CQ 13: Is Image Processing (3D Reconstruction / MPR) in Postmortem CT Useful for Determining the Cause of Death?

Recommendation Grade: C1

There are case reports demonstrating the usefulness of 3D reconstructed images based on postmortem CT. However, no scientific evidence currently exists to definitively prove their usefulness.

Explanation

Several case reports have demonstrated the usefulness of 3D reconstructed images derived from postmortem CT data:

- For evaluating high-density structures such as bone and metal:
    - Assessment of bone fractures and skeletal anomalies in a stillborn infant with osteogenesis imperfecta[1]
    - Evaluation of ligature marks, as well as hyoid and thyroid cartilage fractures in cases of hanging[2]
    - Analysis of multiple traumatic injuries from a motorcycle accident[3]
    - Examination of skull fractures in a fall-related death[4]
- In gunshot fatalities, 3D imaging was useful for evaluating wound trajectories and spatial relationships[5] [6]
- For identifying the causative object in trauma-related deaths[7]
- Regarding coronary artery disease, which is difficult to assess using non-contrast CT:
    - Observation of coronary artery calcifications[8]
    - Evaluation of **coronary arteries using postmortem CT angiography (PMCTA)**[9]
- For intravascular gas visualization and analysis:
    - Fatal cases of air embolism[10] [11]
    - Hemorrhagic death due to tumor invasion of the common carotid artery[12]

Other applications include:

- Investigation of causes of death in stillborn infants[13]
- Identification and quantification of subdural hematoma in advanced decomposition cases[14]

Column: Utilization of 3D Imaging

3D images created using imaging workstations are often found to be helpful in explaining findings to investigators or lay judges, and are already being used in practical forensic and legal settings. When creating such images, it is essential to ensure objective presentation and to take great care not to fabricate or alter findings in any way. The goal should be faithful visualization of existing anatomical or pathological structures based on the original data.

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

【PubMed】

#	Search formula	Number of articles
1	Search (postmortem) AND ((computed tomography OR magnetic resonance))	13,847
2	Search (((postmortem) AND ((computed tomography OR magnetic resonance)))) AND volume rendering	51
3	Search (((((postmortem) AND ((computed tomography OR magnetic resonance)))) AND volume rendering)) AND Humans	42

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

#	Search formula	Number of articles
1	((((死後/AL or 死亡時/AL) and (画像診断/TH or 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) or ("死亡時画像診断"/TH or "Autopsy imaging"/AL))))	4,490
2	((((死後/AL or 死亡時/AL) and (画像診断/TH or 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) or ("死亡時画像診断"/TH or "Autopsy imaging"/AL))) and ((容積表現法/TH or ボリュームレンダリング/AL)))	10
3	((((死後/AL or 死亡時/AL) and (画像診断/TH or 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) or ("死亡時画像診断"/TH or "Autopsy imaging"/AL))) and ((容積表現法/TH or ボリュームレンダリング/AL)) and (AB=Y and PT=会議録除く))	9

■**References**

1） Zou DH et al： Determination of a newborn with lethal type II osteogenesis imperfecta and other anomalies using autopsy and postmortem MSCT：a case report. Fa Yi Xue Za Zhi 2016；32：69-73（level 5）

2） Maiese A et al： When the hidden features become evident： the usefulness of PMCT in a strangulation-related death. Leg Med 2014；16：364-366（level 5）

3） Moskała A et al：The importance of post-mortem computed tomography （PMCT） in confrontation with conventional forensic autopsy of victims of motorcycle accidents. Leg Med 2016；18：25-30（level 5）

4） Hyodoh H et al： Objective skull fracture evaluation by using the postmortem 3D-CT skull fracture score in fatal falls. Leg Med 2022；56：102048（level 4b）

5） Maiese A et al： Post mortem computed tomography： useful or unnecessary in gunshot wounds deaths?：two case reports. Leg Med 2014；16：357-363（level 5）

6） Tartaglione T et al： Importance of 3D-CT imaging in single-bullet cranioencephalic gunshot wounds. Radiol Med 2012；117：461-470（level 5）

7) Aromatario M et al： Weapon identification using antemortem CT with 3D reconstruction, is it always possible?：a report in a case of facial blunt and sharp injuries using an ashtray. Leg Med 2016；18：1-6（level 5）

