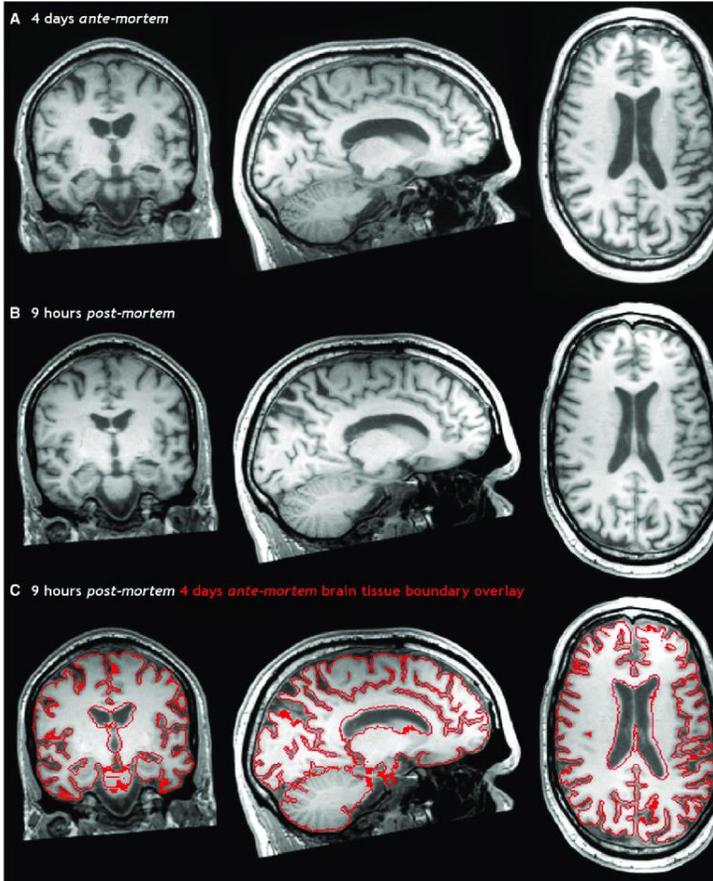


**C10 REDEFINING AUTOPSY:
THE DIAGNOSTIC POWER
OF POSTMORTEM MRI & CT**

Objectives



- ▶ Understand the Modalities used in Postmortem Imaging Autopsy.
- ▶ Define Traditional Autopsy and Postmortem Imaging Autopsy.
- ▶ Illustrate the process of Traditional Autopsy and Imaging Autopsy.
- ▶ Compare the use of Traditional Autopsy and Postmortem Imaging Autopsy.
- ▶ Compare the benefits, limitations, and contraindications of Postmortem CT versus Postmortem MRI.

Boon, B. D. C., Pouwels, P. J. W., Jonkman, L. E., Keijzer, M. J., Preziosa, P., Van De Berg, W. D. J., Geurts, J. J. G., Scheltens, P., Barkhof, F., Rozemuller, A. J. M., Bouwman, F. H., & Steenwijk, M. D. (2019). Can post-mortem MRI be used as a proxy for in vivo? A case study. *Brain Communications*, 1(1), fcz030. <https://doi.org/10.1093/braincomms/fcz030>

Introduction

A traditional autopsy is a surgical, invasive procedure in which all body cavities are examined to determine the cause of death and document disease or injury.

Magnetic Resonance Imaging (MRI) is a noninvasive technique that creates detailed images of internal body structures without using ionizing radiation.

Postmortem angiography is a CT-based whole-body imaging technique that uses iodinated contrast to visualize vascular systems and soft tissues, helping identify vessel narrowing, blockages, and aneurysms in postmortem investigations.

