**CQ41 What are useful findings in postmortem CT to determine acute drug poisoning?**

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

In drug poisoning, orally administered toxicological agents may be recognized as a high attenuation body in the gastrointestinal tract, which may be a trigger for the diagnosis, but postmortem CT alone cannot confirm the diagnosis.

**Explanation----------**
**Background**

Poisoning is a state in which some kind of damage is caused to the activity of the living body due to the chemical action of substances taken into the human body. In forensic toxicology, the target poisoning causative substance is often referred to as a "drug poison". The drug poison referred to here is "a chemical substance directly or indirectly involved in human death, or a chemical substance introduced as an element that constitutes a crime". Therefore, not only chemical substances known as so-called poisons but also various chemical substances such as pharmaceuticals, drugs of abuse, pesticides, and household products are targeted as medicinal poisons [1]. In general, clinical practice, there are many reports and findings for in vivo CT/MRI findings of drug poisoning. In particular, the following various toxicological findings have been reported by brain MRI: illegal drugs (methamphetamine, cocaine, heroin, etc.), toluene, methanol, ethylene glycol, and therapeutic drugs (methotrexate, 5-Fluorouracil, metronidazole, etc.).

However, there are few reports on postmortem CT/MRI findings of drug poisoning, and most of these are from postmortem CT findings in the gastrointestinal (GI) tract of orally administered drug/toxicants. There are very few reports focusing on other parts of the body, such as the brain or lungs, other than the GI tract and very few reports on postmortem MRI findings of drug poisoning. Clinically, as in forensic medicine, acute toxic poisoning leads to a definitive diagnosis by measuring the concentration of toxic substances in the blood.

**Postmortem CT/MRI findings of the gastrointestinal tract observed in deaths due to drug poisoning**

There is one case-controlled study on postmortem CT findings in the gastrointestinal tract of death due to poisoning. This study compared 61 cases of drug addiction due to suicide attempts (overdose of therapeutic drug) and 61 cases of a control group. In the report, 19 patients (31%) in the drug poisoning death group had a high attenuation region in the stomach with an average CT value of 146

HU, and 3 patients in the control group had an unclear high attenuation region in the stomach. It was suggested that the region of high attenuation in the stomach would trigger the discovery of drug poisoning [2].

In addition, there are relatively many reports of postmortem CT findings in cases of suicidal drug poisoning due to overdoses of psychotropic drugs, with 20 out of 23 cases showing high attenuation in the stomach [3], and there are five case reports of high attenuation areas in the stomach/duodenum [4-8].

There are case reports of postmortem CT findings due to illegal drugs such as cocaine and methamphetamine relating to 'body packing' (internal concealment of drugs within the GI tract or other orifices.) [9-11]. In a case report, postmortem CT showed a capsule-like structure with a high attenuation region in the stomach, and postmortem MRI showed a low signal on T1- and T2-weighted images [9]. In two cases, postmortem CT was considered to have capsule-like structures in the stomach and colon [10, 11

