

Special Article

Post-COVID-19 Respiratory Management: Expert Panel Report

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Expert Panel Report: Vallabhbhai Patel Chest Institute, University of Delhi, Delhi and National Pulmonary Experts

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Methodology

The process of development of the “Post-COVID-19 Respiratory Management Expert Panel Report” was undertaken by the Department of Pulmonary Medicine, Vallabhbai Patel Chest Institute (VPCI), Delhi. A panel of national respiratory experts was constituted which included representatives from the Institutes and also experts in the field from all over the country. For the development of the Expert Panel Report, an extensive initial literature search and review was done, followed by a joint meeting. The review of the literature was performed by searching the electronic databases PubMed, Medline, Google Scholar, Science Direct and Cochrane database, and meetings were organised by the VPCI, Delhi, coordinated by the chairperson and recorded by the rapporteurs. After a detailed discussion on the available literature in the meetings, group discussions and final decisions were made based on a consensus approach. The final document was reviewed by all the members of the expert panel.

This is the first expert panel report on the management of post-COVID-19 patients from India. However, this report may need revision with the development of the experience and evidence-based literature over a period of time.

Summary

1. Post-COVID-19 is defined as symptoms extending beyond 3 weeks from a positive report for COVID-19 infection.
2. Acute post-COVID-19 is defined as symptoms extending beyond 3 weeks from the onset of first symptoms, while chronic post-COVID-19 is defined as symptoms extending beyond 12 weeks.
3. Common post-COVID-19 symptoms are cough, low-grade fever and fatigue, followed by shortness of breath, chest pain, headache, muscle pains and weakness, gastrointestinal upset, etc.
4. In persons with symptoms for 3 or more weeks after COVID-19 onset, clinical assessment is required.
5. For most of the patients, primary care facility would provide the initial consultation and management.
6. Patients at high risk for developing post-COVID-19 complications should be directly referred to and managed at tertiary care level.
7. These high-risk patients include: elderly patients (age >60 years), patients with co-morbidities (diabetes mellitus, hypertension, coronary artery disease, etc.), patients requiring oxygen on discharge from COVID-19 management, patient who required non-invasive ventilation (NIV) or mechanical ventilation (MV) during COVID-19 management and patients with pre-existing chronic respiratory diseases.
8. Medical management of post-COVID-19 patients at primary care facility mainly targets symptomatic treatment.
9. Patients should also be assessed for co-morbidities, like diabetes, hypertension, kidney disease or ischemic heart disease.
10. Patients should be trained for self-management if there is no life-threatening co-morbidity.
11. Self-management will include self-monitoring—daily pulse oximetry, proper diet and sleep, avoid/quit smoking and limiting/avoiding alcohol, limiting caffeine, rest and relaxation, self-pacing and gradual increase in exercise as tolerated.
12. Pulmonary rehabilitation and Yoga can be helpful in reducing dyspnoea, increasing exercise capacity, improving quality-of-life and diminishing health-care resource utilisation.
13. Indications for specialist assessment include clinical seriousness/worsening along with respiratory, cardiac, or neurological symptoms that are new, persistent or progressive.
14. Some of the indications for tertiary care specialist referral would be: worsening breathlessness, oxygen saturation (SpO₂) <96%, unexplained chest pain, new confusion and focal weakness.
15. The initial visit at tertiary care centre should target the establishment of a patient’s baseline after COVID-19 and would require a detailed present and past medical, social history along with appropriate investigations.
16. Presently, scientific evidence on the management of post-COVID-19 pulmonary fibrosis and obstructive airway disease is lacking.
17. Apart from the standard principles of pulmonary disease management (including oxygen therapy [as indicated], pulmonary rehabilitation and yoga), pharmacologic management of these patients needs to be individualised by the treating physician till more evidence emerges.
18. The aims of the present document are to provide basic guidance on the management of post-COVID-19 patients based on the opinion of the panel of national experts in pulmonary medicine.
19. The present document needs to be updated with modifications based on the newer insights and research on post-COVID-19 management.

Introduction

COVID-19 pandemic has gripped the entire world and caused a lot of morbidity and mortality. Even the patients after having recovered from COVID-19 are found to be suffering from a variety of symptoms – labelled as “**Post-COVID-19**”.

Acute post-COVID-19 is defined as symptoms extending beyond 3 weeks from the onset of first symptoms, **while chronic post-COVID-19** is defined as symptoms extending beyond 12 weeks.¹ Usually 10% of the patients who have tested positive for severe acute respiratory symptom corona virus 2 (SARS-CoV-2) remain unwell beyond 3 weeks, but a smaller proportion may have symptoms for months.² The symptoms vary widely as even mild COVID-19 patients may be associated with long-term common symptoms, such as cough, low-grade fever and fatigue.² Other reported symptoms include shortness of breath, chest pain, headaches, muscle pains and weakness, gastrointestinal upset, rashes, metabolic disruption, thromboembolic conditions, and depression.³ The expert panel have observed a rise in number of such post-COVID-19 patients presenting to various health-care set-ups. Despite all these observations, there is still a lack of guidance for the management of these post-COVID-19 sequelae. Hence, the present panel of experts was constituted to formulate guidelines for the management of these post-COVID-19 patients.

