

King George's Medical University
Department of Pediatrics
Standard Operating procedure for management of
Severe acute respiratory infection (SARI) in Children
30th March, 2020

Background:

COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a major public health crisis threatening humanity at this point in time. The virus possibly originated in bats and was transmitted to humans through yet unknown intermediary animals in Wuhan, Hubei province, China in December 2019. As of 24th March, as per the WHO estimates, there are 375,498 confirmed cases and 16,362 deaths. The disease is transmitted by inhalation or contact with infected droplets and the incubation period ranges from 2 to 14 d. The symptoms are usually fever, cough, sore throat, breathlessness, fatigue, malaise among others. The disease is mild in about 80% of the reported cases. In those with comorbidities (diabetes, hypertension, immunocompromised, malignancies in adults) and elderly the disease is often severe progressing to acute respiratory distress syndrome (ARDS) and multi organ dysfunction. The fatality rate is reportedly between 2-3% but can vary from 0.5-10% depending on the number tested, the percentage of elderly people in the population and availability of critical care support in the hospitals. So far, pediatric population does not seem to have severe disease commonly and the outcomes are excellent. Diagnosis is by demonstration of the virus in respiratory specimen (nasal and posterior pharyngeal swab/endotracheal secretions or BAL) by using specific RT-PCR. Common laboratory findings include normal/ low white cell counts with elevated C-reactive protein (CRP). X-ray and CT scan pictures in moderate to severe disease are suggestive of diffuse bilateral interstitial involvement of lungs. The findings may be abnormal even in those with no symptoms or mild disease. Treatment is essentially supportive; role of antiviral agents is yet to be established. Prevention is the key and home isolation of suspected cases and those with mild illnesses. Strict infection control measures at hospitals that include contact and droplet precautions may help break the chain of transmission and protect healthcare professionals.

Definition:

An ARI with history of fever or measured temperature $\geq 38\text{ C}^\circ$ and cough; onset within the last ~10 days; and requiring hospitalization (Global Epidemiological Surveillance Standards for Influenza http://www.who.int/influenza/resources/documents/influenza_surveillance_manual/en/ Geneva: WHO; 2014.)

The criteria for suspecting COVID are being periodically updated by the Govt. of India and ICMR

When to suspect in children:

- All symptomatic* children who have undertaken international travel in the last 14 days

OR

- A patient with severe acute respiratory illness (fever and ONE sign/symptom of respiratory disease AND requiring hospitalization) AND exclusion of an alternative diagnosis which may entirely explain the clinical presentation

OR

- Asymptomatic direct and high-risk contacts of a confirmed case (should be tested once between day 5 and day 14 after contact)

***1. Symptomatic** refers to any of these: fever/cough/shortness of breath.

2. Direct and high-risk contacts include those who live in the same household with a confirmed case and HCP who examined a confirmed case.

3. Confirmed case- A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.

Severe pneumonia

Child with cough or difficulty in breathing; plus at least one of the following

- Central cyanosis or spo2 < 90%
- Severe respiratory distress (e.g. - grunting, very severe chest indrawing)
- Sign of pneumonia with a general danger sign: inability to breast feed or drink, lethargy or unconsciousness, or convulsion
- Other signs of pneumonia may be present: chest indrawing, fast breathing (in breaths per minute): < 2 months ≥ 60 ; 2-11 month, ≥ 50 ; 1-5 years, ≥ 40 . The diagnosis is clinical. Chest imaging can exclude complications

1. Prompt recognition of **suspected patients** allows for timely initiation of appropriate IPC measures
2. Prompt documentation of those with severe illness, such as severe pneumonia, allows for optimized supportive care treatments and safe, rapid referral and admission to designated hospital area as per the Institutional or National protocols.
3. Patients with comorbidities, such as **cardiovascular disease and diabetes mellitus**, have increased risk of severe disease and mortality. Their earlier presentation may be mild but considering the potential high risk of deterioration, they should be admitted to a designated unit for close monitoring.

