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Case report

Tissue microscopic changes and artifacts in multi-phase post-mortem computed tomography angiography in a hospital setting: A fatal case of systemic vasculitis

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ABSTRACT

A 27-year-old man suddenly died in hospital of acute respiratory distress syndrome secondary to severe systemic vasculitis. Multi-phase post-mortem computed tomography angiography followed by scientific autopsy of the thoracic and abdominal cavity and histology was performed, illustrating the advantages and drawbacks of such techniques. Imaging enabled us to examine the cranium, as the family refused cerebral dissection. MPMCTA revealed absence of opacification of the left middle cerebral artery. But parenchymal findings of thoracic and abdominal organs were still difficult to interpret after both imaging and macroscopic examination during the autopsy. Microscopic examination provided the definitive diagnosis of cause of death. Analysis revealed systemic vasculitis of the lung complicated by diffuse alveolar, mediastinal, splenic and retroperitoneal lesions. We were unable to determine the type of vasculitis, whether polyarteritis nodosa or microscopic polyangiitis, because of artifactual glomerular collapse. We observed some structural changes in tissue secondary to contrast agent injection, affecting the vascular system and renal parenchyma in particular. Such artifacts must be known in order to avoid misinterpreting them as pathological findings. MPMCTA and conventional autopsy are two complementary techniques showing both their specific advantages and limits which have to be known in order to choose the appropriate technique. One limit of both techniques is the detection of microscopic findings which can only be obtained by additional histological examination. This case report underlines this fact and demonstrates that caution is required in some cases if microscopic analyses are carried out after contrast agent injection.

1. Introduction

In the last decade, post-mortem imaging has often been studied in a forensic context [1–3]. Post-mortem CT is now recognized as an important tool in death investigation [4,5]. Moreover, the utility of multi-phase post-mortem CT angiography (MPMCTA) compared with conventional autopsy has also been studied [6,7], highlighting the contribution of this new tool for identifying bone and vascular lesions [6,8]. A standardized protocol makes the investigation easy to perform and yields increased diagnostic value [9,10]. Besides full body MPMCTA, other methods have been described and optimized, particularly concerning heart exploration [11–13]. It is generally agreed that, at least at the present time, conventional autopsy and MPMCTA complement each other [14,15]. Some important findings in relation to death can only be highlighted during autopsy or microscopic examination, especially concerning parenchymal lesions of solid organs, which can yield useful

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Fig. 1. Axial reconstruction of the cerebral vascular supply after multi-phase post-mortem CT angiography, after arterial injection. Absence of opacification of both superficial temporal arteries with an aspect of major diffuse sub-cutaneous edema (stars).

information in sudden and natural deaths both in forensics and in medical autopsy [6]. Previous works have demonstrated that specific oily contrast agent mixture we used for this case does not modify significantly biochemical, toxicological or immunological investigations [16,17], but there are no data about parenchymal modifications secondary to the contrast agent injection we used and its microscopic consequences. In this case report of fatal vasculitis, we illustrate some structural changes in tissue secondary to post-mortem contrast agent injection and discuss the contribution of MPMCTA and microscopy in this context.

2. Case report

2.1. Clinical and medical history

A 27-year-old man with no previous medical history presented with pulmonary symptoms (cough), digestive disturbances (pain and diarrhea) and asthenia. These were assumed to be due to infection. The patient was given empiric antibiotic therapy while awaiting the results of bacteriological investigations. His condition, in particular his pulmonary status, quickly deteriorated and he was admitted to an intensive care unit where he was intubated because of an acute respiratory distress syndrome. A clinical CT scan showed bilateral alveolar and interstitial pneumonia and pulmonary arterial thrombosis was suspected. Hypoxemia, refractory to conventional treatment, was managed by extracorporeal membrane oxygenation. Full laboratory tests for infection remained negative. Despite intensive treatment, the patient died of multiple organ failure 5 days after the first medical examination.

2.2. Post mortem radiology

Medical autopsy was decided. Before autopsy, MPMCTA was performed using a specific oily contrast agent, Angiofil® (Fumedica AG, Muri, Switzerland), mixed with paraffin oil. The first step was vascular puncture under ultrasound guidance. Sheaths of 14 French (Check-Flo Performer® Introducer, Cook Medical, Bloomington, Indiana, USA) were inserted in the right common carotid artery and the left internal jugular vein. The injection was performed with an injection system specifically designed for post-mortem use, the Virtangio® machine (Fumedica AG, Muri, Switzerland). Conventional MPMCTA was carried out as described by Grabherr et al., with 4 different acquisitions: non-enhanced (or native CT), arterial, venous and dynamic phase. The examinations were performed with a 16-detector CT scanner (Sensation 16, Siemens, Erlangen, Germany). Slice thickness was 1.25 mm, with 0.75 mm collimation and a 512×512 matrix. All image reconstructions were performed on non-enhanced CT with a slice thickness of 2.0 mm, in increments of 1 mm using soft tissue and bone kernels, and on the different enhanced phases with a slice thickness of 1.0 mm, in increments of 0.5 mm using the soft-tissue kernel. Post-processing was performed on a Leonardo console (Siemens, Erlangen, Germany). Reconstructions were two-dimensional (multiplanar reconstruction, MPR) and three-dimensional (maximum intensity projection, MIP).

A trained forensic radiologist and a clinical radiologist in our institution interpreted results together. Radiological examination revealed an absence of opacification of the left middle cerebral artery (Fig. 1). Those aspects were present on the 3 different enhanced acquisitions (arterial, venous and dynamic). Furthermore, we noted absence of perfusion of both left temporal arteries, which are branches of the external carotids. This aspect was interpreted as being secondary to the massive subcutaneous edema in link with the reanimation (Fig. 2). Bilateral pleural effusion, complete filling of the bronchi and trachea and massive bilateral lung consolidation were visible (Fig. 3). Furthermore, after

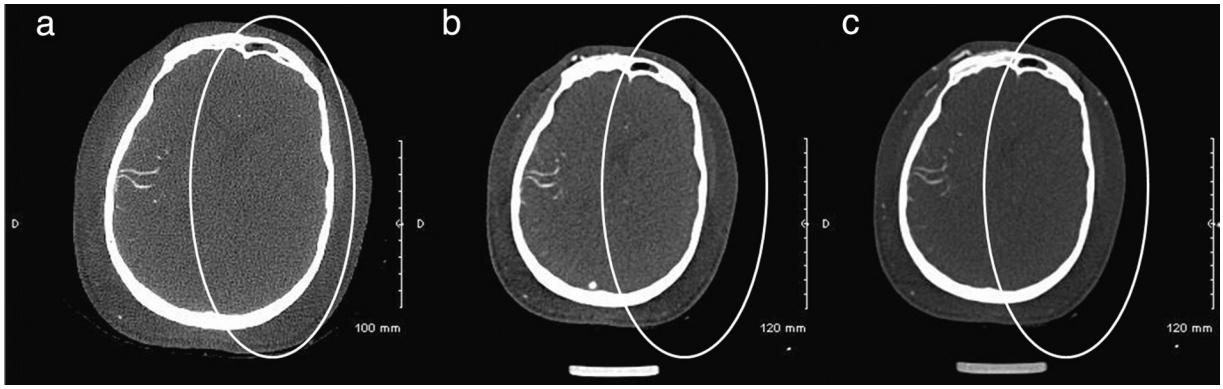

Fig. 2. Axial reconstructions of the cerebral vascular supply after multi-phase post-mortem CT angiography, (a) after arterial injection, (b) after venous injection, (c) after dynamic injection. Absence of opacification of the left middle cerebral artery during the three different times of acquisition (circle).