8） Wan L et al： Assessment of a sudden death case due to coronary artery disease based on the PMCT and forensic autopsy. Fa Yi Xue Za Zhi 2012；28：379-382（level 5）

9) Takahashi Y et al： Use of postmortem coronary computed tomography angiography with water-insoluble contrast medium to detect stenosis of the left anterior descending artery in a case of sudden death. Leg Med 2016；19：47-51（level 5）

10）Jackowski C et al： Visualization and quantification of air embolism structure by processing postmortem MSCT data. J Forensic Sci 2004；49：1339-1342（level 5）

11）Takahashi Y et al：Postmortem computed tomography evaluation of fatal gas embolism due to connection of an intravenous cannula to an oxygen supply. Leg Med 2017；27：1-4（level 5）

12）Tajima S et al：Availability of postmortem CT for fatal bleeding attributed to common carotid artery rapture：a case report. Japanese Journal of Diagnostic Imaging 2013；31：124-128（level 5）

13）O’Donoghue K et al： Investigation of the role of computed tomography as an adjunct to autopsy in the evaluation of stillbirth. Eur J Radiol 2012；81：1667-1675（level 5）

14) Sano R et al：Use of postmortem computed tomography to reveal acute subdural hematoma in a severely decomposed body with advanced skeletonization. Leg Med 2013；15：32-34（level 5）

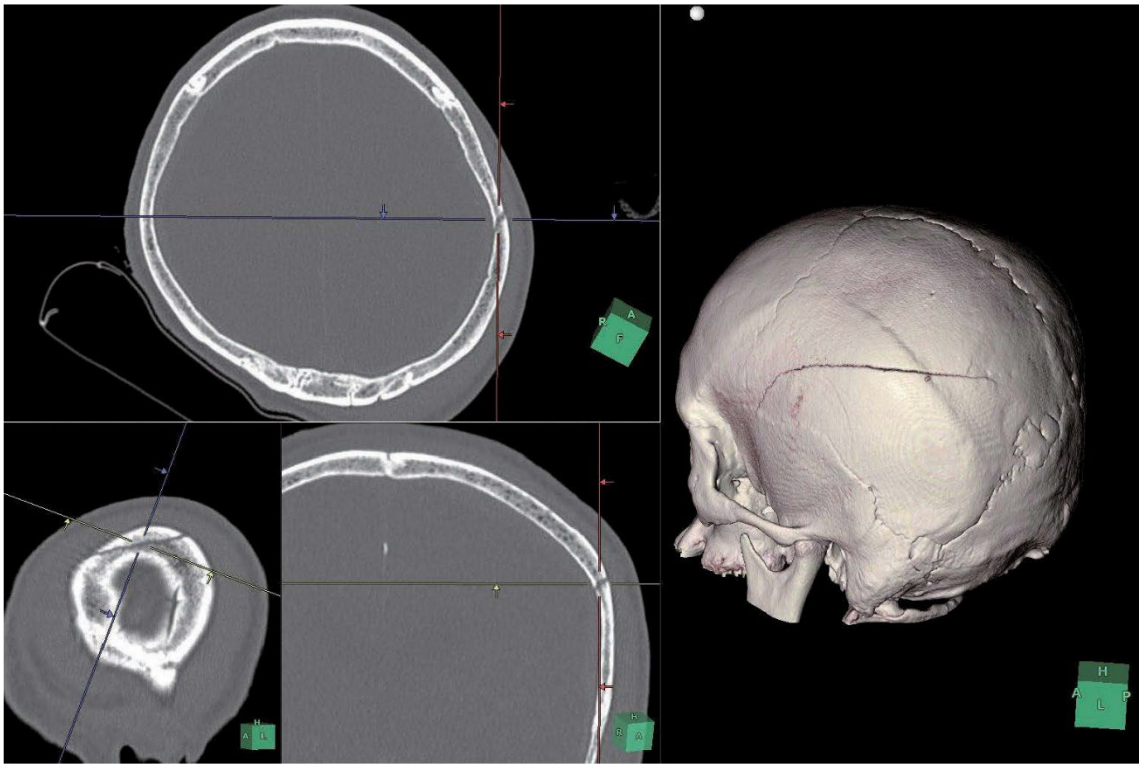

Figure: Male in his 60s – Subdural Hematoma and Skull Fracture

A subdural hematoma caused by head trauma is observed. A fracture line in the left parietal bone is visible on the VR image.