

A Comparative Study of Angiographic Profile in Diabetic Population in a Tertiary Care Hospital Before and After Covid

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Abstract: *Background:* Patients with coronavirus disease 2019 (COVID-19) can present with a large panel of cardiac manifestations, including myocardial infarction with (type 1) or without (type 2) obstructive coronary artery disease, arterial or venous thromboembolic disease, pericarditis and myocarditis, arrhythmias, acute heart failure, shock or cardiac arrest. Acute Coronavirus Disease 2019 (COVID-19) has been associated with new-onset cardiovascular disease (CVD) and diabetes mellitus (DM), but the long term impact of COVID-19 on cardiometabolic outcomes still remain unclear. The long-term cardiovascular outcomes in diabetic COVID-19 survivors remain largely unclear. This study aimed to determine the cardiovascular impact of COVID-19 on diabetic patients. *Methodology:* This is a retrospective study comparing angiographic profiles of diabetic patients for whom CAG was indicated and done in the department of cardiology, King George hospital, Visakhapatnam before covid (2018 and 2019 years) and after covid (2021 and 2022 years). Results for analysis were done with the help of SPSS (Statistical Package for Social Sciences) version 21 and MINITAB version-18. *Conclusion:* Patients with Diabetes mellitus (DM) had indications to undergo CAG more after covid when compared situation before covid. There was no significant difference with respect to age and gender distribution and presence of risk factors like hypertension and smoking in the diabetic population studied in pre covid and post covid periods. There was significant increase in clinical presentation as Acute Coronary syndrome (ACS) post covid in diabetic population. In our study, diabetic patients having significant and mild coronary artery disease were statistically higher after covid indicating patients having risk factors and comorbidities became more symptomatic and had an indication for CAG with increased severity of coronary artery disease after covid. Thrombus burden in coronaries on CAG was higher after covid.

Keywords: COVID-19 infection, SARS Cov-2 virus, Diabetes mellitus, Coronary angiography, Long covid.

1. Introduction

Cardiovascular complications of corona virus disease 2019(covid 19) are well described, but post-acute cardiovascular manifestations of covid 19, especially ischemic heart disease have not yet been comprehensively characterised. The cardiac manifestations like myocardial infarction, impaired myocardial flow reserve from micro vascular injury, cardiac failure, life-threatening arrhythmias, coronary artery aneurysm, aortic aneurysm, accelerated atherosclerosis, venous and arterial thromboembolic disease including life threatening pulmonary embolism may manifest as Long-COVID after recovery from acute illness with prolonged duration of disease and impaired recovery especially in immunocompromised states like diabetes.¹ New Cardiovascular disease events were increased nearly 6-fold during acute COVID-19 and nearly 50% in post-acute COVID-19.² Studies comparing demographic data, burden and outcome in ischemic heart disease in diabetic population before and after covid are lacking. In this study, we compared the database of angiographic profile of diabetic patients for whom coronary angiography (CAG) was indicated and done before covid (2018 and 2019) and after covid (2021 and 2022).

2. Methods

This is a retrospective study comparing angiographic profiles of diabetic patients for whom CAG was indicated and done in the department of cardiology, King George hospital, Visakhapatnam before covid (2018 and 2019 years) and after covid (2021 and 2022 years). The data were fed to the computer. The tabulations and the results for analysis were done with the help of SPSS (Statistical Package for Social Sciences) version 21 and MINITAB version-18 and Microsoft Excel for Statistical measurements such as simple percentages, percentage scores and mean rank etc., Chi-square tests were administered to check the independency of two categorical variables i.e., Covid Profile Vs demographic variables and other dependent variables of the current research. For the variable Thrombus, proportion test is performed to verify whether there is any significant difference in proportions between before and after Covid situations. For all the tests, P value < 0.05 was considered statistically significant.

3. Results

Out of a total 1472 diabetic patients for whom CAG was indicated and done in the four years, CAG was done for 641 patients before covid (2018 and 2019 years) and 831 patients after covid (2021 and 2022 years). Patients with Diabetes mellitus (DM) had indications to undergo CAG more after covid when compared situation before covid (831 vs 641 patients) indicating that patients with immunocompromised state like DM have been more symptomatic and undergone CAG after covid 19. The mean age in both groups was similar (55 years). Overall males (62% vs 38%) were more when compared to females. Although males were more affected than females before covid and after covid, there was no statistical gender difference between the two groups. There was no statistical difference in smokers (25% vs 28%) between the two groups. The percentage of diabetic patients having coexistent hypertension was higher overall (70%) and in both pre covid (73%) and post covid period (69%). There was significant increase in clinical presentation as Acute Coronary syndrome (ACS) post covid in diabetic population (715 patients vs 512 patients). Regarding angiographic profile, diabetic patients having significant coronary artery disease and mild coronary disease were significantly higher after covid indicating patients having comorbidities like diabetes mellitus became more symptomatic with presence of significant disease on coronary angiography. The data suggesting normal epicardial coronaries on CAG was less after covid (60 vs

129 patients) when compared to pre covid period. Thrombotic load in coronaries on CAG was higher when compared before covid and it was statistically significant. The number of patients with significant disease undergoing revascularization (PTCA and CABG) was comparatively higher in diabetic patients in post covid period.

