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Original Article

Cardiac Tamponade as a Complication of Myocardial Infarction: A Rapidly Fatal Entity

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ABSTRACT

Cardiac tamponade (CT) is a clinical emergency, characterised by pressure on the heart due to accumulation of fluid in the pericardial space, which may be blood, pus or other fluids. CT impairs ventricular filling during diastole and thus reduces cardiac output. It is an important cause of sudden natural death due to cardiovascular involvement. Cardiovascular causes account for more than 45–50% cases of sudden deaths. Among the various causes of CT, rupture of acute myocardial infarction (RAMI) and rupture of dissecting ascending aortic aneurysm (RD3A) are most common. There is very scarce data in literature on the incidence of CT as a cause of death in the cases of sudden deaths, except one large study and most other case reports. Death due to CT remains unobserved in almost 50% of cases and even if observed, CT due to haemopericardium (HP) in cases of RAMI gives little time to clinician to make a correct diagnosis and treatment, leading to suspicion about cause and manner of death and many legal complications. Thus, the present study was undertaken to find out the incidence of CT in the cases of sudden death, the frequency of various causes of CT, age groups affected, its pathology and survival time. This study was conducted in the Department of Forensic Medicine & Toxicology at Indira Gandhi Medical College, Nagpur. During a period of two years, 2,759 medico-legal autopsies were performed in this department, of which in 189 cases there was sudden natural death, which were selected for the present study, of which 9 patients died due to CT. All the nine patients of CT were male. CT is the third most common cause of death due to myocardial infarction (MI) after only to rhythm disturbances and cardiogenic shock. It is most often related to HP, attributable to either RAMI or intra-pericardial RD3A, though in our study it was only RAMI.

Keywords: Cardiac tamponade, Haemopericardium, Sudden death, Myocardial infarction, Rupture of acute myocardial infarction, Dissecting ascending aortic aneurysm, Coronary artery disease

INTRODUCTION

Sudden death as defined by the World Health Organisation is death within 24 h from the onset of symptoms, but for medico-legal purpose the most suited definition of sudden death is a death which is not known to have been caused by any trauma, poisoning or violent asphyxia, and where death occurs all of a sudden or within 24 h of the onset of the terminal symptoms[1]. Of all cases of sudden natural deaths, about 45–50% are due to diseases of the cardiovascular system[1–3] in which cardiac tamponade (CT) is one of the important cause of sudden death as a complication of acute myocardial infarction (MI)[4].

CT is a condition in which there is collection of fluid in the pericardial space over and above the normal pericardial fluid volume (30–50 ml). The increase in pressure in the pericardial sac results in compression of the heart leading to abnormal functioning. The fluid collection may be rapid or gradual. Acute CT is usually associated with 200–300

ml of sudden accumulation of fluid[5] while in chronic slowly evolving CT, with 1,000–2,000 ml[5–7]. The CT is caused by an increase in intrapericardial pressure due to the accumulation of blood, pus, other fluids or gas in the pericardial space. CT typically leads to crisis by decreasing venous return which impairs diastolic ventricular filling[5] with resultant decreased cardiac output, impaired tissue oxygenation and death. Rapidly evolving haemopericardium (HP) (200 to 300 ml) is more likely to cause of death from CT than slowly developing pericardial fluid accumulation (up to 2,000 ml)[6]. Slow collection of fluid allows pericardium to stretch gradually to its maximum distensibility.

The cause of CT includes HP consequent to either rupture of an acute myocardial infarction (RAMI) or intrapericardial rupture of dissecting ascending aortic aneurysm (RD3A)[6]. Other causes may be heart surgery, pericarditis caused by bacterial or viral infection, wounds to the heart, other possible causes include: malignancy[7], hypothyroidism, placement of central line[8,9], radiation therapy to the chest, recent invasive heart procedure, recent open heart surgery[10]. HP has been described as a complication in 5–10% of patient with acute myocardial infarction (AMI)[11,12], and the commonest cause of death in acute MI after only to arrhythmias and cardiogenic shock[4].

The present research study was done to estimate the incidence of CT in the cases of sudden deaths, survival time in such cases, age groups affected and pathology leading to myocardial rupture.

MATERIAL AND METHODS

The present study was conducted in the Department of Forensic Medicine & Toxicology at Indira Gandhi Medical College, Nagpur. All the cases irrespective of age groups and sex, who died suddenly and/or unexpectedly and brought to Indira Gandhi Medical College, Nagpur from 2000 to 2001 for medico-legal autopsy were studied.

