

COVID-19 – Management of Symptomatic Newborn Infants

*This Local Operating Procedure is developed to guide safe clinical practice in Newborn Care Centre (NCC) at The Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this Local Operating Procedure. It is **interim advice, and subject to change**. Using this document outside the Royal Hospital for Women or its reproduction in whole or part, is subject to acknowledgement that it is the property of NCC and is valid and applicable for use at the time of publication. NCC is not responsible for consequences that may develop from the use of this document outside NCC.*

1. AIM

- To guide safe and appropriate management of newborn infants with suspected/confirmed COVID-19 in the NCC

2. PATIENT

- Symptomatic newborn infants with suspected/confirmed COVID-19

3. STAFF

- Medical and nursing staff

4. CLINICAL PRACTICE

NOTE:

Newborn infants born to women with COVID-19 are unlikely to be symptomatic at birth. The need for resuscitation (including intubation at birth) is more likely to be unrelated to COVID-19.

Although the infant may be suspected to have COVID-19, empiric antibiotic therapy for bacterial sepsis should not be delayed.

New variants of concern (VOCs) are emerging and the full characteristics and the impact of VOCs on neonates are still unknown and evolving. While every effort is made to keep this document up to date, it is recommended to discuss with on-call ID consultant of the day on the management of the neonate.

If respiratory support is required, neonate should be managed with devices currently used in clinical practice, but a viral filter can be added to minimise the spread of viral particles in the air.

CPAP using ventilator is preferred over bubble CPAP (Draeger VN500 is used in our NCC). Attach the viral filter to the exhaust vent of Draeger VN500.

Consider prone positioning wherever possible.

Consider higher PEEP strategy for moderate to severe COVID-19.

Do not routinely use continuous infusions of muscle relaxants. If required, intermittent boluses are preferred.

COVID-19 – Management of Symptomatic Newborn Infants cont'd

Precautions for staff

- Use contact, droplet and airborne precautions when taking care of neonates with suspected/confirmed COVID19.
- Airborne precautions are mandatory when performing aerosol generating procedures (AGP).
- AGPs include:
 - Endotracheal intubation and extubation
 - Open airway/nasopharyngeal/oropharyngeal suctioning
 - Opening a ventilator circuit for bag and mask or Neopuff ventilation
 - Non-invasive ventilation (CPAP or BiPAP)
 - High flow nasal cannula therapy
 - Mechanical ventilation through an uncuffed endotracheal tube
 - Nasopharyngeal swab/aspirate collection
 - Surfactant administration and nebulised medicinesNB. Insertion of a gastric tube is not typically considered an AGP but staff may choose to adopt airborne precautions

Management

General

- Keep the infant in isolation/single room where possible.
- Infants should be cohorted and isolated where single rooms are not available.
- Infant should be cared for in closed incubator.
- When incubator is not suitable (e.g. hyperthermia), infant can be nursed in an open cot, with a distance of 2 metres between cots.
- Perform sepsis work-up including FBC, CRP, blood cultures, blood gas, lactate, CXR, UEC. Add coagulation profile, CSF and liver function tests as appropriate.
- Perform combined nose/throat swab testing. Repeat testing in 24 hours if negative swab but ongoing clinical suspicion.
- If RT-PCR positive – perform D-Dimer, coagulation profile, fibrinogen, troponin-T.
- Administer empiric antibiotics promptly. **Empiric therapy should be de-escalated once the bacterial sepsis is no longer considered a possibility.**
- Closely monitor for any deterioration and respond immediately.

Respiratory support

- Provide appropriate support avoiding unnecessary aerosol generating interventions.
- Tachypnoea without increased work of breathing – consider less aerosol generating low flow nasal cannula oxygen.
- Commence CPAP promptly for any worsening respiratory distress.
- Ventilator CPAP is preferred over bubble CPAP (Draeger VN500 is used in our NCC). Attach the viral filter to the exhaust vent of Draeger VN500.
NB. We do not use humidified high flow nasal cannula (HHFNC) as the initial respiratory support in our NCC.
- Administer surfactant as per regular indication.
- Watch closely for any worsening clinical condition.
- Intubation and mechanical ventilation – There is no change in the way intubation and airway access is managed in COVID-19 scenario except:
 - Consider elective mechanical ventilation in a controlled environment to minimise the viral exposure to staff
 - The most experienced NCC team member (consultant/fellow/trainee with advanced neonatal life support) should intubate

