Thrombolysis of Mobile Right Atrial Thrombi Following Severe Pulmonary Embolism

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Summary: Thrombolysis may favorably affect the clinical outcome of mobile right atrial thrombus following pulmonary embolism (PE). We report the case of three patients with mobile right atrial thrombus following PE, in whom fibrinolysis was performed. Atrial mass disappeared on the control echocardiogram, but control ventilation perfusion scan showed new perfusion defects in all patients. Thrombolysis seems successful for the treatment of patients with mobile right atrial thrombus following PE; however, recurrent PE may be induced by fibrinolysis. This may affect the benefit of such therapy and should be taken into account when using this therapeutic treatment.

Key words: pulmonary embolism, thrombolysis, atrial thrombi, deep venous thrombosis

Introduction

Thrombolytic agents are frequently used in the treatment of severe pulmonary embolism (PE) and are advocated for patients presenting with hemodynamic instability or severe hy-

poxemia.^{1,2} Thrombolysis may also favorably affect the clinical outcome of hemodynamically stable patients with right ventricular dysfunction.³ Mobile right atrial thrombi are associated with poor clinical outcome because of the high rate of massive PE^{4,5} and their treatment remains controversial. We report the cases of three patients in whom mobile right atrial thrombi, diagnosed following severe PE, were treated by thrombolysis with good clinical outcome and disappearance of the thrombi.

Case Reports

Between April 1997 and March 1998, three consecutive patients were admitted to the cardiology department for acute PE complicated by mobile right atrial thrombi detected by echocardiography. At time of diagnosis, all patients underwent transthoracic echocardiogram, completed by transesophageal echocardiography when the diagnosis of right atrial thrombi was uncertain (one patient). A ventilation perfusion scan was performed, and all scans were considered positive according to PLOPED study; that is, defects on the perfusion scan did not match the ventilation scan (high probability scan).⁶ Fibrinolysis was performed using recombinant tissue plasminogen activator (rt-PA): 10 mg intravenous (IV) bolus, followed by 90 mg over 120 min, associated to heparin (30,000 UI/day). Echocardiogram was performed in all patients 1 day after fibrinolysis. A ventilation perfusion scan was also realized after fibrinolysis. Patients were discharged with oral anticoagulants.

The characteristics of the three patients are depicted in Table I. None of them had clinical symptoms of recurrent PE since fibrinolysis had been performed. An echocardiogram done 1 day after fibrinolysis showed the disappearance of right atrial thrombus (Fig 1A, B). A ventilation perfusion scan, done after fibrinolysis (1 day later in Patients No. 1 and 3, 4 days later in Patient No. 2) showed an improvement in perfusion in previous perfusion defects, but also new defects in all patients (Fig. 2A, B).

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TABLE I Patient characteristics

Patient No.	1	2	3
Age	62	81	79
Sex	M	F	M
Previous history	Atrial fibrillation	Myocardial infarction	Implantable pacemaker (atrioventricular block) Myocardial infarction
Onset of symptoms	10 April 1997	4 July 1997	23 March 1998
Clinical data	Acute dyspnea	Acute dyspnea	Acute thoracic pain associated with recent dyspnea
Electrocardiogram	Atrial tachycardia: 117/min Negative T waves in lead V ₁₋₆	Atrial fibrillation: 100/min	Electrostimulated rhythm: 70 beats/min
Blood gas level (kPa)	PaO ₂ = 11.7 PaCO ₂ = 3.4	PaO ₂ = 6.7 PaCO ₂ = 4	PaO ₂ = 9.3 PaCO ₂ = 4.3
Ventilation-perfusion scan before fibrinolysis	Bilateral perfusion defects not matching ventilation scan	Bilateral perfusion defects not matching ventilation scan	Bilateral perfusion defects not matching ventilation scan
Echocardiogram before fibrinolysis ^a	Right-sided heart enlargement Right atrial thrombus Pulmonary artery systolic hypertension (50 mmHg) ^b	Right-sided heart enlargement Serpiginous right atrial thrombus which prolapsed through the tricuspid orifice Pulmonary artery systolic hypertension (55 mmHg) ^b	Serpiginous atrial thrombus, attached to the implantable electrodes, which prolapsed through the tricuspid orifice Pulmonary artery systolic hypertension (45 mmHg) ^b
Clinical data 1 day after fibrinolysis	Dyspnea resolution	Dyspnea resolution	Thoracic pain and dyspnea resolution
Electrocardiogram 1 day after fibrinolysis	Sinus rhythm 90/min Negative T waves in leads V ₁₋₆	Atrial fibrillation 80/min	Electrostimulated rhythm 70 beats/min
Echocardiogram 1 day after fibrinolysis ^a	Pulmonary artery systolic pressure 35 mmHg ^b Disappearance of atrial thrombus	Pulmonary artery systolic pressure 30 mmHg ^b Disappearance of atrial thrombus	Pulmonary artery systolic pressure 30 mmHg ^b Disappearance of atrial thrombus
Ventilation perfusion scan after fibrinolysis ^c	Perfusion improvement New defect in the right lower lobe	Perfusion improvement New defect in the anterior and apical segments of the upper right lobe	Perfusion improvement New defect in the superior segment of the left lower lobe
B-mode vascular ultrasonography	Left superficial femoral vein thrombosis	Bilateral common femoral vein thrombosis	Right peroneal and tibial vein thrombosis

