Blood, Heart and Circulation

Case Report ISSN: 2515-091X

Diffuse hepatic hemorrhage in a patient undergoing emergency conventional coronary artery bypass surgery following cardiopulmonary resuscitation

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Abstract

A 71-year-old male patient was admitted with a diagnosis of acute myocardial infarction, he underwent an urgent coronary angiography and stent implantation to a totally occluded circumflex coronary artery. During the percutaneous coronary intervention, cardiac arrest occurred and a short-lived and successful mechanical and medical cardiopulmonary resuscitation was applied. Once a satisfactory cardiac rhythm and arterial blood pressure were obtained, the patient underwent coronary artery bypass surgery on an emergency basis. During the operation, a high volume of intraabdominal hemorrhage secondary to hepatic injury was observed following additional exploratory laparotomy. We performed perihepatic packing for diffuse hepatic hemorrhage, since there was no particular focus of bleeding or rupture in the liver. In spite of accurate and sufficient fluid and blood product replacement, the patient died on account of hypovolemic shock. This report highlights the possibility of diffuse hepatic hemorrhage secondary to liver injury related to cardiopulmonary resuscitation.

Introduction

Hepatic injury and hemorrhage following manual cardiac compression as one of major components of cardiopulmonary resuscitation (CPR) is an unusual condition with an incidence of ~0.6-3%, and is the most frequent intraabdominal complication related to CPR. Although hepatic injury and hemorrhage following CPR is very rare, it is associated with high mortality rate when occur [1-5]. Here, we presented a case report of diffuse hepatic hemorrhage secondary to liver injury in a patient undergoing emergency conventional coronary artery bypass grafting (CABG) operation following CPR.

Case presentation

A 71 year-old male was treated with aspirin, clopidogrel and low molecular weight heparin with a diagnosis of acute myocardial infarction (MI) in another health facility, and was referred to our hospital. Physical examination and routine biochemical tests were not revealed any significant finding. The patient presenting with MI had undergone a coronary stent implementation to a totally occluded circumflex coronary artery. Cardiac arrest occurred during the procedure, and systemic heparin and intracoronary tirofiban were administered to the patient. After a successful CPR, the patient was taken to CABG operation on an emergency basis. With cardiopulmonary bypass (CPB) support, CABGx3 operation was performed on beating heart. During the operation, the decrease in venous flow and fall of hematocrit level to 12% were compensated by blood product transfusion and crystalloid fluid replacements. The patient was weaned from CPB support smoothly without any inotropic drug support. Nevertheless, hypovolemic shock developed in a short time and the fall of hematocrit level continued. Upon observing abdominal distension, intraabdominal hemorrhage was anticipated, emergency exploratory laparotomy was performed, and 2500 ml of fresh blood was observed in the peritoneal cavity. The patient was re-heparinized and connected to the extracorporeal circulation, and then intraabdominal blood volume was retrieved into the extracorporeal circulation. There was no particular focus of bleeding or rupture in the liver. Instead, the hepatic capsule was almost completely torn, and diffuse and profuse bleeding was observed on the whole surface of the liver (Figure 1). Perihepatic packing was performed, extracorporeal circulation was urgently terminated, and heparin was neutralized with protamin. Seven units of erythrocyte suspension, 5 units of fresh frozen plasma, 675 mg of calcium gluconate and 1 gr of tranexamic acid were rapidly infused. The excessive bleeding could not be controlled and the patient died due to hypovolemic shock.

Discussion

Celio [6] and Reagan *et al.* [7] reported successful open cardiac massage with thoracotomy in 1956. Four years later, Kouwenhoven *et al.* [8] described the closed-chest cardiac massage and postulated that patients recovered faster with this technique. Other reports which demonstrating the efficiency of the closed-chest technique also published in the ensuing three years, nonetheless Baringer *et al.* [9] and Portal *et al.* [10] reported some complications related to the closed technique such as rib fracture, hemothorax, hemopericardium, hepatic injury and bone marrow embolism.

