



Original Article

## Autopsy Profile of Non-traumatic Fatal Cardiac Tamponade: A Retrospective Medicolegal Study from Eastern India

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### ABSTRACT

**Background:** Cardiac tamponade is a life-threatening condition caused by accumulation of fluid within the pericardial cavity resulting in impaired cardiac filling and circulatory collapse. In medicolegal practice, non-traumatic fatal cardiac tamponade represents an important cause of sudden natural death. Published Indian literature predominantly comprises isolated case reports, and comprehensive autopsy-based analyses remain scarce.

**Objectives:** To analyse the demographic characteristics, pathological spectrum, and autopsy findings of non-traumatic fatal cardiac tamponade encountered during medicolegal autopsies.

**Materials and Methods:** A retrospective descriptive study was conducted using medicolegal autopsy records of non-traumatic cardiac tamponade cases examined between January 2024 and June 2025 at selected tertiary care centres in Eastern India. Cases showing accumulation of blood or fluid within the pericardial sac sufficient to produce fatal cardiac tamponade were included. Demographic data, circumstances preceding death, pericardial contents, cardiac pathology, associated findings, and final cause of death were extracted and analysed.

**Results:** Sixteen cases fulfilled the inclusion criteria. The age of the deceased ranged from 34 to 89 years. Males constituted the majority of cases. The commonest cause of fatal cardiac tamponade was rupture of the ascending aortic root, followed by ventricular free wall rupture. Rare causes included malignant mediastinal mass infiltrating the pericardium and spontaneous rupture of the left atrial wall. Pericardial blood volume ranged from 150 g to 550 g. Most cases demonstrated significant atherosclerotic changes, ventricular hypertrophy, old fibrotic scars, and coronary sclerosis. The majority of individuals collapsed suddenly at home without antecedent trauma.

**Conclusion:** Non-traumatic cardiac tamponade is an important cause of sudden natural death encountered during medicolegal autopsy. Aortic root rupture emerged as the predominant pathology in the present study. Thorough examination of the heart, great vessels, and pericardial cavity is essential for establishing the cause of death and identifying unusual etiologies.

**Keywords:** Cardiac tamponade; Hemopericardium; Sudden cardiac death; Medicolegal autopsy; Aortic rupture; Ventricular rupture.

### INTRODUCTION

Cardiac tamponade refers to impaired cardiac function resulting from increased intrapericardial pressure due to accumulation of fluid, blood, pus, or other pathological material within the pericardial sac. The rapidity of accumulation rather than the absolute volume determines the hemodynamic consequences. Acute hemopericardium may lead to abrupt circulatory collapse and sudden death<sup>1-3</sup>.

In forensic practice, cardiac tamponade may arise from traumatic and non-traumatic causes. Non-traumatic causes include rupture of the ascending aorta, ventricular free wall rupture following myocardial infarction, atrial rupture, neoplastic

infiltration of the pericardium, and spontaneous hemopericardium.<sup>16-18</sup> Although individual case reports have been described, larger autopsy studies from India remain limited.<sup>7,8,9</sup>

The present study was undertaken to evaluate the spectrum of non-traumatic fatal cardiac tamponade encountered during medicolegal autopsies and to document their demographic and pathological characteristics.

## **MATERIALS AND METHODS**

### **Study Design:**

Retrospective descriptive study.

### **Study Period:**

January 2024 and June 2025.

### **Study Setting:**

Medicolegal autopsies performed at selected tertiary care centres of Eastern India.

### **Inclusion Criteria:**

- Cases diagnosed as fatal non-traumatic cardiac tamponade at autopsy.
- Presence of hemopericardium or significant pericardial effusion causing cardiac compression.
- Availability of complete post-mortem documentation.

### **Exclusion Criteria:**

- Traumatic cardiac tamponade.
- Decomposed bodies with inadequate assessment.
- Incomplete records.

### **Data Collection:**

The following variables were extracted:

- Age and sex.
- Circumstances preceding death.
- History of symptoms.
- External injuries.
- Pericardial contents and quantity.
- Heart weight.
- Left ventricular wall thickness.
- Site of rupture.
- Coronary artery pathology.
- Associated pathological findings.
- Final cause of death.