(WHO guidelines)

Areas where patients with SARI are cared for should be equipped with pulse oximeters, functioning oxygen systems and disposable, single-use, oxygen-delivering interfaces (nasal cannula, nasal prongs, simple face mask and mask with reservoir bag)

Clinical Presentation:

A cohort study done on 44 672 Chinese cases reported that out of total cases, 2·1% of patients were younger than 20 years, and 1·2% were asymptomatic (.).In comparison to adults, children with COVID-19 had milder clinical manifestations; approximately fifty percent of pediatric patients were asymptomatic (ie, no fever and no cough).

Another observational cohort study was done at three hospitals in Zhejiang province, China (Ningbo Women and Children's Hospital, The Third Affiliated Hospital of Wenzhou Medical University, and Wenzhou Central Hospital of Wenzhou). From Jan 17 to March 1, 2020, 36 (5%) children with mean age of 8·3 years were identified to be infected with severe acute respiratory syndrome coronavirus 2. Among the cases, males predominate. SARS-CoV-2 infection was confirmed by RT-PCR of samples taken from upper nasopharyngeal swabs.

The main route of transmission for pediatric patients was close contact with family members with COVID-19 (89%). Other routes were a history of exposure to epidemic areas (33%). The clinical presentation was mild in 47% children (ranging from asymptomatic infection to upper respiratory symptoms including, pharyngeal congestion, sore throat, and fever). The remaining 53% children had features of moderate clinical type including symptoms of mild pneumonia such as fever, cough, fatigue, headache, and myalgia. ***No severe and critically ill cases were seen among the children.***

Most frequent symptoms at the time of admission were fever (36%), and dry cough (19%). Other symptoms included sore throat (6%), pharyngeal congestion (3%), dyspnoea or tachypnoea (3%), and vomiting or diarrhoea (6%). Neurological symptoms or signs of cardiac, liver, or renal failure were not appreciated.

Two types of abnormal x-ray picture include, multiple opacities and patchy opacities. Variables associated with severity of COVID-19 were decreased lymphocytes, elevated body temperature, and high levels of procalcitonin, D-dimer, and creatine kinase MB. All children received interferon alfa by aerosolisation twice a day, 14 (39%) received lopinavir–ritonavir syrup twice a day, and six (17%) needed oxygen inhalation. Mean time in hospital was 14 (SD 3) days. By Feb 28, 2020, all patients were cured.

In another study, the median time from onset of illness to diagnosis was 2 days. Among 2000 children, the proportion of ‘severe and critical’ cases was 10.6%, 7.3%, 4.2%, 4.1% and 3.0% for the age group of <1, 1-5, 6-10, 11-15 and >15 years, respectively. As observed by author, young children, particularly infants, were vulnerable to 2019-nCoV infection. Attention-grabbing finding was there were more critical cases in the suspected than confirmed category. There is paucity of data on COVID-19 in pregnancy and newborn. Available data suggest that in general the pregnancy and neonatal outcomes are good.

Available evidence demonstrate that although COVID-19 in children seemed to be mild in terms of presenting symptoms, the prevalence of pneumonia with COVID-19 (53%) was higher than with H1N1 influenza (11%). A striking characteristic of COVID-19 is that despite the pattern of disease being mild or moderate clinical type, it affects several vital organs (lungs and heart), as revealed by increased amounts of myocardial enzymes.

So it can be concluded that presentation of COVID-19 in pediatric patients is milder.

As per directive from Ministry of Health and Family Welfare (MoHFW), Government of India, all suspected cases are to be reported to district and state surveillance officers. ***The helpline number is 011-23978046 or 1075***

INVESTIGATIONS:

Sample collection:

- Sample will be collected in the **SARI ward** of KGMU once a day at 1.00 pm.
- Nasopharyngeal swab to be collected by health care worker (HCW) in viral transport media (VTM) and transported on ice by sweeper to Department of Microbiology
- HCWs should use a medical mask, goggles or face shield, a clean, non-sterile, long-sleeved gown; and gloves.
- The person transporting specimens should be trained in safe handling practices and spill decontamination procedures

- Maintain proper infection control when collecting specimens
- Restrict entry to visitors or attendants during sample collection
- Complete the requisition form for each specimen submitted
- Proper disposal of all waste generated (yellow container)

