

## CASE PRESENTATION

# Management of left ventricle thrombus in patients with myocardial infarction: a series of three cases and review of literature

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### Abstract

Left ventricle thrombus (LVT) is a possible complication after myocardial infarction, portending a significant risk of thromboembolic events. LVT is more frequent in patients with anterior myocardial infarction, in patients with decreased left ventricular ejection fraction, and in patients with antero-apical aneurysm. To avoid a cardio-embolic event, current guidelines recommend anticoagulation therapy in all patients with LVT, free of active bleeding. We present a series of three cases of anterior myocardial infarction with ST-elevation treated with percutaneous coronary interventions, and LVT. Anticoagulation and dual antiplatelet treatment were recommended in all three cases until the resolution of the LVT, without any hemorrhagic complications. However, even if triple therapy was started on all cases, one patient presented embolic stroke during hospitalization, with complete recovery within one week of treatment.

**Keywords:** left ventricle, thrombus, myocardial infarction

### Rezumat

Printre complicațiile posibile ale infarctului miocardic se remarcă prezența trombilor intracavitari, care asociază un risc important de embolizare. În general, această complicație apare cu predilecție în infarctul miocardic cu localizare anterioară, la pacienții cu fracție de ejecție scăzută și cu aneurism antero-apical. Ghidurile actuale recomandă inițierea tratamentului anticoagulant la pacienții cu tromb localizat în ventriculul stâng în vederea prevenției unui eveniment embolic, ținând cont de riscul hemoragic al pacienților. În cele ce urmează, vă prezentăm o serie de trei cazuri de infarct miocardic anterior cu supradenivelare de segment ST, care au beneficiat de revascularizare percutană cu implantare de stent și tratament medicamentos standard cu dublă antiagregare plachetară. Pacienții au dezvoltat pe parcursul internării tromb apical la nivelul ventriculului stâng. Prin urmare, s-a asociat tratament anticoagulant la terapia standard menționată anterior, fiind continuat până în momentul rezoluției trombului din ventriculul stâng. Totuși, sub tripla terapie, unul din pacienți a prezentat accident vascular cerebral, cu recuperare în aproximativ șapte zile de tratament.

**Cuvinte cheie:** ventricul stâng, tromboza apicală, infarct miocardic

## INTRODUCTION

Cardiovascular diseases remain the leading cause of mortality worldwide, and acute myocardial infarction (MI) is a common and morbid event in patients with cumulative cardio-vascular risk factors<sup>1</sup>. However, the number of deaths caused by acute MI diminished since

the expansion and increased accessibility to primary percutaneous coronary interventions (PPCI)<sup>2-4</sup>. Left ventricle thrombus (LVT) is a possible complication in patients with acute MI, with an incidence of 1.6%, even if treated with PPCI<sup>6</sup>. The highest incidence of LVT is during the first 5 days after the acute event<sup>5,6</sup>.

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The likelihood of developing LVT is higher in patients with large anterior myocardial infarction with ST segment elevation (STEMI), especially in those presenting anterior-apical aneurysm<sup>2,6,12</sup>. Thromboembolic events associated with LVT, such as embolic stroke, remain feared complications, with poor outcome<sup>2</sup>.

Hereby, we present the outcome of 3 cases of acute anterior STEMI, complicated with LVT, even though PPCI was performed. Triple therapy, with anticoagulation and dual antiplatelet treatment, was started on all three cases. However, one patient developed embolic stroke, with complete resolution of the neurologic deficit after one week of maximal treatment. Anticoagulation was discontinued after LVT resolution, and no bleeding events were present.

## CASE SERIES

A 44-year-old male, known with type 2 diabetes and dyslipidemia, presented to a regional hospital with anterior STEMI, 6 hours after significant chest pain onset (first episode in life). He received standard dual antiplatelet therapy (DAP, Aspirin and Clopidogrel) and thrombolytic therapy (Tenecteplase), and then he was transferred to our Cardiology Department to perform emergency coronary angiography. Coronary angiography revealed a 95% stenosis of the left anterior descending artery (LAD), with no other critical lesions. A drug eluting stent (DES) was implanted, without peri-procedural complications. The time between onset of symptoms and rescue PCI was 12 hours and 43 minutes.