Definition

Post-COVID-19 is defined as symptoms extending beyond 3 weeks from a positive report for COVID-19 infection.¹

High Risk Groups

Following sub-group of patients are at higher risk of developing post-COVID-19 complications, and hence, should be managed at tertiary care level.

1. Elderly patients (age >60 years).
2. Patients with co-morbidities (diabetes mellitus, hypertension, coronary artery disease, etc).
3. Patients 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

1. For most of the patients, primary care facility would provide the initial consultation and management.
2. This should include, apart from diagnosis and treatment of acute and chronic illnesses, health

promotion, disease prevention, health maintenance, counselling and patient education.⁴

3. Primary care providers have to coordinate various activities, like initial diagnosis, treatment, referral, consultation, monitoring and follow-up.⁵
4. In persons with symptoms for 3 or more weeks after COVID-19 onset, clinical assessment is necessary.¹
5. Full history from the date of first symptom followed by clinical examination should be done including measurement of temperature, pulse rate, blood pressure, pulse oximetry, assessment of functional status, examination of respiratory system, and if indicated, clinical testing can also be done.¹
6. Investigations should be ordered selectively and for specific clinical indications after a careful history and examination. *For example*, anaemia needs to be excluded in a breathless patient, lymphopaenia is a feature of severe, acute COVID-19. Elevated blood biomarkers indicative of other pathologies may be included as given below:
 - (a) Markers of infection/inflammation
 - C-reactive protein
 - White cell count
 - Ferritin
 - (b) Markers of prothrombotic state
 - D-dimer
 - Ferritin
 - (c) Markers of cardiac morbidity
 - Natriuretic peptides
 - Troponin
7. Patients who were not admitted to intensive care unit but had a significant respiratory illness require referral and management at tertiary care level.
8. Specialist referral is also required if there are new, persistent, or progressive symptoms or abnormal chest x-ray or desaturation on pulse oximetry.¹

General principles of medical management of post-COVID-19 in primary care settings

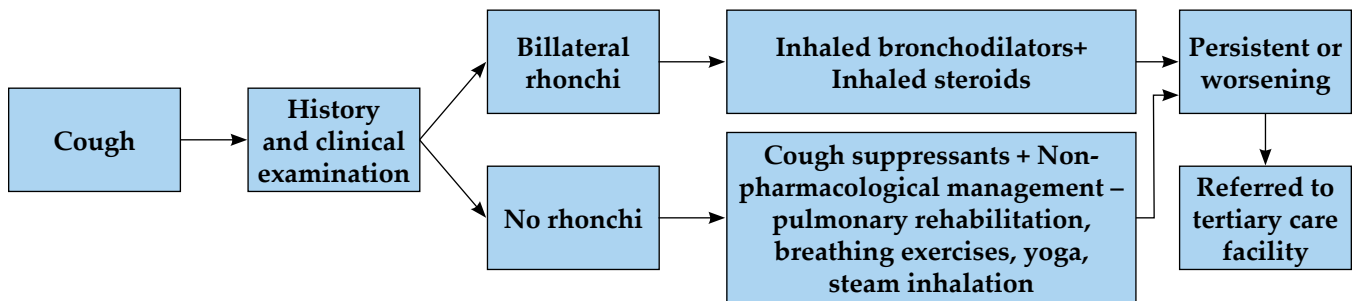
1. Medical management of post-COVID-19 patients include symptomatic treatment, such as treating fever with paracetamol, consider antibiotics for secondary infection, optimise control of long-term conditions and treat specific complications.¹
2. Patients should be assessed for co-morbidities, as many patients have co-morbidities, such as diabetes, hypertension, kidney disease or ischaemic heart disease.¹
3. Patients should be trained for self-management if there is no life-threatening co-morbidity.¹

4. Self-management will include self-monitoring, daily pulse oximetry, proper diet and sleep, avoid/quit smoking and limiting/avoiding alcohol, limiting caffeine, rest and relaxation, self-pacing and gradual increase in exercise as tolerated.¹

