Management of Hyperglycemia in COVID-19 and Post-COVID-19 Syndrome - Proposed Guidelines for India

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Abstract
SARS-CoV-2 virus spread rapidly all over the globe in 2020 and the second wave has taken our nation, India by storm. The pandemic has posed unique challenges in people with metabolic disorders, including diabetes, hypertension, obesity, pulmonary, cardiovascular, kidney and non-alcoholic fatty liver disease. Uncontrolled diabetes, in conjunction with endocrine, inflammatory and metabolic effects of the infection itself has made management of hyperglycemia in COVID-19 infection particularly challenging. Furthermore, the post-COVID-19 syndrome has also emerged as a sequela in COVID-19 survivors, increasing the risk of death, complications and adding further burden on the health care system. With more than a year of experience, we have gained substantial insight; and now provide practical recommendations on the management of hyperglycemia in COVID-19 as well as post COVID-19 syndrome.

Introduction
The pandemic has proven to be a huge challenge to the healthcare system, especially in India. It has become evident that diabetes is one of the most important risk factors for increased morbidity and mortality in patients with COVID-19 infection.¹ Optimal management of hyperglycemia in patients with COVID-19 infection and well as post COVID-19 is extremely important to reduce this risk. It is observed that there is considerable heterogeneity in the effect of COVID-19 on glucose metabolism, ranging from mild to severe hyperglycemia with or without ketoacidosis. The severity is mainly attributed to steroid therapy, cytokine storm, acute stress, autoimmune damage to the β-cells and COVID-19 induced pancreatitis.² Moreover, the resurgence of COVID-19 in India has brought newer challenges in the management of hyperglycaemia. In comparison to the first, the second wave caused predominantly by the SARS-CoV-2 variants reported a surge in the number of cases affecting the younger population, patients presenting with shortness of breath, requiring oxygen supplementation and/or mechanical ventilation.³,⁴ Of all co-morbid conditions that have been associated with the severity of the COVID-19 infection, diabetes takes the centre stage due to its increased prevalence among our population. Studies have shown that uncontrolled hyperglycaemia per se causes increased mortality among patients with COVID-19 infection.⁵ ⁶

Even under normal circumstances, clinical decision making in the management of diabetes is complex, more so during the pandemic due to increased severity of the infection among diabetes patients in comparison to persons without diabetes. Limited access to diabetes care in the hospitals has caused a setback in the optimal glycaemic management resulting in hyperglycaemia and poor treatment outcomes for COVID-19 infection. The immune-escape of the “double” and “triple” SARS-CoV-2 variants poses a great concern on the emergence of re-infections especially among diabetes patients. Moreover, there are emerging data on the direct detrimental effect of the virus on the pancreatic β-cells, predisposing COVID-19 patients to an increased risk of new-onset diabetes.⁴,⁷,⁸

Beyond this, there are many uncertainties with COVID-19 infection. Hence an expert committee was formed to address many of these unanswered questions, and develop a consensus guideline on the management of hyperglycemia for people with COVID-19 for use in both primary and specialist care, and to further address issues pertaining to post COVID-19 sequaleae as well.

The expert committee which reviewed and finalized this document comprised of eminent diabetologists and endocrinologists who have contributed extensively to public health research in diabetes in India. The members have individually published important scientific data relating to the management of COVID-19 in India. The guideline was developed through practical expertise in the clinical management of diabetes and COVID-19. A systematic literature search of published studies and articles was performed using PubMed SEARCH,

The following recommendations were proposed with the intention to guide clinicians to manage hyperglycaemia in COVID-19 infection and post-COVID-19 syndrome more effectively.

**Hyperglycaemia in COVID-19 Infection – Clinical Scenarios and Pathophysiology**

In order to treat hyperglycaemia is COVID-19 infection, it is important to differentiate the various types of clinical presentations/scenarios.

