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Blunt Traumatic Pericardial Rupture

—Case Report and Literature Review

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ABSTRACT

Pericardial rupture following blunt chest trauma is rare and associated with high mortality rate ranging from 30% to 64%. We review 42 cases which have been reported in the literature in last 17 years and report a case of our own. We have found that 83% of the cases were men with a mean age of 49 years. The most frequent cause was traffic accidents (79%). Preoperative diagnosis of traumatic rupture of the pericardium has been improved in recent 17 years, and the result is satisfactory. Early detection, timely treatment is the key. Pneumopericardium may be a valuable radiographic clue for diagnosis. The management of pericardial rupture is mainly to avoid the risk of cardiac strangulation or acute tamponade. If the injury is recognized timely, treatment is simple and effective.

Keywords: Traumatic Rupture of the Pericardium; Diagnosis; Management

1. Introduction

Pericardial rupture following blunt chest trauma is rare and associated with high mortality rate ranging from 30% [1] to 64% [2]. If pericardial rupture is not detected and treated promptly, it may be fatal owing to cardiac herniation. Timely diagnosis can avert disaster because surgical management is relatively simple and effective. In this report, we review the cases communicated in the literature in the last 17 years and report a new case of our own. Relevant articles were identified by searching electronic databases (e.g., Medline, EMBASE, CENTRAL, mRCT and Pascal), as well as the correspondent references from 1994 to September 2011.

2. Case Report

A 36-year-old man suffering from a direct blow to the left precordial chest arrived at the emergency department. In the initial examination, he was found tachypneic with abnormal breathing pattern on his left chest. His systolic blood pressure was 85 mmHg and heart rate was 110/min. A chest CT scan revealed left haemopneumothorax, bilateral pulmonary contusion and left multiple ribs fractures. Electrocardiogram showed generalized T-wave inversion with sinus tachycardia. His troponin I was 0.17 ng/ml (normal value < 0.04 ng/ml).

The patient was then transferred to the intensive care unit (ICU). A left-sided chest tube evacuated 800 ml blood within two hours. His systolic blood pressure dropped to 82 mmHg with heart rate up to 120/min. Then an emergent operation was decided. The approach was through a left anterolateral thoracotomy. At operation, 700 ml blood was sucked out, and a left pericardial rupture was found at the left diaphragmatic pericardium. The tear was vertical, 5.5 cm long. A complete pericardiotomy was performed, the left ventricle was intact with wine surface. There was no visible bleeding. Then the fixation of the broken ribs was done. The patient was back to ICU. His troponin I dropped to normal on the 9th postoperative day (or POD#9). Echocardiography showed pericardial effusion with left ventricular diastolic dysfunction two weeks later. The patient was found postoperative sinus tachycardia with heart rate of 120 - 130/min. Metoprolol 25 mg was given two times a day, and the heart rate dropped to 100/min. The patient was discharged 2 weeks later. The follow-up Electrocardiogram showed normal sinus rhythm two months later.

3. Discussion

The most recent literature review about the traumatic rupture of the pericardium was reported by Gallego in

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1996, with 40 cases collected between 1983-1993 [3]. Since 1994, we have found documents for 42 new cases, [4-37] most of which are isolated case reports. In our review, we have considered age and sex of the patients, mechanism, associated lesion, diagnosing methods, complications, treatment and corresponding outcome.

3.1. Epidemiology

The epidemiologic dates are summarized in **Table 1**, 35 male cases (83.3%) and 7 female cases (16.7%). The average age was 49 years (18 - 83). The most frequent cause was traffic accident (33 cases, 78.6%), the second frequent cause was falling (6 cases, 14.3%).

3.2. Associated Lesions

Associated lesions are presented in **Table 2**. The rib fractures (50%) were the most common ones and the lesions of the bones (47.6%) were the second common ones. The abdominal lesions and head injuries were also very common (correspondingly 28.6% and 26.2%).

3.3. Diagnosis

The methods used to diagnose the rupture of the pericardium were showed in **Table 3**. In Gallego's collection, only 20% of the total 40 cases were diagnosed by diagnostic investigations before surgery. 80% of the cases were diagnosed casually during surgical operation for other unrelated lesions. In our collection, 38.1% of the total 42 cases were diagnosed preoperatively by CT scan and chest radiograph. Compared with Gallego's collection [3], it is a great progress. This indicates that doctors' ability of diagnosing traumatic rupture of the pericardium has been gradually improving. In many cases, the patients got diagnosis and treatment promptly before surgery, and the mortality and morbidity were reduced successfully. But the diagnosis of traumatic pericardial rupture is still a big challenge because of non-specific clinical symptoms and shortage of the physical signs, especially for those patients without cardiac herniation. In our case, the patient had neither clinical symptoms nor physical signs that suggested the possibility of pericardial rupture. The patient was operated through thoracotomy because of hemorrhage and hypotension.

The electrocardiogram was usually normal or showed non-specific abonormalities and had no help for the diagnosis of pericardial rupture. Pneumopericardium may be a valuable radiographic clue. In the event of pneumopericardium, the Macklin effect is the major cause [38], but the pericardial space may also be connected

Table 1. Epidemiology.

