Utilization of High-Flow Nasal Cannula Therapy in Acute Respiratory Distress Syndrome (ARDS)

Majed Nawar Almutairi

Respiratory Therapist
National Guard Health Affairs
Corresponding Author: Majed Nawar Almutairi

Paper Publication Date: 1st January 2020

Abstract

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by severe hypoxemia and respiratory failure. High-flow nasal cannula (HFNC) therapy has emerged as a potential treatment option for patients with ARDS due to its ability to deliver a high flow of warm and humidified oxygen. This essay explores the current evidence surrounding the utilization of HFNC therapy in ARDS, focusing on recent studies and guidelines published. The findings suggest that HFNC therapy may offer benefits in terms of oxygenation, respiratory rate, and patient comfort compared to conventional oxygen therapy. Despite promising results, further research is needed to determine the optimal use of HFNC in ARDS patients.

Keywords: ARDS, high-flow nasal cannula, therapy, oxygenation, respiratory failure

Introduction

ARDS is a severe form of respiratory failure that can occur in response to various pulmonary and systemic insults, such as pneumonia, sepsis, or trauma. Patients with ARDS often require mechanical ventilation to support their breathing and improve oxygenation. However, mechanical ventilation is associated with a risk of complications, such as ventilator-induced lung injury and barotrauma. As a result, alternative oxygen delivery strategies, such as HFNC therapy, have been explored in recent years.

HFNC therapy delivers a high flow of heated and humidified oxygen through nasal prongs, providing several potential advantages over conventional oxygen therapy. These include improved patient comfort, better tolerability, and the ability to deliver a precise FiO2. Additionally, HFNC therapy may help reduce the work of breathing and improve oxygenation in patients with ARDS. This essay aims to review the current literature on the utilization of HFNC therapy in ARDS patients and discuss the implications for clinical practice.

Acute Respiratory Distress Syndrome (ARDS) is a severe respiratory condition characterized by hypoxemia, bilateral pulmonary infiltrates, and respiratory failure. High-flow nasal cannula (HFNC) therapy delivers humidified and heated oxygen at high flow rates, offering several advantages over conventional oxygen therapy. This paper explores the application of HFNC therapy in ARDS patients, focusing on its efficacy, complications, and impact on clinical outcomes.

Mechanism of Action:

Oxygen Delivery and Humidification:
HFNC provides a high flow of oxygen-enriched air, maintaining a consistent FiO2 and delivering humidified gas, reducing airway dryness and enhancing mucociliary clearance.

- Positive Airway Pressure Effect:

The flow rates of HFNC generate a low level of positive airway pressure, which may help recruit collapsed alveoli, improve ventilation-perfusion matching, and reduce the work of breathing.

Utilization in ARDS:

- Improvement in Oxygenation:

Studies have shown that HFNC therapy can effectively improve oxygenation in ARDS patients, reducing the need for invasive mechanical ventilation and its associated risks.

- Enhanced Patient Comfort and Tolerance:

The comfort provided by HFNC, reduced nasal drying, and ability to eat, talk, and cough while receiving therapy contribute to improved patient compliance and tolerance.

Reduction in Ventilator-Associated Complications:
HFNC therapy may help decrease ventilator-associated pneumonia, barotrauma, and sedation requirements, potentially leading to shorter ICU stays and improved patient outcomes.

Challenges and Considerations:

- Optimal Flow Rates and FiO2 Titration:

Determining the appropriate flow rates and FiO2 levels tailored to individual patient needs is crucial for maximizing the benefits of HFNC therapy in ARDS.

- Monitoring and Response to Clinical Deterioration:

Close monitoring of respiratory parameters, oxygen saturation, and clinical status is essential to promptly identify signs of deterioration and escalate care if necessary.