1. **Pre-existing known case of diabetes with COVID-19 infection**
2. **Undetected diabetes identified during COVID-19 infection**
3. **Prediabetes, converted to type 2 diabetes, due to COVID-19 infection/stress**
4. **Steroid/stress induced hyperglycaemia**
5. **New onset diabetes due to COVID-19 infection**

A classification has been brought out on the heterogeneous hyperglycaemic states based on the presentation of hyperglycaemia in individuals with or without known diabetes in varying degrees of COVID-19 infection. Among the groups described, patients with diabetes or prediabetes treated with corticosteroids for moderate to severe COVID-19 infection experience acute rise in blood glucose levels, and require high doses of insulin. Even without steroid therapy, infection and acute stress is said to increase blood glucose levels. Many patients with COVID-19 infection, develop ketoacidosis, and hyperglycaemic hyperosmolar state (HHS), resulting in worsening of outcomes. In an analysis by Li et al, the prevalence of ketosis was 6-4% in patients with COVID-19 without diabetes as compared to 11-6% in patients with COVID-19 with diabetes, resulting in a higher mortality rate (33-3%).

Even individuals with no prior history of diabetes or pre-diabetes may present with ketoacidosis suggesting acute insulinopenia due to the severity of COVID-19 infection and pneumonia.

In a study that compared adults diagnosed with new onset diabetes during the time of the pandemic and prior showed that individuals newly diagnosed with diabetes with a history of COVID-19 infection had significantly higher blood glucose values and HbA1c compared to those without a similar history. However, no differences in symptomatology or other biochemical characteristics were noted between the two groups.

As discussed, although, acute stress and infection with the cytokine storm may itself be a trigger to result in hyperglycaemia and ketosis, the direct effect of SARS Co-V-2 virus on the pancreatic β-cells may be considered. It is proposed that affinity of the SARS-CoV-2 spike protein towards angiotensin converting enzyme 2 receptor expressed on the pancreatic β-cells among other tissues facilitates its entry causing direct viral tissue damage. This may result in an acute loss of insulin secretory capacity, which could lead to a rapid metabolic deterioration resulting in diabetic ketoacidosis or HHS. This SARS Co-2-V tropism may result in β-cell destruction of the pancreate, leading to of new onset diabetes in previously normoglycemic patients with COVID-19 infection. Even in the absence of new-onset diabetes, varying degrees of metabolic dysregulation in patients with COVID-19 may occur due to immune cell infiltration, necroptic cell death and SARS-CoV-2 viral infection of the pancreatic beta-cells.

**Challenges in Management of Hyperglycaemia in COVID-19 Infection**

There are various challenges in patients with COVID-19 infection that may need to be addressed or overcome to achieve glycemic control.

These may include:

1. Lack of/inability to frequently monitor blood glucose due to restricted contact between nurses/healthcare worker and the patient
2. Lack of/non-availability of diabetes care expert in many hospital settings thus hyperglycaemia is given less importance to management.
3. Concomitant use of steroid therapy, and the infection/virus itself that contributes to hyperglycaemia and makes the correction of blood glucose more challenging.

4. Virtual consultation – Insulin initiation becomes challenging

**Hyperglycaemia and COVID-19 – Clinical Implications**

Diabetes has been identified as the major risk factor for worsening of outcomes in patients with COVID-19 infection. A study in UK that included more than 5500 patients with COVID-19 reported that poor glycemic control, as indicated by increased HbA1c values prior to hospital admission, was associated with a high risk of in-hospital mortality. The in-hospital death was greater in patients with HbA1c of ≥7.5% (Hazard Ratio (HR) 3.36, 95% CI 2.18–2.56) than in those with lower HbA1c values (HR 1.50, 95% CI (1.4–1.6)).

In line with this observation, findings from various other studies also suggest that at-admission hyperglycaemia is strongly associated with mortality and complications among known and new-onset diabetics. At-admission hyperglycaemia was defined as increased blood glucose levels measured at the time of hospital admission or on the immediate next day of admission on fasting. In another study, with 1122 patients with COVID-19 admitted to hospital in the USA, the mortality rate was four times higher in those with diabetes or hyperglycaemia during the hospital stay (28.8%) than those with normoglycaemia (6.2%).

