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## Case Report

# Cardiac arrest identified by a chest CT scan in a patient with normal telemetry findings

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### ABSTRACT

Early recognition of cardiac arrest has been linked traditionally to clinical signs and telemetry findings. Few case reports have presented normal telemetry findings in patients with cardiac arrest where a contrast enhanced CT scan of the chest was able to identify the diagnosis. The early recognition of a cardiac arrest whether by telemetry monitoring or CT scan is important to improve the clinical outcomes. This case report presents a patient who was hypertensive and unresponsive upon arrival to the emergency department. A chest CT scan to rule out aortic dissection showed no contrast in the pulmonary arteries, aorta, and the rest of the heart chambers although normal telemetry findings were present. Resuscitation was initiated, and patient survived with poor neurological recovery.

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## Introduction

In-hospital cardiac arrest mortality remains high despite modest improvement in survival during the last decades [1]. Early recognition of cardiac arrest (CA) with prompt initiation of cardio-pulmonary resuscitation (CPR) in order to restore circulation leads to better outcomes [2]. While the vast majority of In-hospital Cardiac Arrest is detected by clinical signs or by means of telemetry monitoring, there are few reports of CA that were first detected by Computed Tomography (CT) scans.

Herein, we report 1 case of CA that was identified by contrast-enhanced CT of the chest in a patient with normal telemetry findings.

## Case presentation

A 60-year-old African-American female with history of obesity, essential hypertension, and type 2 diabetes mellitus; was admitted to the Emergency Department after being found

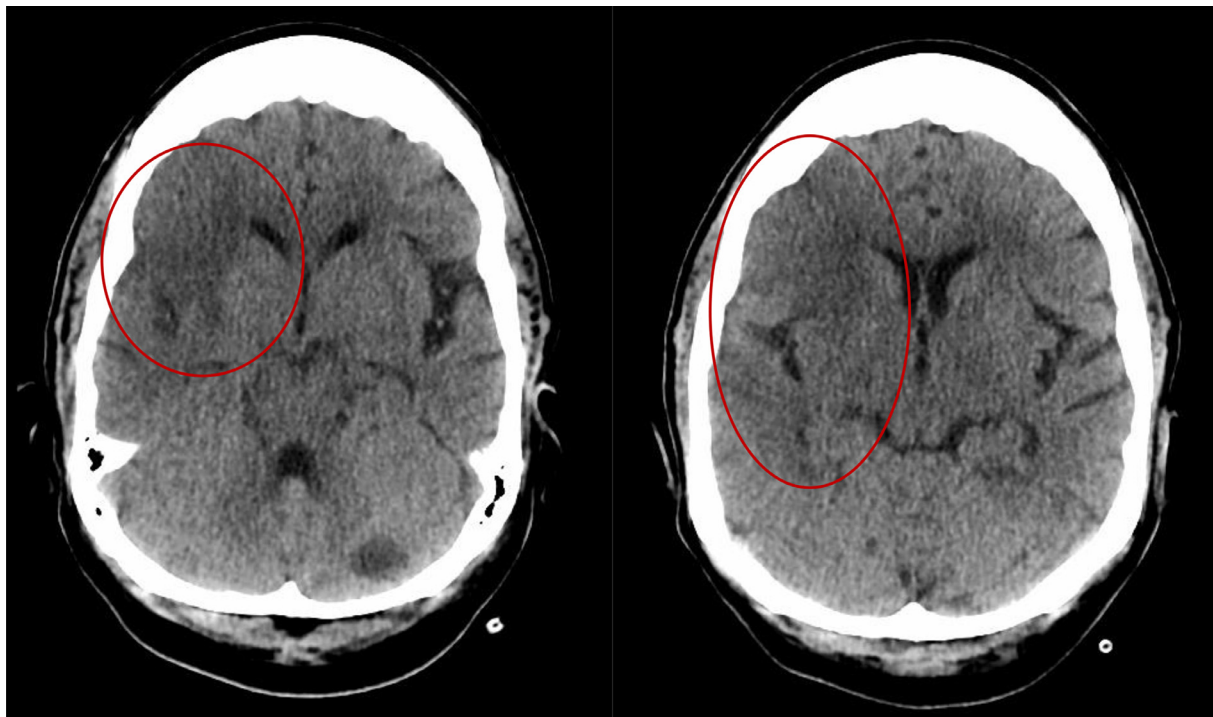
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**Fig. 1 – A and B. Acute MCA territory infarct.**