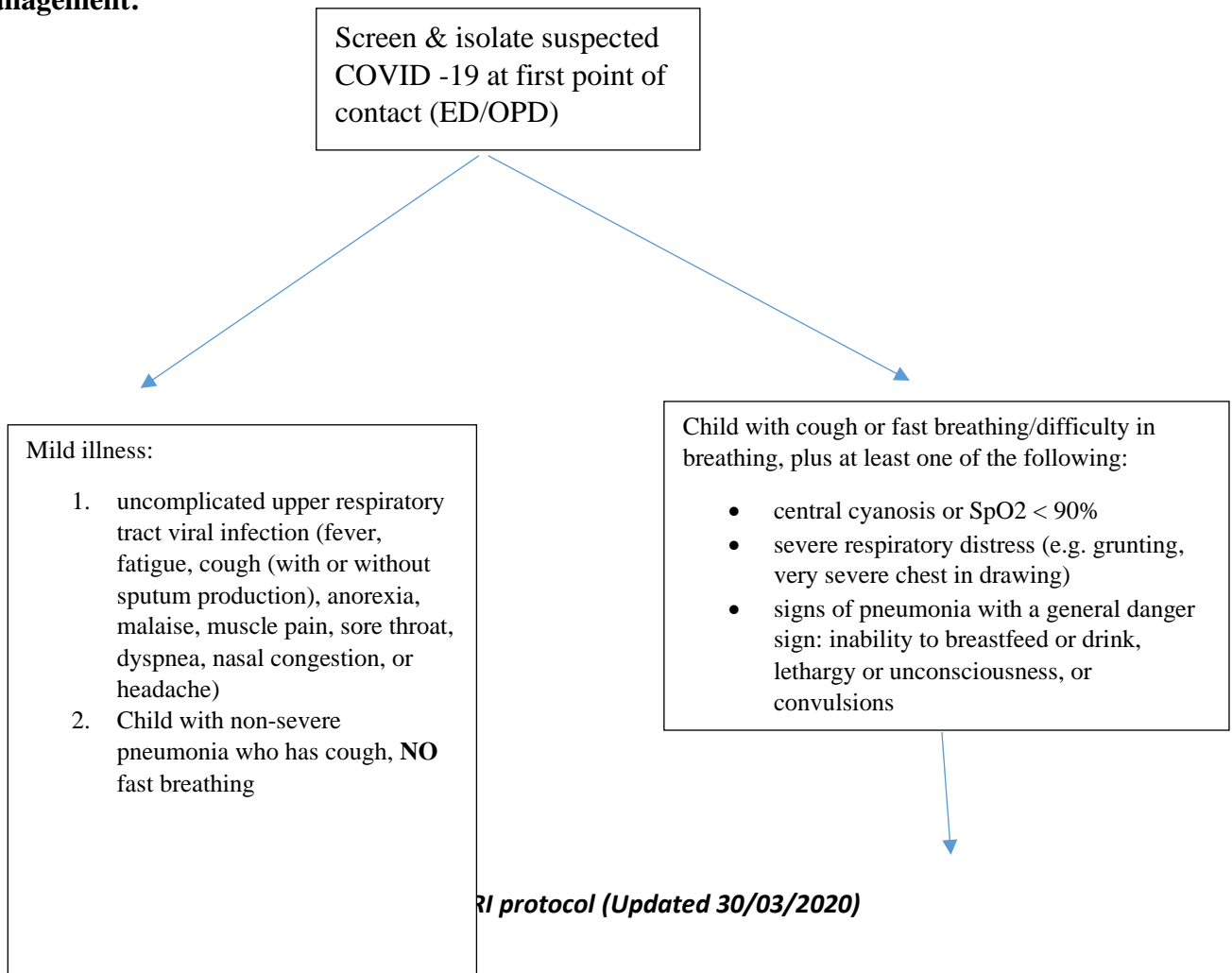
Appendix 1: (AIIMS Delhi guidelines)