In a study conducted in South India, by Arun et al, among 800 patients with COVID-19 infection, treated in the intensive care unit, the mortality rate was two times higher in patients with diabetes (10.2%) as compared to the non-diabetic patients (5.9%), p = 0.021. Furthermore, mortality was more than three times higher in patients with uncontrolled diabetes (HbA1c >8%) (59.1%) as compared to patients with a HbA1c of <6.5% (22.7%). An analysis by Singh et al showed that among patients with diabetes and COVID-19 infection, there were significant increases in acute respiratory distress syndrome (14.8% vs. 7.2%, p = 0.01) acute kidney injury (3.2% vs. 0.4%, p = 0.04) and acute heart injury (6.8% vs. 1.6%, p = 0.01) among poorly-controlled diabetes patients (n=528, blood glucose >180 mg/dl) compared to patients with well-controlled diabetes.
To check blood glucose and HbA1c levels as part of routine blood investigations

- If HbA1c (<7%) and blood glucose levels (FPG <130mg/dl, PPG <180mg/dl) are satisfactory
  - In patients with stable regimes, oral antidiabetic agents / injectable therapy should be continued.
- If HbA1c (≥7%) and blood glucose levels (FPG ≥130mg/dl, PPG ≥180mg/dl) are unsatisfactory
  - Intensify / adjust therapy with caution, to add on insulin when needed.

**Suggested Advice:**
- The choice of discontinuation of specific antidiabetic agents must be considered with clinician’s discretion (Refer to table)
- Frequency of glucose monitoring* can be left to the discretion of the treating doctor, however more frequent monitoring is advisable in patients on insulin or newly initiated insulin therapy
- *Self-monitoring of Blood glucose (SMBG), with glucometer or Continuous Glucose Monitoring System (CGMS) may be advised when necessary

**Fig. 1: Flowchart - Mild COVID-19**

To check blood glucose, presence of ketones in urine and HbA1c level at admission

- For Patients not in the Intensive Care Unit
  - Decision based on clinical status including hydration, nutritional status & risk of hypoglycemia
  - If satisfactory, to continue stable antidiabetic regime
    - Decision of discontinuing specific agents to be decided by clinician discretion
  - If unsatisfactory, to intensify therapy, to add on oral agents / insulin (Insulin is the preferred choice)

- For Patients in the Intensive Care Unit
  - To stop oral anti-diabetic therapy and initiate intravenous insulin

**Suggested Advice:**
- In patients who require hospitalization, high priority must be given for glucose monitoring to reduce mortality and complications
- Use of high dose steroids makes glucose control in these patients more challenging

**Fig. 2: Flowchart - Moderate to Severe COVID-19 infection**

(n=282, blood glucose 70 - 180 mg/dl). Another study from New Delhi, India also reported that among those admitted for COVID-19, patients with pre-existing diabetes and new-onset hyperglycaemia had increased proportion of severe cases (20.1% vs 9%, p=0.002), mortality (6.3 vs 1.4%, p=0.015), ICU admission (24.3 vs 12.3%, p=0.002) and those requiring oxygen (53.4 vs 28.3%, p=0.001) compared to patients without diabetes. Presence of diabetes or hypertension worsened the disease condition leading to increased mortality.15

The recent surge in cases of mucormycosis have also been a concern among patients with COVID-19 infection. It has become evident that patients with poor glycemic control, diabetic ketoacidosis and on high doses of steroid therapy are more prone to the opportunistic mucormycosis infection.16

Hence there is ample evidence to conclude that good glycaemic control is extremely important and essential to improve outcomes in patients with COVID-19 infection. The purpose of this review is to stress the importance of blood glucose as the fifth parameter among the vital signs in monitoring patients with COVID-19 infection.17

