

GUIDELINES ON MANAGEMENT OF CORONAVIRUS DISEASE 2019 (COVID-19) IN NEONATES

Introduction

The COVID-19 global pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has rapidly spread worldwide with substantial consequences for public health. Emerging evidence suggests that it is considered possible (but not proven), that SARS-CoV-2 can be transmitted vertically. Majority of neonates born to mothers with COVID-19 are either uninfected or only exhibit mild symptoms at birth. To date, viral RNA has not been detected in placenta, amniotic fluid, vaginal secretions or breast milk. While this route of transfer needs to be considered, neonates are at increased risk of COVID-19 after birth through close contact with the mother, caregivers or infected persons via respiratory droplets transmission. Hence, when caring for these neonates, droplet and contact precautions must be adhered to at all times and airborne precautions when performing aerosol generating procedures.

This guideline has been prepared taking into account the scientific data available as of November 7 2020. The guidance is subject to change with the acquisition of further knowledge about the COVID-19 pandemic, its perinatal transmission and clinical characteristics of cases of neonatal COVID-19 infection.

Each hospital is encouraged to tailor this guideline individually according to the availability of resources, hospital logistics, patient volume, potential risk of exposure to the neonate and health care workers (HCW) during the care of a neonate born to a mother with suspected, probable or confirmed COVID-19.

1. Case Definition

1.1. Definition for neonate suspected of COVID-19 infection:

- a. Neonates born to pregnant women who are suspected, probable or confirmed cases of COVID-19 infection. (Refer Annex 1: Case Definition of COVID-19).
- b. Neonates born to pregnant women who are persons under surveillance (PUS)
- c. Neonates exposed after birth to those who are suspected, probable or confirmed cases of COVID-19 infection

All suspected neonates are under consideration in this guideline regardless of whether they are symptomatic or asymptomatic.

(Refer Annex 1: Case Definition of COVID-19.)

1.2. Definition for neonate with confirmed COVID-19 infection:

A neonate with **laboratory confirmation** of infection with COVID-19, irrespective of clinical signs or symptoms (Refer Annex 1: Case Definition of COVID-19 and Annex 5 Guidelines on Laboratory Testing for COVID-19, Guidelines COVID-19 Management in Malaysia).

2. Delivery Room Management of Neonates

2.1. Preparation prior to delivery

- a. Referral to the specialist of Neonatal Intensive Care Unit (NICU) prior to delivery.
- b. If possible, resuscitation of the neonate should be conducted in adjacent room. If not feasible, the resuscitator should be physically separated from the mother's delivery area by a distance of at least 2 meters. A curtain/physical barrier can be used between the two areas to minimize the risk of exposure to maternal aerosol. Intubation of the mother for a GA Caesarean section is a significant aerosol generating procedure (AGP).
- c. The number of HCW handling the resuscitation should be kept to a minimum to limit the staff exposure. Only essential and experienced HCW should be in the delivery area, with backup team available outside the room. Each hospital should make their own arrangements for designating staff.
- d. Adequate time (at least 30mins prior to delivery) should be given to the neonatal team to don personal protective equipment (PPE). PPE should be donned in an adjacent room/area before entering the delivery room.
- e. Commonly used equipment for neonatal resuscitation should be readily available (e.g. kept in a disposable bag) to avoid taking the full resuscitation trolley into the delivery area unless required.
- f. If additional equipment is required, this can be passed to the resuscitation team by the backup team outside the delivery area.
- g. A designated resuscitator, transport incubator and single use equipment (if available) should be used

