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# POST - COVID-19 Respiratory Management

**Symptoms of COVID-19**:

| | | | | | |
|---|---|---|---|---|---|
| cough | low-grade fever | fatigue | breathlessness | chest pain | Headaches |
| muscle pains & weakness | gastrointestinal upset | rashes | metabolic disruption | thromboembolic conditions | depression |

**Post - COVID-19: defined as symptoms extending > 3 weeks from a positive report for SARS-COV-2 infection.**

**Acute - Post-COVID-19 : defined as extending even after 3 weeks from the onset of first symptoms.**

**Chronic post - COVID-19 : defined as symptoms extending beyond 12 weeks. Prevalence 10 %.**

**High Risk Groups :** They should be managed at tertiary care level.

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|---|---|
| 1. | age > 60 years |
| 2. | Co-morbidities e.g. Diabetes Mellitus (DM), End Stage Renal Disease (ESRD), Hypertension, Coronary Artery Disease (CAD), Ischemic Heart Disease (IHD) |
| 3. | Those requiring oxygen on discharge from COVID-19 management |
| 4. | Patient who required non-invasive ventilation (NIV) or mechanical ventilation (MV) during COVID-19 management |
| 5. | Patients with pre-existing chronic respiratory diseases |

**Post COVID-19 Patient Management at Primary Care Level :**

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|---|---|---|---|
| Temperature | Pulse Rate | Blood Pressure | Pulse Oximetry |
| Functional Status | Respiratory System Examination | Clinical Testing | |

**Clinical assessment :**

1. **History :** cough, breathlessness, chest pain, co-morbidities
2. **On Examination :** Auscultation to assess for rhonchi,vitals, particularly $SpO_2$ to assess desaturation
3. **Investigations :** Complete Blood Count (CBC), Chest X-Ray, ECG
4. **Elevated blood biomarkers :**

| a) **Markers of infection/inflammation**: | b) **Markers of Prothrombotic state** : | c) **Markers of Acute Coronary syndromes**: | **d) Marker of Heart failure** |
|---|---|---|---|
| ➢ C-reactive protein (CRP)<br>➢ White Cell Count (WBC)<br>➢ Serum Ferritin | ➢ Plasma D-dimer<br>➢ Serum Ferritin | ➢ Troponin | ➢ Natriuretic Peptides |

**Exclude Anaemia** in a breathless patient. **Lymphopaenia** suggest severe, acute COVID-19.

**Specialist referral** : if new persistent or progressive symptoms develop or abnormal chest X-Ray or desaturation.

**General principles of medical management of post COVID-19 :**

1. Treat **fever** with **Paracetamol**,. If **bilateral rhonchi : inhaled bronchodilators plus inhaled steroids** with or without systemic steroids. If **no rhonchi** : **cough suppressants plus non pharmacological management, pulmonary rehabilitation, breathing exercises, yoga, steam inhalation.**
2. Asses for **co-morbidities.**
3. Train patient for **self-management** if there is no life-threatening co-morbidity.

**Self-management :** self-monitoring, daily pulse oximetry, proper diet & sleep, quit smoking and limiting/avoid Alcohol, limiting caffeine, rest, relaxation self – pacing & gradual increase in exercise as tolerated.

**I. Cough :**

a. Potential mechanisms of cough in post viral respiratory infection are inflammation, epithelial damage, mucus impaction and neuro-modulatory changes (heightened cough reflex sensitivity).
b. Chronic cough is defined as one that persists **beyond 8 weeks**.
c. In the absence of signs of super-infection like cough can be managed with **breathing control exercises**, for e.g. **diaphragmatic breathing**, **slow deep breathing, pursed lip breathing, yoga techniques.**
d. **If fever and purulent sputum : give Antibiotics**.
e. **If painful pleural inflammation : Chest X-Ray, Ultrasound Thorax, Non contrast HRCT Thorax.**

**II. <u>Breathlessness</u> :**

a. Primary driver of breathlessness is the viral lung infection causing an interstitial pneumonia with a reduction in lung diffusing capacity. **Do Chest X-Ray, Pulmonary Function Test, 6 minutes' walk test (6MWT), Pulse Oximetry.**
b. Breathlessness tends to improve with breathing exercise e.g. positioning, pursed-lip breathing and coordinated breathing training.
c. Acceptable $S_PO_2$ is 94% to 98% and a level of 92% or below requires Supplementary Oxygen (unless the patient is in chronic respiratory failure).
d. Oximeter readings persistently in the 94% to 95% range require assessment and investigation.
e. If there is pre-existing lung disease & Chronic Respiratory failure, $S_PO_2$ of 88% to 92% is acceptable.

**Pulse Oximetry in Post COVID-19 Patients :**

- Self-monitoring of oxygen saturations by **Pulse Oximeter** is advised if persistent dyspnoea.
- Baseline assessment of resting $S_PO_2$ of ≥ 96% if symptoms suggest exertional desaturation (ligh-headedness or severe breathlessness on exercise) – requires exertional desaturation test.
- In remote testing, patient can perform Pulse Oximetry after walking 40 steps on a flat surface.
- If on-site supervised testing – patient can perform one-minute sit to stand test (as fast as they can).
- A fall of 3% in the saturation reading on mild exertion is abnormal and requires investigations.

**Breathing Control :** Sit in comfortable position with your arms supported; relax your shoulders and body.

- Put one hand on chest and the other on your Abdomen. Close your eyes.
- Slowly breathe in through your nose, with your mouth closed. Abdomen will move out against your hand. Hand on your chest will hardly move if your breathing is controlled.
- Breathe out through your nose. This will result in your abdomen falling gently. Imagine all the tension in your body leaving as you let the air out.
- Make breaths slow, relaxed and smooth. Use as little efforts as possible and feel relaxed with every breath out.