**Management of Blood Glucose in COVID-19 Infection**

A. **Patients with pre-existing diabetes and COVID-19 infection**

In patients with pre-existing diabetes with COVID-19 infection, the first step is to check blood glucose levels and HbA1c at baseline.18

- In Mild to Moderate COVID-19 infection / Home isolation

The flow chart (Figure 1) provides recommendations on the management of hyperglycaemia and self-monitoring of blood glucose for diabetes patients with mild infection and are in home quarantine. In mild to moderate cases, with satisfactory blood glucose control (HbA1c (<7%, FPG <130mg/dl, PPG <180mg/dl) there is no compelling need to change therapy. However, close and frequent home monitoring of blood glucose is recommended, with up-titration of therapy if required through the course of infection. In patients with unsatisfactory glucose levels (HbA1c ≥7%, FPG ≥130mg/dl, PPG ≥180mg/dl), treatment intensification is recommended in order to achieve target blood glucose levels. The choice of glucose lowering agents can be made with clinicians’ discretion.

- In Moderately-SevereCOVID-19 infection

This is defined as having fever and at least one sign/symptom of respiratory disease and requirement for hospitalization.19 The flowchart (Figure 2) provides recommendations for patients with moderate to severe COVID-19 infection who require hospitalization. Glucose monitoring must be given high priority, so as to reduce mortality and complication risk. As discussed earlier, the use of high dose steroids makes glucose control in these patients more challenging. Specific recommendations have also been given by the Ministry of Health and Family Welfare on the management of diabetes at patient care facility for COVID-19.20

B. **Management of Hyperglycaemia in previously non-diabetic patients**
with COVID-19 infection

In all patients with COVID-19 infection, it is advised to check blood glucose and HbA1c as part of routine blood work up. Table 1 provides recommendations for treatment of hyperglycaemia in patients not known to have diabetes previously.

### Glucose Lowering Agents in COVID-19 Infection

Over the last year and more, we have learnt that the oral glucose lowering agents cause no negative effects or worsening in the course of SARS-CoV-2 infection. In patients with mild to moderate infection, there is no compelling need to withhold or stop antidiabetic medication if the patients eating and drinking adequately. Patients with severe infection who require hospitalization may need modification in ongoing antidiabetic therapy and insulin initiation. The decision must be made based on the patient’s clinical status, including hydration status, nutritional status, risk of hypoglycemia and renal status.

The use of oral antidiabetic agents however does have specific considerations in COVID-19 infection as shown in Table 2.

### Metformin

Metformin has been implicated to have anti-viral effects in the past, against infections including Hepatitis B, Hepatitis C, and even in HIV, through mechanisms not clearly known. Additionally, metformin may also exhibit anti-inflammatory, anti-oxidative and immune-modulatory effects. These beneficial effects that the drug offers may in fact improve host response to COVID-19 infection.

There are several clinical studies that have assessed outcomes in patients on Metformin with COVID infection. The most recent Coronavirus Disease and Diabetes Outcome (CORONADO) study in patients with diabetes and COVID-19 infection, showed significant improvement in outcomes in metformin users versus non-users, including a significant 37% risk reduction in mortality observed in metformin users (OR 0.63; 95% CI 0.52-0.77; p < 0.001). Several other retrospective analyses have shown significant improvement in outcomes with the use of metformin in patients with diabetes and COVID-19 infection.

Although there is evidence suggesting a favourable effect of metformin in COVID-19 infection, the drug must be discontinued in patients with acute renal injury, sepsis or respiratory distress.

### Dipeptidyl-Peptidase 4 Inhibitors (DPP4i)

Experimental studies suggest that DPP4i may also have anti-inflammatory effects. Another theory is that the soluble DPP-4 might act as a co-receptor for a subset of corona viruses, hence may interfere with their binding and hypothetically reduce the viral load.

