

Management of Pediatric Patient with Suspected/Confirmed Covid-19 Infection

Guidelines for Pediatric Critical Care Units in Saudi Arabia

Background:

At this point in time, there is no evidence that children have a greater risk for COVID-19. The greatest number of reported infections are occurring in the adult population. There have, however, been some reported infections in children, most resulting in minor respiratory infections and flu-like symptoms. Still, some children may develop severe disease that warrants PICU admission.

Aims and scope:

To optimize PICUs preparedness and management of pediatric COVID-19 patients, the MOH prepared this guideline in August 2021.

The specific objectives of the COVID-19 clinical pathways are to:

- Guide hospital-based providers on how to evaluate and diagnose children with a possible severe COVID-19 infection.
- Direct hospital-based providers on how to appropriately triage patients with possible COVID-19 infection, including when to consult PICU team.
- Ensure medical staff apply proper isolation and personal protective equipment procedures

Targeted Population:

All pediatric patients who are suspected/ confirmed COVID-19 infection in the ED, hospital wards, and PICUs.

Targeted End User:

- Pediatric Emergency Medicine physicians.
- Pediatric Critical Care Medicine physicians.
- Pediatric Critical Care and Emergency Medicine Nurses.
- Pediatricians

Methodology used:

The guideline was developed by doing a literature review of all pediatric related articles on COVID-19 from 2019 till August 2021 by 3 reviewers and coming up with written document. The key words used for search were: Pediatric, Children, Critical, Pediatric Intensive Care, COVID-19, MIS-C, SARS-CoV-2, Management, Infection Control. The next step was having a meeting with 12 consultants from PICU, rheumatology, Infectious disease, and general pediatricians. Final revision was done with meeting representatives of tertiary PICUs from different area of the kingdom of Saudi Arabia from MOH hospitals and experts from other non-MOH hospitals. Conflict was solved by discussion and voting.

Disclaimer:

These clinical pathways have been summarized specifically for use at PICUs in Saudi Arabia and are made available for informational and educational purposes only. The clinical pathways are not intended to be, nor are they, a substitute for individualized professional medical judgment, advice, diagnosis, or treatment. Although the designated committee made all efforts to ensure the accuracy of the contents, we make no warranty of any kind as to the completeness of the information or its fitness for use at any particular facility or in any individual case, as the COVID-19 pandemic keeps evolving.