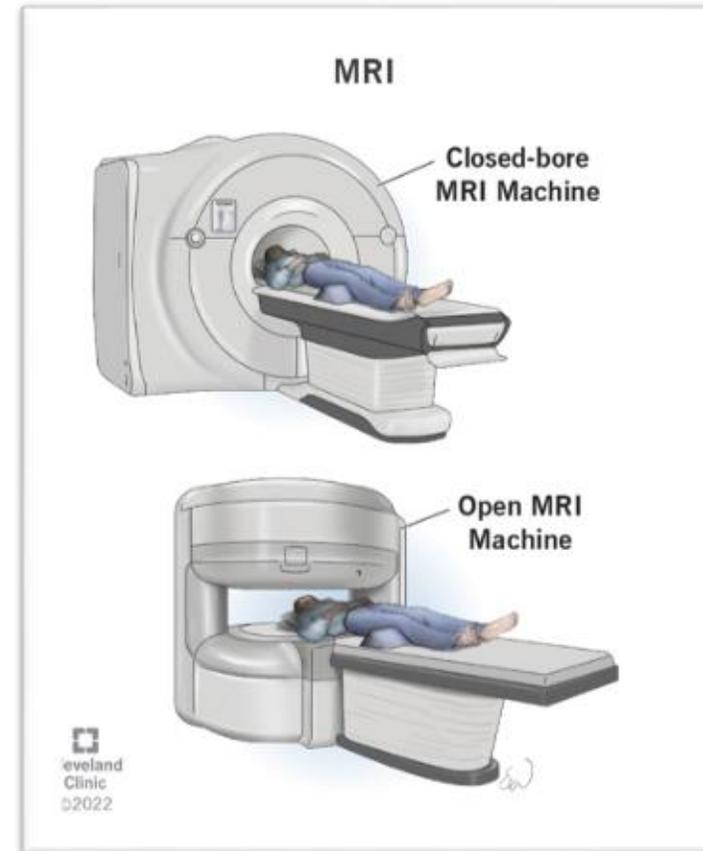
Post-Mortem Imaging aims to provide high-resolution imaging, while also offering other valuable benefits to forensic and medical reasoning.

Utilizing postmortem imaging allows for better outcome and ability to detect disease however, there are limitations that impact the ability to detect disease with PMI alone.

Magnetic Resonance Imaging (MRI)

MRI ~ Magnetic Resonance Imaging

- ▶ Noninvasive imaging technique that produces detailed images of internal structures within the human body without the use of ionizing radiation.
- ▶ MRI uses magnets and radio waves to align tiny particles called protons. When disrupted, these protons release signals that the MRI detects to distinguish different tissues (MRI - Mayo Clinic, n.d.).
- ▶ MRI excels in the visualization of soft tissue and organs, much more than CT scans and X-rays.



Professional, C. C. M. (2025, June 25). MRI (Magnetic Resonance Imaging). Cleveland Clinic. <https://my.clevelandclinic.org/health/diagnostics/4876-magnetic-resonance-imaging-mri>

Computed Tomography (CT)

CT ~ Computed Tomography

- ▶ Noninvasive imaging technique that produces detailed images of internal structures within the human body with the use of ionizing radiation (*CT Scan - Mayo Clinic, n.d.*).
- ▶ Uses X-rays and a computer to create detailed cross-sectional images of the body.
- ▶ Shows bones, organs, and tissues in high detail.
- ▶ Helps doctors diagnose injuries, diseases, and abnormalities quickly.



(FAST Integrated Workflow With FAST 3D Camera - Safeguard Correct and Consistent Patient Positioning, n.d.)

Traditional Autopsy

Overview

- Commonly known as a conventional autopsy (Ayoub & Chow, 2008).
- It is performed like a surgical operation.
- Lengthy and invasive medical procedure.

Main Goal

- Find cause of death.
- Document findings of disease or injury.

Traditional Autopsy Procedure

► First Phase

- This also includes removal and examination of the brain
- External inspection
 - Document all marks, scars, tattoos, or any other identifying characteristics
 - Photographs and radiographs are taken for visual documentation

► Second Phase

- Begins with a deep Y-shaped incision on the chest and abdomen (The Editors of Encyclopedia Britannica, 1998)
- Organs will then be removed
- The organs removed will be inspected and weighed
 - Samples may be taken of the body fluid, tissue, and organs

Forensic vs Medical Autopsies

Medical reasons

- At request of family members.
- Helps figure out disease or health-related problems that might have caused death.

Forensic reasons

- When someone passes unexpectedly, traumatically, or under suspicious circumstances.
- Usually used by legal authorities.
 - Helps aid in investigations of death.