^a All patients underwent transthoracic echocardiogram, but a transesophageal echocardiography was performed in Patient No. 3 as the presence of implantable electrodes made the diagnosis of right atrial thrombus uncertain.

^b Pulmonary pressures were estimated from the tricuspid regurgitation flow velocity.

^c All scans were performed 1 day after fibrinolysis except in Patient No. 2 (4 days after fibrinolysis).

Discussion

Right atrial thrombi following PE portend a poor prognosis with death due to recurrent PE.⁷ Their incidence in PE is approximately of 7%,^{8,9} and 18%¹⁰ in patients with massive pulmonary embolism. Mobile thrombi, representing pulmonary embolism in transit, carry an especially high mortality rate with conservative treatment (50%), with death frequently occurring within days after diagnosis.¹¹ The treatment of choice is heart surgery with cardiopulmonary bypass.^{4, 11} In a retrospective study of 48 patients with mobile right atrial thrombi, the thrombus-related mortality in relation to treatment was 64% in the anticoagulation group versus 27% in the surgery group.¹¹ In a retrospective study by Farfel *et al.*, the mortality in patients undergoing surgery (15%) was lower than that with conservative treatment (48%).⁴ Although selection of surgical

patients was biased in both studies, these studies show that anticoagulation is insufficient in these patients. Intravenous thrombolysis may be an alternative to open heart surgery and is extensively used in this indication,¹²⁻¹⁴ although no clinical trial has demonstrated the superiority of this therapeutic measure compared with surgery. The efficacy of IV fibrinolysis in the lysis of right atrial thrombi has been documented in a few cases without major complications;¹²⁻¹⁴ however, sudden death following fibrinolysis has been described.¹⁵ Based on these data, we chose to perform IV fibrinolysis in these patients in whom echocardiogram and ventilation perfusion scan were undertaken before and after fibrinolysis. All patients improved clinically a few hours after fibrinolysis onset. However, new perfusion defects were observed 2 days after fibrinolysis in all patients, concomitant with the disappearance of right atrial thrombus. These changes in the sequential perfusion

FIG. 1 (A) Multiplanar transesophageal echocardiography, showing a serpiginous right atrial thrombus (arrows), attached to the implantable electrodes, prolapsing through the tricuspid orifice. LA = left atrium, LV = left ventricle, RV = right ventricle, AI and VI = atrial and ventricular implantable probes. (B) Multiplanar transesophageal echocardiography, 1 day after thrombolysis (100 mg rt-PA), showing disappearance of atrial thrombus. RA = right atrium.

FIG. 2 (A) Initial ventilation perfusion scan showing perfusion defects of the left lung and hypoperfusion of the right lower lobe. (B) Perfusion scan 2 days after thrombolysis showing improvement of left lung perfusion but new perfusion defect in the right middle lobe.

lung scans appeared to be explained more likely by recurrent PE than by intrapulmonary perfusion shifts, as they were con-

comitant with the disappearance of right atrial thrombus. Our data show that fibrinolysis may be efficacious in lysis of right

atrial thrombi, but also that it may be responsible for recurrent PE, as suspected by Martinez-Tallo *et al.*¹⁶ Although local lysis may occur, part of the thrombus embolizes into the pulmonary circulation. This adverse effect is probably overcome by the benefit of fibrinolysis on the pulmonary obstruction, since fibrinolysis leads to the decrease in pulmonary artery systolic pressures observed and is responsible for the clinical improvement (dyspnea resolution) in our patients.

Conclusion

Thrombolysis is efficacious for the treatment of patients with mobile right atrial thrombus following pulmonary embolism. However, it may be responsible for recurrent PE, which could impact on the benefit of such therapy. Such limitations of fibrinolysis in this indication should be taken into account when using this therapeutic measure.

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