Serum cardiac troponin I and ST-segment elevation in patients with acute pericarditis

E. Bonnefoy, P. Godon, G. Kirkorian, M. Fatemi, P. Chevalier and P. Touboul

Service de Réanimation et Soins Intensifs de Cardiologie, Hôpital Louis Pradel, Lyon, France

Objective ST-segment elevation in acute pericarditis is believed to be caused by superficial myocardial inflammation or epicardial injury. We used cardiac troponin I, a sensitive and specific marker of myocardial injury, to assess myocardial lesions in idiopathic acute pericarditis and its relationship to ST-segment elevation.

Patients and Methods Sixty-nine consecutive patients (53 men, 48 ± 17 years) with idiopathic acute pericarditis were included. We used an enzymoimmunofluorometric method to measure serum cardiac troponin I on admission (myocardial infarction threshold was 1.5 ng . ml⁻¹).

Results Cardiac troponin I was detectable in 34 patients (49%) and was beyond the 1.5 ng . ml⁻¹ threshold in 15 (22%). Coronary angiography performed in seven of these 15 patients was normal in all of them. ST-segment elevation was observed in 93% of the patients with cardiac troponin I >1.5 ng . ml⁻¹ vs 57% of those without (P<0.01). Sensitivity of ST-segment elevation to detect myocardial injury was 93% and specificity 43%. Patients with a cardiac troponin I increase higher than 1.5 ng . ml⁻¹ were more likely to have had a recent infection (66% vs 31%; P=0.01) and were younger (37 ± 14 vs 52 ± 16 years; P=0.002). There was no significant relationship with other parameters such as pericardial friction rub, fever, PR segment abnormalities, echocardiographic findings or C-reactive protein.

Conclusion In patients with idiopathic acute pericarditis, an increase in cardiac troponin I is frequently observed, especially in younger patients and those with a recent infection. Although ST-segment elevation does not reliably indicate myocardial injury, a significant cardiac troponin I increase is only seen in these patients. (Eur Heart J 2000; 21: 832–836) © 2000 The European Society of Cardiology

Key Words: Acute pericarditis, cardiac troponin I, myocarditis, troponins, ST-segment elevation.

See page 798 for the Editorial comment on this article

Introduction

The serial ECG pattern considered to be characteristic of acute pericarditis is an initial ST-segment elevation, followed by gradually changing T wave inversion without development of Q waves[1]. Such an ECG finding has been considered adequate for the diagnosis of acute pericarditis, based on the fact that some patients with proven pericarditis have this ECG pattern[2,3]. ST-segment elevation is believed to be related to a current of injury caused by superficial myocardial inflammation[3]. Recently there has been progress on the identification of very specific serum markers of myocyte injury. Elevation of cardiac troponin I which regulates the calcium interaction between actin and myosin, is a sensitive and highly specific marker for cardiac injury[4].

In this investigation, we used cardiac troponin I to assess myocardial lesions in idiopathic acute pericarditis and its relationship to ST-segment elevation.

Methods

Patients and methods

In this retrospective, monocentric study, we reviewed the emergency department and hospital database and screened patients who: (1) were hospitalized with the final diagnosis of acute idiopathic pericarditis between January 1996 and December 1997 and, (2) had cardiac troponin I measurement on admission. Patients were selected if they presented with the association of typical
inspiratory or positional chest pain with at least one of the following: pericardial friction rub, serial compatible ST-T changes, pericardial effusion on echocardiography.

None of the patients had unstable angina, recent myocardial infarction, neoplastic disease, congestive heart failure or any other condition that might be an obvious cause of pericarditis. Twelve patients were not selected because they did not have cardiac troponin I measurement on admission. Their clinical characteristics were not different from those of the study population.

Serum cardiac troponin I was measured by an enzyme-immuno­fluorometric method (Dade, Stratus instrument). The minimum detectable concentration is 0·35 ng . ml⁻¹ (according to the manufacturer’s information). Concentrations of cardiac troponin I are undetectable (97·5 percentile) in apparently healthy individuals[5,6] and the threshold for myocardial infarction has been set at 1·5 ng . ml⁻¹.

Daily electrocardiograms were systematically retrieved as were the following parameters: C-reactive protein, erythrocyte sedimentation rate, white blood count. Echocardiography was performed in all patients. Wall motion abnormalities were noted along with moderate and circumferential pericardial effusions.