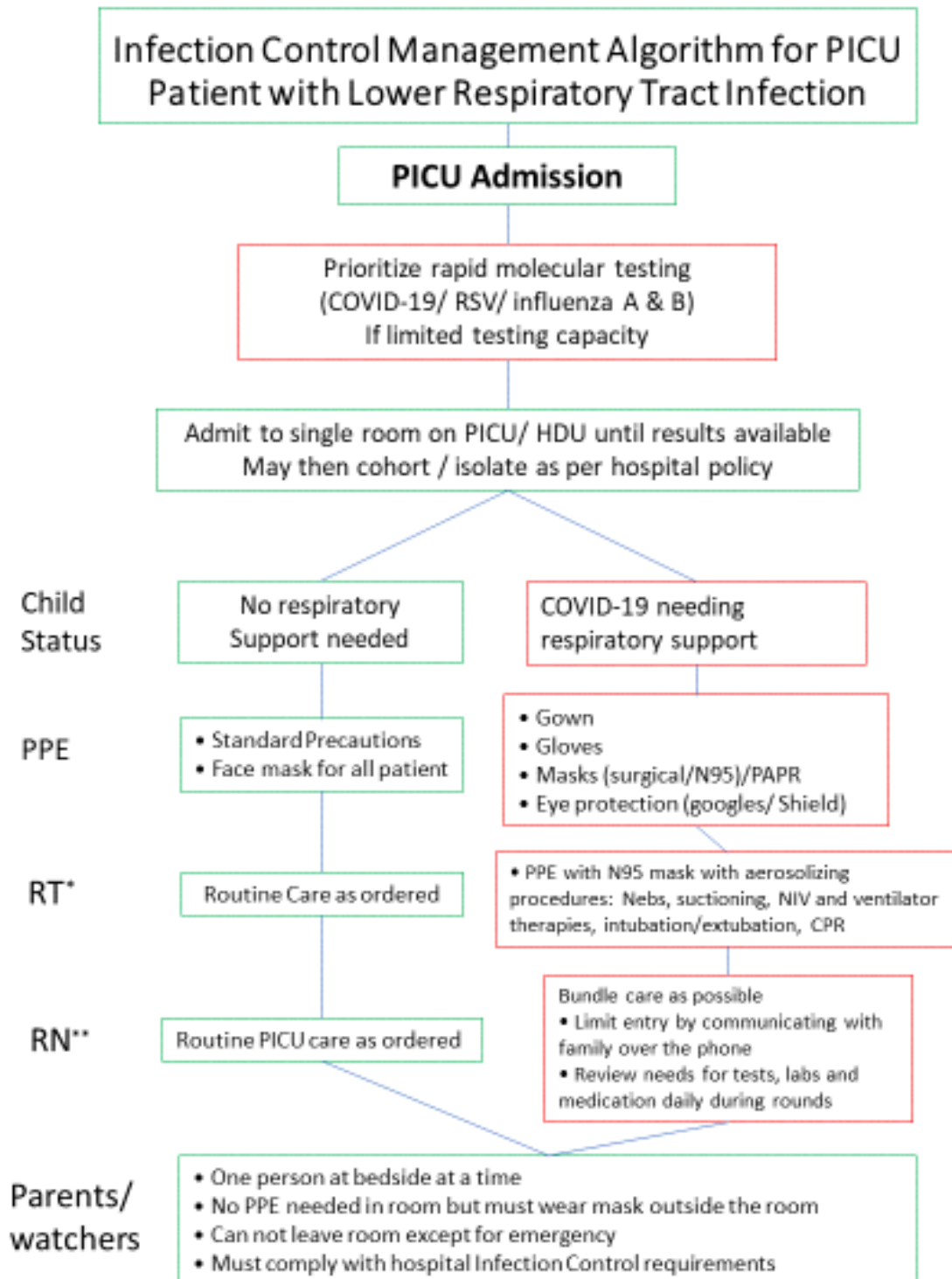
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1. Essential infection control precautions for Pediatric COVID-19 patients:

- Coronavirus (COVID-19) is mainly transmitted by droplets (human to human especially from coughing or sneezing) and by contact (when touching contaminated surfaces then touching the mouth, nose or eye) as declared by WHO.
- It strongly recommended to be handled as air-borne disease as many infected cases can't be explained by above mechanisms, especially during aerosol generating interventions.
- Coronavirus (COVID-19) is characterized by its ability to spread rapidly among healthcare staff who are not properly protected.
- It can be difficult to rapidly diagnose, and suspected cases should be handled as confirmed until proven otherwise.
- The key infection control considerations for all healthcare staff managing critically ill children with suspected/confirmed COVID-19 are:
 - Safe isolation
 - Wearing of Personal Protective Equipment (PPE)
 - Strict adherence to above precaution when transferring suspected/confirmed Covid-19 cases

2. Infection Control Management Algorithm for PICU Patient with LRT Infection:



*RT: Respiratory Therapist, **RN: Registered Nurse

3. The Golden Rule: Plan ahead (do not rush)

This document serves as a reference only for management of patients admitted to PICU with moderate to severe COVID-19 infection. It can be modified according to individual case scenario and the feasibility of resources in PICU settings.

