Considerations for the management of pediatric patients with suspected or confirmed COVID-19

Introduction

This information resource has been compiled to assist healthcare professionals with the management of neonates, infants, and children with suspected or confirmed COVID-19. This information is not intended to replace the recommendations or requirements of your local hospital policies.

This resource refers to the World Health Organization (WHO) guidelines.[1] Please use the link within this resource to ensure you are accessing the WHO's most up-to-date advice.

The epidemiological and clinical patterns of COVID-19 remain unclear, particularly among neonates, infants and children.

- In the neonatal population, several studies have found the risk of vertical transmission of COVID-19 at birth is unlikely, and that there is a low risk of babies being infected at birth, even if born to a COVID-19-positive mother.[2-5]
- In a study of 2,143 pediatric patients with confirmed or suspected COVID-19,[6] it was found that:
  - 94% of pediatric patients were diagnosed as asymptomatic, mild or moderate.
  - 5.9% of pediatric patients were diagnosed as severe or critical, compared with 18.5% of adult patients. There was one reported death of a 14-year-old patient in this study.
- Subsequent studies published out of Europe[7] and the US[8] have supported this early data from China:
  - A small percentage of all COVID-19 cases are in children (1.7% in the US data, despite making up 22% of the US population, and 1.2% in the Italian data).
  - Few pediatric patients are diagnosed with severe or critical illness, with only 2% admitted to PICU in the US data.
  - Only three deaths (< 0.2% of pediatric patients) were reported in the US data, and no deaths were reported in pediatrics in the Italian study.

In most pediatric cases, there is no evidence to suggest therapy decisions should be changed. Care should be driven by the patient's underlying physiological and clinical presentation in **conjunction with current evidence-based respiratory-management strategies**.

Respiratory management of pediatrics in the context of COVID-19

Patients requiring respiratory support due to COVID-19 illness will have a high viral load, and they pose a potential infection risk to healthcare professionals and other patients. All patients with confirmed or suspected COVID-19 illness must be managed with appropriate isolation and personal protective equipment (PPE) precautions. Refer to your hospital policy or the WHO guidelines.

The WHO define endotracheal intubation as an aerosol-generating procedure, and is therefore subject to additional airborne precautions.[1] In addition, due to the uncertainty around the potential for aerosolization, nasal high flow (NHF) and noninvasive ventilation (NIV), including bubble CPAP, should be used with airborne precautions. The magnitude of risk posed by noninvasive therapies needs to be evaluated against the risk posed by loud talking (crying),[9] coughing and known 'high risk' aerosol-generating procedures such as intubation.[10] However, a cautious approach to all potentially infectious patients receiving respiratory support is recommended, irrespective of modality, until further safety evaluation can be completed.

Nasal high flow

The WHO guidelines suggest commencing oxygen therapy with nasal cannula or prongs is the preferred oxygen therapy-delivery method for young children as they may be better tolerated, and NHF may be considered in select patients with hypoxemic respiratory failure. All patients treated with NHF should be closely monitored for clinical deterioration.[1]

For institutions considering reducing the flow rates delivered via NHF during this pandemic, please be aware that this may negatively impact therapy effectiveness, and currently there is no evidence to suggest this mitigates risks to healthcare personnel. Appropriate isolation and airborne PPE precautions are still recommended (irrespective of flow rate) and, once in place, we suggest following evidence-based flow rates to maximize therapy effectiveness.

For data on aerosol dispersion, please visit Nasal High Flow Therapy COVID-19 Information.

Fisher & Paykel (F&P) Healthcare Nasal High Flow pediatric products#

- Optiflow™ Junior, Optiflow Junior 2, and Optiflow Junior 2+ nasal high flow interfaces, F&P high flow circuits, and associated accessories are intended for single-patient use only.

CPAP

The WHO guidelines note that in situations where mechanical ventilation might not be available, bubble nasal CPAP may be used for patients with severe hypoxemia and may be more readily available.[1]

For institutions where bubble CPAP is the current standard of care for newborn infants requiring respiratory support (for non-COVID-19 reasons), there are currently no recommendations to change clinical practice for the majority of neonatal patients.

With any bubble CPAP delivery system there are two main places where gases and potential aerosols are likely to leak: between the patient and the mask/prongs (patient leak), and where the air exits from the bubble CPAP generator (intentional leak).

