

# Early Transoesophageal Echocardiography (TOE) in Cardiac Arrest: A Case Study

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## ABSTRACT

*We describe a case of abrupt cardiac arrest in an 80 year old woman. Emergent transoesophageal echocardiography (TOE) helped clarify the diagnosis of pulmonary embolism, and guide management and ongoing resuscitation. This case highlights the utility of TOE in the peri-arrest setting and in the diagnosis of massive pulmonary embolism. TOE can also be useful in providing prognostic information and determining the choice of therapeutic drug treatment and vasopressor support. (Critical Care and Resuscitation 2006; 8: 31-35)*

**Key words:** Cardiac arrest, pulmonary embolus, echocardiography

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Transoesophageal echocardiography (TOE) is increasingly utilised in intensive care units as a diagnostic tool in the setting of sudden haemodynamic instability. We report the case of a patient who suffered a cardio-respiratory arrest on a general medical ward, where TOE helped to guide resuscitation, diagnosis and management

## CASE REPORT

An 80 year woman with a past history of recurrent urinary tract infections, supraventricular tachycardia (SVT) and cholecystectomy presented to the emergency department with a two week history of fever, intermittent chest pain and night sweats. A mid-stream urine sample taken at her general practitioner's surgery 1 week previously had shown an elevated white cell count and she had been commenced on cephalexin, without improvement.

She was admitted under the care of an infectious diseases physician, who found no source for the fever. There was no history of recent travel, surgery, or thrombophilia. Admission observations included a pulse rate of 85 beats per minute (bpm), oxygen saturation on pulse oximetry of 95% on room air and a blood pressure (BP) of 150/80 mmHg. Chest auscultation was unremarkable

and her calves were nontender. Her initial blood tests showed a white cell count of 10300 cells/mm<sup>3</sup> (neutrophil count of 6980 cells/mm<sup>3</sup>). The electrocardiogram (ECG) showed sinus rhythm with no remarkable features and chest x-ray was non-diagnostic. Antibiotics were ceased on admission and a fever chart commenced. Blood, sputum and urine cultures were taken.

She remained afebrile during her hospital admission and on day 3 was due to be discharged for further investigation as an outpatient. However, prior to discharge she collapsed in the shower and was helped back to bed. She complained of mild chest pain and was diaphoretic. Observations revealed a pulse of 110 bpm, BP of 105/60 mmHg and Glasgow coma score (GCS) of 13. She rapidly deteriorated, with a decrease in systolic blood pressure to 60 mmHg and conscious state to a GCS of 10. An ECG showed deep S waves in lead II, 1 mm of ST elevation in lead III and 2 mm of ST depression in aVL. Shortly afterwards, her conscious state decreased further to a GCS of 3 with an unrecordable blood pressure. She was intubated, resuscitated with normal saline and intravenous adrenaline and was transferred to the intensive care unit (ICU).

Resuscitation continued in ICU whilst a TOE was performed urgently. The TOE revealed free floating clot in the right atrium (figure 1), clot in the IVC (figure 2) and hepatic vein, a distended akinetic right ventricle

(figure 3), tricuspid regurgitation (figure 4) pulmonary regurgitation (figure 5), an estimated pulmonary artery systolic pressure greater than 60 mmHg, sluggish flow in the pulmonary artery and an empty left ventricle.



Figure 1. Thrombus in right atrium.