### **Statistical Analysis:**

Data were entered into Microsoft Excel and analysed using descriptive statistics. Continuous variables were expressed as mean, range, and standard deviation where applicable. Categorical variables were expressed as frequencies and percentages.

## **RESULTS**

A total of sixteen cases were included.

### **Demographic Characteristics:**

Among the 16 cases studied, 11 (68.8%) were males and 5 (31.2%) were females, with a male-to-female ratio of 2.2:1. The mean age of the deceased was 50.3 years (range 34–89 years). The majority were found unconscious at home or collapsed suddenly following non-specific symptoms.

### **Etiological Spectrum:**

- Ascending aortic root rupture – predominant cause.
- Ventricular free wall rupture – second most common cause.
- Mediastinal malignancy with pericardial invasion.
- Left atrial rupture.
- Massive pericardial effusion.

### **Pericardial Findings:**

The quantity of blood or fluid within the pericardial cavity ranged from 150 g to 550 g.

### **Cardiac Findings:**

Frequent findings included:

- Coronary artery sclerosis.

- Atheromatous changes of great vessels.
- Left ventricular hypertrophy.
- Thickened valves.
- Old fibrotic myocardial scars.
- Biventricular enlargement.
- Subendocardial haemorrhage.

**Table 1. Demographic and Clinical Profile of Fatal Non-traumatic Cardiac Tamponade Cases (n = 16)**

Sl. No.	Age (years)	Sex	Circumstances preceding death	Place of occurrence
1	60	Male	Fell from bed	Home
2	41	Female	Did not wake from sleep	Home
3	49	Male	Chest pain followed by collapse	Home
4	52	Male	Sudden death	Home
5	43	Female	Sudden illness	Home
6	73	Female	Illness with fall	Home
7	52	Male	Collapse at home	Home
8	39	Male	Found dead in paddy field	Field
9	36	Male	Fall in bathroom	Home
10	34	Male	Found unconscious in bed	Home
11	58	Male	Sudden death	Home
12	37	Female	Fell unconscious	Home
13	89	Female	Fall from bed	Home
14	43	Male	Brought dead	Home
15	47	Male	Found unconscious	Home
16	52	Male	Found in room	Home

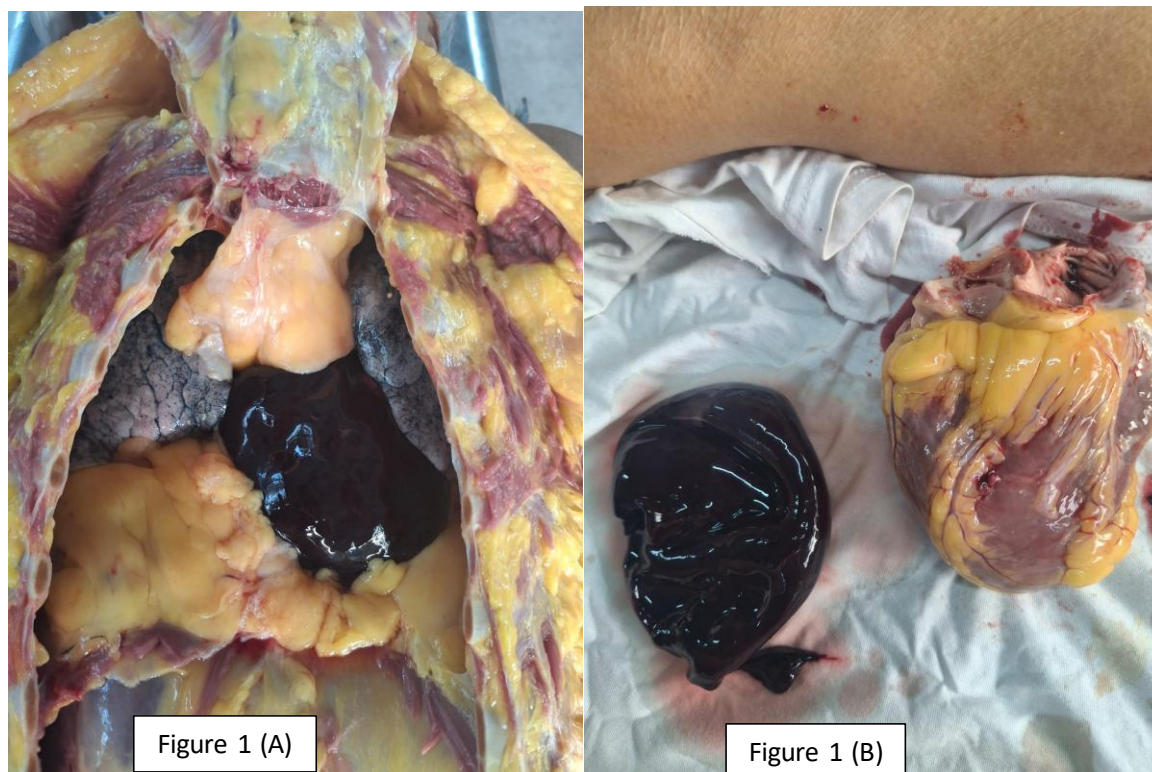
**Table 2. Autopsy Findings in Fatal Cardiac Tamponade**