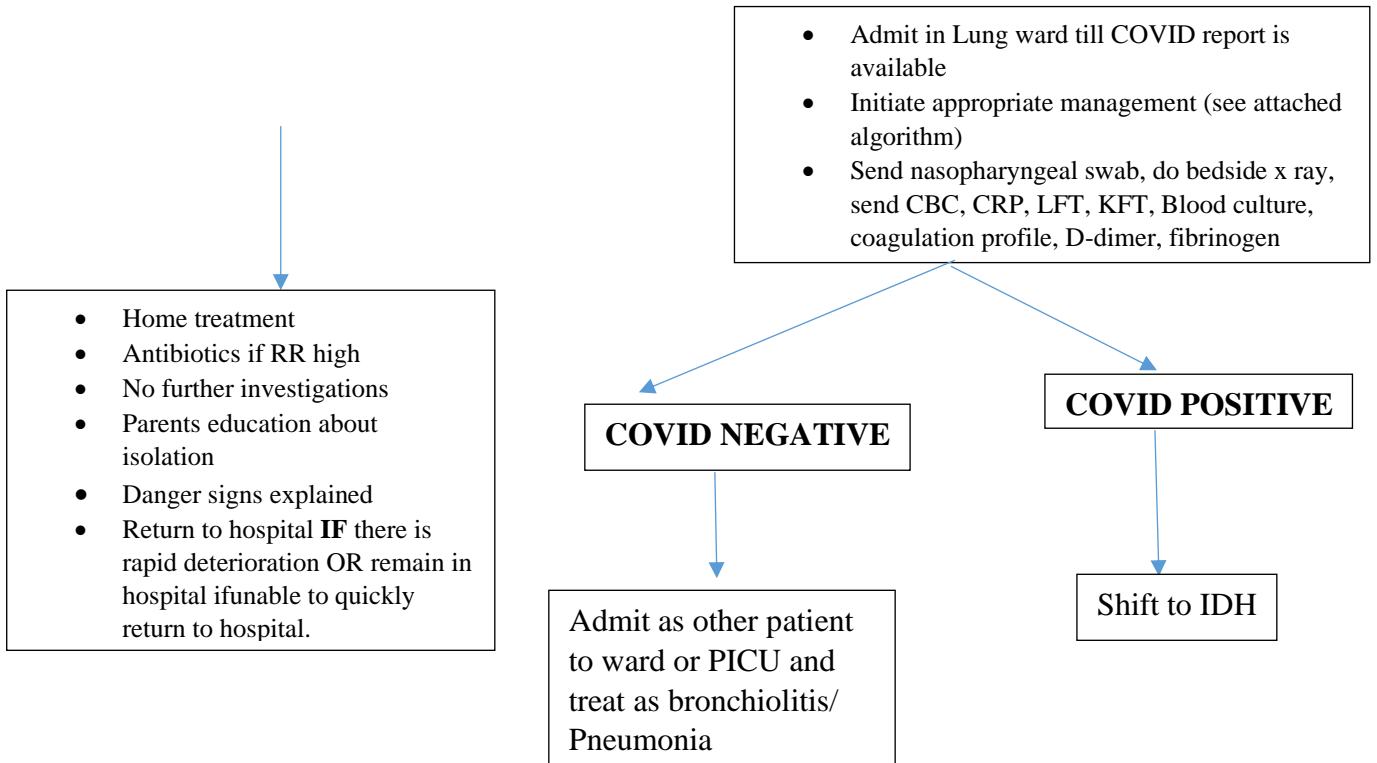
Respiratory specimen collection methods:

Nasopharyngeal swab:

1. Use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts.
2. Tilt patient's head back 70 degrees. While gently rotating the swab, insert swab less than one inch into nostril (until resistance is met at turbinates). Rotate the swab several times against nasal wall and repeat in other nostril using the same swab. Place tip of the swab into sterile viral transport media tube and cut off the applicator stick.
3. For throat swab, take a second dry polyester swab, insert into mouth, and swab the posterior pharynx and tonsillar areas (avoid the tongue); avoid touching the tongue, teeth, and gums. Place tip of swab into the same tube and cut off the applicator tip.

