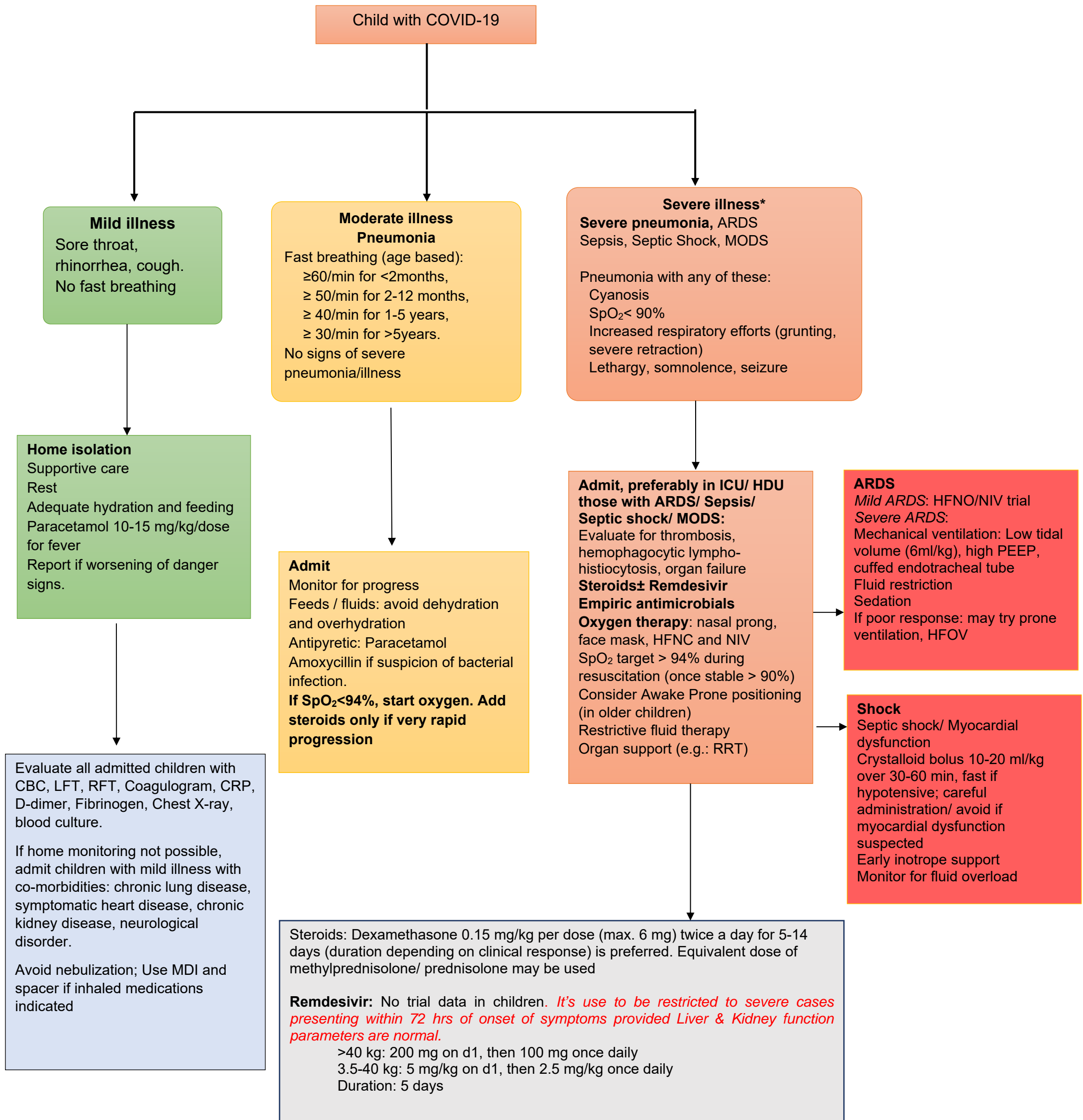


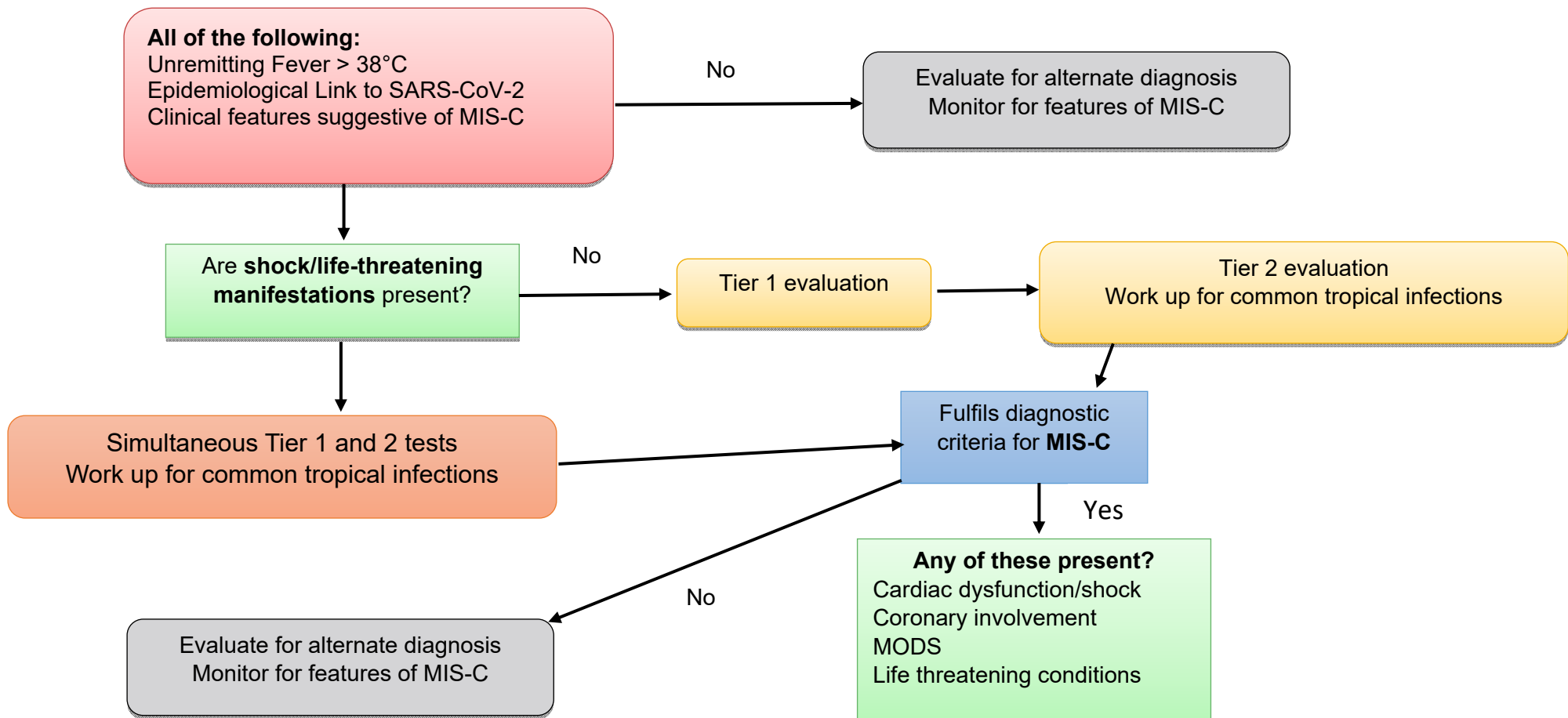
Management of COVID-19 in children (from 2 months to 18 years)



\* Includes Critical illness as defined by World Health Organization

For management of Multi System Inflammatory Syndrome in Children , refer to MIS-C protocol

**Management of Multisystem inflammatory syndrome in children and adolescents temporally related to COVID-19**



**Diagnostic Criteria for MIS-C**

- Children and adolescents 0–19 years of age with fever  $\geq 3$  days
- AND two of these:**
  - Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet).
  - Hypotension or shock.
  - Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities (including ECHO findings or elevated Troponin/NT-pro BNP),
  - Evidence of coagulopathy (by PT, PTT, elevated d-Dimers).
  - Acute gastrointestinal problems (diarrhoea, vomiting, or abdominal pain).
- AND**
  - Elevated markers of inflammation such as ESR, C-reactive protein, or procalcitonin.
- AND**
  - No other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes.
- AND**
  - Evidence of COVID-19 (RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19.

**Steroid** (Methylprednisolone 1-2 mg/kg/d)  
**+ IVIg** (2 g/kg over 24-48 hr)  
**+ Antimicrobials**

May start treatment while completing evaluation for tropical infections (depending on acuity of condition)

Rule out tropical infections first

**Steroid** (Methylprednisolone 1-2 mg/kg/d): first line,  
**OR**  
**IVIg** (2 g/kg over 24 hr to 48 hrs): alternative/first line, as per availability/feasibility

**If no improvement or worsening of symptoms, options include**

- Repeat IVIg and/ or High dose steroid (Methylprednisolone 10-30 mg/kg/d for 3-5 days)
- If unresponsive to above, may consider high dose Anakinra; 2-10 mg/kg/dose (max 100 mg/dose) SQ/IV q6-12h