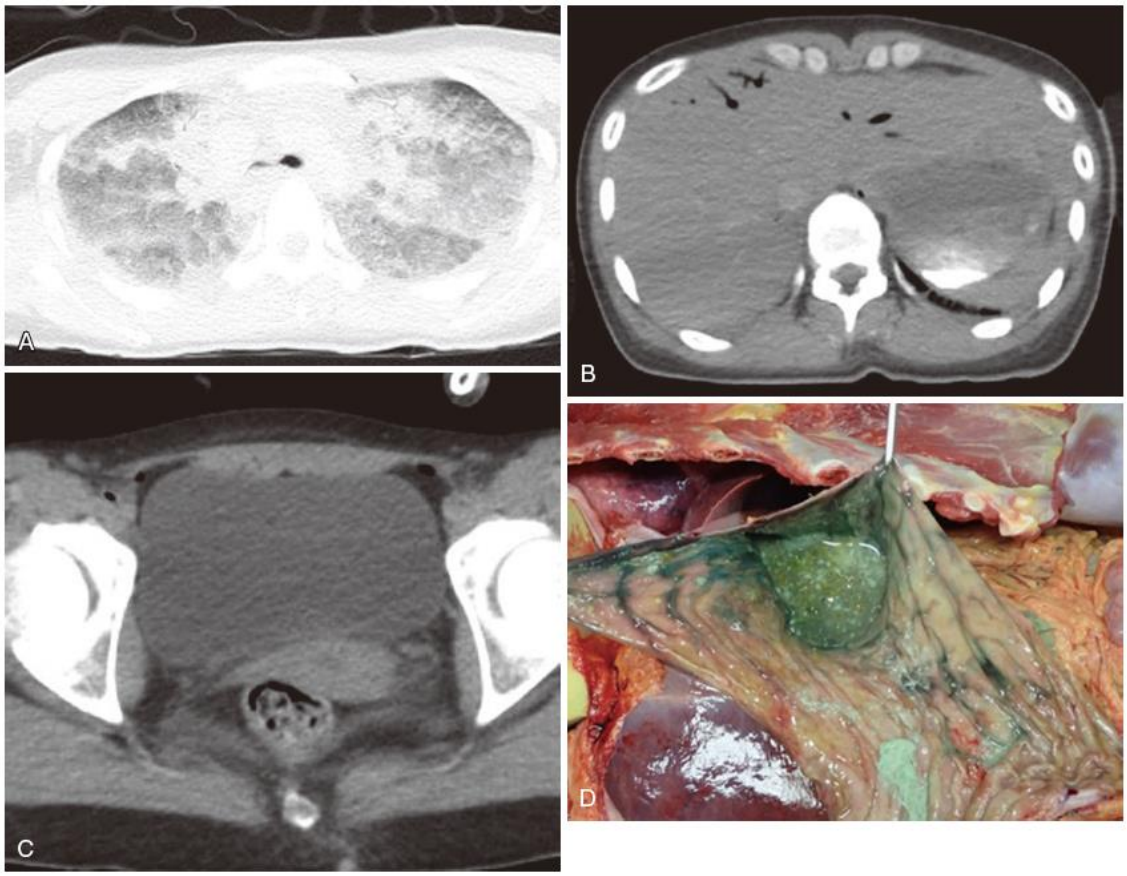
**Postmortem CT/MRI findings other than in the GI tract observed in deaths caused by poisoning**

There is one case-control study on postmortem CT findings in sites other than the GI tract. A comparison of 55 cases of death due to opioid poisoning and 55 cases of a sex- and age-matched control group, in which significant findings such as cerebral edema, emphysema, and bladder tightness were found in the poisoned death group [12]. This triad of signs were absent in the control group, and the sensitivity of the findings was 26% but the specificity was 100% [12].

There is also one case report of a death due to drug poisoning (formic acid, diphenhydramine, and ethanol). Postmortem CT and MRI showed a horizontal plane due to fat in the pleural effusion, and the same part showed a high signal on T1-weighted images on postmortem MRI [13].

There is one case-control study of fatal hemorrhages complicated with methamphetamine poisoning. In the poisoning group, there were 9 cases with intracerebral hemorrhages out of 24 cases. While, there were 24 cases with intracerebral hemorrhage out of 60 cases without methamphetamine poisoning. In the cases of intracerebral hemorrhage mainly located on the basal ganglia, the midline shift distance was significantly larger among the poisoning group and the calcification of the aortic valve was significantly smaller among the poisoning group. This report indicated that these findings could be a trigger for notification of this entity [14]. In addition, there was one case report of an intracerebral hemorrhage on postmortem CT [15].

**Figure 1, Female in the 20s, drug poisoning**




400 tablets empty of medicine were found indoors where the body was discovered

A CT: Diffuse ground glass opacity is observed in both lungs.