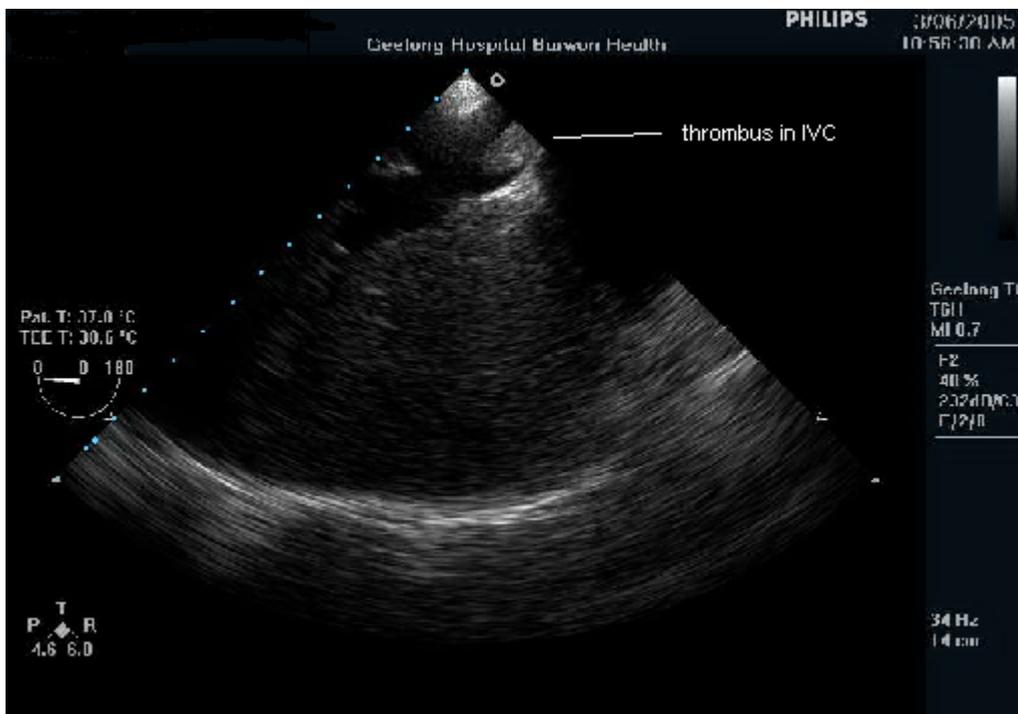


Figure 2 Inferior vena caval thrombus.

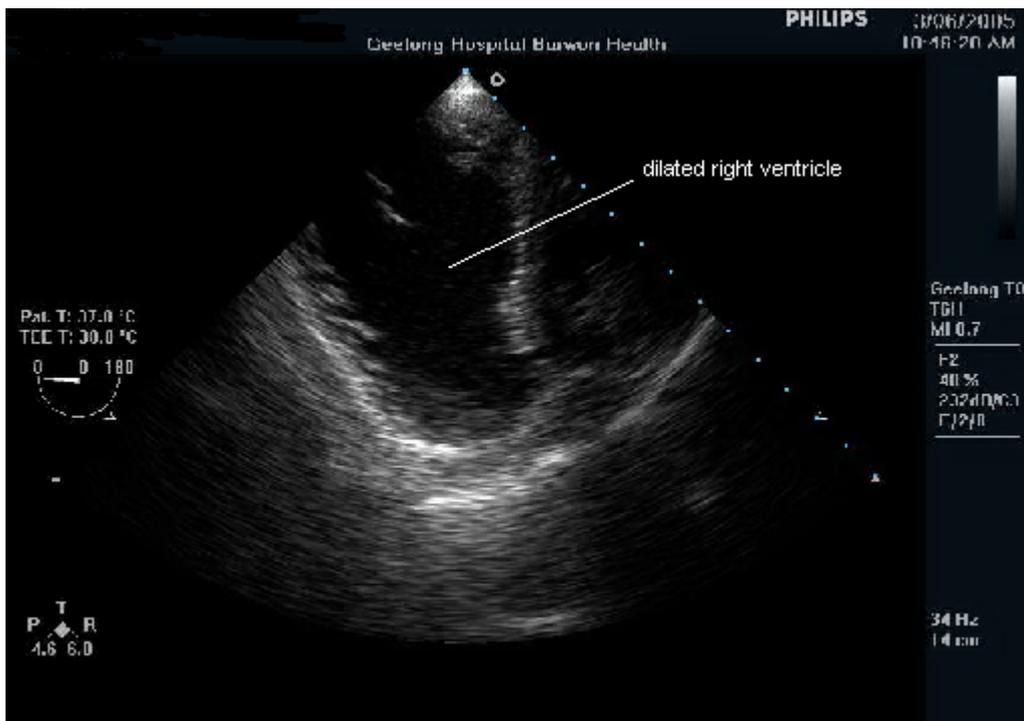


Figure 3. Dilated right ventricle.