Infection Control Recommendations for COVID-19 suspected/confirmed cases in PICU

- All PICU staff should get fit-tested & trained to use of N95 respirator masks (or PAPR) as they are expected to be assessing or caring for suspected/confirmed cases of COVID-19
- All PICU staff should be trained in the safe donning & doffing of Personal Protective Equipment (PPE) & its appropriate use (training minimize errors and reduce staff exposure)
- Suspected patients should be placed in respiratory isolation (negative pressure room is strongly recommended when available) or a specified cohort area with HEPA filter
- Visitors should be prohibited or extremely restricted. If one parent/caregiver is exceptionally allowed to stay with the child, she/he should remain in the isolation room or cohorted area and should wear surgical mask as per hospital infection control policy.
- Transport of COVID-19 suspected/confirmed patient should be minimized and planned for very well and any investigation or procedure outside PICU should be considered carefully (risk to benefit)

Comorbidities with possible increased risk

(Early PICU consultations or triaging decision)

- **Long term respiratory conditions**, including but not limited to:
 - Severe Asthma
 - Chronic lung disease of prematurity with oxygen dependency
 - Cystic Fibrosis
 - Interstitial Lung diseases
 - Respiratory complications in children with complex medical needs
- **Immunocompromised states**, including but not limited to:
 - Malignancy on active treatment with chemotherapy or radiotherapy
 - Post-transplantation
 - Immunosuppressive medication - including long-term steroid use
 - Congenital immunodeficiency
 - Asplenia - structural or functional
- **Cyanotic or Hemodynamically significant heart disease**
- **Chronic Kidney disease or patient on dialysis**
- **Younger age < 2 yrs**
- **Obesity**
- **Children with diabetes**

How to manage a pediatric cardiac arrest or pre-arrest in suspected/confirmed cases

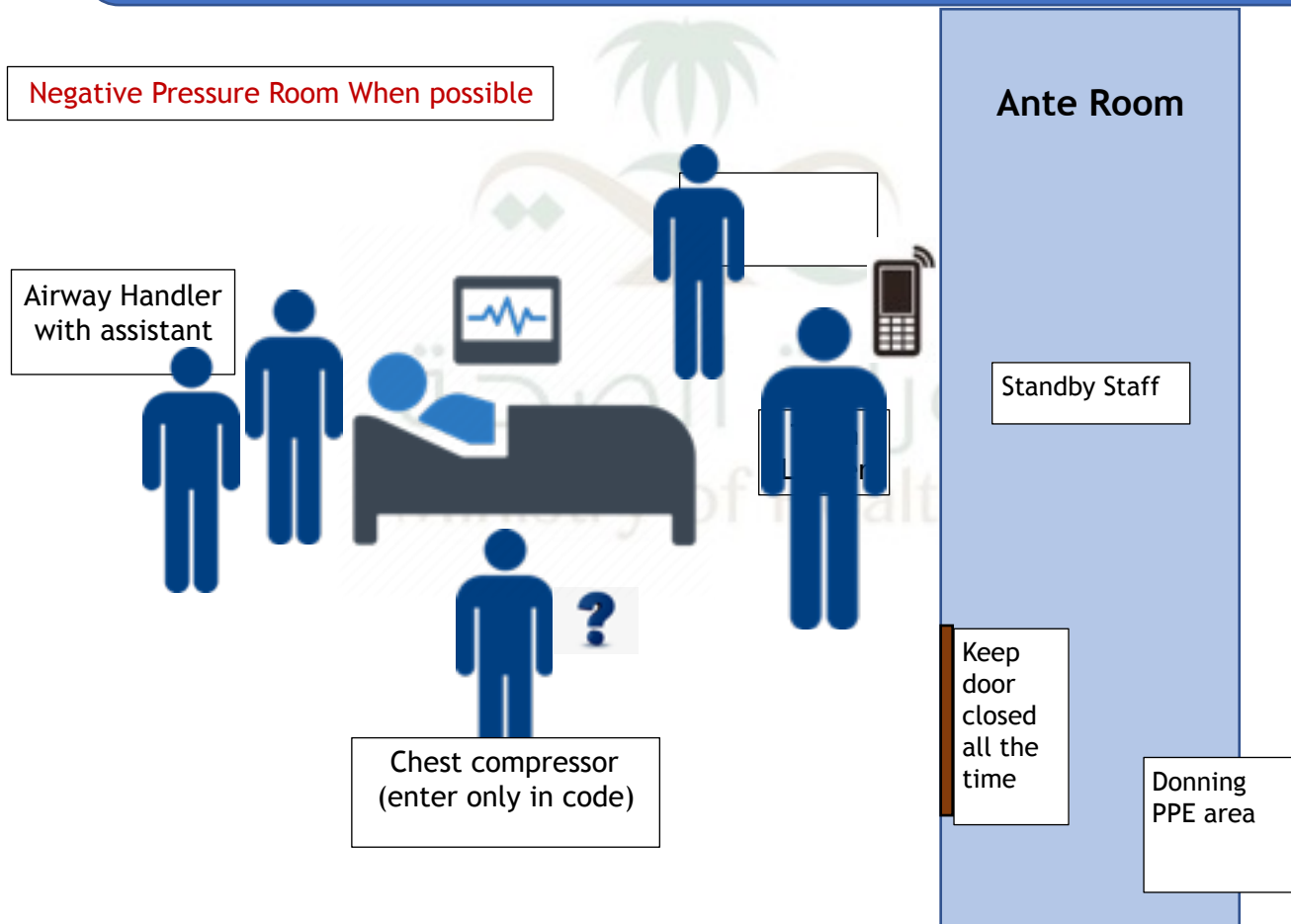
- Do not use the hospital cardiac arrest team and create COVID-19 code team if possible.
- All team members should be mask fit tested and able to don and doff PPE comfortably (practice).
- Lines of communication should be easily available to the team inside the room and the team outside
- Allow the least number of the team to enter the room as determined by code team leader (minimum 4).
- Keep equipment outside the room until needed.
- Most expert intubator undertakes first attempt at intubation.
- Consider airway adjuncts and video laryngoscopy.
- If the child is intubated and ventilated - try not to disconnect from the ventilator when doing CPR
- Cuffed ETT preferable with inflated cuff
- If plan for manual ventilation use small tidal volumes
- Ensure filter is placed between face mask and bag (or ETT and bag)
- If the crash trolley is used - dispose of all disposable contents within the isolation room before taking the trolley out of the room to be cleaned