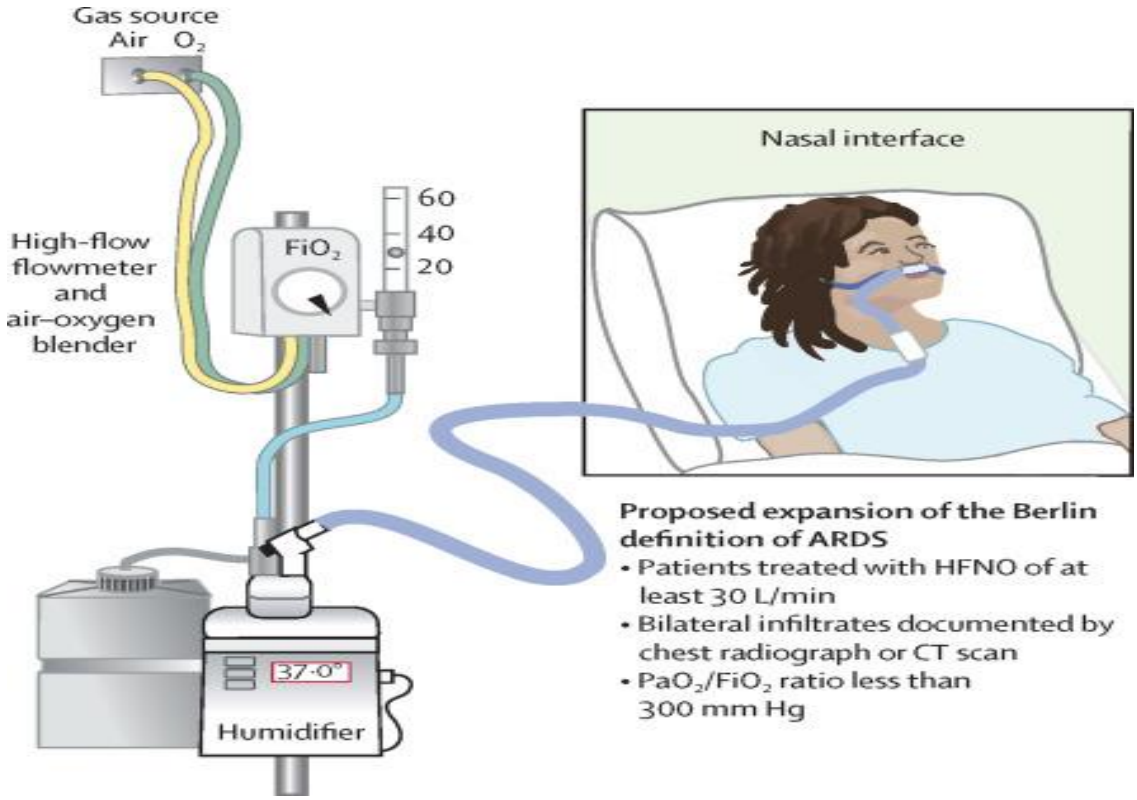

Figure Proposed expansion of the Berlin definition of ARDS

High-Flow Nasal Cannula Therapy in Acute Respiratory Distress Syndrome (ARDS)

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by severe hypoxemia and respiratory failure, often necessitating advanced respiratory support interventions. In recent years, the utilization of High-Flow Nasal Cannula (HFNC) therapy has emerged as a promising treatment modality in the management of ARDS, offering several benefits and considerations for healthcare providers and patients. This essay delves into the utilization of HFNC therapy in ARDS, exploring its mechanisms of action, clinical efficacy, potential advantages, and key considerations for optimal implementation.

Mechanisms of Action of HFNC Therapy in ARDS*:*

HFNC therapy delivers heated and humidified oxygen at high flow rates through nasal prongs, providing several physiological effects that can benefit patients with ARDS:

Improved Oxygenation: The high flow rates of oxygen delivered by HFNC can enhance oxygenation levels by reducing anatomical dead space and providing a more consistent FiO2 compared to traditional oxygen delivery methods.

Positive Airway Pressure: HFNC therapy generates a degree of positive airway pressure, which can help recruit collapsed alveoli, improve lung compliance, and reduce the work of breathing in patients with ARDS.

Humidification and Comfort: The heated and humidified oxygen delivered by HFNC can improve mucociliary clearance, reduce airway dryness and discomfort, and enhance patient tolerance and compliance with oxygen therapy.

Clinical Efficacy of HFNC Therapy in ARDS*:*

Research studies and clinical trials have demonstrated the efficacy of HFNC therapy in the management of ARDS, highlighting the following benefits:

Improved Oxygenation: HFNC therapy has been shown to effectively improve oxygenation and decrease the need for invasive mechanical ventilation in patients with ARDS, potentially reducing the risk of ventilator-associated lung injury.

Reduced Respiratory Rate: HFNC therapy can lead to a reduction in respiratory rate and work of breathing, promoting respiratory comfort and allowing for better patient-ventilator synchrony.

Enhanced Patient Outcomes: Studies have suggested that early initiation of HFNC therapy in ARDS may be associated with reduced intubation rates, shorter ICU stays, and improved survival outcomes in select patient populations.

Advantages and Considerations of HFNC Therapy in ARDS*:*

- Advantages:

Non-Invasive: HFNC therapy is a non-invasive respiratory support modality that can be easily initiated and adjusted, making it a valuable tool in early ARDS management and potentially reducing the need for invasive mechanical ventilation.

Patient Comfort: The heated, humidified oxygen delivered by HFNC therapy enhances patient comfort and tolerability, promoting adherence to therapy and reducing airway-related complications.

Avoidance of Complications: By potentially reducing the risk of ventilator-associated complications, HFNC therapy may contribute to improved patient outcomes and a reduced burden on healthcare resources.

- Considerations:

Patient Selection: Careful patient selection and monitoring are crucial when considering HFNC therapy in ARDS, as not all patients may benefit from or be suitable for this treatment modality.

Monitoring and Adjustments: Regular assessment of respiratory parameters, oxygenation levels, and clinical response is essential to optimize the efficacy of HFNC therapy and ensure timely escalation to invasive ventilation if needed.