Inclusion Criteria:

1. The cases which were admitted in Indira Gandhi Medical College, Nagpur or in other hospitals, and died within 24 h of onset of terminal symptoms of natural disease, and also the cases in which death was unobserved or unattended, and then brought for medico-legal autopsy.
2. The cases of natural cause of sudden death as reported after postmortem examination due to involvement of cardiovascular system with CT were selected for the study.

Exclusion Criteria:

1. The cases of unnatural cause of death.

Thorough history about the onset of terminal symptoms and their duration was obtained from the relatives/ accompanying persons. In case of hospitalised patients, hospital records were checked for diagnosis/provisional diagnosis and time of onset of terminal symptoms and death.

The opinion as to the cause of death was framed after doing meticulous postmortem examination, gross and histopathological examination of affected organs and viscera report. The following parameters were confirmed at each postmortem examination:

(1) The gender and the age of deceased

(2) The cause of CT

(3) The cause of HP

(4) Presence of coronary artery thrombosis

OBSERVATIONS AND RESULTS

During two-year period, 2,759 medico-legal autopsies were performed in the Department of Forensic Medicine & Toxicology at Indira Gandhi Medical College, Nagpur. Among all the medico-legal autopsies performed, 189 (6.85%) cases were of sudden natural death, which were brought for autopsy because either the cause of death was not known or it was suspicious. Out of these, 104 deaths (55% of sudden death cases) were due to involvement of cardiovascular system, of which, 9 patients (4.76% of all sudden deaths) died due to CT (Table 1).

Table 1: Showing disease and sex wise distribution of cases

Systems and diseases	Sex		Total	
	Male	Female	No.	%
Cardio-vascular system				
Cardiac tamponade	9	0	9	4.76
Myocardial infarction	18	0	18	9.52
Coronary artery disease	73	4	77	40.74
Total	100	4	104	55.02

All CT deaths were secondary to rupture of acute myocardial infarction (RAMI) and formation of HP (Photo 1). All the cases of deaths due to CT were among male patients.

There was no death due to CT up to the age of 20 years. One patient died due to CT between the age group of 21 and 30 years, three patients between the age group of 31 and 40 years, one patient between the age group of 41 and 50 years, no patient died between the age group of 51 and 60 years, two died between the age group of 61 and 70 years and two died above 70 years of age (Table 2). RD3A was not seen in the present study.

Table 3 shows the ruptured ventricle and involved surface of the heart in cases of CT. In six out of nine cases, left ventricle was involved, with rupture of inferior surface of heart (Photo 2). Anterior surface of right ventricle was involved in two cases, while in only one case right atrium was involved.

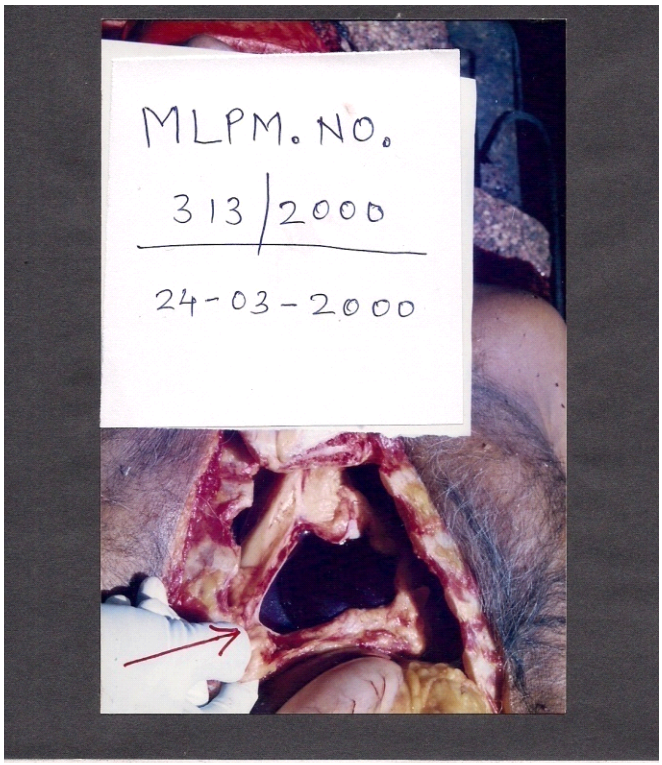
Table 4 shows blocks in coronary arteries. Single and double coronary block was present in four cases each, and triple vessel block in one case.

