

CQ 3: What types of fluid accumulation are observed as postmortem changes on CT?

Recommendation Grade: C2

Postmortem CT may show fluid accumulation in the paranasal sinuses, trachea and bronchi, pleural cavities, and peritoneal cavity. These findings are generally non-specific, and it is often difficult to determine whether they reflect pre-existing conditions, postmortem changes, or findings related to the cause of death. Since the volume of fluid can vary depending on the postmortem interval, interpretation must be made carefully, taking into account clinical history and other contextual information in addition to imaging findings.

Explanation

• Background

After death, increased vascular and membrane permeability can lead to fluid accumulation in the paranasal sinuses, trachea and bronchi, pleural cavities, and peritoneal cavity.¹⁻⁹ These fluid collections are non-specific findings and by themselves, are not sufficient to determine the cause of death.

• Imaging Findings

Postmortem CT is useful for detecting and quantifying fluid accumulation in the paranasal sinuses, trachea and bronchi, pleural cavities, and peritoneal cavity.¹⁻⁹ Fluid accumulation in the paranasal sinuses is seen in approximately 30% to 65% of postmortem CT scans and is generally considered a non-specific finding.^{5 8 9} However, in cases of drowning, fluid accumulation in the maxillary and sphenoid sinuses is reportedly more frequent and of higher density than in non-drowning cases, and may support the diagnosis.⁶ Additionally, when comparing saltwater and freshwater drownings, freshwater cases tend to show greater fluid accumulation in the sinuses, and lower density.¹⁰

Fluid in the trachea and bronchi is observed in approximately 60% to 80% of postmortem CTs, making it a relatively common finding.^{4, 9} When pleural effusion, atelectasis, or pulmonary infiltrates are present, they may cause greater collapse of the lung parenchyma and increase the likelihood of tracheal fluid accumulation. This finding also becomes more common with longer postmortem intervals.⁴ It is important to note that tracheal or bronchial fluid is not inherently pathological, and a careful distinction must be made from drowning, asphyxiation, or aspiration.

Pleural and peritoneal effusions are also detectable on postmortem CT, with reported incidence rates of approximately 30% and 20%, respectively.⁹ In a study investigating temporal changes in pleural effusion using postmortem CT, the volume of pleural fluid was found to be comparable to antemortem levels for up to 30 hours after death, but increased significantly between 30 and 42 hours postmortem.² Additionally, if contrast-enhanced CT was performed before death, increased vascular permeability may lead to leakage of contrast agent into the peritoneal cavity, resulting in elevated CT attenuation

values.³ Care should be taken not to misinterpret this as hemorrhagic or infectious fluid.

○ Literature Search Strategy and Selection (September 17, 2023)

【PubMed】

#	Search formula	Number of articles
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"))	30,768
2	(((((fluid OR effusion OR ascites))))AND #1	2,555

【医中誌 Ichushi-Web (Japan Medical Abstracts Society Database)】

#	Search formula	Number of articles
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)	781
2	(液体/AL or 液貯留/AL or 胸水/AL or 腹水/AL)and #1	56

■References

- 1) Heo JH et al : The significance of evaluating sphenoid sinus fluid by postmortem computed tomography in cases of drowning. J Forensic Leg Med 2023 ; 97 : 102551 (level 4b)
- 2) Hyodoh H et al : Time-related course of pleural space fluid collection and pulmonary aeration on postmortem computed tomography (PMCT) . Leg Med 2015 ; 17 : 221-225 (level 4b)
- 3) Ishida M et al : Longitudinal comparison of ascites attenuation between antemortem and postmortem computed tomography. Forensic Sci Int 2021 ; 321 : 110727 (level 4b)
- 4) Ishida M et al : Fluid in the airway of nontraumatic death on postmortem computed tomography : relationship with pleural effusion and postmortem elapsed time. Am J Forensic Med Pathol 2014 ; 35 : 113-117 (level 4b)
- 5) Kawasumi Y et al : Assessment of the relationship between drowning and fluid accumulation in the paranasal sinuses on post-mortem computed tomography. Eur J Radiol 2012 ; 81 : 3953-3955

(level 4b)

- 6) Kawasumi Y et al : Diagnosis of drowning using post-mortem computed tomography based on the volume and density of fluid accumulation in the maxillary and sphenoid sinuses. *Eur J Radiol* 2013 ; 82 : e562-566 (level 4b)
- 7) Lo Gullo R et al : Quantification of interstitial fluid on whole body CT : comparison with whole body autopsy. *Forensic Sci Med Pathol* 2015 ; 11 : 488-496 (level 4b)
- 8) Sieswerda-Hoogendoorn T et al : Normal cranial postmortem CT findings in children. *Forensic Sci Int* 2015 ; 246 : 43-49 (level 4b)
- 9) Wagensveld IM et al : Total-body CT and MR features of postmortem change in in-hospital deaths. *PloS One* 2017 ; 12 : e0185115 (level 4b)
- 10) Sugawara M et al : Postmortem computed tomographic features in the diagnosis of drowning : a comparison of fresh water and salt water drowning cases. *Jpn J Radiol* 2019 ; 37 : 220-229 (level 4b)

