Dr. RMLIMS COVID ICU Management SOP

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Prepared by:

1. Dr. Sai Saran,
   COVID ICU in charge , Dr. RMLIMS, Lucknow (On Deputation),
   Assistant Professor, Department of Critical Care Medicine, Super specialty Cancer Institute and Hospital, Lucknow
2. Prof. PK Das
   Professor & Nodal Officer COVID hospital,
   Department of Anaesthesiology and Critical Care, Dr. RMLIMS, Lucknow

Approved by:

1. Prof. Deepak Malviya,
   Professor & Head, Department of Anaesthesiology and Critical Care, Dr. RMLIMS, Lucknow
2. Prof. Nuzhat Hussain
   The Director, Dr. RMLIMS, Lucknow

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Scope of SOP: For doctors and nurses posted in ICU to understand the management of critically ill COVID patients.

Purpose of SOP: Standardised approach to management in order to decrease the morbidity and mortality, keeping in mind, the availability of the equipment, manpower and other logistics in COVID ICU RMLIMS.

1. Preparation for a patient admission in ICU:

1.1 Once you receive a call that a patient is coming, enquire about his vitals (sensorium, heart rate :HR, blood pressure :BP, saturation (SpO_2), respiratory rate (RR) and current oxygen or ventilatory support). Obtain brief history like co-morbidities (Hypertension, coronary artery disease: CAD, diabetes mellitus: Diabetes mellitus, cerebrovascular accident :CVA, lung diseases like tuberculosis: TB, asthma, chronic obstructive pulmonary disease: COPD), past H/O of surgeries, ICU stay or ventilatory support (to rule out tracheal stenosis like complications). At the same time, note his medications and ask him to carry them if possible, along with the medical records, to be sent on whatsapp number of the control room. In the same call ask the team, to take out all the ornaments and handover to the relatives. Forward all the records and details obtained to the COVID ICU whatsapp group.

1.2 If he is sick according to the details available- ask for a 1 minute video focussing on his breathing pattern and vitals. If sick for transportation, ask the referring team to intubate and initiate mechanical ventilation along with further resuscitation, then shift accompanied by a trained staff.

1.3 The resident doctor on the floor alerts the paramedical staff to arrange for an oxygen cylinder (full capacity) with a oxygen mask if the patient is on oxygen OR a portable NIV machine: if on NIV along with oxygen cylinder ; transport ventilator with maximum respiratory supports for those on invasive ventilatory support.

1.4 The nursing in-charge of that particular bed prepares the bed:

a. Clean blankets, bed sheets, pillows
b. Monitor switched on with ECG electrodes attached
c. Ventilator ready with medium and large sized NIV masks or interfaces
d. All forms of oxygen therapy : nasal prongs, oxygen mask, oxygen with reservoir bag at the bed side
e. New Bubble humidifier ready with adequate water content.
f. IV cannulas (18 and 20 G) at least two each with transparent dressing ready
g. Glucometer with gluco-strips
h. 2 bottles of crystalloids

1.5 A team of 3 (resident doctor, nurse/anaesthesia technician and ward attendant), will get down once the ambulance arrives (the control room should again inform that the ambulance has arrived). Mean while the security guard again verifies for any ornaments (if so) on the patient's body. If the ornaments are present, the security guard will ask the family to wait for another 15-20 minutes at the gate.

1.6 The lift operator needs to block the lift for the patient transportation during that time (green corridor). The team's job is "not to talk anything" about the patient clinical condition to the relatives, just shift him inside the ICU as quickly as possible.

1.7 Once the patient is received on the bed, attach pulse oximetry, ECG followed by NIBP cuff. Note his RBS. Secure IV cannula if not present.

1.8 Discuss with consultant and give the drugs, once you receive the ICU chart.

2. Management of the patient in ICU:

2.1 Respiratory support:

2.1.1 On spontaneous breathing :

a. Oxygen supplementation if SpO_2 <92% titrated to SpO_2:90-94%
b. Nasal prongs- flow rate: 2-4 L/min
c. Simple face mask :5-7 L/min
d. Oxygen with reservoir bag (ORB)-Minimum flow rate 10-15 L/min. If not maintaining on ORB with respiratory rate (RR)<25 bpm→ High flow nasal oxygenation (HFNO) therapy. Ensure adequate amount of clean water sufficient to produce bubbles and new bubble humidifier.

