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Case Report

When life-saving measures lead to trauma: Subcapsular hepatic hematoma after CPR ☆

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ABSTRACT

Cardiopulmonary resuscitation (CPR) is a critical intervention for cardiac arrest but can result in significant internal injuries due to the force of chest compressions. Among these, subcapsular hepatic hematoma is a rare and serious complication. Here we present a 55-year-old male with a history of alcohol abuse presented with a severe ischemic stroke and subsequently required CPR due to pulseless ventricular tachycardia. Following resuscitation, the patient developed a subcapsular hepatic hematoma, likely caused by the trauma of chest compressions. The patient also had a complex clinical course involving hemorrhagic conversion of the stroke and the need for anticoagulation due to bilateral pulmonary emboli, which further complicated the management of the hepatic hematoma. The identification of the hematoma was achieved through contrast-enhanced CT imaging after the patient exhibited worsening abdominal discomfort and signs of internal bleeding. The management focused on balancing the need for anticoagulation with the risks of further bleeding from the hematoma. A multidisciplinary approach was essential, involving close monitoring, potential surgical intervention, and careful adjustment of anticoagulant therapy. This case emphasizes the importance of recognizing the potential for internal injuries following CPR, especially in patients requiring anticoagulation. Early detection through imaging and a coordinated, multidisciplinary approach are crucial in managing such complications and improving patient outcomes.

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Introduction

Cardiopulmonary resuscitation (CPR) is a critical life-saving intervention designed to maintain circulatory flow and oxygenation in patients experiencing cardiac arrest [1]. The primary goal of CPR is to preserve brain function and prevent death by manually compressing the heart to circulate blood to vital organs [2]. While CPR is essential in emergencies, the procedure itself can lead to significant complications due to the forceful nature of chest compressions required to maintain circulation [3].

Complications from CPR are not uncommon and can range from minor injuries to severe trauma [4]. Rib fractures are among the most frequently observed injuries, occurring in a significant percentage of patients who undergo CPR [5]. These fractures can lead to further complications, such as pneumothorax or damage to internal organs [6]. In addition to skeletal injuries, CPR can also cause damage to internal structures, including the lungs, heart, and abdominal organs, as the force of compressions is transmitted through the chest and abdomen [7].

The severity of CPR-related complications often depends on factors such as the duration of resuscitation, the intensity of compressions, and the patient's underlying health conditions [3]. While the immediate focus of CPR is to save lives, the potential for traumatic injuries emphasizing the need for careful postresuscitation assessment and management [8]. Understanding the spectrum of CPR-related complications is crucial for optimizing patient outcomes and minimizing the risk of long-term harm [7].

Case presentation

A 55-year-old male with a history of alcohol abuse was found unresponsive by his family and presented to the emergency department (ED) with acute onset of left-sided weakness, dysarthria, and urinary incontinence. On arrival, his National Institutes of Health Stroke Scale (NIHSS) score was 21, indicating severe stroke symptoms. Initial noncontrast computed tomography (CT) of the head showed no acute intracranial pathology, but a computed tomography angiography (CTA) of the head and neck revealed a distal right middle cerebral artery (MCA) M1 occlusion.

Given the severity of his presentation, the patient underwent emergent mechanical thrombectomy, as thrombolytic therapy was contraindicated due to the extended time since symptom onset. Angiogram during the thrombectomy confirmed the CTA findings (Fig. 1). Post-thrombectomy, the patient was admitted to the neuro ICU, where he exhibited significant agitation and symptoms of alcohol withdrawal, managed with a Clinical Institute Withdrawal Assessment (CIWA) protocol and scheduled phenobarbital. On the fifth day of hospitalization, the patient developed a hemorrhagic conversion of his stroke, complicating the clinical course and requiring a careful reassessment of his treatment plan (Fig. 2).

