Consensus statement on the safe use of respiratory therapy and NIV to minimise aerosolisation of CoVID-19

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Preamble

This document has been developed with input from clinicians at different institutions (both public and private). This is a live document which will continue to be updated as new evidence becomes available. Due to the low rates of community transmission in Australia and New Zealand we have avoided much of the disease thus far compared to our international colleagues. There are now evidence-based guidelines available to guide management of CoVID-19 and ASA has ongoing input into these guidelines. (https://covid19evidence.net.au)

Background

CoVID-19 virus is highly contagious. The use of nebulisers, high flow oxygen and non-invasive ventilation all pose a risk of transmission of viral infection to staff and patients. While these therapies offer significant benefits to some patients, there are often alternative approaches to management that have less risk of transmitting viral infection via aerosolisation. **The risk of transmission can be minimised by restricting the use of these high-risk therapies to patients that really need them and ensuring health care workers are aware of the risks and use isolation /single rooms and personal protective equipment (PPE).**

Ideally this approach should be applied to all patients, even those who do not have suspected or confirmed CoVID-19. This is to minimise the risk of aerosolisation of virus in the patient that is asymptomatic but has CoVID-19. This is especially relevant in a paediatric setting where in contrast with infected adults, most infected children appear to have a milder clinical course including asymptomatic infections. Many hospitals have decided to have a designated CoVID-19 team seeing all patients and planning management.

Nebulisation

- Nebulisation of bronchodilators and steroids is not necessary for most patients and this therapy should be replaced by metered dose inhaler (MDI) with a spacer.
- Nebulisation of saline to improve sputum clearance should not be used.
- Nebulisation of antibiotics has clear benefit in only a very limited number of chronic respiratory diseases and should not routinely be used.

- If nebulisation is used in a patient with suspected or known CoVID-19, the patient should be managed in the highest level of isolation available (class N-negative pressure room is optimal, single room with door closed is adequate) with PPE precautions for health care personnel.

High flow oxygen

- For oxygen therapy the lowest flow rate of oxygen should be used to maintain oxygen saturations to minimize risk of viral aerosolisation. Although commonly used, high flow oxygen therapy via nasal prongs (HFNP) is unnecessary for many patients and this therapy should be replaced by O_2 via standard nasal prongs/cannula, Hudson mask, or non-rebreather mask.
- Some sleep physicians suggested that oxygen flow rates higher than 6L/min led to more aerosol dispersion and humidified HFNP with well-fitted nasal prongs may be a better option. This may potentially delay intubation or avoid it. The choice of therapy will depend on resources, staffing, PPE etc and should be made on a case by case basis after review by ICU/respiratory/sleep physician. However rapid intubation and ventilation, where clinically indicated, remains the safest option to reduce the risk of aerosol transmission to health care workers in the current CoVID-19 setting. In China, patients on oxygen therapy wore masks and it is unclear whether this led to a reduction in aerosolisation of virus.
- If a patient with suspected or confirmed CoVID-19 is a suitable candidate for endotracheal intubation and ventilation, HFNP should be avoided completely and early intubation considered to reduce risk of transmission to health care workers.
- If HFNP is to be used in a patient with suspected or known CoVID-19, the patient should be fitted with an interface to minimize leak in the highest level of isolation available (class N-negative pressure room is optimal, single room with door closed is adequate) with PPE precautions for health care personnel.

Non-invasive ventilation, including CPAP (acute)

- Non-invasive ventilation is delivered by a mask or mouthpiece and includes BiPAP and CPAP. As the pandemic continues, it may be prudent to assume that all patients requiring NIV have potential CoVID-19 (including those with COPD/OHS etc), and therefore use double-limb non-vented masks with an expiratory filter in the circuit and PPE until swabs are negative (safest). When this equipment is depleted, single limb circuit with a well fitted non-vented full face mask, attached to an appropriate microbial filter and exhalation port (on the side of the filter closest to the device) can be used with PPE (next best option). In both configurations, a humidifier should not be used as this will saturate the filter and increase airway resistance. The microbial filter should be replaced every 24 hours.
- Patients without suspected or proven CoVID-19 may be treated with non-invasive ventilation (NIV) for standard acute clinical indications. These patients will usually be managed in ICU (or in CCU for pulmonary oedema requiring CPAP) or in a specialized respiratory ward.

