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Case Report

CASE REPORT

Major liver trauma post-mechanical cardiopulmonary resuscitation—the first reported case of survival with normal cardiovascular and neurological outcome

P. Sharma* and C. Hernandez-Caballero

Royal Brompton and Harefield NHS Foundation Trust, Harefield Hospital, Hill End Road, Harefield UB9 6JH, UK

*Correspondence address. Royal Brompton and Harefield NHS Foundation Trust, Harefield Hospital, Hill End Road, Harefield UB9 6JH, UK. E-mail: pranev.sharma@doctors.org.uk

Abstract

Cardiopulmonary resuscitation (CPR) is often conducted with mechanical devices, such as Lund University Cardiac Arrest System in the setting of cardiac arrest during coronary catheterization, to enable effective chest compressions for a prolonged period. Certain injuries from such devices are common such as skin lesions, sternal and rib fractures. Others are rarer, such as visceral injury to the heart, major vessels, lung, liver, spleen and stomach. Major liver injuries have been previously reported but were universally fatal. Here, we report the first case of a capsular liver tear post-mechanical CPR, requiring immediate laparotomy and primary repair, resulting in patient survival with a normal cardiovascular and neurological and outcome.

INTRODUCTION

FAST is an acronym for focused assessment with sonography for trauma and its performance is thoroughly described by the American Institute of Ultrasound in Medicine and the American College of Emergency Physicians. In the last decade, FAST has become a very useful tool in the assessment of patients with blunt abdominal trauma, because it is a highly sensitive, non-invasive technique that allows a rapid recognition of intra-peritoneal bleeding in hypotensive patients who need an emergency laparotomy. This would include trauma post-cardiopulmonary resuscitation (CPR), where injuries to abdominal viscera would result in free intra-peritoneal fluid in the most dependent areas.

In expert hands, this technique should not take more than 2 minutes to complete.

CASE REPORT

A 54 year-old man with no past medical history was brought to hospital with cardiac sounding chest pain and an electrocardiogram revealing ST elevation in leads II, III and aVF. He was taken for immediate primary coronary intervention for an inferior segment elevation (ST) elevation myocardial infarction via right radial approach. During diagnostic imaging of his left mainstem artery, he suffered a Ventricular Fibrillation (VF) cardiac arrest on table. He had immediate CPR by hand and then the Lund University Cardiac Arrest System (LUCAS) device was used. He required a total of five shocks in order to restore spontaneous circulation. His total downtime was approximately 10 minutes. During CPR, coronary angiography continued and he was found to have a right coronary artery culprit lesion, which was successfully treated with primary percutaneous coronary

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intervention (drug-eluting stent). At the end of his procedure, arterial blood gases showed an Hb of 69 g/l, significantly lower than his admission Hb of 112 g/l. However, this was in the context of 3 l of IV fluid during the resuscitation and angiogram. Repeat formal laboratory blood tests were requested as well as cross-match.

He was then transferred to the intensive care unit for ongoing post-resuscitation care. Within minutes of arrival to the intensive care unit, he became significantly more haemodynamically unstable, requiring large doses of vasopressor to maintain blood pressure. Repeat arterial blood gas testing revealed an Hb of 45 g/l, at which point a peri-arrest call was put out. Clinically, he had a clear chest, normal heart sounds but a distended abdomen. He received hypovolaemic shock treatment, with fluids and blood transfusion. A bedside FAST scan was conducted, in the setting of a patient with shock and acute abdominal distension after cardiopulmonary resuscitation. In the hepatorenal recess view, free fluid was observed in Morison's space with a varying degree of echogenicity. This finding was highly suggestive of an acute intra-peritoneal bleed, and in the context of recent CPR, a liver laceration was suspected.

He was taken for immediate laparotomy, which revealed a grade III liver haematoma, according to the American Association for the Surgery of Trauma liver trauma classification (intra-parenchymal hematoma of more than 10 cm). A definitive primary hepatic surgical repair was performed, and the patient was transferred back to the intensive care unit for supportive care.

Despite the history of a cardiac arrest and peri-arrest a few hours later, with haemorrhagic shock from liver trauma, he showed good neurological signs on sedation hold in the intensive care unit. His organ support was gradually weaned off, and he was discharged from the intensive care unit 5 days after initial admission and from hospital 4 days later. Echocardiography showed globally preserved systolic function with an ejection fraction of 59% and mild diastolic dysfunction. He made a full functional neurological recovery.

DISCUSSION

The best predictors of prognosis after cardiac arrest are time without spontaneous circulation (known as downtime) and quality of CPR. Devices such as LUCAS are designed to deliver good quality chest compressions at an effective rate and depth. Whilst there is a lack of evidence showing its superiority to manual chest compressions, its use is undeniably helpful in situations where a prolonged downtime might be expected. Such situations would include acute myocardial infarction as the cause of cardiac arrest, where urgent left heart catheterization and coronary reperfusion is required, whilst CPR is in progress.

All forms of chest compressions can result in trauma. There is some evidence to suggest a higher incidence of rib fractures with mechanical CPR [1], whilst other studies have found no overall difference in injury rate [2]. Meta-analysis data have shown no overall difference in adverse events [3].

There is a paucity of data available on exact rates of complications from CPR, be it mechanical or manual, but the reported incidence of liver injury ranges from 0.6 to 2% [1, 4]. There are isolated reports of patients obtaining return of spontaneous circulation but subsequently dying from a liver injury sustained from CPR [5–7]. Survival with good neurological outcome after liver injury sustained from mechanical CPR has only been reported once before to our knowledge [8] and that too from less severe injuries than we report, as surgery was not required. In contrast, there are multiple reports of survival from liver injuries induced by manual CPR [4]. Whilst this is only case-report-level evidence, there may be some logic behind a higher force of trauma sustained from mechanical CPR and therefore lower survivability.

To our knowledge, our case is the first reported survivor of major liver trauma sustained after mechanical CPR requiring surgical treatment with normal cardiovascular and neurological outcome. It is also important to acknowledge this case did not deal with an injury to the liver parenchyma resulting in failure of synthetic liver function, and this patient had swift treatment of his injury. These factors would have also contributed to the favourable outcome and may be more challenging to reproduce in other clinical centres.

We re-emphasize the need for all patients undergoing CPR, particularly mechanical CPR, to have close monitoring of vital signs, Hb and lactate in the immediate post-resuscitation period. Should there be a dramatic fluctuation, liver injury is one of the differential diagnoses to be considered.

FAST is a rapid, safe and non-invasive technique that all intensivists should be familiar with independently of their area of specialization. In our cardiothoracic unit, where trauma is extremely rare, the use of this tool allowed for a rapid diagnosis of an infrequent life-threatening complication that is usually fatal if not detected promptly.

CONFLICT OF INTEREST

No conflict of interests.

FUNDING STATEMENT

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ETHICS STATEMENT

Not applicable.

CONSENT

Written consent was granted by the patient for anonymous publication as a case report.

GUARANTOR

Dr Pranev Sharma.

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