2.2. Resuscitation/Stabilization of the neonate at birth

- a. There is insufficient evidence to make recommendations on immediate skin to skin contact. If skin to skin contact is considered, mother should use a surgical face mask while holding the neonate. Whenever possible, shared decision making with the parents before delivery regarding the potential risks and benefits of skin to skin care is recommended. The discussion should include risks of exposure to both the neonate and to HCW.
- b. There is insufficient evidence to make recommendations on delayed cord clamping (DCC)
- c. Stabilization/resuscitation of the neonate should be according to Neonatal Resuscitation Program (NRP) Guidelines. Take measures to minimize potential COVID-19 exposure.
 - Initial steps:
Routine neonatal care and the initial steps of neonatal resuscitation are unlikely to be aerosol generating. These include drying, tactile stimulation, placement into a plastic bag or wrap, assessment of heart rate, placement of pulse oxymetry and ECG leads.
 - Suction: Suction of the airway after the delivery should not be performed routinely for clear or meconium stained amniotic fluid. Suctioning is considered AGP and is not indicated for uncomplicated deliveries
 - Positive pressure ventilation:
Bag and mask/T piece and mask ventilation should be used as recommended by the NRP. A small viral/bacterial filter should be placed in between the self-inflating bag/T piece resuscitator device and the mask (Figure 1). It remains unclear if the use of a T-piece resuscitation device to provide CPAP/PPV via facemask could generate aerosols. *Note: The filter adds significant dead space and the smallest available filter should be used. Since there has been no reported cases of COVID-19 in neonates < 1000g, it may be reasonable not to use filters while applying bag and mask ventilation to these neonates. This is to avoid the possible risk of hypercapnia with subsequent intraventricular haemorrhage.*

- Endotracheal intubation:
Endotracheal intubation should be by the most experienced person. If available, use a video laryngoscopy system to maintain some distance from the neonate's airway. An appropriately sized endotracheal tube (ET) should be used to avoid excessive leak.
 - Endotracheal medications:
Endotracheal instillation of medications, such as surfactant or epinephrine are AGPs. Intravenous delivery of epinephrine via a low lying umbilical venous catheter is the preferred route of administration during neonatal resuscitation.
- d. Post stabilization, the neonate should be transferred into the transport incubator without undergoing any non-urgent neonatal care.
- e. Transport the neonate via passage of minimal exposure. Each hospital should develop predefined route and elevator for transport to the ward. If the neonate is delivered in an undesignated hospital, the neonate should be transferred to the designated hospital from the delivery room. Transport team should be in appropriate PPE according to Annex 8: Infection Prevention and Control (IPC) Measures in Managing suspected COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia. If the team transporting the baby is the same as that attending the delivery, consider changing PPE before the transfer as the PPE used in the delivery area will be contaminated.
- f. The equipment used should be disposed based on universal recommendations following a biohazard decontamination protocol. If the equipment is reused, follow general protocol for disinfection and sterilization (Refer Policies and Procedures on Infection Prevention and Control, Ministry of Health Malaysia, 2019).

3. Post-Natal Care of the Neonate

- a. There is limited evidence to guide the postnatal care of neonates born to mothers who are suspected, probable, confirmed or person under surveillance (PUS) for COVID –19 in the third trimester of pregnancy.
- b. Temporary separation of mother and newborn after birth will minimize the risk of postnatal infection from maternal respiratory secretions.
- c. Mothers with suspected, probable, confirmed and who are person under surveillance (PUS) for COVID-19 may room in with their newborns when

adequate precautions are taken to protect the neonates from the maternal respiratory secretions.

- d. Whenever possible, the decision of whether a neonate should room in with the mother should be made on a case-by-case basis using shared decision making between the parents and the health care provider. Considerations in this decision should include:

- The clinical condition of the mother
- The gestational age and clinical condition of the neonate
- COVID-19 testing results of mother (suspected, probable, confirmed or PUS)
- Desire to breast feed
- Individual hospital policy and hospital logistics
- Other risks and benefits of temporary separation of mother with suspected or confirmed COVID-19 and her neonate.

- e. Each hospital is encouraged to develop individual guidelines on this aspect of care.

- f. Place of care

- i. **Well** neonates who do not require medical intervention born to **asymptomatic** mothers.

