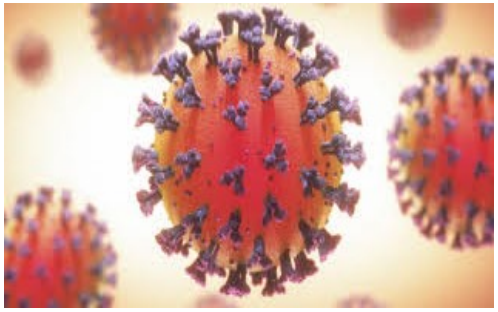
Protocol for Management of COVID-19 in Pediatric Age Group, Life Saving Techniques



Dr. Priyanshu Mathur

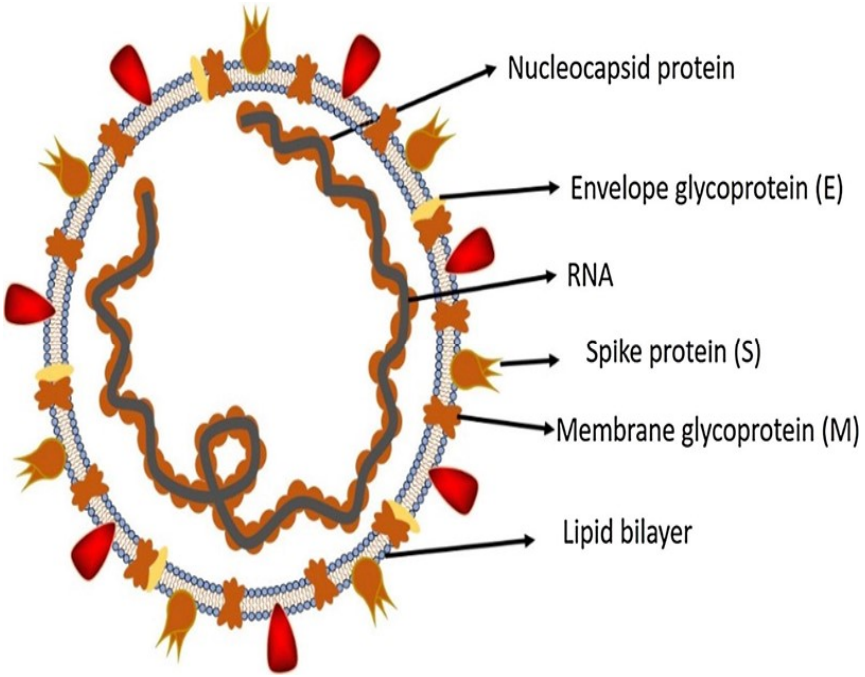
MD Pediatrics, Fellowship Metabolic Genetics & NBS (USA)

Associate Professor, Pediatric Medicine,

SMS Medical College, Jaipur

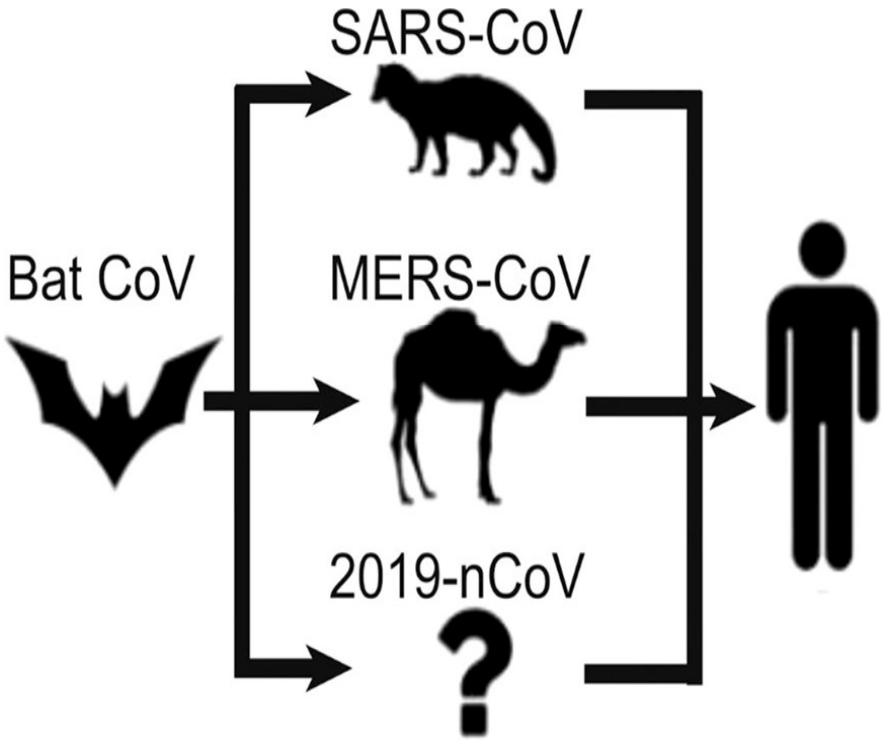
Email: priyanshu82@gmail.com

BACKGROUND – CORONAVIRUS



- Coronaviruses belong to the **Coronaviridae family** in the Nidovirales order.
- Corona represents **crown-like spikes** on the outer surface of the virus; thus, it was named as a coronavirus.
- Coronaviruses are **enveloped viruses, minute in size (65–125 nm in diameter)** and contain a **single-stranded RNA** as a nucleic material, size ranging from 26 to 32kbs in length.
- The coronaviruses are made up of **four structural proteins**, namely, the **spike (S), membrane (M), envelop (E) and nucleocapsid (N) proteins.**

HUMAN CORONAVIRUS ORIGINS



- The most likely ecological reservoirs for coronaviruses are **bats**, but it is **believed that the virus jumped the species barrier to humans from another intermediate animal host.**
- This intermediate animal host could be a **domestic food animal, a wild animal, or a domesticated wild animal** which has not yet been identified.

BACKGROUND - COVID-19

- COVID-19 caused by SARS CoV-2
- WHO declared it as a **public health emergency of international concern** on **30th January 2020.**
- WHO subsequently declared it to be a **pandemic** on **11th March 2020.**
- 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.**
- It is well documented that **children are less commonly affected with this infection and majority of them are asymptomatic or mildly symptomatic.**

EPIDEMIOLOGY

- Whereas children comprise 22% of the US population, approximately **14% of all cases of COVID-19 reported** to the Centers for Disease Control and Prevention (CDC) were **among children** (as of May 2021).
- In general, children develop **milder illness compared to adults**, but they are still at risk for severe illness and complications of COVID-19.
- A **small proportion (<10-20%) of symptomatic children may need hospitalization** and **1% to 3% of symptomatic children may have severe illness requiring admission into intensive care units.**
- It is important to **maintain broad differential while evaluating sick children during pandemic**; since children with SARS-CoV-2 infection may present with other serious conditions including intussusception or diabetic ketoacidosis.

