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Legal Admissibility of Virtual Autopsy Evidence in Indonesia's Criminal Justice System

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Abstract

Advances in forensic medical science have introduced virtual autopsy, commonly known as virtopsy, as a technological approach that addresses several limitations associated with conventional invasive autopsy procedures. Despite its potential to support criminal investigations, Indonesian law has not yet established a comprehensive framework governing its evidentiary status and application in criminal proceedings. This study examines the legal position of virtual autopsy within Indonesia's criminal justice system and evaluates its medicolegal implications for forensic examination and criminal evidence. The research employs a normative juridical method using statutory and conceptual approaches to analyze the relevant legal provisions and principles governing forensic examinations and criminal procedure. The findings identify three principal issues. First, Indonesian forensic practice continues to recognize conventional autopsy as the established method for examining causes of death, while virtual autopsy primarily serves a complementary function. Second, virtopsy offers potential advantages through noninvasive examination, digital documentation, and the preservation of forensic findings, which may strengthen investigative efficiency and evidentiary assessment. Third, the absence of sufficiently specific legal standards concerning procedural validity, scientific reliability, and evidentiary admissibility creates uncertainty regarding its independent use in criminal proceedings.

Keywords: Criminal Justice; Forensic Evidence; Indonesia; Virtual Autopsy; Virtopsy;

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Introduction

The development of science and technology has fundamentally transformed the administration of criminal justice, particularly through the increasing integration of scientific methods into criminal investigations and evidentiary proceedings. Forensic medicine occupies a strategic position within this transformation because it provides scientifically grounded information concerning injuries, causes of death, and circumstances potentially associated with criminal conduct.[1] In cases involving homicide,

[1] R A I BAHADUR Jaising P Modi, 'Chapter I - Legal Procedure In Criminal Courts', in *A Text-Book of Medical Jurisprudence and Toxicology* (Butterworth-Heinemann, 2013), pp. 1–18 https://doi.org/https://doi.org/10.1016/B978-1-4832-0033-0.50005-X

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suspicious deaths, or unexplained fatalities, forensic examinations contribute to reconstructing relevant events and establishing medical facts that may assist investigators, prosecutors, and judges. Nevertheless, conventional forensic procedures continue to encounter significant practical, ethical, cultural, and legal challenges. These challenges are particularly evident in Indonesia, where the necessity of conducting invasive postmortem examinations may conflict with family objections, religious considerations, and social expectations regarding the respectful treatment of deceased persons. Accordingly, contemporary criminal justice requires forensic methods that maintain scientific reliability while accommodating legitimate ethical considerations and ensuring compliance with applicable legal procedures.[2]

One technological development addressing these challenges is virtual autopsy, commonly referred to as *virtopsy*. This method employs advanced postmortem imaging techniques, including computed tomography (CT), magnetic resonance imaging (MRI), and three-dimensional anatomical reconstruction, to examine deceased persons without necessarily performing extensive physical dissection. Virtual autopsy allows forensic specialists to visualize skeletal injuries, identify certain internal abnormalities, document anatomical conditions, and preserve digital information for subsequent examination.[3] Unlike conventional autopsy, which involves direct anatomical examination and may require tissue sampling, virtual autopsy generates digital representations that can be stored, reviewed, and interpreted by qualified forensic experts. These characteristics offer potential advantages for criminal investigations, particularly regarding documentation, independent expert review, and the preservation of forensic findings. However, the scientific effectiveness of virtual autopsy varies according to the type of injury, suspected cause of death, and imaging modality employed. Consequently, its application must be evaluated through scientifically validated procedures rather than assumptions that technological innovation necessarily produces superior forensic conclusions.[4]

Empirical studies provide substantial evidence regarding the diagnostic potential and limitations of postmortem imaging. A systematic review and meta-analysis involving 66 studies and 4,213 individuals found that

[2] William P Bozeman and others, 'Safety and Injury Profile of Conducted Electrical Weapons Used by Law Enforcement Officers Against Criminal Suspects', *Annals of Emergency Medicine*, 53.4 (2009), 480–89 https://doi.org/https://doi.org/10.1016/j.annemergmed.2008.11.021

[3] Romica Cergan and others, 'The Current Status of Virtual Autopsy Using Combined Imaging Modalities: A Scoping Review', *Journal of Clinical Medicine*, 14.3 (2025), 782 https://doi.org/10.3390/jcm14030782

