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English Article

CASE REPORT

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A Case of Cardiopulmonary Resuscitation-induced Liver Injury

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It is well known that external chest compression during cardiopulmonary resuscitation (CPR) frequently results in complications of varying severity.¹⁾ Fractures of rib bone and sternum often occur during CPR. However, incidence of CPR-related injuries of abdominal organs are few, those injuries to the abdominal viscera result in life-threatening complications after CPR. Since hepatic injury after resuscitation often lack the apparent clinical symptoms, CPR-induced liver injury is seldom overlooked, resulting in fatal complication. We report the case of CPR-associated hepatic injury.

Case

A 76-year-old woman, who had oral medical treatment for rheumatoid arthritis, was transferred to the general hospital via ambulance because of consciousness disturbance followed by dyspnea. When the patient arrived at emergency room, she fell into cardiopulmonary arrest. Cardiopulmonary resuscitation with external chest compression and artificial respiration was immediately performed, and spontaneous circulation was returned in about five minutes. In hematological examination after return of spontaneous circulation (ROSC), the patient had hepatitis B surface antigen (HBs Ag) positive and elevated liver enzymes. The patient was transferred to our intensive care unit about 11 hours after ROSC.

Physical findings at ICU admission

The patient was intubated and received mechanical ventilation on admission to the ICU. Consciousness level was clear and the Glasgow Coma Scale (GCS) was 11 (E4, VT, M6). Blood pressure was 142/81 mmHg under administration of dopamine and noradrenaline at the speed of 15 $\mu\text{g}/\text{kg}/\text{min}$ and 0.2 $\mu\text{g}/\text{kg}/\text{min}$, respectively. Heart rate of the patient was 120 beats/min of sinus rhythm. The laboratory data were as follows: 5.5 g/dL of hemoglobin, 2.06 of PT-INR, 68.2 sec of APTT, 0.7 mg/dL of T-Bil, 9,384 IU/L of AST, 4,480 IU/L of ALT, 13,272 IU/L of LD, 72 mg/dL of BUN, 2.6 mg/dL of creatinine

and 6.4 mg/dL of magnesium.

Abdominal echogram showed fluid collection around the liver and hypoechoic shadow in the center of left lobe. The whole-body contrast computed tomography (CT) was performed for scanning intra-abdominal condition because of extremely low hemoglobin level and extremely high transaminase level. The abdominal contrast CT showed the hepatic injury (American Association for the Surgery of Trauma liver injury scale Grade 1) from medial segment to anterior segment (Fig. 1).

Ten units of red blood cells and twelve units of fresh frozen plasma were transfused for the correction of anemia and coagulopathy. After the transfusion, the laboratory data improved as follows: 10.2 g/dL of hemoglobin, 1.20 of PT-INR, 30.6 sec of APTT. The transfusion led her hemodynamic status to be stable, and dose of dopamine and noradrenaline were decreased while keeping the mean blood pressure more than 70 mmHg.

Administration of the catecholamine was ceased twelve hours after ICU admission. Because hemodynamic stability was obtained after transfusion, weaning from mechanical ventilation was started. Following transfusion, increased hemoglobin level was maintained. The reason for cardiopulmonary arrest was suspected to be hypermagnesemia

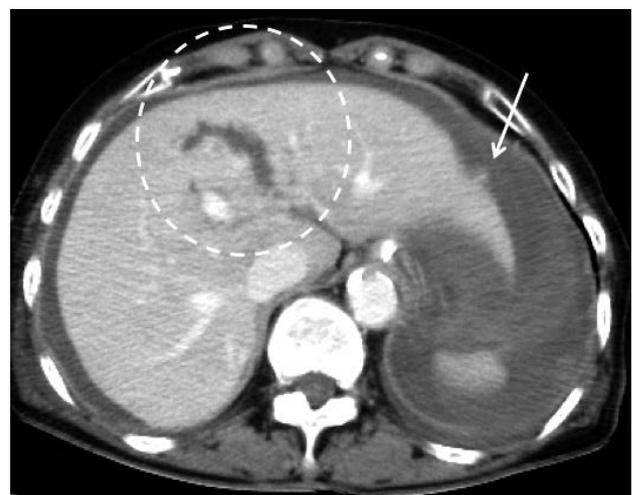


Figure 1: Abdominal CT reveals the hemoperitoneum. A white arrow shows the laceration of left hepatic lobe (S3). A dot circle shows the hepatic injury from medial segment to anterior segment.

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caused by oral medication of purgative. Therefore, continuous renal replacement therapy (CRRT) was performed to reduce magnesium concentration. Blood concentration of magnesium decreased from 6.4 mg/dL to 4.8 mg/dL twelve hours after CRRT, and decreased to 2.7 mg/dL at the second ICU day. We stopped CRRT and extubated after confirming her good oxygenation. Consciousness level of the patient was clear and respiratory and hemodynamic status was stable. Therefore, at the third ICU day, the patient discharged to the general ward from the ICU.

Discussion

We showed a case of hepatic injury due to external chest compressions at CPR. It is well known that many acute complications result from inappropriate chest compressions during CPR. The most frequent complications are the fracture of sternum or rib, and the injury of intrapleural organs such as myocardial contusion, pulmonary contusion, and hemopneumothorax. On the other hand, the abdominal complications are the gastric rupture, splenic injury, and liver injury and so on.¹⁾ The frequency of hepatic injury is about 2 percent of the whole complications. Typically, liver injury is located on the left side of the falciform ligament.^{2,3)} The injury is caused by the application of excessive pressure on the sternum and improper placement of the hands with compression of the xiphoid bone. Another reason for the hepatic injury is hepatomegaly complicated with heart failure.^{1,4)} Moreover, the patients receiving anticoagulant therapy could worsen the bleeding due to CPR-induced liver injury.⁵⁾ We should be aware that organ injuries including liver injury can occur when chest compressions are performed for cardiopulmonary resuscitation in patients treated with thrombolytics, antithrombotics or antiplatelet-agents.

Immediately after CPR, there is a risk of occurring hemodynamic derangement when transporting to the CT

examination room. Therefore, bed-side ultrasound echogram was generally recommended to diagnose intra-abdominal bleeding when hemodynamic state was unstable.⁶⁾

In our case, screening of hepatic injury was made by ultrasound echogram. However, confirmative diagnosis and extent of hepatic injury were made by CT scan since we should decide to select surgical procedure or observational management to control intra-abdominal bleeding.

This case told us the importance of the early and confirmatory examination of intra-abdominal findings when the patient's hemodynamic state is unstable after CPR.

The chest compressions during CPR can cause hepatic injury. The complication leads to be fatal if we cannot make an accurate and early diagnosis. It is important to do abdominal sonography and CT at the early stage of post resuscitation.

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