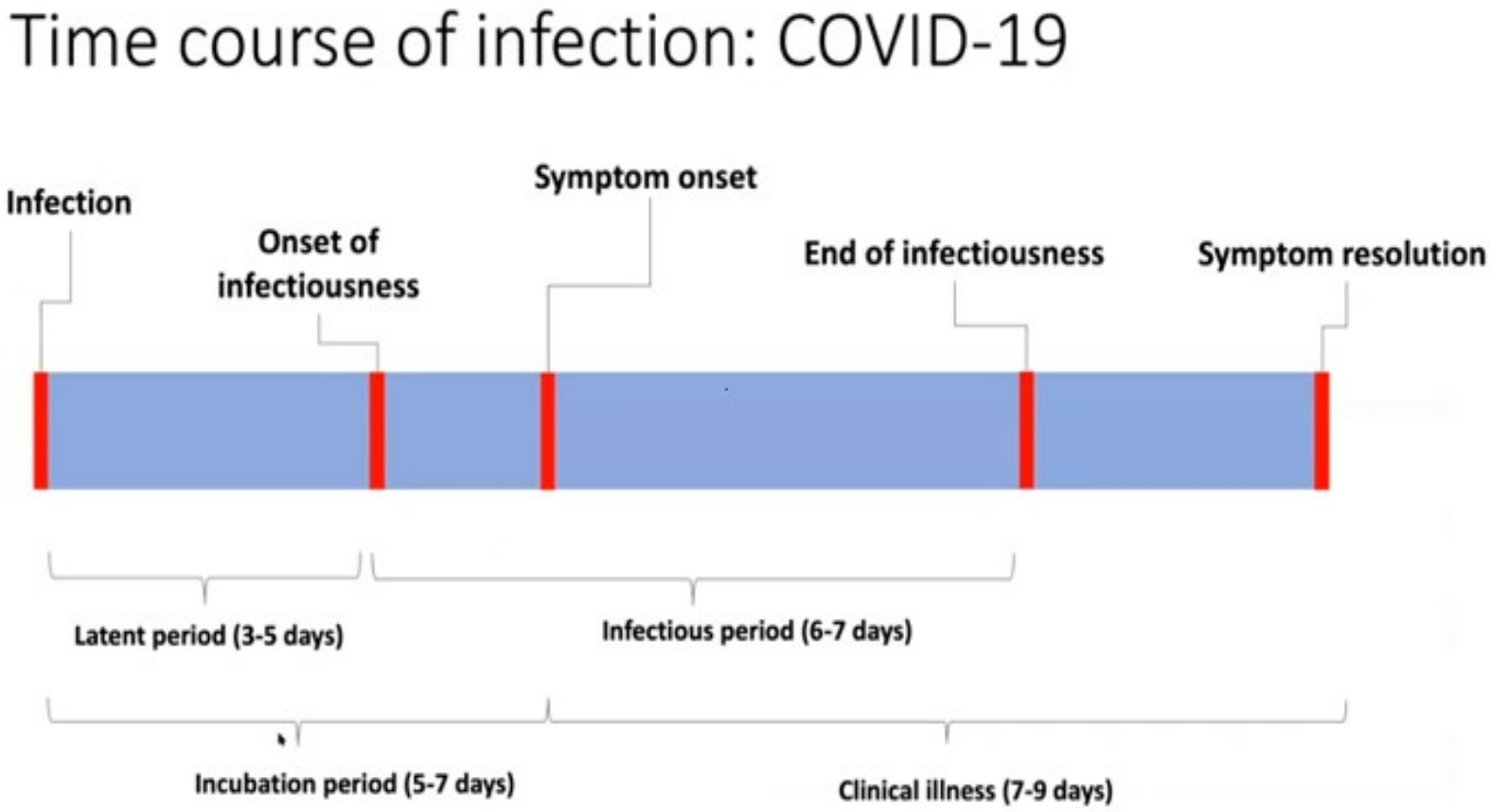
EPIDEMIOLOGY

- It is **unclear how well children transmit SARS-CoV-2** compared to infected adults.
- Testing for SARS-CoV-2 recommended in children
  i. **With symptoms of COVID-19**
  ii. **After close contact (< 6 feet distance for ≥ 15 minutes) with person with confirmed or probable SARS-CoV-2 infection**
  iii. **With planned invasive medical procedure scheduled**

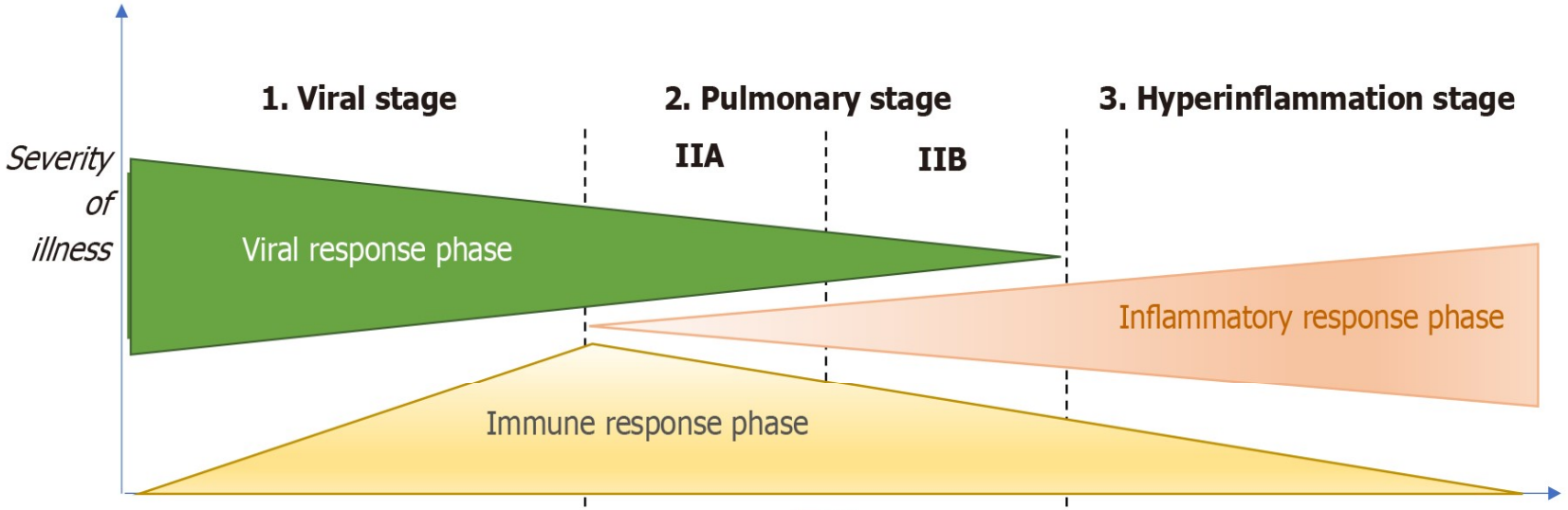
PATHOPHYSIOLOGY

- The virus is transmitted via **respiratory droplets and aerosols** from person to person.
- Once inside the body, the virus binds to **host receptors and enters host cells through endocytosis or membrane fusion.**
- **ACE-2** has been identified as a **functional receptor for SARS-CoV** and is **highly expressed on the pulmonary epithelial cells**.
- Virus binds through S (spike) protein, which composed of **two functional subunits (S1 and S2),** among which S1 is responsible for **binding to the host cell receptor** and S2 subunit plays a **role in the fusion of viral and host cellular membranes.**
- Postmembrane fusion, the virus enters the pulmonary alveolar epithelial cells and the viral contents are released inside.

TIME COURSE


Time course of infection: COVID-19
Infection
Onset of infectiousness
Symptom onset
End of infectiousness
Symptom resolution
Latent period (3-5 days)
Infectious period (6-7 days)
Incubation period (5-7 days)
Clinical illness (7-9 days)

PATHOPHYSIOLOGY



	1. Viral stage	2. Pulmonary stage	3. Hyperinflammation stage
Signs	Lymphopoenia, increased prothrombin time, D-dimer and LDH	Abnormal chest imaging, transaminitis Low-to-normal procalcitonin	Elevated inflammatory markers (CRP, LDH, IL-6, D-dimer, ferritin), troponin, NT-proBNP
Symp--toms	Constitutional symptoms, fever, dry cough, diarrhoea, headache, *etc*.	Shortness of breath hypoxia (PaO_2/FiO_2 < 300)	ARDS SIRS/Shock Cardiac failure

PATHOPHYSIOLOGY

Most patients with Covid-19 **predominantly have respiratory tract infection** associated with SARS CoV 2 infection.