[4] Ida Musofiana and Tomás Mateo Ramon, 'Reconstructing Judicial Reasoning in Sexual Violence Cases Against Children: A Comparative Study of Indonesian and European Court Decisions', *Jurnal Jurisprudence*, 16.1 (2026) https://doi.org/10.23917/jurisprudence.v16i1.16820

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postmortem CT combined with MRI achieved a pooled sensitivity of 0.97 for detecting skeletal injuries.[5] Postmortem CT angiography demonstrated a pooled sensitivity of 0.91 for certain soft-tissue and organ findings, while its pooled sensitivity for correctly identifying causes of death was 0.79. These findings indicate that postmortem imaging can provide considerable diagnostic value, although accuracy depends on the examination technique and the medical condition being investigated.[6] The study also identified variation across diagnostic categories, demonstrating that different imaging modalities cannot be treated as universally interchangeable. Such evidence supports the selective integration of virtual autopsy into forensic examinations while emphasizing the continued importance of conventional procedures in cases requiring direct tissue examination or laboratory investigation.[7]

Further empirical findings demonstrate the risks associated with relying exclusively on postmortem imaging. A validation study published in *The Lancet*, involving 182 adult deaths, reported major discrepancies between radiological and conventional autopsy determinations of cause of death.[8] The discrepancy rates were 32% for CT, 43% for MRI, and 30% for combined radiological assessments. The researchers identified particular diagnostic difficulties involving ischemic heart disease, pulmonary embolism, pneumonia, and certain intra-abdominal conditions.[9] Similarly, a forensic investigation involving 339 cases found that postmortem CT alone established the cause of death in only 7% of cases, while additional information was required in 54%. These results demonstrate that virtual autopsy may provide valuable evidence but cannot automatically replace conventional autopsy in every criminal investigation. Its evidentiary

[5] Maiyada A. Aldossary and others, 'Comparing Post-Mortem Computed Tomography versus Traditional Autopsy in Detecting Intracranial Hemorrhage as a Cause of Death: A Systematic Review and Meta-Analysis', *Forensic Imaging*, 46 (2026), 200832 https://doi.org/10.1016/j.fri.2026.200832

[6] Yohsuke Makino and others, 'Accuracy of Forensic Pathologists in Incorporating Post-mortem <scp>CT</Scp> (<scp>PMCT</Scp>) in Forensic Death Investigation', *Journal of Forensic Sciences*, 67.6 (2022), 2351–59 https://doi.org/10.1111/1556-4029.15131

[7] Himmaturojuli Rosyid Ridlo and others, 'Unregulated Orthodontic Practice and Its Implications for Equity and Sustainability in Public Health', *Journal of Sustainable Development and Regulatory Issues*, 4.2 (2026) https://doi.org/10.53955/jsderi.v4i2.355

[8] Alicia B. Byrne and others, 'Genomic Autopsy to Identify Underlying Causes of Pregnancy Loss and Perinatal Death', *Nature Medicine*, 29.1 (2023), 180–89 https://doi.org/10.1038/s41591-022-02142-1

[9] Bogdan Stancu and others, 'Intestinal Obstruction as Initial Presentation of Idiopathic Portal and Mesenteric Venous Thrombosis: Diagnosis, Management, and Literature Review', *Diagnostics*, 14.3 (2024), 304 https://doi.org/10.3390/diagnostics14030304

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usefulness must therefore be assessed according to the specific medical findings, diagnostic limitations, and circumstances of each case.[10]

In Indonesia, the application of virtual autopsy is particularly relevant to the relationship between forensic examination and criminal law enforcement. The determination of causes of death is not merely a medical responsibility but also a legal process requiring compliance with criminal procedural rules and professional standards.[11] Historically, Articles 133 and 134 of Law Number 8 of 1981 concerning the Criminal Procedure Code regulated requests for forensic medical examinations and procedures associated with autopsy.[12] These provisions established an important legal foundation for obtaining medical expertise in criminal investigations. However, reliance on this legislation as the principal contemporary legal framework is no longer appropriate because Law Number 20 of 2025 concerning the Criminal Procedure Code entered into force on 2 January 2026 and replaced Law Number 8 of 1981. This legislative development requires a reassessment of the procedural foundations governing forensic examinations and the presentation of scientifically generated evidence in criminal proceedings.[13]

The legal recognition of virtual autopsy has also developed substantially through Indonesian health legislation. Law Number 17 of 2023 concerning Health provides an express statutory basis for the application of postmortem virtual autopsy.[14] Article 156 paragraph (2) recognizes forensic autopsy, laboratory examinations, and postmortem virtual autopsy as methods that may be employed in providing medical services for legal purposes. Article 156 paragraph (3) further requires such services to be performed by medical professionals acting within their expertise and authority.[15] These provisions are significant because they establish that virtual autopsy is not merely an experimental technique operating outside the Indonesian legal framework.

