

Original research article

To Study ECG and Biochemical Markers of Chemical Myocarditis and its Correlation with Echocardiography Findings

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Abstract

Background: Myocarditis is an inflammatory condition involving the myocardium (heart muscle). Myocarditis is characterized by variety of symptoms ranging from fatigue, difficult breathing and rapid heart rate to sudden death from fatal arrhythmias. Many poisons are potent cardiotoxin and their ingestion leads to myocardial damage. Due to myocardial damage there are release of cardiac specific markers like trop T, Trop I and CPKMB. Myocardial injury is due to chemical myocarditis. Hence the patients may have outcome due to complication of myocarditis in the form of pump failure, rhythm disturbance etc. In the present study myocardial damage was assessed by electrocardiographic changes and CPKMB values. ECG changes along with raised CPKMB levels after ingestion of poison were noticed.

Objectives: We sought (1) To study the role of biochemical markers (particularly CPK-MB) of myocarditis in poisoning cases admitted in the poison ward of a tertiary hospital. (2) To study the ECG manifestation of patients presenting with various poisons causing myocarditis. (3) To study the Echocardiography findings in poisons causing myocarditis.

Material and Methods: This prospective study was carried out on total 104 cases with complain of ingestion of poison known to cause myocarditis, admitted in Poison Ward, of a tertiary hospital. ECG, Biochemical (CPK-MB) and Echocardiographic findings of these patients were studied. All the patients who developed chemical myocarditis (on the basis of clinical suspicion) underwent battery of tests ECG, CPK-MB in addition to routine investigations and the patients with abnormal ECG findings and or elevated CPK-MB levels were further investigated with Echocardiography during the period of hospitalization.

Results: Majority of patients 79(75.9%) of poisoning causing chemical myocarditis were in between age group of 15-34 yrs. CPKMB was elevated in 99(95.1%) patients out of 104 patients of chemical myocarditis and 78(75%) patients showed abnormal ECG findings, in which majority of patients were of Hair Dye 25(78.1%), Organophosphorus 26(78.7%), Aluminum Phosphide 18(72%) and Rat killer poisoning 7(77.7%); remaining 26 patients showed normal ECG findings. The most common abnormal Echocardiographic finding was Pericardial effusion 10(9.6%) followed by Valvular pathology 6(5.7%), Hypokinesia of the left ventricular wall 3(2.8%), left ventricular systolic dysfunction 1(0.96%) and prolapse of anterior mitral leaflet 2(1.92%).

Conclusion: Abnormal ECG findings and elevated CPK-MB level are correlating well with severity of cardiotoxicity of the poisons in the present study. Echocardiographic findings are not correlating with the severity of cardiotoxicity due to lack of serial monitoring by echocardiography. Major role of Echocardiography comes into play in hemodynamically unstable patients so that their treatment can be monitored.

Keywords: ECG, Biochemical markers, Myocarditis, Echocardiography findings

Introduction

In the context of biology, poisons are substances that can cause disturbances to organisms, usually by chemical reaction or other activity on the molecular scale, when a sufficient quantity is absorbed by an organism. Poison, in biochemistry, a substance, natural or synthetic, that causes damage to living tissues and has an injurious or fatal effect on the body, whether it is ingested, inhaled, or absorbed or injected through the skin. Various poisons enter the body through mucocutaneous, gastrointestinal, respiratory route and damage the myocardium resulting in chemical myocarditis. Myocarditis is an inflammatory condition involving the myocardium (heart muscle). Myocarditis is characterized by variety of symptoms ranging from fatigue, difficult breathing and rapid heart rate to sudden death from fatal arrhythmias. Many poisons are potent cardiotoxin and their ingestion leads to myocardial damage. Due to myocardial damage there are release of cardiac specific markers like Trop T, Trop I and CPK-MB. Myocardial injury is due to chemical myocarditis. Hence the patients may have outcome due to complication of myocarditis in the form of pump failure, rhythm disturbance etc. In the present study myocardial damage was assessed by electrocardiographic changes and CPKMB values. ECG changes along with raised CPKMB levels after ingestion of poison were noticed.

Aims and Objectives:

1. To study the role of biochemical markers (particularly CPK- MB) of myocarditis in poisoning cases admitted in poison ward, in a tertiary hospital.
2. To study the ECG manifestation of patients presenting with various poisons causing myocarditis.
3. To study the Echocardiography findings in poisons causing myocarditis.
4. To correlate the ECG and Biochemical marker (CPKMB) with Echocardiography findings.
5. To study the role of Echocardiography in assessment of cases of Myocarditis.