Table 1: Age wise distribution of diabetic patients before and after covid

		Profile		Total
		Before Covid	After Covid	
Age	Up to 20 Yrs	1 0.2%	0 0.0%	1 .1%
	21- 30 Yrs	5 0.8%	5 .6%	10 .7%
	31- 40 Yrs	35 5.5%	39 4.7%	74 5.0%
	41- 50 Yrs	173 27.0%	201 24.2%	374 25.4%
	51- 60 Yrs	236 36.8%	326 39.2%	562 38.2%
	61- 70 Yrs	155 24.2%	212 25.5%	367 24.9%
	71- 80 Yrs	34 5.3%	46 5.5%	80 5.4%
	>80 Yrs	2 .3%	2 .3%	4 .3%
Total		641 100.0%	831 100.0%	1472 100.0%

Table 2: Mean age comparison between diabetic patients before and after covid

Age		X	n	p	Z-Value	P-Value	Conclusion
< 45Yrs Males	Before Covid	102	641	0.159	0.78	0.436	Not Significant
	After Covid	120	831	0.144			
< 55Yrs Females	Before Covid	538	641	0.839	-0.86	0.390	Not Significant
	After Covid	711	831	0.856			

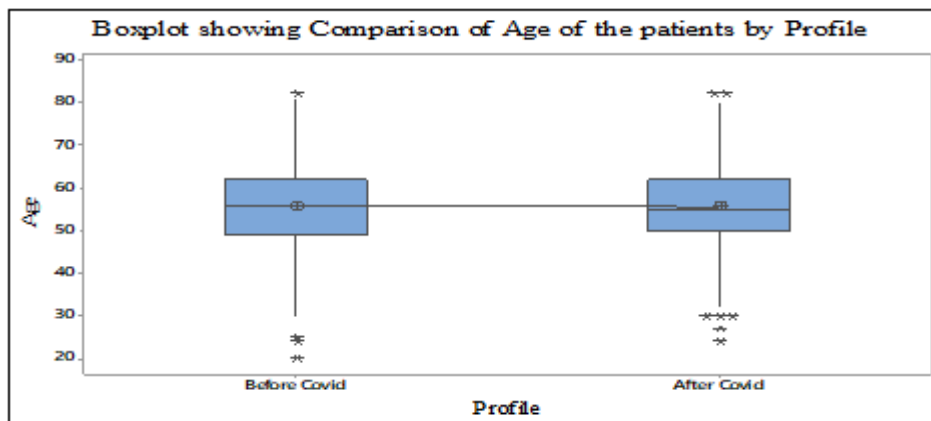


Figure 1: Mean age comparison between diabetics before and after covid

Table 3: Gender wise distribution of diabetic patients before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Sex	Male	401 62.6%	512 61.6%	913 62.0%
	Female	240 37.4%	319 38.4%	559 38.0%
Total		641 100.0%	831 100.0%	1472 100.0%

Chi-Square: 0.137, P-value: 0.711, Not Significant

Table 4: Tobacco smoking comparison in diabetics before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Tobacco	No	481 75.0%	596 71.7%	1077 73.2%
	Yes	160 25.0%	235 28.3%	395 26.8%
Total		641 100.0%	831 100.0%	1472 100.0%

Chi-Square: 2.029, P-value: 0.154, Not Significant

Table 5: Comparison of prevalence of Hypertension in diabetics before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Hypertension	No	173 27.0%	261 31.4%	434 29.5%
	Yes	468 73.0%	570 68.6%	1038 70.5%
Total		641 100.0%	831 100.0%	1472 100.0%

Chi-Square: 3.399, P-value: 0.065, Not Significant

Table 6: Comparison of clinical presentation in patients before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Clinical Diagnosis	ACS	512 79.9%	715 86.0%	1227 83.4%
	CSA	67 10.5%	36 4.3%	103 7.0%
	Others	62 9.7%	80 9.6%	142 9.6%
Total		641 100.0%	831 100.0%	1472 100.0%

