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Cardiac Manifestations of COVID-19 and COVID-19 Vaccine

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Abstract **Review Article**

Covid-19 pandemic is an unprecedented health issue across the globe. Covid-19 is known to affect multiple organ system of the body including cardiovascular system. The incidence of acute cardiac injury in COVID-19 patients has been estimated to be approximately 8–12%. COVID-19 is often found to be complicated with hypercoagulable state resulting in to thrombotic events. Covid-19 vaccines has also been found associated with deterioration of cardiovascular function among patients having risk factors and even in healthy young adults. Improved survival has been demonstrated by the timely implementation of suitable reperfusion and supportive therapy. A large, reliable multicenter data is needed to establish a relation between Covid-19 vaccine and adverse cardiovascular outcome.

Keywords: Acute Coronary Syndrome, Cardiovascular Diseases, Covid-19, Vaccines.

BACKGROUND

It is well stablished now that Covid-19 affects multiple organ system across age groups, ethnicity and either gender. Cardiovascular manifestations of Covid-19 are among important causes of morbidity, disability and mortality and pose a significant burden on healthcare system around the globe [1]. Cardiovascular manifestations of Covid-19 may present with Pericarditis, Myocarditis and even Acute coronary syndrome (ACS) [2]. Moreover, some increase in episodes of ACS has been found among patients recovered from Covid-19 [3]. Covid-19 vaccines has also been found associated with deterioration of cardiovascular function among patients having risk factors and even in healthy young adults [4]. Improved survival has been demonstrated by the timely implementation of suitable reperfusion and supportive therapy [5]. With this background we conducted a sort literature review evaluating effects of Covid-19 and Covid-19 Vaccine on cardiovascular system.

DISCUSSION

Several studies have documented association between cardiovascular disease and increased risk of infection and the severity of clinical presentation of Covid-19 [6-8]. The cardiovascular complications of COVID-19 include multitude of clinical presentations including myocarditis, pericarditis, acute coronary syndromes (ACS), thromboembolic events, arrhythmias and heart failure [9]. Though respiratory system is thought to be the predominant manifestation for COVID-19 illness, COVID-19 is known to worsen cardiovascular disease and may also create cardiac complications even in the absence of pre-existing cardiac illness [10]. The risk of complications in STEMI and Covid-19 increases with age and comorbidities [11]. The incidence of acute cardiac injury in COVID-19 patients has been estimated to be approximately 8–12% [12]. The presenting ECG changes may or may not be associated with cardiac specific enzyme elevation [13]. Patient with covid-19 may present with cardiovascular involvement in the initial days or even during convalescence [14]. Moreover, STEMI can present without initial clinical manifestation of COVID-19 infection [15]. Primary PCI was the recommended standard of care (American College of Cardiology) for patients with STEMI during Covid-19 pandemic [16].

COVID-19 is often found to be complicated with hypercoagulable state resulting in to thrombotic events [17-19]. Limited number of autopsies conducted on Covid-19 related deaths has also supported cardiac injury related to thrombosis [20]. Garg A *et al.*, opined in their case report that the prothrombotic milieu associated with COVID-19-mediated cytokine release, as evident by elevated D-dimer and CRP might be

responsible for acute thrombotic occlusion in a 35-year-old patient [21]. Juthani P *et al.*, reported a 29-year-old male patient with acute myocardial infarction without any significant comorbidities. Patient was tested Covid-19 positive by RT-PCR, deranged coagulation profile, raised inflammatory markers and complete occlusion of Left Anterior Descending (LAD). Patient was successfully treated with drug eluting stent in LAD and medications [22]. Similarly, Moreno JM *et al.*, also reported a case of 29-year-old man with clinical, electrophysiological and biochemical evidence of AMI in a Covid-19 positive patient [23]. In a retrospective cohort study, Covid-19 was found independently associated with higher three-month risk for venous thrombosis, but not arterial thrombosis, compared to influenza [24].

Adverse cardiac events have also been found associated with Covid-19 vaccination. Myocarditis and pericarditis were common instead of more severe events like MI. The risk benefit ratio supports continuing vaccination drive [25]. Baudihi *A et al.*, also reported a case of 23-year-old young man who developed AMI one day after his second dose of Covid-19 vaccine [26]. Similarly, another case was reported wherein AMI was encountered within twenty-four hours of CoronaVac Covid-19 vaccine [27]. Azir M *et al.*, reported a case of 17-year-old patient presented with Myocarditis mimicking STEMI three day after Covid-19 mRNA vaccine who was later recovered with standard treatment [28]. Cardiovascular complications may also be manifested after booster dose of Covid-19 vaccine [29]. Zafar U *et al.*, concluded in their systematic review that a definitive association cannot be stablished on the basis of available literature [30]. Known benefits of the COVID-19 vaccine outweigh the known or suspected risks [31, 32].