There are several retrospective studies that assessed the effects of DPP4 inhibitors in COVID-19 infection. The results of most of these analyses suggest that these agents do not have a negative impact on the prognosis of the infection. In the prospective CORONADO study, the rates of discharge from hospital were significantly higher in DPP-4i users (22%) as compared to the non-users. However, there was no difference in mortality rates between patients using DPP4i versus non-users. A large retrospective study, SIDIACO-RETRO, studied the effect of sitagliptin in patients with type 2 diabetes and COVID-19 infection (n=334). The results showed a significant relative risk reduction (56%) in mortality in patients with type 2 diabetes and COVID-19 using sitagliptin, as compared to standard-of-care. The DPP4i have advantages of being well tolerated with low risk of hypoglycemia and can be safely used through wide range of estimated Glomerular Filtration Rate (eGFR), with dose adjustment. In patients with mild to moderate COVID-19 infection, the DPP4i can be safely continued. However, in severe infection, the decision must be made based on the patient’s clinical status (Figure 2).

### Sodium Glucose Cotransporter -2 (SGLT2) Inhibitors

There exists a hypothesis that the SGLT2 inhibitors can decrease intracellular pH and increase lactate concentrations which could reduce viral load in COVID-19 infection. SGLT-2i may also have anti-inflammatory properties and reduce oxidative stress, which may in turn provide a positive impact in COVID-19 infection. There have been some studies to assess the effects of this group of agents in patients with COVID-19 infection. A study by Kim et al, suggested no difference in death rates or severity of illness in SGLT2i users versus non users with COVID-19 infection. Similarly, preliminary results from the Dapagliflozin in Respiratory Failure in Patients with COVID-19 [DARE] study shows no worsening of outcomes in patients with respiratory failure with COVID-19 infection. Furthermore, Dapagliflozin was well tolerated by the patients, with numerically fewer adverse events than placebo.

However, it is strongly recommended to use these group of drugs with caution during acute infection due to the risk of dehydration, electrolyte imbalance and euglycaemic diabetic ketoacidosis.

### GLP-1 Receptor Agonists (GLP-1) Agonists

GLP-1 Receptor agonists may worsen nausea and due to their gastrointestinal side effects, must be discontinued in patients with severe COVID-19 infection, due to the risk of aspiration. Experimental models suggest that both GLP-1 receptor agonists may have some anti-inflammatory effects. Although there are some case reports of GLP-1 therapy in patients with COVID-19 infection describing improved outcomes, these agents have not been widely studied in COVID-19 infection. The CORONADO study, did however report that in patients with COVID-19 infection, there was no detrimental effects or worsening in outcomes, among GLP-1 RA users (254/2794) compared to non-users.

### Sulphonylureas

Caution must be sought with the
use of sulphonylureas due to the risk of hypoglycemia, especially if the patient is not eating well during acute infection. Some retrospective studies with sulphonylureas in patients with COVID-19 infection have reported no harm or detrimental effects. Similarly reports from the CORONADO study also found neither detrimental nor beneficial effects on outcomes in the combined group of sulphonylureas and glinides. However, it is strongly recommended to judiciously use sulphonylureas, due to their high risk of hypoglycemia.

**Pioglitazone**

There exists some evidence from experimental and human studies that pioglitazone may have anti-inflammatory properties, including reduction in levels of inflammatory markers like Interlukin (IL) -6, IL -8 and tumor necrosis factor alpha (TNF-α). However, there is little known about its effects in patients with COVID-19 infection, including the CORONADO study where effects of pioglitazone were not reported. 26 It is recommended to avoid the use of pioglitazone in patients with severe COVID-19 infection due to its risk of fluid retention.

**Insulin**

Insulin is the safest option, especially in patients who are critically ill and will benefit from intravenous insulin use. Insulin requirements may also be very high due to the hyper-inflammatory state during COVID-19 infection as discussed earlier. In patients without proper food intake, and are previously on oral agents conversion to subcutaneous insulin may be required. The disadvantage of insulin use is the risk of hypoglycemia, which can be largely reduced with frequent and close monitoring of blood glucose.

