VIRUS INFLUENCE ON HEART ANALYSIS BY AI

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Abstract : Infection caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), various other viruses are also circulating, presenting similar symptoms and leading to confusion among individuals suffering from chronic conditions related to heart disease and other serious illnesses. The historically significant virus, COVID-19, is characterized by persistent fever, an incessant dry cough, phlegm production, and fatigue, frequently accompanied by pulmonary complications. These symptoms can also arise from other infections, allergies, and various viral pathogens. SARS-CoV-2 is known for its high transmissibility, making a large portion of the population vulnerable to infection. The primary reservoirs of these viral diseases are wild animal hosts and infected individuals, with transmission occurring through respiratory droplets and direct contact. Since the onset of the outbreak, both governmental and scientific entities have swiftly worked to identify the causative agent, sharing the viral genetic sequence without delay, and implementing measures to control the spread of the epidemic[4]. Concurrently, recent studies have uncovered significant insights into the biology and disease mechanisms of SARS-CoV-2 and its variants; researchers have also concentrated on epidemiology, clinical characteristics, diagnosis, management, and the development of drugs and vaccines, When severe, viral infections manifest as a systemic illness marked by hyper inflammation, cytokine storms, and increased levels of cardiac injury biomarkers. This review primarily examines the impact of various viruses that have emerged following COVID-19 on cardiac function, drawing on the latest survey findings and expert consensus. Additionally, we will discuss ongoing initiatives and experiences from different regions worldwide[6], which may enhance our comprehension of the epidemic and deepen our understanding of this emerging infectious disease affecting heart function, along with updated recommendations for prevention, control, and critical management of this serious issue.

Index Terms : virus disease, Pathogenesis, Epidemiology, Prevention and management.

I.INTRODUCTION

The severe outbreak of corona virus disease 2019 has posed a significant threat to global public health. The infection, caused by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), was initially isolated from individuals who had contact with seafood and related waste, and it is believed to have crossed species barriers to initiate primary infections in humans. Subsequently, the virus has primarily spread through human-to-human transmission. The situation has been exacerbated by the rapid movement of people via air travel[7], which has facilitated the global dissemination of various harmful viruses, particularly impacting individuals with pre-existing heart conditions[1].

This review aims to summarize the latest research and expert opinions regarding the virology, immunology, epidemiology, clinical manifestations, diagnosis, and management of the viruses currently in circulation. Our objective is to provide a comprehensive understanding of the virus and its associated disease, particularly in relation to cardiovascular health, while offering ongoing recommendations for prevention, control[9], and management strategies. Certain variants and seasonal viruses have been shown to infect coronary arteries, leading to increased inflammation in atherosclerotic plaques. These findings indicate that various variants may elevate the risk of heart attacks and strokes. COVID-19 is recognized for heightening the risk of such cardiovascular events, with severe cases likely contributing to this increased risk through widespread inflammation. However, it remains uncertain whether COVID-19 variants or other viruses directly impact blood vessels[2].

II.LITERATURE SURVEY

Research indicates that during the initial two years of the pandemic, from March 2019 to March 2024, there were approximately 300,000 additional deaths globally attributed to cardiovascular disease beyond what was anticipated for that period. The majority of these fatalities occurred among individuals aged 65 and older, who are at the highest risk for cardiovascular complications. However, there was also a significant increase in heart-related deaths among younger adults[2]. Notably, a study revealed that the most pronounced rise in heart attack fatalities during this timeframe was observed in individuals aged 25 to 44, with even younger age groups, such as those aged 11 to 18, also experiencing an uptick. Initially, medical professionals and researchers believed that the impact of the virus on heart and other bodily tissues would manifest only after a year of infection; however, heart failure cases continue to rise across all age demographics due to various viral variants[3]. Ongoing research aims to uncover the reasons behind the sudden increase in heart failures, even among younger populations.