The second patient was a 40 years-old man, transferred to our department for anterior STEMI. Symptoms debut was 72 hours prior, but their intensity increased in the last 24 hours before admission. Emergency transthoracic echocardiography (TTE) showed apical dyskinesia and LVT. He was started on dual antiplatelet therapy with Aspirin and Clopidogrel and prepared for emergency coronarography. The coronary angiography showed single vessel coronary artery disease, with complete occlusion of the proximal LAD. Two DESs were implanted, with optimal procedural result and without complications. The time between the transfer of the patient and primary PCI was 3 hours and 30 minutes.

The third patient, a 42 years-old man, presented to our department with recurrent anterior STEMI. He had a history of anterior STEMI 8 years ago, when he was diagnosed with single vessel coronary artery disease and received a bare metal stent (BMS) in the

proximal segment of the LAD. He continued smoking and interrupted his medication one week before the onset of symptoms. Emergency coronary angiography showed acute thrombotic occlusion of the proximal part of the BMS. Consequently, a DES was implanted at the level of proximal LAD, with good procedural result. The duration between the onset of symptoms and PCI was 4 hours.

After procedure, all 3 patients received standard dual antiplatelet therapy with Clopidogrel and Aspirin. TTE performed during the first 48 hours after the procedure revealed LV spontaneous echo contrast and apical LVT. Anticoagulation with low molecular weight heparin and Acenocumarol was started in all 3 patients, until a therapeutic INR (2-3). Patients were discharged on Acenocumarol and DAP.

Extensive laboratory work-up for a hypercoagulability state were negative in the first two patients. Conversely, the third patient was positive for hyperhomocysteinemia and mutation A1298C, in a heterozygote form. After one week of correct anticoagulation, he developed ischemic stroke. Brain computed tomography, Doppler ultrasound of cervico-cerebral arteries, and 24-hours Holter ECG monitoring were performed. Carotid atherosclerotic plaques and atrial fibrillation were excluded, and the LVT was pointed as a source of the cerebral embolism. Consequently, standard treatment with antiplatelet therapy and oral anticoagulation were continued, and the patient presented recovery of the neurologic deficit within one week.

Thus, all 3 patients followed triple therapy with Aspirin, Clopidogrel, and Acenocumarol, for 90 days. Three-month follow-up showed improvement of the LVEF and the resolution of LVT in all three patients. Therefore, oral anticoagulation was stopped, while DAPT was continued for 12 months, then followed by low dose of Aspirin (100 mg o.d.). At 2 years follow-up, all 3 patients were free from any cardiovascular or cerebral events.

## DISCUSSION

Blood stasis, secondary to dyskinesia and wall motion abnormalities, subendocardial tissue injury, and various inflammatory factors contributing to a hypercoagulability status, were all incriminated in the mechanism of MI complicated with LVT<sup>2,4,7-9</sup>. There is a limited number of studies addressing the occurrence and possible complications of LVT after myocardial infarction. A recent retrospective study conducted

by Mao et al. on 1698 patients with MI showed the presence of LVT in 28 cases (1.6%). They showed that intervention on LAD was independently associated with LVT, while a higher LVEF was associated with a lower incidence of LVT<sup>6</sup>. An interesting study by Osherov et al. showed that the presence of LVT is similar in patients with MI receiving all types of treatment: thrombolysis, interventional, and conservative treatment<sup>11</sup>. They analyzed 642 patients and separated them in three groups: PPCI group, thrombolytic group and conservative treatment group. The rate of LVT after anterior MI was 6.2%, with no statistical difference for the LVT rate according to treatment: 21 (7.1%) of 297 patients in the PPCI group, 10 (7.8%) of 128 patients in the thrombolytic group, and 9 (4.1%) of 217 patients in the conservative group ( $p=0.28$ )<sup>11</sup>. Another prospective study by Rehan et al. analyzed 92 patients with STEMI, treated with rescue or facilitated PCI. Four patients (4.3%) developed LVT, diagnosed by using unenhanced and enhanced imaging with Perflutren lipid microspheres. All 4 patients had STEMI involving LAD and a mean LVEF of 31%.