2.1.2 Keep all forms of therapy with you: nasal prongs, simple face mask, ORB and HFNC. Upgrade or downgrade based on titration to SpO2:90-94%

2.1.3. Cough suppressants (Dextromethorphan syrup only if exaggerated reflex, as it is protective reflex)

2.1.4. Attach ECG leads to all patients, so that RR comes on the monitor and in the control room

2.1.5. Awake proning in patients on low oxygen supports (on nasal prongs or HFNC with FiO_2<0.5: SpO_2: 90-92%) and hemodynamically stable.

2.1.6. HFNO thearpy and ORB : Only if RR < 25 bpm and only when they are eating and drinking. Keep patients with RR>25 bpm for a minimum time on such therapy- More time on NIV.

2.1.7. Titrate Oxygen in all forms of therapy to SpO_2:90-94% only …. "Oxygen is a drug – Please prescribe it". More oxygen could contribute to further atelectatsis and fibrosis.

2.1.8. When to start Non-invasive ventilation (NIV): NIV for all those with RR>25 bpm and conscious and cooperative. Cautious use of Dexmeditomidine at 40-60 mcg/hour as sedation only if required.

2.1.9. ABG analysis atleast twice a day, for those in shock and invasive ventilatory support.

2.1.10. Rely on SpO2 and FiO2 in patients on NIV/HFNC unless, they are in shock or renal failure. Calculate ROX index: SpO2/FiO2/RR <3.8, go ahead for invasive mechanical ventilation ; 3.8-4.88 : close observation- might deteriorate; >4.88 Observe on NIV/HFNC.

2.1.11. Intubation and invasive mechanical ventilation: For those in

a. Poor GCS: <10 ;
b. Gasping on NIV support (SpO_2<90 %; HR>120 bpm; RR> 35 bpm; with high FiO_2 (>0.7) after 2 hours on NIV
c. HFNO with FiO_2>0.8 and total flow >50 L/min

2.1.12 Preparation for invasive mechanical ventilation:

Rationale :Patient might survive for another 1 hour comfortably on NIV- If you take out his/her respiratory drive to survive you need to optimize the oxygenation, ventilation and hemodynamics→ Without preparation it can be loss of life)

i. Proper head positioning: Pillow below the head (head ring preferable)

ii. Apply nasal prongs and fix oxygen at rate of 4-6L/min, if on HFNO continue it with FiO_2:1

iii. Ensure one wide bore (at least 18 G) IV cannula - Hang 500 ml saline in pressure bag-start running

iv. Arterial BP monitoring, when critically ill

v. Connect Noradrenaline (4mg/50ml infusion) in the central venous catheter (CVC) or a separate IV cannula and start at 3 ml/hour.

vi. Aspirate nasogastric tube if already present

vii. Drugs: Ketamine 1mg/kg (1ml=50 mg) + Fentanyl 200 microgram (1ml=50 mcg)+ Suxa 0.5 mg/kg (1ml= 50 mg) or Rocuronium 1 mg/kg (1ml=10mg)

viii. Feeding tube insertion: Insert orogastric tube during the same attempt for feeding and confirm its position

ix. Vent settings: VCV only: TV:450-500 ; RR: 30 ; I:E: 1:1.5 ; Pmax: 70 ; FiO_2 from 1; PEEP: 10-12 and other settings accordingly (Target MVe: 10-12 L/min).

x. Keep the MVe alarm lower limit accordingly based on the blood gas report-$PaCO_2$: 35-45 mm Hg

2.1.13 Prone the patient if P/F ratio is <150, using two blankets and rolling the patient in line without disconnecting the ventilator (loss of PEEP: desaturation) and taking care of invasive lines (get all the lines inside the two blankets). Decrease the PEEP to 2-4 cm H_2O lower value from the existing (maintain at 10-12 in Prone),after 2 hours in prone so that we can sustain de-recruitment that can happen in supine position (maintain at 12-16 in supine) later on, once in supine increase the PEEP by 2-4 cmH_2O.

2.1.14. Use hand restraints for all intubated ventilated patients

2.1.15. Deep sedation (Propofol 10mg/mL, Fentanyl 50 mcg/ml preparation for 2 days ; 2 days with Midaz- fentanyl) with less use of paralysis. Can use enteral sedation Tab. Lorazepam 4mg OD to BD, in patients requiring prolonged mechanical ventilation (continuous preparation of infusions in COVID ICU – lack of time and manpower).