- **Ensure Proper Donning/Doffing PPE with assistant**
(someone who observe and guide what you are doing to ensure your safety)



4. Code arrangements for pediatric COVID-19: Golden Rule:

Unstable, pre-arrest or arrest pediatric patients with suspected/confirmed COVID-19



Suggested COVID-19 Response Team Role distribution in Critical Situation/±Code

Minimize number of team members, Anticipate and prepare ahead

Only essential equipment needed for patient care will be placed inside the patient room

5. Special considerations for aerosol generating procedures in COVID-19 patients

- Procedures that produce aerosols of respiratory secretions, carry an increased risk of transmission.
- Re-useable equipment should be avoided if possible; if used, it should be decontaminated according to the manufacturer's instructions before removal from the room
- Use dedicated equipment in the isolation room.
- Avoid storing any extraneous equipment in the patient's room
- Dispose of single use equipment as per clinical waste policy inside room
- Ventilators should be protected with a high efficiency filter
- Closed system suction should be used

Aerosol Generating Procedures (AGPs)	Precautions
<ul style="list-style-type: none"> ➤ Intubation, extubation ➤ Bag & mask ventilation ➤ Open suction ➤ NPA swab test ➤ High Flow Nasal Cannula (HFNC) ➤ Non-invasive ventilation - CPAP, BiPAP ➤ Tracheostomy - insertion, removal, suction ➤ Bronchoscopy ➤ Dental procedures 	<ul style="list-style-type: none"> ✓ Require full PPE (N95 mask) ✓ Be undertaken in a negative pressure or at least single room with door closed and HEPA filter ✓ Avoided unless essential or proven to be clinically helpful ✓ Only staff required for the procedure or care of the patient should be present ✓ Do not enter or exit room during the procedure or open the door

6. Respiratory Support of children with COVID-19 respiratory distress/failure

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- Respiratory failure is very unlikely in children (< 5% symptomatic cases)
- Deterioration usually occurs in the 2nd week with tachypnea, dyspnea and mainly hypoxemia
- If SpO₂ <94%, administer Oxygen via simple nasal cannula or face mask
- **Connect the cannula to the patient first before turning the flow on to minimize aerosols generation**
- **Avoid HFNC to reduce work of breathing** if SpO₂ is adequate, as it is associated with significant droplet aerosolization & virus spread
- If hypoxia persists despite, HFNC can be tried, but should be commenced in a negative pressure room (if available) with full PPE
- If deterioration despite HFNC consider early intubation preferably done electively inside PICU with full preparation.