Despite all these evidences, the incidence of LVT is lower in the “PPCI era” by comparison to the „pre PPCI era”, when only thrombolysis was used in patients with acute MI<sup>18</sup>. For example, in the GISSI-2 study, conducted by Vecchio et al. in 1991, the LVT was observed in 51 of 180 patients (28%) with anterior

or acute MI, receiving thrombolysis with streptokinase or recombinant tissue-type plasminogen activator (rt-PA). The study described only one embolic event during hospitalization<sup>19</sup>.

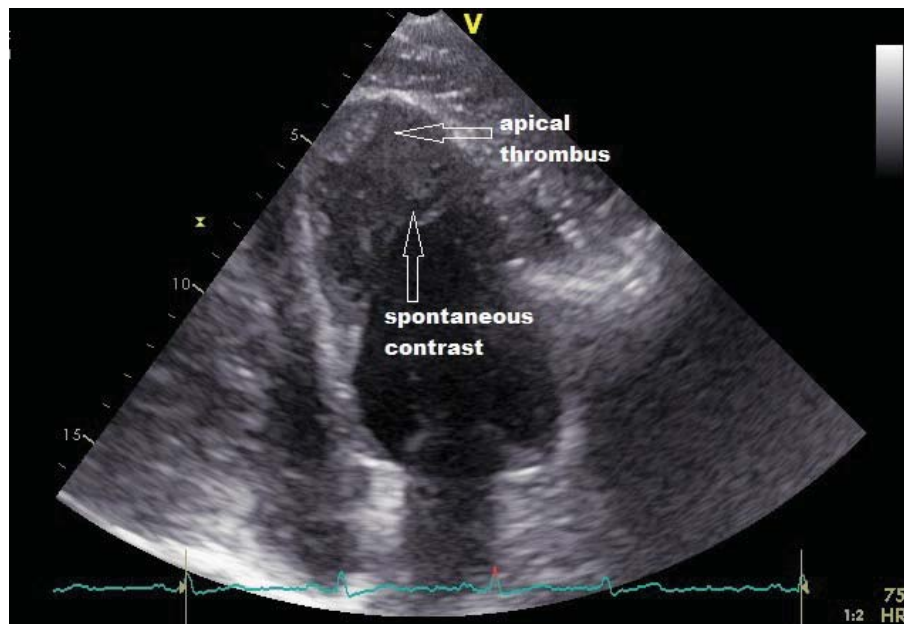
The incidence of LVT diminished after the introduction of interventional therapy. The Fragmin in Acute Myocardial Infarction (FRAMI) Study evaluated efficacy and safety of Dalteparin in the prevention of arterial thromboembolism after an acute anterior MI, and showed that Dalteparin is associated a lower risk of LVT formation, but a higher risk of hemorrhage. They observed a risk reduction of LVT in the Dalteparin treatment group of 0.63 (95% CI: 0.43-0.92,  $p=0.02$ )<sup>20</sup>.

Solheim et al. showed that patients with LVT, treated with DAP therapy and PCI, have a higher peak creatinine kinase levels, larger infarct sizes, and lower LVEFs, assessed by TTE or single photon emission computed tomography<sup>10</sup>.