Symptoms of myocarditis can closely resemble those of a heart attack. Additionally, viral infections, including COVID-19 and its variants, as well as other recently circulating viruses, can lead to the formation

of very small blood clots that obstruct tiny blood vessels, causing pain. The virus may also trigger a systemic inflammatory response[21], damaging blood vessels and increasing the risk of clot formation, which can impede blood flow to the heart and potentially result in a heart attack.

Various stages of virus attack on heart leads to failure

TABLE 1 : STAGESR OF HEART PROBLEMS

MYCARDIAL INFARCTION	MYCARDITIS
ARRITHMIAS	TAKOTSUBO CARDIOMYOPATHY
HEART FAILURE	OST COVID-19 SYDROME
MYCARDIAL NECROSIS	SYCHOLOGICAL EFFECT OF COVID-19

III.ROLE OF AI AND MACHINE LEARNING IN MEDICAL TREATMENT.

Artificial intelligence (AI) predictions mostly depends on precise data. Now days every engineer and Doctors feeling AI may be threat for their jobs but it is not correct, AI not threat for them but they should know how to use AIin their daily job for engineers and Doctors.

AI is going create so many miracles in the field of medical sciences, it helps in diagnosis and prescribibg the correct medicine as the AI will analyses using the huge data.AI thinks very fastly than human brain and the same time it resolves more than one task at a single step. Lakhs of data it preserve and analyses and gives precise data and even it has a grat capability of studying and identifying the smallest defects I various test reports which may not observe by the Doctors precisely[5]13] .It identify even the symptom of dangerous diseases in early stages i.e 5 -6 yrs early and instruct the doctors to start the treatment.

It also helps to investigate the current treatment and medicines and helps to invent advanced medicines quickly[14]. it also guides us to new lifestyles with good health based on the patient body nature.

One doctor may not see more x-rays I one day but the AI can study and generate thousands and gives the precise report on each one very quickly. sometime doctor may confuse in the patient symptoms and to give treatment ,in such sceneries the AI will help. If we give patient age, weight, height and symptoms it gives precise predictions and helps very quickly the suitable treatment,

A doctor quoted that a patient with fever confirmed ,but the minute features in x-ray ot identified by the doctors ,but AI has studied the minute things and revealed a spot in the x-ray and has given report that it is the symptom of TB[17], then he was treated with T medicine and recovered within 40 days. like that AI very quickly identifies the spots and tells what type of spot it is and reason, even it helps in endoscope reports also in finding defects and others cancer related blocks which may not find y seniors doctors also.AI just by seeing it gives the precise report whether it is cancer related or not.

Generally robotics are helping doctors in oration time, but if the use AI it hels lot by observing minute nerves and helps doctors to not touch the irrelevant minute nerves. mostly in brain surgery it helps lot and even reduced the time also.AI analyses the personal history of patients and predicts the risk of diabetic, blood pressure ,heart problems, lungs related problems very precisely[18].

AI also tells the correct reason for obesity and also guides the food /diet for controlling the obesity by studying their blood analysis. Early days for finding a medicine for long run disease taken 20 yrs also but with the help of AI it may take 1-2 yrs, best example covid vaccination found by AI only very fastly with precise combination.

AI medical beds also their for analyzing the patient and warns them, it gives all the reports telling his disease status like blood pressure. diabetics lungs status, skin reactions and its stage, electrolytes, temperature, oxygen percentage what not everything about patient test reports will be generated periodically. Even it also instruct the nurses to monitor the Celine drops based on the improvement of the patient.

With the help of AI "prescription recorder and intelligent summary maker" also invented for recording the conversation between the doctor and the patient. magically it never record sthe irrelevant conversations like if docrot asks about the movie etc.

We should not give wrong data to AI, otherwise we will not get precise report .So one should not compromise I giving the data to the AI tools.

With the help of AI already fixed chisin the brain and even in legs to rectify the paralysis at the same time the this may use in other side to take control of others body.

