and nurses
- Respiratory therapist.
- HDU staff
- Ward RN

I.VII Updating: next update 3 years

I.VIII Funding: None

I.IX Conflict of Interest: None

II. Indications /contracindication of HFNC:

II.I: Indications:
- Acute hypoxemic respiratory failure
- Increased work of breathing
- Preoxygenation before intubation
- Acute COPD exacerbation
- Severe pneumonia requiring high flow oxygen
- Acute pulmonary edema
- Post extubation support.
- Postoperative respiratory failure.
- In severely distressed DNR patients
- Patients with do-not-intubate (DNI) status and respiratory failure.
II. II Contraindications of HFNC:

a. Need immediate mechanical ventilation
b. Low level of consciousness with Glasgow Coma Scale score < 9 (HFNC can be used in these patients to facilitate intubation)
c. Abnormalities or surgery of the face, nose, or airway that preclude an appropriate-fitting nasal cannula
d. Post-CPR or respiratory arrest

III. General HFNC rules of use:

The following are general rules for use of HFNC:
a. It can be used in Critical Care Units, ED, and General wards.
b. Infection control rules should be applied for communicable diseases
c. Frequent clinical (with venous/arterial blood gases as indicated) evaluation every 2 hours to ensure efficacy and safety.
d. The patient should be monitored for the need for escalation to mechanical ventilation

IV. Steps of setting the HFNO parameters and further adjustment:

The HFNC allows the modification of only two variables: the percentage of oxygen being delivered and the rate of gas flow.

IV.I initial setup:

a. Set Humidity as close to 37° as possible and titrate to affect airway hydration and patient comfort.
b. Start with high flow rates (50-60 L/min) and titrate to affect Respiratory Rate (RR) and patient comfort.
c. Set FiO2 between 0.21 to 1.0 and titrate to affect SpO2 (within target range).
d. SpO2 target range from 92% to 94% or 88% to 92% for patients with a risk of hypercapnia.
e. When increasing support is needed, move flow up first then Oxygen.
f. When reducing support, move Oxygen down first then flow.
g. The flow rate should be increased if:
   - Respiratory rate fails to improve,
   - Oxygenation fails to adequately improve,
   - Breathing remains labored.
h. As required to reduce oxygen down to 0.21 and keep humidified air going.
IV.II. Weaning of HFNC:

a. When O2 goals are achieved and the patient is clinically improving (decrease in respiratory rate and respiratory distress): reduce FiO2 gradually by 5-10% every 2-4 hours.
b. When FiO2 ≤ 40% is reached, flow can be gradually reduced by 5-10 L/min every 2-4 hours.
c. Switching to conventional O2 therapy should be considered when FiO2 < 35% and flow < 20 L/min. The conventional O2 flow should not be above 2 L/min, without an active humidification system being introduced to add a base flow of humidified air (HFNC machines can be used for this purpose).

V. Signs of Failure of HFNO (one of the following)

Worsening or non-improvement of oxygenation:
1. Increased FiO2 while target SpO2 is not achieved,
2. Increased work on breathing

Worsening or non-improvement of ventilation and/or work of breathing:
1. Respiratory rate is worsening or not improving,
2. Thoraco-abdominal asynchrony worsening or not improving,
3. Clinical signs of exhaustion,
4. PaCO2 worsening or not improving,
5. pH worsening or not improving.

VI. References


Figure 1 Flowchart, management of acute respiratory failure using high flow nasal cannula

Acute respiratory failure
Post extubation
Acute pulmonary edema
Acute COPD Exacerbation

Yes
Apply HFNC (Preoxygenation)
Proceed with intubation

No
Need immediate intubation or GCS <9

Apply HFNC

Worsening

Admit to ICU
Start weaning slowly

Improving

- Humidity: 37°C, titrated to patient comfort
- Flow rate: 50 to 60 L/min, titrated to effect on RR
- FiO₂: 0.21 to 1.0, titrated to SpO₂ 90% to 94% or 88% to 92% for patients with risk of hypercapnia
- Monitor SpO₂, RR and SpO₂ every 15 min for the first hour, then every 2 hours or as required
- Maintain therapy during transport to destination if possible