- Bubble CPAP therapy should be treated as an aerosol-generating therapy and appropriate PPE should be employed.
- A well-sized and fitted mask/prong should be used to reduce patient leak.
- Attempts to filter the expiratory gas should consider the effects of that filtration on the therapy efficacy.[11]

F&P Healthcare Infant CPAP products#

- The F&P Bubble CPAP generator, F&P FlexiTrunk™ nasal interface, F&P Infant CPAP circuits, and all associated accessories are intended for single-patient use only.
- Addition of an anti-viral solution to bubble CPAP generators has been documented previously.[12] F&P Healthcare has not tested the efficacy of such solutions in terms of their ability to reduce aerosolization of a virus from the bubble CPAP system effectively. However, use of a 0.1% acetic acid solution (vinegar) will have no adverse effects on the material of the bubble CPAP generator. The F&P Bubble CPAP generator should always be mounted below the level of the patient.
- The placement of a filter anywhere in the expiratory gas path of the bubble CPAP system is not advised. F&P Healthcare recommends extreme caution when using filters in unapproved or improvised ways. Resistance to flow, filtration efficiency in different conditions, instrumental dead space, flow dynamics through the system and the potential for gas-trapping are just some of the important safety factors healthcare professionals should consider. If placing a filter on the bubble CPAP system where it vents to the atmosphere, be aware that the bubble CPAP generator is not designed to be sealed, and therefore not all exiting expiratory gas will be filtered.
- For placement of a filter on ventilator-driven CPAP circuits, please consult the ventilator manufacturer. For questions related to the use of filters with F&P ventilator circuits, please visit Viral & Bacterial Filtration of F&P Healthcare Filters and F&P Evaqua™ 2 Circuits.

Resuscitation

Although neonatal and infant resuscitation should be considered an aerosol-generating procedure, the European Respiratory Council have stated that there is no current evidence suggesting infection of the respiratory tract at birth or subsequent viral spread generated through devices or resuscitation procedures.[13] The Resuscitation Council UK notes that there are no reported cases of healthcare professionals contracting COVID-19 from a newborn baby through resuscitation procedures.[14] Given this evidence, alongside the likelihood of mask leak and the negative therapeutic effects that adding filters to the circuits is likely to have, the risks of using filters during infant resuscitation may be greater than the benefit that they could provide.

F&P Healthcare Infant Resuscitation products#

- The F&P Neopuff™ is intended for multiple-patient use. Neopuff is a positive-pressure device which provides unidirectional gas flow. Gas exits the system through the positive end expiratory pressure (PEEP) valve. This prevents any of the patient's exposed fluids re-entering the device, which reduces the risk of contamination between patients. Please refer to the product technical manual for instructions for cleaning Neopuff between use on patients.
- F&P Infant Resuscitation circuits and masks are intended for single-patient use only.
- The placement of a filter between the T-piece and resuscitation mask is not advised. F&P Healthcare recommends extreme caution when using filters in unapproved or improvised ways. Resistance to flow, filtration efficiency in different conditions, instrumental dead space, flow dynamics through the system and the potential for gas-trapping are just some of the important safety factors healthcare professionals should consider.

Invasive ventilation

When invasive ventilation is needed, delivering heated and humidified gas is widely recommended and practiced during invasive respiratory support.[15]

F&P Healthcare Infant Invasive Ventilation humidified circuits#

- F&P Infant Invasive circuits are intended for single-patient use only.
- For pediatric/neonatal ventilators that do not have an inherent expiratory filter and vent to the atmosphere, a disposable filter may be used.
  - Ensure that the filter has 15 mm connections to facilitate secure connections, minimize dead space and optimize ventilator performance.
  - Use only regulatory agency-approved filters. They have been tested in accordance with internationally recognized standards for filtration efficiency against bacteria and viruses.
  - Be aware that the filtration efficiency of filters changes with operation. Check ventilator settings periodically, and replace filters as per the manufacturer's specification.
- F&P Filters (RT016, RT019, RT020) are not intended for use with F&P neonatal invasive ventilation circuits. For further information on the use of inspiratory/expiratory filters with invasive ventilation circuits, please visit Viral & Bacterial Filtration of F&P Healthcare Filters and F&P Evaqua™ 2 Circuits.

Heated humidification

COVID 19 patients, who are critically ill with severe respiratory disease, need high levels of humidity to assist with secretion management and mucus plugging.[16] Heated humidification promotes efficient ventilation and gas exchange,[17] and preserves optimal mucociliary function.[18]

For information about heated humidification for healthcare professionals managing COVID-19 patients, please visit Heated Humidification for Healthcare Professionals Managing COVID-19 Patients.