- Temporary separation of mother and newborn after birth may be considered to prevent transmission of COVID-19 to the neonate.
- Mothers and neonates may room in according to usual unit practice
- If the mother is rooming in with her neonate, the following guidelines should be followed to minimize the risk of transmission:
 - The neonate should be kept at least 2 meters (6 feet) from the mother unless she is breast feeding. Use of an incubator may facilitate distancing and provide the neonate an added measure of protection from respiratory droplets
 - Consider formal documentation of parental decisions regarding rooming in
 - Mothers must comply to strict hand hygiene measures to prevent the possible transmission of the infection by droplet or by contact with respiratory secretions
 - Mothers should perform hand hygiene meticulously, including before and after breastfeeding and when providing hands on care for the neonate
 - Mothers should wear a surgical mask while breastfeeding and providing hands on care for the neonate
 - Breast feeding can be allowed (Refer no. 7 Nutritional support)
 - Regular cleaning and disinfection of surfaces in the room

- Mothers with suspected or confirmed COVID-19 infection should not be considered as posing a potential risk of virus transmission to their neonates if they have met the following criteria
 - At least 10 days have passed since their symptoms first appeared (up to 20 days if they have more severe to critical illness or are severely immunocompromised), **AND**
 - At least 24 hours have passed since their last fever without the use of antipyretics, **AND**
 - Their other symptoms have improved
- ii. Separation of mother and neonate maybe necessary for mothers who are symptomatic and not able to care for their neonate in a safe way
- iii. Separation of mother and neonate maybe necessary for neonates who are unwell or at higher risk of illness (e.g. preterm infants, infants with underlying medical conditions)

g. General care of the neonates

- Negative pressure isolation room if available.
- Recommended PPE must be worn by all attending HCW when attending to the mother and caring for the neonate (Refer to Annex 8: Infection Prevention and Control (IPC) Measures in Managing SUSPECTED COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia).
- All body fluids and linens are treated as potential biohazards.
- On arrival to the room, the neonate should be cleaned. Bathing should be considered in a stable term newborn. Baby should be weighed in the room. Vitamin K and immunization can be given. There is no contraindication to immunization.
- Soiled linen should be disposed of according to Annex 8: Infection Prevention and Control (IPC) Measures in Managing SUSPECTED COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia.
- Closed incubator should be used.
- Promptly notify infection control team.
- Complete the Communicable Diseases Notification Form (Refer Annex 7: Notification Form, Guidelines COVID-19 Management in Malaysia).
- Terminal cleaning and disinfection of the room should be done following discharge of the neonate (Refer Annex 8: Infection Prevention and Control (IPC) Measures in Managing SUSPECTED COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia - Terminal Cleaning of an Isolation Room.

4. Clinical Manifestations

4.1. Clinical Findings

- a. Neonates with COVID-19 infection are classified according to the presence or absence of apparent symptoms and signs.
- b. The clinical manifestations may be asymptomatic, mild, or severe.
- c. Clinical findings, especially in premature infants, are non-specific.
- d. Therefore, it is important to closely monitor vital signs, respiratory and gastrointestinal symptoms and signs. The signs may include:
 - Temperature instability: the temperature of an infected neonate may be elevated, depressed, or normal
 - Respiratory and cardiovascular signs may include tachypnea, grunting, nasal flaring, increased work of breathing (WOB), hypoxia, apnea, cough, or tachycardia.
 - Gastrointestinal symptoms may include vomiting and loose stools
 - Other findings may include poor feeding and lethargy

4.2. Laboratory findings

- a. Laboratory examinations may be non-specific.
- b. Full blood count (FBC) may show normal or decreased leukocyte counts, or decreased lymphocyte counts.
- c. Other findings include:
 - I. mild thrombocytopenia, and
 - II. elevated levels of creatine kinase, alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, and lactate dehydrogenase.
- d. COVID-19 can be detected in the
 - Upper respiratory tract (URT; nasopharyngeal and oropharyngeal)
 - Lower respiratory tract (LRT; endotracheal aspirate, or bronchoalveolar lavage)
 - Blood
 - Stool

4.3. Radiography findings

- a. Chest radiograph or lung ultrasound is likely to show evidence of pneumonia.
- b. Abdominal radiograph may show the characteristic radiographic features of intestinal ileus.

