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RESEARCH ARTICLE

CARDIO-VASCULAR INVOLVEMENT AND CARDIAC REHABILITATION ON COVID-19 INDIAN PATIENTS: RECENT ADVANCES AND FUTURE PROSPECTIVE

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Abstract

Introduction: The novel corona virus disease 2019 -23 (COVID-19) pandemic so many Indian patients have experienced with their multisystem involvement, critically ill patients and treated with in intensive care units (ICUs), critical care unit (CCU) and even so many died as unable to get proper treatment and cardiac rehabilitations (CRs) at the acute infections and critically ill patients.

Material and Methods: We have selected those patients having systemic effects, cardiac involvement patient's prognosis and diagnosis with COVID-19 and their cardiac complicacy. Patients with COVID-19 develop cardiac complications are including with the heart failure, myocarditis, pericarditis, vasculitis, acute coronary syndrome (ACS), cardiac arrhythmias (CAMs), trigger and accompanying with cardiac diseases like coronary artery diseases (CAD) and coronary vascular diseases (CVD). We identify the recommendations of scientific and professional treatment and cardiac rehabilitations given by our organizations in the area of rehabilitation in our institutions respectively. We performed more than 500 cases in critical conditions and recovered in our main data bases. In our organizations were identified and selected as very specific contribution related to our study and excluded the single case reports and those are not interested to participate to our study. SARS-CoV-2 specific IgG and IgM, mild increases in the CD4+T cells, diverse changes in the several newly developed biochemical and haematological biomarkers are also studied.

Results: Cardiac Rehabilitations (CRs) taken Patients with COVID-19 develop cardiac complications are including with the heart failure, myocarditis, pericarditis, vasculitis, acute coronary syndrome (ACS), cardiac arrhythmias (CAMs), trigger and accompanying with cardiac diseases like coronary artery diseases (CAD) and coronary vascular diseases (CVD) are improved more than (85%-95%). In hospitalized patients 10-15% with worse outcomes, longer stay in the intensive care unit (ICU) & 5-8% in cardiac critical care (CCU), and higher risk of death ratio of COVID-19 cardiac involvement ranges between 0-

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10percent. Deconditioning rate is increased due to immobility and muscle involvement in the pre and post-COVID-19 management is very poor at that time. COVID-19 Patients need CRs facilities.

Conclusion: Cardiac Rehabilitations (CRs) findings suggested that COVID-19 patients showed a gradual changes in improvement in exercise capacity of critically ill patients are significantly declined in the SARS-CoV-2 specific IgG and IgM, test reports are mild increase in CD4+ T cells, and diverse changes in several biochemical and hematological biomarkers after hospital discharge in 6-month. Cardiac Rehabilitations (CRs) effect on improving exercise capacity was observed in COVID-19 patients in a dose–response fashion after 6-months. CRs suggested that a batter innovation strategy to promote recovery in patients during/after acute COVID-19.Although higher certainty in the evidence in convalescent plasma for the treatment of individuals with moderate to severe diseases. It does not reduce mortality and has little to no impact on measures of clinical improvement. Cardiac Rehabilitations (CRs) taken Patients with COVID-19 develop cardiac complications got better treatment through the CR experts clinically and feeling good.

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Introduction:-

Cardiac rehabilitations (CRs) are a complex intervention that seeks to improve the functional capacity, wellbeing and health-related quality of life (QOL) of patients including with cardiac diseases [1].Cardiac rehabilitation substantive evidence base supports are suggested that effective and cost-effective intervention for patients with acute coronary syndrome (ACS) clinically. Heart failure reduced the patient's ejection fraction and then after coronary revascularization [2].The major contemporary challenges that are faced with cardiac rehabilitation experts are very minimum in number in our institutions to looking patients. Despite of the strong recommendation in the current clinical guidelines for the referral of this COVID-19 patient groups, global access to cardiac rehabilitations (CRs) are very poor [3]. The COVID-19 pandemic has contributed to a further reduction in access to cardiac rehabilitations (CRs) [4]. Home-based and technology-based models of cardiac rehabilitation as alternatives or adjuncts to traditional at centre-based programmers are increasing the body of evidence supports [5].