Management:





Indications for hospital admission:

ONE of the following criteria can be used for admission:

1. Respiratory distress
2. SpO₂ < 92% on room air
3. Shock/ poor peripheral perfusion
4. Not feeding well/ poor fluid intake, esp. in young children
5. Lethargic, esp. in young children
6. Seizures, esp. in young children

Investigations in admitted patients:

Chest X-ray:

- X-ray chest in COVID patients show interstitial shadows, ground glass opacities (GGO), reticulonodular shadows.
- Chest x rays are not routinely recommended even if they are on oxygen.
- To isolate children and avoid movement, **portable chest X-rays** will have to be done.
- Chest X-rays should be considered in children requiring oxygen on Day 3 of admission (suggesting disease progression or severe illness).
- Children not admitted to ICU may require a chest X-ray if they have worsening hypoxemia, particularly if they have pre-existing conditions.
- Typical CT Chest findings reported in adults are bilateral and peripheral ground-glass and consolidative pulmonary opacities. With a longer time after the onset of symptoms, CT

findings were more frequent, including consolidation, bilateral and peripheral disease, greater total lung involvement, linear opacities, “crazy-paving” pattern, and the “reverse halo” sign.

- **Other investigations** include complete blood counts (there may be lymphopenia), serum chemistry to assess organ dysfunction in sick patients, arterial blood gases, especially in those who need mechanical ventilation.

Mild illness:

1. These children have no respiratory difficulty, are feeding well, have SpO₂ >92%,
 2. These children have uncomplicated upper respiratory tract viral infection (fever, fatigue, cough (with or without sputum production), anorexia, malaise, muscle pain, sore throat, dyspnea, nasal congestion, or headache)
-
1. The treatment will be domiciliary.
 2. Appropriate antibiotic may be prescribed if respiratory rate is high
 3. Supportive care: control of fever using paracetamol (10- 15 mg/kg/ dose SOS/ or 4-6 hourly); **avoid ibuprofen and other NSAIDs**
 4. Home isolation
 5. Adequate hydration.
 6. Danger signs should be explained.

Duration of home isolation:

Afebrile for 72 hours AND at least 7 days after symptom onset

OR

2 negative samples 48 hours apart

Management of hospitalized cases

General Measures:

1. Oxygen supplementation to maintain SpO₂ > 94% ; Nasal prongs or cannula are preferred in children as it may be better tolerated
2. Conservative fluid management if there is no evidence of shock (restrict fluids to 80% if urine output is >1 mL/kg/hr)
3. Symptomatic treatment: paracetamol for fever (10- 15 mg/kg/ dose SOS/ q 4-6 hourly if required); avoid ibuprofen and other NSAIDs
4. MDI with face mask preferred over nebulisation as risk of aerosol generation higher with nebulisation.
5. Empirical antimicrobials (Ceftriaxone) within 1 hour of admission in case of sepsis;
6. Oseltamivir may be considered if influenza is a differential/ administer if test for influenza is positive
7. Systemic corticosteroids are not recommended, unless indicated for any other reason

8. MDI preferred over nebulization to reduce risk of aerosolization
9. Close monitoring for worsening clinical status is of paramount importance

A medical mask should be secured on face of the child receiving oxygen therapy, if the child tolerates. **Monitoring:** Child should be monitored clinically- respiratory parameters including SpO₂, hemodynamic parameters, sensorium, urine output.

Specific therapy:

Drugs that may be considered on the basis of registered trials in adults/in-vitro data include:

1. **Lopinavir/Ritonavir:** Suggested dose of LPV/r is 10 mg/2.5 mg per kg BD for maximum 14 days; maximum dose is 400 mg/100 mg BD.

Syrup LPV/r 80 mg/ 20 mg per mL; **Tablet** LPV/r 100 mg/ 25 mg; **Tablet** LPV/r 200 mg/ 50 mg].

