

### **REVIEW OF LITERATURE**

- 1) **Marco Loffi, *et.al* (2020)** conducted a retrospective study on “Coronary artery disease in patients hospitalized with Coronavirus disease 2019 (COVID-19) infection” and found that patients with COVID-19 and CAD have an exceedingly higher risk of mortality, which is attributable, however, to the burden of comorbidities rather than to a direct effect of CAD on the risk mortality. ARDS developed in 73.4% of patients with CAD compared with 46.5% of those without CAD. Overall, a total of 1000 patients were discharged: 69 (55%) and 931 (82%) patients with CAD and without CAD. At follow-up, a total of 43 patients (4.3%) died after being discharged alive, nine (13%) in the CAD group and 34 (3.6%) in the no-CAD group. Rehospitalization was needed in 21 (2.1%) patients; of these, one (1.5%) was in the CAD group and 20 (2.2%) in the no-CAD group. The two main causes of rehospitalization were new-onset dyspnea (16 patients) and pulmonary embolism (five patients).
- 2) **Etheresia Pretorius, *et.al* (2021)** performed a study on “Persistent clotting protein pathology in long COVID/Post-Acute Sequelae of COVID-19(PASC)” is accompanied by increased levels of antiplasmin” where hypercoagulability is an increasingly recognized complication of COVID-19 infection and anticoagulation has become central in the comprehensive COVID-19 management. In Long COVID/PASC lingering symptoms persist for as much as 6 months or longer after acute infection. Where COVID-19 survivors complain of recurring fatigue or muscle weakness, being out of breath, sleep difficulties, and anxiety or depression. In Digested pellet deposits (microclots) from acute COVID-19 samples vs digested plasma from control samples C-reactive protein the p value was 0.003 and in Digested pellet deposits from long COVID microclots samples vs digested plasma from control samples C-reactive protein the p value was 0.007. Results presented were pointed to a significant failure in the fibrinolytic process during COVID-19 and also in patients with lingering long COVID-19 symptoms.
- 3) **Neal M. Dixit, *et.al* (2021)** conducted a systematic review on “Post-Acute COVID-19 Syndrome and the cardiovascular system: What is known?”. Cardiovascular symptoms such as Chest pain and Palpitations commonly occur in PACS. While autopsy studies have shown that the SARS-CoV-2 rarely causes direct myocardial injury, several syndromes such as myocarditis, pericarditis and postural orthostatic tachycardia syndrome have been implicated in PACS. Patients hospitalized with acute COVID-19 who display biomarker evidence of

myocardial injury may have underlying coronary artery disease revealed by physiological stress of SARS-CoV-2 infection and may benefit from medical optimization. Elevations in troponin, which occurred in roughly 20-30% of hospitalized patients, strongly correlated with mortality, increasing odds of death by 2-5 times depending on the degree of elevation. Right ventricular dilation is commonly seen in severe COVID-19. In a follow-up study of 384 patients hospitalized for COVID-19, elevations of D-dimer, ferritin, and C-reactive protein (CRP) normalized within 2 months following discharge. Chest radiographs remained abnormal or worsened in just over 10% of patients.

- 4) **Benjamin A. Satterfield, *et.al* (2021)** performed a study on “Cardiac involvement in the long-term implications of covid-19” showed manifestations of acute cardiovascular injury associated with SARS-CoV-2 infection are diverse, including acute myocardial infarction, myocarditis, stress cardiomyopathy, pericarditis, arrhythmias, multisystem inflammatory syndrome in both adults (MIS-A) and children (MIS-C), stroke, macro thrombotic disease including arterial and venous thromboembolism, micro thrombotic disease and bleeding diathesis. Collateral damage in patients owing to delays in presentation to hospital and treatment of acute coronary syndromes, strokes and other cardiovascular disorders. Cardiovascular complications in patients with moderate-to-severe COVID-19 and evidence of cardiac injury like elevated troponin levels and reduced left ventricular ejection fraction. Dyspnea is the most frequent persistent symptom reported and chest pain is the most common persistent cardiovascular symptom among patients surviving moderate-to-severe COVID-19; one study reported chest pain in 18% of survivors at 30 days and in 13% at 60 days. Palpitations were also common, being present in 9% of survivors at 30 days, 14% at 60 days and 9% at 6 months. QT interval prolongation has been noted in patients hospitalized with COVID-19.
- 5) **Shreyasi Gupta, *et.al* (2021)** performed a study on “Challenge of post-COVID era: management of cardiovascular complications in asymptomatic carriers of SARS-CoV-2”. Pre-existing cardiovascular disorders and their associated risk factors such as hypertension, obesity and diabetes mellitus have been reported to pose significant threat during SARS-Cov-2 infection. A study involving asymptomatic or mildly symptomatic children with SARS-Cov-2 infection has revealed ventricular repolarization and increased risk of developing ventricular arrhythmias. Patients with any structural or functional abnormalities in heart should undergo a repeat echocardiogram in a span of 1–3 months after discharge and then followed up for a minimum period of 6 months. This study has shown there is a

possibility that an individual infected by SARS-CoV-2 will develop cardiovascular complications which might even aggregate further during follow-up, even in absence of primary symptoms of COVID-19.