B

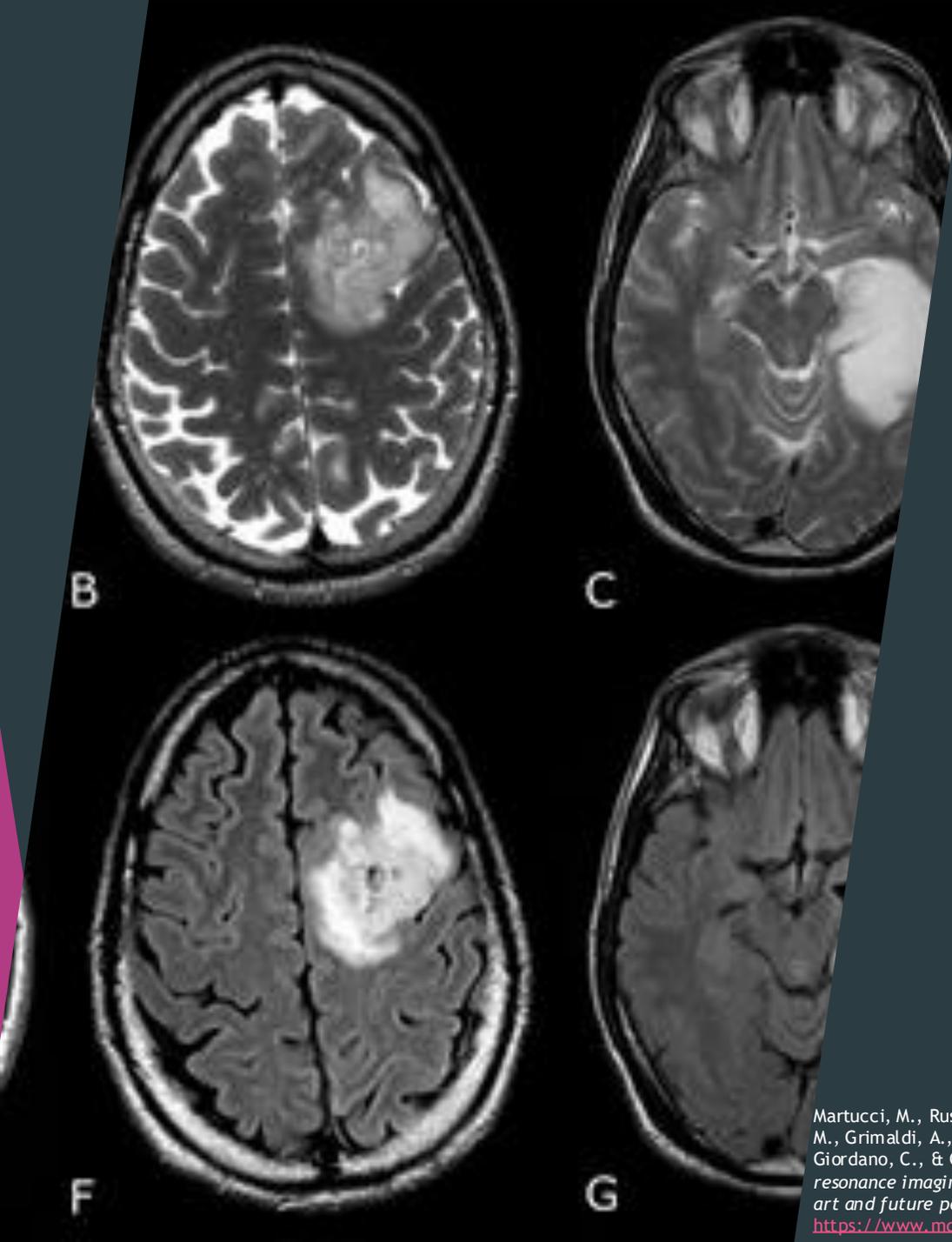


What is Post-Mortem Imaging?

- ▶ Uses medical imaging techniques like CT or MRI on a deceased body.
- ▶ Helps examine injuries, diseases, or causes of death without traditional autopsy (Lundström et al., 2012).
- ▶ Provides detailed internal images for investigation and research.

Postmortem MRI (PMMR)

- ▶ Allows medical and forensic professionals to examine internal structures without an invasive procedure.
- ▶ Offers valuable and precise reconstructed images.
- ▶ Evaluates soft tissue and other major organs (Lundström et al., 2012).
 - Can show clear visualization of organ herniations.



Case Study & PMMR Findings

Summary

- 42 yr old male found deceased at home
- Body found supine on bed
- No External Injuries
- Cause of death initially undetermined