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[10] Reinhilde Jacobs and others, 'Radiographic Diagnosis of Periodontal Diseases – Current Evidence versus Innovations', *Periodontology 2000*, 95.1 (2024), 51–69 https://doi.org/10.1111/prd.12580

[11] Arief Budiono and others, 'Rethinking Patient Protection and Legal Accountability in Artificial Intelligence Assisted Orthopedic Surgery', *Journal of Human Rights, Culture and Legal System*, 6.2 (2026), 444–66 https://doi.org/10.53955/jhcls.v6i2.995

[12] Bambang Prayitno and others, 'Victim Impact Statements for Equitable Judicial Protection of Crime Victims', *Journal of Human Rights, Culture and Legal System*, 6.2 (2026), 55–105 https://doi.org/10.53955/jhcls.v6i2.1004

[13] Aberto Sandri and others, 'Beyond the Excited Delirium Controversy: Two Forensic Cases and Contemporary Literature Review', *Legal Medicine*, 87 (2026), 103022 https://doi.org/10.1016/j.legalmed.2026.103022

[14] Yudy and Vionita Simanjuntak, 'Implementation Challenges of Postmortem CT-Scan in a Low-Resource Setting: Lesson from a Methanol Poisoning Case in Indonesia', *Forensic Imaging*, 2026, 200850 https://doi.org/10.1016/j.fri.2026.200850

[15] Fabrice Dedouit and others, 'The Current State of Forensic Imaging – Post Mortem Imaging', *International Journal of Legal Medicine*, 139.3 (2025), 1141–59 https://doi.org/10.1007/s00414-025-03461-x

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Instead, it constitutes a medically recognized examination method whose application must comply with professional competence and relevant legal requirements. Consequently, the central legal issue has shifted from the general recognition of virtual autopsy to the conditions governing its implementation and evidentiary use.[16]

Article 157 of Law Number 17 of 2023 provides an additional legal foundation by requiring efforts to determine the causes of death and identities of deceased persons for law enforcement and population administration purposes. Article 157 paragraph (2) expressly includes postmortem virtual autopsy among the methods available for determining causes of death. Meanwhile, Article 157 paragraph (3) establishes family consent requirements for specified postmortem examinations, including virtual autopsy. Article 158 additionally requires autopsy procedures performed by medical professionals to respect religious norms, sociocultural values, morality, and professional ethics.[17] These provisions demonstrate the legislature's attempt to reconcile the objectives of forensic examination with the protection of human dignity and relevant social values. Nevertheless, family consent must be interpreted together with the more specific provisions governing forensic examinations undertaken in connection with suspected criminal conduct.[18]

Government Regulation Number 28 of 2024 concerning the Implementation of Law Number 17 of 2023 provides further clarification. Article 467 paragraph (2) recognizes forensic autopsy, laboratory examination, and postmortem virtual autopsy within medical services for legal purposes. More importantly, Article 472 paragraph (1) identifies several methods of examining deceased persons, including forensic autopsy and postmortem virtual autopsy.[19] Article 472 paragraph (2) establishes the general requirement of family consent for specified examinations. However, Article 472 paragraph (3) provides an exception where there are indications of suspected criminal conduct and medical examination is requested by law enforcement authorities in accordance with applicable legislation. This distinction is essential because it demonstrates that family objections do not necessarily operate as an absolute prohibition against forensic examinations

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[16] Gianmarco Sirago and others, 'Operational Definitions and Evidentiary Readiness for XR, Digital Twins, Virtual Worlds and Metaverse-like Systems in Forensic and Legal Medicine', *Science & Justice*, 66.4 (2026), 101468 https://doi.org/10.1016/j.scijus.2026.101468

[17] Anjli Parrin and others, 'The Protection of Dead Persons under International Human Rights Law: Evaluating Gaps and Developing a Principles Framework', *International Review of the Red Cross*, 107.929 (2025), 720–46 https://doi.org/10.1017/S181638312510074X