1. **Asymtomatic phase**
2. **Invasion and infection of the upper respiratory tract**
3. **Involvement of the lower respiratory tract and progression to ARDS**

PATHOPHYSIOLOGY

1. **Asymtomatic phase –**

- This stage lasts a couple of days and the immune response generated during this phase is a limited one. In spite of having a low viral load at this time, the individuals are highly infectious, and the virus can be detected via nasal swab testing.

2. **Invasion and infection of the upper respiratory tract –**

- In this stage, the disease manifests with symptoms of fever, malaise and dry cough.
- There is a greater immune response during this phase involving the release of C-X-C motif chemokine ligand 10 (CXCL-10) and interferons (IFN-β and IFN-λ) from the virus-infected cells.
- The **majority of patients do not progress beyond this phase as the mounted immune response is sufficient to contain the spread of infection.**

PATHOPHYSIOLOGY

3. Involvement of the lower respiratory tract and progression to ARDS –

- The virus-laden pneumocytes now release **many different cytokines and inflammatory markers** such as interleukins (IL-1, IL-6, IL-8, IL-10 and IL-12), tumour necrosis factor-α (TNF-α), IFN-λ and IFN-β, CXCL-10, monocyte chemoattractant protein-1 (MCP-1) and macrophage inflammatory protein-1α (MIP-1α).
- This **'cytokine storm' acts as a chemoattractant** for neutrophils, CD4 helper T cells and CD8 cytotoxic T cells, which then begin to get sequestered in the lung tissue.
- Due to the **persistent injury** caused by the sequestered inflammatory cells and viral replication leading to loss of both type 1 and type 2 pneumocytes, there is **diffuse alveolar damage eventually culminating in an acute respiratory distress syndrome.**

PATHOPHYSIOLOGY

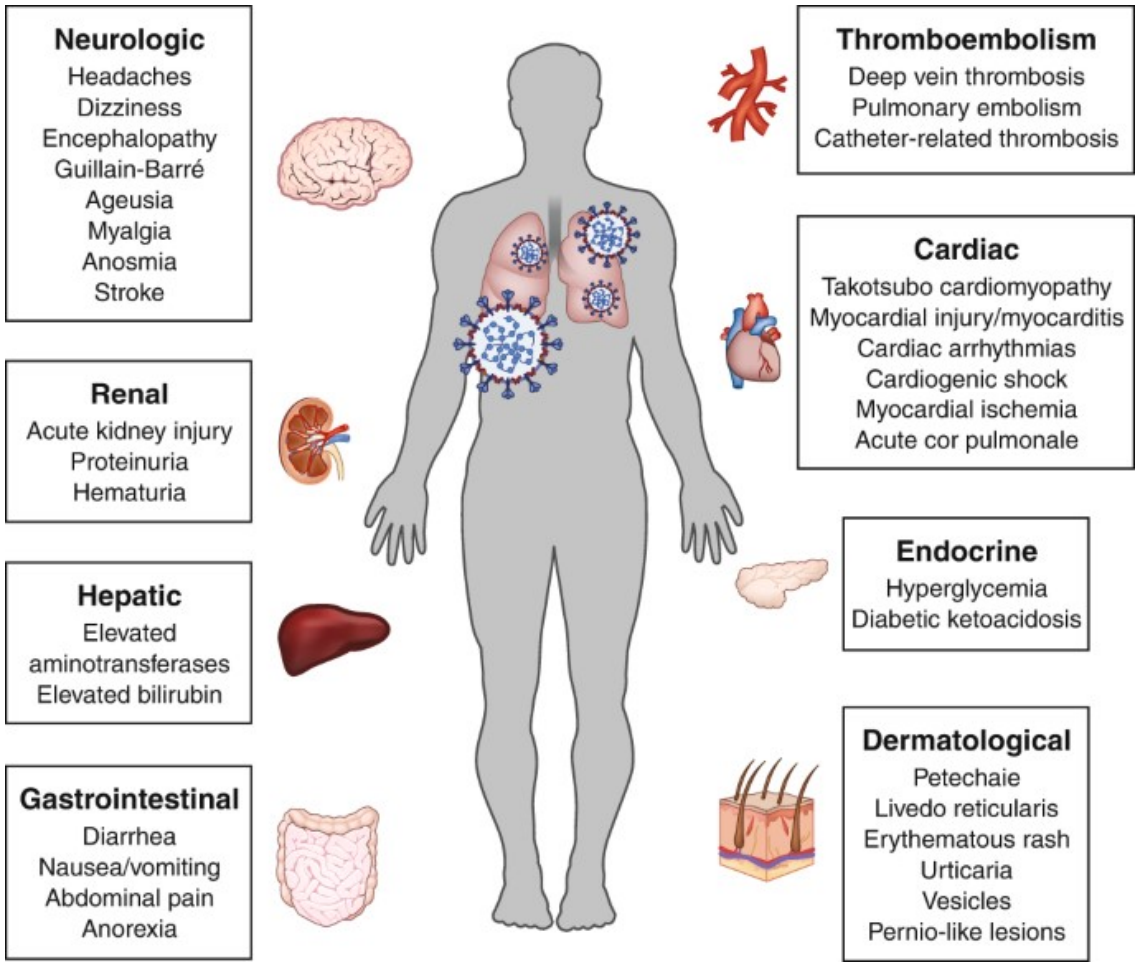
- Some of them may progress to **severe and systematic disease characterized by Acute Respiratory Distress Syndrome (ARDS), sepsis and septic shock, multiorgan failure including acute kidney injury, acute cardiac injury.**

COVID-19 symptoms in children – at a glance

Common symptoms		
Fever	Sore throat/throat irritation	Diarrhoea
Cough	Body ache/headache	Anorexia/nausea/vomiting
Rhinorrhoea	Malaise/weakness	Loss of sense of smell and/or taste