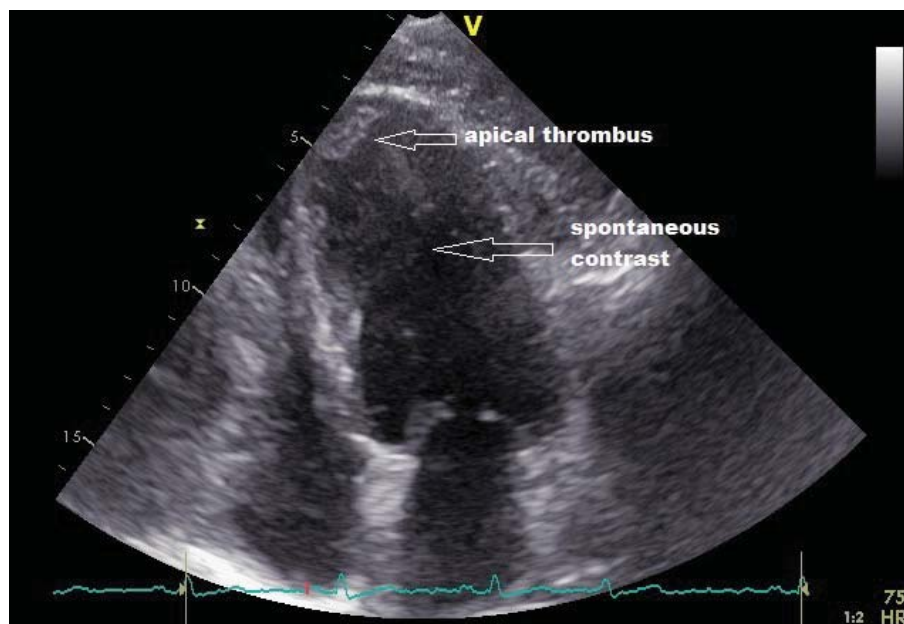
The main complication of the LVT is embolic stroke. In 1989, Jugdutt B. addressed the possibility of embolism in patients with LVT, emphasizing specific characteristics, such as thrombus mobility and protrusion, and the presence of adjacent hyperkinesia<sup>9</sup>. A more recent study described a stroke risk algorithm for patients with MI without atrial fibrillation<sup>15</sup>. Algorithm criteria included: older age, Killip class 3 or 4, hypertension, reduced LVEF (<35%), and estimated glomerular filtration rate <45 ml/min/1.73 m<sup>2</sup>. Using

**Table. Incidence of LVT in different studies performed in patients with myocardial infarction**

Authors / Year / Name of the Study	Number of patients	Thrombus incidence
Etrugrul Okuyan / 2010 Risk factors for development of left ventricular thrombus after first acute anterior myocardial infarction-association with anticardiolipin antibodies	70	30
Solheim / 2010 Frequency of left ventricular thrombus in patients with anterior wall acute myocardial infarction treated with percutaneous coronary intervention and dual antiplatelet therapy	100	15
Osherov/ 2009 Incidence of early left ventricular thrombus after acute anterior wall myocardial infarction in the primary coronary intervention era	642	40
Y. Shacham / 2013 Left Ventricular Thrombus Formation and Bleeding Complications during Continuous In-Hospital Anticoagulation for Acute Anterior Myocardial Infarction	429	18
Driesman / 2015 Incidence and Predictors of Left Ventricular Thrombus After Primary Percutaneous Coronary Intervention for Anterior ST-Segment Elevation Myocardial Infarction	687	47
Gianstefani S /2014 Incidence and predictors of early left ventricular thrombus after ST-elevation myocardial infarction in the contemporary era of primary percutaneous coronary intervention	1059	42
Naoki Maniwa / 2017 Anticoagulation combined with antiplatelet therapy in patients with left ventricular thrombus after first acute myocardial infarction	1850	92
Marzenna Z. / 2008 Predictors of Left Ventricular Thrombus Formation in Acute Myocardial Infarction Treated With Successful Primary Angioplasty With Stenting	2911	73



**Figure 1.** Apical 4 chamber echocardiographic view of the left ventricle. Presence of a thrombus attached to the apex and the interventricular septum of the left ventricle and spontaneous contrast, after myocardial revascularization (first patient).