Important consideration:

- Both HFNC and NIV have been used in pediatric COVID-19.
- They can be used in suspected/confirmed cases if strict isolation precautions are adhered to - i.e. staff are in full PPE and patient is isolated as per infection control policy.
- However, the risk of aerosol generation with HFNC or NIV is considered to be high, and early intubation and invasive ventilation may be necessary in some cases.

Special Consideration for Mechanical Ventilation in COVID-19 cases

Adult data suggest variable pathophysiology of the disease at different stages and in different population.

Data is lacking for pediatric but generally, consider the following:

- Using high PEEP (8-10) when lung compliance is good is not advised.
- When ARDS present then high PEEP (10-15), low tidal volume and lung recruitment will be more suitable).
- When using high PEEP monitor mixed venous saturation and its impact on cardiac output
- Tidal volume 6-8 ml/Kg per IBW in compliant lung (4-6 in poor compliance)
- Prone positioning is recommended early with significant hypoxemia.
- HFOV can be used in severe hypoxemia case

7. Management of other manifestations/complications of COVID-19 pediatric patient in PICU

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Shock	No specific recommendations for COVID-19 infected pediatric patients. Please refer to Surviving Sepsis Campaign latest guidelines.
AKI	No specific recommendations
Myocardial involvement	it is emerging as one of most significant and life-threatening complication of COVID-19 in children. (see MIS-C section)
Other organ involvement	Supportive PICU care, no specific COVID-19 evidence based recommendations

8. Medication used in PICU for COVID-19 pediatric patients

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Antipyretics	Paracetamol is the 1st line anti-pyretic Avoid Ibuprofen in general especially with poor fluid intake or suspected Acute Kidney Injury
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Bronchodilators	Wheeze is not a common problem with COVID-19 as it is not a small airway disease but has been reported. Should not be routinely used unless wheeze or prolonged expiratory phase present. Use bronchodilators with MDI/spacer rather than nebulization, where possible, to minimize droplet spread
Steroids	See MOH COVID-19 guideline
Antimicrobials	Strongly recommended when signs of secondary bacterial infection are present especially with worsening clinical status few days after admission.
COVID-19 specific therapies	Consult ID as the recommendation is changing rapidly with more evidence evolving about the benefit vs harm. <i>Reference: Saudi MOH COVID-19 Guidelines Version 3.1 (including Pediatrics) 19 August 2021:</i> https://www.moh.gov.sa/Ministry/MediaCenter/Publications/Documents/MOH-therapeutic-protocol-for-COVID-19.pdf

9. PICU and Inpatient Clinical Pathway for Evaluation of Possible Multisystem Inflammatory Syndrome (MIS-C):

9. PICU and Inpatient Clinical Pathway for Evaluation of Possible Multisystem Inflammatory Syndrome (MIS-C):

- Criteria for diagnosis:

- Patient aged < 15 years presenting with fever (>38.0°C for ≥24 hours, or report of subjective fever lasting ≥24 hours), laboratory evidence of inflammation (Including, but not limited to, one or more of the following: an elevated CRP, ESR, fibrinogen, procalcitonin, D-dimer, ferritin, LDH, or IL-6; elevated neutrophils; reduced lymphocytes; and low albumin), and evidence of clinically severe illness requiring hospitalization, with multisystem (≥2) organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic or neurological)
- No alternative plausible diagnoses
- Positive for current or recent SARS-CoV-2 infection by RT-PCR, serology, or antigen test; or COVID-19 exposure within the 4 weeks prior to the onset of symptoms

- Definition:

- Mild symptoms: patients presenting with fever for ≥ 3 days and who are well-appearing (i.e., normal vital signs and reassuring physical examination) with only mild symptoms suggestive of MIS-C.
- Moderate to severe symptoms: patients presenting with fever along with one or more organ involvement (cardiac, renal, respiratory, hematological, gastrointestinal, dermatologic or neurological) or with elevated inflammatory markers.
- Inflammatory markers are measured at the time of admission and then serially to monitor progression based on clinical judgment. Similarly, if cardiac markers are elevated, they should be followed serially to monitor progression according to the clinical judgment.
- Children admitted to the hospital with MIS-C should be managed by a multidisciplinary team that includes general pediatric/ PICU, pediatric rheumatologists, cardiologists, infectious disease, and hematologists.
- **Management:**

- Patients with mild manifestations, as outlined, no further treatment is required and can be managed as outpatient with close follow up (see Appendix 1).
- Patients with moderate to severe manifestations, as outlined, need to be admitted to the ward or PICU as required and should receive IVIG (2 grams per KG), then if no improvement follow treatment pathway (see Appendix 1).

There are no established therapies for COVID-19-associated CSS or MIS-C. These medications are to be used only with guidance from Rheumatology, Cardiology and Infectious Diseases. Patients who are being evaluated for immunomodulatory therapy should also be considered for antiviral therapy if they are not already receiving it.

- Supportive Care: Children with moderate to severe signs and symptoms should be admitted to the hospital. Admission to a pediatric intensive care unit is appropriate for children with hemodynamic instability (shock, arrhythmia), significant respiratory compromise, or other potentially life-threatening complications
- Thromboprophylaxis (please refer to **Saudi MoH Protocol for Patients Suspected of/Confirmed with COVID-19**)
- Antiviral therapy (please refer to **Saudi MoH Protocol for Patients Suspected of/Confirmed with COVID-19**)
- Immunomodulator Dosing and Monitoring

Immunomodulator Dosing Safety monitoring

IVIG with methylprednisolone see below table "*Medication Related Information*"

MIS-C with or without features of Kawasaki disease or signs of myocardial dysfunction

OR

- Severe or critical COVID-19 with evidence of CSS IVIG 2 g/kg + methylprednisolone at 0.8 to 1 mg/kg every 12 hours (maximum of 30 mg for 12 hours) for 5 days
- IVIG 2 g/kg + methylprednisolone bolus of 15 to 30 mg/kg/d for 3 days Assess cardiac function and fluid status prior to giving to avoid fluid overload
- Baseline renal function tests, urine output, IgG level, CBC
- Monitor clinically for signs of hemolysis after first dose
- Potential adverse reactions: anaphylaxis,
- Infusion reaction, hemolysis, transaminitis, aseptic meningitis
- Pulmonary adverse reactions; blood pressure (prior to, during, and following infusion); clinical response.
- For patients at high risk of hemolysis (dose ≥ 2 g/kg, given as a single dose or divided over several days, and non-O blood type): Hemoglobin or hematocrit prior to and 36 to 96 hours post-infusion and again at 7 to 10 days post-infusion