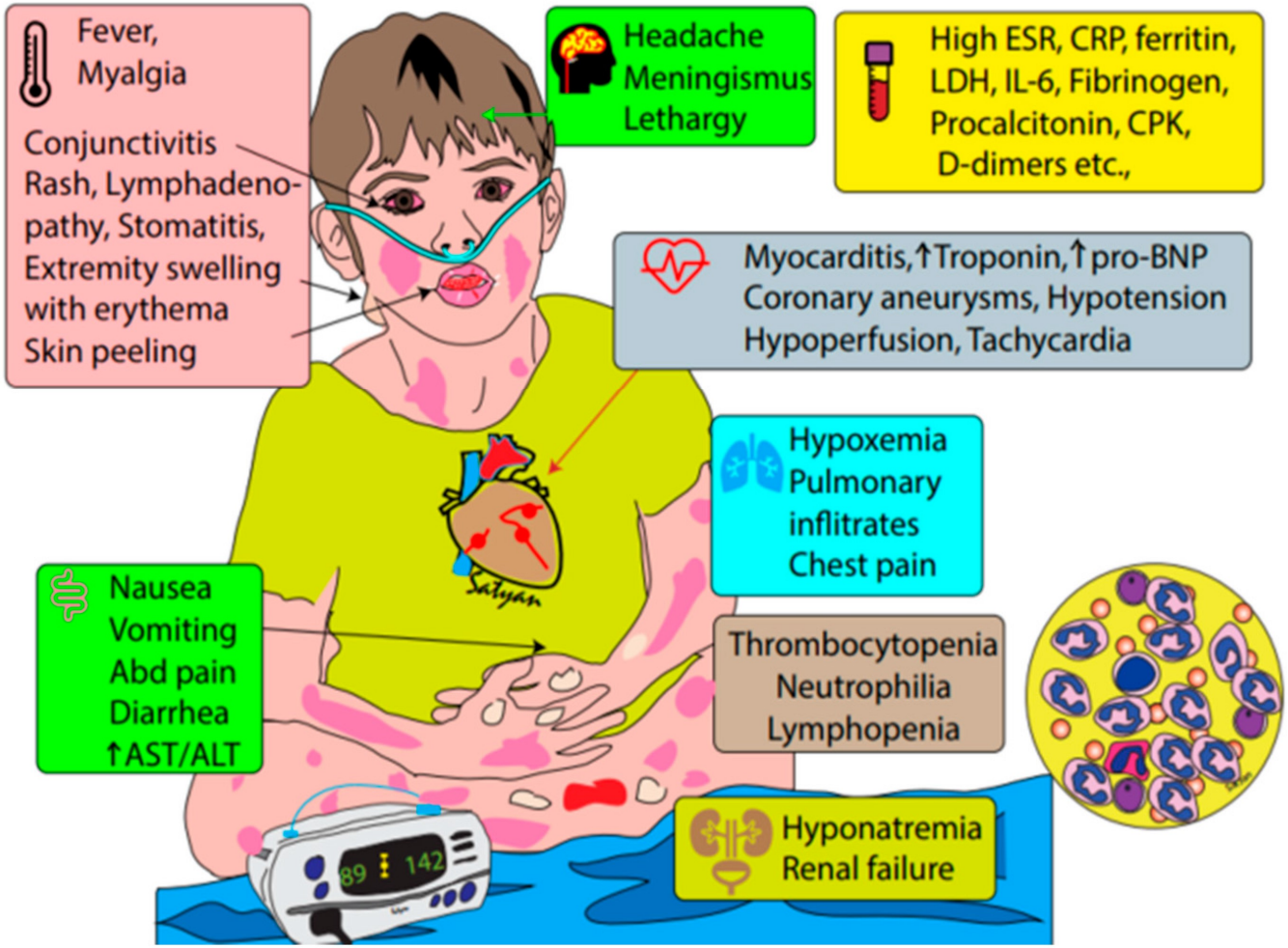
Differentiating symptoms/signs	Asymptomatic	Mild	Moderate	Severe
Respiratory rate/min	**Normal** with age dependent variation	**Normal** with age dependent variation	**Rapid respiration** (age based) <2 months ≥60/min 2-12 months ≥50/min 1-5 years ≥40/min >5 years ≥30/min	**Rapid respiration** (age based) <2 months ≥60/min 2-12 months ≥50/min 1-5 years ≥40/min >5 years ≥30/min
SpO_2 on room air	≥94%	≥94%	≥90%	<90%
Grunting, severe retraction of chest	×	×	×	+/-
Lethargy, somnolence	×	×	×	+/-
Seizure	×	×	×	+/-

CLINICAL FEATURES – EXTRAPULMONARY MANIFESTATIONS



CLINICAL FEATURES – MIS-C

A syndrome with name of **multi system inflammatory syndrome** has been described in children. Such cases are **characterized by: unremitting fever > 38^{0}C, epidemiological linkage with SARS CoV – 2 and clinical features suggestive of** Multi System Inflammatory Syndrome.



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 c**ontact 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.**

CASE DEFINITION (AS PER WHO SURVEILLANCE GUIDELINES)

- Probable Case:

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

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

- Confirmed Case:

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

18th June 2021

सत्यमेव जयते

Guidelines for Management of COVID-19 in Children (below 18 years)

Ministry of Health & Family Welfare

Government of India

MANAGEMENT

- Children with Covid-19 infection can be **asymptomatic, mildly symptomatic, moderately sick or can have severe illness.**

1. **Asymptomatic children**
2. **Mild disease**
3. **Moderate disease**
4. **Severe disease**
5. **MIS-C**

Guidelines for Management of COVID-19 in Children

Asymptomatic

- Suspected contact
  [RAT or RTPCR negative or not available]
- Incidentally detected
  [RAT or RTPCR positive]

Home isolation
(tele consultation SOS)

Mainstay of Treatment

- Infants and younger children to stay under immediate care of parents/guardians
- No specific medication required for COVID-19 infection
- Continue medications for other conditions, if any
- Promote COVID appropriate behaviour (mask, strict hand hygiene, physical distancing); please see **guide for using mask**
- Fluids and feeds: ensure oral fluids to maintain hydration and give a nutritious diet
- Advise older children and family to stay connected and engage in positive talks through phone, video-calls, etc.
- Parent/caregivers to contact the doctor in case of appearance of symptoms

Investigations

- No investigations needed

Mild

- Sore throat, rhinorrhoea
- Cough without breathing difficulty
- SpO_2 ≥94% on room air
- For other symptoms, see **COVID-19 symptoms – at a glance**

Home isolation (tele consultation SOS)
or COVID Care Centre

Mainstay of Treatment

- For fever, give paracetamol 10-15mg/kg/dose; may repeat every 4-6 hours
- For cough, give throat soothing agents and warm saline gargles in older children and adolescents
- Fluids and feeds: ensure oral fluids to maintain hydration and give a nutritious diet
- No other COVID-19 specific medication needed
- Antimicrobials are not indicated
- Maintain monitoring chart including counting of respiratory rate 2-3 times a day, look for chest indrawing, cold extremities, urine output, oxygen saturation, fluid intake, activity level, especially for young children
- Promote COVID appropriate behaviour (mask, strict hand hygiene, physical distancing); please see **guide for using mask**
- Advise older children and family to stay connected and engage in positive talks through phone, video-calls, etc.
- Parent/caregivers to contact the doctor in case of deterioration of symptoms

Investigations

- No investigations needed

Moderate

- In addition to symptoms in mild cases, check for pneumonia which may not be apparent
- Rapid respiration (age-based): **<2 months** RR ≥60/min; **2-12 months**, RR ≥50/min; **1-5 years**, RR ≥40/min; **>5 years**, RR ≥30/min;
  AND/OR SpO_2 90–93% on room air
- For other symptoms, see **COVID-19 symptoms – at a glance**

Admit in DCHC or COVID-19 Hospital

Mainstay of Treatment

- Initiate oxygen if SpO_2 is <94% and maintain between 94–96%
- Maintain fluid and electrolyte balance
  - Encourage oral fluids (breast feeds in infants)
  - Initiate intravenous fluid therapy if oral intake is poor
- Corticosteroids are not required in all children with moderate illness; they may be administered in rapidly progressive disease
- Fever with temperature >38°C (or 100.4°F): Paracetamol 10-15mg/kg/dose; may repeat every 4-6 hours
- Anti-microbials to be administered if there is evidence/strong suspicion of superadded bacterial infection; please see **antimicrobial use guide**
- Supportive care for comorbid conditions, if any

Remdesivir (an emergency use authorization drug) is NOT recommended in children
There is lack of sufficient evidence on safety and efficacy with respect to Remdesivir in children below 18 years of age

Investigations

- Baseline: CBC including ESR, blood glucose
- Chest X-Ray

CT chest is not indicated in diagnosis or management of COVID-19 infection in children
Consider CT chest only if no improvement in respiratory status

Severe

- **SpO_2 <90% on room air**
- **Any of the following – signs of severe pneumonia, acute respiratory distress syndrome, septic shock, multi-organ dysfunction syndrome, or pneumonia with cyanosis, grunting, severe retraction of chest, lethargy, somnolence, seizure**
- **For other symptoms, see COVID-19 symptoms – at a glance**

