Chest compressions for a patient in cardiac arrest after penetrating trauma with a knife still in situ

Thomas McCarthy, Bozena Lassota-Korba, Tony O'Leary, Richard Knight, Paul Murphy, Rajesh Pandey

A 45-year-old man was brought by ambulance to the emergency department. He was in shock, with a knife handle protruding from his abdomen. His pulse became undetectable. With the knife still in situ, external cardiac massage was provided on immediate transfer to the operating theatre. Resuscitation and haemostasis were achieved and the patient was eventually discharged from hospital. This case report discusses the risks of chest compressions for trauma patients with a penetrating weapon still in situ.

The patient had deliberately driven into a tree with a knife poised over his abdomen. Spontaneous ventilation was noted and a pulse was initially palpable but blood pressure was not measurable. A 6 inch knife handle was protruding vertically from the abdomen at the left subcostal margin. Glasgow Coma Score was 5/15.

Two large bore intravenous cannulae were sited and warm Gelofusin commenced. A decision was made to intubate the patient and then transfer him to the operating theatre. After rapid sequence induction, an endotracheal tube was sited and bilateral air entry confirmed.

After intubation a central pulse became undetectable. The electrocardiogram (ECG) showed a sinus tachycardia. Chest compressions at a rate of 100/min were immediately started, while the knife handle was held steady. A intravenous bolus of 1 mg adrenaline was given and the patient was immediately transferred to the theatre with chest compressions continuing en route.

Ninety seconds later, on arrival in theatre, the chest compressions were stopped and return of spontaneous circulation with a blood pressure of 82/42 mm Hg was noted.

SURGICAL INTERVENTION

Haemostasis was achieved after laparotomy and then thoracotomy. The knife, with an 8 inch non serrated blade and 1¼ inches wide at the base, was removed under direct vision. A penetrating injury to the stomach was repaired, the splenic vessels were ligated and distal pancreatectomy, left adrenalectomy and splenectomy were performed.

During the course of the laparotomy, the anaesthetist noted decreased air entry and expansion in the left hemithorax. A left chest drain was placed

and immediately drained 500 ml blood. A left thoracotomy was then performed. No lung injury was found but copious bleeding from the intercostal vessels between the 10th and 11th left posterior ribs was controlled.

ANAESTHETIC MANAGEMENT

General anaesthesia was maintained. A double lumen endotracheal tube was placed for the thoracotomy. Colloid and blood products were transfused to balance blood loss of 3200 ml from the left chest drain and 3000 ml from the abdomen. Blood pressure was maintained around 90/45 mm Hg.

OUTCOME

After a 41 day stay in the intensive therapy unit, which was complicated by ventilator-associated pneumonia and a gastric leak, the neurological outcome was normal and the patient was discharged to the psychiatric unit.

DISCUSSION

Outcome in pulseless patients with penetrating trauma is poor, at 2.6%.¹ Literature searches yielded no evidence on management of a pulseless patient with a knife retained in the upper abdomen. A patient with pulseless electrical activity after penetrating thoracic trauma may warrant a thoracotomy in the emergency department.² The rationale for performing laparotomy before the thoracotomy and the benefit versus risk of chest compressions is now discussed.

As the knife was retained in the abdomen at the left subcostal margin the surgeon performed a laparotomy first to inspect the course of the knife. Thoracotomy was later performed when the anaesthetist inserted a left intercostal chest drain, which immediately drained 500 ml blood. This hae-

mothorax was not clinically evident on arrival. Also, the accident and emergency department in our general hospital is not suitable for a thoracotomy. There is inadequate space and light.

Advanced life support resuscitation guidelines (UK) recognise hypovolaemia as a reversible cause of cardiac arrest and state chest compressions and ventilation should be given with minimal interruptions until the underlying cause is resolved, but do not specifically mention trauma.³

Alternatively, advanced trauma life support guidelines state that closed heart massage is ineffective in a hypovolaemic patient.² Loss of cardiac output in penetrating trauma may be caused by haemorrhage, tension pneumothorax or cardiac tamponade. Chest compressions will help none of these because the heart is unable to fill during relaxation. Also, a proportion of any cardiac output that is gained from chest compressions will be lost via traumatised vasculature.

The surgeon in this case thought the injuries were caused by the initial knife wound and not compounded by chest compressions. However, the medial edge of the knife blade was in proximity to the aorta and this could well have been penetrated.

With ongoing chest compressions a further dilemma is whether to remove the knife or not. Leaving the knife in place may risk trauma to adjacent and intact vessels and viscera while removing the knife may loose any tamponade effect. Also, it will be helpful for the surgeon to be able to inspect the course of the knife if it is left in place until the operation.

A telephone survey of consultants in all emergency departments in the Mid Trent Critical Care Network confirmed that all six would perform chest compressions in this situation. Five of the six said they would leave the knife in situ. One said they might remove the knife if they thought the chest compressions were compounding a vascular injury.

The loss of pulse in our patient may have been related to the negative inotropy and vascular dilatation of the anaesthetic induction agent, as well as to exsanguination. In future, induction in the operating theatre with the surgeon scrubbed and ready would be considered.

In summary, this case highlighted a dilemma between providing chest compressions to maintain perfusion to central organs, versus the risk of worsening the injury. The full recovery of our patient suggests the chest compressions were justified.

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Authors' affiliations

Thomas McCarthy, Bozena Lassota-Korba,
Tony O'Leary, Richard Knight, Paul Murphy,
Rajesh Pandey, Pilgrim Hospital, Boston,
Lincolnshire, UK

Correspondence to: Dr Thomas McCarthy,
Pilgrim Hospital, Sibsey Rd, Boston,
Lincolnshire, PE21 9QS, UK;
tmccarthy@doctors.org.uk

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Images in emergency medicine

Venous gangrene secondary to an aorto-caval fistula

Vijay Naraynsingh, Michael J Ramdass

We report the unusual case of a 60-year-old-man presenting with left lower limb venous gangrene caused by an aorto-caval fistula. There was associated bilateral lower limb and scrotal oedema. In this case a ruptured aortic aneurysm with acute fistulation into the vena cava (fig 1) was repaired in the conventional manner. However, the patient underwent above-knee amputation of irreversible venous gangrene.

Venous gangrene is typically caused by ilio-femoral thrombosis, whereas aorto-caval fistulation is a rare occurrence with only 250 cases reported. The diagnosis of an aorto-caval fistula can be missed if meticulous examination of the abdomen is not done, especially for a pulsatile mass and a bruit which is associated with an

aorto-caval fistula. We hope this case will help our colleagues to consider this diagnosis when a case of venous gangrene is encountered.

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Authors' affiliations

V Naraynsingh, M J Ramdass, Department of Surgery, Medical Associates Hospital, Trinidad, West Indies

Correspondence to: Michael J Ramdass, Medical Associates Hospital, Cor. Albert & Abercromby Streets, St Joseph, Trinidad, West Indies; jimmyramdass@gmail.com

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Figure 1 Ruptured aortic aneurysm with acute fistulation into the vena cava.