CQ22 Is it possible to interpret (existence / cause of death) of a malignant tumor on postmortem images?

Grades of recommendations:
C1 for evaluating the condition
C2 for determining the cause of death

As a finding of fatality due to a malignant tumor, a large volume of malignant pleural effusion causing respiratory failure and a large volume of ascites due to peritoneal dissemination can be detected by postmortem CT.

There are several reports of detection of malignant tumors using postmortem CT/MRI. However, there are tumors that may be mistaken for other diseases and that are difficult to detect by postmortem CT/MRI, such as diffuse infiltrative tumors. Postmortem images may not allow detection of all such malignancies.

Explanation----------

Direct causes of death with common malignant tumors

The following clinical causes of death associated with malignant tumors have been reported: breast tumors, lung tumors, ovarian tumors, as well as respiratory failure due to massive malignant pleural effusion associated with pleural dissemination of mesotheliomas [1], liver failure due to diffuse liver metastasis [2-5], heart failure due to myocardial metastasis [6], pulmonary artery tumor embolisms [7], and large volumes of ascites due to peritoneal dissemination of ovarian tumors [8].

Postmortem CT allows a straightforward detection of fluid in the body cavity, large volumes of pleural effusion and ascites can be detected [9]. Diffuse liver metastases [2-5], myocardial metastases [6], and pulmonary artery tumor embolisms [7] are difficult to diagnose also on clinical CT and may be difficult to detect on postmortem CT.

Diagnosis of malignant tumors on postmortem CT

There are no reports of detailed examinations of direct causes of malignant tumors on postmortem CT. There is a case report of a suffocation death where bronchial metastasis of renal tumors was diagnosed by CT after death, but no pathological examination was performed [10].

Malignant tumors detectable by postmortem CT

The following tumors have been reported as examples of malignant tumors detected by postmortem CT scans and confirmed by autopsies: brain tumors [11, 12], pharyngeal tumors [14], lung tumors [12, 13], bronchial tumors [14], pleura tumors [14], intestinal tumors [15-17], liver tumors [9], and adrenal