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Key words: *hepatic injury, hepatic hemorrhage, cardiopulmonary resuscitation*

Received: April 22, 2017; **Accepted:** May 25, 2017; **Published:** May 29, 2017

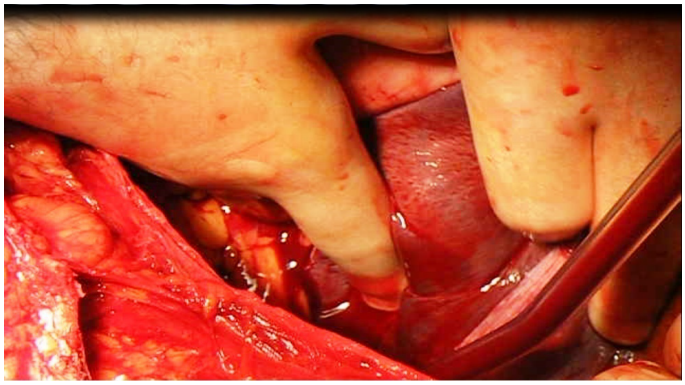

Figure 1. Intraoperative view of diffuse hepatic hemorrhage

There is no significant difference between the definition of resuscitation made a half century ago and the recommendations pertaining latest updated guidelines. It is advised by the international guidelines that the pressure should be applied only on the sternum to avoid complications like rib fractures and soft tissue injuries [11-13].

Complications related to CPR are well known since the very day it was first defined and is present in the literature. Most frequently rib fracture (in postmortem studies 25-50%), sternal fracture, chest wall hematoma, pneumothorax, cardiac contusion, less frequently thoracic aorta rupture, diaphragmatic rupture and gastric perforation are seen as complications of CPR. Very rarely hepatic injuries can be contemplated [14,15]. Hepatic injury related to CPR is very rare but carries a high mortality rate [1-5]. Meron *et al.* [1] in their study spanning 14.5 years among 2558 cardiac arrest cases found 15 (0.06%) cases of major hepatic injuries (11 rupture, 4 hemorrhage and hematoma). Six of them were detected at postmortem period, of the surviving 9 patients six were treated surgically, the other 3 medically. One patient from each group has survived (mortality rate of 87%). Numerous hypotheses have been advocated for explaining the causes of hepatic injury. According to Meron *et al.* [1] it may be due to improper employment of CPR, on the other hand Kunstyr *et al.* [2] have claimed that blunt trauma, vibration of the sternal saw or piercing traumas due to chest tube insertion combined with the augmenting effect of hepatic congestion can lead to hepatic injury. Krischer *et al.* [14] have postulated that 73% of hepatic injury cases are due to rib fractures. Becit *et al.* [16] reported that the injury or the hemorrhage could be spontaneous.

A typical post-CPR hepatic injury is located on the left of the falciform ligament and usually it is due to the forceful pressure exerted on the hand placed on the xyhoid [3]. According to Adler *et al.* [17] the features of hepatic injury are deteriorating hypovolemic shock in a patient on anticoagulants with enlargement of the abdominal circumference. Hachiro *et al.* [18] have reported a patient receiving ticlodipin with pericardial tamponade after CPR in the absence of rib and sternal fracture.

In order to minimize CPR complications, mechanical devices (the LUCAS device, etc) have been developed but in pilot study no difference was found to conventional method regarding efficiency or complications [19].

In major and continuing hepatic hemorrhage due to injury for hemostasis the hepatoduodenal ligament can be encircled with a Penrose (pringle method) and temporarily clamped. Meanwhile, treatment alternatives should be considered and necessary medications (antithrombin III, protamin, fibrinogen, tranexamic acid, platelet suspension, whole fresh blood, fresh frozen plasma) can be administered. If oozing is persisting perihepatic packing may be employed (de-packing can be done 48-72 hours after stabilization) [20].

In this present case, our patient received both anticoagulant and antiaggregant agents, and sustained hepatic congestion due to the cardiac arrest, CPR had to be performed on the angiography table in suboptimal conditions, and he was a high-risk patient in terms of hepatic injury and hemorrhage because of the being subject of exposed to extracorporeal circulation. It might not be possible to avert all the risks but minimizing could well be. The resuscitation should be applied on the mid portion of the sternum and in a perpendicular angle, sternum should be depressed 5 cm, over ventilation avoided. At easy accessible institutions, the access to antithrombin III, fibrinogen, platelet suspension, fresh whole blood, and routine availability of cell saver and rapid blood transfusion systems, and lastly multidisciplinary team organization are of utmost importance. Almost as important is physicians dealing with such patients (emergency physician, cardiologist, surgeon, etc.) should always bear in mind the possibility of hepatic injury. In order to avoid, identify and treat this kind of rare condition, the first requirement is to anticipation and awareness of such rare complications.

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