[18] Tersia Oosthuizen and Loene M. Howes, 'The Development of Forensic DNA Analysis: New Debates on the Issue of Fundamental Human Rights', *Forensic Science International: Genetics*, 56 (2022), 102606 https://doi.org/10.1016/j.fsigen.2021.102606

[19] Chathula Ushari Wickramasinghe and others, 'Usefulness of Virtual Autopsy in Diagnosing Pathologies in the Paediatric Population: A Systematic Review', *SAGE Open Medicine*, 11 (2023) https://doi.org/10.1177/20503121231172002

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conducted for criminal justice purposes. Instead, the legality of such examinations depends on the applicable statutory authority, procedural requirements, and circumstances of the investigation.[20]

The evidentiary implications of virtual autopsy must also be examined under the revised Indonesian Criminal Procedure Code. Article 235 paragraph (1) of Law Number 20 of 2025 recognizes several forms of evidence, including witness testimony, expert testimony, documentary evidence, physical evidence, electronic evidence, judicial observation, and other legally obtained materials capable of supporting proof during judicial proceedings. This development is particularly relevant because virtual autopsy produces medical interpretations supported by digitally generated imaging information. Such findings may contribute to expert testimony and may involve documentary or electronic evidence, depending on their form, authentication, and presentation. Nevertheless, statutory recognition of electronic evidence does not automatically establish that every virtual autopsy result possesses sufficient probative value. Courts must still evaluate the reliability of the examination, the qualifications of the relevant experts, the authenticity of the underlying information, and its relationship to the facts requiring proof.

The medicolegal challenges surrounding virtual autopsy therefore involve several interconnected dimensions. *First,* scientific reliability requires appropriate imaging protocols, validated examination techniques, and qualified interpretation by forensic medical specialists. *Second,* procedural legality requires that forensic examinations be conducted pursuant to lawful investigative authority and applicable professional requirements. *Third,* digital evidentiary integrity requires reliable documentation of image acquisition, data preservation, examination procedures, and subsequent handling. *Fourth,* judicial assessment requires an appropriate distinction between medical findings, expert interpretations, and legally established facts. These dimensions are especially important because the availability of sophisticated imaging technology does not eliminate the possibility of diagnostic error, inaccurate interpretation, or evidentiary disputes. Without clear standards addressing these concerns, virtual autopsy findings may become vulnerable to challenges concerning their scientific credibility and procedural legitimacy.[21]

Previous scientific research has established the diagnostic capabilities of postmortem imaging and demonstrated its usefulness in detecting particular

[20] Ni Luh Gede Astariyani and Julio de Araujo da Silva, 'Legal Protection of Doctors in the Handling of Medical Emergencies', *Contrarius*, 1.3 (2025), 214–31 https://doi.org/10.53955/contrarius.v1i3.215

[21] Carol Stevenson and others, 'Reliability and Validity of a Quality Tool for Assessing Clinical Forensic Medicine Legal Reports', *Journal of Forensic and Legal Medicine*, 89 (2022), 102359 https://doi.org/10.1016/j.jflm.2022.102359

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injuries and anatomical abnormalities. The systematic review involving 4,213 individuals provides substantial evidence supporting the application of selected imaging modalities in forensic examinations. Meanwhile, the validation study involving 182 deaths and the review of 339 forensic cases demonstrate the limitations of virtual autopsy when used independently. These studies collectively establish that virtual autopsy is most appropriately evaluated according to the medical circumstances of individual cases rather than treated as a universal substitute for conventional autopsy. However, their primary contributions concern diagnostic accuracy and forensic methodology, rather than the interpretation of Indonesian legislation or the procedural requirements governing criminal evidence.[22]

Existing Indonesian legislation, conversely, provides a normative foundation for recognizing virtual autopsy but does not, through the provisions examined in this study, resolve every technical and evidentiary question associated with its implementation.[23] Law Number 17 of 2023 establishes the legal recognition of virtual autopsy, while Government Regulation Number 28 of 2024 regulates its position within medical services for legal purposes and clarifies certain consent requirements. Law Number 20 of 2025 provides the contemporary criminal procedural framework for evaluating expert and electronic evidence. Nevertheless, the relationship among these regulatory instruments requires systematic legal analysis. In particular, questions remain concerning the evidentiary classification of virtual autopsy findings, the procedures required to authenticate digital forensic information, and the standards by which courts should assess the reliability of imaging-based expert conclusions. These issues constitute the principal research gap addressed in this study.[24]