2.1.16. Prepare two extra syringes of Norepinephrine, Midaz-Fenta and keep one Inj. Vecuronium syringe 8 mg ready at bed side for intubated, mechanical ventilated patients and in shock.

2.1.17. Check the position of ET tube fixed at what level (compare it with yesterday's) - cuff pressure : no leak

2.1.18. Change the ET tube every 7 days electively on case-case basis to endotracheal tube with sub-glottic aspiration port- Otherwise there might be sudden blockage of the tube in prone position.

2.1.19. Change the HME filter every two days (Monday and Thursday) and closed suction system every 7 days (every Monday). Can change early if visibly soiled or blocked.

2.1.20. Closed suction: Always use close suction system for sectioning and ensure that the tip of the suction catheter is outside the endotracheal tube. After suctioning, if it is left inside ventilation will not be possible and peak pressure increases.

2.1.21. Sedation vacation at 8-9 am, an hour before the rounds after ensuring that this patient is with restraints on.

2.1.22. Recruitment manoeuvres, in VCV – check the peak airway pressure if it is <40 , press the inspiratory hold for 20 sec while ensuring that the patient is on deep sedation an release. There may be transient fall in BP and SpO_2. But check if there is improvement in SpO_2 after 10-15 minutes, if so repeat the procedures every 6 hours.

2.1.21 Troubleshooting in mechanical ventilation :

a. Mode: always use volume control mode in critically ill patients and pressure support mode in patients in weaning. In volume control mode set the Pmax at a higher range in between 70-100 cm of H_2O (uniformity can be maintained throughout the stay of the patient in ICU and the trends can be easily followed if a same ventilatory mode is being used). This will ensure delivery of the set tidal volume in case of emergency.

b. High pressures: High Peak airway pressure indicates that there is some kink or obstruction in the circuit or blockage of ET tube (check the position of closed suction catheter), or bronchospam or endobronchial intubation. First try to act on them .... Simultaneously Put an inspiratory hold for 10 seconds and check the plateau pressure in such cases. If Plateau pressure is also high then it is because of poor lung compliance.

c. Leak on mechanical ventilation : observe the volume times scalar, if the set tidal volume is not getting delivered, the most common site of Leak is the endotracheal tube cuff, kindly inflate it and check cuff pressure. The next common sight of leak is the HME filters and the closed suction catheter assembly. The capnography port in the HME filter needs to be blocked. Close suction assembly can have a leak in its way : check it. Later on check the entire circuit.

2.1.22.Tracheostomy: Wait till 10-14 days, until ARDS improves- FiO_2<0.6 and PEEP<10 and Norepinephrine requirement <0.1 mcg/kg/min along with no coagulopathy. Do tracheostomy (percutaneous) with apneoic ventilation for 2-3 minutes during the dilation of the airway.

2.1.23.Weaning : Use PSV mode – PS:6-8 and PEEP:5-8; FiO_2<0.5 → RR <20 bpm with TV= 8 ml/kg ; $PaCO_2$:35-45 mm Hg and hemodynamically stable→ Proceed for SBT (spontaneous breathing trial) -

2.1.24. Extubation: If tolerated on PSV as above spontaneous breathing trail (SBT) for 4-6 hours,

2.1.25. Successful SBT: No change in HR, RR, BP by 20% , along with RR: 15-20 bpm ; $PaCO_2$ at the end : 35-45 mm Hg and SpO_2 >92% (P/F ratio >250) do a "Cuff Leak test"- to rule out airway oedema.

2.1.26. Cuff leak test : Put on VCV with 6-8ml/kg TV ; Aspirate the feeding tube, suction the oral cavity- deflate the cuff if the audible leak (difficult in COVID ICU), TV difference is more than 100 ml (prescribed 450 → Leak 100 ml) → Cuff leak test is positive. If negative start Inj Methylpred 40 mg Q8H for 2 days and redo the test, along with Direct laryngoscopy to evaluate the airway oedema resolution and plan for extubation.

2.1.27. Post extubation care:

i. NIV (CPAP) for 2 days for 10-12 hours/day
ii. Chest physiotherapy thrice a day
iii. Minimal oxygen supplementation- titrated to SpO_2: 90-94%

iv. Deep breathing exercises or Incentive spirometry thrice a day

2.2.Hemodynamic support:

2.2.1. CVC insertion : for those on NIV > 12 hours/day, femoral route is an option, as NIV will be ongoing on the head end side.

