COVID-19
LITERATURE REPOSITORY

Respiratory Management in patients with confirmed or suspected COVID-19

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Discussion

The guidelines for respiratory management in patients with confirmed or suspected COVID-19 have changed rapidly over the last few months, reflecting uncertainty in the SARS-CoV-2 transmission characteristics, possibility of transmission from aerosol-generating procedures and baseline risk of transmission reflecting community prevalence. The clinical spectrum of respiratory disease ranges from upper respiratory tract symptoms (mild illness) through pneumonia (moderate to severe illness) to Acute Respiratory Distress Syndrome (ARDS) (1).

Transmission dynamics:

Current evidence suggests that SARS-CoV-2 in the community is primarily transmitted through respiratory droplets and to a lesser extent, fomites (droplets remaining on surfaces heavily contaminated by an individual with respiratory symptoms) (2). The transmissibility of respiratory viruses relates both to the size of the particle and the propulsion through which it enters the environment. Larger particles fall faster with gravity and therefore rarely spread more than a metre from their source. This understanding has advised the current physical distancing policies in many countries, including Australia, to limit the spread of COVID-19.

Smaller particles can occasionally become aerosolised when introduced into the environment at higher pressure or through a mechanism that interferes with passive gravity. This results in small particles remaining suspended for a longer period of time, allowing further travel and overall greater transmissibility. This is of particular concern during aerosol-generating procedures, common in the routine care of paediatric illness, including high flow nasal cannula (HFNC), chest physiotherapy, non-invasive ventilation (NIV), nebulizers, tracheal intubation and airway suctioning (2). These aerosol-generating procedures have had a large influence on the protocols that surround COVID-19 management, particularly for acute care services. The expected particle exposure, based on patient disposition and stage of illness, dictates the personal protective equipment (PPE) requirements for healthcare workers (3). For COVID-19, contact + droplet + airborne precautions are recommended for aerosol-generating procedures (4).

The paradox of evidence based medicine:

Whilst there is a general consensus on when to start supplemental oxygen therapy for hypoxemia in children (<90%) (1), there has been much debate over the method of respiratory support and oxygen delivery in COVID-19 due to the concerns for aerosolization. Early in the preparedness phase for COVID-19, guidelines reflected the concern of healthcare acquisition from exposure to aerosolised droplets and consequently recommended early intubation to a closed circuit ventilators in preference to 'open' systems more commonly utilised in paediatrics such as high flow nasal cannula (HFNC). Subsequently, evidence of the efficacy of PPE in preventing HCW acquisition(5) as well as low rates of respiratory failure amongst paediatric patients with COVID-19 (6, 7) have caused a reflection on accepted best practice. On balance, decisions should balance likelihood of patient benefit against the risk of infection for healthcare workers (8).

Severe respiratory manifestations of COVID-19 in paediatric patients are rare. The lack of paediatric specific data is problematic in planning best practice guidelines, as extrapolating adult data is often misleading. Consequently,

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there is a lack of consensus amongst international guidelines for paediatric COVID-19 presenting as ARDS. Standard ARDS management has been adopted, with some modifications to minimise risk of transmission to healthcare workers and balance the infection and prevention control measures against the optimal clinical care for patients.

Adult patients require respiratory support for pathology and comorbidities quite unlike paediatric cohorts and have a different morbidity profile associated with intubation, especially when considering tracheal development and potential for airway trauma. In the context of COVID-19, utilising non-invasive ventilation methods (HFNC and NIV) often allows patients to be managed locally for common childhood illnesses including bronchiolitis and asthma which avoids retrieval and family separation, intubation-associated morbidity and prolonged hospital admission. Additionally, the decision to intubate paediatric patients with long-standing complex comorbidities often has significant flow-on effects. Policies of early intubation to avoid non-invasive AGP's can precipitate considerations regarding ceilings of care in children who may not fare well through a period of intubation and ventilation but who would otherwise survive a viral illness with a lower level of support.