CONCLUSION

Increased incidence and severity of Covid-19 infection are found in patients with cardiovascular disease and Covid-19 also adversely affects cardiovascular system. Coagulation profile is often found deranged in these patients. Strong suspicion and timely diagnosis are empirical to have favorable outcome. Cardiovascular complications may occur in young patients without obvious risk factors in Covid-19 patients. Though Covid-19 vaccines has been found associated with some cardiovascular adverse events, benefits of the COVID-19 vaccine outweigh the known or suspected risks. A large, reliable multicenter data is needed to establish a relation between Covid-19 vaccine and adverse cardiovascular outcome.

REFERENCES

1. Hessami, A., Shamshirian, A., Heydari, K., Pourali, F., Alizadeh-Navaei, R., Moosazadeh, M., ... & Rezaei, N. (2021). Cardiovascular diseases burden in COVID-19: Systematic review and meta-analysis. *The American journal of emergency medicine*, *46*, 382-391.
2. Shafi, A. M., Shaikh, S. A., Shirke, M. M., Iddawela, S., & Harky, A. (2020). Cardiac manifestations in COVID-19 patients—A systematic review. *Journal of cardiac surgery*, *35*(8), 1988-2008.
3. Polito, M. V., Silverio, A., Bellino, M., Iuliano, G., Di Maio, M., Alfano, C., ... & Galasso, G. (2021). Cardiovascular involvement in COVID-19: what sequelae should we expect?. *Cardiology and Therapy*, *10*(2), 377-396.
4. Jeet Kaur, R., Dutta, S., Charan, J., Bhardwaj, P., Tandon, A., Yadav, D., ... & Haque, M. (2021). Cardiovascular adverse events reported from COVID-19 vaccines: a study based on WHO database. *International journal of general medicine*, 3909-3927.
5. Devereaux, P. J., Xavier, D., Pogue, J., Guyatt, G., Sigamani, A., Garutti, I., ... & POISE (PeriOperative ISchemic Evaluation) Investigators. (2011). Characteristics and short-term prognosis of perioperative myocardial infarction in patients undergoing noncardiac surgery: a cohort study. *Annals of internal medicine*, *154*(8), 523-528.
6. Bonow, R. O., Fonarow, G. C., O'Gara, P. T., & Yancy, C. W. (2020). Association of coronavirus disease 2019 (COVID-19) with myocardial injury and mortality. *JAMA cardiology*, *5*(7), 751-753.
7. Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., ... & Cao, B. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The lancet*, *395*(10229), 1054-1062.
8. Yang, C., & Jin, Z. (2020). An acute respiratory infection runs into the most common noncommunicable epidemic—COVID-19 and cardiovascular diseases. *JAMA cardiology*, *5*(7), 743-744.
9. Mohamed Ali, A., Wasim, D., Larsen, T. H., Bogale, N., Bleie, Ø., & Saeed, S. (2021). Acute myocardial infarction due to microvascular obstruction in a young woman who recently recovered from COVID-19 infection. *Journal of Cardiovascular Development and Disease*, *8*(6), 66.
10. Bansal, M. (2020). Cardiovascular disease and COVID-19. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(3), 247-250.
11. Treskova-Schwarzbach, M., Haas, L., Reda, S., Pilic, A., Borodova, A., Karimi, K., ... & Harder, T. (2021). Pre-existing health conditions and severe COVID-19 outcomes: an umbrella review approach and meta-analysis of global evidence. *BMC medicine*, *19*, 1-26.
12. Lippi, G., & Plebani, M. (2020). Laboratory abnormalities in patients with COVID-2019 infection. *Clinical chemistry and laboratory medicine (CCLM)*, *58*(7), 1131-1134.