**Aspirin** (indications: Thrombocytosis, or Coronary aneurysm Z-score  $\geq 2.5$ )

- Dosage: 3 - 5 mg/kg/day; max 81 mg/day

**Enoxaparin** (indications: Coronary aneurysm (Z-score  $> 10$ ) or Thrombosis or LVEF  $< 35\%$ )

- Dosage: 1 mg/kg twice daily SC
- Preferably monitor with factor Xa level 0.5- 1

- Taper steroids over 2-3 weeks while monitoring inflammatory markers
- For Children with cardiac involvement
  - Repeat ECG 48 hourly, Repeat ECHO at 7-14 days and between 4 to 6 weeks (and after 1 year, if initial ECHO was abnormal)

**Tier 1 Investigations (may be done at Covid Care Centre, Dedicated Covid Health Centre):** CBC, Complete metabolic profile (LFT/RFT/blood gas/glucose), CRP and/or ESR, SARS-CoV-2 Serology and/or PCR, Blood Culture

**Positive Tier 1 screen (both of these should be present):** 1. CRP  $> 5$  mg/dL and/or ESR  $> 40$  mm per hour; 2. At least one of these: ALC  $< 1000/\mu\text{L}$ , Platelet  $< 150,000/\mu\text{L}$ , Na  $< 135$  mEq/L, Neutrophilia, Hypoalbuminemia.

**Tier 2 Investigations (may be done at Dedicated Covid Hospital):** Cardiac (ECG, Echocardiogram, BNP, Troponin T); Inflammatory markers (Procalcitonin, Ferritin, PT, PTT, D-dimer, Fibrinogen, LDH, Triglyceride, Cytokine panel); Blood Smear; SARS-CoV-2 serology.

**Common tropical infections** include: Malaria, Dengue, Enteric fever, Rickettsial illness (scrub typhus), etc.

## 1. Background and Epidemiology:

WHO declared Covid – 19 caused by SARS CoV-2 as a public health emergency of international concern on 30<sup>th</sup> January 2020 and subsequently declared it to be a pandemic on 11<sup>th</sup> March 2020.

It is well documented that children are less commonly affected with this infection and majority of them are asymptomatic or mildly symptomatic. A small proportion (<10%- 20%) of symptomatic children may need hospitalization and 1% to 3% of symptomatic children may have severe illness requiring intensive care admission.

Direct person to person transmission occurs through close contact, mainly through respiratory droplets that are released when the infected person coughs, sneezes or talks. These droplets may also land on surfaces where the virus remains viable.

Median incubation period is 5.1 days (range 2 to 14 days). As per current evidence, the period of infectivity starts 2 days prior to onset of symptoms and lasts up-to 8 days.

## 2. Case definition ( As per WHO surveillance guidelines )

Suspect Case:

A. A patient with acute respiratory illness (fever and at least one sign/ symptom of respiratory disease, e.g. cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of Covid – 19 disease during the 14 days prior to symptom onset.

OR

B. A patient with any acute respiratory illness AND having been in contact with a confirmed or probable Covid – 19 case in the last 14 days prior to symptom onset;

OR

C. A patient with severe acute respiratory illness (fever and at least one sign/ symptom of respiratory disease, e.g.; cough, shortness of breath; AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation.

Probable Case:

A. A suspect case for whom RT – PCR testing for Covid – 19 virus is inconclusive.

OR

B. A suspect case for whom RT – PCR test could not be performed for any reason.

Confirmed Case:

A person/ child with laboratory confirmation of Covid – 19 infection irrespective of clinical signs and symptoms.

## 3. Clinical Features:

Majority of children with covid infection may be asymptomatic or mildly symptomatic. Common symptoms include- fever, cough, breathlessness/ shortness of breath, fatigue, myalgia, rhinorrhea, sore throat, diarrhea, loss of smell, loss of taste etc. Few children may present with gastrointestinal symptoms and atypical symptoms. A new syndrome with name of multi system inflammatory syndrome has been described in children. Such cases are characterized by: unremitting fever > 38°C, epidemiological linkage with SARS CoV – 2 and clinical features suggestive of Multi System Inflammatory Syndrome.

## 4. Management of children with Covid – 19 disease:

Children with Covid 19 infection may be asymptomatic, mildly symptomatic, moderately sick or severe illness.

**Asymptomatic** children are usually identified while screening, if family members are identified. Such children do not require any treatment except monitoring for development of symptoms and subsequent treatment according to assessed severity.

**Mild disease:** Children with mild disease may present with sore throat, rhinorrhea, cough with no breathing difficulty. Few children may have gastrointestinal symptoms also.