Medical informatics robotic assistant arranged (MERA) in AIG which helps patients in clarifying the doubts in prescritions and also tells the way of tablet dosages and timings for taking tablets. Patients can use this any number of times till they understood in many languages.

IIIA.AI RELATED MEDICAL SERVICE AVAILABLE:

AI will note the patient reports and observes continuously and alerts the doctors and nurses if there is any deviations identified. many software developed to alert the doctors by giving important parameters of patients to that software.AI software will give precise report like Phibro scan for generating precise report for fatty livers . Even intelligent toilets also exist to tell about the diet requirement for the any individuals.

Machine Learning (ML) is utilized across various domains, such as natural language processing, computer vision, speech recognition, email filtering, agriculture, and healthcare. The use of ML to address business challenges is referred to as predictive analytics[8].

Machine Learning, commonly known as ML, is a subset of Artificial Intelligence (AI) focused on the development of algorithms and statistical models that enable computers to learn from data. This

capability allows them to make predictions or decisions autonomously, without explicit programming. In essence, machine learning empowers computers to derive insights from data, identifying patterns and relationships that facilitate predictions or conclusions about new, unseen data..

IIIb.PROCESSING THE LARGE DATA TO GET THE REQUIRED SUGGESTION FOR SEVERE CASES :

DATA COLLECTION
DATA PRE-PROCESSING
CHOSING THE RIGHT MODEL
TRAINING THE MODEL
EVALUATING THE MODEL
HYPER PARAMETER TUNING AND OPTIMIZTION
PREDICTIONS AND DELOYMENT

IIIc.MEDICAL INFORMATION ABOUT THE VIRUS.

The structure of corona viruses is categorized into four primary subgroups: α, β, γ, and δ. The α subgroup comprises six members, which include human pathogens such as Cov229E and CoV-HKU1. The β subgroup features notable human pathogens, including CoV-OC43, SARS-CoV, and MERS-CoV (King et al., 2012; Lefkowitz et al., 2018). SARS-CoV-2 is classified within the β subgroup as well, with its amino acid sequences in the seven conserved domains of the genomic open reading frame 1ab (ORF1ab) showing a 94.6% similarity to those of the original SARS-CoV (Zhou P et al., 2020b)[7].

Typically, the corona virus is spherical or exhibits various shapes, measuring between 120 and 160 nm in diameter. It features a petal-shaped projection formed by a triple Spike (S) protein, a hallmark of corona viruses. This S protein plays a crucial role in the attachment of the virus and the fusion of membranes during the infection process (King et al., 2012). In addition to the S protein, the genomes of corona viruses generally encode three other structural proteins: the Membrane (M) protein, the Envelope (E) protein, and the Nucleocapsid (N) protein. The M protein, consisting of 218 to 263 amino acids, has an N-terminus that is modified by O- or N-glycans and a hydrophilic C-terminal tail. The E protein, which ranges from 74 to 109 amino acids[8], may play a role in enhancing virulence, with approximately 20 copies present in each virion. The N protein, comprising 349 to 470 amino acids, is a phosphorylated protein bound to RNA that aids in the proper folding of genomic RNA into the nucleocapsid (King et al., 2012).

The pandemic, initiated by the Covid-19 virus in recent times, has had widespread effects across various sectors. Quarantine emerges as a critical aspect of this pandemic experience. The increased time individuals spend at home has unveiled numerous facets of their daily practices. In this context, communication stands

out as a fundamental necessity. During periods of confinement, communication tools have proven essential for both personal interactions and for seeking information regarding the pandemic.

