Original Research Paper

General Medicine

CLINICAL PROFILE, RADIOLOGICAL AND LABORATORY PARAMETER, AND OUTCOME OF MYOCARDITIS

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ABSTRACT **Background & objectives –** Myocarditis is an inflammatory disease of the cardiac tissue, as myocarditis has a variable clinical presentation and outcome. We studied the clinical profile, radiological & laboratory parameters in patients having myocarditis and the outcomes of the patients. **Methods –** We conducted an observational and cross-sectional study on 50 patients, who fulfilled the case definition, inclusion & exclusion criteria. The study was conducted over 18 months. Data was collected and analyzed in standard proforma. **Results –** The mean age of the study population was found to be 47.6 years. Males are more affected than females, 64% and 36% respectively. The most common presenting complaint was breathlessness (70%) followed by fever (62%) and cough (52%). The most common etiology causing myocarditis was, viral infections (60%). The most common ECG and 2d echo findings were sinus tachycardia (50%) and global RWMA (24%). Overall mortality among the cases was 18%. **Conclusion –** High clinical suspicion of myocarditis should always be kept even in patients having mild complaints and sinus tachycardia, as timely diagnosis and appropriate intervention can prevent irreversible myocardial damage.

INTRODUCTION –

Myocarditis, by definition, is an inflammatory disease that affects the cardiac tissue. It is a multifactorial disease with variable clinical presentation and outcomes. However, as the diagnosis relies on infrequently performed endomyocardial biopsy, its actual incidence remains unknown. Myocarditis may occur because of infections, immune system activation or exposure to drugs or toxins. Clinical presentation of the disease is highly variable, which can range from mild & self-limiting to fulminant disease that can cause severe ventricular dysfunction causing LVF or cardiogenic shock (1).

However, it is difficult to estimate the true incidence of acute myocarditis, the incidence is estimated to be 10-22 per 100,000 cases, with an estimated 1.5 million cases worldwide in 2013 (2). Acute myocarditis is more common in younger adults and appears to affect both sexes and various races equally (3,4), and is considered the most commonly known cause of dilated cardiomyopathy in children less than 18 years of age (5).

The most common etiology being Idiopathic, amongst the known causes, Viral infections are the most common etiological agent, and the most prominently linked virus with myocarditis is enteroviruses like Coxsackie B (6), but also associated with other viruses like parvovirus B19, adenovirus, influenza A virus, human herpesvirus (HHV), Epstein–Barr virus, cytomegalovirus, hepatitis C virus, and HIV (7). During the recent SARS Covid-19 pandemic, many cases of myocarditis have been reported globally that were associated with covid 19 virus infection (20). Other than viral diseases Bacterial, Fungal, Protozoal diseases can also cause myocarditis. Along with infectious diseases, various noninfectious etiologies can precipitate myocarditis via several known and unknown mechanisms (8).

MATERIALS AND METHODS –

We conducted an observational cross-sectional study, over 18 months at a tertiary care centre in Maharashtra. The study was approved by the institute's ethics committee. Cases were selected by simple random sampling of the subjects who fit into the study inclusion criteria of probable myocarditis.

Detailed history regarding symptoms and relevant clinical examination was done in cases, further investigations like standard 12 leads ECG, 2D echocardiography and CPKMB levels were obtained along with other routine investigations. The outcome of the patients was assessed in terms of recovery (shifted out of ICU and discharged) and deaths and results were computed using statistical analysis.

1. Inclusion criteria
- Patients with age more than 12 years.
- Patients of either sex.
- Patients with complaints of acute onset of chest pain/palpitations/breathlessness/fever.
- Patients who give consent for participation in the study, for those who are unable to give consent, valid consent will be taken from the patient's relatives.

2. Exclusion criteria
- Patients with age less than 12 years.
- Patients with a known history of cardiovascular disease.
- Patients who do not give consent to participate in the study.

- Case definition - Patients admitted in ICU with signs and symptoms of myocarditis including
- Symptoms of cardiovascular disorders like chest pain, breathlessness, palpitation, fever.
- Patients with ECG & 2D Echo abnormalities and elevated CPKMB levels (>24 IU/ml).

RESULTS -
The following data are of 50 patients with myocarditis, collected over 18 months duration and was analyzed during the study –
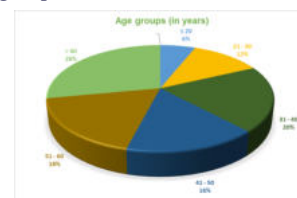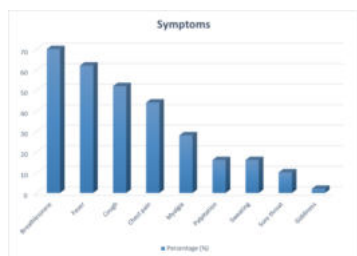
Figure 1 – Age group-wise distribution

Figure 2 – Gender-wise distribution

Figure 3 – Symptoms

Among 50 patients, 44% patients had comorbidities, the most common comorbidity was found to be Hypertension followed by Diabetes mellitus. And 78% of patients had tachypnea (Respiratory rate ≥ 20/min).

Among all 50 patients who had myocarditis, 16 patients had severe illnesses (that required ventilatory support, including both invasive and non-invasive).

The mean CPKMB values were compared between the survivors (n=41) and those who died (n=9), which was 98.49 (± 91.01) and 142.66 (±142.11) (p=0.2422).