Several days later, the patient experienced acute respiratory distress leading to a code blue, during which he went into pulseless ventricular tachycardia (VT) and required CPR, including chest compressions and defibrillation. Following this event, imaging studies revealed bilateral pulmonary emboli (Fig. 3) with right heart strain, multiple rib fractures, and a chest wall hematoma. Additionally, a large subcapsular hepatic hematoma (Fig. 4) was identified on a subsequent CT scan, likely related to the chest compressions performed during the resuscitation efforts. Despite multiple interventions, the patient's condition continued to deteriorate, and he ultimately succumbed to his injuries after further episodes of cardiac arrest.

Fig. 1 – Angiogram (coronal view) originating in the right carotid artery demonstrating a thrombus occluding the right distal MCA (red arrow).

Discussion

The formation of a subcapsular hepatic hematoma after CPR in this case shows the substantial risks that can arise from the physical force used during resuscitation [9]. While CPR is crucial in life-threatening situations, the intense pressure applied to the chest can result in unintended trauma to internal organs [10]. The liver, due to its size and anatomical position beneath the diaphragm, is particularly vulnerable to injury from the compressive forces of CPR [11]. The development of a subcapsular hepatic hematoma, though rare, is a serious complication that requires prompt recognition and management to prevent further morbidity or mortality [12].

The pathophysiology of subcapsular hepatic hematoma in the context of CPR involves the transmission of force from chest compressions to the liver, which can cause tearing of

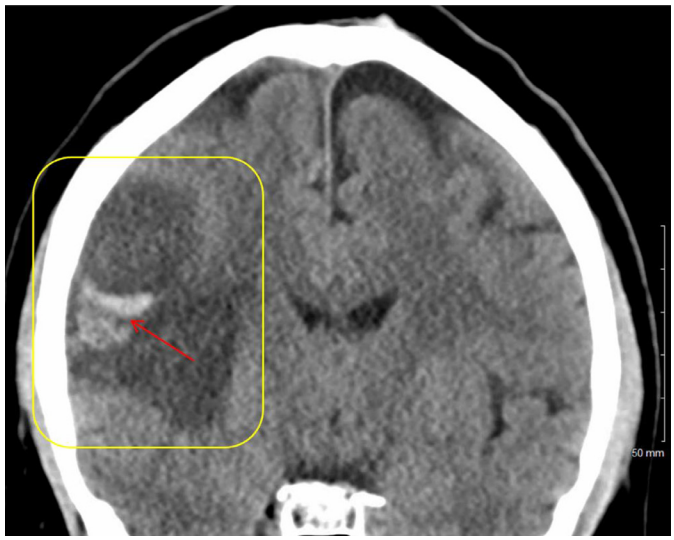

Fig. 2 – CT brain with contrast (coronal view) demonstrating a large area of decreased attenuation (yellow box) involving much of the distribution of the right middle cerebral artery consistent with an acute infarct with areas of acute hemorrhage (red arrow) throughout this infarct.

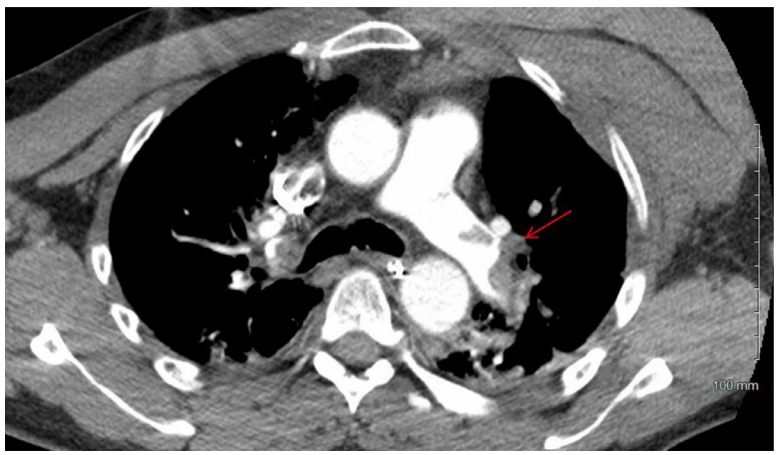

Fig. 3 – CTA pulmonary (axial view) with thrombus in the left pulmonary artery (red arrow).

the hepatic capsule or injury to the liver parenchyma [13,14]. This leads to the accumulation of blood between the liver capsule and the parenchyma, forming a hematoma [15]. The risk is heightened in patients who undergo prolonged or vigorous CPR, particularly those with pre-existing liver conditions, coagulation disorders, or those on anticoagulant therapy [16]. In this case, the patient's need for anticoagulation due to the presence of pulmonary emboli added a layer of complexity, as it increased the likelihood of hematoma expansion and subsequent bleeding [17,18].