Sl. No.	Pericardial Contents	Quantity	Heart Weight (g)	LV Wall Thickness	Associated Findings
1	Liquid & clotted blood	300 g	350	26 mm	Atheroma, valve thickening
2	Red clotted blood	350 g	290	22 mm	Coronary sclerosis
3	Liquid & clotted blood	450 g	375	26 mm	Valve thickening
4	Clotted blood	150 g	350	18 mm	Ventricular softening
5	Liquid & clotted blood	350 g	280	16 mm	Mediastinal tumour
6	Liquid & clotted blood	250 g	375	20 mm	Coronary sclerosis
7	Straw coloured fluid	450 g	375	20 mm	Fibrotic scar
8	Liquid & clotted blood	50 g	425	22 mm	Ventricular rupture
9	Liquid & clotted blood	550 g	400	20 mm	Fibrotic scar
10	Liquid & clotted blood	450 g	300	22 mm	Fibrotic scar
11	Straw coloured fluid	150 g	325	24 mm	Bronchopneumonia
12	Liquid & clotted blood	150 g	300	26 mm	Myocardial softening
13	Liquid & clotted blood	150 g	375	20 mm	Coronary sclerosis
14	Liquid & clotted blood	150 g	285	22 mm	Myocardial softening
15	Liquid & clotted blood	200 g	300	22 mm	Fibrotic scar
16	Liquid & clotted blood	235 g	300	22 mm	Left atrial rupture

**Table 3. Etiological Classification of Fatal Cardiac Tamponade**

Etiology	Number of Cases	Percentage (%)
Ascending aortic/root rupture	7	43.8
Ventricular free wall rupture	4	25.0

Etiology	Number of Cases	Percentage (%)
Massive non-haemorrhagic pericardial effusion	2	12.5
Mediastinal malignancy with hemopericardium	1	6.2
Left atrial rupture	2	12.5
<b>Total</b>	<b>16</b>	<b>100</b>



**Figure 1.** Medico-legal autopsy findings demonstrating hemopericardium. (A) Large intrapericardial blood clot occupying the pericardial cavity after opening the thorax. (B) Heart specimen after removal showing adherent organized blood clot consistent with fatal cardiac tamponade.

## DISCUSSION

The present retrospective medicolegal study demonstrates that non-traumatic cardiac tamponade is an important cause of sudden natural death encountered during forensic autopsies. The majority of victims collapsed suddenly at home following non-specific symptoms such as chest discomfort, syncope, unexplained unconsciousness, or were found dead in bed. Similar observations have been reported in previous autopsy studies, emphasising the clinically silent nature of fatal hemopericardium and the indispensable role of medicolegal autopsy in determining the true cause of death.<sup>8,9</sup>