13. Loghin, C., Chauhan, S., & Lawless, S. M. (2020). Pseudo-acute myocardial infarction in a young COVID-19 patient. *Case Reports*, *2*(9), 1284-1288.
14. Mohamed Ali, A., Wasim, D., Larsen, T. H., Bogale, N., Bleie, Ø., & Saeed, S. (2021). Acute myocardial infarction due to microvascular obstruction in a young woman who recently recovered from COVID-19 infection. *Journal of Cardiovascular Development and Disease*, *8*(6), 66.
15. Sisakian, H., Martirosyan, S., Shekoyan, S., Terteryan, A., & Hovhannisyan, M. (2022). Asymptomatic COVID-19 and ST-elevation myocardial infarction in young adults: lessons learned from two similar cases. *ESC Heart Failure*, *9*(1), 775-781.
16. Mahmud, E., Dauerman, H. L., Welt, F. G., Messenger, J. C., Rao, S. V., Grines, C., ... & Henry, T. D. (2020). Management of acute myocardial infarction during the COVID-19 pandemic: a position statement from the Society for Cardiovascular Angiography and Interventions (SCAI), the American College of Cardiology (ACC), and the American College of Emergency Physicians (ACEP). *Journal of the American College of Cardiology*, *76*(11), 1375-1384.
17. Ozer, M., Abbasi, F., Mahdi, M., Goksu, S. Y., & Struble, E. (2021). Massive biventricular thrombi complicating new-onset heart failure in a patient with suspected COVID-19. *Journal of Cardiology Cases*, *24*(3), 144-147.
18. Le Berre, A., Marteau, V., Emmerich, J., & Zins, M. (2020). Concomitant acute aortic thrombosis and pulmonary embolism complicating COVID-19 pneumonia. *Diagnostic and interventional imaging*, *101*(5), 321.
19. Shams, A., Ata, F., Mushtaq, K., Munir, W., & Yousaf, Z. (2020). Coronary thrombosis in a young male with COVID-19. *IDCases*, *21*, e00923.
20. Pellegrini, D., Kawakami, R., Guagliumi, G., Sakamoto, A., Kawai, K., Gianatti, A., ... & Finn, A. V. (2021). Microthrombi as a major cause of cardiac injury in COVID-19: a pathologic study. *Circulation*, *143*(10), 1031-1042.
21. Garg, A., Hakeem, H., Divita, M., Grewal, J., Cohen, M., & Lapa, A. (2020). ST-elevation myocardial infarction in a young patient with anomalous right coronary artery and COVID-19 pneumonia. *European Heart Journal-Case Reports*.
22. Juthani, P., Bhojwani, R., & Gupta, N. (2020). Coronavirus disease 2019 (COVID-19) manifestation as acute myocardial infarction in a young, healthy male. *Case reports in infectious diseases*, *2020*.
23. Moreno, J. M. M., Ramos-Yataco, A., Garcia, E. V., Palacios, C. H., & Sánchez, G. S. (2022). ST-Elevation Myocardial Infarction With Occluded Culprit Coronary Artery in a Young Patient Recovered From Mild COVID-19: A Case Report. *Cureus*, *14*(9).
24. Ward, A., Sarraju, A., Lee, D., Bhasin, K., Gad, S., Beetel, R., ... & Dash, R. (2022). COVID-19 is associated with higher risk of venous thrombosis, but not arterial thrombosis, compared with influenza: Insights from a large US cohort. *PLoS One*, *17*(1), e0261786.
25. Ho, J. S., Sia, C. H., Ngiam, J. N., Loh, P. H., Chew, N. W., Kong, W. K., & Poh, K. K. (2021). A review of COVID-19 vaccination and the reported cardiac manifestations. *Singapore medical journal*.
26. Boudihi, A., Doudouh, O., Ismaili, N., & El Ouafi, N. (2023). Acute myocardial infarction complicated by severe left ventricle systolic dysfunction in a young patient after Covid 19 vaccination: a case report. *Radiology Case Reports*, *18*(2), 435-440.
27. Panthong, S., Vimonsuntirungsri, T., Thapanasuta, M., Udayachalerm, W., & Ariyachaipanich, A. (2022). Acute Coronary Syndrome After Inactivated SARS-COV-2 Vaccine A Case Report. *International Heart Journal*, *63*(2), 388-392.
28. Azir, M., Inman, B., Webb, J., & Tannenbaum, L. (2021). STEMI mimic: focal myocarditis in an adolescent patient after mRNA COVID-19 vaccine. *The Journal of Emergency Medicine*, *61*(6), e129-e132.
29. Singh, A., Nguyen, L., Everest, S., Afzal, S., & Shim, A. (2022). Acute pericarditis post mRNA-1273 COVID vaccine booster. *Cureus*, *14*(2).
30. Zafar, U., Zafar, H., Ahmed, M. S., & Khattak, M. (2022). Link between COVID-19 vaccines and myocardial infarction. *World Journal of Clinical Cases*, *10*(28), 10109.
31. Lau, C. L., & Galea, I. (2022). Risk–benefit analysis of COVID-19 vaccines—a neurological perspective. *Nature Reviews Neurology*, *18*(2), 69-70.
32. Shiri, T., Evans, M., Talarico, C. A., Morgan, A. R., Mussad, M., Buck, P. O., ... & Strain, W. D. (2022). The population-wide risk-benefit profile of extending the primary COVID-19 vaccine course compared with an mRNA booster dose program. *Vaccines*, *10*(2), 140.