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Clinical Image

Cardiac Arrest during Computed Tomography Scanning: Imaging Findings

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CLINICAL IMAGE

A 78-year-old woman complaining of chest pain and a sudden increase in breathlessness was admitted to the emergency department. She showed symptoms of tachycardia and dyspnea with reduced oxygen saturation (75%). Because of increasing respiratory distress, the patient was transferred to the computed tomography (CT) unit in order to evaluate the possibility of acute vascular disorders such as aortic dissection and pulmonary embolism. CT scans obtained after the injection of contrast agent through the left antecubital vein with an automatic contrast injector at a rate of 3 mL/s. Incoming images revealed the regurgitation of contrast medium from the right atrium into the inferior vena cava (IVC) and hepatic veins with no opacification of the right ventricle, left heart chambers, or aorta (Figures 1, 2). After recognizing these unusual findings, scanning was halted, and the patient was removed from the gantry and found to be pulseless. Emergency service professionals were called, and cardiopulmonary resuscitation (CPR) was initiated immediately. The CPR was successful; the patient was intubated and transferred to the intensive care unit. Despite aggressive intensive care, however, the patient died within 48 hr of the CT.

Cardiac arrest during CT imaging is a very rare occurrence. However, it is vitally important to recognize the characteristic imaging signs so that scanning can be halted and CPR can be immediately performed. CT findings of acute cardiac arrest include regurgitation of contrast medium from the right atrium into the inferior vena cava and abdominal veins, markedly dense venous structures, with decreased enhancement of the abdominal organ, contrast pooling in dependent lungs, contrast stasis in pulmonary veins [1-3].

Figure 1 Contrast enhanced computed tomography (CT) image at level of the pulmonary artery (A) shows opacification of the superior vena cava and azygos vein. Image at the level of the heart (B) reveals reflux of contrast into the SVC from right atrium. Right ventricle and left heart chambers and descending aorta are not opacified. (C) Note the retrograde opacification of the IVC and hepatic veins mainly in the right lobe of the liver. The contrast agent appearing to be very dense because of the absence of flowing blood in the vascular system. (SVC: Superior vena cava; PA: Pulmonary artery; A: Aorta; RA: Right atrium; LA: Left atrium; RV: Right ventricle; LV; Left ventricle, IVC: Inferior vena cava; HVs: Hepatic veins) .

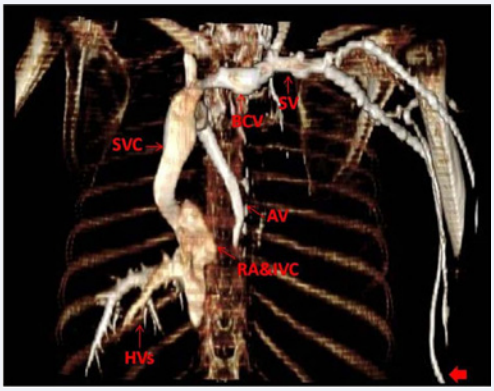

Figure 2 Three dimensional reconstruction CT image. The contrast agent injected through the left antecubital vein (arrow) enters the right atrium via the superior vena cava and then refluxes into the inferior vena cava and hepatic veins. (SV: Left subclavian vein; BCV: Brachiocephalic vein; AV: Azygos vein; SVC: Superior vena cava; RA: Right atrium; IVC: Inferior vena cava; HVs: Hepatic veins).

The basic mechanism of these imaging signs depends on a lack of cardiac pump function and blood flow during a cardiac arrested state. The contrast medium in the superior vena cava refluxes into the major dependent areas of the venous system, such as the IVC and the hepatic veins, due to the pressure generated by the mechanical injector. Also, the pooling of contrast medium in these veins without any dilution with the circulating blood leads to a markedly dense appearance of these venous structures [1-3].

The ideal solution is of course to provide cardiopulmonary monitoring with essential resuscitation equipment and trained practitioners in every CT unit for risky patient groups, but unfortunately, this would be difficult to implement under current conditions. As a practical solution, the appropriate transfer of these patients to a CT unit should be carried out in accordance

with emergency healt care practitioners,or a CPR course should be implemented to teach basic life support skills to radiology technicians. If a technician recognizes the characteristic CT features of an impending cardiac arrest, scanning must be stopped, and the patient must be removed from the CT gantry. CPR must be initiated immediately within the framework of a predetermined emergency plan.

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