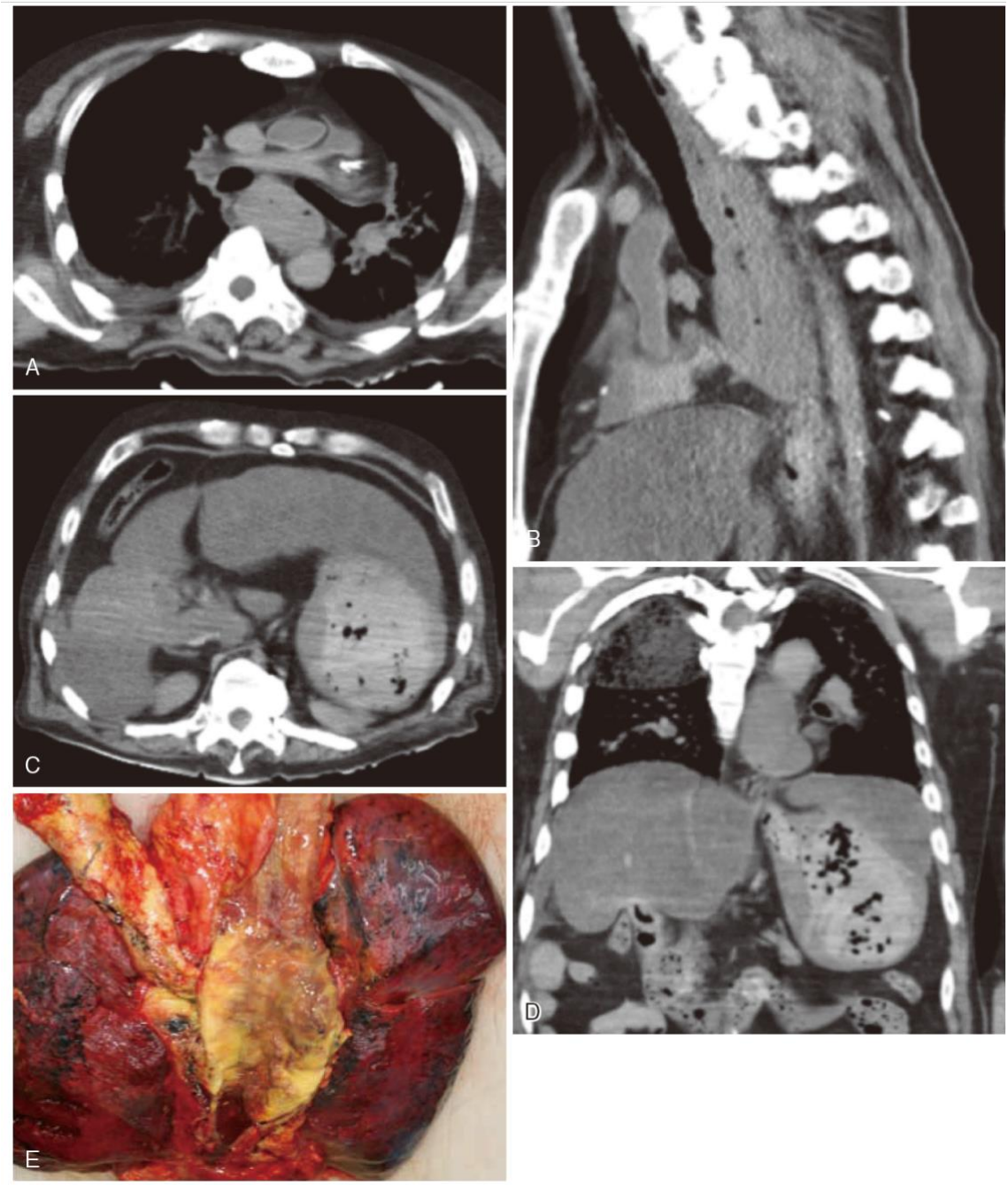
tumors [18]. It has been reported that using postmortem CT, primary lung tumors and metastatic lung tumors were difficult to distinguish even if they were detected as mass lesions, and that metastatic liver tumors and liver abscesses could not be distinguished [14]. It has also been reported that gallbladder tumors and pancreatic tumors were mistaken for duodenal tumors [14], suggesting that it may be difficult to diagnose tumors in adjacent organs. A histological diagnosis is necessary for a definitive diagnosis, but there is no report that this requires a conventional autopsy, and there is a report that a minimally invasive autopsy (postmortem puncture diagnosis) is useful [11, 17].

Malignant tumors that cannot be detected by postmortem CT

The following tumors have been reported as malignant tumors that could not be detected by postmortem CT: lung tumors [13], bronchial tumors [14], metastatic liver tumors [13], colon tumors [14], and gastric tumors [19].

The following tumors have been reported as malignant tumors that could not be identified in antemortem images and were diagnosed by biopsy or autopsy: invasive liver metastasis (breast tumors [2, 3, 5], malignant lymphomas [3, 4], lung tumors [3], prostate tumors [3], renal tumors [3], melanomas [3], neuroblastomas [3]), intravascular lymphomas [20], invasive pancreatic tumors [21], and pulmonary artery tumor embolisms [7]. These lesions were thought to be difficult to identify on postmortem CT. It has also been reported that postmortem MRI could not identify liver metastases of renal tumors, melanomas, and neuroblastomas [3].

Figure: Esophageal cancer



A-D CT, E Autopsy macroscopic findings

The postmortem CT shows a large tumor mass in the middle esophagus (A, B). High attenuation is observed in the stomach and duodenum (C, D). Based on the above findings, gastrointestinal bleeding may have occurred. In addition, the liver shows a marked image of fatty cirrhosis.

The autopsy findings (E) showed that blood clots were attached to the anus side of the large esophageal cancer, and necrotic lesions were found just below them (E).