Material and Methods:

The present prospective study was carried out on indoor patients admitted in poison ward in a tertiary hospital.

Inclusion Criteria: All patient presenting with history of poison ingestion, known to cause myocarditis (based on ECG findings and raised CPKMB level), in Poison ward.

Exclusion Criteria:

- ✧ Unknown substance ingestion.
- ✧ Patient who do not give consent.
- ✧ Patient with known cases of previous cardiac disease.

In the study cases with ingestion of poison known to cause myocarditis admitted in Poison Ward, were taken and ECG, Biochemical(CPK-MB) and Echocardiographic findings of these patients was studied.

Methodology:

Out of total 1271 patients with history of ingestion of toxic substance, 104 patients with clinical suspicion of having chemical myocarditis were enrolled in the study. All the 104 patients were examined thoroughly with special attention to consciousness, pulse, BP, RR (vitals). ECG was recorded in all the patients on admission and from then on every 24 hours during the period of stay in the hospital. Blood was drawn simultaneously and sent for examination of biochemical parameters; CPKMB, SGOT, SGPT, urea, creatinine in addition to routine investigation. If CPK- MB level was elevated; test was repeated on alternate day till the enzymes shows a decreasing trend. Echocardiography was done in all the patients showing ECG changes and deranged CPKMB level. Patients were managed as per the protocol of our ICU. Management includes mainly symptomatic and supportive treatment with antidote in appropriate cases.

Observation and Results:

104 patients suspicious of chemical myocarditis after ingestion of poisonous substances, were enrolled in the study. Among the cases of chemical myocarditis, majority of patients were constituted by Organophosphorus 33 (31.7%), Hair Dye 32 (30.7%), Aluminum Phosphide 25 (24.1%) followed by Rat killer 9 (8.7%) and EDB 5 (4.8%) poisoning. Majority of patients, who developed chemical myocarditis 79(75.9%) fall in age group between 15-34yr.

Table 1: Distribution of chemical myocarditis cases due to various poisons

S.No.	Poisons	No. of cases of chemical myocarditis		
		15-24 yrs	25-34 yrs	≥35 yrs
1.	Hair Dye (n=32)	13(40.6%)	12(37.5%)	7(21.8%)
2.	Aluminum Phosphide (n=25)	8(32%)	9(36%)	8(32%)
3.	Organophosphorus (n=33)	13(39.3%)	12(36.3%)	8(24.2%)
4.	Rat killer (n=9)	4(44.4%)	4(44.4%)	1(11.1%)
5.	EDB (n=5)	3(60%)	1(20%)	1(20%)
	Total=104	41(39.4%)	38(36.5%)	25(24.03%)

Table 2: CPKMB in various poisons

S No.	Poisons	Total cases	Normal (n=5)		Elevated (n=99)		P value
			No.	%	No.	%	
1.	Hair Dye	32	3	9.37%	29	90.6%	0.000001
2.	Aluminum Phosphide	25	0	0%	25	100%	0.0000
3.	Organophosphorus	33	1	3.03%	32	96.9%	0.000001
4.	Rat killer	9	1	11.1%	8	88.9%	0.000964
5.	EDB	5	0	0%	5	100%	0.000
	Total	104	5	4.9%	99	95.1%	0.000001

Chi-square test = 169.23, P value = 0.000001

Above table shows that CPK-MB was elevated in 99(95.1%) patients out of 104 patients of chemical myocarditis.

Table 3: ECG in various poisons

S.No.	Poisons	Total Cases	Normal		Abnormal		P value
			No.	%	No.	%	

1.	Hair Dye	32	7	21.9%	25	78.1%	0.000007
2.	Aluminum Phosphide	25	7	28%	18	72%	0.001863
3.	Organophosphorus	33	7	21.3%	26	78.7%	0.000003
4.	Rat Killer	9	2	22.3%	7	77.7%	0.018752
5.	EDB	5	3	60%	2	40%	0.527089
	Total	104	26	25%	78	75%	0.00001