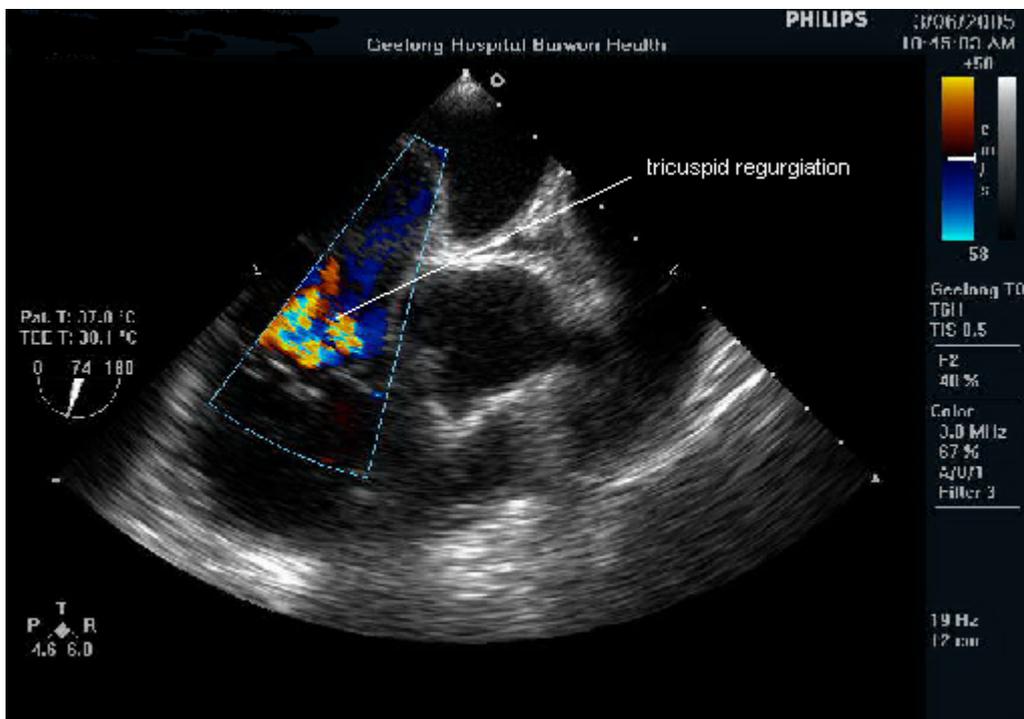


Figure 4. Tricuspid regurgitation.