These tools assume diverse roles and functions throughout the communication process, with internet-based applications being particularly noteworthy. Social media platforms, in particular, have gained prominence for their effectiveness in disseminating, transmitting[9], and circulating information. Research within the relevant literature indicates that social media significantly influences the acquisition and sharing of information. The ongoing pandemic has not only altered personal life practices but has also transformed institutional practices. Notable shifts in motivation and behaviour have been observed in areas such as information acquisition and interpretation, consumption motivation, and content creation and sharing. The impact of social media tools and platforms on these transformations is undeniable. Furthermore, the influence and implications of social media in corporate communication processes are also significant. During this period, corporate brands have utilized their official social media accounts to relay information about the pandemic, providing both updates and social messages through these channels.

IIId. GOVERNMENT MEASURES TO STOP THE VIRUS SPREAD

The Government of India has been actively engaged in addressing the COVID-19 pandemic, implementing measures to enhance the health system's readiness for comprehensive management of the virus. Throughout the pandemic[18], India achieved some of the lowest positivity and mortality rates while also recording one of the highest recovery rates worldwide. The nation's public health initiatives were significantly reinforced by its robust research and development capabilities in the creation of COVID-19 vaccines. The strategy for the vaccination campaign was meticulously planned ahead of time, grounded in scientific research and international best practices.

IIIe. CLINICAL FEATURES

The primary symptoms associated with COVID-19 include fever, fatigue, and a dry cough. Additionally, some individuals may experience muscle aches, nasal congestion, a runny nose, a sore throat, or diarrhea. Typically, these symptoms are mild and develop gradually. It is also important to note that some individuals may contract the virus without exhibiting any symptoms or feeling unwell.

This study included records of cases that fulfilled the established case definition, along with documented demographic, epidemiological, and clinical parameters in the medical records. Records lacking complete information or failing to meet any of the inclusion criteria or case definitions were excluded from the analysis. Furthermore[11], patients who declined admission or refused treatment for COVID-19 in a hospital setting were also excluded. For patients who were discharged against medical advice, follow-up outcomes were obtained by contacting the patients' relatives via telephone.

IIIf. DIAGNOSIS AND ASSESSMENT OF SEVERITY AND ITS MANAGEMENT

At present, the fundamental strategies for managing the population impact of COVID-19 include disease prevention and control, supportive care, and vigilant monitoring. Patients who are severely or critically ill typically necessitate oxygen therapy and intensive care, as the disease often advances to cause complications such as acute respiratory distress syndrome , respiratory failure, and septic shock. Despite comprehensive therapeutic interventions, the mortality rate for patients in intensive care units (ICUs) remains approximately 40%. To mitigate mortality associated with severe COVID-19, efforts have been directed towards developing therapies aimed at either inhibiting viral replication or modulating the immune response of the host. One such treatment, Arbidol, a broad-spectrum antiviral medication previously approved for influenza, has been administered to a group of patients at the First Affiliated Hospital of Zhejiang University in Hangzhou, China (Xu KJ et al., 2020). Additionally, systemic glucocorticoids[11], despite being a subject of debate, have been investigated in a number of patients with mild disease; this approach was found to be well tolerated, and there was no prolongation of viral shedding (unpublished data). Furthermore, a combination of glucocorticoids and the antiviral immunomodulatory agent interferon-α (IFN-α) has also been assessed.

IV. VIRUS EFFECT ON HEART

The factors contributing to heart diseases include lifestyle changes, dietary habits, smoking, stress, feelings of loneliness, and environmental pollution. The impact of COVID-19 has intensified these issues, rendering them more severe[10]. Certain heart-related symptoms may indicate a potential infection with SARS-CoV-2, the virus responsible for COVID-19. Complications associated with COVID-19 can involve damage to the heart muscle or the formation of blood clots.

Research indicates that the likelihood of experiencing cardiovascular issues, such as heart attacks or strokes, remains elevated for several months following the resolution of a SARS-CoV-2 infection. Additional studies support this finding. For instance, data from England's healthcare system reveal that individuals hospitalized due to COVID-19 are approximately three times more likely to encounter significant cardiovascular complications within eight months post-hospitalization compared to those who were not infected. Another study indicates that within four months after infection, individuals who had contracted COVID-19 faced a roughly 2.5-fold increased risk of developing congestive heart failure compared to their uninfected counterparts.