Other useful resources and guidelines

- **Australia:** Queensland Children's Health Guidelines for Pediatric Emergency Care.
- **UK:** Royal College of Paediatrics and Child Health (UK). COVID-19 Guidance for Paediatric Services.
- **UK**: Mullins, E., Evans, D., Viner, R. M., et al. Coronavirus In Pregnancy And Delivery: Rapid Review And Expert Consensus.
- **China:** Wang, L., Shi, Y., Xiao, T., et al. Chinese expert consensus on the perinatal and neonatal management for the prevention and control of the 2019 novel coronavirus infection (First edition).
- **US:** Centers for Disease Control and Prevention. Information for Pediatric Healthcare Providers.
- **EUR:** European Respiratory Council COVID-19 Guidelines. Section 5. Newborn Life Support.
- **UK:** Resuscitation Council UK. COVID-19 Resources: Newborn Life Support.
- Boast A, Munro A, Goldstein H. An evidence summary of Paediatric COVID-19 literature, Don't Forget the Bubbles, 2020. Available at: http://doi.org/10.314440/DFTB.24063

Further F&P Healthcare product resources

For further information on our pediatric product range, including specification sheets, instructions for use, and instructional videos, please visit our Infant Respiratory Care Support page.

For further information on our F&P heated humidifiers and flow generators, please visit:

- F&P 850™ Humidification System
- F&P 950™ Humidification System
- AIRVO™ 2 Humidified High Flow System

 # Always refer to the user instructions supplied with the product for full setup instructions, warnings, cautions and contraindications. If a device setup is off-label, the user recognizes that it is not the approved setup of the device and that the responsibility for doing so is their own.

References

1. World Health Organization. Clinical management of COVID-19. Interim guidance 27 May 2020. (2020).
2. Chen H. et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. Lancet 395, 809–15 (2020).
3. Li N. et al. Maternal and neonatal outcomes of pregnant women with COVID-19 pneumonia: a case-control study. Preprint at https://doi.org/10.1101/2020.03.10.20033605 (2020).
4. Chen, Y., Peng, H., Wang, L., et al. Infants Born to Mothers With a New Coronavirus (COVID-19). Front Pediatr. 8, 104 (2020).
5. Schwartz, D. Analysis of 38 pregnant women with COVID-19, their newborn infants, and maternal-fetal transmission of SARS-CoV-2: Maternal Coronavirus Infections and Pregnancy outcomes. Preprint at https://doi.org/10.5858/arpa.2020-0907-SA (2020).
6. Dong, Y. et al. Epidemiological Characteristics of 2143 Pediatric Patients With 2019 Coronavirus Disease in China. Pediatrics 145, e20200702. (2020).
7. Livingston, E. & Bucher, K. Coronavirus Disease 2019 (COVID-19) in Italy. JAMA 323, 1885 (2020).
8. CDC COVID-19 Response Team. Coronavirus Disease 2019 in Children – United States, February 12–April 2, 2020. MMWR 69, 422–426 (2020).
9. Stadnytskyi, V., Bax, C. E., Bax, A. & Anfinrud, P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. Preprint at https://doi.org/10.1073/pnas.2006874117 (2020).
10. Price, S. et al. Respiratory management in severe acute respiratory syndrome coronavirus 2 infection. Eur. Hear. J. Acute Cardiovasc. Care 0, 1–10 (2020).
11. Shalish, W., Lakshminrusimha, S., Manzoni, P., Keszler, M. & Sant'Anna, G. COVID-19 and Neonatal Respiratory Care: Current Evidence and Practical Approach. Preprint at https://doi.org/10.1055/s-0040-1710522 (2020).
12. Wilson, P., Benckert, M., Moresky, R., & Morris, M. Development and Implementation of a Training-of-Trainers program for continuous positive airway pressure in neonatal and pediatric patients in five low- and middle-income countries. J Trop Pediatr., 63, 358–364(2017).
13. European Respiratory Council. COVID-19 Guidelines. Section 5. Newborn Life Support. https://erc.edu/covid (2020).
14. Resuscitation Council UK. COVID-19 Resources: Newborn Life Support. https://www.resus.org.uk/media/statements/resuscitation-council-uk-statements-on-covid-19-coronavirus-cpr-and-resuscitation/covid-19-resources-nls/ (2020).
15. Restrepo, R. D., & Walsh, B. K. AARC Clinical Practice Guideline. Humidification during invasive and noninvasive mechanical ventilation: 2012. Respiratory Care 57, 782–788 (2012).
16. The Intensive Care Society. COVID-19: From the Intensive Care Society – shared experience among an international panel of intensive care clinicians. https://www.ics.ac.uk/ICS/Pdfs/COVID-19/COVID-19_shared_experiences_in_international_intensive_care_settings.aspx (2020).
17. Lellouche, F. et al.. Effect of the humidification device on the work of breathing during noninvasive ventilation. Intensive Care Med., 28, 1582–1589 (2002).
18. Williams, R. B., Rankin, N., Smith, T., Galler, D., & Seakins, P. Relationship between the humidity and temperature of inspired gas and the function of airway mucosa. Crit Care Med. 24, 1920–1929 (1996).