Management of post-COVID-19 symptoms in primary care settings

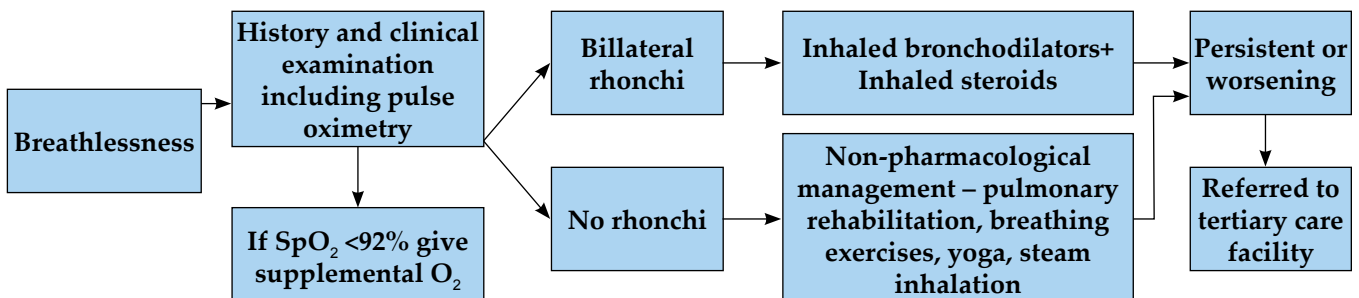
1. Cough

- A. Potential mechanisms of cough in post viral respiratory infection include inflammation, epithelial damage, mucus impaction and neuro-modulatory changes (heightened cough reflex sensitivity).⁶
- B. Chronic cough defines as one that persists beyond 8 weeks.⁷
- C. In the absence of signs of super-infection or other complications, like painful pleural inflammation, cough can be managed with simple breathing control exercises, such as diaphragmatic breathing, slow deep breathing, pursed lip breathing, yoga techniques.⁸



2. Breathlessness

- A. A degree of breathlessness is common after acute COVID-19.¹
- B. Primary driver of breathlessness is the viral lung infection causing an interstitial pneumonia with a reduction in lung diffusing capacity.⁹
- C. Severe breathlessness, which is seen rarely in patients who were not hospitalised, may require urgent referral.¹



- D. Breathlessness tends to improve with breathing exercises which include positioning, pursed-lip breathing and coordinated breathing training.¹⁰
- E. Pulse oximeters may be useful for assessing and monitoring of the respiratory symptoms after COVID-19.¹
- F. Patients should be provided with a pulse oximeter and an observations diary with instructions on how to self-monitor.¹
- G. Target range for SpO₂ is 94% to 98% and a level of 92% or below as requiring supplementary oxygen (unless the patient is in chronic respiratory failure).¹
- H. Oximeter readings persistently in the 94% to 95% range require assessment and investigation.¹
- I. Appropriate adjustments should be made for patients with lung disease and known hypoxia, in whom the range of SpO₂ of 88% to 92% is considered acceptable.¹

3. Fatigue

- A. The prolonged nature of fatigue in some post-acute COVID-19 patients shares features with chronic fatigue syndrome.¹¹
- B. Fatigue management and guidance for the clinicians is limited and there is much debate and controversy about the role of graded exercise in chronic fatigue.¹²

Pulse Oximetry in Post-COVID-19 Patients

- Self-monitoring of oxygen saturations by pulse oximeter is advisable in patients with persistent dyspnoea in the post-acute COVID-19
- Baseline assessment for patients with resting SpO₂ of 96% or above but with symptoms suggestive of exertional desaturation (such as, light-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
- Alternatively, 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 indicates need for the investigations

Breathing Control

- Means using least effort and breathing gently
- Sit in a comfortable position with your arms supported; relax and loosen your shoulders and body
- Put one hand on chest and the other on your abdomen
- Close your eyes – this will help you to relax and focus on your breathing
- Slowly breathe in through your nose, with your mouth closed. Your abdomen will move out against your hand. The 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 your breaths slow, relaxed and smooth. Try to use as little effort as possible and feel more relaxed and calmer with every breath out
- Also, gradually try to breathe more slowly

Breathing Techniques

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

Try all of them and follow whichever technique works well for you

1. Pursed-lip breathing

- Breathe in through your nose gently
- Thereafter, purse your lips as if you are going to blow a candle. Blow out with your lips in this pursed position
- Blow out only for as long as it is comfortable – do not try to force to empty your lungs

2. Blow-as-you-go

- This helps in making tasks and activities easier
- Use it for doing something that makes you breathless
- Breathe in before you make the effort
- Then breathe out while you are making the effort. *For example*, when standing up, breathe in before you step or stand up, and then blow out as you stand up
- Try pursing your lips as you blow out

3. 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 take either one or two steps as you breathe out
- Take more steps as you breathe in or as you breathe out, if you feel better
- Try different combinations to find out what works best for you, *e.g.*, two steps in, two steps out

- C. Due to lack of direct evidence, exercise in such patients should be undertaken cautiously and should be withheld if the patient develops fever, breathlessness, severe fatigue or muscle aches.¹