Cardiovascular issues encompass irregular heart rhythms, heart failure (the heart's inability to function effectively), coronary artery disease (the accumulation of plaque in arteries that restricts blood flow), heart attacks, and additional conditions. According to Topol, the onset of many cardiovascular complications likely occurs when the virus infiltrates the endothelial cells that line the blood vessels. In response to the damage inflicted during the infection, blood clots form as part of the healing process. However, these clots can obstruct blood vessels, resulting in symptoms ranging from mild leg pain to severe heart attacks. A study involving over 500,000 COVID-19 cases revealed that individuals who contracted the

virus faced a 167% increased risk of developing blood clots within two weeks post-infection compared to those who had influenza. Robert Harrington, a cardiologist at Stanford University in California, notes that even after the initial infection has resolved, plaques may build up in areas where the immune response has harmed the blood vessel lining, leading to narrowing of the vessels[16]. This can result in serious issues, such as heart attacks and strokes, even months after the initial injury has healed. Harrington emphasizes that early complications can indeed lead to later health issues. The implications of vaccinations, reinfections, and the Omicron variant of SARS-CoV-2 raise further questions regarding the virus's impact on cardiovascular health. A study published in May by Al-Aly and his team indicates that while vaccination diminishes the risk of developing these long-term complications, it does not completely eliminate it.

V.METHODS OF DATA COLLECTION

In response to infection by the corona virus, the body produces a significant amount of proteins known as cytokines, which facilitate communication between cells and assist in combating the pathogens. In certain individuals, potentially due to genetic variations, this typical immune response can become excessive, leading to a condition known as a cytokine storm. During a cytokine storm, the immune response triggers inflammation that can overwhelm the body, resulting in the destruction of healthy tissues and damage to vital organs, including the kidneys, liver, and heart.

In some individuals, heart rates may fluctuate between fast and slow without any apparent cause or relation to physical exertion. Post notes that symptoms such as shortness of breath, chest pain, or palpitations following a COVID-19 infection are frequently reported. "Any of these issues could be linked to cardiac function, but they may also stem from other factors, including the effects of severe illness, prolonged inactivity, and extended periods of recovery in bed." While shortness of breath alone is not always indicative of a serious condition, it becomes a concern when accompanied by low oxygen levels (below 92%). Additionally, individuals may experience breathlessness during exertion after COVID-19 due to a prolonged period of inactivity, necessitating a gradual return to physical fitness. Symptoms of myocarditis can also resemble those of a heart attack[3].

A type 1 heart attack, which occurs when a blood clot obstructs one of the heart's arteries, is infrequently observed during or following a COVID-19 infection. According to experts, type 2 heart attacks are more prevalent in the context of COVID-19. These heart attacks may arise from heightened stress on the heart, which can be induced by factors such as rapid heart rate, diminished blood oxygen levels, or anemia, as the heart muscle struggles to receive adequate oxygen to perform additional work. Instances of this have been noted in individuals suffering from acute coronavirus disease, although it is less frequently seen in those who have recovered from the illness.

Individuals with preexisting heart conditions face an elevated risk of severe cardiovascular and respiratory complications due to COVID-19. Research indicates that influenza virus infections also pose a greater risk to individuals with heart disease compared to those without such conditions. Furthermore, studies have demonstrated that respiratory infections, including the flu, can trigger heart attacks.

Moreover, some individuals may suffer heart damage that resembles the injury typically associated with a heart attack, even in the absence of the fatty, calcified blockages that usually cause such events. This situation can arise when the heart muscle is deprived of oxygen, which in the case of COVID-19 may result from an imbalance between oxygen supply and demand. Fever and inflammation can elevate heart rate and increase the metabolic requirements of various organs, including the heart[13]. This stress is further exacerbated if the lungs are infected and unable to effectively exchange oxygen.