NEONATAL SERVICES DIVISION

Approved by Safety & Quality Committee
July 2021

COVID-19 – Management of Symptomatic Newborn Infants cont'd

- Keep the number of staff in the room to a minimum – proceduralist, RN and one other assistance (RN or doctor)
- Prepare drugs including atropine in smaller infants to aid in the management of hypoxia induced bradycardia
- If the infant is already receiving CPAP, continue CPAP for preoxygenation until intubation
- Low flow nasal oxygen (<1 L/min) may be used alternatively for preoxygenation
- ETT (for preterm infants any time and any infant requiring intubation at birth) – use the appropriate sized uncuffed ETT as per usual practice.
 - Rationale: (1) NCC teams are familiar with uncuffed ETT and it is best to use the familiar procedures in emergency; (2) Infants at birth are unlikely to be infectious through respiratory droplets and the requirement for intubation is more likely to be unrelated to COVID-19; (3) Staff are wearing appropriate PPE for AGPs
 - There is an option of using microcuffed ETT in bigger neonates, particularly neonates readmitted with COVID-19 pneumonia
- Provide further respiratory support (e.g. high frequency ventilation [HFOV], inhaled nitric oxide [iNO] therapy) as per clinical need.

Mechanical ventilator filters

- In our NCC, we have 2 mechanical ventilators:
 - Draeger VN500 ventilator – has a bacterial in-built inspiratory and expiratory filter (within the machine). An external viral filter (Carefusion Airlife 303EU Bacterial/Viral filter) can be connected to the exhaust hose (Figure 1).
 - Macquet Servo-N ventilator –has an in-built viral filter on the expiratory limb with a filtration efficiency against microbes and viruses as small as 0.02 microns.



Figure 1. Draeger VN500 ventilator. An external viral filter can be connected to the exhaust hose (circled).

Fluid status and supportive therapy

- Monitor fluid status.
- Breastfeeding is to be supported as tolerated.
- Other supportive therapy including haemodynamic support should continue as usual and should not be influenced by COVID-19 status.

NEONATAL SERVICES DIVISION

Approved by Safety & Quality Committee
July 2021

COVID-19 – Management of Symptomatic Newborn Infants cont'd

Corticosteroids

- Consider using dexamethasone daily intravenously or orally for up to 10 days (or acceptable alternative regimen) in children and adolescents with acute COVID-19 who are receiving oxygen (including mechanically ventilated patients).
- The dose in newborn infants is unclear, however, dose regimens recommended for ARDS or as per Australasian Neonatal Medicines Formulary (www.ANMFonline.org) can be prescribed.

Antiviral therapy

- Discuss with paediatric infectious diseases physician about the need for remdesivir.
- Dose: IV loading dose of 5 mg/kg followed by 2.5 mg/kg daily for a total of 5 days (up to 10 days in consultation with infectious diseases physician).^{1,2}

De-isolation criteria

- De-isolation to general care can be considered after 24-48 hours of illness if the following two criteria are BOTH met:
 - Two consecutive negative swabs 24 hours apart
 - Consultation and approval from paediatric infectious diseases physician

Discharge

- ALL three criteria are to be met:
 - Resolution of acute illness for at least 48 hours
 - Two consecutive negative swabs at least 24 hours apart
 - Consultation and approval from paediatric infectious diseases physician

Post discharge

- Follow the advice of the paediatric infectious diseases physician regarding ongoing quarantine and isolation at home.
- Arrange GP/paediatrician follow up as required.

5. EDUCATIONAL NOTES

- New variants of concern (VOCs) are emerging and the full characteristics and the impact of VOCs on neonates are still unknown and evolving. While every effort is made to keep this document up to date, it is recommended to discuss with on-call ID consultant of the day on the management of the neonate.
- Please refer to Australian guidelines for the clinical care of people with COVID-19 by the National COVID19 Clinical evidence taskforce. (<https://app.magicapp.org/#/guideline/L4Q5An/section/jOIQ7L>) for the up to date recommendations.
- If respiratory support is required, neonate should be managed with devices currently used in clinical practice, but carefully limiting the generation of aerosols and the spreading of droplets exhaled during oxygen delivery and ventilation strategies.
- Consider using high-flow nasal oxygen or non-invasive ventilation therapy for neonates with hypoxaemia or respiratory distress associated with COVID-19 and not responding to low-flow oxygen. Use it with caution and pay strict attention to staff safety, including the use of appropriate PPE.
- The preferred location for high-flow nasal oxygen is a negative pressure room or a single room with the door closed. If these locations are not immediately available then high-flow nasal oxygen or non-invasive ventilation should not be withheld if indicated. However, it should be recognised that this therapy may pose an aerosol risk to staff and other patients, and appropriate precautions should be used.