Chi-Square: 21.023, P-value: 0.000, Significant

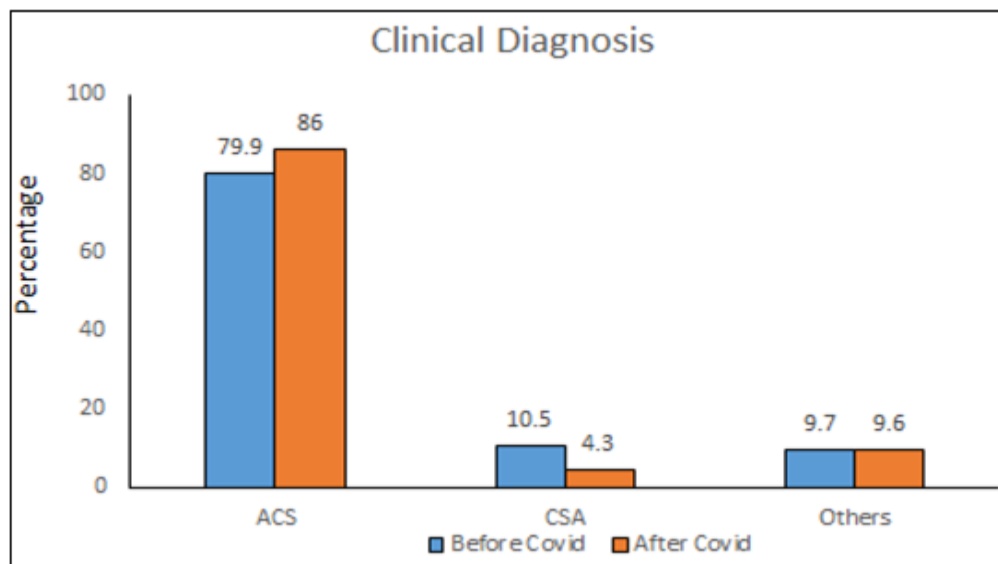


Figure 2: Comparison of clinical presentation in patients before and after covid groups

Table 8: Comparison of Angiographic diagnosis in patients before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Angiographic diagnosis	CAD DVD	131 20.4%	162 19.5%	293 19.9%
	CAD- LMCA+ DVD	13 2.0%	17 2.0%	30 2.0%
	CAD- LMCA+ TVD	35 5.5%	34 4.1%	69 4.7%
	CAD LMCA+ SVD	3 .5%	2 2%	5 .3%
	CAD mild disease	69 10.8%	222 26.7%	291 19.8%
	CAD SVD	165 25.7%	227 27.3%	392 26.6%
	CAD TVD	96 15.0%	107 12.9%	203 13.8%
	Normal Epicardial Co	129 20.1%	60 7.2%	189 12.8%
	Total		641 100.0%	831 100.0%

Chi-Square:97.158, P-value: 0.000, Significant

Table 10: Comparison of Intervention done in patients before and after covid groups

		Profile		Total
		Before Covid	After Covid	
Plan	CABG	137 21.4%	161 19.4%	298 20.0%
	Medical Management	206 32.1%	297 35.7%	503 34.2%
	PTCA	298 46.5%	373 44.9%	671 45.6%
Total		641 100.0%	831 100.0%	1472 100.0%

Chi-Square:2.293, P-value: 0.318, Not Significant

Table 11: Comparison of Thrombus burden in patients before and after covid groups

Profile	Thrombus	n	p	Z-Value	P-Value	Decision
Before Covid	45	641	0.070203	-2.05	0.041	Significant
After Covid	83	831	0.09988			

4. Discussion

This is a retrospective study done at King George Hospital, Visakhapatnam comparing Coronary angiographic data in diabetic population before covid (2018 and 2019 years) and after covid (2021 and 2022 years). There is increased prevalence of diabetes mellitus during and post covid period because of life style changes and use of steroids for prolonged periods during management of severe covid 19

infections. Patients with immunocompromised state like DM have been more symptomatic and undergone CAG after covid 19. There is evidence that new-onset diabetes is increased during the acute COVID-19 illness, and the cardiovascular manifestations and poorer outcomes in diabetics in the 1-year follow-up post covid.^{4,5}

Mean age in both the groups was similar (55 years) and overall males were more when compared to females both in pre covid and post covid period. In a retrospective study done by Wang W, et al, Risks of cardiovascular complications were evident in both male and female similarly after 1 year post COVID.³ In our study, there was no statistical difference in diabetic patients with risk factors like hypertension and smoking between the two groups. The percentage of diabetic patients having coexistent hypertension was higher overall (70%) and in both pre covid (73%) and post covid period (69%). Hypertensives were affected more in acute phase of covid-19, but data regarding long term outcomes in hypertensives post Covid is lacking.⁶