Admit in HDU/ICU of COVID-19 Hospital

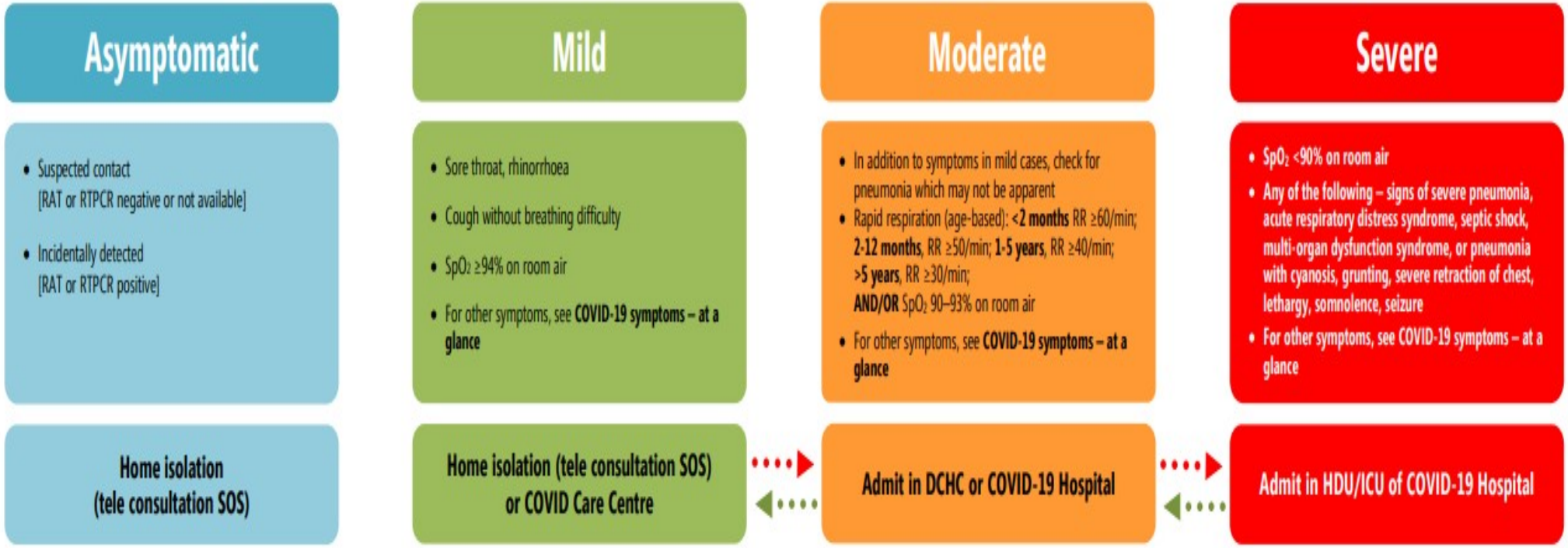
Mainstay of Treatment

- **Initiate immediate oxygen therapy and maintain target SpO_2 94–96%**
- **Maintain fluid and electrolyte balance**
- **Corticosteroids therapy to be initiated**
- **Anticoagulants may also be indicated**
- **Exercise caution; see use of corticosteroids and anticoagulants guide**
- **In case Acute Respiratory Distress Syndrome (ARDS) or shock develops, initiate necessary management; see ARDS and Shock guide**
- **Antimicrobials to be administered if there is evidence/strong suspicion of superadded bacterial infection; see antimicrobial use guide**
- **May need organ support in case of organ dysfunction e.g. renal replacement therapy**

Investigations

- Baseline: CBC including ESR, blood glucose, CRP, LFT, KFT, serum ferritin, D-Dimer
- Chest X-Ray

Guidelines for Management of COVID-19 in Children



Mainstay of Treatment

- Infants and younger children to stay under immediate care of parents/guardians
- No specific medication required for COVID-19 infection
- Continue medications for other conditions, if any
- Promote COVID appropriate behaviour (mask, strict hand hygiene, physical distancing); please see **guide for using mask**
- Fluids and feeds: ensure oral fluids to maintain hydration and give a nutritious diet
- Advise older children and family to stay connected and engage in positive talks through phone, video-calls, etc.
- Parent/caregivers to contact the doctor in case of appearance of symptoms

Investigations

- No investigations needed

Mainstay of Treatment

- For fever, give paracetamol 10-15mg/kg/dose; may repeat every 4-6 hours
- For cough, give throat soothing agents and warm saline gargles in older children and adolescents
- Fluids and feeds: ensure oral fluids to maintain hydration and give a nutritious diet
- No other COVID-19 specific medication needed
- Antimicrobials are not indicated
- Maintain monitoring chart including counting of respiratory rate 2-3 times a day, look for chest indrawing, cold extremities, urine output, oxygen saturation, fluid intake, activity level, especially for young children
- Promote COVID appropriate behaviour (mask, strict hand hygiene, physical distancing); please see **guide for using mask**
- Advise older children and family to stay connected and engage in positive talks through phone, video-calls, etc.
- Parent/caregivers to contact the doctor in case of deterioration of symptoms

Investigations

- No investigations needed

Mainstay of Treatment

- Initiate oxygen if SpO_2 is <94% and maintain between 94–96%
- Maintain fluid and electrolyte balance
  - Encourage oral fluids (breast feeds in infants)
  - Initiate intravenous fluid therapy if oral intake is poor
- Corticosteroids are not required in all children with moderate illness; they may be administered in rapidly progressive disease
- Fever with temperature >38°C (or 100.4°F): Paracetamol 10-15mg/kg/dose; may repeat every 4-6 hours
- Anti-microbials to be administered if there is evidence/strong suspicion of superadded bacterial infection; please see **antimicrobial use guide**
- Supportive care for comorbid conditions, if any

Investigations

- Baseline: CBC including ESR, blood glucose
- Chest X-Ray

Mainstay of Treatment

- **Initiate immediate oxygen therapy and maintain target SpO_2 94–96%**
- **Maintain fluid and electrolyte balance**
- **Corticosteroids therapy to be initiated**
- **Anticoagulants may also be indicated**
- **Exercise caution; see use of corticosteroids and anticoagulants guide**
- **In case Acute Respiratory Distress Syndrome (ARDS) or shock develops, initiate necessary management; see ARDS and Shock guide**
- **Antimicrobials to be administered if there is evidence/strong suspicion of superadded bacterial infection; see antimicrobial use guide**
- **May need organ support in case of organ dysfunction e.g. renal replacement therapy**

Investigations

- Baseline: CBC including ESR, blood glucose, CRP, LFT, KFT, serum ferritin, D-Dimer
- Chest X-Ray

Remdesivir (an emergency use authorization drug) is NOT recommended in children

There is lack of sufficient evidence on safety and efficacy with respect to Remdesivir in children below 18 years of age

CT chest is not indicated in diagnosis or management of COVID-19 infection in children

Consider CT chest only if no improvement in respiratory status

MANAGEMENT

1. **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.**
2. **Mild disease:** Children with mild disease may present with **sore throat, rhinorrhea, cough with no breathing difficulty.** Few children may have **gastrointestinal symptoms also. These children can be managed at home with home isolation and symptomatic treatment.** Such children do not need any investigations.

MANAGEMENT

- Treatment of mild illness in home isolation is **symptomatic.**
- For Fever: **Paracetamol** 10-15 mg/kg/dose can be given; 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 B1a, Convalescent plasma infusion or dexamethasone.**

MANAGEMENT

- 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.

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.

MANAGEMENT

- 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.**

MANAGEMENT

- **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

3. Moderate 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 >60/ min, Age: 2 to 12 months: respiratory rate >50/min, Age: 1 to 5 years: respiratory rate >40/min, Age: more than 5 years: respiratory rate >30/min and **oxygen saturations above 90%.**
- Children with moderate Covid – 19 disease **may be suffering from pneumonia which may not be clinically apparent.**

MANAGEMENT

- **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 COVID-19 hospital 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.