5. Guidelines for Management of Neonates with Suspected or Confirmed COVID-19 Infection

- a. Table 1: Guidelines for Management of Asymptomatic Neonates
- b. Table 2: Guidelines for Management of Symptomatic Neonates
- c. Table 3: Guidelines for Management of Symptomatic Neonates Exposed to Postnatal Contact with confirmed or probable COVID-19 Infection

Table 1: Guidelines for Management of Asymptomatic Newborns

Maternal COVID-19 Status/ Result	Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay	Discharge Criteria for Neonate
RT-PCR SARS-CoV-2 POSITIVE OR Sample taken pending results	<ul style="list-style-type: none"> RT-PCR nasopharyngeal swab/aspirate Indicated within 24 hours after birth if mother's result is positive 	NEGATIVE	Not indicated	<ul style="list-style-type: none"> Close monitoring and supportive care Repeat second sample after 48-72hours 	<ul style="list-style-type: none"> If both the neonate's samples are negative, neonate can be discharged according to the usual unit practice. <ol style="list-style-type: none"> The neonate will be designated as '<i>Person under Surveillance</i>' (Refer Annex 12: Management of Close Contacts of Confirmed Case) The neonate can be discharged to home if there is a healthy (non-infected) caregiver or when mother is discharged. Home surveillance under supervision and observation order. Notify PKD Parents/caregiver to continue monitoring at home using Neonatal Home Assessment Tool to complete for 14 days after the date of their first sample

Maternal COVID-19 Status/ Result	Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay	Discharge Criteria for Neonate
RT-PCR SARS-CoV-2 POSITIVE OR Sample taken pending results	<ul style="list-style-type: none"> RT-PCR nasopharyngeal swab/aspirate Indicated within 24 hours after birth if mother's result is positive 				e. Refer No 9: Post discharge management for neonates who are close contact <i>/Person Under Surveillance</i>
		POSITIVE	FBC CRP	<ul style="list-style-type: none"> Close monitoring and supportive care Repeat second sample after 48-72hours/ clinically indicated Consider consultation with ID team 	<p>The neonate can be discharged from the infectious disease ward or released from the COVID-19 Care Pathway after fulfilling the following criteria #:</p> <ol style="list-style-type: none"> If the neonate remains well for 10 days after the date of their first positive RT-PCR for SARS CoV-2 The neonate can be discharged to home if there is a healthy (non-infected) caregiver or when mother is discharged Home surveillance is not required Refer no 9: Post Discharge Management for Neonates who are confirmed COVID-19

Note: No COVID-19 test is required before neonate is discharged from the ward (Refer Annex 2: Management of suspected, probable and confirmed COVID-19 case)

Table 2: Guidelines for Management of Symptomatic Newborns

Maternal COVID-19 Status/ Result	Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay	Discharge Criteria for Neonate
RT-PCR SARS-CoV-2 POSITIVE OR Sample taken pending results	<ul style="list-style-type: none"> RT-PCR nasopharyngeal swab/ aspirate or tracheal aspirate (lower respiratory preferred if intubated) Indicated soon after birth 	POSITIVE	<ul style="list-style-type: none"> FBC CRP Blood Culture Chest radiograph Other investigations according to local unit guidelines Consider other viral infections: send SARI panel for detection of other viruses including influenza, enterovirus 	<ul style="list-style-type: none"> Medical management is according to neonatal unit guidelines for neonatal sepsis. Antibiotics to treat neonatal sepsis should be considered Consultation with paediatric infectious disease team 	<p>The neonate can be discharged from the infectious disease ward or released from the COVID-19 Care Pathway when fulfil the following criteria #:</p> <ol style="list-style-type: none"> At least 10 days have passed since onset of symptoms AND at least 24 hours have passed since resolution of fever without the use fever reducing medications AND symptoms (respiratory, gastrointestinal and systemic) have improved The neonate can be discharged to home if there is a healthy (non-infected) caregiver or when mother is discharged Home surveillance is not required Refer no 9: Post Discharge Management for Neonates

