CQ05 Is it useful to use postmortem images to identify, quantify, and characterize body fluids?

Grade of recommendations: B

Postmortem CT/MRI can detect fluid in the body cavity and subcutaneous edema, and the T2-weighted image of postmortem MRI clearly shows the fluid in the body. The liquid that can be detected by postmortem CT/MRI is considered to exceed that of an autopsy except for trace liquids, and the positional relationship with other organs can be accurately diagnosed. Postmortem CT can be used to measure liquid volume. A postmortem CT allows the diagnosis of blood in the body using the CT attenuation. In postmortem CT, CT attenuation of liquid changes due to postmortem changes and changes in temperature. When frozen, it exhibits low absorption, so caution is required when interpreting images.

Explanation----------

Significance of detecting liquids in a corpse

In addition to blood, various fluids such as cerebrospinal fluid, pericardial fluid, pleural effusions, urine, and other secreted fluids are present in the body. In the corpse, the localization and amounts of these liquids may be related to the cause of death and are important for the interpretation of the cause of death.

Detection of fluid in the body using postmortem images

Postmortem CT/MRI can visualize fluid collection in body cavities such as in the cranial, pleural, pericardial, and peritoneal cavity, and subcutaneous fluid retention [1-7]. In the T2-weighted image of postmortem MRI, the liquid is clearly visualized as a high signal intensity [8-11].

Liquid detectability on postmortem CT/MRI may be superior to an autopsy. In particular, subcutaneous fluid retention is clearly visualized on postmortem CT/MRI because its properties are different from subcutaneous fat, and its detectability exceeds that in an autopsy [1, 4, 10]. However, a small amount of fluid that can be detected by autopsy may not be detected by postmortem CT [5, 12].

Localization and quantification of liquid by postmortem images

If fluid is drained during an autopsy, its prior localization can be difficult to determine. However, postmortem CT/MRI clearly shows the localization of the liquid. This makes it easy to understand the positional relationship with other organs [11, 13].

The measurement of liquid volume using postmortem CT has been performed since the early 1980s [12]. On postmortem CT, the amount of fluid in the pleural cavity [3, 4, 7], fluid in the peritoneal cavity [4, 14], and fluid in the pericardial cavity [2, 4, 7] has been measured. The volume has been

compared with the volume of the liquid obtained by autopsy. The volume of fluid obtained by postmortem CT matches the volume obtained by autopsy in the pleural and peritoneal cavities [3, 4, 7, 14], but in the pericardial cavity it may be larger than in the autopsy [2, 4, 7]. If a large amount of fluid accumulates in the pericardial space, pericardial fluid may flow out at the time of an autopsy and be underestimated.

Property diagnosis of liquid using CT attenuation

It has been reported that blood can be distinguished from the CT attenuation of liquids on postmortem CT, because blood exhibits 40 to 90 HU (average 60 HU) values and it exhibits high absorption compared with other liquids such as cerebrospinal fluid, serum, bile, and urine [15]. Because postmortem CT showed high CT attenuation in the ventricles or digestive tract, it was reported that intraventricular hemorrhage [5] or digestive tract hemorrhage [16] were detected. However, in postmortem CT, the CT attenuation may change due to postmortem changes and temperature changes [15]. The liquids produced by postmortem putrefaction show –130 to 80 HU (30 HU on average) values, which vary greatly depending on the timing of the imaging and the location of the site [15]. In the case of a putrefied corpse, it is difficult to distinguish its properties using absorption values due to the effects of gas in the intestinal tract and the peritoneal cavity [17]. In a report investigating changes in the absorption value of body fluids with temperature, serum and cerebrospinal fluid had values of 30 HU and 20 HU at 4°C, but 20 HU and 10 HU at 40°C, respectively. There is a difference of 10 HU depending on the temperature [15]. When the liquid freezes, it shows low CT attenuation [18]. There is a case report where the cause of death was intraperitoneal hemorrhage due to fallopian tube rupture in pregnancy. The corpse was examined 4 days after cryopreservation. On the postmortem CT, a highly absorbed clot was observed in the pelvis, which was near the bleeding site, and frozen liquid showed a linear, low-absorption image under the distant diaphragm. Based on the above findings, it was possible to estimate the bleeding site using the postmortem CT [18].

See CQ06 and CQ39 for postmortem changes in body fluid and body fluids due to drowning, respectively.

Literature search formula and literature selection（2019/3/28）

PubMed

#	Search formula	Number of documents
1	(((((("postmortem CT") OR "postmortem MRI") OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem MRI") OR "postmortem imaging"	810
2	#1 AND liquid	7
3	#1 AND fluid	56

4	#1 AND effusion	25
5	#1 AND ascites	5
6	#1 AND ascites 5 6 #2 OR #3 OR #4 OR #5	78

Ichusi（Medical journal）

#	Search formula	Number of documents
1	(死後 /AL) and ((FT=Y) PT= 原著論文 , 会議録除く CK= ヒト)	4,573
2	(死亡時 /AL) and ((FT=Y) PT= 原著論文 , 会議録除く CK= ヒト)	678
3	((画像診断 /TH or 画像診断 /AL)) and ((FT=Y) PT= 会議録除く CK= ヒト)	266,892
4	((X 線 CT/TH or X 線 CT/AL)) and ((FT=Y) PT= 会議録除く CK= ヒト)	102,448
5	((MRI/TH or MRI/AL)) and ((FT=Y) PT= 原著論文 , 会議録除く CK= ヒト)	85,771
6	#1 or #2	5,044
7	#3 or #4 or #5	277,138
8	#6 and #7	1,225
9	((液体 /TH or 液体 /AL)) and ((FT=Y) PT= 原著論文 , 会議録除く CK= ヒト)	5,910
10	(胸水 /TH or 胸水 /AL)	18,699
11	(心膜液 /TH or 心嚢液 /AL)	2,372
12	心嚢水 /AL	739
13	(腹水 /TH or 腹水 /AL)	28,617
14	#9 or #10 or #11 or #12 or #13	52,535
15	#8 and #14	75

References

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[8] Barber JL et al: Pleural fluid accumulation detectable on paediatric post-mortem imaging: a possible marker of interval since death? Int J Legal Med 2016; 130: 1003-1010 (Level 4b)

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[10] Tumanova UN et al: Possibilities of postmortem magnetic resonance imaging for evaluation of anasarca in newborns. Bull Exp Biol Med 2019; 166: 671-675 (Level 4b)

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[18] O'Donnell C et al: Massive hemoperitoneum due to ruptured ectopic gestation: postmortem CT findings in a deeply frozen deceased person. Leg Med 2011; 13: 245-249 (Level 5)