

Management of mobile right heart thrombi: A prospective series

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Abstract

Background: Mobile right heart thrombi (MRHT) are uncommon but their true prevalence is unknown. The aim of our study was to assess the prevalence of MRHT by a systemic use of transthoracic echocardiography in a prospective series of consecutive patients admitted for acute severe pulmonary embolism (PE) and to adopt intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) as the first line intention to treat patients with proven MRHT. **Methods and results:** We performed a systematic transthoracic echocardiogram from November 1997 to June 1999 in 335 consecutive patients admitted for suspected acute massive PE in whom the diagnosis was subsequently confirmed by perfusion lung scan or angiography. MRHT was identified in 12 of the 335 patients (4%). Nine patients presented a coil form and three patients a ball form. The thrombolytic employed in all cases was rt-PA according to the following protocol: 10 mg in a bolus and 40 mg over 2 h, followed by 50 mg over 5 h, up in a total dose of 100 mg, associated with a bolus of 5000 units of heparin. Control echocardiograms were performed 12 h after the initiation of treatment and at 12-month follow-up. Three patients died before the onset of thrombolytic infusion. The nine remaining patients were submitted to thrombolytic therapy using rt-PA. In seven of the nine remaining patients, MRHT was no longer observed after 12 h and the echocardiographic signs of RV overload had disappeared. The two last patients required adjunctive surgery because of evidence of persistent thrombus in a pulmonary artery. After 24 h, both scintigraphy and angiography demonstrated improved pulmonary perfusion. At 1-year follow-up, all patients were alive and the pulmonary artery pressure estimated by Doppler echocardiography was <30 mm Hg. **Conclusions:** The incidence of right heart thrombus is low in patients admitted for acute PE. Thrombolytic therapy with rt-PA appears to be rapidly effective in most patients with MRHT. The thrombus usually resolves and pulmonary perfusion is rapidly improved. Systematic echocardiogram appears to be useful for rapidly detecting MRHT in patients with suspected massive PE.

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Mobile right heart thrombi (MRHT) can be diagnosed by transthoracic echocardiography and are observed almost exclusively in patients with severe pulmonary embolism (PE) [1,2]. They can embolize at any moment and have a dismal prognosis [3,4]. MRHT are uncommon [2] but their true incidence is unknown. Of the 2454 patients included in the ICOPER registry [5], 1135 underwent echocardiography: intracardiac thrombus was found in 45 patients (4%), in the right atrium in 32. The management of 38 patients with mobile MRHT has recently been described, but this was a retrospective study [1]. Hitherto, no prospective study has

investigated the prevalence of right heart thrombi in a consecutive series. The management of MRHT remains controversial [6]. The most frequently proposed treatment is surgery, consisting in embolectomy under cardiopulmonary bypass. Intravenous thrombolysis may dissolve clots in several locations at the same time, with the potential risk of migration of fragments following clot lysis. Published series are small with non standardised therapy. The single meta-analysis included a heterogeneous group of patients.

The aims of this study were to prospectively assess the incidence of MRHT in a consecutive series of patients admitted for severe PE and to adopt intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) as the first line intention to treat patients with proven MRHT. We also report on a 12-month follow-up of the 12 patients in whom MRHT was identified.

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1. Materials and methods

1.1. Patient selection

We performed a transthoracic echocardiogram from November 1997 to June 1999 in all consecutive patients admitted to the intensive care unit for suspected acute massive PE. The diagnosis was confirmed by perfusion lung scan or pulmonary angiography. Transthoracic echocardiogram was obtained as the first imaging technique within 70 ± 20 min after the onset of symptoms. And the immobile thrombi developed in situ were not included in this study.