MANAGEMENT

Children with moderate disease should be administered:

i. For fever: **Paracetamol** 10-15 mg/kg/dose. May be repeated every 4-6 hourly. (temperature > 38^0C, i.e. 100.4^0F).

ii. **Antibiotics such as Amoxycillin to be administered, if there is evidence/strong suspicion of bacterial infection.**

iii. For SpO2 below 94%, **oxygen supplementation** is required.

iv. **Corticosteriods 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**.

MANAGEMENT

4. Severe Disease:

- Children with **SpO2 level less than 90%** are categorized as having severe disease.
- 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 HDU/ICU of COVID-19 Hospital.
- They should be **assessed for: thrombosis, haemophagocytic lymphohistiocytosis (HLH), and organ failure.**

MANAGEMENT

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

Treatment:

i. **Intravenous fluid therapy**

ii. **Corticosteriods:** 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.

iii. **Anti-viral agents:** There is lack of sufficient safety and efficacy data of Remdesivir in children below 19 years of age.

MANAGEMENT

iv. There is **no role of Hydroxychloroquine, Favipiravir, Ivermectin, lopinavir/ritonavir, Umifenovir.**

v. Children may need **organ support** in case of organ dysfunction; e.g. Renal Replacement Therapy.

vi. 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 (≤6mL/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).

MANAGEMENT

Awake prone position may be considered in older hypoxemic children if they tolerate.

vii. **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

Management of Acute Respiratory Distress Syndrome (ARDS) and Shock guide

Management/treatment of ARDS

ARDS may be classified based on Pediatric Acute Lung Injury Consensus Conference (PALICC) definition into mild, moderate and severe

Mild ARDS

- High flow nasal oxygen (start with 0.5 L/kg/min to begin with and increase to 2 L/kg/min with monitoring) or non-invasive ventilation (BiPAP or CPAP) may be given

Moderate – Severe ARDS

- Lung protective mechanical ventilation may be initiated; low tidal volume (4-8 ml/kg); plateau pressure <28-30 cmH_2O; MAP <18-20 cmH_2O; driving pressure <15 cmH_2O; PEEP 6-10 cmH_2O (or higher if severe ARDS); FiO_2 <60%; sedoanalgesia ± neuromuscular blockers; cuffed ETT, inline suction, heat and moisture exchange filters (HMEF)
- Avoid frequent disconnection of ventilator circuit, nebulization or metered dose inhaler
- Restrict fluids; calculate fluid overload percentage, keeping it <10%
- Prone position may be considered in hypoxemic children if they are able to tolerate it
- Daily assessment for weaning and early extubation; enteral nutrition within 24 hours, achieve full feeds by 48 hours
- Transfusion trigger Hb <7g/dL if stable oxygenation and haemodynamics and <10 g/dL if refractory hypoxemia or shock

Management of shock

- Consider crystalloid fluid bolus 10-20 ml/kg cautiously over 30-60 minutes with early vasoactive support (epinephrine)
- Start antimicrobials within the first hour, after taking blood cultures, according to hospital antibiogram or treatment guidelines
- Consider inotropes (milrinone or dobutamine) if poor perfusion and myocardial dysfunction persists despite fluid boluses, vasoactive drugs and achievement of target mean arterial pressure
- Hydrocortisone may be added if there is fluid refractory catecholamine resistant shock (avoid if already on dexamethasone or methylprednisolone)
- Once stabilized, restrict IV fluids to avoid fluid overload
- Initiate enteral nutrition – sooner the better
- Transfusion trigger Hb <7g/dL if stable oxygenation and haemodynamics, and <10 g/dL if refractory hypoxemia or shock

MANAGEMENT OF MULTISYSTEM INFLAMMATORY SYNDROME IN CHILDREN AND ADOLESCENTS (MIS-C)

A new syndrome with name of **multisystem inflammatory syndrome** as been described in children having COVID-19.

- Such cases are characterized by: **unremitting fever > 38^0C, epidemiological linkage with SARS CoV – 2 and clinical features suggestive of Multi System Inflammatory Syndrome.**
- Diagnostic criteria of MISC in Children (WHO criteria): a constellation of clinical and laboratory parameters has been suggested for diagnosis.

Management of Multisystem Inflammatory Syndrome (MIS-C) in children and adolescents temporally related to COVID-19

Multi System Inflammatory Syndrome in Children (MIS-C) is a new syndrome in children characterized by unremitting fever >38°C and epidemiological linkage with SARS-CoV-2

Diagnostic criteria (WHO)

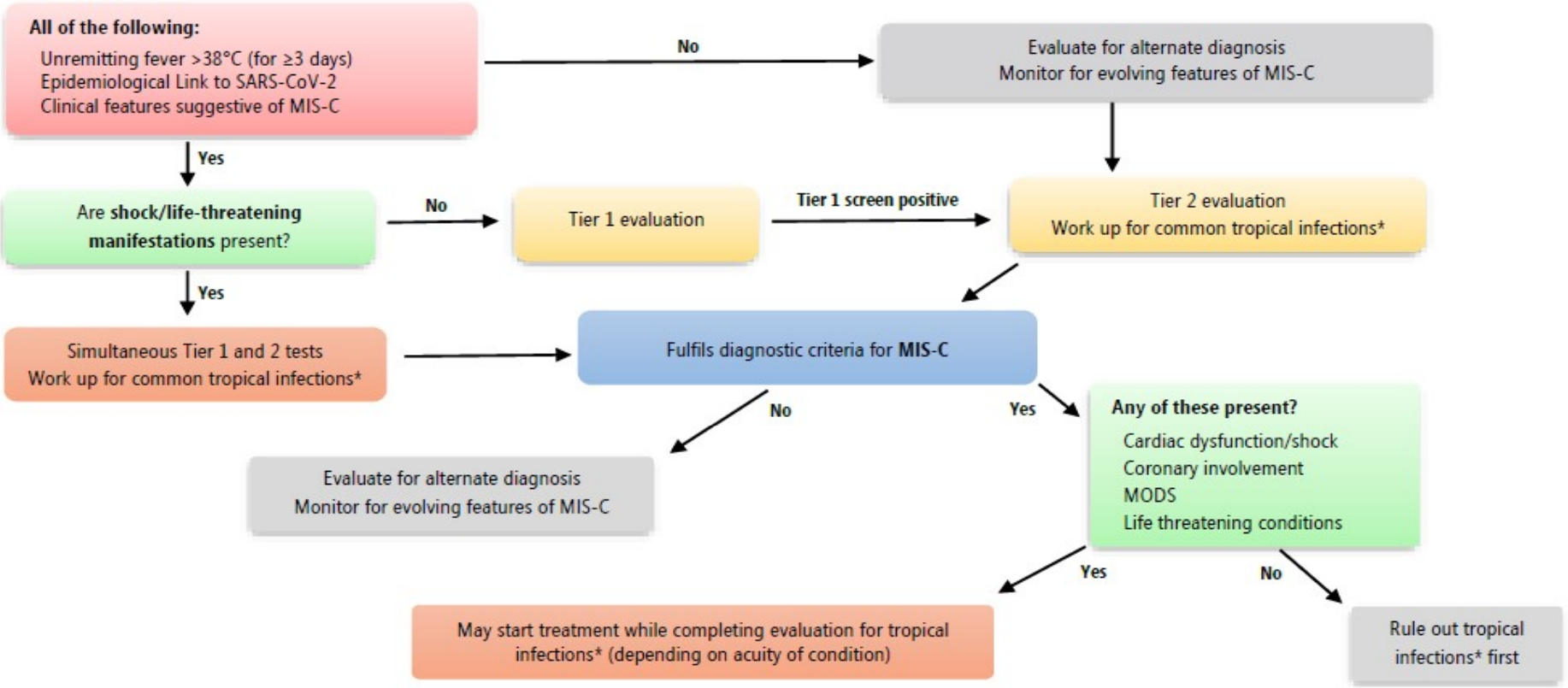
- Children and adolescents 0–18 years of age with fever ≥3 days
- **And** **any two** of the following:
  - Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet)
  - Hypotension or shock
  - Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities (including ECHO findings or elevated Troponin/NT-proBNP)
  - Evidence of coagulopathy (PT, PTT, elevated D-Dimers)
  - Acute gastrointestinal problems (diarrhoea, vomiting, or abdominal pain)
- **And** elevated markers of inflammation such as ESR (>40 mm), C-reactive protein (>5 mg/L), or procalcitonin
- **And** no other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes
- **And** evidence of recent COVID-19 infection (RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19