There was significant increase in clinical presentation as Acute Coronary syndrome (ACS) post covid in diabetic patients. In a retrospective study done by Wang W, et al, at 1 year post covid, the incidence of ischemic heart disease (IHD) along with cardiomyopathy and heart failure was higher.³ A recent report by Yan Xie et al. has provided substantial evidence from the US Department of Veterans Affairs National Healthcare Databases (VHA) that the risk and 1-year burden of CVD are high in both hospitalized and non-hospitalized survivors of acute COVID-19.⁷ In our study, diabetic patients having significant and mild coronary artery disease were statistically higher after covid) indicating patients having risk factors and comorbidities became more symptomatic and had an indication for CAG with increased severity of coronary artery disease after covid. SARS-CoV-2 is likely to have both direct and indirect pathways that promote atherosclerosis development and progression and so it is associated within an increased risk of myocardium infarction.⁸ Risk of cardiovascular events is elevated not just in the acute period but for years afterwards. In addition to the acute inflammatory changes in the lung, this inflammatory response has a systemic component which may have implications for atherosclerosis progression and development, leading to ischemic heart disease. A potential source of this risk can be seen in the progression of coronary artery calcium burden following pneumonia.⁹ In our study, the number of diabetic patients with significant disease undergoing revascularization (PTCA and CABG) was comparatively more after Covid-19 infection. Thrombotic load in coronaries on CAG was higher when compared before covid and it was statistically significant in our study. Knight and colleagues suggested that arterial and venous thrombosis remain elevated for 49 weeks after COVID-19 resulting in adverse cardiovascular outcomes post covid.¹⁰

5. Conclusion

In our study, diabetics had indications to undergo CAG more after covid indicating that patients with immunocompromised state like DM have been more symptomatic and undergone CAG after covid 19. There was no significant age gender difference in diabetics affected

with CAD before and after covid. There was no statistical difference in prevalence of risk factors like hypertension and smoking in pre covid and post covid period. There was significant increase in clinical presentation as Acute Coronary syndrome (ACS) post covid in diabetic population. Regarding angiographic profile, these diabetic patients having mild coronary artery disease and significant coronary artery disease were statistically higher post covid indicating patients with immunocompromised state like diabetes mellitus became more symptomatic and had an indication for CAG after covid. Thrombus burden in coronaries on CAG was higher after covid. The number of patients with significant disease undergoing revascularization (PTCA and CABG) was revascularization (PTCA and CABG) was comparatively higher in post covid period. Studies of post covid 19 sequelae, especially ischemic heart disease across the spectrum of hospital care settings is lacking. As the pandemic enters its third year, addressing this knowledge gap on the long-term impact of the SARS-CoV-2 infection especially in immunocompromised population like Diabetes mellitus may help in management of post covid 19 cardiovascular sequelae, especially ischemic heart disease. The limitations of this study are lack of information about the exposure to covid infection and its severity in post covid data. The vaccination status of the individuals in post covid group were not known in this study.

References

- [1] Becker RC. Toward understanding the 2019 Coronavirus and its impact on the heart. *J Thromb Thrombolysis* 2020.
- [2] Rezel-Potts E, Douiri A, Sun X, Chowienczyk PJ, Shah AM, Gulliford MC (2022) Cardiometabolic outcomes up to 12 months after COVID-19 infection. A matched cohort study in the UK. *PLoS Med* 19(7): e1004052. <https://doi.org/10.1371/journal.pmed.1004052>.
- [3] Wang W, Wang CY, Wang SI, Wei JC. Long-term cardiovascular outcomes in COVID-19 survivors among non-vaccinated population: A retrospective cohort study from the TriNetX US collaborative networks. *EClinicalMedicine*. 2022 Nov; 53:101619. doi: 10.1016/j.eclinm.2022.101619.
- [4] Carfi A, Bernabei R, Landi F. Persistent symptoms in patients after acute COVID-19. *JAMA*. 2020;324(6):603–605.
- [5] Harrison SL, Fazio-Eynullayeva E, Lane DA, Underhill P, Lip GYH. Comorbidities associated with mortality in 31,461 adults with COVID-19 in the United States: a federated electronic medical record analysis. *PLoS Med*. 2020;17(9): e1003321.
- [6] Soeiro AM, Pêgo-Fernandes PM. Post-COVID-19 cardiological alterations. *Sao Paulo Med J*. 2021;139(6):543-544. Published 2021 Aug 30. doi:10.1590/1516-3180.2021.
- [7] Xie Y, Xu E, Bowe B, Al-Aly Z. Long-term cardiovascular outcomes of COVID-19. *Nat Med*. 2022;28(3):583–590.
- [8] Kwong JC, Schwartz KL, Campitelli MA, et al. Acute myocardial infarction after laboratory-confirmed influenza infection. *N Engl J Med*. 2018;378(4):345–353.

- [9] Corrales-Medina VF, Dwivedi G, Taljaard M, et al. Coronary artery calcium before and after hospitalization with pneumonia: the MESA study. PLoS One. 2018;13(2): e0191750.
- [10] 10. Knight R, Walker V, Ip S, Cooper JA, Bolton T, Keene S, et al. Association of COVID-19 with arterial and venous vascular diseases: a population-wide cohort study of 48 million adults in England and Wales. 2021.