1.2. Echocardiographic imaging

All patients underwent transthoracic echocardiography as soon as a PE was suspected, using a Hewlett-Packard echocardiograph 2000 or 5500, equipped with a 3.5 MHz transducer. Two-dimensional and Doppler recordings were obtained in parasternal long- and short-axis, apical-2 and -4 chamber and subcostal views. MRHT were defined as mobile masses in the right heart without visible attachment to the wall. Pulmonary artery systolic pressure (PasP) was determined from the velocity of tricuspid regurgitation using pulsed or continuous wave Doppler echocardiography and by applying the simplified Bernoulli equation. Signs of association acute cor pulmonale were diagnosed in the presence of ≥ 1 following criteria: (1) right ventricular (RV) dilatation (end-diastolic diameter >30 mm or RV/LV end-diastolic diameter ratio >1); (2) paradoxical systolic septal motion; and (3) pulmonary hypertension, acceleration time of pulmonary flow <90 ms or the presence of a transtricuspid pressure gradient >30 mm Hg. RV pressure overload of pulmonary flow was not considered to be acute in the presence of hypertrophy of the right ventricular wall (free wall thickness >7 mm). Masses such as vegetations, primary or metastatic tumors, embryological remnants or thrombi attached to the wall of the right atrium or the right ventricle or to an intracardiac device were excluded.

1.3. Perfusion lung scan

Lung scans were performed with 99 mTC-labeled human albumin microspheres. Six views were required. A normal or near-normal lung scan excluded PE and a high-probability scan (clear-cut perfusion defects of ≥ 1 pulmonary segments, mismatched at chest radiography) confirmed the diagnosis. Patients with intermediate probability scans or on request of surgeon before embolectomy underwent angiography.

1.4. Pulmonary angiography

Non-ionic contrast material was injected into the main pulmonary artery. In patients with uncertain PE diagnosis,

selective injections were performed with oblique views. The diagnosis of PE required direct visualisation of the embolus or intramural filling defect constant in ≥ 2 different views or after repeated injections. And the angiogram showing a vascular obstruction $>30\%$, corresponding to a miller index score >11 , in case of PE.

1.5. Color venous duplex scanning

Examination was performed ≤ 48 h from hospital admission with Toshiba SSA270A equipment with 5- and 7.5-MHz probes. Lack of vein compressibility was interpreted as a positive result and was confirmed with color-flow imaging and pulsed-wave Doppler analysis. Absent or reduced flow, lack of respiratory variation and failure to increase flow with calf compression were used to confirm the diagnosis. Pelvic and upper limb veins were routinely examined in patients with a negative lower-limb scan.

1.6. Treatment

Patients with MRHT, if eligible for intravenous thrombolysis, were immediately treated with rt-PA according to the following protocol: 10 mg as a bolus and 40 mg over 2 h, followed by 50 mg over 5 h, without exceeding a total dose of 100 mg, associated with a bolus of 5000 units of heparin. Because the rt-PA at a dose of 100 mg/7 h, in combination with a suitable dosage of heparin, enabled a 42% reduction in total pulmonary resistance or from the first 50 mg of treatment [7], this rapidity of action encouraged us to use rt-PA in accordance with Goldhaber's protocol [7] to treat MRHT. On the other hand, in the presence of contraindication or unsuccessful thrombolysis, surgical embolectomy was considered.

1.7. Follow-up investigations

A control echocardiography was performed 12 h after the onset of treatment. Other investigations included a perfusion-ventilation lung scan, venous Doppler ultrasound usually after 24–48 h. Follow-up echocardiograms were obtained on day 7 and at 1 year.

1.8. Statistical analysis

Data are given as mean $\pm$ S.D. Measurement values hemodynamic and blood gas (data), as well as early and late evolution echocardiographic before and after rt-PA infusion of the patients with MRHT were grouped and their means were compared. The paired *t*-test was carried out to estimate the difference between two groups. Analyses of variance (ANOVA), along with post-hoc test (Scheffe), if the ANOVA test resulted in significance, were used for comparison between more than two groups. A *p*-value of <0.05 was considered statistically significant.

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