

# Pericardial decompression syndrome: A rare but potentially fatal complication of pericardial drainage to be recognized and prevented

Massimo Imazio

Pericardial decompression syndrome is a rare but potentially fatal complication following pericardial drainage and all physicians performing this intervention or taking care of patients who performed the drainage should be well aware of it.

On this basis, the paper by Pradhan et al.<sup>1</sup> is an important analysis of published cases from 1983 to 2013. The authors should be commended for drawing attention to this important and neglected issue. In the paper, the authors report 35 cases (mean age 47 years, 66% females) submitted for pericardial drainage (18 cases of pericardiocentesis, 16 cases of pericardiostomy and one both). About 60% had a previous history of malignancy and 40% of cases had neoplastic aetiology of the effusion. Cardiac tamponade was the indication for the intervention in most cases (94%). The mean amount of drained pericardial fluid was 888 ml (from 450 to 2100 ml). The onset of the syndrome ranged from immediate to symptoms and signs developing after 48 hours. About one-third of cases have a presentation with cardiogenic pulmonary oedema without shock, while the others had a presentation with shock (Figure 1). About 80% of cases showed elevation of cardiac biomarkers of myocardial injury (i.e. troponins) when evaluated. The syndrome carries a high mortality since about 30% of reported patients died. Reported deaths were confined to the group submitted for surgical drainage.

There are important questions to be addressed for clinicians in the acute care setting.

What is the pericardial decompression syndrome? How many patients may be affected? What are the causes? How to treat the pericardial decompression syndrome? What is the expected and possible outcome? Is it possible to prevent the syndrome and how?

1. What is the pericardial decompression syndrome? The term 'pericardial decompression syndrome' was proposed by Angouras et al.<sup>2</sup> in 2010, commenting on a reported case<sup>3</sup>

of acute cardiac failure developing after pericardial drainage for cardiac tamponade in an attempt to standardize the definition and improve the recognition of the syndrome. As outlined by them, this syndrome has no uniform clinical presentation (Figure 1) and may be associated with both surgical pericardiostomy and pericardiocentesis, whereas the cause of pericardial effusions and clinical scenarios varies widely.

2. How many patients may be affected? Pericardial decompression syndrome is characterized by a paradoxical haemodynamic deterioration and/or pulmonary oedema following apparently uncomplicated pericardial drainage. It is generally accompanied by some degree of ventricular dysfunction. The onset may be immediate or within 1–2 days. This syndrome is rare.<sup>2–4</sup> There are limited epidemiological data suggesting that the incidence is <5%, especially after surgical drainage,<sup>5,6</sup> while it is unknown in the general population and especially following pericardiocentesis.

3. What are the causes? A few patients have some underlying pathology that may affect myocardial function, such as malignant myocardial infiltration or chemotherapy-induced cardiomyopathy.<sup>2</sup> Yet in the majority of cases there is no obvious cause for apparent paradoxical ventricular dysfunction after drainage and various pathophysiological mechanisms have been suggested, including the haemodynamic, ischaemic (persistent diminished coronary perfusion)

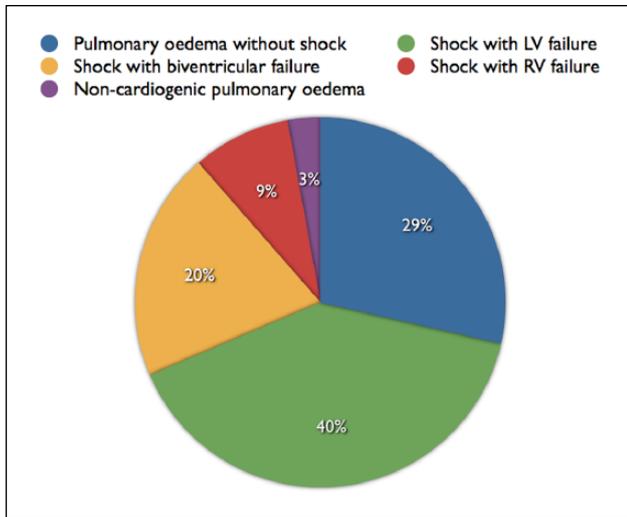
---

Cardiology Department, Maria Vittoria Hospital and University of Torino, Italy

**Corresponding author:**

Massimo Imazio, Cardiology Department, Maria Vittoria Hospital and University of Torino Via Cibrario 72, 10141 Torino, Italy.  
Email: massimo\_imazio@yahoo.it; massimo.imazio@unito.it

European Heart Journal: Acute Cardiovascular Care  
2015, Vol. 4(2) 121–123  
© The European Society of Cardiology 2014  
Reprints and permissions:  
sagepub.co.uk/journalsPermissions.nav  
DOI: 10.1177/2048872614557771  
acc.sagepub.com  