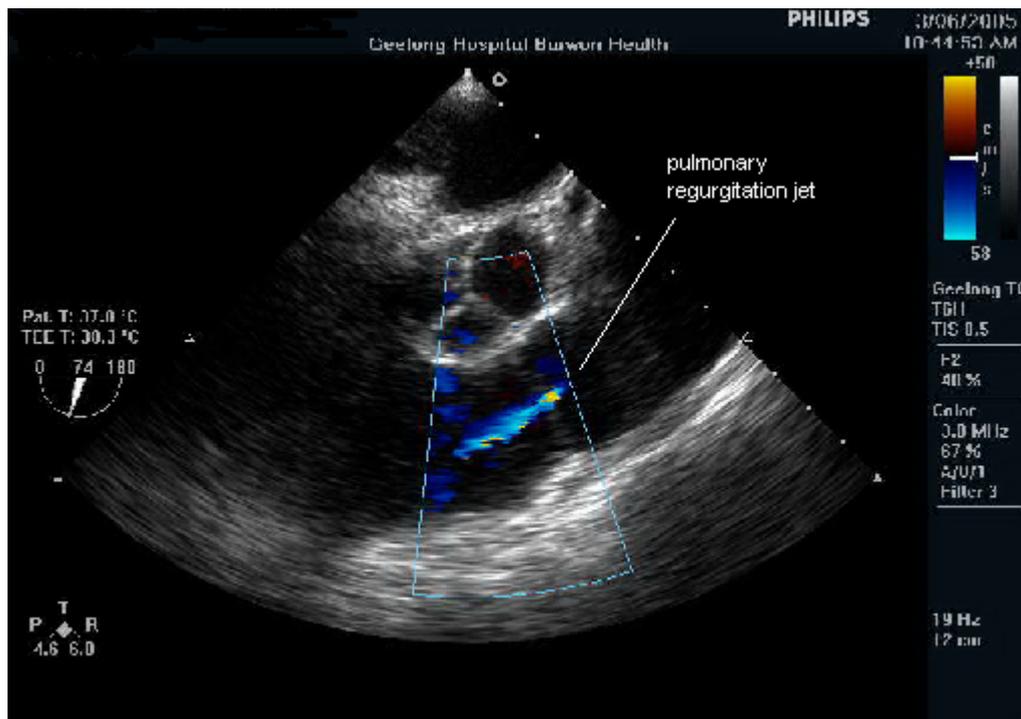


Figure 5. Pulmonary regurgitation jet

A single bolus of intravenous recombinant tissue plasminogen activator (reteplase [rapilysin], 10 IU, Roche pharmaceuticals, NSW, Australia) was given without any improvement in clinical condition. Urgent pulmonary embolectomy was considered, but with prolonged severe haemodynamic instability requiring ongoing cardiopulmonary resuscitation (CPR) and escalating inotropic requirements, the decision was made to cease ongoing resuscitation and the patient died shortly after. A D-dimer level from a blood sample taken during the arrest was grossly elevated at 1652  $\mu\text{g/L}$  (Normal < 200  $\mu\text{g/L}$ ).

## DISCUSSION

The utility of TOE as a rapid, relatively non-invasive, diagnostic tool makes it useful in the setting of sudden cardiorespiratory deterioration or arrest. TOE is able to accurately and rapidly identify many of the causes of circulatory collapse.

The accuracy of echocardiography in diagnosing pulmonary embolism (PE) has been estimated up to 80% sensitivity and 97% specificity,<sup>1</sup> which compares favourably to spiral CT pulmonary angiography (sensitivity up to 97.5%, specificity 90.1%)<sup>2</sup> and contrast pulmonary angiography (sensitivity up to 96% specificity 99%).<sup>3</sup> The advantages of TOE in the haemodynamically unstable patient are threefold.

1) The first is the rapidity of TOE as a diagnostic tool, the ability to get images within minutes allows early

diagnosis and institution of therapies aimed at reversing pathology, such as thrombolysis for PE, or angiography for myocardial ischaemia.

- 2) The second is the portability of TOE. The ability to bring the diagnostic tool to the patient prevents the risks of moving unstable patients to remote locations and allows ongoing management in an ICU setting.
- 3) The third advantage is haemodynamic information in addition to diagnostic information. This includes assessment of left and right ventricular systolic function, left ventricular diastolic function, preload and valve function.

The most specific echocardiographic signs of PE are: clot in the pulmonary arterial tree (specificity up to 100%), regional right ventricular dysfunction in which the apex is spared (sensitivity 77%, specificity 94%),<sup>4</sup> and free floating thrombus in the right atrium (positive predictive value up to 97%).<sup>5</sup> Floating right heart thrombi are uncommon (approximately 3.7% of patients with pulmonary embolism),<sup>5</sup> but are associated with a mortality of up to 45%. Right ventricular dysfunction has been shown to improve after thrombolysis, but this has not yet been linked to a mortality benefit.<sup>6</sup> TOE can also help stratify these patients into prognostic groups.<sup>7,8</sup> Right ventricular dysfunction in particular is a poor prognostic sign, and this finding alone is associated with a doubling of the risk of adverse outcomes.<sup>9</sup>

The differential diagnosis of cardiac arrest are many

and several of the common causes are outlined in table 1.

**Table 1. Causes of cardiac arrest visible on transoesophageal echocardiography**

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Acute myocardial infarction  
 Pulmonary embolism  
 Myocarditis/pericarditis  
 Cardiac tamponade  
 Acute valvular insufficiency  
 Haemorrhage/hypovolaemia  
 Ventricular rupture  
 Right/left ventricular failure

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We would submit that TOE is useful in clarifying these causes and is possible whilst ongoing resuscitation continues. In this case the key decision was distinguishing massive pulmonary embolism, which may benefit from thrombolysis or embolectomy,<sup>10,11</sup> from myocardial infarction, best dealt with via angiography.<sup>12</sup> It is also possible using TOE to monitor the response to resuscitation and guide ongoing management decisions regarding fluid, inotrope and vasopressor support. TOE has an excellent safety profile, with a serious complication rate estimated at less than 1 in 5000.<sup>13</sup>

In summary this case demonstrates the role of TOE as a diagnostic tool in the setting of chest pain and cardiorespiratory arrest. The establishment of a diagnosis in the acute setting enabled guided management, and avoidance of unhelpful and harmful therapies.

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