Statistics

All results were expressed as mean ± standard deviation and median (mean ± SD (median)), except when stated otherwise. Continuous variables were analysed by unpaired t-test. Nominal and ordinal values were compared by Fisher’s exact test. Correlations between cardiac troponin I, creatine kinase and myoglobin levels were calculated by using the Spearman rank correlation. A P value <0·05 was considered to show statistical significance.

Results

Patients

The study group comprised 69 patients. Mean age was 48 ± 17 (median: 48) years with 53 males (75%). Recent history of infection was present in 27 (39%), fever in 32 (46%), pericardial friction rub in 11 (16%). ST-segment elevation was noticed on the first ECG in 45 patients (65%) and PR segment deviation in 26 (38%). Pericardial effusion (defined as a localized (>0·5 mm) or circumferential effusion) was detected with echocardiography in 28 patients (41%). Echocardiographic wall motion abnormality was present in five patients.

Cardiac troponin I elevation

Cardiac troponin I was detected on admission in 34 patients (49%). The mean cardiac troponin I value was 8 ± 12 (median: 1) ng . ml⁻¹. It was above the 1·5 ng . ml⁻¹ threshold in 15 (22%) with a mean value of: 17 ± 13 (median: 13) ng . ml⁻¹. Coronary angiography performed in seven of these patients because of cardiac troponin I elevation was normal in all of them.

Cardiac troponin I and ST-segment elevation (Fig. 1)

ST-segment elevation was observed in 23 (67%) of the 34 patients with a detectable cardiac troponin I level and in 22 (62%) of the 35 patients without. ST-segment elevation was present in almost all the patients with cardiac troponin I ≥1·5 ng . ml⁻¹ (14/15; 93%) and in 31 (57%) of the 54 patients below this threshold (P<0·01). Sensitivity of ST-segment elevation to detect important myocardial injury (as defined by a cardiac troponin I level ≥1·5 ng . ml⁻¹) was 93% but its specificity was 43%.

Clinical, biological, and follow-up data (Table 1)

Patients with an increase in cardiac troponin I above 1·5 ng . ml⁻¹ were younger (37 ± 14 (median: 38) vs 52 ± 16 (median: 50) years; P=0·002) and were more likely to have had a recent infection (60% vs 31%; P=0·01). There was no significant relationship with other parameters such as pericardial friction rub or pericardial effusion, fever, PR segment deviation, erythrocyte sedimentation or C-reactive protein elevation. These trends were not apparent for all the patients with detectable serum cardiac troponin I level as a whole. All patients with an echocardiographic wall motion abnormality (n=5) had a detectable level of cardiac troponin I and four had serum cardiac troponin I above 1·5 ng . ml⁻¹. There was a significant but weak correlation between cardiac troponin I and myoglobin (r=0·42) and cardiac troponin I and the CPK (r=0·57).
The mean initial hospital length of stay was of the same magnitude in patients with and without detectable cardiac troponin I levels (6±4±4 days) vs 49±3±1 days). Follow-up was complete in 61 patients (30 with positive and 31 with negative cardiac troponin I). In these patients, relapse rate (14 patients; 28%) was not different between cardiac troponin I positive and negative patients (8 (27%) vs 6 (19%); P=0.4); 12 patients (6 (20%) cardiac troponin I positive and 6 (19%) cardiac troponin I negative patients) were rehospitalized in this setting. The same frequencies were observed in patients with cardiac troponin I above the 1.5 ng . ml⁻¹ threshold.

**Discussion**

Our work indicates that in patients with idiopathic acute pericarditis, (1) a cardiac troponin I increase is frequently observed, especially in younger patients and those with a recent infection, (2) although ST-segment elevation does not reliably indicate myocardial injury, a significant cardiac troponin I increase is only seen in these patients.