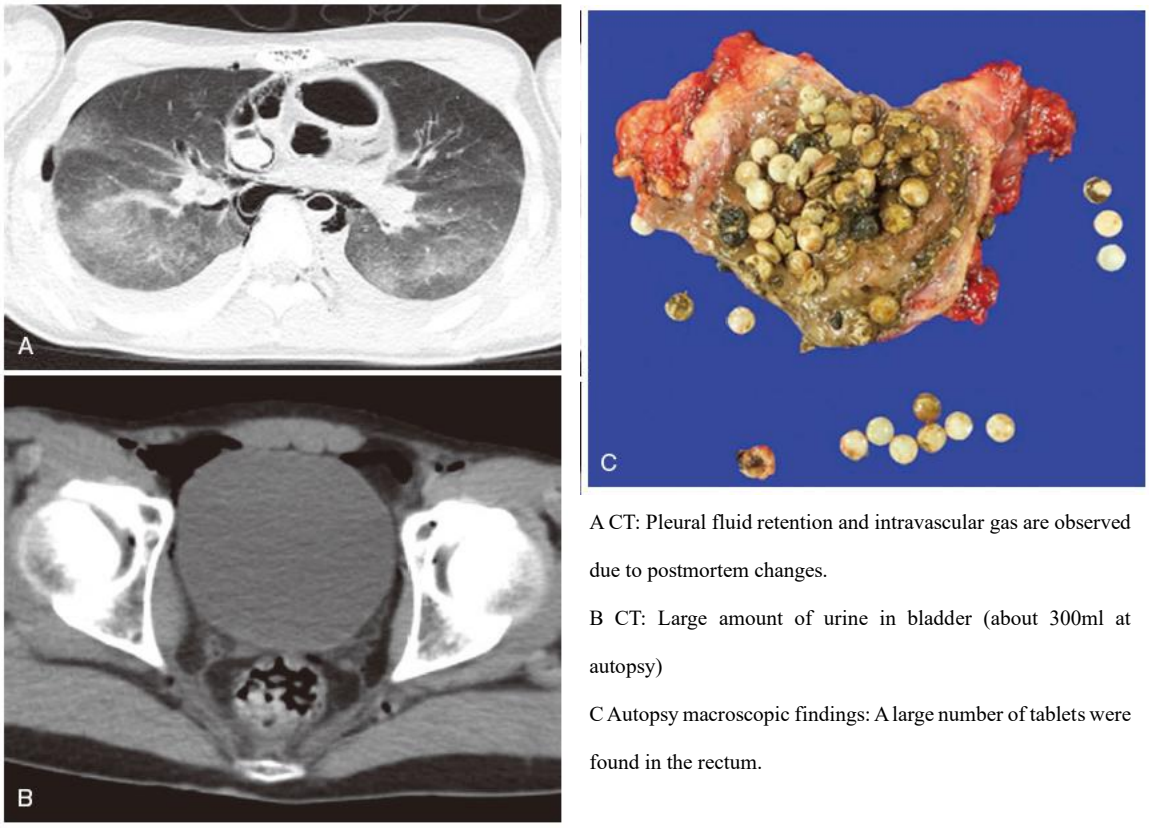
B CT: Precipitation of high attenuation is observed in the stomach.

C CT: Large amount of urine in bladder (about 270ml at the autopsy).

D Autopsy macroscopic findings: The left side is the head side. A blue-green drug deposit is observed in the stomach.

The radiopaque agent shows as a highly absorbing structure on thepostmortem CT. The drug poisoning is often characterized by pulmonary edema being stronger than the usual postmortem changes (hypostasis) and much bladder urine (note incontinence). In this case, a lethal dose of a psychoactive drug was detected in the postmortem blood test.

**Figure 2, Male in the 20s, drug poisoning (10 days after death)**




A CT: Pleural fluid retention and intravascular gas are observed due to postmortem changes.

B CT: Large amount of urine in bladder (about 300ml at autopsy)

C Autopsy macroscopic findings: A large number of tablets were found in the rectum.

Literature search formula and literature selection (2019/ 6 /2)

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"))) OR (((((postmortem) OR postmortem) OR "postmortem")) AND MDCT)) OR ((MSCT) AND (((postmortem) OR postmortem) OR "postmortem")) | 23,367 |
| 2 | ( (medication) O R (chemical) O R ( d r u g ) ) A N D ( (abuse) OR(poisoning) OR (intoxication)OR(overdose)) | 267,861 |

| | | |
|---|---|---|
| 3 | #1 and #2 | 287 |

Ichushi（Medical Journal）

| # | Search formula | Number of documents |
|---|---|---|
| 1 | ((死亡時画像/AL) and ((FT=Y) and AB=Y)) or (((死後検査/TH or autopsy/AL) and imaging/AL) and ((FT=Y) and AB=Y) and (一酸化炭素/AL)) or ((死後画像/AL) and ((FT=Y) and AB=Y)) | 10 |
| 2 | ((薬毒物中毒/AL) or (消化管/AL)) | 94 |
| 3 | #1 and #2 | 4 |

**References**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methadone) fatalities: frequent findings and comparison to autopsy. Eur Radiol 2014; 24: 1276-1282 (Level 4b)

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