2. **Hydroxychloroquine** 7- 8 mg/kg/dose BD for Day 1 and then Day 2 onwards, 7- 8 mg/kg once a day for 5 days; **Avoid with Azithromycin, can lead to arrhythmia**
 - **Be aware about common side effects of HCQ including** headache, dizziness, ringing in your ears; nausea, vomiting, stomach pain; loss of appetite, weight loss; mood changes, feeling nervous or irritable; skin rash or itching; low heart rate, hypoglycaemia etc
 - **Caution: DO NOT co-administer Lopinavir/ritonavir and Hydroxychloroquine** due to drug interaction which may cause increased Hydroxychloroquine levels and subsequent toxicity (e.g. QT prolongation, hypoglycemia).

Criteria for ICU admission:

- Requiring mechanical ventilation
- Shock requiring vasopressor support
- Worsening mental status
- Multi-organ dysfunction syndrome

Non-invasive ventilation:

In children with COVID-19, the use of NIV is currently discouraged because of risk of aerosol generation.

When to intubate:

- Impending respiratory arrest
- Child not maintaining saturation >90% on non-invasive oxygen supplementation
- Hypotension requiring vasopressor support
- GCS < 8 with threatened airway

In situations where invasive ventilation is not available due to resource limitation bubble CPAP may be offered for new-born and children with severe hypoxemia.

How to intubate:

- Pre-oxygenation with 100% FiO₂
- Try to avoid bag and mask ventilation (due to aerosol generation)
- The most skilled member of the team should be identified at the beginning of each shift for performing intubations
- Rapid sequence intubation to be done
- During induction, monitor for hemodynamic instability and use fluids and vasopressors if required
- After intubation, appropriate cleaning/disinfection of equipment and environment should be done

Management strategies for ARDS

The general principles of management of child with ARDS apply to a child with COVID-19 associated ARDS. The principles include lung protective ventilation: appropriate PEEP; low tidal volume ventilation. Children with refractory hypoxemia may benefit from ventilation in prone position.

Care of ventilated patient:

- Fresh, preferably disposable ventilator circuit to be used for every new patient; use an expiratory filter
- HME to be changed every 48 hours or when visibly soiled; use a viral filter in the expiratory circuit.
- Use closed suctioning technique and avoid routine suctioning
- Sedation and muscle relaxants may be used in difficult to ventilation patients
- Use low Tidal volume ventilation, 3 – 6ml/kg predicted body weight (PBW) for poor compliance and 5 - 8ml/kg PBW with better preserved compliance and maintain target plateau pressure less than 28.
- Titrate PEEP for persistent hypoxia. Max PEEP 15 cm of H₂O for children (WHO recommendations)
- Opt for restrictive fluid than liberal fluid therapy.
- Do not use steroids for patient with pneumonia with no ARDS.
- In patients with severe ARDS low dose methyl prednisolone 1-2mg /kg/day for 5- 7 days

Special considerations during resuscitation

- Minimize the number of people inside the room during high aerosol generating events like cardiopulmonary resuscitation.
- One airway specialist, one nurse/doctor for chest compression and one nurse for administering medications are essential.
- Other assistants may remain outside the room and may enter only if necessary, after donning full PPE.
- Hand bagging needs to be avoided. Connect HME or bacterial filter to it to limit aerosol generation. Use 2 person 2 handed technique for bagging, one person to hold the face mask tight while the other ventilates to minimise aerosol generation by decreasing leak.
- Airway management should be SAS (safe, accurate, swift). Safe for patient and staff, Accurate, avoiding unfamiliar, unreliable and repeated techniques and Swift i.e timely without rush or delay.
- There is no emergency intubation in pandemic
- Unplanned intubation will harm both patient and health care worker increasing risk of spread of infection and worse outcome.
- Perform intubation only after putting on complete PPE
- If facility available intubate in a negative pressure room with > 12 air changes per hour or 160 litres /second / patient in areas with natural ventilation and then shift to main ICU preferably with the same facility to minimise aerosol generation and exposure to others.
- Treatment algorithm and cognitive aids needed like ET tube size, fixing length etc should be displayed in the room.
- Ensure full neuromuscular blockade before attempting intubation to limit aerosol generation.
- All drugs needed should be preloaded preferably outside the room.
- Adrenaline 0.1ml per kg 1 in 10,000 solution.
- Atropine 0.02 mg/kg (not needed as routine, use in case of bradycardia or as antisialogogue before ketamine)
- Ketamine 1- 2mg/kg
- Vecuronium 0.1mg/kg or Rocuronium 1.2mg/kg or suxamethonium 1mg/kg

