

## **CQ02 What are the findings of postmortem hypostasis/coagulation on postmortem CT/MRI?**

### **Grades of recommendations:**

**C1 for evaluating the hypostasis**

**C2 for evaluating the coagulation**

### **Explanation-----**

#### **Hypostasis**

When the corpse is placed in a specific posture with the blood circulation stopped, the blood in the vessels follows gravity and sinks towards the lower surface of the body. This phenomenon is called hypostasis. Hypostasis is one of the early postmortem changes which appear immediately after death [1]. As described below, hypostasis in postmortem images is visualized in various ways depending on the organ. In postmortem CT, it is generally visualized as a high-attenuation region on the gravity side in blood vessels, considered to arise from hemoglobin protein and iron contained in sedimented erythrocytes (protein is the main factor, and iron is considered to have a minor involvement in iron) [2].

#### **Blood after death**

At normal death, clotting spontaneously occurs when blood circulation stops. When deceased in a gradual manner, blood in the corpse usually coagulates. If the blood in the heart has some degree of liquidity at the time of the autopsy, the cause of death is considered to be sudden death. This is because plasmin dissolves blood clots with the blood activation of plasminogen activator from vascular endothelial cells due to excessive stress during the death phase in the case of sudden death, ischemia, and secretion of adrenaline and histamine. This keeps the blood fluid [1].

#### **Intra-cranium**

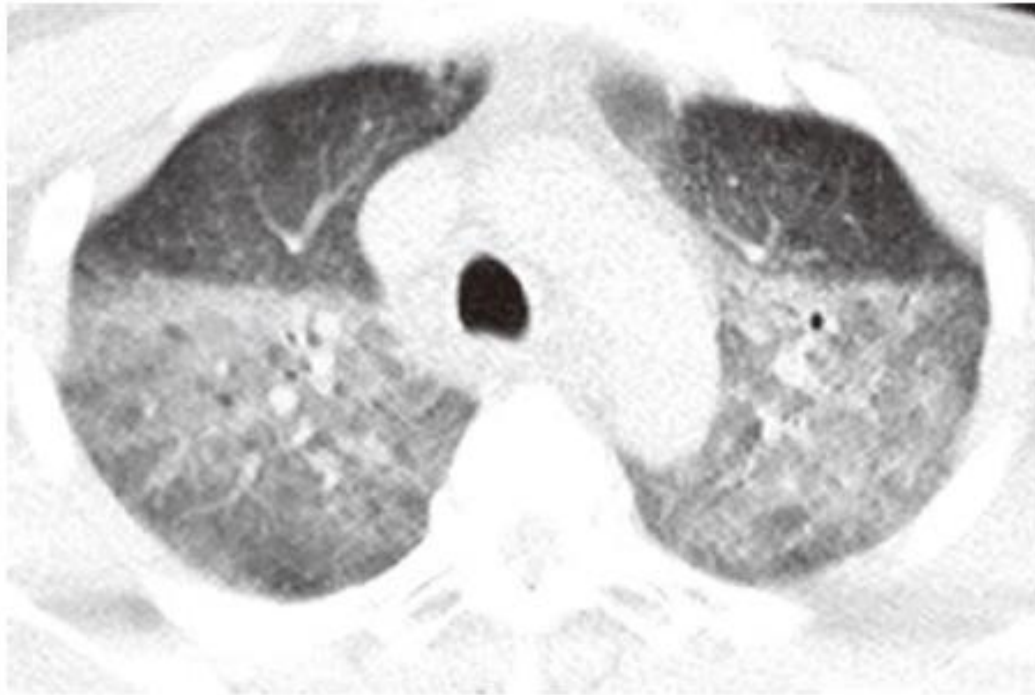
Intra-cranial hypostasis is typically found at the sinus as a high attenuation structure on postmortem CT. In a report comparing ante- and post-mortem CT, the CT value in the dorsal part of the superior sagittal sinus has been reported to increase from an average of 42 HU to an average of 49 HU [3]. The hypostasis on postmortem CT is also seen in the lateral sinus, and the physiological left-right difference in the sinus is visualized as an asymmetric blood hypostasis [3].