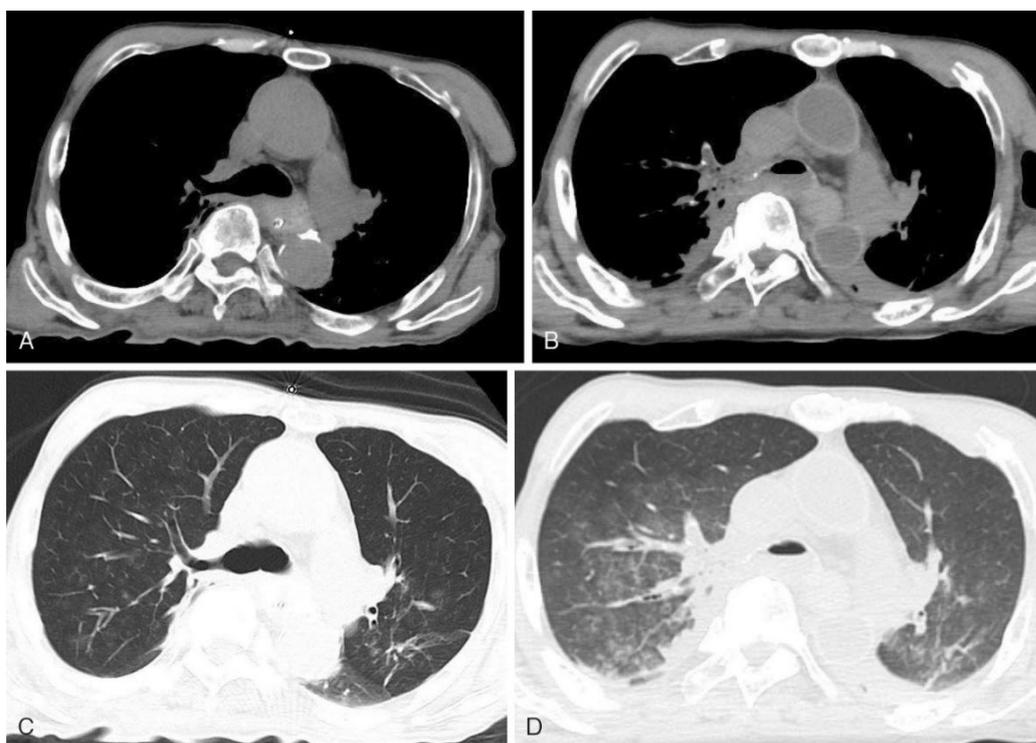


Figure 1. Male in his 70s – Acute Cardiovascular Event (Post-Resuscitation)

A, C: Immediately after death B, D: Approximately 36 hours postmortem

(A, B: Mediastinal window C, D: Lung window)

As the postmortem interval progresses, pleural effusion appears, likely influenced by fluid administration during resuscitation. A horizontal fluid level is seen within the trachea, suggesting the accumulation of fluid that has refluxed from the lungs into the airway. In the lungs, dorsally predominant ground-glass opacities are observed, consistent with hypostasis.

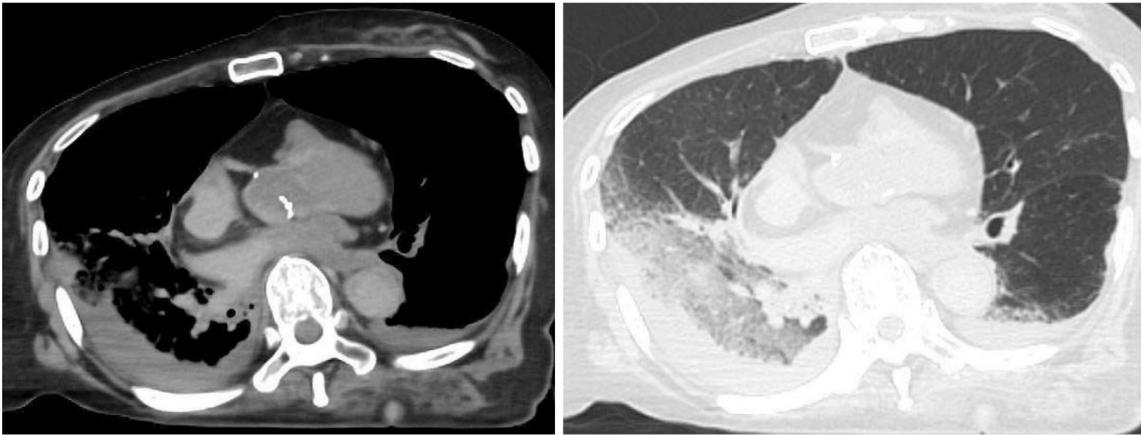


Figure 2. Female in her 90s – Renal Failure

Marked hypostasis is observed in the right dorsal lung, along with bilateral pleural effusions, more prominent on the right than on the left.

Asymmetry in pleural effusion may be seen in cases with pleural adhesions.

No horizontal fluid levels are seen within the heart or great vessels.