2.2.2. Rationale: He might get intubated at anytime so be prepared ; useful for sampling ; TPN if enteral nutrition cannot meet the calories – Change to subclavian or IJV once get intubated.

2.2.3. Secure arterial line in those critically ill and transduce it.

2.2.4. Stabilize hemodynamics arterial MAP: 65-75 mm Hg (titrate norepinephrine accordingly)

2.2.5. Give a fluid bolus (500 ml fluid in pressure bag with in 10 minutes) - check responsiveness- if there repeat.

2.2.6. Norepinephrine (4 amp/50 ml NS) titrated to MAP :65-75 mm Hg once it reaches 15 ml/hour → Convert it to 10 amp/50 ml NS titrated to MAP. Start Vasopressin at 2.4 ml/hour (40 units in 40 ml NS), whenever Norepinephrine increases more than 0.1mcg/kg/min. start Hydrocort 200 mg/24 ml at 1 ml/hour or can continue with Dexa 8 mg IV OD or equivalent dose of Methyl pred 40 mg IV OD.

2.3.**Neuro protection strategy**:

2.3.1 To be done in those patients with ischaemic infarct our into intra cerebral hemorrhagic (ICH) . Intubation and Mechanical ventilation in those with GCS less than 8.

2.3.2 Strict Head end elevationto 45° . No general body care with head down positioning to be done . Endotracheal suction only if required with deep sedition and analgesia.

2.3.3 Pupils and ONSD (Optic nerve sheath diameter : target <0.5 mm) monitoring every 6 hourly

2.3.4 Sedation and analgesia targeting RAAS :-3 to -5.

2.3.5 Targeting MAP : 70-80 mm Hg.; PaO2 90-100 ; PaCO2: 30-35 ; Na : 145-155 ; K: 4.5-5.5 mmol/L.

2.3.6 The balance of fluid should be plus or -500 ML per day.

2.3.7 Obtain a neurosurgical consultation

2.3.8 These patients do not require an Remdesivir or steroids. They should be put on mechanical DVT prophylaxis only for the initial two weeks.

2.4 **Nutritional support** :

2.4.1. Enteral as long as tolerated ; In critical phases or initial phase of resuscitation or worsening hemodynamics : start 25% Dextrose at 25 ml/hour and 10 % aminoacids at 20 ml/hour through CVC only. This ensures maintenance of basal energy expentidure and prevents protein breakdown while giving time for enteral feeds to act. Once enteral route is satisfactory, stop these.

2.4.2. Check RBS at admission and Q8H for diabetics otherwise Q12H

2.4.3. Those on NIV > 10 hours/day: Insert nasogastric tube – relieves distension of stomach and can be used for feeds (200 ml volume Q 6H- start with lesser volumes as NIV itself will lead to stomach distension- if tolerated proceed)

2.4.4. Check the position of Feeding tube daily (it might have come out and lie in oesophagus due to various movements which can happen : prone etc.,) Ask the patient if he conscious on NIV support for any regurgitation of feeds→ If present reduce the volume and give prokinetics

2.4.5.Laxative (Syp.Cremaffin 15-30 ml HS) if stool not passed for more than 2 days and enema (PC or Lactulose) in critically ill on those on invasive vent support

2.4.6. Insulin titrating RBS : 140-180 mg% . Use peak-less long-acting insulin like Inj. Glargine (Lantus) 15-20 units S/C once a day. Those in shock start IV insulin therapy.

2.5 General ICU Care:

2.5.1. Not allowed for washroom for any reason (Give diapers and pan)- He/she might collapse in the washroom.

2.5.2. Remove all the ornaments from the patient's body like bangles, rings, chains, nose ring etc., as once oedema happens it will be very difficult to remove.

2.5.3. Foleys catheter and attach urometer only

2.5.4. Ensure oral care and invasive lines insertion site care (Check pressure bag : filled with saline or not ? : Zero and optimize the waveforms)

2.5.5. Whenever you disconnect patients from NIV support, even for 5 minutes; ensure that he/she drinks adequate amount of water and mouth rinsing with Chlorhexidine/Betadine gargles. These patients will be severely dehydrated and oral care is extremely important, as they can get intubated at anytime.

2.5.6. Empty uro-bags and change diapers at 7 am and 7 pm - note them in ICU charts ; otherwise it is not possible get Input/output for these patients.