4. Chest Pain

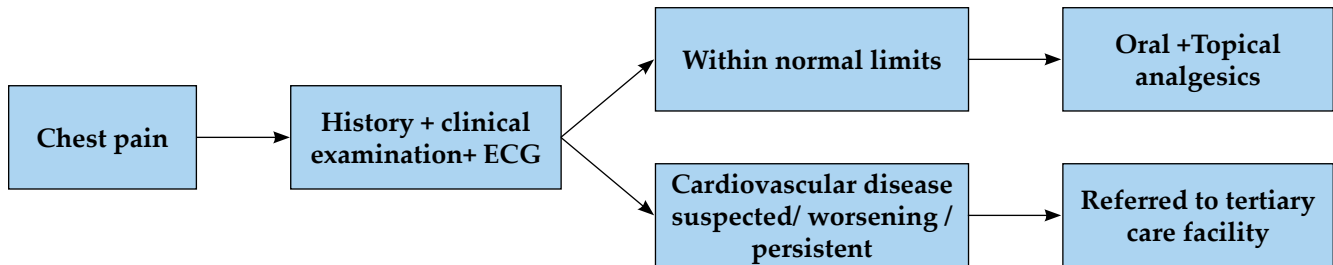
- A. Chest pain is common in post-acute COVID-19 patients.¹
- B. Clinical assessment of the post-acute COVID-19 patient with chest pain should follow similar principles to that for any chest pain: a careful history, taking account of past medical history and risk factors, a physical examination, backed up as indicated by the investigations.¹³
- C. Where the diagnosis is uncertain, pulmonary embolism or serious cardiovascular disease is suspected or the patient is acutely unwell, urgent cardiology/tertiary care referral is required for the specialist assessment and management.¹

- B. Many patients are still recovering spontaneously in the first 6 weeks after acute COVID-19 and do not generally require fast-track entry into a pulmonary rehabilitation programme.¹

- C. Those who have had significant respiratory illness may benefit from pulmonary rehabilitation.¹³
- D. In the context of COVID-19, rehabilitation can be delivered by various virtual models, including video linked classes and home education booklets with additional telephone-based support.¹

7. Yoga

- A. Yoga helps in healing of physical body as well as restoring inner balance.
- B. Yoga comprises of proper exercises (*asanas*), proper breathing (*pranayama*), proper relaxation (*shava asana*), proper food and meditation.



5. Thromboembolism

- A. COVID-19 is an inflammatory and hypercoagulable state, with an increased risk of thromboembolic events.¹⁴
- B. Many hospitalised patients receive prophylactic anticoagulation.¹⁵
- C. Recommendations for anticoagulation after discharge vary, but patients with higher risk are typically discharged from hospital with 10 days of extended thrombo-prophylaxis.¹⁵
- D. According to guidance on the management of COVID-19, patients with confirmed venous thromboembolism should be treated with therapeutic-dose anticoagulation for 3 months.¹⁶
- E. Patient with suspected thromboembolism should be referred to tertiary care centre.

6. Pulmonary Rehabilitation

- A. Pulmonary rehabilitation reduces dyspnoea, increases exercise capacity, improves quality-of-life and diminishes health-care resource utilisation in patients with chronic lung conditions including those recovering from a SARS-CoV-2 infection.

- C. Yoga may be helpful in reducing stress and restoring mental and physical health.

8. Ventricular dysfunction

- A. Left ventricular systolic dysfunction and heart failure after COVID-19 can be managed according to standard guidelines.¹⁷
- B. Cardiovascular exercise must be avoided for 3 months by all the patients after myocarditis or pericarditis.¹⁸
- C. Patient with suspected ventricular dysfunction should be referred to tertiary care centre.

9. Neurological sequelae

- A. Ischaemic stroke, seizures, encephalitis, and cranial neuropathies have been described after COVID-19.¹⁹
- B. A patient suspected of these serious complications should be referred to a neurologist,¹
- C. Common non-specific neurological symptoms, which seem to co-occur with fatigue and breathlessness, include headaches, dizziness, and cognitive blunting.²⁰

Recommendations for Inclusion into the Pulmonary Rehabilitation Programme

- During the acute disease stage having dyspnoea and cough, 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 (in the long term)
- Decreased work performance/productivity
- Increased utilisation of medical resources associated with hospital and emergency room admissions due to chronic respiratory problems secondary to COVID-19

Recommendations for Exclusion from the Pulmonary Rehabilitation Programme

- Patients with neurological, cardiac, renal, or polytrauma or other body systems involvement
- These patients require specific pre-defined rehabilitation, *e.g.*, complex neurological or stroke rehabilitation
- Patients presenting with fall-related injuries
- Patients with co-existent active cancer
- Patients presenting
 - (a) with severe frailty
 - (b) in the end-of-life period and
 - (c) with overwhelming palliative care needs

- D. Until evidence-based guidance appears on how to manage such symptoms, it is recommended that supportive management and symptom monitoring in primary care.¹
- E. Patient with suspected neurological sequelae should be referred to tertiary care centre.