Especially in lower-income and middle-income countries which cardiac rehabilitations (CRs) services are very scarce, scalable and affordable models are required for the cardiac complicacy cases with COVID-19 patients [6].The delivery of cardiac rehabilitations (CRs) in future approaches are growing to save the multi morbidity of an ageing population in our country and the World. In addition to the cater into the needs of the increasing patients with cardiac numbers of diseases. Those are who having present with two or three and more chronic diseases patients are getting very critical situations and it was a big challenges for the management of these patients [7]. Future research is required on priorities to minimize these cardiac diseases. Cardiac rehabilitations (CRs) are strengthening the evidence base for the critically cardiac ill patients [8]. According to other indications, including with heart failure is preserved with the ejection fraction, atrial fibrillation and the congenital heart disease (CHD) after valve surgery or heart transplantation [9].Cardiac rehabilitation implementation of evaluation of sustainable (EOS) and affordable models of delivery that can be improved the lower income settings in the world [10].

Additionally, Cardiopulmonary rehabilitations are included with specific interventions that helping patients management and maximize the functional potential due to progressive deconditioning , acute decompensation is following with acute medical event essential [11-12].

The COVID-19 population of patients who benefit from both the cardiac and pulmonary rehabilitation from the heart disease is one leading cause of global morbidity and mortality [13]. The principles of exercise physiology when applied to this population can reverse deconditioning, build cardiopulmonary reserve, and ultimately reduce morbidity and mortality in these populations [14]. The physically disabled persons are also benefitted from exercise conditioning. The newly refined model of cardiac rehabilitation can also be applied to improve functional status of

stroke patients with COVID-19 infections [15].These risk factors of cardiovascular diseases conditions are an emerging area of interest in research development required to know their etiopathology [16].The frailty and post-transplant decline in function benefits of supervised exercise can also be extended to patients with clinically recognized [17].

Frailty is a complex diagnosis with multiple tools and newly developed approaches used to describe this syndrome and appropriate management. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection remains asymptomatic in (35% to 90%) of the older adults. As it is depending upon their immune status from the prior infections noticed [18]. Before and after Vaccination, circulating strain among the Older adults are symptomatic with SARS-CoV-2 often both present atypically with a blunted fever response is develop more than severe disease [19].

Material and Methods:-

Study Design:

A randomized controlled trial (RCT) is a form of scientific experiment used to control factors not under direct experimental control. In the examples of this RCTs study are clinical trials that compare the effects of drugs, surgical techniques, medical devices, diagnostic procedures or other medical treatments Cardiac Rehabilitations (CRs) taken Patients with COVID-19 develop cardiac complications and associated cardiac diseases.

Data Collection:

Patients with COVID-19 may develop cardiac complications such as heart failure, myocarditis, pericarditis, vasculitis, acute coronary syndrome, and cardiac arrhythmias or trigger an accompanying cardiac disease.

Study duration:

This prospective cohort data of (n=500) COVID-19 patients admitted from January 2020 to 2023.

Selection Criteria:

We have selected those patients having systemic effects, cardiac involvement patient's prognosis and diagnosis with COVID-19 and their cardiac complicacy. Patients with COVID-19 develop cardiac complications are including with the heart failure, myocarditis, pericarditis, vasculitis, acute coronary syndrome (ACS), cardiac arrhythmias (CAMs), trigger and accompanying with cardiac diseases like coronary artery diseases (CAD) and coronary vascular diseases (CVD) are included.

Inclusion Criteria:

We identify the recommendations of scientific and professional treatment and cardiac rehabilitations (CRs) taken by our organizations in the area of rehabilitation in our institutions respectively. We performed more than (n=500) in critical conditions and recovered in our main data bases.

