## H62 Exsanguination on Postmortem Computed Tomography (CT) — What Remains When Blood Leaves the Body

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After attending this presentation, attendees will understand the typical findings that can be seen or expected on postmortem CT in cases of fatal bleeding.

This presentation will impact the forensic science community by providing a review of the literature on exsanguination on postmortem CT as well as results of a case-control study in order to support the scarce literature on the subject.

**Introduction:** Exsanguination is a common cause of death and may be differentiated in internal and external hemorrhage. Internal blood loss may occur naturally in gastrointestinal bleedings, but it is also frequent in deceleration trauma and consecutive vascular ruptures. The cause of lethal external exsanguination is nearly always non-natural and most common in cases of sharp force injury, traffic accidents, and any form of dismemberment. In classic forensic pathology, loss of a large volume of blood can be assumed when a body presents with only minor lividity. The spleen, kidneys, and liver usually present with discoloration and pallor at autopsy. For postmortem CT, the low density of the lungs as well as decreased cross-sectional areas of great vessels has been reported.[1,2] This study attempted to compare organ radiodensities organs and measure vascular cross-sectional areas in order to characterize exsanguination on postmortem CT.

**Methodology:** (Results for the control group are printed in **bold**.) In this case-control study, 60 cases that died from internal or external exsanguination were retrospectively matched with cases of identical age and sex. All controls presented no history or evidence of antemortem or peri-mortem loss of blood at external examination and autopsy. The case group was 66% **(66%**) male with a mean age at time of death of 55.1 (**55**) years. The interval between death and CT examination was 29 (**34**) hours. Causes of death were "blood loss" in all cases, with internal (31), external (27), and both internal and external (3) bleeding. In the control group, causes of death were cardiac (36), central nervous (14), metabolic (4), respiratory (4), due to infection (2), and hypothermic (1). Density of the lungs, spleen, kidneys, and liver and were measured by manually applied regions of interest using syngo.via. Cross-sectional areas of the ascending aorta, the descending aorta, and the superior vena cava were measured in a transversal slide at the height of the tracheal bifurcation.

**Results:** (Results for the control group are printed in **bold**.) Average cross-sectional areas differed significantly ($P<0.001$) for the ascending aorta (3.5cm$^2$; **5cm$^2$**), the descending aorta (2.36cm$^2$; **3.36cm$^2$**), and for the superior vena cava (2.21cm$^2$; **4.02cm$^2$**). Radiodensities of kidneys (40.5HU; **39.9HU**) and the spleen (50.9HU; **49.9HU**) did not differ between cases and controls. Radiodensity of the liver was significantly ($P<0.001$) higher in cases (56.8HU) than in controls (**46.3HU**). Pulmonary density was significantly ($P<0.001$) lower in cases (-661HU) than in controls (**-529HU**).

**Discussion**: While kidney and spleen radiodensity exhibited no difference between cases and controls, liver density was higher in cases of lethal exsanguination. This may be explained with the higher-than-blood parenchymal density of the liver antemortem (47.5HU) in comparison to the spleen and kidneys, resulting in an average increase of radiodensity with less blood content.[3] For the lungs, a lesser blood content reliably leads to a reduction in radiodensity. The reduction in cross-sectional areas of vascular structures close to the heart represents a collapse of the vessels in cases of exsanguination. This collapse is more pronounced in the vena cava in comparison to the aorta, most probably due to thinner vascular walls. In conclusion, decreased vascular cross-sectional areas as well as decreased pulmonary density and increased liver density are indicators for fatal exsanguination and may support and grade this diagnosis.

**Reference(s):**

1. Schober, Daniel et al. Post-mortem CT: Hounsfield unit profiles obtained in the lungs with respect to the cause of death assessment. *International Journal of Legal Medicine.* 131.1 (2017): 199-210.
2. Sogawa, Nozomi et al. Postmortem CT morphometry of great vessels with regard to the cause of death for investigating terminal circulatory status in forensic autopsy. *International Journal of Legal Medicine.* 129.3 (2015): 551-558.
3. Lamba, Ramit et al. CT Hounsfield numbers of soft tissues on unenhanced abdominal CT scans: Variability between two different manufacturers' MDCT scanners. *American Journal of Roentgenology*. 203.5 (2014): 1013-1020.

**Exsanguination, Postmortem CT, Radiodensity**