

EDITORIAL

Tough decisions in pulmonary embolism: thrombolysis or embolectomy?

Alphonsus Liew^{1,†} and Tamir Malley^{2,†*}¹CMR Unit, Royal Brompton Hospital, London, UK, and ²Charing Cross Hospital, London, UK

*Correspondence address. Charing Cross Hospital, Fulham Palace Rd, London W6 8RF, UK. Tel: +44-020-3311-1234; E-mail: tam.malley@doctors.org.uk

Patients presenting with acute pulmonary embolism (PE) and persisting haemodynamic instability need to be considered for primary reperfusion therapy with, commonly, thrombolysis or even surgical embolectomy [1]. Both treatment options can pose significant risks to the patient, but are potentially life-saving when used appropriately. Absolute contraindications to thrombolysis include cases where there is high risk of haemorrhage including previous haemorrhagic stroke, recent major surgery or trauma, recent gastrointestinal bleeding, central nervous system neoplasm or known bleeding diathesis [2]. In the presence of such contraindications, surgical embolectomy can be considered for intermediate to high and high-risk PE [1]. In clinical practice, the treatment decision is not always clear-cut and the 'European Society of Cardiology (ESC)' offers guidelines especially in situations where therapeutic options might be open to contention [1].

Two such cases recently published in the Journal provide an insight into the successful treatment of clinically challenging presentations of intermediate to high and high-risk PE, one using thrombolysis [3] and the other surgical embolectomy [4].

The first case, by Kostetskiy *et al.* [3], describes a fit and healthy 56-year-old gentleman undergoing surgical repair for an open fracture of his left tibia. Towards the final stages of the operation, the patient became hypoxic, tachycardic and profoundly hypotensive requiring inotropic support. His electrocardiogram tracing revealed new atrial fibrillation, right bundle branch block and central venous pressure measured at 35 mmHg. The main differential included PE and despite no imaging confirmation, the situation was 'considered life-threatening' and 'due to high risk of death' thrombolysis was undertaken [3]. The role of thrombolysis as a first-line treatment in massive PE is well established. It has been shown to improve

haemodynamic stability with respect to right ventricular (RV) dysfunction and pulmonary arterial pressure in the short term [5, 6]. However, it is associated with an increased risk of major haemorrhage (10%) and intracranial bleeding (1.7%) compared to anticoagulation alone [7–9]. Although recent surgery is an absolute contraindication to thrombolysis, the ESC guidelines state that 'most contraindications to thrombolysis should be considered relative in patients with life-threatening, high-risk PE' [1]. Kostetskiy *et al.* had a challenging decision to make: undertake thrombolysis in a patient with an unconfirmed but most certainly large PE perioperatively, or simply watch and wait? They decided to proceed with thrombolysis and ensured appropriate measures to reduce thrombolysis-related blood loss were taken, notably by applying a femoral tourniquet proximal to the operative site. The patient was saved by their intervention, with haemodynamic stability achieved and only a total blood loss of 300 ml, indicating that when no alternative therapy exists, thrombolysis even in patients with contraindications might be the appropriate life-saving therapy.

The second case by Namana *et al.* [4] reports the case of a 47-year-old female with a saddle embolus extending into both main pulmonary arteries causing RV dysfunction without haemodynamic instability. A decision was made to proceed with surgical embolectomy, following which she recovered well, with improving RV function and discharged home 6 days later. Interestingly, the ESC guidelines state that surgical embolectomy should normally be reserved for high-risk PE and for selected patients with intermediate- to high-risk PE when haemodynamic instability is imminent or if thrombolysis is contraindicated or has failed [1]. However, with improving outcomes following surgical embolectomy, clinicians are increasingly considering early surgical intervention [10–13]. This case

[†]Contributed equally to this editorial.

Received: June 27, 2016. Revised: July 11, 2016. Accepted: July 17, 2016

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raises a number of important questions. Firstly, should surgical embolectomy be considered as a first-line treatment in these patients? Secondly, does surgical embolectomy have advantages over thrombolysis? Thirdly, should early echocardiography be performed to assess for RV dysfunction in haemodynamically stable patients in order to expedite escalation of therapy and potentially surgical treatment?

Thrombolysis is associated with an increased risk of major haemorrhage, which becomes even more significant in submassive PE where the margin between improved mortality rates and increased bleeding complications is narrow [8]. However, surgical embolectomy has been associated with similar intracerebral bleeding rates but reduced major bleeding complications compared to thrombolytic therapy in the treatment of massive PE [14]. This appeal of reduced bleeding complications has made embolectomy an emerging first-line option in treating acute massive PE, and more recently submassive PE, despite the lack of recommendations from the ESC and American Heart Association [1, 2]. With such extensive thrombus as shown in figure 5 in the case by Namana *et al.* [4], thrombolysis is unlikely to attain complete clot lysis, and a significant proportion of these patients will have residual thrombus, placing them at risk of suboptimal initial benefit and chronic thromboembolic disease; potentially requiring further surgical intervention when clot extraction is more difficult, pulmonary hypertension is established and RV function is permanently impaired.

Patients with RV dysfunction and positive troponin are classified as intermediate to high risk according to the ESC [1] and should be considered for thrombolytic therapy to prevent haemodynamic collapse [1]. This is important because PE leading to RV strain and subsequent RV failure can rapidly result in death. Currently, the ESC recommends use of echocardiography in haemodynamically unstable patients [1], but no guidance is offered on the use of imaging in haemodynamically stable patients. The report by Namana *et al.* is a case in point with regard to the benefits of early echocardiography guiding management, in this case reperfusion with surgical embolectomy [4].

These two cases exemplify two important clinical scenarios in the treatment of PE. With regard to thrombolysis in high-risk PE, a careful and timely risk-benefit analysis is vital in determining whether an absolute contraindication, such as recent surgery, is likely to cause mortality or significant morbidity when proceeding with thrombolytic treatment. In terms of surgical embolectomy, while studies have found this to be an effective treatment for submassive PE [10, 12, 13], literature comparing thrombolysis and embolectomy in this subgroup of patients is lacking and randomized control trials are needed to compare these interventions. In addition, there may be an important role for early echocardiography in detecting RV dysfunction in order to best guide PE treatment.

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