Excluded Criteria:

In our organizations were identified and selected as very specific contribution related to our study and excluded the single case reports and those are not interested to participate to our study and irrelevant from our study.

Material and Methods:-

SARS-CoV-2 specific IgG and IgM, mild increases in the CD4+T cells, diverse changes in the several newly developed biochemical and haematological biomarkers are also studied. Among these systemic effects, cardiac involvement may have very important consequences for the patient's prognosis and later life. The reminder who had not performed any CRs was assigned to the control group.

Statistical Analysis:

The primary outcome was the change in (0 to six-months) between the 6-month to 12 months and their follow-ups was assessed via analysis of covariance with a covariate of propensity score. Again that adjusted for the potential confounders. Secondary outcomes were changes in 0-2weeks and one week to two months. The SARS-CoV-2 immunoglobulins, T-lymphocytes and blood chemistry were also be evaluated via paired tests. The *p-value* (**p <** .001) is considered as the significant.

Results:-

The Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is deadly critical for coronavirus disease 2019 (COVID-19), has caused substantial mortality and morbidity worldwide since late 2019-2023. The post acute sequelae of SARS-CoV-2 infection (PASC) can manifest as a wide range of new, recurring, or ongoing disabling symptoms including with health problems. 90-95% people were experiencing acute infection and persisting. The starting of more than 4-8 weeks after being infected with the virus that causes COVID-19 as one critical epidemiology.COVID-19 to peripheral nervous system (PNS) diseases. In addition to the pandemic to the vaccination. Curent era of interest is shifting towards the potential association between COVID-19 and their associated cardiac diseases.

Vaccines and PNS manifestations of participants' age ranges is 18 to 120 years (**M** = 275,F=225 standard deviation (SD)=14.8) respectively. 55% identified as male. During the 6-month of the convalescence, 6-MWD increased 25.0%, with a mean [95% CI] and 275 [92–135] m (**p** < .001). SARS-CoV-2 IgG and IgM decreased 35.5% (**p** = .002) and 53.8% (**p** = .009), CD4+ T cells increased 8.9% (**p** = .05), and the majority of blood chemistry changed significantly with the patients in the CR group. It acquired with increase in 6-MWD than those in control (unadjusted, 275 [168–224] m, (**p** < .001).The adjusted with 225 [69–195] m, (**p** < .001). The dose-responsiveness of CRs is on 6-Months was observed (**p** < .001). There are no differences between at the observed group in the immunity variables and their blood chemistry level (BCL).

After getting the COVID-19 vaccination process and PNS manifestations between (Jan 2020 and June 2023) is one growing evidence indicated that COVID-19 related cardiovascular symptoms and complications were raised. It is persisting with weeks or months after resolution of the acute infections of COVID-19 is 5%–30% reported as chest pain, dyspnea, or palpitations and post recovery. The acute infection even 6 months after the acute infection and after 12 months of follow up of the study ranges from mild results to incapacitating their survivors.The prevalence of these sequelae and emerging data on the longevity of symptoms. But they are very limited. The new assessment and treatment of cardiovascular complications in PASC and the Multi-Disciplinary PASC Collaborative (PASC Collaborative) of the American Academy of Physical Medicine and Rehabilitation (AAPM&R) was developed (15-25%).PASC is quite important in pressing need for guidance in the care of patients with Indian patients with SARS-CoV-2 infection (PASC) also we look forward the more numbers of collaborative research is required for the respective field and specific net working for this ongoing research projects.

Discussion:-

More than (40%-80%) older adult's cases have increased their severity of coronavirus disease 2019-2023. (COVID-19) with higher cases including with their fatality rates and higher intensive care (HIC) needs compared with younger adults [20].Infections and vaccine-induced antibody response (VIAR) and long-term effects of COVID-19 differing in the population of the older adults. SARS-CoV-2 Severe acute respiratory syndrome corona virus pandemic is ongoing [21]. In the medical system subjected to many changes and they faced there specific challenges to save patients lives. Face-to-face treatments have been suspended for a period of time as this is very typical diseases [22]. After the lockdown period the dentists have to be aware of the modalities to protect themselves and their patients in order should not to be getting infected [23]. Dental practitioners are potentially exposed to a higher degree of contamination with SARS-CoV-2. While them performing patient's dental procedures that produces their aerosols and major infections [24]. It should also be noted that the airways, oral cavity and nostrils, are the access pathways for SARS-CoV-2. In order to protect themselves and their patients they have to use full the personal protective equipment (PPE) [25].