- Patients with suspected or proven CoVID-19 alone (i.e. no comorbidities) should not need bilevel NIV since hypoxemia is best treated with oxygen therapy and early intubation where necessary (i.e. bilevel NIV should be avoided). There may be a role for CPAP acutely to open up alveoli (PEEP) which may help to delay intubation or assist in the post-extubation phase. This should be considered on a case by case basis with careful attention to the use of non-vented masks and filters.
- However, some patients with comorbidities may develop an indication for NIV (e.g. acute hypercapnia due to COPD, obesity hypoventilation etc) and may be considered for acute NIV. In this situation there is a clear benefit to the patient to commence NIV.
- If NIV is used in a patient with suspected or known CoVID-19, the patient should be fitted with an interface with minimal leak in the highest level of isolation available (class N-negative pressure room is optimal, single room with door closed is adequate) and with "airborne" / PPE precautions.
- Planning needs to be underway for Phase 2 when all isolation rooms and ICU beds are full and there will be CoVID-19 designated wards. NIV may be needed in this situation and there will be a significant risk of aerosolised infection.
- It is recommended that all respiratory and sleep physicians and nurses be upskilled in the practical use of NIV.

Non-invasive ventilation, including CPAP (long term users) at home

- There is no evidence that the long-term use of NIV (including CPAP) increases the risk of development of upper or lower respiratory tract infections. Therefore, patients without suspected or proven CoVID-19 can continue their usual CPAP/Bilevel NIV.
- An important issue is possible aerosolization of upper airway secretions by NIV which may assist viral spread. This would likely occur via the exhalation port of the mask. Users of these therapies who are or are potentially infected with CoVID-19 should be aware of this possibility and should not use CPAP or bilevel NIV around others. This is relatively easy in most adults but very difficult to minimise household co-infection for paediatric patients where parents have necessary regular close contact and may co-habit the bedroom.
- Therapy continuation or discontinuation in the setting of suspected or proven CoVID-19 infection should be advised by the treating respiratory or sleep physician and individualised depending on patient- related risk/benefit.
- Manufacturer guidelines should be followed regarding cleaning/disinfection of mask and tubing.
- For CPAP users
    - **Adult or paediatric patients with suspected or proven CoVID-19 in the home environment should be advised to consider discontinuation of CPAP therapy until recovered (up to 14 days) under the advice of their sleep or respiratory physician.** Temporary cessation of CPAP is generally safe for patients. This is what has been suggested by AASM and is a conservative approach. Some sleep physicians felt that CPAP may be protective in this setting and given the importance of sleep on immune function that it could be continued if the patient could self-isolate. Other potential higher risk groups for cessation may include occupational drivers who become sleepy off therapy. This decision

should be made by the treating respiratory or sleep physician and should be reviewed regularly.

- For Bilevel NIV users
    - **For those suspected or proven CoVID-19 Bilevel NIV users in the home environment therapy should continue unless advised by the treating respiratory or sleep physician.** These patients should be monitored closely by phone or telemedicine and the approach individualized depending on the patient-related risk/benefit. The patient should practice self-isolation in the bedroom if Bilevel NIV is continued.

Non-invasive ventilation, including CPAP in treatment naïve users (e.g. patients trialling CPAP or NIV in a clinic or at home)

- Most sleep laboratories have ceased face to face CPAP set ups because of the risk for aerosolisation of CoVID-19 droplets that could infect the clinician/therapist/patient and other patients attending later. Particle dispersion is highest using nasal pillows at higher pressures (e.g. 20 cmH_2O) and may be the lowest with a well-fitting oronasal mask although no specific data pertaining to CoVID-19 is available currently. It is possible to send equipment to patients and instruct them via telehealth or via phone. Cleaning and disinfection guidelines from the manufacturer should be strictly adhered to during this time.

- **The ASA recommends that non-essential face to face CPAP or NIV set ups should now cease to limit the potential community spread of CoVID-19 and for staff safety. This aligns with current Department of Health guidelines to reduce elective surgery.**

- For essential CPAP/NIV set ups that must occur face to face patients should still be screened for risk as per the latest Department of Health guidelines (epidemiological risk factors and symptoms) and delayed if suspected or confirmed case of CoVID-19. Otherwise, for those who proceed a risk mitigation approach is to perform set up under isolation (class N-negative pressure room is optimal, single room with door closed is adequate) and with “airborne” / PPE precautions.

Paediatric patients

The information below is provided as an additional guide for clinical staff, highlighting some issues specific to paediatric patients who are either already established on CPAP/NIV/Invasive home ventilation or require initiation of therapy during acute illness. It is not intended to supersede local infection control advice but to support management of this specific patient population who have additional risks that need to be considered.

Introduction

1. Healthy children appear to be less susceptible to CoVID-19 although there are some vulnerable sub-groups (e.g. infants) [1,2].
2. Children may be asymptomatic with CoVID-19.
3. Assumptions about whether all patients should be presumed to have CoVID-19 should be adjusted according to the community spread (load) of the disease and with local advice from individual infectious diseases teams. It is recommended that children who are using aerosolising therapies such as CPAP/NIV or require such therapy to be implemented to treat acute respiratory disease, are considered high risk of spreading disease. Early testing for CoVID-19 in this group will be important at the time of admission to hospital and children should be managed as if positive, with appropriate PPE use and isolation, until results are available.