In this case, the patient's need for anticoagulation due to the presence of pulmonary emboli added a layer of complexity, as it increased the likelihood of hematoma expansion and subsequent bleeding. Current guidelines and studies suggest that the timing and type of anticoagulation need to be carefully managed and individualized. The Eastern Association for the Surgery of Trauma (EAST) guidelines states that chemical DVT prophylaxis can be used for patients with isolated blunt hepatic injuries without increasing the failure rate of nonoperative management. Some literature suggests that chemical DVT prophylaxis will not negatively impact nonoperative management [19], but the literature remains largely inconclusive at this time.

In setting of blunt liver trauma, it may be appropriate to consider alternatives strategies to anticoagulation including lower doses, use of bridging therapies or alternative strategies such as catheter-directed thrombolysis (CDT). The EKOS catheter uses low-dose thrombolytics delivered directly to the clot through a catheter, reducing the risk of systemic bleeding compared to full dose systemic thrombolytics. Ultrasound-assisted CDT has been shown to exceed heparin alone in improving RV size within 24 hours without major bleeding or recurrent VTE [20]. An alternate strategy is an open embolectomy, but this procedure carries higher risks

Fig. 4 – CT chest, abdomen, and pelvis (axial view) with left hepatic subcapsular hematoma measuring 9 x 9 x 8 cm (red arrow).

and is only indicated when thrombolysis or catheter assisted embolectomy has failed or in the case of shock that is likely to cause death before thrombolysis can take effect [21].

The clinical presentation of subcapsular hepatic hematoma can be subtle and easily overlooked, especially in the context of a critically ill patient recovering from a major event like CPR [23]. Symptoms may range from mild abdominal discomfort to severe pain, and in some cases, patients may present with signs of hemorrhagic shock if the hematoma is large or ruptures [24]. Hemodynamic instability, unexplained drops in hemoglobin, or worsening abdominal pain in a post-CPR patient should raise suspicion for this complication [25]. Imaging studies, particularly contrast-enhanced CT scans, are essential for diagnosing and assessing the extent of the hematoma [26]. In this case, the hematoma was identified during follow-up imaging after the patient's condition worsened, showing the need for vigilance in monitoring for such complications.

Management of subcapsular hepatic hematoma requires a tailored approach based on the size of the hematoma, the patient's clinical stability, and the presence of ongoing bleeding [27]. The AAST liver trauma classification system grades injuries by their location, mechanism and size, and the World Society of Emergency Surgery (WSES) guidelines state the indications for being taken to the operating room versus non-op management [22]. In stable patients with small, contained hematomas, conservative management with close observation, pain control, and serial imaging may be sufficient [27,28]. However, larger hematomas or those associated with significant hemodynamic instability may necessitate more aggressive interventions [29]. Options include percutaneous drainage under radiologic guidance, embolization of bleeding vessels, or, in severe cases, surgical exploration and evacuation of the hematoma [30]. The decision to pursue surgical or interventional treatment must consider the risks of further bleeding, especially in patients requiring anticoagulation, as was the case here [31].

Conclusion

Subcapsular hepatic hematoma is a rare but significant complication that can occur following CPR due to the forceful nature of chest compressions. Managing this condition becomes particularly challenging when anticoagulation is needed, as it requires careful consideration of both the risk of bleeding and the necessity to prevent thromboembolic events. Early detection through appropriate imaging and a coordinated multidisciplinary approach are essential in addressing this serious complication and improving patient outcomes.

Patient consent

We confirm that we have obtained written, informed consent from the patient for the publication of this case report. The patient has been thoroughly informed about the details that will be published and understands the implications of the publication. The written consent is stored securely and is available for review by the editorial team upon request.

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