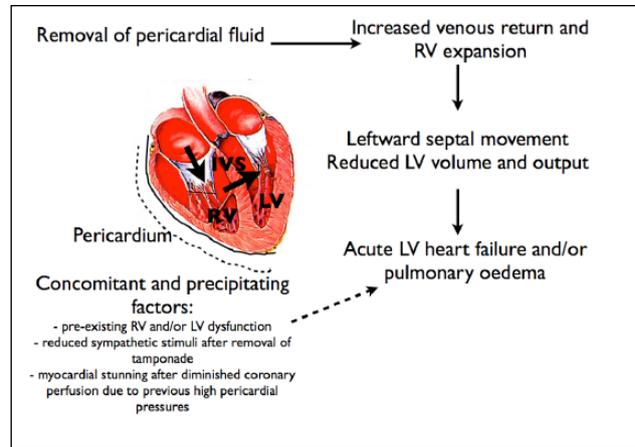
**Figure 1.** Presentation of the cardiac decompression syndrome after pericardial drainage: 2/3 of cases with shock and 1/3 with pulmonary oedema without shock.

and autonomic imbalance hypotheses.<sup>1,4-7</sup> The simplest explanation is the haemodynamic one related to interventricular interdependence (Figure 2). The removal of pericardial fluid compressing the right chambers especially is responsible for an increased venous return and expansion of right chambers that occurs at the expense of the left chambers, leading to a possible acute left-side heart failure and pulmonary oedema. In addition, the unmasking of a pre-existing Left Ventricle (LV) (and/or Right Ventricle (RV)) dysfunction may be an additional contributing or precipitating factor as well as an imbalance in the sympathetic-parasympathetic system with a possible reduction of sympathetic stimulation following the removal of the cardiac tamponade physiology. An additional contributing factor may be represented by prolonged myocardial stunning after previous diminished coronary perfusion for pericardial fluid compression during tamponade.

Surgical drainage is more often associated with mortality since it is responsible for fast pericardial decompression with more rapid expansion of the right chambers.

4. How to treat the pericardial decompression syndrome? Treatment of the syndrome is essentially supportive and recovery of ventricular function is expected in survivors.

5. What is the expected and possible outcome? The syndrome carries a high mortality rate. About one-third of patients may die, especially following pericardiostomy since probably this intervention is responsible for a greater sudden change of cardiac chambers volume compared with pericardiocentesis as outlined in the causes of the syndrome.



**Figure 2.** Possible pathophysiology of cardiac decompression syndrome after pericardial drainage (see text for explanation).

In any case high mortality may be in part related to a selection bias since available data are based on case reports, generally related to fatal or outstanding events rather than successful management.

#### 6. Is it possible to prevent the syndrome and how?

The paper underlines that there is no minimal amount of fluid to be recommended for drainage in order to prevent the syndrome that may occur even following the drainage of <500 ml of pericardial fluid. There are no established published methods or studies to propose preventive measures. In the setting of cardiac tamponade, a reasonable approach may be to remove pericardial fluid until resolution of the cardiac tamponade (this can be easily achieved by haemodynamic or echocardiographic monitoring) then avoiding the removal of additional fluid and placing prolonged pericardial drainage in order to achieve a slow removal of additional pericardial fluid. Prolonged pericardial drainage can be removed when there is a daily fluid return below 30 ml.<sup>8,9</sup>

#### Conflict of interest

None declared.

#### Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

#### References

- Pradhan R, Okabe T, Yoshida K, et al. Patient characteristics and predictors of mortality associated with pericardial decompression syndrome: a comprehensive analysis of published cases. *Eur Heart J Acute Cardiovasc Care*. Epub ahead of print. 1 September 2014. pii: 2048872614547975.
- Angouras DC and Dosios T. Pericardial decompression syndrome: a term for a well-defined but rather underreported

- complication of pericardial drainage. *Ann Thorac Surg* 2010; 89: 1702–1703.
3. Karamichalis JM, Gursky A, Valaulikar G, et al. Acute pulmonary edema after pericardial drainage for cardiac tamponade. *Ann Thorac Surg* 2009; 88: 675–677.
  4. Ligerio C, Leta R and Bayes-Genis A. Transient biventricular dysfunction following pericardiocentesis. *Eur J Heart Fail* 2006; 8: 102–104.
  5. Vandyke WH, Jr., Cure J, Chakko CS, et al. Pulmonary edema after pericardiocentesis for cardiac tamponade. *New Engl J Med* 1983; 309: 595–596.
  6. Dosios T, Theakos N, Angouras D, et al. Risk factors affecting the survival of patients with pericardial effusion submitted to subxiphoid pericardiostomy. *Chest* 2003; 124: 242–246.
  7. Gregory JR, McMurtrey MJ and Mountain CF. A surgical approach to the treatment of pericardial effusion in cancer patients. *Am J Clin Oncol* 1985; 8: 319–323.
  8. Imazio M, Mayosi BM, Brucato A, et al. Triage and management of pericardial effusion. *J Cardiovasc Med* 2010; 11: 928–935.
  9. Imazio M and Adler Y. Management of pericardial effusion. *Eur Heart J* 2013; 34: 1186–1197.