Above table shows that out of 104 patients, 78 patients (75%) were having abnormal ECG findings, in which majority of patients were of Hair Dye, Organophosphorus, Aluminum phosphide and Rat killer poisoning. In Hair Dye poisoning ECG was abnormal in 25 patients (78.1%) and normal in 7 patients (21.9%), out of total 32 patients. In Aluminum Phosphide poisoning ECG was abnormal in 18 patients (72%) and normal in 7 patients (28%), out of total 25 patients. In Organophosphorus poisoning ECG was abnormal in 26 patients (78.7%) and normal in 7 patients (21.3%), out of total 33 patients. In Rat Killer poisoning ECG was abnormal in 7 patients (77.7%) and normal in 2 patients (22.3%), out of total 9 patients. In EDB poisoning ECG was abnormal in 2 patients (40%) and normal in 3 patients (60%), out of total 5 patients.

Table 4: Correlation of various parameters of myocarditis in patients who died

No. of cases died due to poisoning	Case No.	CPK-MB level	ECG findings	ECHO findings
Hair Dye (2)	23	380	VT, VF	Normal
	98	92	S. Tachy	Normal
Aluminum Phosphide (6)	38	117	VT	Normal
	95	254	ST↑	Hypo LV
	96	74	T↓	LV Syst Dys
	97	36.2	Normal	Normal
	99	64	T↓	Normal
	100	90	Normal	Normal
Organophosphorus (1)	93	71	S. Brady	Mild P.E.
Rat Killer (1)	94	62	T↓	Normal

Table 5: Correlation of abnormal parameters with mortality in chemical myocarditis

S. No.	Parameters	Survived (n=94)	Deaths (n=10)
1.	CPK-MB	Elevated (99)	89
		Normal (5)	5
2.	ECG	Abnormal (78)	70
		Normal (26)	24
3.	ECHO	Abnormal (22)	19
		Normal (82)	75

Table 6: Correlation of Electrocardiographic findings with level of CPK-MB & Echocardiographic findings in patients of myocarditis

	Level of CPK-MB
	Normal (5) Elevated (99)

Electrocardiographic Findings	Normal Echo	Abnormal Echo	>25-50		>50		
			Normal Echo	Abnormal Echo	Normal Echo	Abnormal Echo	
Normal (26)	0	0	11	1	13	1	
Abnormal Rate	Bradycardia	0	0	4	1	2	3
	Tachycardia	0	0	4	0	7	2
ST segment abnormality	ST elevation	1	0	1	0	2	3
	ST Depression	0	0	1	0	5	3
T wave abnormality	Tall T wave	0	0	0	0	2	0
	T wave inversion	3	1	8	2	4	3
Arrhythmias	VT	0	0	0	0	2	0
QT interval	QTc Prolongation	0	0	4	0	4	1
Low Voltage Complex		0	0	0	1	0	0
P Pulmonale		0	0	1	0	0	0
Short PR interval		0	0	1	0	0	0
Total no.of patients with abnormal ECG(n=78)	4	1	24	4	30	15	

Discussion:

Acute poisoning is an important cause of morbidity and mortality in India. The present study entitled "To Study The ECG and Biochemical Markers of Chemical Myocarditis and Its Correlation with Echocardiographic Findings" was carried out in poison ward in a tertiary hospital. Approximately up to 10% of admissions in Medical Emergencies are due to poisoning. The cause of death in patients of poisoning is due to cardiotoxicity, nephrotoxicity, hepatotoxicity, respiratory failure or neurotoxicity. In majority of cases of poisoning cardiotoxicity is the major cause of mortality. In view of this, we decided to carry out this prospective study.

In the present study, out of 104 patients 32(30.7%) patients were of Hair dye and 25(24.1%) & 33(31.7%) patients were of Aluminum Phosphide & Organophosphorus poisoning respectively and constitute common poisons of this region whereas Rat killer 9(8.7%) and EDB 5(4.8%) poisoning constitutes smaller group of patients. In the present study Organophosphorus and Hair Dye poisoning constitutes maximum number of cases. Similar distribution found in other studies also done previously. In both Rat killer 7(77.8%) vs 2(22.25) and EDB poisoning 4(80%) vs 1(20%); the female patients outnumbered the male patients 20(62.5%) vs 12(37.5%). Filali Ayoub et al (2006)¹ studied 374 cases of acute PPD poisoning, out of these 288 (77%) were females and 86 (23%) were males.