ARDS management in paediatric patients –HFNC / NIV:

Evidence for preferred respiratory support between HFNC and NIV in to manage ARDS-related type 1 respiratory failure caused by respiratory viruses remains mixed (9). Some favour HFNC, extrapolated from a systematic review in 2017 which found that in adults, HFNC was not associated with a difference in mortality compared to NIV or standard oxygen via nasal prongs or face mask (10). The Surviving Sepsis Guidelines (SSG), developed by an international expert panel under guidance from the WHO and Centre for Disease Control (CDC) to provide preliminary evidence-based guidelines for the acute management of adults with severe COVID -19, favour HFNC; also reflected in the Australian national guidelines, endorsed by ANZICS (8, 9, 11). There have been limited studies in children, however The European Society for Paediatric and Neonatal Intensive Care (ESPNIC) guidelines currently recommend use of NIV as first line for children with hypoxemia and respiratory distress in the context of ARDS (12).

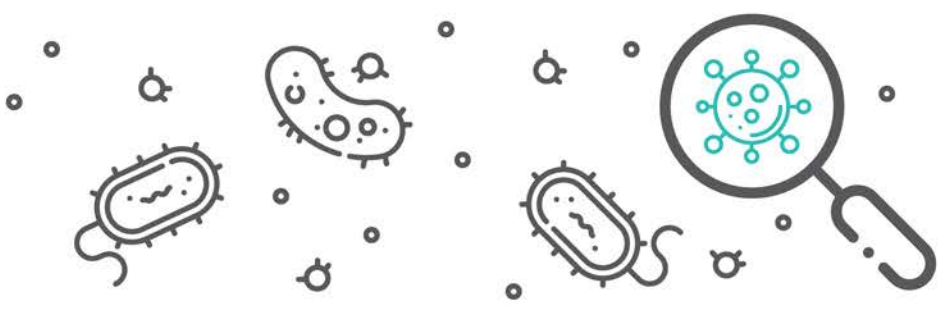
Given the lack of paediatric data to guide consensus, first-line therapy choice could be at the discretion of the treating hospital and local facilities. Other considerations such as staff training in NIV, safety of managing patients on NIV on wards as opposed to high dependency or intensive care wards, and tolerance of respiratory support should be considered. Children may tolerate HFNC better than NIV (1), and it may be more readily available at hospitals, especially in peripheral/regional settings.

ARDS management in paediatric patients – Intubation:

As intubation is an AGP, current recommendations for patients with COVID-19 that require intubation are aimed to minimise risks to staff, including rapid sequence intubation (RSI) in a negative pressure room, minimising staff within the room and adequate PPE use (8, 11-13). Each institution has adapted local guidelines for the management of severe COVID-19, including the Sydney Children's' Hospitals Network (SCHN). A randomised control trial in children (<16yrs) undergoing elective surgery demonstrated cuffed endotracheal tubes have less leakage than uncuffed endotracheal tubes for both volume- and pressure-controlled. As such, cuffed tubes have been adopted as standard practice (14). Similar to the NIV circuit set-up, the ventilator circuit should be fitted with bacterial/viral filters as well as in-line suction to allow for clearance of airway secretions without disconnecting the ventilator. Lung protective ventilation and prone positioning also remain part of standard care for paediatric ARDS and do not represent an increased risk in COVID-19 transmission.

Conclusions

1. Respiratory support for children with COVID-19 should balance the most appropriate level of support for each patient against the risks to staff and other patients.
2. The paucity of paediatric specific data for the management of acute respiratory distress and/or respiratory failure limits the strength of evidence based recommendations for paediatric COVID-19.
3. Extrapolated data from adults suggest there is no mortality benefit of non-invasive ventilation compared to high flow nasal canulae therapy and the choice of support should be case based.
4. Early recognition of deterioration requiring intubation allows adequate RSI planning and ensures staff are



protected and exposure to aerosol-generating procedures can be minimised.

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