Septic shock:

- Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] < 5th centile or > 2 SD below normal for age) or two or more of the following: altered mental state; bradycardia or tachycardia (Heart rate < 90/min or > 160/min in infants and < 70/min or >150/min in children); prolonged capillary refill (> 2 sec) or feeble pulses; tachypnea; mottled or cold skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.
- Management should be as per Surviving Sepsis Campaign Guidelines

Supportive treatment in critically ill children:

- Head end elevation; avoid if child has poor perfusion/ shock
- Oral hygiene with antiseptic mouthwash
- Glycemic control to maintain blood glucose in range of 100- 180 mg/dl
- Foley's catheter for accurate urine output monitoring
- Ryle's tube for enteral feeds/ medications
- Bedsore prevention by position change every 2 hours

Discharge Criteria: On resolution of symptoms

- **Suspected case** – if the laboratory results for COVID-19 are negative, discharge is to be decided as per discretion of the treating physician based on his provisional/confirmed diagnosis
- **Confirmed case**– resolution of symptoms, radiological improvement with a documented virological clearance in 2 samples at least 24 hours apart.

Cardiac Arrest

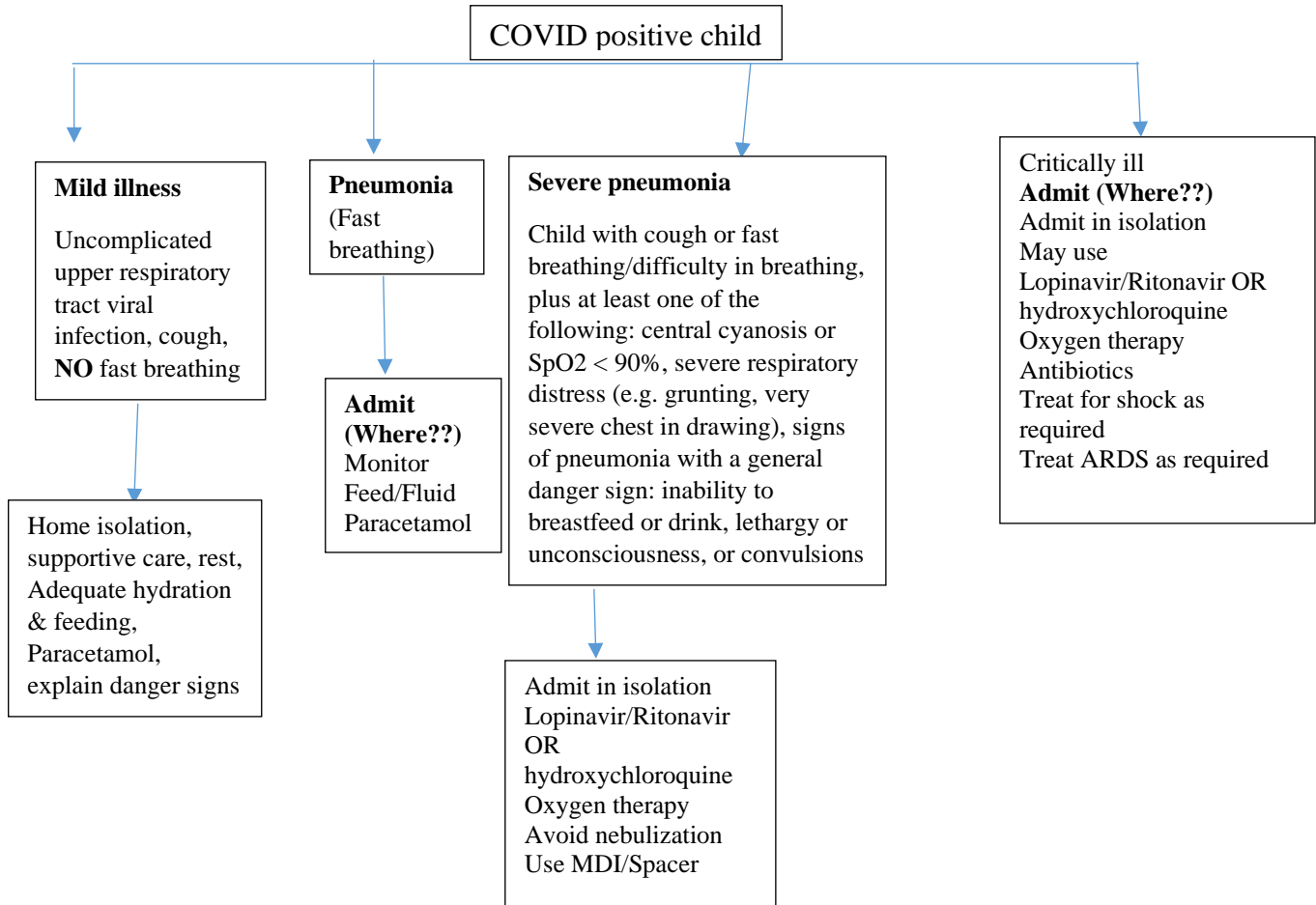
- Recognise cardiac arrest. Look for absence of signs of life and normal breathing and feel for brachial pulse (Infants) or carotids (older children). Do not listen or feel for breathing by putting your ear or cheek close to patient's mouth.
- Avoid mouth to mouth or pocket mask ventilation
- The staff should have gown, gloves, eyeshield or goggles before starting CPR (complete aerosol generating procedure PPE).
- Start CPR with chest compression.
- If patient is having oxygen mask before start of CPR leave it in situ to limit spread of aerosol. Otherwise if readily available put a mask and start CPR. Limit entry of people into the room during CPR.
- For bag and mask ventilation, connect HME or bacterial filter to it to limit aerosol generation. Use 2 person technique for bagging, one person to hold the face mask tight while the other ventilates to minimise aerosol generation.
- Identify and treat any reversible causes. Defibrillate shockable rhythms rapidly