**Axial noncontrast CT scan of the brain showing a large, cortical-based area of low attenuation in the distribution of the right MCA (red circles) with overlying sulcal effacement consistent with an acute right MCA territory infarct. (Color version of figure is available online.)**

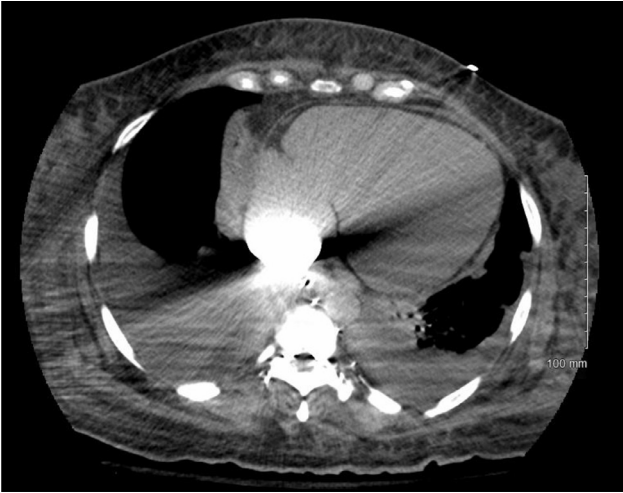
unresponsive at home. Upon arrival, patient was unconscious, tachycardic with heart rate of 132/min, hypertensive with blood pressure of 204/157 mmHg, and had an agonal breathing. Neurological exam revealed fixed and dilated pupils, rightward gaze preference, and absence of pain response, cough, and gag reflex. A National Institutes of Health Stroke Scale score of 35 was calculated. She was immediately intubated and stroke code was activated followed by performance of a brain CT that revealed an acute large infarct in the right middle cerebral artery territory (Figs. 1A, B, and 2).

The presence of significant hypertension prompted to obtain a contrast-enhanced CT of the chest to rule out aortic dissection. Contrast material of 100 cc was injected for the study at a rate of 5cc/s. After 20 seconds of injection, the study was performed using the thinnest collimation available. Scanning was performed in a craniocaudal fashion after 20 seconds from the onset of injection. Images that were visualized on-site showed intravenous (IV) contrast in the superior vena cava, right atria, and inferior vena cava (IVC), but no contrast in the pulmonary arteries, aorta, and the rest of the heart chambers (Figs. 3 and 4). An immediate assessment revealed absence of carotid and femoral pulses at the time when cardiorespiratory monitor parameters were present including normal pulse oximetry saturation of 99% and third-degree atrioventricular block on monitor before entering into ventricular fibrillation. These findings in concordance with the absence of IV contrast in the heart chambers were considered as pulseless electrical activity. The patient became bradycardic,



**Fig. 2 – Recent infarct.**

**Axial nonenhanced CT scan of the brain showing a right, sharply demarcated wedge-shaped and heterogeneously hypodense lesion within the right occipital lobe (red circle) suggestive of a recent infarct. (Color version of figure is available online.)**



**Fig. 3 – Non-beating heart.** Axial contrast-enhanced CT of the chest showing an enhanced superior vena cava (SVC) with absence filling of the right ventricle suggestive of a nonbeating heart. Notice is made of a bilateral pleural effusions. (Color version of figure is available online.)

with third-degree atrioventricular block on monitor before entering into ventricular fibrillation.

CPR was immediately initiated and return of spontaneous circulation was achieved after 6 minutes. ECG confirmation was not needed as it would have caused a delay in the initiation of the Advanced Cardiovascular Life Support protocol. The patient was then transferred to the intensive care unit where she was initiated on vasopressors and started on hypothermia protocol. A poor neurological recovery was present

and patient remained with ventilator-dependent respiratory failure, and was transferred to a long-term care facility after 1 month of being discharged from the hospital.