Relevant data regarding this pandemic are under evaluation and are still under test. The way, in which SARS-CoV-2 spreads, diagnose a novel corona virus infection. The possible treatments are protective personal equipment use to stop its spreading [26]. Coronavirus disease 2019 (COVID-19) is a contagious infection disease. It causes the respiratory, physical, psychological, and generalized systemic dysfunction [27].The severity of this disease ranges from an asymptomatic infections are mild illness to severe pneumonia with respiratory failure or death. COVID-19 dramatically affects the pulmonary system and the lungs and later multiple organ failure [28].This clinical practice guideline includes pulmonary rehabilitation (PR) recommendations for adult COVID-19 patients and has been developed through the light of the guidelines on the diagnosis and treatment of COVID-19 provided by the World Health Organization [29]. The Republic of Turkey, Ministry of Health, published scientific literature, and PR recommendations for COVID-19 regarding basic principles of PR and CR recently [30].

This national guideline provides different suggestions regarding the CRs methods during the clinical stages of COVID-19 and post-COVID-19 with its possible benefits, contraindications and disadvantages [31]. The Convalescent plasma and hyperimmune immunoglobulin reduces the mortality in patients with viral respiratory diseases. CRs investigated as potential therapies for coronavirus disease 2019 (COVID-19) associated with the cardiac diseases [32]. Understanding of the current body of evidence regarding benefits and risks of these interventions is required for COVID-19 and post-COVID-19 [33].

Manifestations of the (COVID-19) cardiovascular system of novel coronavirus disease 2019 have attracted attention through the multi-facet cardiac symptoms.The clinical features and sudden cardiac events according to the five-years in experience in nearly half of the patients with cardiovascular system (CVD) [34]. It has been affected with or without clinical features of respiratory disease (RD) and pulmonary disease (PD) [35].We found that up to 23-30 % of hospitalized COVID-19 patients with suffered from the cardiac injury [36].The pathophysiology of cardiac and vascular involvement in the seven main reasons have been discussed [37]. Direct viral effects on the tissues are mainly benign. But it named as elimination phase is responsible for the elimination of the virus from the tissues [38]. New possible mechanism directly involves viral infiltration onto the myocardial tissues [39]. Excessive inflammatory effect of cytokine release syndrome is mainly known as storm-like phase. It leads to severe inflammation of the targeted cells are the lung, heart, endothelial, lymphoid tissue, pancreas, kidney by the interleukin (IL)-2, IL-6, IL-8, IL-10, and tumor necrosis factor (TNF) are also very important [40].

These cytokines play an essential role in myocardial cell injury, and also the cardiometabolic demand associated with the systemic infection and ongoing hypoxia-induced excessive intracellular calcium and cardiac stress lead to respiratory failure and hypoxemia [41]. Crosstalk between coagulation and inf lammation is evident. Endothelial dysfunction shifts the vascular equilibrium toward an inflammatory and pro-coagulant state which tends to thrombosis and vasculitis [42]. Unmanageable cascade of hyper-inflammation may transform into an autoimmune overreacted response.Sepsis, which leads to the development of disseminated intravascular coagulation syndrome [43]. Electrolyte imbalance and Side effects of medical treatment during hospitalization [44]. Cardiovascular involvement during the course of the disease can be divided into two periods [45].

