The straddling atrial thrombus: From image to treatment

Thrombus enclavé dans le foramen ovale : de l’image au traitement

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The article by Fauveau et al. [1] in this issue of the Archives of Cardiovascular Diseases addresses the unusual but spectacular and frightening situation of a thrombus straddling a patent foramen ovale. Indeed, the first point to note in the article is the fact that, despite their marked interest in this topic, the authors could only gather four personal cases of a straddling thrombus from three busy cardiology departments. Moreover, their thorough bibliographic search found fewer than 100 published cases over a 22-year period. The rarity of straddling thrombi is in sharp contrast with the very high prevalence (about 20%) of patent foramen ovale in the general population. This discrepancy underlines the need to take great care in incriminating a patent foramen ovale and deciding on its closure after an otherwise unexplained stroke.

The principal data from the study, however, relate to pulmonary embolism associated with intra-atrial thrombosis. It should be remembered that pulmonary embolism remains a true clinical challenge that still has a very high mortality rate (17% mortality at 3 months in the International Cooperative Pulmonary Embolism Registry [ICOPER] [2]).

The role of transthoracic echocardiography in assessing the prognosis of pulmonary embolism must be emphasized. Although transthoracic echocardiography alone does not have adequate sensitivity to facilitate diagnosis of an acute pulmonary embolism, it is a powerful and noninvasive tool for predicting prognosis. Right ventricular dysfunction detected by echocardiography is indeed an independent predictor of early death [2]. Furthermore, right heart thrombosis, which is observed more often in patients with critical haemodynamic status, is also a strong marker of adverse outcome [3,4].


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A thrombus straddling a patent foramen ovale is usually found in the setting of massive pulmonary embolism with or without concomitant stroke. During the past 15 years, studies have focused on the relationship between a patent foramen ovale and undetermined strokes [5]. The most evident link was the hypothesis of a paradoxical embolism, which led to the proposal that a paradoxical embolism through a patent foramen ovale was a more frequent occurrence than previously thought.

Most venous thrombi arising from the vena caval flow in the right atrium are in fact directed to the atrial septum — more precisely, to the fossa ovalis. The foramen ovale is closed by a flap-like valve on the left side of the left atrium. In patients with cor pulmonale, the raised right-sided pressures may induce a reopening of the foramen ovale and a right-to-left atrial shunt or an increase of the shunt in patients with persistent patent foramen ovale, who represent 18% of the general population.

In a prospective study, contrast echocardiography was performed in 139 consecutive patients with a major pulmonary embolism. A patent foramen ovale was diagnosed in 48 patients (35%); these patients had a mortality rate of 33% compared with 14% in patients without a patent foramen ovale and a significantly higher incidence of ischaemic stroke. Contrast echocardiography right-to-left shunt through a patent foramen ovale is therefore a strong independent predictor of mortality [6].

Owing to the adverse outcome of a patent foramen ovale in patients with massive pulmonary embolism, aggressive therapeutic options such as thrombolytic treatment, surgery with closure of the patent foramen or catheter thrombus fragmentation to restore pulmonary vascular patency and normalize right-sided haemodynamics should be considered as soon as possible [7].

The authors emphasize the role of transoesophageal echocardiography. Obviously, reliable diagnosis of thrombus trapped in the atrial septum can sometimes be difficult with transthoracic echocardiography, but transoesophageal echocardiography is not without side-effects in patients with massive pulmonary embolism. The procedure requires sedation, which may be difficult if patients are not haemodynamically stable or have severe respiratory distress. If done without sufficient sedation, transoesophageal echocardiography can induce cough efforts that are Valsalva-like maneuvers, raising right-sided pressures with risk of paradoxical embolism. On the other hand, more profound sedation in such patients may require intubation and ventilation, which in this setting may lead to further deterioration of the haemodynamic status.

Concerning treatment, no randomized trials have compared the results of heparin therapy, thrombolysis and embolectomy in any subset of patients with massive acute pulmonary embolism [8]. Such randomized trials will probably never be performed.

In theory, thrombolysis may prevent the worsening of right-sided heart failure by resolution of the pulmonary artery thrombus and much of the source of thrombus, decreasing the likelihood of recurrent large pulmonary embolism or stroke. Nevertheless, no study has shown a significant effect of thrombolysis on mortality, recurrent pulmonary embolism or major haemorrhage versus heparin alone. Thrombolysis in the ICOPER did not reduce mortality (or recurrent pulmonary embolism at 90 days) in patients with acute massive pulmonary embolism [8].

Several criteria derived from non-randomized trials have been suggested as indications for surgical embolectomy [9]:
- massive pulmonary embolism;
- haemodynamic instability despite heparin;
- failure of thrombolytic treatment;
- contraindications for thrombolysis.

In the very specific situation of a thrombus straddling a patent foramen ovale, the risk of clot fragmentation leading to potential paradoxical embolism with thrombolysis probably outweighs the potential benefits of thrombolysis. Emergency surgical embolectomy with cardiopulmonary bypass allowing concomitant patent foramen ovale closure and, if necessary, pulmonary embolus suction appears to be a better therapeutic strategy [10—12]. Aggressive treatment should not therefore be regarded as a last-resort strategy; the results of embolectomy could be optimized if patients were referred for this procedure before the onset of cardiogenic shock or severe systemic embolus such as massive stroke. It should be remembered that most paradoxical emboli occur early, at the onset of pulmonary embolism, probably because of the resultant increase in right atrial pressure, which reopens the unfused fossa ovalis. On the other hand, mortality in massive pulmonary embolism seems to be related more to the consequences of acute right failure than to the presence of an intra-auricular thrombus [2].

Prognosis in the article by Fauveau et al. [1] related more strongly to the severity of the initial presentation than to the therapeutic choices made once the straddling thrombus was confirmed. Indeed, there were no major outcome differences between heparin treatment and a surgical approach, and the high incidence of adverse outcomes in patients who received thrombolysis can be explained by the severity of their clinical presentation.

Heparinotherapy is thus a valid and reasonable option in patients with comorbidities and a high surgical risk and should not be considered as a compassionate treatment. However, in patients with a large thrombus trapped in the interatrial septum and without severe comorbidity, prompt surgical embolectomy should be recommended in association with closure of the patent foramen ovale to prevent further catastrophic recurrent pulmonary and/or systemic emboli. At that moment, however, this recommendation is based on common sense rather than evidence.

References