2.5.7. Indent the drugs : Keep all the drugs required for a patient by 11 am and throw all the used boxes of the drugs in the steel bin below, empty them by morning.

2.5.8.Physiotherapy sessions for all those intubated and extubated recently every day

2.5.9. Apply Vaseline to nasal bridge, for those on prolonged NIV therapy (>10 hours/day) so that interface induced pressure ulcer doesn't occur

2.5.10. Body care with 2% Chlorhexidine wipes daily

2.5.11. Care of genitals and perineal region

2.5.12. Change diapers every 12 hourly or whenever soiled.

2.5.13. Keep all the railings of the ICU bed up and prevent patient falls.

2.5.14.Keep the infusions on one side (attached to the ICU bed on a stacking) and ventilator on the other side only. (whenever infusions get changed, there can be a drag on the ventilatory circuit and infusions on a stacking attached to the bed only as there can be a drag on CVC, and CVC might come out).

2.5.15. Mention the day of insertion of invasive lines on the ICU chart

2.6 **Pharmacotherapy:**

2.6.1 Inj Azithromycin 1gm IV OD or Inj Doxycycline if coming from community

2.6.2 If coming from another hospital (>3 days stay) : Inj. BL-BLI (Piperacillin-Tazobactum 4.5 gm IV Q 6H) or Inj Cefoperazone-sulbactum 3gm IV Q 8H)

2.6.3 If in shock or Invasive vent support or H/O of convalescent plasma therapy or Tocilizumab therapy - Carbapenam (Meropenam 1gm IV Q8H or Imipenem-Cilastatin 1gm IV Q 8H)

2.6.4 Colistin or Polymyxin-B + Teicoplanin + Caspofungin if shock is not improving with in 2days ..,(review of TLC; Procalcitonin; cultures)

2.6.5 Blood cultures and ET aspirates for C/S on the same day or 2nd days (Lack of time and manpower is the main issue- Focus on rest of the management aspects like timely proning, feeds, giving drugs, oral care and body care: rather than sending these cultures and waiting for their reports- treat the most common microorganisms that can cause infections like Klebsiella, Acinetobacter, Pseudomonas, Enterococcus, Candida, with an idea of local antibiogram)

2.6.6 Inj Remdesivir 200 mg IV loading followed by 100 mg IV OD for 7-10 days ...(review LFT : don't stop for transaminitis in the early phase - it might be because of COVID , wait for 5 days minimum and take decision and stop early if not on oxygen therapy later on).

2.6.7 Steroids: Inj Dexa 0.2 mg/kg/day (6 mg IV BD for 5 days) or Inj Methylpred 2 mg/kg/day for 5 days (to review IL-6; LDH; ferritin : Every 3 days as per SOP of investigations) and taper and stop if decreasing trends . In septic shock : can continue them or convert to start Inj Hydrocortisone 200 mg/day (50 mg IV Q6H), for 5 days and observe whether shock is improving (if not stop them too). Can add on case-case basis: Inj. Dexa 20 mg OD for 7 days followed by 10 mg OD for 7 days in critically ill, in the first two weeks of ARDS.

2.6.8 Stress ulcer prophylaxis : Inj Pantocid 40 mg IV OD for those on steroids or Inj Rantac 150 mg IV Q12H, thrombocytopenia, ventilatory support.

2.6.9 Inj Clexane 40-60 mg S/C Q12H or Inj Fragmin 5000 units S/C Q12H in patients not in shock .. Inj UFH (25,000/25 ml) at 0.5-0.8 ml/hour (500-800 units/hour) titrtated to APTT : 80-100 sec for those on shock or renal failure —— SCD or DVT pumps in those contraindicated

2.6.10 Inj Vit C 1.5 gm IV once a day

2.6.11 Inj Optineuron 300 mg IV once a day

2.6.12 Tab Zinc once a day

2.6.13 Tocilizumab : If the patient is with in first 5 days of illness – On oxygen therapy with FiO_2>0.5 ; high IL-6 (>40 pg/ml); high ferritin (>500 ng/mL); normal TLC; normal procalcitonin, no past H/O of Tuberculosis→ May consider 400 mg IV (two doses 24-48 hours apart).