However, some studies conducted in other countries have reported treatment with insulin to be associated with lower chance of early hospital discharges and higher mortality. But the findings are likely to be due to confounding by severity of infection, other comorbidities and compliance to diabetes management prior to admission. 21,25,33

The following Table 2 discusses the advantages and disadvantages of anti-diabetic agents used in the treatment of hyperglycaemia in patients with COVID-19 infection.

### Table 2: Antidiabetic treatment during COVID-19

<table>
<thead>
<tr>
<th>Antidiabetic Agent</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Clinical Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>No risk of hypoglycaemia</td>
<td>Risk of lactic acidosis</td>
<td>Risk reduction in mortality by 37% among metformin vs non-metformin users (OR 0.63; 95% CI 0.52-0.77; p &lt; 0.001)25</td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>No risk of hypoglycaemia. Available for a wide renal function range. Potential anti-inflammatory action. Potential modification of SARS-CoV-2 binding to DPP-4</td>
<td>Risk of hypoglycaemia. Electrolyte imbalances. Euglycaemic ketoacidosis.</td>
<td>Decrease in all-cause mortality (HR 0.44; 95% CI 0.29-0.66; p &lt;0.0001) with sitagliptin vs. insulin therapy.29 Reduction in mortality in DPP-4i users, compared to the non-users (HR 0.13; 95% CI, 0.02-0.92; p=0.04).30 Higher rate of discharge from hospital (22%) compared to non-users (OR 1.22; 95% CI,1.02-1.47; p=0.03)26</td>
</tr>
<tr>
<td>SGLT2 inhibitors</td>
<td>No risk of hypoglycaemia. Avoid initiation in acute infection</td>
<td>Risk of hypoglycaemia if oral intake is administered with other glucose-lowering agents. Risk of fluid retention. Risk of hypoglycaemia.</td>
<td>Decreased risk of mechanical ventilation (Adjusted RR 0.03; 95% CI, 0.00-0.70; p = 0.03)15 Studies report no detrimental or beneficial effect compared to non-users.26</td>
</tr>
<tr>
<td>GLP-1 receptor agonists</td>
<td>No risk of hypoglycaemia. Potential anti-inflammatory action. Avoid initiation in acute infection</td>
<td>No confirmatory reports available</td>
<td>Studies report no detrimental or beneficial effect compared to non-users.26</td>
</tr>
<tr>
<td>Sulfonylureas</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioglitzone</td>
<td>? Anti-inflammatory action</td>
<td>Risk of gastrointestinal side effects.</td>
<td>Increase in mortality compared to non-users (27.2% versus 3.5%; adjusted HR, 5.38 [2.75-10.54])20</td>
</tr>
<tr>
<td>Insulin</td>
<td>Recommended in hospitalized/ critical patients.</td>
<td>Intra venous administration</td>
<td></td>
</tr>
</tbody>
</table>

At Discharge from Hospital

Optimal titration of glucose lowering agents prior to discharge must be given high priority for patients, so as to avoid untoward events like hypoglycemia in the post COVID-19 phase. The last 48 hours prior to discharge, may be dedicated to optimize glucose levels, dose titration of insulin and oral agents, with priority on close monitoring of glucose levels, and patient education.

- 48 hours prior to discharge – optimize doses of insulin & oral glucose lowering agents
  - Priority on glucose monitoring, patient education, insulin teaching
  - Transition of injectable steroid to oral steroid, along with recovery from infection, may improve insulin sensitivity, hence insulin requirement may reduce.
  - Ensure diet advice and advice on resuming exercise gradually, based on patient’s status.

**Discharge advice**

- Self Monitoring of Blood Glucose – patients must be encouraged to closely monitor blood glucose levels at home.
- Challenges include: - Continued steroid therapy and changes in dietary habits, including loss of/ increased appetite, loss of taste etc.
- Rehabilitation care team must include dietician and patient educator.
- Advise on resuming exercise – based on patient status.

