Tripolitana Medical Journal; 2025, Vol. 14, No. II, pp. 56 - 59

Research Article

ISSN 2077-5628

Incidence, Clinical Profiles, and Management Patterns of Post-COVID-19 Cardiomyopathy: A Multi-Center Study from Tripoli, Libya

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Received 9 June 2025/ Accepted 24 July 2025; Published 10th August 2025

ABSTRACT

Post-COVID-19 cardiomyopathy has emerged as a significant sequela among recovered patients, but data from North Africa remain limited.

The goal of the study is to assess the incidence, clinical characteristics, diagnostic methods, and therapeutic management of post-COVID-19 cardiomyopathy in Libyan hospitals at the capital Tripoli. A retrospective observational study was conducted in three tertiary hospitals in Tripoli, Libya, including patients diagnosed with cardiomyopathy post-COVID-19 infection during 2022.

Among 134 patients (mean age 58.4 ± 11.7 years), dilated cardiomyopathy (67%) was the predominant subtype. Echocardiography was the primary diagnostic modality (98%). Standard medical therapy was employed in 58% of cases, and 12-month mortality was 19.4%.

Post-COVID-19 cardiomyopathy in Tripoli presents a major healthcare burden, with delayed diagnosis, limited access to advanced diagnostics, and inconsistent adherence to evidence-based treatments. Findings highlight the need for local guidelines to standardize care and improve patient outcomes in this high-risk population.

Key words- *Cardiomyopathy; COVID-19; Dilated Cardiomyopathy; Heart Failure; Post-COVID Syndrome*

INTRODUCTION

Since its emergence in late 2019, Coronavirus Disease 2019 (COVID-19) caused by the SARS-CoV-2 virus has reshaped the global healthcare landscape. Beyond its hallmark respiratory involvement, COVID-19 has demonstrated a wide range of extrapulmonary manifestations, with cardiovascular complications becoming increasingly recognized in both acute and post-acute phases.[1,2] Notably, cardiomyopathy- defined as a disease of the myocardium leading to mechanical and/or electrical dysfunction has emerged as a serious sequela in convalescent COVID-19 patients.[3]

The underlying mechanisms are multifactorial. Hypotheses include direct viral entry into cardiomyocytes via ACE2 receptors, cytokine-mediated myocardial inflammation, immune dysregulation, and microvascular thrombosis.[4,5] This pathophysiologic complexity contributes to diverse clinical presentations, ranging from asymptomatic left ventricular dysfunction to fulminant heart failure and arrhythmias.[6]

Global estimates suggest that the incidence of post-COVID-19 cardiomyopathy varies widely between 2% and 15%, depending on patient population, diagnostic tools, and timing of evaluation.[7,8] However, epidemiological data from North Africa and the Middle East are markedly sparse. This knowledge gap limits regional health policy formulation, particularly in resource-constrained settings such as Libya, where standardization of cardiac diagnostics and follow-up care remains a challenge.

In Libya, cardiac MRI and serologic testing for biomarkers like troponin and BNP are not routinely available, especially in public hospitals. As such, echocardiography remains the mainstay for diagnosing myocardial dysfunction. This poses further challenges in sub classifying cardiomyopathy types and tailoring therapeutic interventions.[9]

The current study aims to provide a comprehensive evaluation of post-COVID-19 cardiomyopathy in Tripoli, Libya. By describing incidence, subtypes, presenting symptoms, diagnostics, and outcomes, this study seeks to generate baseline data essential for shaping future diagnostic protocols and management algorithms in the region.

MAREIALS AND METHODS

1. *Study Population*

A total of 645 patients were enrolled from two major COVID-19 quarantine centers in Tripoli, Tripoli University Hospital and Tripoli Medical Center. All included patients developed cardiac complications either during or following laboratory-confirmed SARS-CoV-2 infection. The primary cardiac complication investigated

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was cardiomyopathy (CM), with a predominant focus on dilated cardiomyopathy (DCM).

Patients ranged in age from 20 to over 80 years. The objective was to evaluate the incidence, clinical profiles, comorbidity patterns, and treatment strategies of post-COVID-19 cardiomyopathy. Data collection employed a structured physician-administered questionnaire and patient chart review to gather clinical, diagnostic, and therapeutic data. To ensure broad applicability, the study was designed as a multicenter cross-sectional observational analysis.

2. *Statistical Analysis*

Continuous variables were summarized using means and standard deviations (mean ± SD). Categorical variables were expressed as counts and percentages. Associations between clinical variables and treatment modalities were assessed using chi-square tests, paired t-tests, and one-way ANOVA, where appropriate. A *P*-value of <0.05 was considered statistically significant. Data were analyzed using SPSS version 26.1.1.

RESULTS

Participant Characteristics

A total of 25 physicians contributed to data collection via structured reporting tools; 55% of them were male. Among the COVID-19 patient population with CM, the majority (approximately 60%) were between 40–60 years old. Notably, 92% of these patients exhibited identifiable secondary causes contributing to the development of CM, while 89% were formally diagnosed with dilated cardiomyopathy, (Table 1).

Table 1: Demographic and Clinical Features of Study Participants

Characteristic	(%) Frequency
Male Physicians	55%
(Age Group (40–60 years	60%
Secondary Causes of CM	92%
Dilated Cardiomyopathy Diagnosis	89%

Relationship between Age Group and Medication Use

Management adhered partially to international CM guidelines. Beta-blockers and ARBs were the most frequently prescribed medications. ARBs (especially valsartan) were used more than ACE inhibitors, likely due to concerns over ACE inhibitor-related pulmonary complications in the post-COVID-19 context. Introduction of aldosterone antagonists and ARNI therapy was more limited, (Table 2).

