

CQ19: Does infusion therapy during cardiopulmonary resuscitation affect postmortem imaging?

Recommendation Grade:

Condition Assessment: C1

In cardiopulmonary arrest cases not caused by trauma, infusion therapy administered during resuscitation is believed to increase lung attenuation values. For accurate interpretation of postmortem imaging, it is essential to confirm the volume of infusion administered during resuscitation in advance. However, no reliable method has been reported for distinguishing between pre-existing pathological changes and reduced lung aeration due to infusion. Therefore, it is recommended that postmortem imaging be interpreted with consideration of the volume of infusion used during resuscitation.

Explanation

• Background

In adult advanced life support, there is limited research on intravenous infusion during cardiopulmonary resuscitation (CPR), making it difficult to clearly assess the benefits or harms of infusion therapy¹. However, treatment guidelines have been established for severe cases involving hypotension, and these guidelines provide general recommendations for infusion volume.

In the treatment of severe trauma, intravenous infusion is considered a method for rapidly restoring systemic circulation and preventing local hypoperfusion and tissue hypoxia in situations such as hypotension caused by blood loss. In such cases, it is recommended that no more than 1–1.5 liters of normal saline be administered². For initial treatment of septic shock, it is recommended to administer ≥ 30 mL/kg of crystalloid solution within 3 hours after evaluating for intravascular volume depletion³. Thus, large volumes of infusion are typically administered in severe cases, and it is not uncommon for substantial amounts of infusion to be given during CPR as well.

• Imaging Findings

Postmortem CT performed after intravenous infusion is believed to show increased lung attenuation values compared to cases without infusion⁴. In emergency settings, circulatory support is often provided via anterior chest compressions, which may also contribute to increased pulmonary attenuation.

Due to postmortem hypostasis of blood, lung attenuation normally increases in the dependent regions of the lungs as part of typical postmortem changes (see CQ2). Therefore, in cases where death occurs despite CPR efforts, postmortem imaging may show pulmonary findings reflecting both normal postmortem changes and modifications due to infusion therapy⁴. An animal study using rabbits reported that large volumes of normal saline administered after death led to increased lung density on

postmortem CT⁵.

Unlike typical hypostatic changes, postmortem CT after intravenous infusion resuscitation may show diffuse, non-gravity-dependent increases in lung attenuation, which requires caution during interpretation. Other conditions that can cause diffuse pulmonary attenuation on postmortem CT, aside from infusion resuscitation, include acute left heart failure (see CQ31), drowning (see CQ43), drug intoxication (see CQ45), intracranial hemorrhage (see CQ27–29), blood aspiration, and pneumonia (see CQ35). In cases where CPR—including infusion resuscitation—was performed for these conditions, interpretation must take into account whether the observed increased attenuation is due to the underlying cause of death or the added effects of infusion. Because definitive conclusions cannot be drawn based on imaging alone, careful interpretation is required.

○ Literature Search Strategy and Selection (as of June 24, 2024)

【PubMed】

#	Search formula	Number of articles
1	Search: (((postmortem) OR (post-mortem)) OR (post mortem))AND ((CT)OR (MDCT)OR (MRI))	13,775
2	Search: (((((infusion) OR (cardiopulmonary resuscitation)OR (cardiac)OR (management))))))	6,064,638
3	Search (#1) AND (#2)	2,605

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

#	Search formula	Number of articles
1	((死亡時画像診断/TH or 死後画像/AL) or (死亡時画像診断/TH or オートプシーイメージング/AL) or ((@X 線 CT/TH and @死亡時画像診断/TH) or 死後 CT/AL)) and (PT=原著論文,解説,総説,図説,Q&A,講義,会議録除く)	825
2	(輸液療法/TH or 輸液/AL or 心肺蘇生術/AL)	41,933
3	#1 and #2	15

● Additional Sources Not Captured by the Search Strategy

References [5]

■ References

- 1) 黒田泰弘ほか：JRC 蘇生ガイドライン 2015 成人の二次救命処置：心拍再開後の集中治療, 予後評価. 日集中医誌 2017 ; 24 : 151-183 (level 4a)
- 2) Rossaint R et al : The European guideline on management of major bleeding and coagulopathy following trauma : sixth edition. Crit Care 2023 ; 27 : 80 (level 4b)
- 3) Egi M et al : The Japanese Clinical Practice Guidelines for Management of Sepsis and Septic Shock 2020 (J-SSCG 2020) . J Intensive Care 2021 ; 9 : 53 (level 4a)
- 4) Michiue T et al : Forensic pathological evaluation of postmortem pulmonary CT high-density areas in serial autopsy cases of sudden cardiac death. Forensic Sci Int 2013 ; 232 : 199-205 (level 4b)
- 5) Hyodoh H et al : The infusion effect in postmortem lung CT. Forensic Imaging 2020 ; 20 : 200367 (level 6)

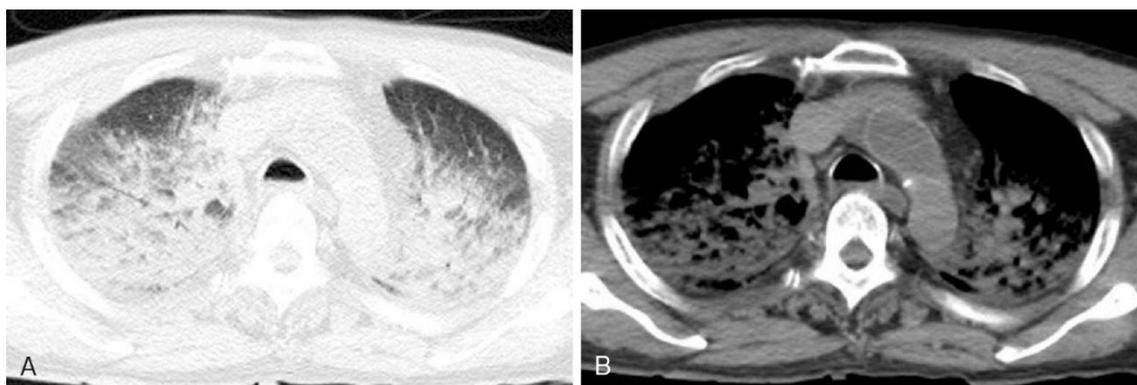


Figure. CT of a Man in His 60s – Case of Massive infusion During CPR; Hypothermia (2 Days Postmortem)

Pulmonary aeration, a characteristic finding in hypothermia, can be easily altered by resuscitative interventions such as infusion. In this case, diffuse areas of decreased aeration are observed in both lungs (A). Retrograde accumulation of infusion from the alveoli is seen reaching the tracheal bifurcation (B).