Parameters	N	%
Total cases	42	100
Sex		
Men	35	83.3
Women	7	16.7
Mean age (years)	49	
Mechanism of injury		
traffic accident	33	78.6
Fall	6	14.3
Crush	3	7.1

Table 2. Summary of injuries associated with pericardial rupture.

Injuries	N	%
Fractures of the ribs	21	50
Pulmonary contusion	13	31.0
Pneumothorax/hemopneumothorax	9	21.4
Pneumopericardium	2	4.8
Pneumopericardium and Pneumothorax/ hemopneumothorax	10	23.8
Pneumomediastinum	7	16.7
Cardiac lesions:		
Atrial	2	4.8
Ventricular	3	7.1
Intrapricardial vessels	6	14.3
Rupture of the diaphragm	9	21.4
Abdominal lesions	12	28.6
Lesions of the bones	20	47.6
Head injuries	11	26.2

Table 3. Methods used to diagnosis pericardial rupture (N = 42).

	N	%
Thoracotomy	13	31.0
Celiotomy	7	16.7
CT scan and Chest radiograph	16	38.1
CAT scan	2	4.8
Thoracoscopic examination	2	4.8
TVR (CPB)	1	2.4
Echocardiography	1	2.4

TVR (CPB): Tricuspid valve replacement (Cardiopulmonary Bypass).

directly to the pleural cavity or tracheobronchi as a consequence of pericardial tear. In our collection, 23.8% of the total cases complicated with pneumopericardium and pneumothorax/hemopneumothorax and got preoperative diagnosis. Pneumopericardium together with pneumothorax/hemopneumothorax may imply existing pericardial rupture. Displacement or apparent enlargement of the heart could be noted sometimes. Thoracoscopic examination may be a useful method for the diagnosis [26]. By this way, not only could we know the diagnosis of the disease, but also the necessity of the tear repair.

The rupture of the pericardium could result from severe complications. In our collection presented in **Table 4**, 50% of 42 patients complicated with cardiac herniation, 16.7% of them complicated with diaphragmatic hernia. 3 of them died of cardiac herniation although the diagnosis was completed preoperatively. Herniated heart could lead to sudden death because of strangulation and circulatory blockage. Patients with cardiac herniation could die of ventricular dysfunction or multiple organs failure in spite of urgent thoracotomy [14]. For some cases, delayed cardiac herniation may take place, in Clark' report, a patient developed symptoms 5 years after the cardiac hernia diagnosis and died of cardiac strangulation suddenly.

3.4. Surgical Management

Not all of the pericardial tears need repair. In our case, we managed the tear by a complete pericardiotomy. Our collection showed that 71.4% of the lesions were repaired with patch, 4.8% of them were managed by wound enlarged, and 9.5% of them were not repaired. It is advisable to repair a tear of 8 - 12 cm in size because of the risk of prolapse and strangulation of the heart [3]. In order to avoid the risk of acute tamponade, the complete pericardiotomy operation is strongly recommended, especially for those patients with cardiac confusion or arrhythmia complications. For those cases complicated with rupture of the diaphragm, the broken pericardium does not need to be stitched.

3.5. Outcome

The final outcome of patients with pericardial rupture depends on the associated injuries and the prompt recognition of a pericardial tear in the multiply traumatized patient. The relation of updated public cases of pericardial rupture due to blunt thoracic trauma was showed in **Table 5**. In our collection, six of the 42 patients (14.3%) died, 3 of them die of atrial/intrapricardial vessels rupture, one die of asystole, one die of right ventricular dysfunction and renal failure(family give up), 1 case die of severe craniocerebral trauma. Compare with Clark' [39] and Gallego's collection, the mortality is low, but it is difficult to tell the mortality of the pericardial rupture alone, because of some cases die of several associated lesions.

Cardiac herniation may result in vascular collapse and sudden death. But interestingly, there have been several reports of asymptomatic luxation of the heart [40-42]. According to these reports, none of the patients developed hemodynamic instability. All of those patients with a right dislocation of the heart didn't have the strangulation of the outflow tracts.

4. Conclusion

From the literature review and our own case we conclude

Table 4. Complication of the pericardial rupture and treatment.

Parameters	N	%
Total cases	42	100
Complication		
Cardiac herniation	21	50
Traumatic diaphragmatic hernia	7	16.7
Treatment of the tear		
Repaired	30	71.4
Not repaired	4	9.5
Wound enlarged	2	4.8

Table 5. Relation of to date public cases of pericardial rupture due to blunt thoracic trauma.

Period	Reference no.	N of patients	Associated injury to		recoveries	deaths
			Heart	Aorta		
1706-1937	4	84	47	3	2	60
1937-1982	11	142	40	4	99	38
1982-1985	7	16	4	1	14	2
1983-1993	16	40	8	0	23	17
1994-2011	present series	42	5	2	36	6

that, in spite of nonspecific symptoms and diagnosis difficulty, preoperative diagnosis of traumatic rupture of the pericardium has been improved in recent 17 years, and the result is satisfactory. Early detection and timely treatment is the key. Pneumopericardium may be a valuable radiographic clue for diagnosis. Cardiac herniation with right dislocation may prevent strangulation of the outflow tracts from happening. The management of pericardial rupture is mainly to avoid the risk of cardiac strangulation or acute tamponade. If the injury is recognized timely, treatment is simple and effective.

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