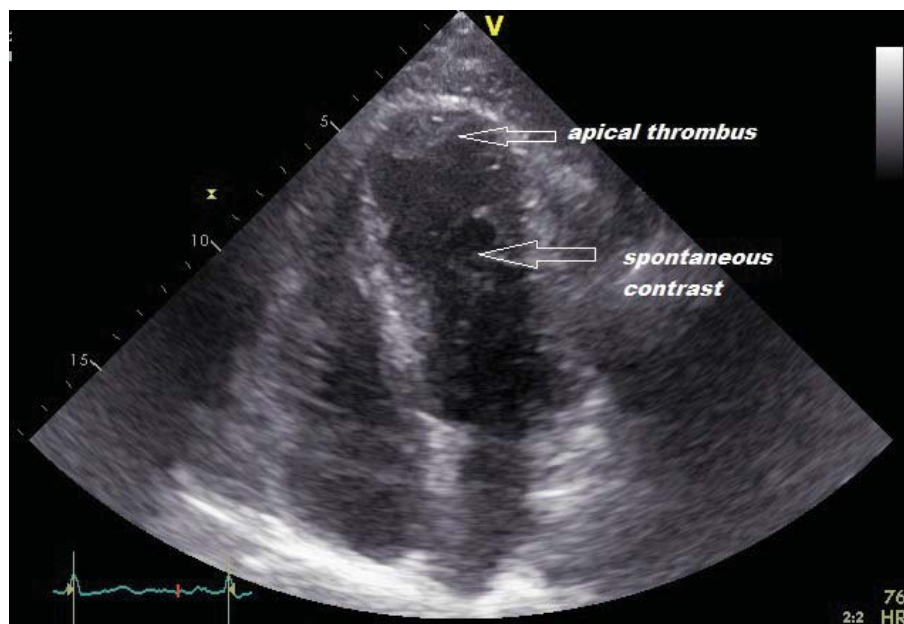
**Figure 2.** Apical 4 chamber echocardiographic view of the left ventricle. Presence of an apical thrombus and spontaneous contrast into the left ventricle, after myocardial revascularization (second patient).

this score, patients who have at least 3 points have similar risk of having stroke as those with atrial fibrillation<sup>15</sup>.

Management of embolic stroke following LVT varies from thrombolysis therapy to anticoagulation with heparin<sup>2,3,8,9</sup>. Vitamin K antagonist have been also recommended, but without being studied in large randomized studies. In 2013, the ACCFAHA released a recommendation for the introduction of warfarin in

STEMI patients who develop mural LVT<sup>21</sup>. Non-vitamin K oral-anticoagulants do not have evidence-based indications in patients with LVT. However, there are few case reports of patients with mural LVT, which were treated with new oral anticoagulants such as Apixaban, Rivaroxaban or Dabigatran, with successful results<sup>22-25</sup>.

Another important aspect is the duration of the anticoagulant therapy in patients with LVT, so far



**Figure 3.** Apical 4 chamber echocardiographic view of the left ventricle. Presence of thrombus and spontaneous contrast at the level of the apex of the left ventricle, after myocardial revascularization (third patient).

scarcely studied. General consensus is that clinical and imaging follow-up at 1, 3, and 6 months should be performed in all patients with LVT. After 6 months, if LVT is excluded by TTE, and no other indications present, the anticoagulation therapy should be stopped<sup>13</sup>. According to the ESC guidelines, patients with LVT after MI should receive oral anticoagulation for at least 6 months<sup>13</sup>. Current ESC guidelines recommend the association of DAPT to oral anticoagulation therapy for a minimum period of one month, which can be prolonged up to 6 months, based on the bleeding risk. However, these recommendations refer to patients with atrial fibrillation, and there are no clear recommendations for patients with LVT<sup>17</sup>.

## CONCLUSIONS

Left ventricular thrombus is a complication occurring mainly after anterior acute myocardial infarction, even if complete revascularization is performed. We suggest that, in all patients presenting with anterior MI, repeated echocardiography should be performed until discharge, in order to exclude left ventricular thrombus. If left ventricular thrombus is present, patients should undergo anticoagulation treatment associated with dual antiplatelet therapy, for a minimum of one month, optimal until the resolution of thrombus. Risk of hemorrhage should be periodically

assessed and therapy adjusted accordingly. Our cases showed resolution of left ventricular thrombus after 3 months of triple therapy, in three random cases of young males with anterior myocardial infarction that received interventional treatment, without bleeding events. Embolic events can occur also in the presence of triple therapy.

**Conflict of interest:** none declared.

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