**Breathing Techniques :**

Breathing control combined with any of the breathing techniques as given below

- **Pursed – lip breathing :** Breathe in through your nose gently. Then purse your lips as if you are going to blow a candle. Blow out with your lips in pursed position. Blow out only for as long as it is comfortable – do not try to force to empty your lungs.
- **Blow – as – you – go :** Use it for doing something that makes you breathless. Breathe in before you make effort. Then breathe out while you are making the effort. For example, when standing up, breathe in before you step or stand up then blow out as you stand up. Try pursing your lips as you blow out.
- **Paced breathing :** This is useful for performing activities like walking or climbing stairs. Count to yourself as you walk or move. For example, breathe in for one step and then either one or two steps as you breathe out. If you feel better take more steps as you breathe in or as you breathe out.
- Try different combinations to find out what works best for you, e.g. two steps in, two steps out.

**III. <u>Fatigue</u> :** Prolonged fatigue in post-acute COVID-19 patients shares features with chronic fatigue syndrome.

**IV. <u>Chest Pain</u> :** Due to Pulmonary embolism or cardiovascular disease indicates urgent tertiary care referral.

**V. <u>Thromboembolism</u> :**

a) COVID-19 is Inflammatory and hypercoagulable state both in Venous and Arterial circulation due to ↑ inflammation, platelet activation, Endothelial dysfunction, Stasis. **Rx** is **Prophylactic Anticoagulation**.
b) Patients with higher risk are discharged from Hospital with **10 days of extended thrombo-prophylaxis Rx**.
c) If **confirmed venous thromboembolism treat with anticoagulation for 3 months**.
**Investigations: D-dimer, duplex Ultrasound, Coagulation Studies, Computed Tomography Pulmonary Angiogram (CTPA).**

**VI. <u>Pulmonary Rehabilitation is required if there is significant respiratory illness</u>.**

Patients who are recovering spontaneously in the first 6 weeks after acute COVID-19 do not require it.

**Indications for inclusion into the Pulmonary Rehabilitation Programme :**

- During the acute disease stage having dyspnoea and cough and there is difficulty in expectoration.
- Respiratory failure, gas exchange abnormalities and immobility.
- Patients with history of mechanical ventilation due to COVID-19.
- Patients who received high flow oxygen therapy and non-invasive ventilation.
- Difficulty in daily living activities due to decreased functional status.
- Nutritional deficiency, Impaired quality of life, Psychosocial problems.
- Fatigue and chronic respiratory symptoms, Decreased work performance,
- Increased utilization of medical resources.

**Indications for exclusion from Pulmonary Rehabilitation Programme :**

- Patients with Neurological, Cardiac, Renal or Polytrauma require specific pre-defined rehabilitation e.g. complex neurological or stroke rehabilitation.
- Patients presenting with fall related injuries.
- Patients with co-existent active cancer.
- Severe frailty, In the end-of-life period, Overwhelming palliative care needs.

**VII.** **Yoga :** Proper exercises (*asanas*), proper breathing (*pranayama*), proper relaxation (*shava asana*).

**VIII.** **Ventricular dysfunction :**

a) Avoid Cardiovascular exercise for 3 months by all the patients after myocarditis or pericarditis.
b) Patient with suspected ventricular dysfunction should be referred to tertiary care centre.

**IX.** **Neurological sequelae:**

a) Headaches, dizziness and cognitive blunting co-occur with fatigue and breathlessness.
b) Refer patients suffering from Ischaemic stroke, seizures, encephalitis and cranial neuropathies.

**X.** **Post traumatic stress disorder** : Mental health and well-being is enhanced by increased social unity, informal social support, mutual aid, community based & collective measures.

**XI.** **Socio-cultural considerations :** Lockdown has worsened safeguarding concerns.

**XII.** **Older patients :** Post COVID-19 chronic pain is commonly observed in elderly patients.

a) Those who survive are at high risk of Sarcopaenia, Malnutrition, Depression and Delirium.
b) Physical symptoms add to the psychosocial impact & cause disrupted access to health-care.

**XIII.** **Indications for referral :**

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|---|---|---|---|
| a) Worsening breathlessness | b) $S_PO_2 < 96$ % | c) Unexplained chest pain | d) New confusion and focal weakness |

**Post COVID – 19 Pulmonary Fibrosis :**

**Investigations : CBC, Comprehensive Metabolic Panel, Coagulation Studies (PT, PTT, D-dimer, Fibrinogen), Serology for Anti-phospholipid and Anti-cardiolipin antibodies, SARS-CoV-2 immunoglobulin-G (IgG) antibody levels, Non-contrast high-resolution CT, Pulse Oximetry on room air at rest and during 6MWT, Pulse Oximetry with supplemental Oxygen if $S_PO_2$ < 88 %, 6MWT (desaturation ≥ 4% is significant), PFT with diffusion capacity (Obstructive or Restrictive defect), Echo.**

**Treatment :** ? **Oral Steroid**, ? Early Antifibrotics (Pirfenidone, Nintedaninte), ? Inhaled steroids.

**Long Term use of Steroids** → Avascular Necrosis → Femoral Head Necrosis, Hyperglycaemia, Psychosis.

**Treatment of POST COVID-19 Obstructive Airway Disease:** Inhaled Bronchodilators, Inhaled Corticosteroids, Oral Methylxanthines, Theophylline. Domiciliary $O_2$ Therapy is rec if resting $PaO_2 < 55$ mmHg.

**Reference : Raj Kumar, et al 2020. Post-COVID-19 Respiratory Management : Expert Panel Report. Indian Journal of Chest Disease & Allied Sciences. Vol.62, No.4, P180-191.**

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