



Royal Australasian College of Surgeons

# Australian and New Zealand Audits of Surgical Mortality

## **ANZASM Case of the Month** **October 2024 Edition**

*(case selected by the ANZASM Committee for your information)*

### **Adverse outcome after prolonged bypass and cross-clamp times**

#### **Cardiothoracic Surgery**

##### **Case Summary**

A patient aged early 60s presented to the emergency department with chest pain and was diagnosed with non-ST-elevation myocardial infarction (MI). Significant comorbidities included type I diabetes, smoking and a previous cerebrovascular accident (CVA) resulting in residual ataxia and instability.

The patient underwent urgent coronary angiography, which showed severe diffuse triple vessel coronary disease with no clear culprit lesion. The patient was medically stabilised with dual anti-platelet therapy, intravenous heparin and non-invasive respiratory support, resolving the chest pain.

A transthoracic echocardiogram 2 days later showed near normal left ventricular size and function. The patient initially declined coronary artery bypass graft (CABG)—not being a good candidate for percutaneous coronary intervention—but following further discussion, agreed to proceed with the operation. Extensive work-up showed bilateral stenoses (50–69%) with preserved left ventricular function. There was a degree of chronic renal impairment and chronic obstructive pulmonary disease.

The patient underwent CABG x 6 on day 12. The operation took 5 hours, with prolonged cardiopulmonary bypass and cross-clamp times. The patient was extubated about 12 hours post-procedure and the initial postoperative course was uncomplicated. The patient was transferred to the ward on postoperative day 5. Episodes of paroxysmal atrial fibrillation occurred, which were managed medically including administration of warfarin. The patient required ongoing rehabilitation and mobility assistance due to the previous CVA and sternal precautions.

On postoperative day 11, the patient vomited and complained of shortness of breath. Vital signs appeared normal; however, nasal prong oxygen for mild desaturation was required. The patient was charted calcium carbonate to treat high phosphate levels. No other changes

were made or concerns identified. (The morning blood pathology had indicated worsening renal failure, with potassium at 5.7 mmol/L.)

An advanced life support call was made at 6:05 pm for asystole. An ECG performed prior to this demonstrated junctional bradycardia of 40 beats per minute. Cardiopulmonary resuscitation was instituted, with some return of spontaneous circulation. The interim diagnosis was asystole due to hyperkalaemia. Potassium of 7.2 mmol/L was noted on the initial arterial blood gases, with profound metabolic acidosis (pH 6.98; lactate 8.1 mmol/L). The patient was transferred to ICU for urgent dialysis but had ventricular fibrillation 2 hours later. Resuscitation was unsuccessful.

### **Discussion**

This high-risk patient was unable to have percutaneous coronary intervention due to diffuse disease. Significant risk factors were present: smoking with chronic airways limitation, diabetes and recent unstable angina pectoris following acute MI.

The angiography report showed significant left anterior descending artery disease and first diagonal artery disease. There was moderate disease in the circumflex artery and right coronary artery with reasonable left ventricular function.

The patient underwent a standard CABG operation employing the left internal mammary artery and long saphenous vein as conduits. Aortic cross-clamp with cardioplegia was employed for myocardial preservation. The cardiopulmonary bypass and cross-clamp times were prolonged, notwithstanding the 6 CABG procedures performed. The wean from bypass was uneventful, with modest standard support.

Given the patient's comorbidities, perhaps more limited surgery and targeted revascularisation with grafts to the major vessels may have been an alternative. It may have been preferable to limit the bypasses to 3 or 4, rather than 6. The postmortem report noted a thrombus in one of the graft vessels.

It seems that a combination of the recent acute MI and extended bypass and cross-clamp times was a major contributor to the adverse outcome. Grafting the small diagonal vessels probably had a limited positive effect on the outcome but was detrimental in prolonging surgery time. Limiting the cross-clamp time may have offered better myocardial protection.

While the early recovery was uneventful, the patient's demise was probably secondary to chronic congestive heart failure, multiorgan failure and likely terminal arrhythmia. The postmortem report of lateral left ventricular infarct with thrombus in the first diagonal artery graft may have occurred either pre- or postoperatively.

The cardiothoracic team was not initially informed of a deterioration in the patient's condition on postoperative day 11. If the cardiothoracic service registrar had been asked to review the patient earlier that day, the patient could have been moved to a higher level of care for monitoring/assessment. The significance of a raised serum potassium in a patient with renal failure may have been noted.

Although the patient's early recovery was progressing, it is not unexpected that multiorgan failure occurred together with acute deterioration. CABG was always a significant risk for

this patient, given the preoperative comorbidities and recurrent unstable angina pectoris after recent acute MI.

### **Clinical Lessons**

It is well known that in patients with recent unstable angina pectoris, acute MI and significant risk factors, longer cardiopulmonary bypass and aortic cross-clamp times increase mortality and morbidity. This can emerge after initial survival post-procedure. More limited and targeted revascularisation with grafts to the major vessels, and shorter cardiopulmonary bypass and cross-clamp times may have improved the outcome.

Communication with the cardiothoracic team about the patient's acute deterioration and worsening renal failure was delayed, limiting the opportunity to act pre-emptively. The consultant was only informed of events an hour after resuscitation was underway. Earlier contact may have facilitated a changed care plan.

Each surgeon has their own approach and tolerance for risk. Although complete revascularisation was theoretically achieved (except for the thrombus in one graft/vessel), sometimes less is more in high-risk patients.

### **Disclaimer**

Please note that these cases are edited from ANZASM first- or second-line assessments that have been generated by expert surgeons in the field. Any recommendations relate to these cases as they were presented.