10. Mental health and well-being

- A. Post-COVID-19 is often associated with low mood, hopelessness, heightened anxiety, and difficulty in sleeping.²¹
- B. Post-traumatic stress disorder may occur, especially in health-care workers and others with caring responsibilities.²²
- C. Mental illness is strongly associated with social determinants, such as poverty, discrimination, and social exclusion.²³
- D. Mental health and well-being are enhanced by increased social unity, informal social support, mutual aid, and other community-based and collective measures.²³

11. Social and cultural considerations

- A. COVID-19 is more common and has a worse prognosis in the acute phase in people who are

poor, elderly and from certain minority ethnic groups.²⁴

- B. Many have co-morbidities including diabetes, hypertension, kidney disease, or ischaemic heart disease.¹
- C. Some have experienced family bereavements as well as job losses and consequent financial stress and food poverty.¹
- D. Strain on many carers has been high. For an important few, lockdown has worsened safeguarding concerns, such as the risk of child or intimate partner abuse.¹

12. Older patients

- A. COVID-19 tends to affect older patients more severely.²⁵
- B. Those who survive are at high risk of sarcopaenia, malnutrition, depression and delirium.²⁶
- C. Post-COVID-19 chronic pain may affect patients of any age but most commonly seen in elderly patients.²⁷
- D. Physical symptoms add to the psychosocial impact and also cause disrupted access to health-care (such as, arrangements for obtaining

regular medication), social interactions (such as, meeting friends) and professional support networks.²⁸

At primary care effort should be made to personalise support with inputs from the multi-professional team (for example, general practitioner, district nurse, social worker and rehabilitation teams).¹

13. Indications for referral

The patient needs referral, if following conditions are observed on examination:

1. Worsening breathlessness
2. SpO₂ <96%
3. Unexplained chest pain
4. New confusion and focal weakness.

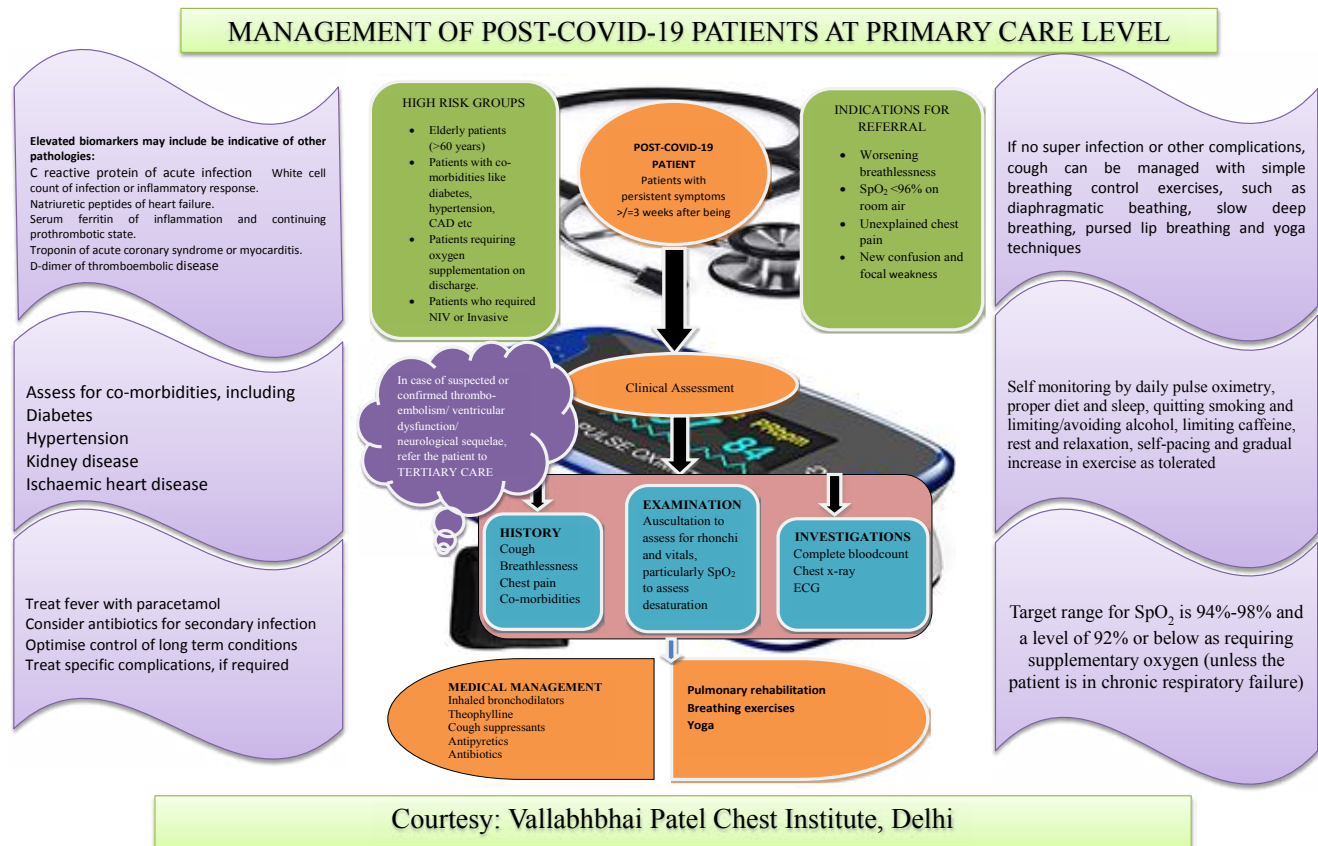
Indications for specialist assessment include clinical seriousness/worsening along with respiratory, cardiac, or neurological symptoms that are new, persistent, or progressive.¹

