

## CASE REPORT

# Unexpected bleeding after cardiopulmonary resuscitation

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## Abstract

Avulsion of the gallbladder is an uncommon complication after cardiopulmonary resuscitation. It has never been reported before. Cardiopulmonary resuscitation is frequently associated with complications such as rib and sternal fractures. Visceral structures are less affected. Abdominal organs might be injured, most frequently due to fractured ribs and/or the sternal bone.

We report on a patient who suffered a circulatory arrest. After cardiopulmonary resuscitation, he developed haemorrhagic shock. Major abdominal bleeding was detected by CT imaging, principally in the upper right quadrant. Emergency laparotomy was performed. The bleeding was found to be caused by an avulsion of the gallbladder secondary to cardiopulmonary resuscitation. Haemodynamic instability after cardiopulmonary resuscitation is not always caused by cardiogenic shock. It is important to be aware of the possibility of traumatic abdominal laceration and bleeding. Early diagnostic measures and emergency surgery can be lifesaving.

## Introduction

A successful cardiopulmonary resuscitation can cause severe side effects. Due to high pressure during chest compression and anticoagulant therapy in cardiac patients, serious complications can occur.<sup>1</sup>

Thoracic complications are more common than abdominal complications, as a result of chest compressions. Some examples are aortic dissection, tracheal rupture, and pulmonary and myocardial contusions. Furthermore, haemothorax and pneumothorax can occur secondary to costal fractures. However, the upper abdominal organs are also at risk due to fractures of the lower ribs or misplaced compressions under the xiphoid process.<sup>2</sup>

A complication of cardiopulmonary resuscitation that has never been described is an avulsion of the gallbladder. On the

basis of this case report, we will discuss the complications of cardiopulmonary resuscitation and the importance of rapid and multidisciplinary treatment.

## Case history

An 85-year-old man was admitted to hospital for an infected knee prosthesis. He had a medical history of hypertension, ischaemic cerebrovascular accident and an aortic endoprosthesis for an abdominal aortic aneurysm. He had undergone recent operations for gonarthrosis. Five days before admission, he discontinued his anticoagulants because of elective surgery.

One day after admission, the patient was about to undergo surgery on his infected knee, but he became unwell in the preparation room. His temperature rose suddenly, associated with hypotension and bradycardia. Other symptoms were absent. It was thought to be a septic shock, as a result of his infected knee prosthesis. The hypotension did not respond to a fluid challenge. Antibiotics were administered and another fluid challenge was given, without any result.

Because of haemodynamic instability, his surgery was cancelled. Just before transport to the intensive care unit (ICU), the patient developed asystole and cardiopulmonary resuscitation was initiated on the basis of a pulseless electric activity. After ten minutes of compressions and three injections of 1 mg of adrenaline, sinus rhythm and a cardiac output returned. In the ICU, cardiopulmonary resuscitation was necessary again because of pulseless electric activity: after 25 minutes of compressions and a total of 8 mg of adrenaline, the patient had a cardiac sinus tachycardia and adequate output.

However, the patient remained haemodynamically unstable and his abdomen seemed to distend. At that moment, his haemoglobin level was 3.8 mmol/l (preoperative haemoglobin level 7.2 mmol/l). He received five units of packed red blood

cells, two units of fresh frozen plasma, combined with continuous infusion of high doses of noradrenaline, adrenaline and enoximon after which the patient appeared to stabilise. Because of a high suspicion of an intra-abdominal bleeding, an ultrasound of the abdomen was performed; a large amount of free fluid was seen, without a focus of bleeding. An emergency CT angiography (CTA) was performed, imaging the aortic endoprosthesis: major bleeding, mainly in the right upper abdomen, and some lacerations of the liver were detected. There seemed to be no relation with the aortic endoprosthesis, nor could any other focus of bleeding be found. It was decided to perform an emergency laparotomy.

During surgery, six litres of blood were evacuated from the abdominal cavity. Upon further inspection, the source of bleeding was detected: the gallbladder was found posterior to the liver and was avulsed from its liver bed. This had resulted in major venous bleeding. A cholecystectomy was not performed, but the haemorrhagic focus was covered with a haemostatic patch. The gallbladder was compressed against the liver bed, using gauze. Eventually, the bleeding stopped.

Postoperatively, the patient remained hypotensive with a low haemoglobin level of 3.2 mmol/l, despite of high doses of adrenaline, noradrenaline and blood transfusions. Given the very poor prognosis, it was decided to cease treatment. The next day, the patient died, due to his persistent haemorrhagic and septic shock. Unfortunately, no autopsy was performed.

## Discussion

It has been reported in earlier studies that complications after cardiopulmonary resuscitation occur in approximately 21-65% of all cases.<sup>1</sup> Frequent complications are rib and sternal fractures (13-97%). Although damage to the abdominal organs after resuscitation is rare, these injuries are mainly caused by rib and/or sternal fractures, which can lead to ruptures and perforations. The upper abdominal organs are most likely to be damaged due to their anatomical position. A rupture of the liver and other traumatic abdominal injury after resuscitation are described in approximately 0.6 to 3% of (postmortem) studies.<sup>1-4</sup>

An avulsion, in which the gallbladder is partially or completely torn from the liver bed, is very rare and has never been described after resuscitation. A partial avulsion of the gallbladder is a condition in which the cystic duct and the artery are still intact, in contrast to complete avulsion, in which the gallbladder is located separately in the abdomen. In that case, rapid diagnosis is necessary.<sup>5-7</sup>

In our case, the gallbladder was probably avulsed from the liver bed by compressions on the sternum during resuscitation. This caused major venous bleeding, but left the liver unaffected. However, there was no evidence for rib or sternal fractures. Other potential causes of bleeding from the gallbladder

are blunt abdominal trauma, malignancy, haemorrhagic cholecystitis, vascular malformations such as an aneurysm, the use of anticoagulants or ectopic pancreatic or gastric mucosa.<sup>5,8-10</sup> A long-standing cholecystitis, as a cause of a gallbladder perforation with bleeding, seems very unlikely in this case and the other causes had been discarded based on the clinical indications and CT imaging.

## Diagnosis and treatment

Symptoms of haemodynamic instability are a common finding in patients during or after cardiopulmonary resuscitation. However, in some cases they indicate other pathology, such as major abdominal bleeding. Rapid diagnosis is essential. An ultrasound of the abdomen can easily and quickly be performed to identify free fluid. If arterial bleeding is suspected, a CTA followed by endovascular intervention is mandatory. In a major intra-abdominal haemorrhage, as in this case, emergency laparotomy is essential.<sup>5,8,10</sup>

## Conclusion

Haemodynamic instability after resuscitation is not always caused by myocardial dysfunction or infarction. When a patient becomes unstable after an apparently successful resuscitation, it is necessary to consider the possibility of intra-abdominal bleeding as a result of the resuscitation. Early diagnostic measures and emergency surgery can be lifesaving.<sup>5,8,10</sup>

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