Ascending aortic root rupture emerged as the predominant cause of fatal cardiac tamponade in the present series. Most of these cases exhibited severe atherosclerotic changes, coronary sclerosis, thickened valves and, notably, old whitish fibrotic scars surrounding the rupture site. Acute hemopericardium resulting from rupture of the ascending aorta has been recognised as a catastrophic complication associated with degenerative vascular changes and aortic pathology. Tsukube et al. described cardiac tamponade as one of the most lethal manifestations of acute aortic pathology, frequently leading to sudden death before definitive intervention can be instituted<sup>15</sup>. The medicolegal significance of thoracic aortic rupture has also been highlighted by Singh et al., who emphasised the importance of careful dissection of the great vessels during autopsy.<sup>13,14,15</sup>

Ventricular free wall rupture constituted the second most common etiology in the present study. These cases demonstrated subendocardial haemorrhage, biventricular enlargement, myocardial softening and advanced coronary atherosclerosis. Such findings are consistent with post-infarction myocardial rupture, a recognised mechanical complication of acute myocardial infarction. Davies<sup>10</sup> and Burke and Virmani<sup>11</sup> described ventricular wall rupture as a major cause of sudden cardiac death occurring in the setting of extensive myocardial necrosis. Recent reports have similarly documented ventricular rupture leading to fatal cardiac tamponade, even in patients without a prior diagnosis of myocardial infarction.<sup>6,13</sup>

An interesting finding in the present series was the presence of old fibrotic scars adjacent to the sites of rupture in several aortic cases. These observations may indicate previous subclinical episodes of ischemic injury or chronic degenerative

processes predisposing to eventual catastrophic rupture.<sup>10,11,19</sup> Although this association requires further investigation, it underscores the potential value of histopathological examination in elucidating the pathogenesis of fatal hemopericardium. The present study also documented rare causes of cardiac tamponade. One case resulted from mediastinal malignancy infiltrating the pericardium and adjacent structures, producing massive hemopericardium. Another case involved spontaneous rupture of the posterior wall of the left atrium. Such unusual etiologies are infrequently reported in routine forensic practice and reinforce the necessity for meticulous examination of the mediastinum, atria and pericardial reflections during autopsy. Previous authors have similarly stressed that uncommon pathological entities may remain undetected if examination is confined to obvious cardiac abnormalities.<sup>9,16,17,18</sup>

The quantity of blood within the pericardial cavity in the present study ranged from approximately 150 g to 550 g. Spodick<sup>1</sup> observed that rapid accumulation of even modest volumes of blood may precipitate acute tamponade, whereas slowly developing effusions may attain larger volumes before becoming symptomatic. Sagristà-Sauleda et al.<sup>2</sup> and Bodson et al.<sup>3</sup> likewise emphasised that the rate of accumulation rather than the absolute quantity is the principal determinant of haemodynamic compromise.

The demographic profile of the present series revealed a predominance of males, with affected individuals spanning a broad age range. Similar male predominance has been observed in previous autopsy studies of fatal cardiac tamponade.<sup>8,9</sup> However, the occurrence of younger victims in the present study, including individuals in the third and fourth decades of life, deserves attention and may reflect regional differences in cardiovascular risk factors or healthcare accessibility.

The findings of this study highlight the crucial role of medicolegal autopsy in sudden unexplained deaths. Thorough evaluation of the pericardial sac, myocardium, coronary arteries and great vessels, supplemented by histopathology whenever feasible, remains essential for establishing the precise cause of death. Standard forensic texts by Knight and Saukko, DiMaio, and Spitz emphasise that incomplete cardiac examination may result in failure to recognise fatal natural diseases masquerading as unexplained sudden death.<sup>13,16,17,18</sup>

The major limitations of the present study include its retrospective nature, relatively small sample size and the lack of uniform histopathological examination in all cases. Nevertheless, the study contributes valuable Indian data on the autopsy spectrum of non-traumatic cardiac tamponade and may serve as a foundation for larger multicentric investigations.

## CONCLUSION

Non-traumatic cardiac tamponade represents a significant cause of sudden natural death in medicolegal practice. Ascending aortic root rupture was the most frequent etiology in the present series, followed by ventricular free wall rupture. Rare causes such as malignant mediastinal infiltration and atrial rupture further expand the pathological spectrum of this condition. Systematic autopsy examination of the heart and pericardium is indispensable for accurate cause-of-death certification and for advancing understanding of sudden cardiac deaths.

## Conflict of Interest:

Nil.

## Financial Support:

Nil.

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