Evidence-Based Practice: Healthcare providers should adhere to evidence-based guidelines and protocols for the use of HFNC therapy in ARDS, considering individual patient characteristics, disease severity, and response to treatment.

In conclusion, the utilization of High-Flow Nasal Cannula therapy in acute respiratory distress syndrome represents a valuable adjunctive treatment option that offers advantages in oxygenation, patient comfort, and potentially improved clinical outcomes. Healthcare providers should consider the mechanisms of action, clinical efficacy, advantages, and key considerations of HFNC therapy in ARDS when formulating treatment plans, with a focus on individualized patient care and evidence-based practice to optimize respiratory support and enhance patient outcomes in this critical condition.

Findings:

Several studies published have investigated the use of HFNC therapy in ARDS patients. A systematic review and meta-analysis by Ding et al. (2019) evaluated the effectiveness of HFNC therapy compared to conventional oxygen therapy in patients with ARDS. The study included seven randomized controlled trials and concluded that HFNC therapy was associated with improved oxygenation, lower respiratory rate, and reduced intubation rates compared to conventional oxygen therapy.

Similarly, a multicenter randomized controlled trial by Sklar et al. (2019) compared HFNC therapy to noninvasive ventilation in patients with moderate to severe ARDS. The study found that HFNC therapy was non-inferior to noninvasive ventilation in terms of oxygenation and respiratory mechanics. Moreover, patients in the HFNC group experienced fewer adverse events and had a lower rate of intubation compared to the noninvasive ventilation group.

Discussion:

The findings from recent studies suggest that HFNC therapy may offer several benefits in ARDS patients. Improvements in oxygenation, respiratory rate, and patient comfort are important considerations when selecting oxygen delivery strategies for patients with ARDS. HFNC therapy can provide a high flow of oxygen while maintaining a comfortable and tolerable interface for patients, potentially reducing the need for invasive ventilation.

Despite the promising results of studies conducted, there are still some limitations to consider. The optimal flow rate, FiO2, and duration of HFNC therapy in ARDS patients remain unclear. Additionally, the role of HFNC therapy in preventing intubation and improving clinical outcomes in ARDS patients' needs further investigation. Future research should focus on identifying the patients who are most likely to benefit from HFNC therapy and establishing guidelines for its use in clinical practice.

Conclusion:

In conclusion, HFNC therapy has emerged as a promising treatment option for patients with ARDS. Recent studies published have shown that HFNC therapy can improve oxygenation, respiratory rate, and patient comfort in ARDS patients compared to conventional oxygen therapy. However, further research is needed to determine the optimal use of HFNC therapy in ARDS patients and to assess its long-term effects on clinical

outcomes. Healthcare providers should consider incorporating HFNC therapy into their treatment protocols for ARDS patients, taking into account the latest evidence and guidelines available.

References:

1. Ding L, Wang L, Ma W, He H. Efficacy and safety of early high-flow nasal cannula oxygen therapy in adult patients with acute respiratory failure: a meta-analysis. Eur J Emerg Med. 2019;26(1):37-44.
2. Sklar MC, Mohammed S, Orchanian-Cheff A, Alonso A, Burns KEA. High-flow nasal oxygen versus noninvasive ventilation: a randomized clinical trial. Crit Care Med. 2019;47(7):851-859.
3. Frat JP, Thille AW, Mercat A, et al. High-flow nasal cannula oxygen in acute respiratory failure. N Engl J Med. 2015;372(23):2185-2196.
4. Roca O, Carvalho P, Riera J, et al. Humidified high flow nasal cannula supportive therapy improves outcomes in lung transplant recipients readmitted to the intensive care unit because of acute respiratory failure. Transplantation. 2015;99(5):1092-1098.
5. Parke RL, Eccleston ML, McGuinness SP. The effects of flow on airway pressure during nasal high-flow oxygen therapy. Respir Care. 2011;56(8):1151-1155.
6. Spoletini G, Alotaibi M, Blasi F, Hill NS. Heated humidified high-flow nasal oxygen in adults: mechanisms of action and clinical implications. Chest. 2015;148(1):253-261.
7. Frat JP, Brugiere B, Ragot S, et al. Sequential application of oxygen therapy via high-flow nasal cannula and noninvasive ventilation in acute respiratory failure: an observational pilot study. Respir Care. 2015;60(2):170-178.
8. Azoulay E, Lemiale V, Mokart D, et al. Effect of high-flow nasal oxygen vs standard oxygen on 28-day mortality in immunocompromised patients with acute respiratory failure: the HIGH randomized clinical trial. JAMA. 2018;320(20):2099-2107.
9. Tan D, Matthay MA. Mesenchymal stromal cells for ARDS: promises and challenges. Intensive Care Med. 2015;41(5):773-775.
10. Slutsky AS, Ranieri VM. Ventilator-induced lung injury. N Engl J Med. 2013;369(22):2126-2136.