ADVICE FOR PARENTS/ ADULTS WHO HAVE COVID-19 AND ARE STAYING AT HOME WITH A CHILD:

- The affected person should stay in a separate room
- The affected person should use a 3-ply mask
- Household members should stay in a different room and be separated from the person as much as possible
- Only an assigned family member should be tasked with taking care of the person and should help with groceries, prescriptions and other personal needs
- Avoid shaking the soiled linen or direct contact with skin
- Use disposable gloves when cleaning the surfaces or handling soiled linen
- Wash hands after removing gloves and before and after eating, drinking and using the washroom with soap and water (at least 20 seconds) or with alcohol-based hand sanitizer (at least 30 seconds)
- Toys that the child plays with should be washed frequently, wherever possible.

Environmental sanitation:

- Immediately remove and wash clothes and bedding that have blood, stool or other body fluids on them
- Clean and disinfect frequently touched surfaces in the quarantined person's room (e.g. bed frames, tables etc.) daily with Sodium Hypochlorite solution (1%) or ordinary bleach (5%)
- Clean and disinfect toilet surfaces daily with regular household bleach solution/phenolic disinfectants
- Wash laundry used by the person separately using common household detergent and dry thoroughly using the warmest temperatures recommended on the clothing label
- Place all used disposable gloves, masks and other contaminated waste in a lined container before disposing of them with other household waste and wash hands with soap and water/alcohol-based hand rub



References:

1. Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. *Zhonghua Liu Xing Bing Xue Za Zhi* 2020; 41: 145–51.
2. Qiu H, Wu J, Hong L, Luo Y, Song Q, Chen D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. *The Lancet infectious disease* March 25, 2020; DOI: [https://doi.org/10.1016/S1473-3099\(20\)30198-5](https://doi.org/10.1016/S1473-3099(20)30198-5)
3. Inpatient guidance for treatment of covid-19 in adults and children. university of Michigan. 2020
4. Resuscitation council UK. Resuscitation of COVID – 19 patients in hospital. March 2020
5. Department of Pediatrics, AIIMS SOP, ver 1.1 25 March 2020)