Alternative diagnoses that must be excluded before making a diagnosis of MIS-C

- Tropical fevers (malaria, dengue, scrub typhus, enteric fever)
- Toxic shock syndrome (staphylococcal or streptococcal)
- Bacterial sepsis

MIS-C with Kawasaki Disease (KD) phenotype is characterised by fever, conjunctival redness, oropharyngeal findings (red and/or cracked lips, strawberry tongue), rash, swollen and/or erythematous hands and feet and cervical lymphadenopathy

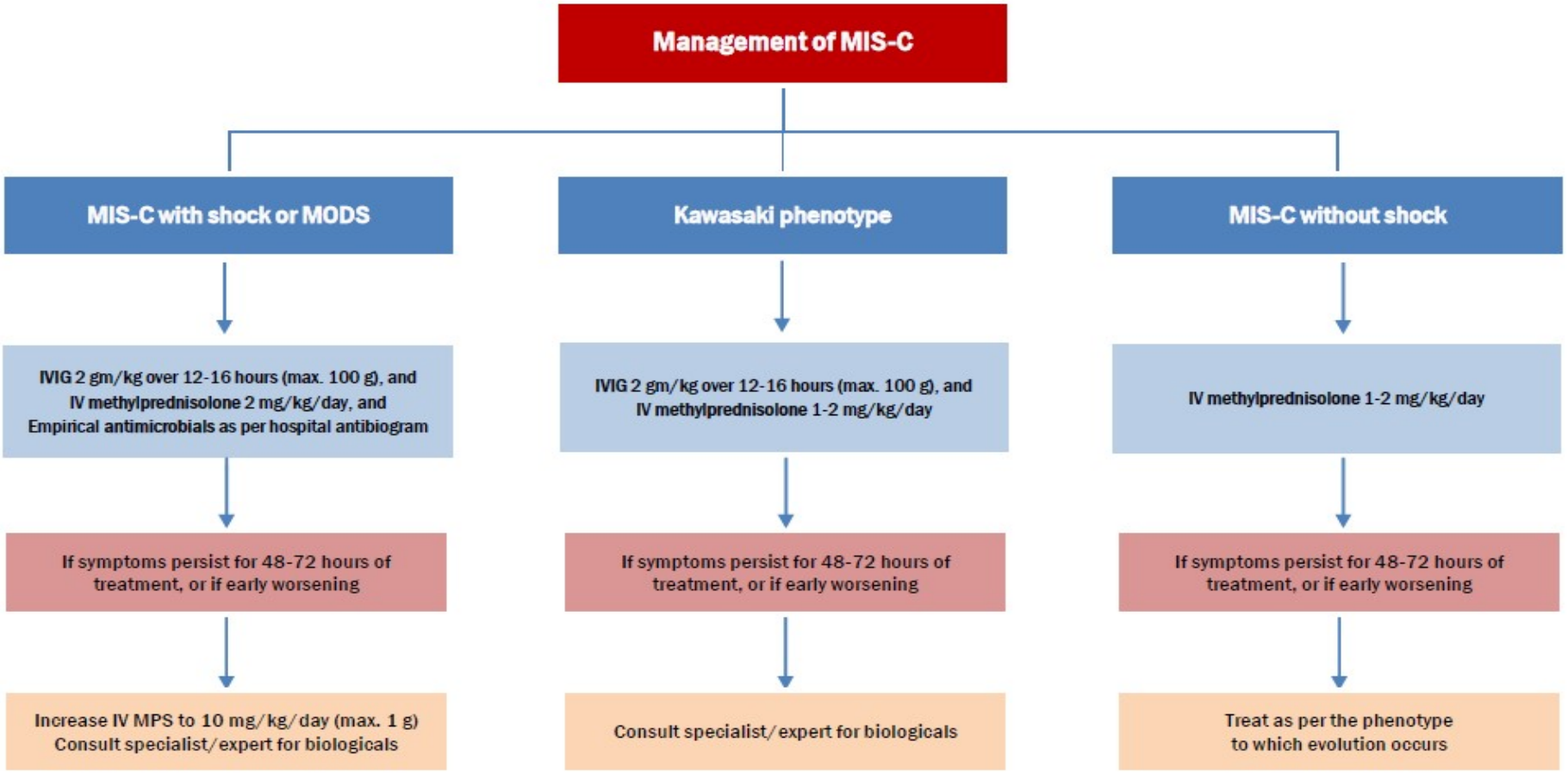
Stepwise investigations in a patient with MIS-C



Tier 1 tests (may be done at Covid Care Centre, Dedicated Covid Health Centre): CBC, complete metabolic profile (LFT/KFT/blood gas/glucose), CRP and/or ESR, SARS-CoV-2 serology and/or RT-PCR, blood culture
Positive Tier 1 screen (***both*** of these should be present):

1. CRP >5 mg/L ***and/or*** ESR >40 mm/hour;
2. At least ***one*** of these: ALC <1000/µL, platelet count <150,000/µL, Na <135 mEq/L, neutrophilia, hypoalbuminemia

Tier 2 tests (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.



- Appropriate supportive care is needed preferably in ICU for treatment of cardiac dysfunction, coronary involvement, shock or multi-organ dysfunction syndrome (MODS)
- IVIG to be given slower (over up to 48 hours) in children with cardiac failure/ fluid overload
- Taper steroids over 2-3 weeks with clinical and CRP monitoring
- Aspirin 3-5 mg/kg/day, maximum 75 mg/day in all children for 4-6 weeks (with platelet count >80,000/µL) for at least 4-6 weeks or longer for those with coronary aneurysms
- Low molecular weight heparin (Enoxaparin) 1 mg/kg/dose twice daily s/c in >2 months (0.75mg/kg/dose in <2 months) if patient has thrombosis or giant aneurysm with absolute coronary diameter ≥8 mm or Z score ≥10 or LVEF <30%
- 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

Use biologicals only after expert consultation and at tertiary care only

MANAGEMENT OF MIS-C

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 thromobosis or Coronary Aneurysm Score is >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.

v. 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.**

Suggested proforma for monitoring in children

Name: ..... Age: ..... Sex: ..... Date: .....