- 6) **Joanna Lewek, *et.al* (2021)** performed a study on “COVID-19 and cardiovascular complications- preliminary results of the LATE-COVID study” where results have shown that, post-COVID-19 complications appeared 1-4 months after disease recovery and severe cardiovascular complications were observed in 27.5% of hospitalized patients. In comparison to those with mild complications, patients with severe complications had significantly higher prevalence of diabetes (36 vs. 8%;  $p = 0.01$ ), decrease in ejection fraction (36% vs. 0%,  $p < 0.001$ ), higher resting heart rate at admission ( $p < 0.001$ ), and higher levels of C-reactive protein ( $p = 0.02$ ) and troponin T (17.9 vs. 4.2 pg/ml;  $p = 0.01$ ). Diabetes, elevated level of CRP and troponin, heart rate variability parameters and worsening of left ventricular ejection fraction are related to the severity of cardiovascular complications following COVID-19 infections.
- 7) **Mohammed Ali Gameil, *et.al* (2021)** conducted a study on “Long-term clinical and biochemical residue after COVID-19 recovery” in 120 COVID-19 survivors of mean age 38.29 and 55.6% male proportion. Among them systolic blood pressure was significantly elevated ( $P=0.001$ ). Erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), D-dimer showed higher values in COVID-19 survivors ( $P < 0.001$ ). Alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyl trans-peptidase (GGT), and alkaline phosphatase (ALP) were significantly elevated in contrast to serum albumin that was reduced in COVID-19 survivors ( $P \leq 0.001$ ). Serum lipase, amylase and albuminuria were higher in COVID-19 survivors ( $P \leq 0.001$ ). COVID-19 survivors experienced residual significant clinical and biochemical alterations that necessitate comprehensive medical care and close follow-up for longer periods is necessary.
- 8) **M. Montero-Cabezas, *et.al* (2021)** performed an observational study on “Angiographic and Clinical Profile of Patients With COVID-19 Referred for Coronary Angiography During SARS-CoV-2 Outbreak: Results from a Collaborative, European, Multicenter Registry” which included 57 patients (mean age:  $66 \pm 15$  years, 82% male), of whom 18% had previous myocardial infarction (MI) and 29% had renal insufficiency and chronic pulmonary disease. In that ST-segment elevation myocardial infarction (STEMI) was the most frequent indication for CAG (58%). Coronavirus disease 2019 was confirmed after CAG in 86% and classified as

mild in 49%, with 21% fully asymptomatic. A culprit lesion was identified in 79% and high thrombus burden in 42%, 7% had stent thrombosis. Of them, 35(78%) of 45 patients showed obvious angiographic thrombus, with high thrombus burden (defined as TIMI-thrombus scale grade 4) present in 19 (42%) of 45 patients. Importantly, in 3(7%) of 45 patients, a stent thrombosis was identified as the culprit lesion. At 40 days follow-up, 16 (28%) patients experienced a major adverse cardiovascular event: 12 deaths (92% noncardiac), 1 MI, 2 stent thrombosis.

9) **Alexandre Abizaid, *et.al* (2022)** conducted a study on “Patients with COVID-19 who experience a myocardial infarction have complex coronary morphology and high in-hospital mortality: Primary results of a nationwide angiographic study” which included a total of 152 patients were included, of whom 142 (93.4%) had COVID-19 diagnosis confirmation. A total of 83 (54.6%) patients presented with ST-elevation MI. The median angiographic Syntax score was 16 (9.0–25.3) and 69.0% had multi-vessel disease. At least one complex lesion was found in 73.0% of patients, 51.3% had a thrombus containing lesion, and 57.9% had myocardial blush grades 0/1. The overall in-hospital mortality was 23.7%. Chest pain occurred in 26.3%. Overall, 77.0% had hypertension, 47.4% diabetes, 34.9% were prior or current smokers, 18.4% had prior coronary artery disease, and 15.8% were obese. SYNTAX score is related with higher mortality (95% CI 1.18–7.64;  $p = .02$ ) after 12 months. Importantly, in our study the overall median SYNTAX score was 16 (9–25.25), demonstrating the severity of CAD in these patients.

10) **Indranill Basu-Ray, *et.al* (2022)** performed a meta-analysis on” Cardiac Manifestations of Coronavirus (COVID-19)” shown that 7%–20% of patients had increased levels of cardiac biomarkers or electrocardiographic (ECG) abnormalities indicating underlying myocardial injury. These patients with myocardial involvement had worse outcomes. In a case series of 41 patients with COVID-19, five patients (12%) had a myocardial injury with elevated levels of high-sensitivity cardiac troponin I and four were in critical condition. A study of 191 patients with COVID-19 reported that 17% had an acute cardiac injury and that all but one of these died. Similarly, a retrospective study of 416 COVID-19 hospitalized patients found that 20% had an underlying myocardial injury; these patients had a much higher mortality rate (51%) than did patients without cardiac injury (5%). Even after recovery from confirmed SARS-CoV-2 infection, cardiac magnetic resonance imaging has shown left ventricular dilatation, lower ejection fraction, MI and inflammation.