Va.RECENT OBSERVATIONS :

Recent studies have indicated that the delta variant poses a greater threat compared to other COVID-19 variants. Additionally, recent observations and surveys have identified a novel bacterium residing within the bodies of individuals, which has been linked to fatalities. This bacterium has been particularly noted in patients who have been hospitalized with COVID-19 for extended periods, leading to severe health complications that vary based on the individual's immune response[12]. Furthermore, extensive research has demonstrated a significant and prolonged increase in the risk of cardiovascular diseases, such as heart attacks and strokes, following a SARS-CoV-2 infection.
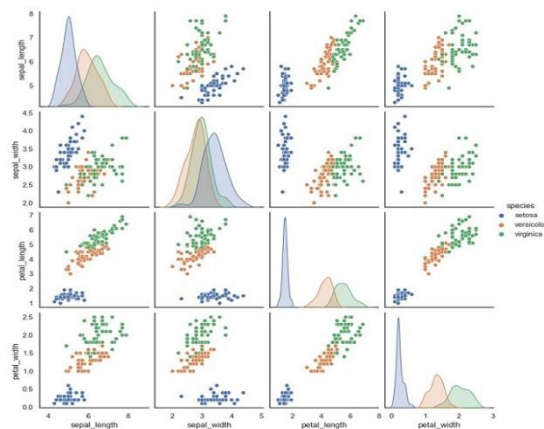
Vb.METHODS- ANALYZING DATA BY MACHINE LEARNING TECHNIQUES

This study is a retrospective observational analysis involving consecutive adult patients who were admitted with confirmed SARS-CoV-2 infection between March and September 2020. Data collection was conducted using the ISARIC case report form, supplemented with information pertinent to cardiovascular conditions.

Patients were admitted either due to symptoms of COVID-19 or for cardiovascular reasons. Information regarding demographic and clinical characteristics, existing comorbidities, current medications, clinical signs and symptoms associated with COVID-19, diagnostic tests performed during hospitalization, treatment administered, complications encountered, and patient outcomes was extracted from electronic medical records. Key indicators of illness severity included admission to the intensive care unit (ICU)[14], the need for mechanical ventilation (MV), instances of renal failure (IR), hemodialysis, and mortality. Follow-up for patients discharged or transferred to other facilities was conducted via telephone six months post-admission to assess their outcomes (alive or deceased).

FIG 1: DTA COLLECTED FOR ANALYSIS

FIG 2 :ANALYSIS OF VIRUS IMPACT ON HEART AND ITS CONSEQUENCES

VI.PRECAUTIONS AND SUGGESTIONS

It is crucial to remain vigilant for any potential symptoms. Both emotional and physical indicators serve as ongoing forms of communication from your heart. During your routine medical check-ups and consultations, it is essential to maintain open and thorough discussions about your overall health with your healthcare provider. If you experience any new, unexplained symptoms, you should schedule a medical examination promptly. In cases of discomfort, shortness of breath, limb swelling, or chest pain[15], seeking immediate medical attention at the nearest emergency department is paramount. Swift recognition and response to cardiac symptoms are vital to preserving your heart's well-being.

VII.CONCLUSION

In certain individuals with COVID-19, symptoms can linger for weeks or even months following the resolution of the acute phase of the illness. This phenomenon is known as 'post-COVID-19 condition' or 'long COVID.'

Medical experts advise maintaining heightened awareness regarding cardiovascular health. Symptoms such as chest pain, shortness of breath, or palpitations should not be overlooked, especially if individuals experience ongoing physical and mental symptoms lasting beyond four to six weeks. The critical role of quality sleep cannot be overstated; if difficulties arise, consulting a specialist may be necessary[16].

COVID-19 vaccinations are effective in reducing the likelihood of infection and severe illness. Although it remains uncertain whether vaccination affects long-term symptoms in those who experience breakthrough infections, it is widely acknowledged that prevention is essential.

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