**Troponin I increase in acute pericarditis**

Myocardial necrosis, as expressed by a detectable increase of cardiac troponin I, appears to be common in acute pericarditis since it was detected in 49% of our patients and elevated above the myocardial infarction threshold in 22%. The classical view is that a cardiac troponin I increase indicates myocardial necrosis or irreversible lesions[⁸]. Although this point is still debated, there is little evidence for the contrary. Only in a swine model, were increased levels of cardiac troponin I found in reversible myocardial ischaemic injury[⁹]. Troponin increase in our patients suggests that severe myocardial lesions are associated with acute inflammation of the pericardium and, in these patients, the frontier between acute pericarditis and myocarditis is not clear cut. Cardiac troponin I increase is common in acute myocarditis[⁸,⁹]. Among patients with histologically or immunologically diagnosed myocarditis, troponin levels were elevated in 53%[⁹]. In experimental myocarditis, cardiac troponin I was increased, even with a minimal myocardial lesion[⁸]. However, there was no strict parallel between cardiac troponin I elevations and the histological severity of myocarditis[⁸,⁹]. As suggested by others, cardiac troponin I positive patients may have a more active process with ongoing damage severe enough to cause a cardiac troponin I increase[⁸,⁹]. It may be related to the pathogenetic mechanisms of the disease (different viruses, viral infection vs auto-immune mediated response to endogenous cardiac protein) which would be more prevalent in a subgroup of patients, for example those of younger age. Smith et al. also observed that timing was the main parameter for the efficacy of cardiac troponin I to detect myocarditis[⁹]. Cardiac troponin I was most likely to be elevated in patients early after onset of symptoms. In our work, the relationship between recent infection and cardiac troponin I increase was consistent with the hypothesis that myocyte injury, as detected by cardiac troponin I increase, occurs early in the patient’s course.

**Troponin I increase and prognosis**

Despite a non-significant trend of an increase in relapse in the troponin-positive group, cardiac troponin I elevation was not related to symptom intensity or disease severity. A similar observation has been made in patients with acute myocarditis[⁸,⁹]. In those patients, the frequency of heart failure symptoms, NYHA functional class, low ejection fraction, arrhythmia was equal in patients with and without troponin increase[⁹]. However,
those works, like ours, probably lacked the power to confirm small differences, and the true prognostic significance of cardiac troponin I elevation in this setting remains uncertain.

**Troponin I increase and ST-segment elevation**

In our study, cardiac troponin I increase was almost only seen in patients with ST-segment deviation. The same observation was made by Karjalainen and Heikkila[3] and Marmor et al[10] with creatine kinase MB. The strong relationship between ST-segment elevation and cardiac troponin I increase may indicate that in many patients with acute pericarditis, ST-segment elevation is related to a high level of myocardial injury and that in some of these patients, the cardiac involvement is of such severity that myocardial necrosis may occur. This finding substantiates what is known about ST-segment elevation in acute pericarditis. Through body surface potential mapping studies it appears that subepicardial muscle fibres play a major role in the pathogenesis of ST-segment elevation[11]. Pathological studies, mostly in bacterial pericarditis, observed that all cases with ST-segment elevation showed definite subepicardial myocarditis[12]. In none of the patients with normal ECG was the pericarditis associated with inflammation of the myocardium. Scintigraphic studies with technetium-99m stannous pyrophosphate in acute pericarditis indicated that myocardial uptake was the major determinant for positive studies[13]. However, almost half the patients with ST-segment elevation have no increase in cardiac troponin I. The same proportion of negative troponin serum was observed in histologically proven myocarditis[8,9]. Intensity and/or duration of disease, individual variability in the release and clearance of cardiac troponin I in response to the kinetics of injury may explain the discrepancies. As in acute myocarditis, auto-antibodies against cardiac troponin I may also have developed in the course of the disease and interfered with the method used to quantify circulating cardiac troponin I.

**Limitations of the study**

Although this series is the largest yet reported of patients with acute pericarditis to undergo cardiac troponin I serum measurements, the sample size is small. This is a retrospective study and, owing to the selection criteria and the number of patients lost for follow-up, the true incidence of cardiac troponin I elevation in acute pericarditis and the prognostic significance of this increase remain uncertain. All our patients were hospitalized indicating a disease with more severe presentation, a potential selection bias. The cardiac troponin I increase may, in theory, be related to concomitant coronary artery disease, and, owing to the ECG presentation, acute myocardial infarction[14]. This is unlikely since coronary angiography, when performed, has shown normal coronary arteries, ECG evolution was typical of acute pericarditis, and echocardiography, which was always performed early, detected a wall motion abnormality in only five patients. However, only a small proportion of the patients underwent heart catheterization and coronary angiography and none underwent an endomyocardial biopsy to show additional myocardial involvement. It is also possible that in some patients, a suggestive thoracic pain of unknown origin was associated with ST-segment elevation due to early repolarization, a normal variant.

**Conclusion**

The present study shows that measurement of cardiac troponin I serum levels provides evidence of myocardial cell damage in patients with acute pericarditis, especially younger patients and those with a recent infection. ST-segment elevation does not reliably indicate myocardial injury as assessed by serum cardiac troponin I level. However, significant cardiac troponin I increase is only seen in the patients with ST-segment elevation. More studies are needed to document the prognostic significance of cardiac troponin I increase in acute pericarditis and its interest in the management of these patients.

**References**