Glucocorticoids

MIS-C with features of shock or coronary artery dilation/aneurysm

OR

Severe or critical COVID-19 with evidence of CSS

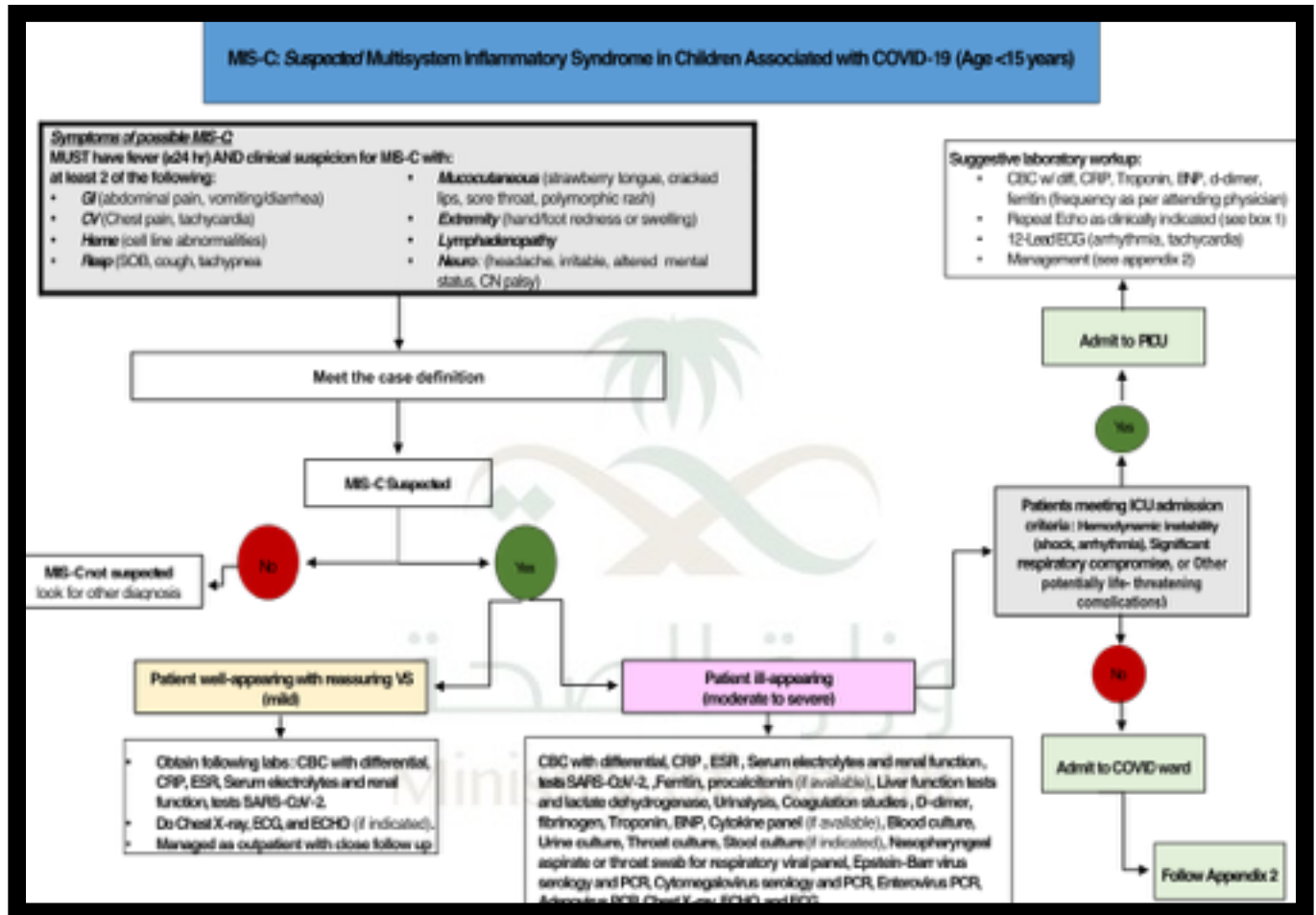
- 1-2 mg/kg/day divided BID (prednisone, prednisolone, methylprednisolone) 5 mg/m² daily (dexamethasone)

Please refer to **Saudi MoH Protocol for Patients Suspected of/Confirmed with COVID-19**