Such children do not need any investigations

These children can be managed at home with home isolation and symptomatic treatment.

For home isolation it is important to assess whether home isolation is feasible by following steps:

- i. There is requisite facility for isolation at his/her residence and also for quarantining the family contacts
- ii. Parents or other care taker who can monitor and take care of child

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- iii. If available, Arogya Setu App should be downloaded
- iv. The parents/care giver has agreed to monitor health of the child and regularly inform his/her health status to the Surveillance Officer/ doctor
- v. The parents/ care giver has filled an undertaking on self-isolation and shall follow home isolation/quarantine guidelines

Children with underlying comorbid condition including: congenital heart disease, chronic lung diseases, chronic organ dysfunction, Obesity (BMI > 2SD) may also be managed at home, if they have features of mild disease and there is easy access to health facility in case of any deterioration. In case there is lack of proper arrangement to manage these children at home/ access to health facility is difficult, such children may be admitted.

**Treatment of mild illness** in home isolation is symptomatic.

For Fever: Paracetamol 10-15 mg/kg/dose; may repeat every 4-6 hours  
For Cough: Throat soothing agents like warm saline gargles- in older children and adolescents  
Fluids & feeds: Ensure oral fluids to maintain hydration, and nutritious diet  
Antibiotics: Not indicated

**There is No role of** Hydroxychloroquine, Favipiravir, Ivermectin, lopinavir/ritonavir, Remdesivir, Umifenovir, Immunomodulators including Tocilizumab, Interferon B 1 a, Convalescent plasma infusion or dexamethasone.

**Monitoring at home:** Explain parents/ care taker to maintain a monitoring chart including counting of respiratory rates 2-3 times a day when child is not crying, looking for chest indrawing, bluish discolouration of body, cold extremities, urine output, oxygen saturation monitoring (hand held pulse oximeter) if feasible, fluid intake, activity level, esp for young children.

There should be regular communication to doctor or health care worker. Parents/ caregiver should be explained whom to contact in case of emergency.

#### **Management of children with Moderate Covid – 19 disease:**

A child with Covid-19 will be categorized as having moderate disease if he/ she has the following:

Rapid respiration as follows

Age: less than 2 months: respiratory rate  $\geq 60$ / min, Age: 2 to 12 months: respiratory rate  $\geq 50$ /min, Age: 1 to 5 years: respiratory rate  $\geq 40$ /min, Age: more than 5 years: respiratory rate  $\geq 30$ /min. And oxygen saturations above 90%.

Children with moderate Covid – 19 disease may be suffering from pneumonia which may not be clinically apparent.

**Investigations:** No lab tests are required routinely unless indicated by associated co-morbid conditions.

**Treatment:** Children with moderate Covid-19 disease should be admitted in Dedicated Covid Health Centre or Secondary level Healthcare Facility and monitored for clinical progress. Maintain fluid and electrolyte balance. Encourage oral feeds (breast feeds in infants); if oral intake is poor, intravenous fluid therapy should be initiated.

Children with moderate Covid – 19 disease should be administered:

- i. For fever: Paracetamol 10-15 mg/kg/dose. May be repeated every 4-6 hourly. (temperature > 38°C, i.e. 100.4°F).
- ii. Amoxicillin to be administered, if there is evidence/ strong suspicion of bacterial infection.
- iii. For SpO<sub>2</sub> below 94%, oxygen supplementation is required.
- iv. Corticosteroids may be administered in rapidly progressive disease. It is not required in all children with moderate illness, specifically during first few days of illness.
- v. Supportive care for comorbid conditions, if any.

#### **5. Management of children with Severe Covid-19 disease:**

Children with SpO<sub>2</sub> level less than 90% are categorized as having severe degree of Covid-19 infection. Such children may be having severe pneumonia, Acute Respiratory Distress Syndrome, Septic Shock, Multi-organ dysfunction syndrome (MODS), or pneumonia with cyanosis. Clinically, such children may present with grunting, severe retraction of chest, lethargy, somnolence, seizure.

Such children should be admitted in Dedicated Covid Hospital/ Secondary/ Tertiary level healthcare facility. Few children may require care in HDU/ICU areas of these facilities. They should be assessed for: thrombosis, haemophagocytic lymphohistiocytosis (HLH), and organ failure.