Table 2: Cardiac tamponade: affection in different age groups

Age groups (Years)	Cardiac Tamponade – Rupture of Heart		
	Male	Female	Total
Upto 10	0	0	0
11-20	0	0	0
21–30	1	0	1
31–40	3	0	3
41–50	1	0	1
51–60	0	0	0
61–70	2	0	2
Above 70	2	0	2
Total	9	0	9

Table 3: Involvement of cardiac chambers and walls

Pathology in heart	Involved chamber	Involved surface	No. of cases
Cardiac tamponade	Left ventricle	Inferior surface	6
	Right ventricle	Anterior surface	2
	Right atrium	Anterior surface	1
Total			9



Photograph 1: Showing blood clots in situ in pericardial cavity in case of cardiac tamponade due to ruptured heart.

Photograph 2: Showing rupture of heart.

Table 4: Number of coronary artery block in cases of cardiac tamponade

Pathology in heart	Single artery block	Double artery block	Triple artery block	Four artery block	Total
Cardiac tamponade	4	4	1	0	9

Table 5: Survival time

Systems involved	Survival time		
	Minimum	Maximum	Mean
Cardiac tamponade	0:15	1:00	0:34

Table 5 shows the survival time, that is the time gap between the onset of terminal symptoms and death; which ranged from 15 min to 1 h, with a mean of 34 min.

DISCUSSION

CT is said to be a rare cause of sudden death[6]. It can present as acute or chronic condition. Among various causes of acute CT due to HP occurring due to natural disease, the most important are RAMI or RD3A[13]. The incidence of CT in cases of sudden death due to natural causes in our study is estimated to be 4.76% and all the cases were due to RAMI. This figure does not match with available literature, as it was never estimated, though in one study by Swaminathan *et al*.[13], the incidence of CT due to HP caused due to RAMI and RD3A was found to be 3.1% in over all post-mortem examinations. The difference may be due to different study groups and different study populations.

This study revealed the age range of deceased from 21 years to above 70 years, which is almost similar to the findings by Swaminathan *et al*.[13] with slightly early incidence in our study. This is due to early manifestation of coronary artery disease in India[14]. All of the cases in our study were males and most of them were below 70 years with only two cases above 70 years, these findings are again comparable to Swaminathan *et al*., who found more incidence of HP in men below 70 years of age. They found more incidences among women above 70 years, which is attributed to increased postmenopausal susceptibility of women to MI. In our study no female case was found, this may be due to differences in geographical dietary and lifestyle patterns between Indian and Western women.

Inferior wall of the heart was most commonly affected (six out of nine cases) in our study, followed by anterior wall of right ventricle (two cases) and right atrium (one case), respectively. These findings are similar to those mentioned in literature[5,11] but differ from that found by Swaminathan *et al*. This may be due to the fact that all cases were males in our study, while in the study by Swaminathan *et al*. maximum cases were female, in which anterior surface is more commonly affected. Thus, in agreement to literature[4] we also found most ruptures through left ventricle.

Although the single coronary artery is said to be most commonly affected, followed by double and triple coronary vessels[14], in our study we found four cases each of single and double coronary artery and one case of triple coronary artery involvement. This is in partial agreement to literature and difference may be due to selection of only sudden death cases with CT in our study.

Although, even after web search we could not find literature mentioning survival time of patients in cases of CT due to HP, literature mentions early cardiac rupture in cases of acute MI, with maximum risk in first 24 h[4,10]. In our study, the minimum survival time was 15 min and maximum was 60 min with a mean of 34 min, which indicates rapid development of CT due to HP in cases of RAMI. In our study, no case of HP due to RD3A was seen.

CONCLUSION

There is scarce literature on causes of HP on routine postmortem examination with exception of individual case reports and some evidence available in standard text books[6,9,10,13,15]. We estimated the incidence of CT in the cases of sudden death is 4.76%.

All the cases of sudden death due to CT were secondary to RAMI. None of the cases were found due to RD3A, pericardial effusion and miscellaneous causes of CT. Left ventricle and anterior surface were the most commonly ruptured areas.

In our study, all deaths due to CT were among males. No case of CT was recorded in females. Majority of the affected males were in the age group of 21–70 years, with only two males above 70 years of age.

In conclusion, we have established the etiology of CT in postmortem population due to RAMI so there is a relation between acute MI and CT.

RECOMMENDATIONS

More studies involving postmortem examination of deaths due to cardiac diseases with special reference to CT should be taken up to find out the incidence of this lethal entity in the cases of sudden cardiac deaths and overall. Basic defect leading to CT due to HP should be looked for, so that treatment methods and modalities for such cases can be evolved to save patients' lives in that very little critical time. Autopsies including both medico-legal and pathological should pool the data to enhance the richness of literature on this not so rare but important and rapidly lethal cardiac entity.

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