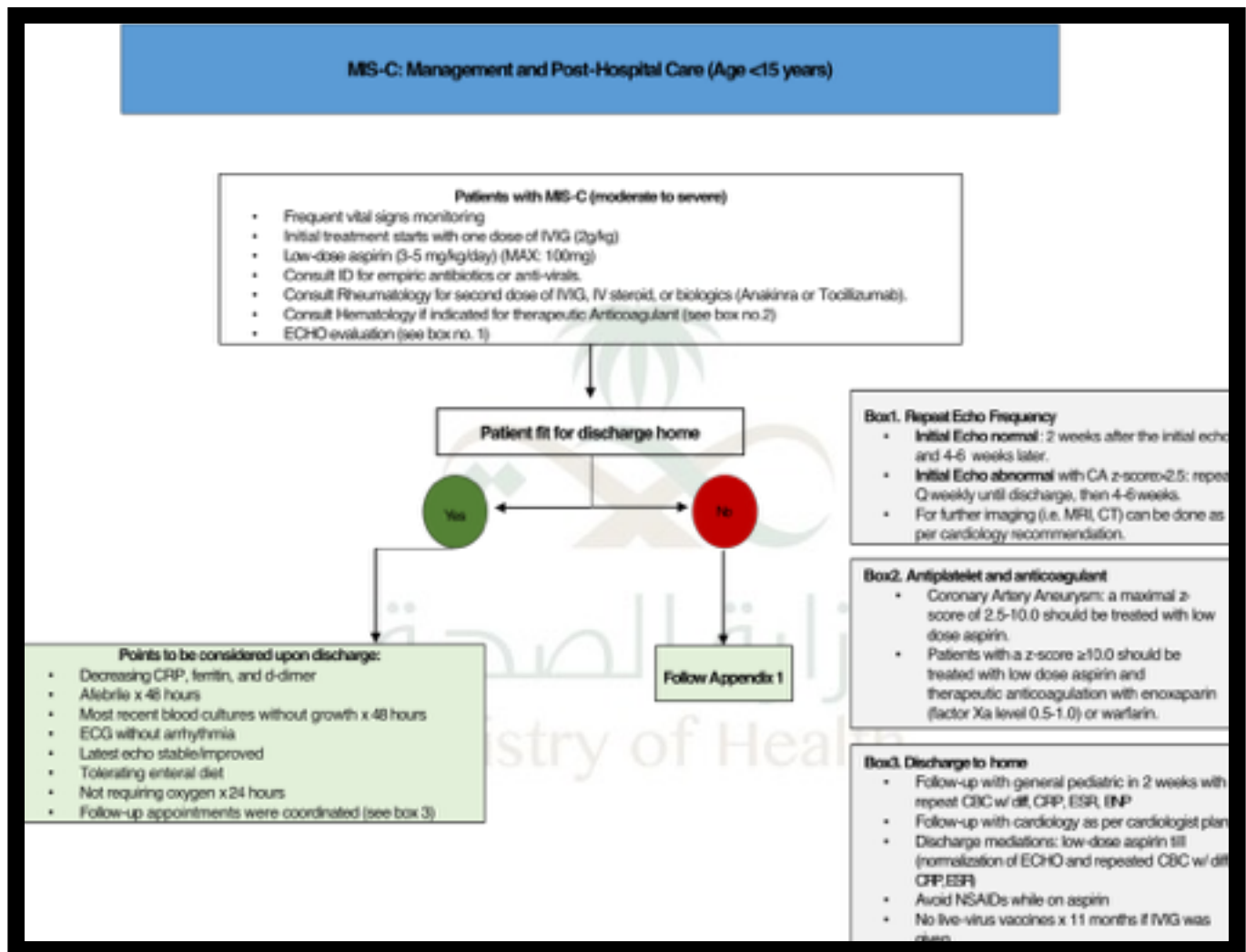
- **HOSPITALIZATION CRITERIA for MIS-C:**

- Any significant finding/abnormality as per attending team judgment
- Respiratory distress.
- Neurologic deficits or change in mental status (including subtle manifestations).
- Evidence of renal or hepatic injury.
- Abnormal ECG findings or abnormal levels of BNP or troponin T.
- Patient aged < 21 years presenting with fever ($>38.0^{\circ}\text{C}$ for ≥ 24 hours, or report of subjective fever lasting ≥ 24 hours), laboratory evidence of inflammation (Including, but not limited to, one or more of the following: an elevated CRP, ESR, fibrinogen, procalcitonin, D-dimer, ferritin, LDH, or IL-6; elevated neutrophils; reduced lymphocytes; and low albumin), and evidence of clinically severe illness requiring hospitalization, with multi-system (≥ 2) organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic or neurological)
- No alternative plausible diagnoses
- Positive for current or recent SARS-CoV-2 infection by RT-PCR, serology, or antigen test; or COVID-19 exposure within the 4 weeks prior to the onset of symptoms

Appendix 1



Appendix 2



References:

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