Autopsy Limitation

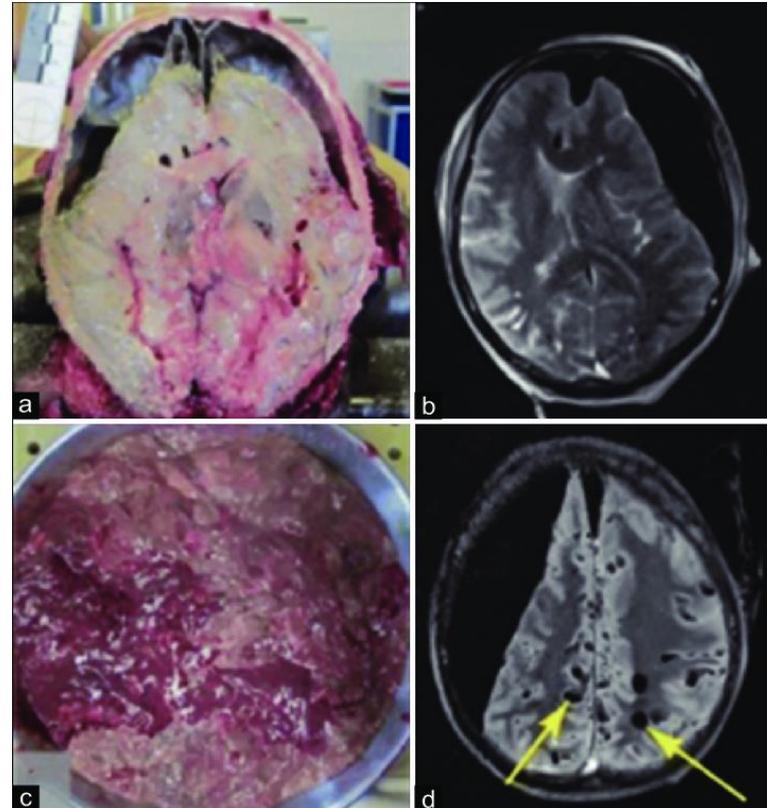
- State of brain tissue limited traditional craniocerebral autopsy

PMMR Findings

- Extensive brain Hemorrhage
- Tempo-parietal Edema
- Intraventricular Hemorrhage

Conclusion

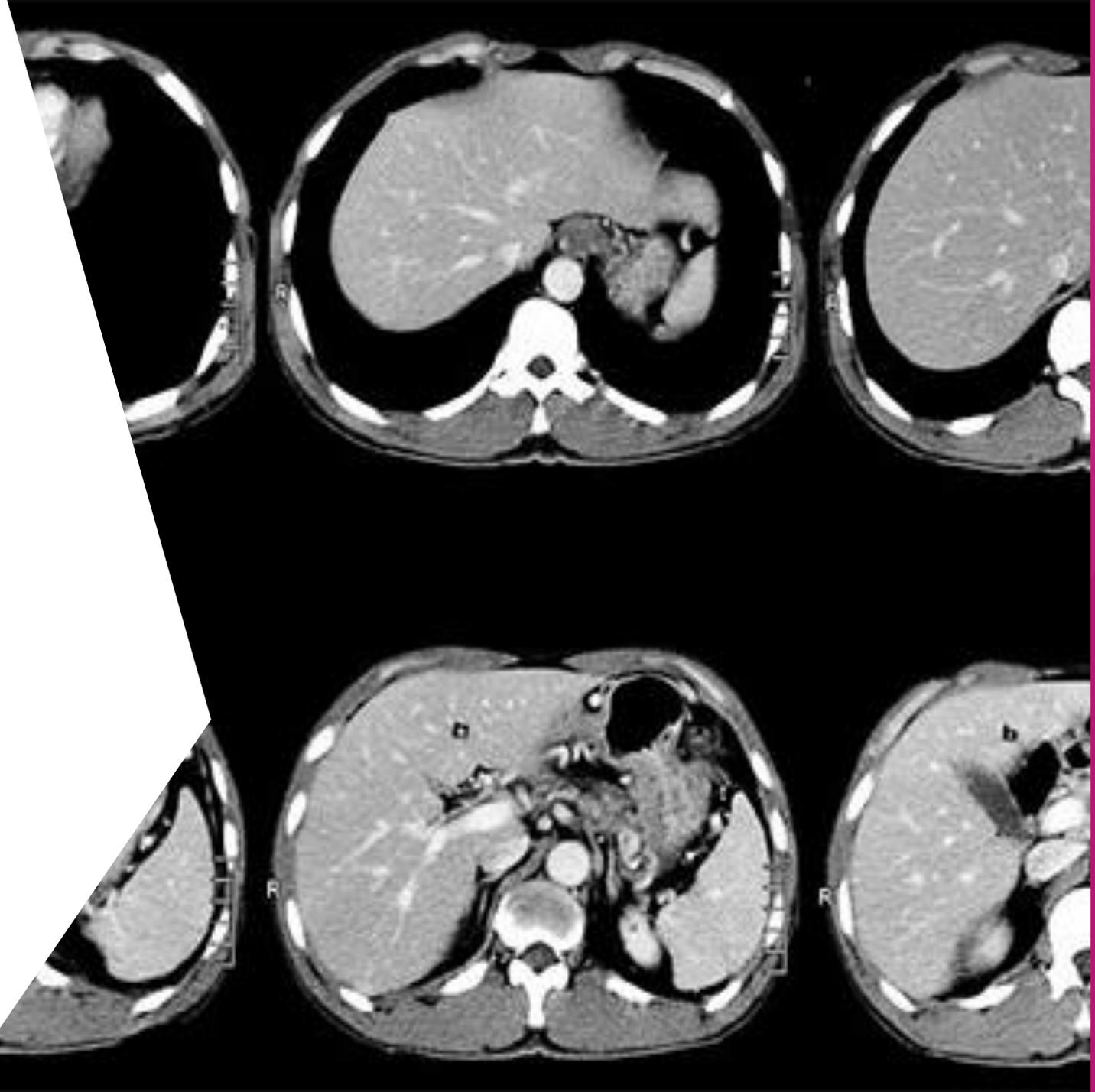
- PMMR enabled a diagnosis despite the advanced decomposition (Yucong et al., 2021c).