Maternal COVID-19 Status/ Result	Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay	Discharge Criteria for Neonate
					who are confirmed COVID-19
		NEGATIVE	<ul style="list-style-type: none"> • FBC • CRP • Blood Culture • Chest radiograph • Other investigations according to local unit guidelines • Consider other viral infections: send SARI panel for detection of other viruses including influenza, enterovirus. 	<ul style="list-style-type: none"> • Medical management is according to the neonatal unit guidelines for neonatal sepsis • Antibiotics to treat neonatal sepsis should be considered • If mother is POSITIVE, repeat sample after 48-72hours • If the mother's first sample is NEGATIVE, it is not indicated to collect second sample for the neonate 	<ul style="list-style-type: none"> • If mother's first sample is <u>negative</u>, the neonate can be discharged according to usual unit practice. Home surveillance is not required • If mother is <u>positive</u>, and both the neonate's samples are negative, neonate can be discharged according to the usual unit practice. <ul style="list-style-type: none"> ○ The neonate will be designated as '<i>Person under Surveillance</i>' (Refer Annex 12: Management of Close Contacts of Confirmed Case) ○ The neonate can be discharged to home if there is a healthy (non-infected) caregiver or when mother is discharged ○ Home surveillance under supervision and observation order. Notify PKD ○ Continue monitoring at home by parents/caregiver using Neonatal Home Assessment Tool to complete for 14 days

Maternal COVID-19 Status/ Result	Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay	Discharge Criteria for Neonate
					after the date of their first sample <ul style="list-style-type: none"> Refer No 9: Post discharge management for neonates who are <i>Person Under Surveillance</i>

Note: No COVID-19 test is required before neonate is discharged from the ward (Refer Annex 2: Management of suspected, probable and confirmed COVID-19 case)

Table 3: Guidelines for Management of Symptomatic Neonates Exposed to Postnatal Contact with COVID-19

Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay+	Discharge Criteria for Neonate
<ul style="list-style-type: none"> RT-PCR nasopharyngeal aspirate/swab or tracheal aspirate (lower respiratory preferred if intubated) Indicated soon after admission 	Positive	<ul style="list-style-type: none"> FBC CRP Blood Culture Chest radiograph Other investigations according to local unit guidelines Consider other viral infections: send SARI panel for detection of other viruses including influenza, enterovirus 	Medical management is according to neonatal unit guidelines in consultation with pediatric infectious disease team.	<ul style="list-style-type: none"> The neonate can be discharged from the infectious disease ward or released from the COVID-19 Care Pathway when fulfil the following criteria #: At least 10 days have passed since onset of symptoms AND at least 24 hours have passed since resolution of fever without the use fever reducing medications AND symptoms (respiratory, gastrointestinal and systemic) have improved Refer no 9: Post Discharge Management for Neonates who are confirmed COVID-19
	Negative		<p>Medical management is according to neonatal unit guidelines</p> <p>If the close contact is positive, repeat second sample after 48-72hours</p>	<ul style="list-style-type: none"> If the close contact is <u>negative</u>, the neonate can be discharged according to usual unit practice. Home surveillance is not required If the close contact is <u>positive</u> and both the neonate's samples are negative, the neonate can be discharged according to the usual unit practice. The neonate will be designated as 'Person under Surveillance' (Refer

Indication and Timing for COVID-19 Screening in Neonate	Neonate COVID-19 Result	Indication for Other Investigations	Management of The Neonate During Hospital Stay+	Discharge Criteria for Neonate
				<p><i>Annex 12: Management of Close Contacts of Confirmed Case)</i></p> <ul style="list-style-type: none"> • The neonate can be discharged to home if there is a healthy (non-infected) caregiver • Home surveillance under supervision and observation order. Notify PKD • Continue monitoring at home by parents/caregiver using Neonatal Home Assessment Tool to complete for 14 days after the date of their first sample • Refer No 9: Post discharge management for neonates who are <i>Person Under Surveillance</i> • •

Note: No COVID-19 test is required before neonate is discharged from the ward (Refer Annex 2: Management of suspected, probable and confirmed COVID-19 case)

6. Neonatal Management: Respiratory Support

A major concern when applying any type of respiratory support to patients with suspected or confirmed COVID-19 infection is the generation of aerosol-containing particles that can spread the disease.