Table 1 – ECG abnormalities

ECG Abnormality				
		Number	Total	Percentage (%)
Rate abnormality	Tachycardia	25	29	58
	Bradycardia	4		
Rhythm abnormality	Atrial fibrillation	2	5	10
	Atrial flutter	1		
	Sinus arrhythmia	1		
	Junctional rhythm	1		
QRS abnormality	Bundle branch block	6	11	22
	Poor r-wave progression	1		
	VPC	4		
T-Wave abnormality	Inversion	12	14	28
	Flattening	2		
PR-Interval abnormality	Prolongation	1	2	4
	Shortening	1		
QTc abnormality	Prolongation	8	9	18
	Shortening	1		
ST-Segment abnormality	Elevation	7	10	20
	Depression	3		

Table 2 – 2D echo abnormalities

2D Echo Abnormality				
		Number	Total	Percentage (%)
	Global	12	14	28
	Segmental	2		
Systolic dysfunction	Mild (EF 41-50%)	10	13	26
	Moderate (EF 31-40%)	2		
	Severe (EF <30%)	1		
Diastolic dysfunction	Mild	4	6	12
	Moderate	1		
	Severe	1		
Valvular abnormality	Mitral Regurgitation (MR)	7	9	18
	Tricuspid Regurgitation (TR)	1		
	MR+TR	1		
Chamber Dilation		7		14

Table 3 – Etiological categorization

Category	Sub-category		Number	Percentage
Infectious	Viral	Covid 19	24	48
		Dengue	6	12
	Bacterial	E. coli	1	2
		Klebsiella	1	2
		Spirochaete	1	2
Non-infectious		Organophosphorus toxicity	12	24
		Vasculo-toxic snake bite	2	4
		Aluminium phosphide toxicity	1	2
		Congenital cardiomyopathy	1	2
		Tetanus	1	2
TOTAL			50	100

DISCUSSION –

Over the past few decades, myocarditis has evolved as a major cause of disease burden and mortality among all age groups, gender, and ethnicity. The prognosis of myocarditis is stratified by the severity and time course along which symptoms develop, additionally several indicators of heart function can be used to predict the course and outcome of patients.

In the present study, males (64%) are predominantly affected as compared to females (36%), which was also found in a study done by Kyto et al (9) & Faiweather et al (10). Speculated to be caused by a protective effect of natural hormonal influences on immune responses in women when compared with men (11,12).

The mean age of the population was 47.6 (±16.32) Years, which was similar to the findings of studies done by Kyto et al (9) & Faiweather et al (10). Comparison between the mean age in survivor and death group was found to be statistically significant (p= 0.008), with a mean age of 46 (±15.69) years and 54.88 (± 18.10) years respectively.

The most common etiology causing myocarditis was found to be viral infections (60%) in our study, which was in concordance with studies done by Fairley et al (13), Dominguez F et al (14) and Kühl U et al (15). Among viral causes, SARS covid -19 was the most common virus found to cause myocarditis.

In the present study, mean systolic blood pressure (SBP) was 115.24 (±23.02) mmHg, mean diastolic blood pressure (DBP) was 72.36 (±16.88) mmHg, & mean arterial pressure (MAP) was 86.65 (±18.37) mmHg, patients with abnormal DBP were associated with higher mortality (P = 0.00054, significant) which was in concordance with the study done by Mahfoud F et al (16) where low baseline SBP, DBP, MAP were found to be independent poor prognostic predictors, with a baseline mean SBP was 115.4 (±17.0), DBP was 70.1 (±10.3), & MAP was 87.2 (±11.7).

In our study, 98% of patients had ECG abnormality which was nearly equal to, that is 92.6% was found by Grün S et al in their study (17). The most common ECG abnormality was Rate abnormality that is nearly 58% (50% had tachycardia and 8% had bradycardia) followed by QRS-abnormality and T-wave abnormality which is 32% and 28% respectively, whereas ST segment abnormality (59%) followed by bundle branch block (10.6%) were the most common ECG abnormalities noted by Grün S et al in their study (17). A study by Younis A et al also found ST segment abnormality as the most common ECG change (18).

Echocardiography is an important part of the standard evaluation of patients with suspected acute cardiac conditions and may show a large spectrum of findings. Even when LVEF is normal, the presence of increased wall thickness, mild segmental hypokinesia, diastolic dysfunction, mild right ventricular dysfunction, pericardial effusion, and abnormal myocardial echogenicity may suggest acute myocarditis. In our study, 28% of patients had regional wall motion abnormality (RWMA) in the form of global or segmental RWMA followed by systolic dysfunction in 26 % cases while valvular

abnormality in 18 % and diastolic dysfunction in 12%, which was in discordance with the study done by Pinamonti et al, described left (69%) and right (23%) ventricle dysfunction, ventricular dilation (64%), ventricular thrombus (15%) and abnormal ventricular filling (7%) in patients with EMB-proven myocarditis (19).

The overall mortality was 18% in our study, out of which 2 % had mortality attributed to fulminant myocarditis causing cardiogenic shock, the rest of the mortalities were secondary to other systemic complications like ARDS, septicemia, acute kidney injury etc.

During the recent pandemic of covid-19 infection cases having myocarditis as an associated systemic complication of infection were found, that can affect the disease course. Among the COVID-19 cases in our study, we found a male gender predominance of 54.2 %. Most of the patients who developed myocarditis were above the age of 65 years (50%), the most predominant clinical symptom was breathlessness followed by cough and fever respectively. ECG findings were variable from sinus tachycardia (in 50%, most common) to Atrial fibrillation, T wave inversion, ST-segment depressions and bundle branch blockages. The most common 2D echo abnormality was global regional wall motion abnormality (25%). The mortality rate among these cases was 16.7%.

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