Yucong, W., Haibiao, Z., Ran, L., Haidong, Z., Dong, Z., Xu, W., & Tiantong, Y. (2021b). Application of virtopsy in forensic pathology. *Journal of Forensic Science and Medicine*, 7(1), 14–23. https://doi.org/10.4103/jfsm.jfsm_67_20

Postmortem CT (PMCT)

- ▶ **Virtopsy**
 - Uses high resolution CT scans to build 3D reconstruction of the human body (Gascho, 2025b).
 - This technique is non-invasive
 - Used for trauma or septic deaths
- ▶ Good addition to traditional autopsy
- ▶ However, it does not detect key soft tissue findings
- ▶ **Virtual Autopsy**
 - Virtual Rendering Technique (VRT)
 - Allows professionals to add or subtract specific anatomy



Postmortem Angiography

- ▶ Traditional angiogram
 - Whole body CT scan
 - Uses Iodinated contrast
 - Helps visualize vascular systems and soft tissue
 - Asses blood flow and aids in identifying narrowing, blocking, and aneurysms (*Post-Mortem CT Angiography Illuminates Causes of Death*, n.d.).



Forensic Study & PMCT Findings

Summary

- Determine if PMCT and Angiography helps detect more lesion than traditional autopsy.
- Evaluate strengths & weakness.
- Define indications for PMCT in Postmortem Investigations.

Methods

- PMCT performed on 500 human corpses followed by traditional autopsy.
- All images read by experienced one pathologist and one radiologist.
- Reviewers unaware of autopsy results.

Conclusion

- PMCT and Angiography detected various lesions.
- Utilizing both PMCT and Traditional autopsy identifies more findings and overall improves diagnostic accuracy (Grabherr et al., 2018).

Benefits vs Limitations

▶ Benefits

- PMMR
 - High-resolution soft tissue analysis.
- PMCT & Angiography
 - Detect skeletal trauma, hemorrhage, and gas patterns.

▶ Limitations

- PMMR
 - Time consuming
 - Sensitive to temperature
 - Body temperature in the deceased is not clearly understood (Ruder et al., 2014).
- PMCT
 - Reduced sensitivity for subtle soft tissue injuries
 - Could not reliably identify causes of death.

Importance of Postmortem Imaging

- ▶ Both PMMR and PMCT offer vital information for the medical industry
- ▶ They also pertain to the forensic investigations
 - Aiding in pathological findings in trauma and investigations
- ▶ Using alongside traditional autopsy
 - Enhances diagnostic accuracy
 - Offers relatives a noninvasive option for discovering cause of death

Conclusion

- ▶ Postmortem imaging autopsy, including PMCT and PMMR, provides high-resolution, noninvasive evaluation of skeletal, soft tissue, and organ pathology.
- ▶ Traditional autopsy relies on invasive dissection, while imaging autopsy offers an alternative method for internal examination without tissue disruption.
- ▶ PMCT is most effective for assessing trauma and skeletal findings, where PMMR is more effective in imaging soft tissue and organ evaluation.
- ▶ Although postmortem imaging has limitations, its use alongside traditional autopsy improves diagnostic accuracy and forensic interpretation.
- ▶ The benefits of using both postmortem CT and MR give the patient better soft tissue analysis and able to detect not only skeletal trauma, but also hemorrhages and gas patterns.
- ▶ The continued integration of postmortem imaging enhances medical and forensic practice while offering a respectful option for families.

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