NEONATAL SERVICES DIVISION

Approved by Safety & Quality Committee
July 2021

COVID-19 – Management of Symptomatic Newborn Infants cont'd

- CPAP using ventilator is preferred over bubble CPAP (Draeger VN500 is used in our NCC). Attach the viral filter to the exhaust vent of Draeger VN500.
- For neonates with COVID-19 and respiratory symptoms who are receiving non-invasive respiratory support, consider prone positioning if patient co-operation is possible. When positioning a patient prone, ensure it is used with caution and close monitoring of the patient.
- For mechanically ventilated neonates with COVID-19 and hypoxaemia despite optimising ventilation, consider prone positioning if there are no contraindications.
- For mechanically ventilated neonates, children and adolescents with COVID-19 and moderate to severe ARDS with atelectasis, consider using a higher PEEP strategy over a lower PEEP strategy.
- For mechanically ventilated neonates, children and adolescents with COVID-19 and hypoxic respiratory failure characterised by severe atelectasis unresponsive to other ventilation strategies, consider using recruitment manoeuvres.
- In neonates and infants, staircase or stepwise incremental recruitment manoeuvres should only be performed using mean airway pressure in a high-frequency oscillatory ventilation mode. Staircase or stepwise (incremental PEEP) recruitment manoeuvres should not be performed during conventional ventilation.
- For intubated neonates, children and adolescents with COVID-19, do not routinely use continuous infusions of neuromuscular blocking agents (NMBAs). However, if effective lung-protective ventilation cannot be achieved, consider targeted intermittent use of NMBAs.
- Do not routinely use HFOV as a first line mode of mechanical ventilation in neonates, children and adolescents with severe COVID-19. HFOV should be limited to a rescue
- therapy in neonates and children not responding to conventional mechanical ventilation in a specialist centre with experience with HFOV.
- HFOV delivers gas at very high flow rates. This may increase the aerosol-generating potential compared to other forms of respiratory support used in intensive care. This may limit the suitability of HFOV in patients with COVID-19 unless strict attention to staff safety and infection control measures can be applied.
- Newborn infants born to women with COVID-19 are unlikely to be symptomatic at birth. The need for resuscitation (including intubation at birth) is more likely to be unrelated to COVID-19.
- Coronaviruses are minute in size (65–125 nm in diameter) and contain a single-stranded RNA as a nucleic material.³
- Potential source of infection in newborn infants: (1) Vertical transmission from COVID-positive mother in the first 14 days of life – unclear at the moment; (2) Horizontal transmission through household cases or through community; (3) Nosocomial infection as a ward cluster.
- Published reports so far suggest children have experienced lower-than-expected rates of COVID-19 and deaths in children appear to be rare. In more than 72,000 total cases from China, 1.2% were in patients aged 10 to 19 years and even fewer (0.9%) were in patients younger than 10 years.⁴ In a separate analysis of 2,143 confirmed and suspected paediatric cases from China, infants were at the highest risk of severe disease (10.6%), compared with older children (4.1% for those aged 11 to 15 years; 3.0% in those 16 years and older).⁵
- Similarly, current published data suggest that neonates with COVID-19 pneumonia generally display mild symptoms. However, recent US media reported death of a 6 week old infant. (<https://www.cbsnews.com/news/six-week-old-baby-dies-coronavirus-believed-to-be-youngest-fatality/>).
- Clinical features: there are no distinguishing clinical features of COVID-19 and symptoms overlap with other acute respiratory infections.⁶

NEONATAL SERVICES DIVISION

Approved by Safety & Quality Committee
July 2021

COVID-19 – Management of Symptomatic Newborn Infants cont'd

- WHO has provided definitions for adults and children. To date, there are only a few case reports of neonates with serious illness.
- Given the lack of data from neonatal populations, we have extrapolated the disease spectrum noted in adult and children to the following categorization to newborn infants:
 - Mild illness: Non-specific symptoms such as fever, cough, nasal congestion (rarely, diarrhoea and vomiting)
 - Mild pneumonia: Tachypnoea ≥ 60 /min and no other signs of severe pneumonia
 - Moderate-severe pneumonia: Grunting, intercostal and subcostal recessions, inability to feed, opacities on chest x-ray
 - Septic shock: Hypotension, altered mental status, tachycardia (>160 bpm), bradycardia (<90 bpm), prolonged capillary refill (>2 sec), feeble pulse, mottled or cool skin, petechial or purpuric rash, increased lactate, oliguria, hyperthermia or hypothermia, disseminated intravascular coagulation, hyperbilirubinaemia
- There is strong evidence supporting the use of iNO in term and near-term newborn infants with hypoxic respiratory failure [LOE I, GOR A].⁷ COVID-19 status should not influence management of hypoxic respiratory failure.
- There is strong evidence supporting the use of surfactant in a range of neonatal conditions where surfactant deficiency or inactivation are implicated in the disease pathogenesis [LOE I, GOR A].^{8,9} Based on these other conditions, we have recommended that surfactant should be considered in cases where surfactant deficiency or inactivation is suspected.
- There are case reports of IV remdesivir in neonates with severe SARS-COV-2 infection [LOE V, GOR D].^{1,2}