- 6.1. For neonates born to mothers who are suspected, probable, confirmed or PUS
 - a. The need for respiratory support is less likely to be COVID-19 lung disease and more likely to be neonatal lung disease such as RDS, TTN, MAS, etc (low concentration of virus in respiratory secretions).
 - b. Consider nursing in negative pressure isolation room if available.
 - c. Neonates should be cared for in an incubator.
 - d. Surfactant administration by intratracheal/ less invasive surfactant administration (LISA) or minimally invasive surfactant therapy (MIST) is considered aerosol generating procedure (AGP). Both the person carrying out the procedure and the assistant should use recommended PPE (including N95 mask/PAPR and face shield) according to Annex 8: Infection Prevention and Control (IPC) Measures in Managing SUSPECTED COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia
 - e. Intubation/extubation, non-invasive ventilation, mechanical ventilation, tracheal suctioning are AGPs. PPE should be used according to Prevention and Control (IPC) Measures in Managing SUSPECTED COVID-19 or Confirmed COVID-19, Guidelines COVID-19 Management in Malaysia.
 - f. Endotracheal intubation should be performed by a skilled person. If available, use a video laryngoscopy system to maintain some distance from the neonate's airway. An appropriately sized ET should be used to avoid excessive leak.
 - g. Respiratory support as per neonatal unit guidelines should be used.
 - h. Term infants with mild respiratory distress can be treated with nasal cannula oxygen less than 2L/min.
 - i. If bag and mask is required, the use of self-inflating bag or T-piece resuscitator with bacterial/viral filter is recommended (Figure 1).

j. Non-invasive ventilation

- Use of non-invasive ventilation is acceptable as long as all protective measures are in place.
- Ensure careful fitting of the interface.
- If indicated, NIV should be delivered by ventilator or dual limb NIV. A viral/bacterial/HEPA filter should be placed on the expiratory limb. Viral /bacterial/HEPA filter cannot be placed on a single limb NIV.
- Bubble CPAP use is not encouraged. If bubble CPAP has to be used, a viral or bacterial filter should be placed in the expiratory limb (before the water reservoir).
- The bacterial/viral/HEPA filter should be replaced every 24 hours or earlier if soiled.
- Use single-use disposable tubing and disposable humidifier chamber.

k. Mechanical ventilation

- There is no evidence to recommend any mode. Follow unit guidelines.
- Compulsory to use closed circuit (in line) suction catheter.
- Single-use dual heating ventilator tubing with disposable heated humidifier chamber should be used.
- HEPA/viral/bacterial filter should be placed on the expiratory limb of ventilator circuit as shown in Figure 2. Filter should be changed every 24 hours or earlier if soiled.
- Avoid any disconnection from ventilator circuit.
- Sedation maybe considered according to unit guidelines.
- Cluster all nursing cares to minimise exposure/contact to patient
- No routine respiratory physiotherapy.



Figure 1:
Self-inflating bag with bacterial /
viral filter attached



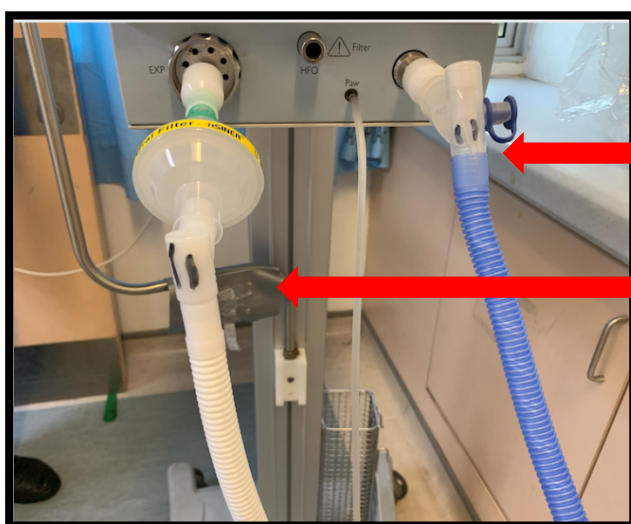
Figure 2:
HEPA filter at expiratory limb of
ventilator circuit

6.2 For neonates admitted with acute respiratory tract infection after postnatal exposure to close contacts who are suspected, probable or confirmed COVID-19 infection (i.e. neonate is suspected to have COVID-19 infection)