2.6.14 Convalescent plasma: If the patient is with in first 5 days of illness – On oxygen therapy with FiO_2>0.5 ; high IL-6; high ferritin; normal TLC; normal procalcitonin. Check the titres in donors with corresponding IgG antibody titres >1:640, then check the similar level of antibody titres in the patient. Thawed plasma, has to be transfused with in 30

minutes. Inj. Avil 50 mg IV and Inj. Perfalgan 500 mg IV before administration – careful monitoring for anaphylactic reactions. Two doses (250 ml each), 48-72 hours apart.

3 **Family Counselling** :

3.1. All patients family members will be updated about the clinical condition of the patients status in between 4-7 pm only daily in a polite and dignified manner.

3.2. Those who are oxygen therapy → "Need further observation"

3.3. Those who are on NIV/HFNC → "High supports – sick and can deteriorate or improve"

3.4. Those who are on invasive mechanical ventilatory support or in shock → "Critically ill, I am sorry to say – we are doing our level best"…… (in a very low voice- adapting to the family members voice).

3.5. The words which were used in the morning rounds should only be updated and simultaneously enquire about any other clinical information asked for in the morning rounds.

3.6. All the team members should maintain uniformity in disclosing the information.

4. ICU Investigations SOP

4.1 At Admission:

a. CBC; RFT; LFT; Na/K/Cl/Mg/Phosphorous/total Calcium/ionized Calcium
b. PT-INR ; APTT;
c. Fibrinogen; D-dimer ; LDH; CRP; IL-6; Ferritin
d. Blood grouping and cross match
e. HIV/HbsAg and anti-HCV
f. Urine routine analysis
g. Serum Amylase and Lipase ; Troponin and CPK-MB
h. ABG analysis
i. CXR

4.1.2. Every Monday and Thursday: CBC, Procalcitonin , RFT ; LFT;PT-INR and APTT; D-dimer; Ferritin; LDH; Fibrinogen; IL-6

4.1.3. Every Wednesday and Saturday: CBC, RFT, Na, K, Cl, Mg and phosphates/ total calcium/ ionized Calcium

4.1.4. CXR: Monday: Bed 1-7; Tuesday: 8-13; Wednesday 24-29; Thursday: 1-7; Friday: 8-13 and Saturday:24-29

4.1.5. CXR after any procedure like CVC in IJV or subclavian, tracheostomy, pleural tap, chest drain or ICD placement etc.,

4.2. Apart from this any other investigation is required, it needs to be specified by the consultant to the data entry operator (DEO). If the consultant assumes that these are not necessary in a particular patient then also the DEO needs to be informed so that they are not sen

5. **Discharge and Follow up:**
   - **5.1** Fitness for discharge: 5 minute walk test with oximetry- Note the HR and SpO_2: Allow the patient walk in the cubicle for 5 minutes.Note the change in HR and SpO_2. If the change in HR is more than 20% and SpO2 < 90%, withhold discharge.
   - **5.2** Antifibrotic medications: Suspect lung fibrosis especially in patients on prolonged oxygen therapy ; retaining PaCo2 despite adequate ventilatory strategy – Tab Pirfenidone 400 mg Q 8H and review LFT after 1 week– if WNL, continue for 1 month.
   - **5.3** Tab Prednisolone if lung fibrosis is suspected :40 mg OD for D1-7 followed by 20 mg OD for D8-14 followed by 10 mg OD from D15-D21 and 5 mg OD from D22-28 and stop.
   - **5.4** Tab Rantac 150 mg BD orally or Tab. Pantocid 40 mg OD
   - **5.5** Check D-dimer, muscle power before discharge and if weak discharge of oral anticoagulants (Tab Dabigatran 150 mg Q12H or Tab Rivaroxaban 15 mg OD for 3 months)
   - **5.6** Steam inhalation thrice a day
   - **5.7** Oximetry during daily routine activities (must be accompanied by family members during initial 1 week post discharge)
   - **5.8** Antimicrobials based on the clinical picture if required.
   - **5.9** Chest and limb physiotherapy if required.
   - **5.10** Deep breathing exercises or Incentive spirometry
   - **5.11** Pulmonary function testing (PFT) and High resolution contrast CT (HRCT) chest after 1 month post discharge and follow up with chest physician.
   - **5.12** CBC; RFT and LFT ; Serum Na/K/Mg/Cl/Ca after 1 month along with HRCT before approaching the chest physician

----- THE END------

Any suggestions or modifications are always welcome. For any queries : contact-

Dr. Sai Saran : 8004505719