The Contemporary Role of Transoesophageal Echocardiography in Emergency Surgery for Massive Pulmonary Embolism

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INTRODUCTION

Pulmonary embolism (PE) is a relatively common cardiovascular emergency with a prevalence of 0.4% among hospitalized patients in the United States[1]. Acute or sub acute massive PE is potentially life-threatening and may result in death if not diagnosed and treated early. Despite advances in diagnosis and stratification no consensus exists regarding optimal treatment. We describe an interesting case of massive pulmonary embolism that required emergent surgery and highlights the value of intra-operative transoesophageal echocardiography which resulted in the incidental but critical finding of intra-cardiac right atrial clot.

CASE REPORT

A 46 year old hypertensive obese male presented with a one day history of pleuritic chest pain and breathlessness. He was discharged from hospital two day previously following an emergency laparotomy for a perforated appendix. On re-admission, his D-dimer was elevated (>4) and a computed tomography pulmonary angiogram (CTPA) confirmed the clinical suspicion of pulmonary embolism (PE). An ultrasound Doppler showed no evidence of lower limb deep vein thrombosis. The CTPA revealed a large volume thrombus in the proximal right and left main branch pulmonary arteries (PA) (Figure 1). A bedside transthoracic echocardiogram (TTE) showed a dilated, hypokinetic right ventricle with mild functional tricuspid regurgitation but no clot. A surgical embolectomy was deemed the best therapeutic option and emergency surgery was scheduled. The patient though initially stable, collapsed haemodynamically post anaesthesia induction and required resuscitation with high inotropic support.

The patient had a further near cardiac arrest during the median sternotomy and was emergently put on cardiopulmonary bypass (CPB) support following adequate systemic heparinisation. At this stage an intra-operative transoesophageal echocardiography (TOE)(mid oesophageal 4-chamber view) revealed a substantial amount of previously undetected clot in the right atrium (RA) (Figure 2) and a small patent foramen ovale (PFO). In view of this, the embolectomy was initially deferred and the RA opened and multiple large thombi extracted (Figure 3). The main PA was then opened and further clot removed from both proximal branch PA vessels bilaterally with a gallstone forceps and additionally with a embolectomy catheter (size 6F) with the aid of real time TOE visualization. This was accomplished on a beating heart without cardioplegic myocardial arrest. The PA vasculature was lavaged with heparinised saline and the vessels closed with a monofilament non-absorbable running 5-0 prolene suture.

The patient was weaned from CPB with minimal inotropic support and extubated ten hours later. His recovery was uneventful and he was commenced on warfarin anticoagulation. His discharge from hospital was delayed for a fortnight due to a sub therapeutic INR. The patient was readmitted a month later for uneventful placement of a caval filter. The results of his pre-operative thrombophilia screen came back but revealed no abnormality.

DISCUSSION

The diagnosis of PE can be challenging due to non-specific clinical presentation however early diagnosis is vital as immediate treatment is highly effective and potentially life-saving. Echocardiography has emerged as an important diagnostic and prognostic tool in the assessment of such patients. The European Society of Cardiology (ESC) guidelines risk stratifies patients for a PE-related early (in-hospital or 30-day) death on the basis of certain echocardiographic parameters in particular, evidence of right ventricular dysfunction (RVD)[2].

In this case the decision to proceed with an emergency surgical embolectomy in an initially haemodynamically stable patient was primarily based on the extensive central PE demonstrated with the CTPA. Additionally, the patient had some RVD on TTE imaging and given his age, the brief clinical history and recent abdominal surgery, this was thought to offer the best result. Systemic anticoagulation or catheter-directed thrombolysis were alternative options but likely to have a suboptimal result and would not have addressed the substantial RA clot although admittedly this was not detected then. The intra-operative TOE proved invaluable and dramatically altered the surgical strategy. In the absence of the TOE the RA clot would have remained undiagnosed and been missed with catastrophic fatal

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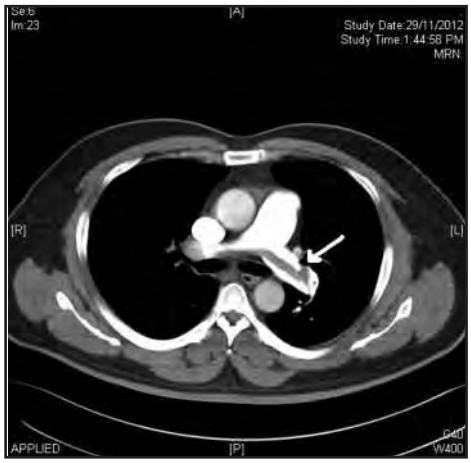

Fig. 1 : CTPA demonstrating filling defects in keeping with large volume thrombus in the proximal right and left main branch pulmonary arteries.