#	**Co-morbid conditions** (if any)	**Controlled** (yes/no)	**Drugs being taken**
1			
2			
3			

Template for recording of symptoms and signs (may be done more frequently for sicker children)

Time	**Lethargy/malaise***	**SoB****	**Temperature**	**BP#**	**Respiratory rate##**	**Chest indrawing**	**SpO_2*** & pulse rate**	**Physical activity**
	(yes/no)	(yes/no)	(record)	(record)	(record)	(yes/no)	(record)	(normal/low)
06:00 am								
12:00 noon								
06:00 pm								
12:00 am								

*Malaise: feeling of unwellness; **SoB: shortness of breath/breathing difficulty/breathlessness ***SpO_2: oxygen levels to be measured by pulse oximeter

measure BP if age appropriate BP cuffs are available; ## record respiratory rate in a calm or sleeping child

PREVENTIVE STRATEGIES

1. Wear a mask
2. Stay 6 feet away from others
3. Get Vaccinated
4. Avoid crowds and poorly ventilated spaces
5. Wash your hands often
6. Cover coughs and sneezes
7. Clean and disinfect
8. Monitor your health daily

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html

Infection Prevention and Control (IPC)

Every COVID care facility should have a multidisciplinary hospital infection control committee; key components of infection control strategy are:

- Standard precautions
- Droplet precautions
- Airborne precautions
- Contact precautions and hand hygiene
- Physical distancing
- Cough etiquette/respiratory hygiene
- Well ventilated rooms
- Monitor healthcare associated infections
- Train all health care workers to develop IPC skills
- Environment cleaning, disinfection and sanitation
- Cleaning/disinfection of frequently touched surfaces/equipment
- Cleaning and disinfection of linen
- Safe management of bio-medical waste
- Triple layer mask to be worn by patient, as per guidance below
- Masks for care givers (home/hospital)

Guide for using mask

- Masks are not recommended for children aged **5 years and under**
- Children aged **6-11 years** may wear a mask depending on the ability of child to use a mask safely and appropriately under direct supervision of parents/guardians
- Children aged **12 years and over** should wear a mask under the same conditions as adults
- Ensure hands are kept clean with soap and water, or an alcohol-based hand rub, while handling masks

Antimicrobial use guide

COVID-19 is a viral infection, and antimicrobials have no role in the management of uncomplicated COVID-19 infection

Asymptomatic and mild cases: antimicrobials are not recommended for therapy or prophylaxis

Moderate and severe cases: antimicrobials should not be prescribed unless there is clinical suspicion of a superadded infection

Septic shock: empirical antimicrobials (according to body weight) are frequently added to cover all likely pathogens based on clinical judgement, patient host factors, local epidemiology and antimicrobial policy of the hospital

Use of steroids and anticoagulants

Steroids

Self-medication of steroids must be avoided

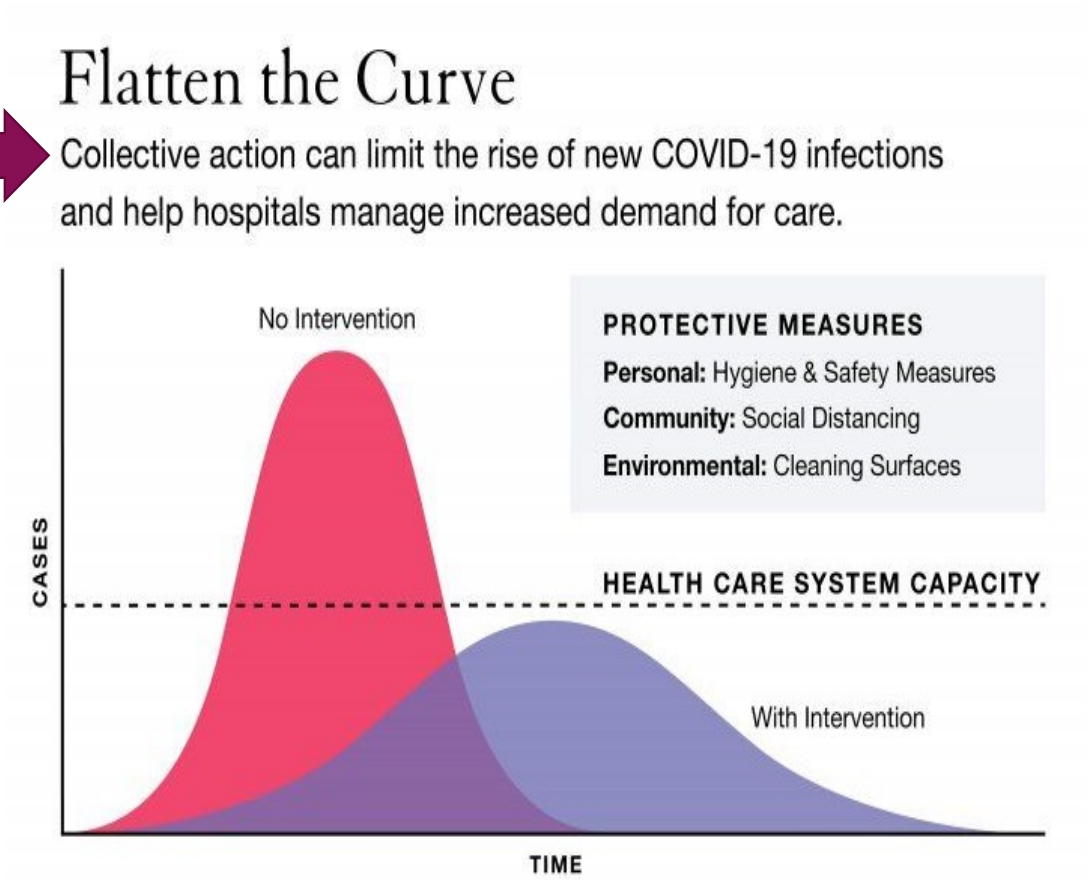
- **Steroids are not indicated and are harmful in asymptomatic and mild cases of COVID-19**
- Indicated only in hospitalized severe and critically ill COVID-19 cases **under strict supervision**
- Steroids should be used at the **right time**, in **right dose** and for the **right duration**
- Indications and recommended dose of corticosteroids – may be used in rapidly progressive moderate and all severe cases
  - Dexamethasone 0.15 mg/kg, maximum dose 6 mg once a day **OR**
  - Methylprednisolone 0.75 mg/kg, maximum dose 30 mg once a day
- Continue for 5-7 days and taper, up to 14 days, depending on clinical assessment on daily basis
- Avoid steroids in first 3-5 days since onset of symptoms as it prolongs viral shedding

Anticoagulants

- Not indicated routinely
- All hospitalized children should be monitored for thrombosis; on suspicion, confirm by appropriate investigations and start on low molecular weight heparin in therapeutic doses for period of 12 weeks with monitoring
- Predisposing risk factors for development of thrombosis – personal history of venous thrombotic events (VTE), family history of first-degree relative with VTE, presence of central venous line, decreased mobility from baseline, burns, active malignancy, estrogen therapy, flare of inflammatory disease, morbid obesity, severe dehydration, recent surgery or trauma
- Prophylactic anticoagulant is indicated in following circumstances (a) strong personal or family history of VTE, or (b) an indwelling central venous line and two or more additional risk factors, or (c) four or more risk factors
- The decision to administer prophylactic anticoagulation must be balanced with the child's bleeding risk
- Children already on anticoagulation therapy may continue same unless they develop active bleeding
- Dose of low molecular weight heparin (Enoxaparin), if indicated in severe cases
  - Prophylactic dose 0.5 mg/kg twice daily, till child is discharged from hospital
  - Therapeutic dose 1 mg/kg twice daily

INFECTION & PANDEMIC CONTROL

- Pediatric population **likely contributes to transmission of COVID-19 in the community due to higher prevalence of mild and asymptomatic disease;** children, with help from parents, can **adopt measures to slow spread of COVID-19 including frequent handwashing and social distancing.**



HEALTH MAINTENANCE FOR ALL CHILDREN DURING COVID-19 PANDEMIC

- Children **should be given all recommended age specific vaccinations, especially influenza** vaccinations for influenza season.
- **Developmental surveillance and early childhood screenings** should continue as well as **referrals for early intervention services** as needed.
- All **newborns should be seen soon after discharge at age 3-5 days with visits occurring ideally in person.**
- Supporting **emotional and behavioral health** needs of children, adolescents, and families during COVID-19 pandemic.


Thank
you!


2 M
KEEP THE
DISTANCE