**CQ35 What are useful findings on post-mortem images to assess penetrating trauma (excluding gunshot wounds)?**

**Grade of recommendations:**
**C1 for evaluating the condition**

Penetrating trauma often shows open skin wounds and is accompanied by subcutaneous tissue or visceral wounds. Postmortem CT may be able to visualize the wound canal if there is air in the tissue or bone fracture. You may be required to distinguish between antemortem damage and postmortem damage, or to determine if it is fatal or simply a case of trauma. A clear determination of these is difficult with only postmortem CT.

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

Penetrating trauma is an injury caused by a knife or stick (long narrow shaped object) penetrating the skin. Subcutaneous tissue and internal organs may be damaged by the entry of a weapon. When the weapon is a blade, it is called a stab wound or incision, and the compound wound is sometimes called a stab incision. In addition, so-called firearm damage where a blunt small metal object penetrates the skin with high speed and high energy is called a gunshot wound (CQ36). Depending on the shape of the wound, the skin may be cleaved (open trauma) or the wound may be narrow (sharp trauma). It is necessary to distinguish penetrating trauma from contusions such as lacerations and fissures accompanied by skin rupture.

**Postmortem CT of a penetrating trauma**

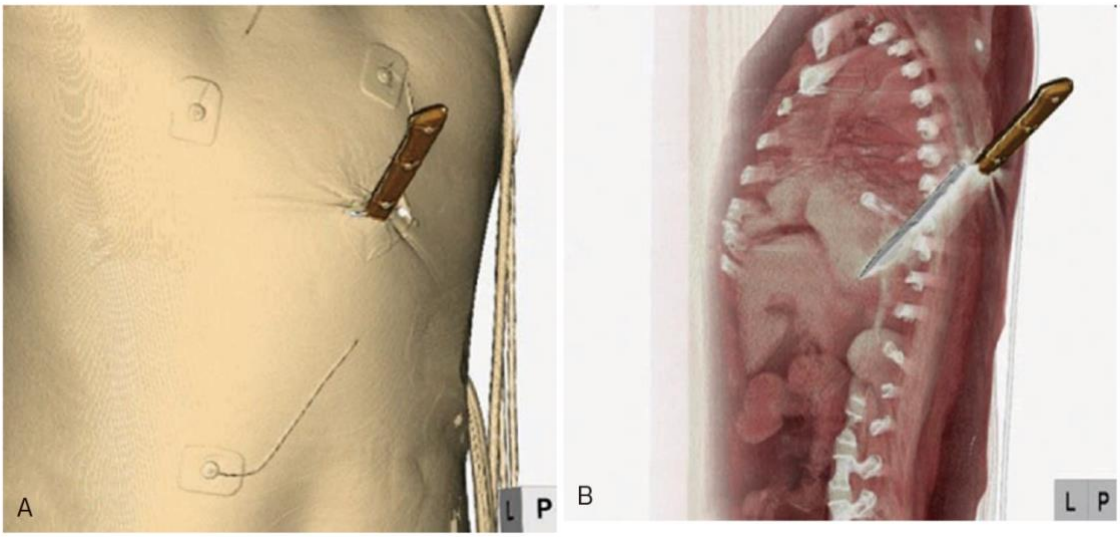
The wound may be confirmed in the postmortem image, but if the wound has a thickness smaller than the slice thickness , it is not visualized same as colors [1]. Gas or bleeding in the subcutaneous tissue or viscera may be confirmed by the amount and localization. Bridges of tissue* [2] are often not visible due to the CT resolution.