Key messages in context of children

1. Ensure ongoing management of underlying diseases is not compromised. This may include ongoing use of aerosolising therapies such as hypertonic saline to manage lower respiratory tract disease when there is no effective alternative.
2. Minimise spread through respiratory therapies to others including families and health care workers by implementing infection control measures: e.g. CoVID screening for patients who are using (or are to use) high risk aerosolising therapies at the time of their admission, cohort screened patients using nebulising therapies, appropriate PPE for staff working in those areas.
3. Take appropriate precautions against aerosol spread of disease when managing any patient with acute respiratory deterioration.
4. Therapies- nebulisation, high flow oxygen therapy, non-invasive (NIV and CPAP) and invasive ventilation via tracheostomy.
    a. Nebulisation and humidification- as per adult recommendations. We should avoid nebulisation if not necessary and bronchodilators should be administered by MDI/spacer. Nebulisation may still be most appropriate therapy for patients with specific indications: post extubation stridor, critical asthma presentation, and severe croup. Airborne precautions should be maintained for children with respiratory illnesses requiring nitrous oxide for procedures.
    b. High Flow Oxygen Therapy (HFOT): In general, the use of HFOT should be avoided if other options are effective e.g. low flow oxygen. If HFOT is to be used, then it

should be used at appropriate treatment levels and precautions for aerosol spread of disease implemented.

c. Non-invasive ventilation – ACUTE IN HOSPITAL SETTING: In general, appropriate respiratory support should not be withheld.
    i. Discussion with infection control/ID teams is recommended for acute management of patients requiring NIV/CPAP. This should include discussion regarding appropriate PPE, ward or HDU/ICU placement in order to minimise risk of spread of infection, whilst ensuring safe management of ventilation.
    ii. Continue routine therapy with NIV/CPAP to treat underlying diseases.
    iii. NIV therapy has clear benefits for many children, including those with acute respiratory failure. However, standard therapy with a vented mask may increase the risk to staff. Interface adjustments to limit aerosolisation and spread of infectious particles should be undertaken only if safe to do so. The use of alternative masks and circuits in young children may increase dead space and lead to poor mask fit (which in turn increases aerosolisation risk) and therefore these risks to the child need to balanced with that of spread of infection.
    iv. Non-vented masks carry additional risks, particularly in young children e.g. suffocation. Use outside of an intensive care setting should generally be avoided.
        1. Older children (e.g. >12yrs) can be managed according to adult recommendations using a non-vented mask with a double limb circuit and inline suctioning or with an expiratory filter in the single limb circuit**. This should only occur in settings where staff are trained and familiar with this equipment- usually PICU.
        2. Younger children are most safely managed using standard vented masks, and staff protected with appropriate PPE. Adjuncts such as use of a surgical mask over the NIV mask or other barriers can be considered but are unproven.
    v. If children receiving ventilation via a tracheostomy have a respiratory illness, they should be managed in HDU/ICU to implement closed circuits with in-line suctioning. Changing to a cuffed tracheostomy tube may also be considered.

d. Non-invasive ventilation – HOME SETTING:
    i. As per adult guidelines patients without suspected or proven CoVID-19 can continue their usual CPAP/NIV/ invasive ventilation therapy.
    ii. Families should be aware of the increased risk of transmission to household contacts if a child is on NIV and unwell. Physicians may consider advising discontinuation of therapy if the child is not dependent on CPAP/NIV for the period of the acute illness until symptoms resolve (or CoVID-19 test negative). The decision of whether to continue or stop CPAP/NIV therapy should be based on whether the risk: benefit assessment favours continued therapy.

iii. In general, children who are on invasive home ventilation via tracheostomy are likely to be dependent on support. In this situation benefit of therapy outweighs risk of transmission and therapy should NOT be ceased. If children in this group become unwell testing for CoVID-19 should occur as soon as possible, with consideration of appropriate PPE use pending results. Admission to hospital may be required if patients cannot be managed safely at home.

5. Sleep studies- follow local infection control/ID advice for essential urgent studies. Note: As all full paediatric studies are in laboratory studies, there is no current alternative (home, or remote) available for patients who require these diagnostic tests.

** Set up for single limb circuit: Add an additional combined bacterial/viral (hepa) filter between the mask and device tubing e.g. non-vented mask ➞ filter ➞ CO_2 exhalation port on tubing device. Note- this set up may increase dead space and require adjustment in ventilator settings.

References

1. Dong, Y., Mo, X., Hu, Y., Qi, X., Jiang, F. Jiang, Z., Tong, S. **Epidemiology of COVID-19 among children in China.** Pre-publication release *Pediatrics* 2020; doi: 10.1542/peds.2020-0702.
2. Zhang, L., Li, Y. Liu, D., Shen, K., Xu, S., Wong, G. **Clinical characteristics of coronavirus disease 2019 in China.** N Engl J Med. DOI: 10.1056/ NEJMoa2002032.