- a. The need for respiratory support is more likely to be due to COVID-19 pneumonia/lung disease (high concentration of virus in respiratory secretions).
- b. Consider negative pressure isolation room if available.
- c. Neonate should be cared for in an incubator.
- d. Respiratory support as per neonatal unit guidelines should be used.
- e. If mild respiratory distress can be treated with nasal canula oxygen less than 2L/min.
- f. Early intubation and mechanical ventilation should be considered.
- g. Endotracheal intubation should be performed by a skilled person. If available, use a video laryngoscopy system to maintain some distance from the neonate's airway. An appropriately sized ET should be used to avoid excessive leak.
 - Non-invasive ventilation (NIV) as first line may be considered as long as protective measures are in place.
 - CPAP or bilevel CPAP is preferred to high flow nasal cannula (HFNC). No data are available for use of HFNC in neonates. NIV should be delivered by ventilator or dual limb NIV. A viral/bacterial/HEPA filter should be placed in the expiratory limb.
 - If these measures are not available, then intubation and mechanical ventilation should be considered. For neonates on trial of NIV, close monitoring is essential, and escalation of therapy should not be delayed if there is no improvement within 30-60 minutes.
- h. Mechanical ventilation
 - There is no evidence to recommend any mode. Follow unit guidelines.
 - Compulsory to use closed circuit (in line) suction catheter.
 - Use single-use dual heating ventilator tubing.
 - For airway humidification, heat moisture exchange filters (HMEF) at the inspiratory limb is preferred to reduce aerosol contamination (Figure 3a

and 3b). However, there is also no strong evidence for its use in neonates.

- HMEF should be changed every 24 hours or earlier if soiled.
- Heated humidification should be used once the neonate's COVID-19 swab is negative.
- Place HEPA/viral/bacterial filters on the expiratory limb of ventilator circuit as shown in Figure 2 and Figure 3a. Filter should be changed every 24 hours or earlier if soiled.
- Avoid any disconnection from ventilator circuit.
- Sedation maybe considered according to unit guidelines.
- Cluster all nursing cares to minimise exposure/contact to patient.
- No routine respiratory physiotherapy.



Inspiratory limb of ventilator circuit

Figure 3A:
Viral Filter at expiratory limb of ventilator circuit, before the ventilator exhalation valve
No heated humidifier