## Discussion

Several CT findings have been described in patients with impending CA including reflux of IV contrast into the coronary sinus, great cardiac vein, superior mesenteric veins, hepatic veins, right renal vein along with nonopacification of the aorta and left cardiac chambers and dependent layering of venous reflux contrast or contrast-fluid level in the IVC [3-5]. The latter, sometimes referred as the “IVC level sign,” is perhaps the most commonly reported in the literature, but has also been reported in patients with low cardiac output or shock [3,4]. Interestingly, Wagner et al. [6] reported a case of severe valvular heart disease and left ventricular failure who had the “IVC level sign” without being in CA or state of shock [6]. Others like regurgitation of IV contrast to ascending lumbar vein, hemiazygous and azygous vein, dorsal veins, and pulmonary veins are less commonly reported in the literature [3,5,7,8]. Table 1 shows reports that identified CA initially based on CT scan of the chest along with a follow up on the patients reported.

In this case, we report a patient who presented with an acute ischemic right middle cerebral artery stroke who later developed CA that was first detected by the absence of contrast filling of the RV and left side heart chambers during the performance of a contrast-enhanced CT of the chest while having an unremarkable cardiorespiratory and oximetry monitoring. Our report challenges current in-patient monitoring practices as exemplified in this case as there was detected



**Fig. 4 – A and B. Cardiac arrest.** Coronal contrast-enhanced CT scan of the chest showing enhanced filling of the SVC, inferior vena cava (IVC), and the right atrium (RA) with no filling of the right ventricle (white arrows) and pulmonary artery. These findings are suggestive of cardiac arrest.

**Table 1 – Cases with CA identified by CT scan of the chest along with a follow-up on the patients reported.**

Cases report	CT findings	Follow-up
Sullivan et al. [4]	Two patients showed RA filling with regurgitation to IVC	One patient, who had ruptured Type A aortic dissection with hemopericardium with both acute aortic and pulmonary arterial intramural hematomas, survived. The second patient died.
Wagner et al. [6]	One patient with severe valvular disease and left ventricular HF without shock/CA had minimal contrast pooling visible in the apical portion of the right ventricle. Patient had severe valvular disease.	Never developed shock or HF and was alive after 8 months.
Bagheri et al. [7]	One of 4 patients had nonopacification of all cardiac chambers but that patient had regurgitation to coronary sinus, great cardiac vein, and hemiazygos vein and venous plexus in back area	The 4 patients died.
Hong et al. [8]	Four patients showed non opacification of left chambers with regurgitation to other areas	The 4 patients died.
Pua et al. [10]	One case of pulmonary embolism (PE) with right side filling but no opacification of left side chambers.	The patient became asystolic during transit from the CT scan facility back to the ED, and died 1 hour later despite aggressive resuscitation.
Jana et al. [11]	One out of 4 cases had non-opacification of all chambers	3 patients died despite resuscitation. The other is not clearly described.
Kansagra et al. [12]	One patient had non opacification of left side chambers with regurgitation to IVC	The patient died.
Escoda et al. [13]	One patient showed contrast levels in RA and IVC as well as regurgitation to IVC and right renal vein	The patient died.

pulse oximetry with normal sinus rhythm throughout the performance of the study even in the complete absence of cardiac output as noted on CT examination. An oxygen saturation of 99% can be expected in the first few seconds following a CA considering the time to equilibration of oxygen saturation using pulse oximetry [9].

The lack of contrast filling of left heart chambers prompted immediate reassessment that revealed absence of carotid pulse followed by the presence of sinus bradycardia and that allowed us to timely start CPR for pulseless electrical activity with achievement of return of spontaneous circulation within 6 minutes of initiation of resuscitation maneuvers. Despite the unfortunate clinical features of presentation (a massive stroke by definition) that played a significant role in the poor neurological recovery of our patient, we believe that early recognition of CA on the CT resulted in a quick response and initiation of CPR that would have been delayed otherwise further increasing burden and likely resulting in worse overall clinical outcomes.

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