Specialist referral may be indicated based on clinical findings, e.g., *respiratory*, if suspected pulmonary embolism, severe pneumonia; *cardiology*, if suspected

myocardial infarction, pericarditis, myocarditis or new heart failure; *neurology*, if suspected neurovascular or acute neurological event and patient may require pulmonary rehabilitation, if patient has persistent breathlessness on follow-up.⁹

Post-COVID-19 Patient Management at Tertiary Care Level

Post-COVID-19 syndrome is defined as symptoms persisting after 3 weeks from a positive COVID-19 report.¹ These post-COVID-19 patients usually have a variety of symptoms, such as generalised pain, fatigue, cough, breathlessness, chest pain, etc. The number of such patients with post-COVID-19 syndrome is likely to increase further as the number of COVID-19 infected individuals is increasing. Most of the post-COVID-19 patients would be first assessed at the primary care level and given symptomatic treatment. However, if these patients have persistent or worsening symptoms or life-threatening conditions, they would be referred to tertiary care centres for appropriate evaluation and management. Also, patients with high risk for post-COVID-19 complications would also be directly



Definition of abbreviations: CAD=Coronary artery disease, ECG=Electrocardiogram, SpO₂= Oxygen saturation, NIV=Non-invasive ventilation.

Patients Requiring Management at Tertiary Care Centres

Referral from Primary Care Centres

- Worsening breathlessness
- SpO₂ <96%
- Unexplained chest pain
- New confusion and focal weakness

High Risk Group

- Elderly patients (age >60 years)
- Patients with co-morbidities (diabetes mellitus, hypertension, coronary artery disease, etc)
- Patients requiring oxygen on discharge from COVID-19 management
- Patient who required non-invasive ventilation or mechanical ventilation during COVID-19 management

referred to tertiary care centres. The initial in-person visits should target the establishment of a patient's baseline after COVID-19.²⁹ This process would require a detailed present and past medical and social history along with appropriate investigations.

Evaluation of the patient

1. Complete blood count
2. Comprehensive metabolic panel
3. Coagulation studies including prothrombin time, partial thromboplastin time, D-dimers and fibrinogen
4. Serology for anti-phospholipid and anti-cardiolipin antibodies
5. SARS-CoV-2 immunoglobulin-G (IgG) antibody levels
6. Non-contrast high-resolution computerised tomographic scan
7. Pulse oximetry on room air at rest and during the 6-minute walk test (6MWT)
8. Pulse oximetry with supplemental oxygen if the SpO₂ <88%
9. 6-minute walk test. In the absence of contraindications, a standard 6MWT as per American Thoracic Society/European Respiratory Society (ATS/ERS) recommendations should be performed. The 6MWT has a strong correlation with the clinical outcomes in chronic respiratory diseases. Oxygen desaturation on performing a 6MWT is an indicator of exercise-induced desaturation and disease severity. Desaturation ≥4% on 6MWT is considered to be clinically significant
10. Pulmonary function test with diffusion capacity. This will help in diagnosing the type of abnormality in post-COVID-19 patients – whether obstructive or restrictive defect is present. Hence, this will be important to guide for the management and follow-up
11. Echocardiogram
12. Assessment of quality-of-life

Post-COVID-19 Complete Assessment and Management²⁹

Supportive and symptomatic treatment

1. Cough

- A. Cough should be evaluated with history, examination and investigations to rule out super-added infections. Fever and purulent sputum may indicate need for antibiotics. Whereas presence of associated pleuritic chest pain will require evaluation of pleural involvement by performing chest x-ray, ultrasound thorax and CT thorax.
- B. If on examination bilateral rhonchi is present, patient can be treated with inhaled bronchodilators and inhaled corticosteroids, with or without short course of systemic steroids on case to case basis.
- C. If all these factors are ruled out, cough can be tried to be managed with simple breathing control exercises, such as diaphragmatic breathing, slow deep breathing, pursed lip breathing.
- D. Also, yoga may play a beneficial role in control of cough.
- E. If despite all above, cough is persistent and disturbing, it can be managed with cough suppressants.