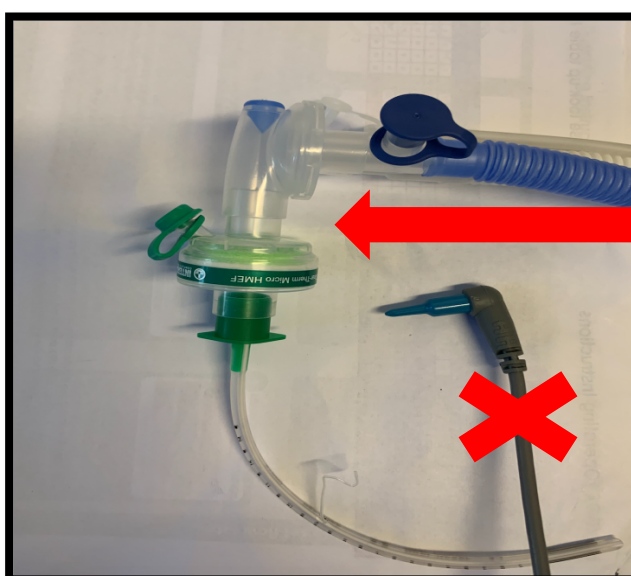


Figure 3B:
HMEF at inspiratory limb of ventilator circuit

Temperature probe used with heated humidifier is not required

7. Neonatal Management: Nutritional Support

- a. Current evidence is limited but there is no evidence showing transmission can occur via breastmilk. However, droplet transmission could occur through close contact during breast feeding
- b. A shared decision between healthcare provider and mother before delivery regarding the potential risks and benefits of breast feeding is necessary to choose optimal nutrition for these infants. The risk of holding the baby in close proximity where the mother maybe infected, should be discussed with the parents.
- c. Depending upon the availability of resources, equipment, patient volume, potential risk of exposure to the HCWs and parents understanding of the potential risk of exposure to the baby, three feeding options are recommended
- d. Each hospital should develop individual guideline on feeding options and the safe use, expression, transportation, handling, storage and administration of expressed breast milk to reduce risk of exposure to HCW.
- e. The feeding options are:
 - i. **Breast feeding**
 - Parents should understand that the risk of transmission with this approach is uncertain but possible. Breast feeding can be allowed for well neonate rooming in with an asymptomatic mother. The mother should take all possible precautions to avoid spreading the virus to her baby, including
 - Mother to practise meticulous breast and hand hygiene with soap and water before breast feeding.
 - Mother to wear a surgical mask when breastfeeding the baby.
 - Educate mother to avoid coughing or sneezing on the baby while breast feeding.
 - ii. **Feeding expressed breastmilk (EBM) by a HCW**
 - This feeding option maybe considered if parents and health care providers prefer to limit risk of transmission. Feeding EBM by HCW is allowed for neonates rooming in with an asymptomatic mother or neonates isolated and separated from mother.
- f. **Guidelines for expressing, handling and transporting breast milk:**
 - Clean the surface where the collection containers will be placed before and after pumping.

- Prior to expressing breast milk, the mother should practise meticulous hand hygiene with soap and water and wash her breast with soap and water.
- The mother should wear a surgical mask when expressing and handling expressed breast milk.
- The mother can express her breast milk either by hand or by using a breast pump.
- Ensure all containers containing EBM are not externally contaminated by wiping the outside of the container/bottles with alcohol/sanitizing wipe.
- HCW assisting the mothers during expression of breast milk should wear appropriate PPE according to MOH guidelines.
- HCW handling and transporting the EBM to the baby should wear appropriate PPE according to MOH guidelines.
- A dedicated breast pump should be used.
- After each pumping session, ALL breast pump parts should be thoroughly washed, and the entire pump should be appropriately disinfected per the manufacturer's instructions.
- EBM of these mothers should not be stored together with EBM from non-infected mothers.
- However, it should be noted that the precautions, as described above, for reducing potential transmission of COVID-19, has not been formally studied.

iii. **Feeding infant formula**

- This option is for neonates whose mothers are unwell to breastfeed or to express breast milk and for mothers who have chosen formula to feed the baby

8. Discharge Criteria

Refer Table 1, 2 and 3.

9. Post Discharge Management:**i) Neonates who are close contact (Person Under Surveillance)***Refer Annex 12: Management of Close Contacts of Confirmed Case)*

- a. Home surveillance under supervision and observation order.
- b. Notify Pejabat Kesihatan Daerah (PKD)
- c. Parents/caregiver must continue monitoring at home using Neonatal Home Assessment Tool (Appendix 1) to complete for 14 days after the date of their first sample
- d. If the neonate develops symptoms, consult with Pediatric Infectious Disease team for arrangement of admission to hospital

ii) Neonates who are confirmed COVID-19

- a. Home surveillance is not required
 - b. For neonates with co-morbidities, an appointment for follow-up should be arranged at the nearest health facilities and adequate supply of medications should be ensured until the next appointment. . Brief summary should be prepared upon discharge.
 - c. Upon discharge, the parents/caregiver should be provided with the hospital's contact number.
- **Infection-prevention education should be given to all caregivers of the neonate**

APPENDIX 1: Neonatal Home Assessment Tool

Nama	:	
No. Kad Pengenalan Ibu/ MyKid	:	
No. Telefon	:	Bimbit: Rumah:
Alamat Rumah	:	
Tarikh Pendedahan Terakhir Kepada Kes*	:	

- Senaraikan KESEMUANYA, gunakan muka surat yang seterusnya – jika perlu

JADUAL PEMANTAUAN HARIAN BAYI**ARAHAN:**

Bagi sebarang gejala yang dilaporkan oleh kontak, sila tandakan (✓) pada ruang yang berkenaan.

Hari 1	Hari 2	Hari 3	Hari 4	Hari 5
Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....
Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()

Hari 6	Hari 7	Hari 8	Hari 9	Hari 10
Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....

Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()
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Hari 11	Hari 12	Hari 13	Hari 14
Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....	Tarikh:/...../.....
Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()	Gejala : Demam () Batuk () Nafas Laju () Kurang Menyusu () Kurang Aktif ()

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