#### **Cardiovascular**

In postmortem CT, cardiovascular hypostasis is typically recognized as a high attenuation area on the gravity side with formation of a horizontal plane in the lumen [4]. The clarity of the blood hypostasis varies from case to case, and it has been reported that the clarity of blood hypostasis of the heart and

large blood vessels are related to serum fibrinogen levels [5]. In postmortem MRI, hypostasis in the heart and large blood vessels is recognized as a low-intensity region on the gravity side of the T2-weighted image [6].

**Figure. Male aged in the 50s, death due to acute cardiovascular disease (2 days after death)**



The postmortem CT shows a dorsal dominant ground glass appearance in both lungs.

A horizontal plane formation is observed at the level of the trachea. This is considered to be a postmortem change (hypostasis).

### **Lung**

In postmortem CT, the hypostasis in the lung parenchyma is recognized as an increased attenuation area on the gravity side. A typical image is a ground glass appearance that forms a horizontal plane [7]. The angle of this horizontal plane is affected by the body position in which the corpse is/was left stationary and is formed by differences in attenuation between the air-containing region and the region in hypostasis. The hypostasis in the lungs may be inconspicuous immediately after death or early after death but tends to become more apparent with time after death. An examination of multiple postmortem CT scans of the same carcass reported that over time the range of increased CT density in the lungs expanded from the dorsal side to the ventral side [8, 9].

### **Blood coagulation (blood clots)**

Clots may be found on postmortem CT as a template-like high attenuation region in the heart chambers or blood vessel lumen [10]. It is difficult to distinguish a pulmonary arterial thrombus that

occurred before death from a clot formed as a postmortem change when a template-shaped high attenuation region in the pulmonary artery was observed on postmortem CT [11]. However, there is also a report that it is possible to distinguish antemortem pulmonary artery thrombi from postmortem clots by non-contrast CT and MRI [12]. In addition, when the superficial cerebral veins are filled with blood and become highly attenuated, differentiation from subarachnoid hemorrhages may be a problem [13].

In the field of forensic medicine, it has been reported that in burnt corpses, blood clots were formed in the lumen of blood vessels, and an air-crescent sign with air entrapped between the blood vessel wall and blood clots was formed [14]. A dark red, soft thrombus in the heart chamber termed a "chicken fat clot" has been examined histologically [15]. It is considered that there are histological differences in the composition of clots where the survival time involved a prolonged death due to malignant tumors or inflammation and sudden death such as poisoning, burning death, or asphyxiation.

**Column-----**

In the field of forensic medicine, caution is required because a distinction is made between burned death (deceased whose cause of death is burnt death) and burned body (including deceased bodies that have been burned and changed after death due to causes other than burnt death).

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Literature search formula and literature selection (2019/6/7)

PubMed

#	Search formula	Number of documents
1	((((((((((((postmortem)OR post-mortem)OR "post mortem"))AND imaging))OR((((postmortem)OR post-mortem)OR "post mortem")) AND CT))OR((((postmortem)OR post-mortem)OR "post mortem")) AND "computed tomography"))OR((((postmortem)OR post-mortem) OR "post mortem"))AND MR))OR((((postmortem)OR post-mortem) OR "post mortem"))AND "magnetic resonance"))OR((((postmortem) OR post-mortem)OR "post mortem"))AND MDCT))OR((MSCT) AND(((postmortem)OR post-mortem)OR "post mortem"))	23,704
2	((hypostasis OR clot))AND #1	85

Ichushi (Medical journal)

#	Search formula	Number of
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		documents
1	(死後CT/AL or 死後MRI/AL or (死亡時画像診断/TH or 死亡時画像診断/AL) or (死亡時画像診断/TH or オートプシーイメージング/AL) ) and (LA=日本語, 英語 and PT= 会議録除く)	529
2	(就下/AL or 凝固/AL) and #1	9

## References

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- [2] New PF et al: Attenuation measurements of whole blood and blood fractions in computed tomography. Radiology 1976; 121: 635-640 (Level 5)
- [3] Takahashi N et al: Quantitative analysis of intracranial hypostasis: comparison of early postmortem and antemortem CT findings. AJR 2010; 195: W388-393 (Level 4b)
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- [11] Ishida M et al: Common postmortem computed tomography findings following atraumatic death: differentiation between normal postmortem changes and pathologic lesions. Korean J Radiol 2015; 16: 798-809 (Level 5)
- [12] von Both I et al: Differentiation of antemortem pulmonary thromboembolism and postmortem clot with unenhanced MRI: a case report. Forensic Sci Med Pathol 2018; 14: 95-101 (Level 5)
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