6. RELATED POLICIES/PROCEDURES/CLINICAL PRACTICE LOP

- Royal Hospital for Women Medical LOP – COVID-19 – Newborn Infants Born to Women with Suspected or Confirmed COVID-19
- Royal Hospital for Women Nursing LOP – COVID-19 – Collection of upper respiratory swabs for testing for SARS-COV-2
- Royal Hospital for Women Factsheet – COVID-19 Parent information

7. RISK RATING

- High

8. NATIONAL STANDARD

- Standard 1 Clinical Governance for Safety and quality in Health Service Organisation
- Standard 3 Preventing and Controlling Healthcare-Associated Infection
- Standard 5 Comprehensive Care
- Standard 8 Recognising and Responding to Acute Deterioration

NEONATAL SERVICES DIVISION

Approved by Safety & Quality Committee
July 2021

COVID-19 – Management of Symptomatic Newborn Infants cont'd

9. ABBREVIATIONS AND DEFINITIONS OF TERMS

COVID-19	Coronavirus Disease 2019	CSF	Cerebrospinal Fluid
NCC	Newborn Care Centre	RT-PCR	Reverse Transcriptase Polymerase Chain Reaction
VOC	Variants of Concern	HHFNC	Humidified High Flow Nasal Cannula
PEEP	Positive End Expiratory Pressure	RN	Registered Nurse
PPE	Personal Protective Equipment	ETT	Endotracheal Tube
AGP	Aerosol Generating Procedure	HFOV	High Frequency Oscillatory Ventilation
CPAP	Continuous Positive Airway Pressure	iNO	Inhaled Nitric Oxide
BiPAP	Bi-level Positive Airway Pressure	ARDS	Acute Respiratory Distress Syndrome
FBC	Full Blood Count	GP	General Practitioner
CRP	C-Reactive Protein	WHO	World Health Organisation
CXR	Chest X-Ray	SARS-COV-2	Severe Acute Respiratory Syndrome Coronavirus 2
UEC	Urea, Electrolytes, Creatinine	NMBAs	Neuromuscular Blocking Agents

10. REFERENCES

1. Wardell H, Campbell JI, VanderPluym C, et al. Severe Acute Respiratory Syndrome Coronavirus 2 Infection in Febrile Neonates. Journal of the Pediatric Infectious Diseases Society 2020.
2. Frauenfelder C, Brierley J, Whittaker E, et al. Infant with SARS-CoV-2 infection causing severe lung disease treated with Remdesivir. Pediatrics. 2020 Sep 1;146(3).
3. Yi Y, Lagniton PNP, Ye S, et al. COVID-19: what has been learned and to be learned about the novel coronavirus disease. Int J Biol Sci. 2020;16:1753-1766.
4. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. JAMA. Published online February 24, 2020.
5. Dong Y, Mo X, Hu Y, et al. Epidemiological characteristics of 2143 pediatric patients with 2019 coronavirus disease in China. Pediatrics. 2020;e20200702.
6. Guan W, Ni Z, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020; 382:1708-20.
7. Barrington KJ, Finer N, Pennaforte T, et al. Nitric oxide for respiratory failure in infants born at or near term. Cochrane Database of Systematic Reviews 2017, Issue 1. Art. No.: CD000399.
8. Seger N, Soll R. Animal derived surfactant extract for treatment of respiratory distress syndrome. Cochrane Database of Systematic Reviews 2009, Issue 2. Art. No.: CD007836.
9. El Shahed AI, Dargaville PA, Ohlsson A, Soll R. Surfactant for meconium aspiration syndrome in term and late preterm infants. Cochrane Database of Systematic Reviews 2014, Issue 12. Art. No.: CD002054.

11. AUTHOR

Primary	May 2020	Srinivas Bolisetty (Lead Clinician), Tim Schindler (Neonatologist), Eszter Jozsa (NE), Charlotte Walter (CNS)
Revision	July 2021	S Bolisetty (Medical Co-Director), S Van Der Jagt (Acting Lactation CNC), S Mathew (Acting CNC), T Schindler (Staff Specialist)

REVISION & APPROVAL HISTORY

October 2020 Original document reviewed, revised and approved by NCC LOPs Committee
July 2021 Revised Document Approved by NCC LOPs Committee

FOR REVIEW: 2022