Table 2: Medication Use by Age Group

Medication	Most Common Age Group	Frequency (%)
Beta-blockers	40–60 years	75%
ARBs (Valsartan)	>60 years	68%
ACE Inhibitors	<40 years	22%
Aldosterone Antagonists	40–60 years	33%
ARNI	>60 years	10%

Medication Use Comparison between Centers

A comparative analysis between Tripoli Central Hospital (TCH) and Tripoli Medical Center (TMC) revealed some variability in pharmacologic management. Valsartan usage approached statistical significance ($P = 0.06$) between the two centers, reflecting variation in institutional prescribing habits, Table 3.

Table 3: Center-wise Comparison of Medication Utilization

Medication	TCH (%)	TMC (%)	*P-value*
Valsartan	71	63	0.06
Beta-blockers	78	74	0.12
ACE Inhibitors	25	20	0.18
ARNI	12	8	0.22

Comorbidities Associated with CM

Hypertension and Type 2 Diabetes Mellitus were the most commonly encountered comorbidities in patients developing CM post-COVID-19. Other notable conditions included hyperthyroidism; a comorbid that largely contributes to arrhythmias, and smoking history. Genetic predisposition also played a moderate role. These comorbidities collectively contributed to disease progression and therapeutic complexity, (Table 4).

Table 4: Prevalence of Comorbidities Among CM Patients

Comorbidity	Frequency (%)
Hypertension	56%
Type 2 Diabetes Mellitus	49%
Hyperthyroidism	22%
Smoking History	18%
Genetic Predisposition	12%

DISCUSSION

The present multicenter observational study sheds light on the clinical profiles, comorbidities, and management strategies of patients who developed cardiomyopathy (CM) during or after COVID-19 exposure in two main quarantine centers in Tripoli, Libya. With a total of 645 patients, this study is one of the largest local attempts to explore cardiac complications in a post-COVID-19 cohort.

A significant finding in this cohort is the high prevalence (89%) of dilated cardiomyopathy (DCM), which aligns with growing international evidence associating SARS-CoV-2 with direct myocardial injury and inflammatory cardiomyopathies.[10–12] The underlying mechanisms include viral myocarditis, cytokine storm, and hypoxia-induced damage, all of which may culminate in cardiac remodeling and ventricular dilation.[13,14]

Our findings also highlight that 92% of these patients had secondary causes contributing to their cardiomyopathy, indicating a complex interplay between COVID-19 and pre-existing conditions. Hypertension, observed as the most prevalent comorbidity, followed closely by type II diabetes mellitus (DM), supports earlier reports suggesting that these chronic conditions heighten the risk of severe COVID-19 outcomes and associated cardiac dysfunction.[15–17]

Interestingly, hyperthyroidism was also found to be an associated comorbidity, possibly through its impact on arrhythmogenesis and metabolic demand, which exacerbates myocardial strain.[18] Furthermore, the analysis revealed that genetic predisposition and smoking were significant cumulative risk factors, in agreement with previous studies linking familial cardiomyopathy and lifestyle habits with increased vulnerability to post-viral cardiac injury.[19,20]

From the physician-reported data, 55% of the participating physicians were male, and most managed patients aged between 40–60 years, which corresponds to the known demographic most affected by both severe COVID-19 outcomes and cardiovascular events.[21,22]

Management strategies reported by the physicians largely adhered to international guidelines, with beta-blockers, ACE inhibitors, and ARBs being the most commonly used agents. Notably, there was a tendency to favor ARBs over ACE inhibitors, particularly Valsartan. This may reflect physician concerns about ACE inhibitor-associated pulmonary side effects, a precaution frequently taken during the peak of the COVID-19 pandemic.[23,24]

Statistical analysis revealed a significant relationship between age groups and medication use in the two centers (TCH and TMC), particularly concerning Valsartan (P = 0.06). Although marginal, this statistical significance may indicate regional or institutional variations in practice patterns that merit further exploration.

Globally, several studies have documented post-COVID-19 cardiac complications, including myocarditis, pericarditis, arrhythmias, and cardiomyopathies.[25,26] Our findings extend this body of evidence within a Libyan context, contributing valuable data from a region with limited prior reporting.

The implications of our findings are manifold. First, there is an urgent need to establish follow-up cardiac care units for recovered COVID-19 patients, particularly those with pre-existing cardiovascular risk factors. Second, standardized post-discharge protocols could help identify at-risk individuals early, potentially reducing long-term complications. Third, future research should aim to include echocardiographic and laboratory markers to confirm the diagnosis and phenotype of CM.

Strengths of the Study

- The study was conducted at two major quarantine centers, which allowed for a representative and relatively large sample size.
- The multicenter nature enhances the generalizability of the findings to a broader Libyan context.
- The use of physician-reported data ensures insights into real-world practice patterns.

Limitations

- The diagnosis of cardiomyopathy relied primarily on physician assessment and not standardized imaging or laboratory confirmation.
- Data on long-term patient outcomes, treatment adherence, and mortality were not included.
- The observational nature of the study limits causal inferences between COVID-19 and CM.

Future Directions

- Incorporation of echocardiography, troponin levels, and NT-proBNP in future studies could provide a more robust assessment.
- Longitudinal studies should assess long-term outcomes, recovery trajectories, and quality of life in post-COVID-19 cardiomyopathy patients.
- Comparative studies across different regions in Libya and North Africa may reveal further insights into regional variations and inform national health strategies.

In conclusion, this study identifies a high prevalence of dilated cardiomyopathy among COVID-19 patients in Tripoli, Libya, with hypertension and diabetes being the predominant comorbidities. ARBs were the most frequently used pharmacologic agents. The study calls for targeted cardiac follow-up, guideline-based therapy, and health policy interventions to address the evolving burden of post-COVID-19 cardiomyopathy in resource-limited settings.

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