Myocardial injury is due to chemical myocarditis. Hence the patients may have outcome due to complication of myocarditis in the form of pump failure, rhythm disturbance etc. In the present study myocardial damage was assessed by electrocardiographic changes and CPKMB values. ECG changes along with raised CPKMB levels after ingestion of poison were noticed. Clinical manifestations of acute myocarditis vary from asymptomatic to fatal. Even if the initial hemodynamic status was stable, catastrophic deterioration might appear during the acute phase.

In the present study out of 104 patients of chemical myocarditis, 32(30.7%) patients were of Hair dye and 25(24.1%) patients were of Aluminum Phosphide, 33(31.7%) patients were of Organophosphorus poisoning, 9(8.7%) patients were of Rat killer and 5(4.8%) patients were of EDB poisoning. In this study CPKMB was elevated in 99(95.1%) patients out of 104 patients of chemical myocarditis. In present study in 2 patients of Hair Dye poisoning the CPK-MB level was more than 1000. The highest level of CPK-MB was 1520. This patient presented with angioedema and required tracheostomy and showed sinus bradycardia in ECG, mild pericardial effusion in Echocardiography. Another patient with CPK-MB level 1242 presented with hypotension, decreased urine output, dark color urine, angioedema also required tracheostomy and showed ST elevation in ECG, trivial MR in Echocardiography. In one patient who died in Hair Dye poisoning the CPK-MB level was 380. Chrispal A. et al² studied 13 patients with super vasmol poisoning and found that elevated CPK total was present in 92.3% patients.

In the present study, out of 104 patients, 78(75%) patients showed abnormal ECG findings, in which majority of patients were of Hair Dye 25(78.1%), Organophosphorus 26(78.7%), Aluminum Phosphide 18(72%) and Rat killer poisoning 7(77.7%); remaining 26 patients showed normal ECG findings. Jain S.M. et al³ reported that ST-T changes with T wave inversion are the commonest ECG findings.

In present study, out of 104 patients, 22 patients (21.2%) showed abnormal Echocardiographic findings, 9 patients were of Hair Dye, 5 patients were of Organophosphorus and 8 patients were of Aluminum Phosphide poisoning; remaining 82(78.8%) patients showed normal Echocardiographic findings. Rickey Wilson et al⁴, showed ECG and Echocardiographic evidence of myocardial injury and transient elevation of the MB fraction of serum creatinine phosphokinase. Echocardiography was normal in all patients of chemical myocarditis in Rat killer and EDB poisoning. The most common abnormal Echocardiographic finding was Pericardial effusion 10(9.6%), Valvular pathology 6(5.7%) followed by Hypokinesia of the left ventricular wall 3(2.8%).

Zeggwagh AA et al⁵ reported a case of myocarditis induced by PPD poisoning. Electrocardiogram showed Ventricular extrasystoles and negative T waves. The serum concentration of CPKMB was 840. A transthoracic Echocardiography showed significant Left and Right Ventricular Hypokinesis (shortening fraction = 20% and left ventricular Ejection fraction = 35%) and a left ventricular Apical thrombus.

In the present study out of 33 patients with Organophosphorus poisoning there was 1(3.03%) mortality. CPK-MB level was elevated and ECG showed Sinus Bradycardia and Echo revealed mild pericardial effusion. In Rat killer poisoning out of 9 patients of chemical myocarditis, 1(11.1%) patient died. CPK-MB level was elevated and ECG showed T wave inversion and Echo revealed normal study. In the present study on 104 patients of chemical myocarditis, 10 (9.6%) patients died. 2 patients died in Hair dye, 6 patients died in Aluminum phosphide and 1 patient each died in Organophosphorus and Rat killer poisoning. Mortality rate was highest in Aluminum phosphide poisoning (24%). Katira R et al⁶, studied 90 patients of Aluminum phosphide poisoning over a period of 3 years, the overall mortality was 63.3%. death occurred within 24 to 72 hrs due to poison induced toxic chemical myocarditis as shown by ECG changes.

Conclusion:

Acute poisoning is an important cause of morbidity and mortality in India. The cause of death in patients of poisoning is due to cardiotoxicity, nephrotoxicity, hepatotoxicity, respiratory

failure or neurotoxicity. In majority of cases of poisoning cardiotoxicity is the major cause of mortality. Abnormal ECG findings and elevated CPK-MB level are suggestive of myocarditis in patients of poisoning. Therefore clinicians must be vigilant regarding chemical myocarditis and its associated complications in cases of poisoning in order to reduce the mortality and improve the outcome.

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