Investigations: Complete blood counts, liver and renal function tests, Chest X-ray

Treatment

1. Intravenous fluid therapy
  - i. Corticosteroids: Dexamethasone 0.15 mg/kg per dose (max 6 mg) twice a day is preferred. Equivalent dose of methylprednisolone may be used for 5 to 14 days depending on continuous clinical assessment.
  - ii. Anti-viral agents: Remdesivir is antiviral agent. There is lack of sufficient safety and efficacy data in children below 19 years of age. Randomized controlled trials of this drug in patients above 18 years of age has not shown significant survival benefits. An emergency use authorization for children has been granted. Till more data are available, it should be used in restricted manner in children with severe illness within three days of onset of symptoms after ascertaining that child's renal and liver functions are normal and they are monitored for side effects of medicine. Suggested doses if body weight > 40 kg: 200 mg on 1<sup>st</sup> day then 100 mg once daily for 4 days. If body weight is between 3.5 kg to 4 kg: 5mg/kg on 1<sup>st</sup> day, 2.5 mg/kg once daily for 4 days. **There is No role of** Hydroxychloroquine, Favipiravir, Ivermectin, lopinavir/ritonavir, Umifenovir.
  - iii. Children may need organ support in case of organ dysfunction; e.g. Renal Replacement Therapy.

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iv. Management of Acute Respiratory Distress Syndrome (ARDS): The principles of treatment are similar to that of ARDS due to any other underlying illness.

- Mild ARDS: High Flow Nasal Oxygenation, Non-invasive ventilation may be given.
- Severe ARDS: Mechanical ventilation may be given with low tidal volume ( $\leq 6$  mL/kg and High Positive End Expiratory Pressure).
- If the child does not improve clinically even then, may consider (if available) High Frequency Oscillatory Ventilation, Extracorporeal Membrane Oxygenation (ECMO).
- Awake prone position may be considered in older hypoxemic children if they tolerate.

Management of Shock: If the child develops septic shock or myocardial dysfunction then he/ she may require:

- Crystalloid bolus administration: 10 to 20 ml/kg over 30 to 60 minutes; be cautious if cardiac dysfunction is there.
- Early inotrope support with monitoring of fluid overload like any other cause of shock.

## 6. Management of Multisystem inflammatory syndrome in children and adolescents temporally related to COVID-19 (MIS-C):

A new syndrome with name of multisystem inflammatory syndrome as been described in children. Such cases are characterized by: unremitting fever  $> 38^{\circ}$  C, epidemiological linkage with SARS CoV – 2 and clinical features suggestive of Multi System Inflammatory Syndrome.

Diagnostic criteria of MIS-C in Children (WHO criteria): a constellation of clinical and laboratory parameters has been suggested for diagnosis. These include:

- Children and adolescents 0–19 years of age with fever  $\geq 3$  days

**AND** two of these:

- Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet).
- Hypotension or shock.
- Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities (including ECHO findings or elevated Troponin/NT-proBNP),
- Evidence of coagulopathy (by PT, PTT, elevated d-Dimers).
- Acute gastrointestinal problems (diarrhoea, vomiting, or abdominal pain).

**AND**

- Elevated markers of inflammation such as ESR, C-reactive protein, or procalcitonin.

**AND**

- No other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes.

**AND**

- Evidence of COVID-19 (RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19.

**Investigations:** as listed above in criteria and investigations to rule out common differential diagnoses.

### Treatment of MIS-C

Drugs to be used in case of Multi System Inflammatory Syndrome in Children in case the child has cardiac dysfunction, shock, coronary involvement, multi organs dysfunction (for details, see algorithm):

- i. Steroids: Methylprednisolone 1 to 2 mg/kg per day.
- ii. Intravenous Immunoglobulin 2 g/kg over 24 to 48 hours.
- iii. Antimicrobials

The child needs appropriate supportive care, preferably in ICU. In absence of cardiac dysfunction, shock, coronary involvement, multi organs dysfunction, one may use steroids or IVIG (for details, see algorithm)

If the child does not improve with the above treatment or deteriorates, options include:

- i. Repeat IVIg
- ii. High dose corticosteroid (Methylprednisolone 10 to 30 mg/kg/day for 3 to 5 days)
- iii. Aspirin: 3 mg/kg/day to 5 mg/kg/day max 81 mg/day (if thrombosis or Coronary Aneurysm Score is  $\geq 2.5$ )
- iv. Low Molecular Weight Heparin: Enoxaparin: 1 mg/kg twice daily subcutaneously. Clotting Factor Xa should be between 0.5 to 1 (if patient has thrombosis/ Coronary aneurysm score  $> 10$  or LVEF  $< 30\%$ )

Steroids have to be tapered over 2 to 3 weeks while monitoring inflammatory markers. For children with cardiac involvement, repeat ECG 48 hourly, repeat ECHO at 7 to 14 days and between 4 to 6 weeks and at 1 year if initial ECHO was abnormal.