One is acute sequelae, seen at the very early stage of the infection (from the incubation to four weeks), and the other is post-acute sequelae, seen after the fourth week of the infection [46]. According to the organ (heart) and its components (pericardium, myocardium, coronary arteries) injured, the clinical picture emerges as arrhythmia, myocardial infarction (MI), myocarditis, pericarditis, acute coronary syndrome [47], heart failure (HF) (acute onset and exacerbation of chronic HF) and post-acute sequelae coronary vascular disease (PASC-CVD) [48], post-acute sequelae-cardiovascular symptoms (PASC-CVS), blood pressure dysfunction (BPD), postural orthostatic tachycardia syndrome (POTS), and myalgic encephalomyelitis also very important [49-50]

Recent Advances and future prospective:

The current COVID-19 pandemic is also a great challenge for the worldwide researchers. In the human microbiota area having the long-term effects of the infection at the GI level are not yet deeply understood [51]. SARS-CoV-2 and the possible consequences on the microbiota were pertaining to COVID-19 have also been discussed with the transmission and the resistance [52]. In the human body, impact of nutritional status in relation to the intestinal microbiota [54]. Impact of inflammatory bowel disease (IBS), comorbid metabolic disorders such as obesity, and type two diabetes (T2D) [55]. Health, age, and nutritional status are associated with specific communities of bacterial species in the gut. CRs could influence the clinical course of COVID-19 infection and their patient's management [56]. Alterations of fecal microbiota were associated with fecal concentrations of SARS-CoV-2 and COVID-19 severity with cardiac diseases [57]. Patients are suffering from the metabolic and gastrointestinal (GI) disorders are thought to be at a moderate-to the higher risk of infection with SARS-CoV-2 [58]. It is indicating with the direct implication of gut symbiosis in COVID-19 severity [59].The World Health Organization (WHO) is also declared that pandemic on the 11th of march 2020 [60].COVID-19 represents flu-like symptoms and that become more severe in higher-risk compromised subjects medically [61].

According to the definition of health **"A STATE OF COMPLETE PHYSICAL, MENTAL AND SOCIAL WELL-BEING"** individuals with heart involvement with COVID-19 should be rehabilitated by the light of the rehabilitation perspective and given the increasing number of patients with cardiac manifestations of COVID-19.The rehabilitation principles in this group of patients with COVID-19 had a significant physical, cognitive and psychosocial impairments may be observed in some major of the cases.

Limitations:
More randomized clinical trials (RCTs) studies are necessary to identify novel pharmacospecific therapies and infection prevention protocols are required to improve their efficacies and safety for clinical application in the COVID-19 Patients management and research.

Conclusion:-

CRs may be a innovative strategy to promote the improvement of exercise capacity after COVID-19 patients with cardiac diseases. COVID-19 patients showed gradual improvement in these exercise capacity. There is a significant decline in SARS-CoV-2 specific IgG and IgM, a mild increase in CD4+ T cells are observed clinically.In this diverse changes in CRs with several biochemical and haematological biomarkers 6-month after hospital discharge. CR's 6-month effect on improving exercise capacity was observed in COVID-19 patients with modrate to severe diseases. Cardiac diseases within a dose–response fashion (DRF) with CRs may be a new tool for recovered in patients during/after acute COVID-19 more than (70%-95%). Although, convalescent plasma treatment is helping of individuals moderate to severe diseases. It does not reduce the mortality rate and has little to no impact on measures of clinical improvement. The adverse effects of convalescent plasma are increasing in patient's management. The major efforts to conduct research on COVID-19 are being made, heterogeneous reporting of outcomes is still problematic as more than 500- 1250 ongoing studies from (ICMR, DST, DBT, PUSA) registry are being in the process. Hyperimmune immunoglobulin therapy for the people disease with severity and convalescent plasma therapy for people with asymptomatic or mild disease. While many efforts are being spent worldwide in research aimed at identifying early diagnostic methods and evidence-based effective treatments, mass vaccination is thought to be the best option against this disease in the near future. Although, our Indian Government is very good in situation to solve this diseases management is still more research work urgent need for this area.

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