**Follow-up visits**

- In patients with new onset hyperglycemia
  - Repeat HbA1c after 3 months.
  - Continue insulin, until clarity on type of diabetes
- After one month / after discontinuation of steroid check for Serum insulin levels/ C-peptide levels, to r/o insulin deficiency/ assess pancreatic β-cell function
- In patients with pre-existing diabetes or unmasked diabetes
After discontinuation of steroid/1 month, patient eats adequately, stabilize Glucose lowering therapy.

In patients not requiring insulin, Insulin therapy can be switched to oral agents.

Post COVID Sequela / Syndrome

In many patients recovery from COVID-19 infection is followed by the post infective stage, which poses many challenges for the patient and treating clinician. Reports suggest residual effects of SARS-CoV-2 infection, such as fatigue, dyspnea, chest pain, cognitive disturbances, arthralgia and decline in quality of life. Manifestation of post-infectious seizures has also been reported indicating the importance of monitoring for neurologic diseases particularly in patients with preexisting co morbidities such as diabetes and hypertension.

As shown in Figure 3, there are three phases in COVID-19 infection (1) acute symptomatic which includes symptoms and abnormalities present for up to 4 weeks (2) ongoing symptomatic with signs and symptoms of COVID-19 from 4 to 12 weeks and (3) post-COVID-19 syndrome includes persistent symptoms and/or delayed or long-term complications over 12 weeks from the onset of acute infection and not attributable to alternative diagnoses.

During the post-COVID phase many patients continue to be on steroid therapy for a significant period even after discharge from hospital, which contributes to uncontrolled blood glucose levels. This has also been a concern in increasing the risk of opportunistic infections like mucormycosis. Thus, maintenance of good glycemic control during the post – COVID-19 phase is of utmost importance for optimal recovery.

Etiopathogenesis / Risk Factors for Post COVID-19 Syndrome

Little is known about the etiopathogenesis of the debilitating symptoms that persist in the post COVID-19 infective phase beyond 3 or 4 weeks from the onset of acute symptoms. The replication-competent of SARS-CoV-2 has not been isolated after 3 weeks. However, development of sequelae or long-term complications of SARS-CoV-2 infection may occur months together affecting various organs and systems. There are also very little data on the risk factors or the high risk groups for post COVID-19 syndrome. One study reported a higher risk of long COVID-19 in women, in persons aged >70 years, patients requiring hospitalization during the acute infection, and presence of asthma, without differences between countries or socioeconomic groups. Also, the number of symptoms during the acute...
COVID-19 infection appears to have an association. Patients’ with ≥5 symptoms during the acute infection had higher risk of long-term symptoms.41 Post-COVID-19 manifestations due to continued inflammation and immune-mediated responses such as arthritis, myositis, pancreatitis, others relating to skin, neurological, endocrine and autoimmune may occur occasionally.42 It is important to be aware of these symptoms as early treatment is crucial in most cases.

Management of Post COVID Syndrome

The management of post COVID-19 syndrome requires a holistic approach with a multidisciplinary team. The diagnosis of post COVID-19 syndrome is primarily a diagnosis of exclusion. The main objective of the clinical approach in management of post COVID-19 syndrome must be to make a systematic and thorough clinical assessment, in order to rule out other causes for the patients presenting symptoms (Figure 4).

Conclusion

The second wave of the COVID-19 pandemic has taken a toll on the healthcare system with thousands of lives affected every day. The healthy, young and the productive were more among those afflicted. The number of new cases is on the increased mortality. At this juncture, requirements include boosting the healthcare system with thousands of ventilators and medical beds. The number of cases among those afflicted. The number of new cases is on the increased mortality. At this juncture, the patient with COVID-19 infection may cause ketosis and ketoadiposis. Diabetes, Obesity and Metabolism 2020; 16:1935-41. https://doi.org/10.10111/dij.14057.