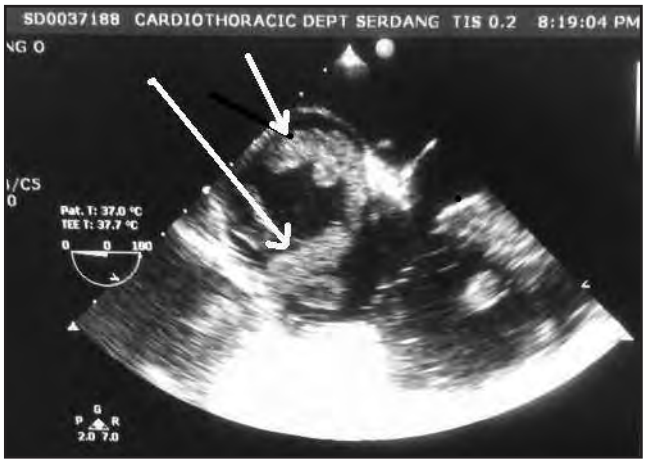

Fig. 2 : Intra-operative TOE demonstrating previously undetected clot in the right atrium.

Fig. 3 : Multiple large thombi extracted from both the right atrium and main branch pulmonary arteries bilaterally.

consequences. The TOE also provided optimal clot visualization to guide the surgeon and ensured adequate thrombus clearance from the proximal pulmonary arterial tree.

TOE is being increasingly utilized in the evaluation of suspected PE due to its diagnostic value reflected by reported high specificity (90-100%), sensitivity (80%) and positive predictive values (PPV) (70-80%)[3]. TOE can additionally demonstrate secondary signs of PA obstruction such as RV dysfunction, functional TR, leftward atrial septal bowing in addition to visualization of intra cardiac or PA thrombus as with our case. Concomitant pathology like an undiagnosed ASD or Ebsteins anomaly may also be detected.

This case also demonstrates the not uncommon scenario of sudden rapid decompensation in a seemingly haemodynamically stable patient due to loss of vascular tone at induction of general anaesthesia. The surgical team must be vigilant and prepared to institute CPB emergently. In this case we elected to perform the embolectomy on a beating heart however a reasonable alternative strategy is to induce a brief period of cardioplegic arrest which provides for a more quiescient and bloodless operative field.

Despite the negative thrombophilia screen and the lack of compelling data to support routine use of caval filters [4,5] in this patient due to the presence of a small PFO we proceeded to insert an IVC filter to minimize the risk of a future paradoxical systemic embolus should a DVT or PE recur. However, the need for a caval filter should be thoughtfully evaluated on an individual case by case basis.

CONCLUSION

Echocardiography provides important diagnostic and prognostic information to guide the management of patients with a PE. Intra-operative TOE in particular is an invaluable adjunct to the cardiac surgeon and should ideally be available in the contemporary practice of surgical pulmonary embolectomy. Echocardiography, TOE in particular, probably remains underutilized and should feature more prominently in the diagnostic interrogation of a patient with a suspected PE.

REFERENCES

1. Stein PD, Beemath A, Olson RE (2005) Trends in the incidence of pulmonary embolism and deep venous thrombosis in hospitalized patients. Am J Cardiol 95: 1525-6.
2. Torbicki A, Perrier A, Konstantinides S, Agnelli G, *et al.* Guidelines on the diagnosis and management of acute pulmonary embolism: The task force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC). Eur Heart J. 2008; 29(18): 2276-315.
3. Pruszczyk P, Torbicki A, Kuch-Wocial A, Pacho R. Heart 2001;85(6): 628-634. Diagnostic value of transoesophageal echocardiography in suspected haemodynamically significant pulmonary embolism.
4. Decousus H, Leizorovicz A, Parent F, Page Y, Tardy B, Girard P, *et al.* A clinical trial of vena caval filters in the prevention of pulmonary embolism in patients with proximal deep-vein thrombosis. Prevention du Risque d'Embolie Pulmonaire par Interruption Cave Study group. N Engl J Med 1998; 338: 409-15.
5. Eight year follow-up of patients with permanent vena cava filters in the prevention of pulmonary embolism: PREPIC (Prevention du Risque d'Embolie Pulmonaire par Interruption Cave) randomized study. Circulation 2005; 112: 416-42.