A wound can be visualized if the following findings are observed in a puncture wound: gas is identified in the lumen of blood vessels or in the heart chamber that is continuous with a severed blood vessel [3], and the track of the wound is marked by gas entering through the open skin or gases from damaged luminal organs [4]. In the case of a puncture wound with a sharp- edged weapon, unlike a gunshot wound, the track of the wound may close when the weapon is pulled out [4]. There is a report that fat turbidity was observed along the path of a stab wound [4]. Postmortem CT undergo image modification due to differences in image states such as body positions at the time of the injury and respiratory phase, as well as post-injury process and postmortem changes. Therefore, it is difficult to

simply evaluate weapons as wound findings by postmortem CT [4]. If the blade is damaged, it may be possible to find a fragment in the wound [4], and it is possible to estimate the damage condition. In the case of damage caused by explosives, there are reports that postmortem CT showed mechanical parts in the wound [5]. There is a report that postmortem enhanced CT angiography showed heart damage that was not identified by the postmortem CT [6]. In chest penetrating trauma cases accompanied by lung injuries, forced ventilation is effective after death to identify the site of injury [7]. Postmortem CT can visualize bone damage that occurs when the weapon moves in and out and solid organs damages with bleeding. However, the position of the organ may move due to postural changes and postmortem changes, so careful consideration must be shown when determining the direction of the wound canal from images [8]. It should be much careful to distinguish between antemortem and postmortem injuries, because slight bleeding in the tissue surrounding the injury may not be pointed out on postmortem CT.

* Bridges of tissue: A tissue structure that connects both wound walls by blood vessels, nerves, connective tissue, and others within the wound cavity.

**Figure Male in the 50s (Upon arrival at the hospital, Living body)**




This patient was stabbed with a knife from the right side of the back. The VR image of the CT makes it straightforward to understand the positional relationship between the knife and the surrounding organs. Even when a CT scan is performed with the knife remaining where it was stuck, it is unlikely that the image cannot be read. (Courtesy of PhD. Keishi Ogura, Department of Radiology, Sapporo Medical University)

**Column----------**

Among wounds, the skin surface is called the "wound", its corner is the "wound angle", the margin is the "wound edge", the cavity connected to the skin is the "wound track (cavity, canal)". A wall that

is formed is called the "wound wall (wound surface)", and the deepest part that the track reaches is called the "wound bottom".

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Literature search formula and literature selection (2019/8/30)

PubMed

| # | Search formula | Number of documents |
|---|---|---|
| 1 | Search (((((("postmortem CT") OR "postmortem MRI") OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem MRI") OR "postmortem imaging" | 844 |
| 2 | Search stab | 7,143 |
| 3 | Search stabbing | 1,146 |
| 4 | Search projectile | 1,988 |
| 5 | Search "sharp force" | 205 |
| 6 | Search (((stab) OR stabbing) OR projectile) OR "sharp force" | 10,088 |
| 7 | Search (((((stab) OR stabbing) OR projectile) OR "sharp force")) AND ((((((("postmortem CT") OR "postmortem MRI") OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem MRI") OR "postmortem imaging") | 10 |

From other than search formula

[2]

**References**


[1] Villa C: Forensic 3D documentation of skin injuries. Int J Legal Med 2017; 131: 751-759 (Level 4b)

[2] Takatsu A: Handbook for Autopsies, 3rd Edition, Nanzando; 2016 (Japanese)

[3] Langlois NEI et al: Arterial perfusion: a useful technique for evaluating incised wounds. J Forensic Sci 2018; 63: 1282-1283 (Level 5)

[4] Garetier M et al: Postmortem computed tomography findings in suicide victims. Diagn Interv Imaging 2017; 98: 101-112 (Level 5)

[5] Kučerová S et al: The application of X-ray imaging in forensic medicine. Soud Lek 2014; 59: 34-38 (Level 5)

[6] Ruder TD et al: Suicidal knife wound to the heart：challenges in reconstructing wound channels with post mortem CT and CT-angiography. Leg Med 2011; 13: 91-94 (Level 5)

[7] Germerott T et al: Postmortem ventilation in cases of penetrating gunshot and stab wounds to the

chest. Leg Med 2013; 15: 298-302 (Level 5)

[8] Harcke HT et al: MDCT analysis of projectile injury in forensic investigation. AJR 2008; 190: W106-111 (Level 6)