2. Breathlessness

- A. After detailed history and clinical examination, the requisite investigations, like chest x-ray, pulmonary function testing, pulse oximetry and 6MWT should be performed.
- B. Patients should be asked to self-monitor with a pulse oximeter and to make an observations diary of the same.¹
- C. Acceptable SpO₂ is 94% to 98% and a level of 92% or below can be managed with

supplementary oxygen (unless the patient is in chronic respiratory failure).¹

- D. Oximeter readings persistently in the range of 94% to 95% may require re-assessment, investigations and follow up.¹
- E. In patients with pre-existing lung disease and chronic respiratory failure, a SpO₂ of 88% to 92% is considered acceptable.
- F. Breathlessness may improve with breathing exercises which include positioning, pursed lip breathing and coordinated breathing training.
- G. Also, yoga may lead to improvement in breathlessness.

3. Consideration of a new diagnosis of venous thromboembolic disease

- A. COVID-19 is an inflammatory and hypercoagulable state with an increased risk of thromboembolic events.¹⁴
- B. COVID-19 may predispose patients to thrombotic disease, both in the venous and arterial circulations, because of excessive inflammation, platelet activation, endothelial dysfunction, and stasis.³⁰
- C. Recommendations for anticoagulation after discharge vary, but patients with higher risk are typically discharged from hospital with 10 days of extended thromboprophylaxis.¹⁵
- D. For the diagnosis of new venous thromboembolic disease, investigations like D-dimer, duplex ultrasonography, other coagulation studies and computed tomographic pulmonary angiogram (CTPA) may be done on an individualised basis.
- E. As per the guidance on the management of COVID-19, patients with confirmed venous thromboembolism should be treated with therapeutic-dose anticoagulation for 3 months, following the same standard of care as for patients without COVID-19.¹⁶

4. Assessment and management of fatigue and anxiety

- A. After proper clinical evaluation, patient should be counselled about the extent of disease and gradual recovery.
- B. Fatigue may benefit with gradual graded rehabilitative exercises and yoga.
- C. However, these need to be performed under supervision and to be rolled back if the symptoms worsen.
- D. If anxiety or other psychological symptoms persist or worsen, patient should be referred to

psychiatrist for appropriate management.

5. Pulmonary rehabilitation

- A. Pulmonary rehabilitation (PR), defined as “a multi-disciplinary intervention based on personalised evaluation and treatment which includes, but is not limited to, exercise training, education, and behavioural modification designed to improve the physical and psychological condition of people with respiratory disease.”³¹
- B. Those who had significant respiratory illness may benefit from pulmonary rehabilitation.¹³
- C. The most effective form of rehabilitation for COVID-19 survivors remains unproven, and there is no evidence that rehabilitation is beneficial for COVID-19 survivors. However, there is some evidence from previous outbreaks of viral pneumonias that a PR-based programme might be effective.³²
- D. Because of the present COVID-19 situation, rehabilitation can be delivered by various virtual models, including video linked classes and home education booklets with additional telephone support.¹

6. Yoga

- A. Yoga helps in healing of physical body as well as restoring inner balance, hence may be beneficial in improving general well-being and providing symptomatic relief.
- B. Yoga comprises of proper exercises (*asanas*), proper breathing (*pranayama*), proper relaxation (*shava asana*), proper food and meditation.
- C. Yoga may be helpful in reducing stress and restoring mental and physical health.

Respiratory Disease-specific Conditions Requiring Expert Opinion and Further Research

1. Post-COVID-19 pulmonary fibrosis

A post-COVID-19 patient can be diagnosed to have developed pulmonary fibrosis based on chest x-ray, resting or exertional desaturation, pulmonary function testing including diffusion capacity and CT thorax. The management of such cases is described as follows:

Domiciliary oxygen therapy

Long-term oxygen therapy is recommended for patients with pulmonary fibrosis with a resting PaO₂ <55mmHg. Patients with pulmonary fibrosis who experience severe breathlessness could be

considered for palliative oxygen therapy.³³ Short-term oxygen therapy can be considered for patients with SpO₂ <93% at rest or when the patient is ambulatory for 1 minute provided the patient is able to maintain a stable SpO₂ with low flow nasal cannula.³⁴

Steroids

Direct evidence for the use of corticosteroids in COVID-19 is very limited.