Literature search formula and literature selection (2019/8/3)

PubMed

#	Search formula	Number of documents
1	((((((((((postmortem) OR postmortem) OR postmortem)) AND imaging)) OR (((((((postmortem) OR postmortem) OR postmortem)) AND ct)) OR (((((postmortem) OR postmortem) OR postmortem)) AND computed tomography))) OR (((((((postmortem) OR postmortem) OR postmortem)) AND mr)) OR (((((postmortem) OR postmortem) OR postmortem)) AND magnetic resonance))))	24,438
2	malignancy	3,258,639
3	causes of death	201,682
4	#1 and #2 and #3	185

Ichushi（Medical Journal）

#	Search formula	Number of 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)) 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)	542
2	(腫瘍/TH or 悪性腫瘍/AL)	2,071,609
3	(剖検/TH or 剖検/AL)	76,130
4	#1 and #2 and #3	31

From other than search formula

[1, 2, 4, 5, 8, 9, 12-15, 17, 18, 20]

References

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[3] Simone C et al: Rapid liver enlargement and hepatic failure secondary to radiographic occult tumor invasion: two case reports and review of the literature. J Med Case Rep 2012; 6: 402 (Level 5)

[4] Rowbotham D et al: Acute liver failure secondary to hepatic infiltration: a single centre experience of

18 cases. Gut 1998; 42: 576-580 (Level 5)

[5] Allison KH et al: Radiographically occult, diffuse intrasinusoidal hepatic metastases from primary breast carcinomas: a clinicopathologic study of 3 autopsy cases. Arch Pathol Lab Med 2004; 128: 1418-1423 (Level 5)

[6] Murakami T et al: Cardiac metastasis of renal pelvic cancer. Int J Urol 2007; 14: 240-241 (Level 5)

[7] Lammi M et al: Pulmonary tumor embolism. Lung 2010; 188: 441-443 (Level 5)

[8] Yamazaki M et al: Autopsy report of an ovarian cancer where the patient died without being treated. The journal of criminology 2000; 66: 209-216 (Level 5)(Japanese)

[9] Takahashi N et al: Multiple lung tumors as the cause of death in a patient with subarachnoid hemorrhage: postmortem computed tomography study. Jpn J Radiol 2009; 27: 316-319 (Level 5)

[10] Takahashi N et al: The effectiveness of postmortem multidetector computed tomography in the detection of fatal findings related to cause of non-traumatic death in the emergency department. Eur Radiol 2012; 22: 152-160 (Level 4b)

[11] Bolliger SA et al: Postmortem imaging-guided biopsy as an adjuvant to minimally invasive autopsy with CT and postmortem angiography: a feasibility study. AJR 2010; 195: 1051-1056 (Level 4a)

[12] Poulsen K et al: Computed tomography as routine in connection with medico-legal autopsies. Forensic Sci Int 2007; 171: 190-197 (Level 5)

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[14] Roberts IS et al: Postmortem imaging as an alternative to autopsy in the diagnosis of adult deaths: a validation study. Lancet 2012; 379: 136-142 (Level 4b)

[15] Li HJ et al: Diagnostic imaging, preautopsy imaging and autopsy findings of 8 AIDS cases: a comparative study. Chin Med J 2009; 122: 2142-2148 (Level 5)

[16] O'Donnell C et al: Demonstration of liver metastases on postmortem whole body CT angiography following inadvertent systemic venous infusion of the contrast medium. Int J Legal Med 2012; 126: 311-314 (Level 5)

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[19] Yamazaki K et al: Comparison between computed tomography（CT）and autopsy findings in cases of abdominal injury and disease. Forensic Sci Int 2006; 162: 163-166 (Level 5)

[20] Kitanaka A et al: Intravascular large B-cell lymphoma with FDG accumulation in the lung lacking CT/（67）gallium scintigraphy abnormality. Hematol Oncol 2009; 27: 46-49 (Level 5)

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