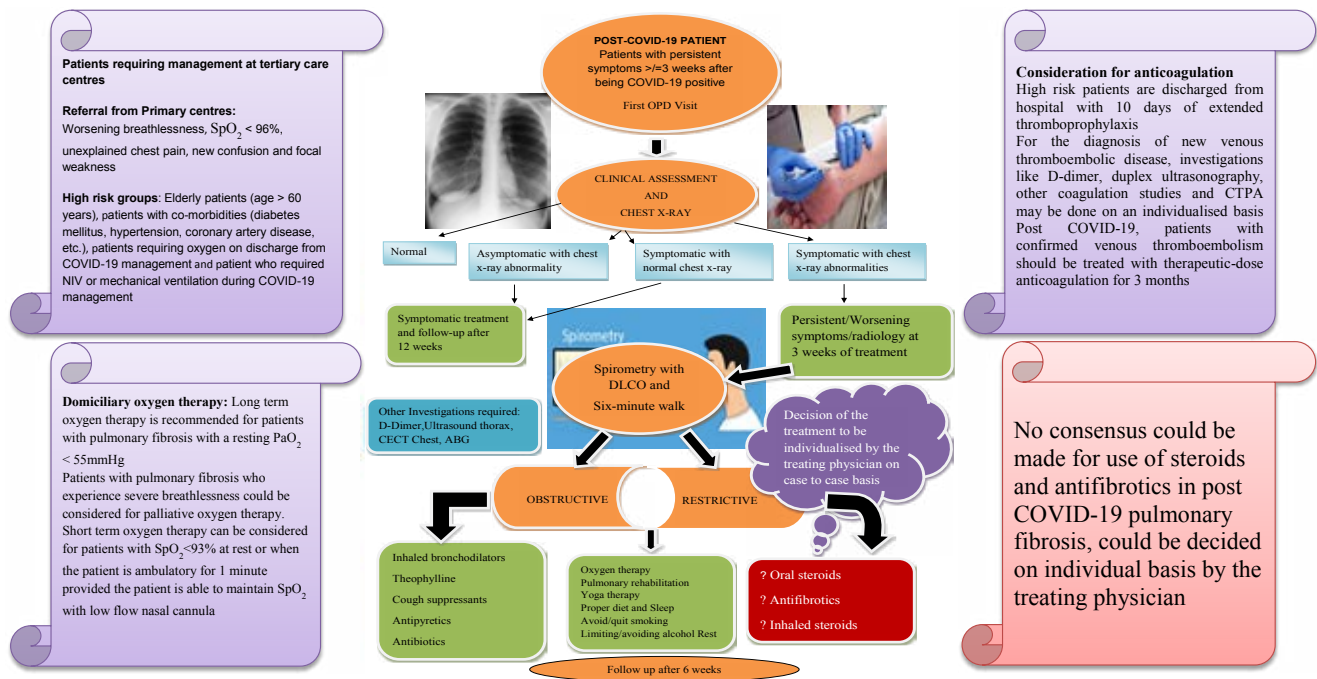
1. Also, long-term use of steroids may be associated with side-effects, like avascular necrosis that results in femoral head necrosis, hyperglycaemia during steroid treatment and psychosis.³⁵
2. In the discussion in the expert group, almost 70% to 80% participants were of the opinion of prescribing low-dose steroids early in such cases because of the clinical improvement observed on steroid therapy in post-COVID-19 patients.
3. *However, no consensus could be made and use of steroids in post-COVID-19 pulmonary fibrosis could be decided on individual basis by the treating physician.*

Antifibrotics

Antifibrotics (Pirfenidone and Nintedanib) have been successfully used in the management of IPF.

1. Pirfenidone has pleiotropic action (anti-oxidant, anti-inflammatory and anti-fibrotic).
 2. So, **Pirfenidone can be probably be used** in post-COVID-19 patients showing clinical and/or radiological and/or physiological evidence of fibrotic lung disease.^{36,37}
 3. In the discussion in the expert group, some participants were of the opinion of prescribing antifibrotics early in such cases, which may prevent occurrence/progression of fibrosis.
 4. *However, no consensus could be made and use of antifibrotics in post-COVID-19 patients with pulmonary fibrosis could be decided on individual basis by the treating physician.*
2. **Post-COVID-19 obstructive airway disease**
- A. Data on the prevalence of obstructive airway disease in patients who have recovered from COVID-19 is lacking at present.

MANAGEMENT OF POST COVID PATIENTS AT TERTIARY CARE LEVEL



Courtesy: Vallabhbhai Patel Chest Institute, Delhi

Definition of abbreviations: SpO₂=Oxygen saturation, NIV=Non-invasive ventilation, OPD=Out-patient department, PaO₂=Partial pressure of oxygen, DLCO=Diffusing capacity of the lungs for carbon monoxide, CTPA=Computed tomography pulmonary angiogram, CECT=Contrast-enhanced computed tomography, ABG=Arterial blood gas.

- B. Studies done during the previous SARS pandemic have demonstrated that recovered patients with coronavirus pneumonia can be left with damaged lungs. Impaired lung functions were commonly observed in these studies and were documented to last for months or even years.³⁸
- C. Considering the above case scenario, the prevalence of small airway obstructive diseases is likely to increase with time among post-COVID-19 patients with documented residual radiographic abnormalities.
- D. Evaluation of such patients would require proper clinical evaluation followed by chest x-ray, CT thorax and pulmonary function test apart from other investigations on an individualised basis.
- E. **Management can be done with inhaled bronchodilators, inhaled corticosteroids and oral methylxanthines.**
- F. Further, pulmonary rehabilitation and yoga may have an important role in symptomatic relief in such cases also.

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