This research lies in its integrated examination of virtual autopsy through the interaction of health law, criminal procedure, and forensic evidentiary principles.[25] Unlike approaches that focus primarily on technological advantages or diagnostic effectiveness, this study develops a medicolegal

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[22] Abdullah Al-Matrouk and others, 'Quality Assurance and Quality Control in Forensic Science: From Evidence Collection to Laboratory Analysis', in *Investigative and Predictive DNA Testing* (Elsevier, 2026), pp. 391–406 https://doi.org/10.1016/B978-0-443-30128-5.00026-6

[23] Kaye N. Ballantyne and others, 'A Transparent Approach: Openness in Forensic Science Reporting', *Forensic Science International: Synergy*, 8 (2024), 100474 https://doi.org/10.1016/j.fsisyn.2024.100474

[24] Rahul Panwar and others, 'Artificial Intelligence in Forensic Medicine and Forensic Nursing: A Systematic Review of Clinical Applications, Ethical Risks, and Implementation Challenges', *Journal of Forensic and Legal Medicine*, 122 (2026), 103226 https://doi.org/10.1016/j.jflm.2026.103226

[25] Ivan Dieb Miziara and Carmen Silvia Molleis Galego Miziara, 'Autopsy Pathology's Paradigm Shift: Artificial Intelligence and Emerging Technologies in the Era of Digitally Integrated Death Investigation', *Diagnostics*, 16.15 (2026), 2405 https://doi.org/10.3390/diagnostics16152405

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analytical framework encompassing three dimensions: statutory recognition, procedural validity, and evidentiary reliability. Statutory recognition concerns the legal authority to conduct virtual autopsy under Indonesian health legislation. Procedural validity concerns the lawful authorization, performance, documentation, and preservation of forensic examinations. Evidentiary reliability concerns the scientific accuracy, authenticity, expert interpretation, and judicial evaluation of virtual autopsy findings. By integrating these dimensions, the research seeks to clarify how technological innovation can be incorporated into criminal investigations without compromising legal certainty, scientific accountability, or procedural fairness.[26]

The express recognition of virtual autopsy under Law Number 17 of 2023 and Government Regulation Number 28 of 2024, together with the introduction of the revised Criminal Procedure Code in 2026, creates a significant opportunity to strengthen forensic evidence practices. However, this opportunity also generates a need for clearer implementation standards and institutional coordination. Without adequate guidance, investigators, forensic physicians, prosecutors, and judges may adopt inconsistent approaches to the interpretation and evidentiary use of virtual autopsy findings. Such inconsistency may undermine legal certainty and create disputes concerning the reliability of forensic conclusions. Conversely, a coherent medicolegal framework could facilitate scientifically justified examinations, improve evidentiary transparency, and strengthen public confidence in criminal justice institutions.[27]

Based on these considerations, this study aims to analyze the legal status, procedural requirements, and evidentiary implications of virtual autopsy within Indonesian criminal law enforcement. Specifically, the research addresses three principal questions: *First,* how do Law Number 17 of 2023, Government Regulation Number 28 of 2024, and Law Number 20 of 2025 regulate the application of virtual autopsy in criminal investigations? Second, what medicolegal challenges arise concerning the scientific reliability, procedural validity, and evidentiary assessment of virtual autopsy findings? Third, what legal and institutional framework is necessary to strengthen the responsible integration of virtual autopsy into Indonesia's criminal justice system. By answering these questions, the study seeks to contribute to the development of forensic examination standards that integrate technological

[26] Patria Bayu Murdi and Rahimah Embong, 'Legal Issues of Health Frontier in Two Countries: Challenges from Indonesia and Singapore', *Journal of Sustainable Development and Regulatory Issues*, 2.3 (2024) https://doi.org/10.53955/jsderi.v2i3.51

[27] Matteo Nioi and others, 'From Routine to Risk: Medical Liability and the Legal Implications of Cataract Surgery in the Age of Trivialization', *Journal of Clinical Medicine*, 14.19 (2025), 6838 https://doi.org/10.3390/jcm14196838

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innovation with the principles of legality, evidentiary reliability, and substantive justice.[28]

Methodology

This study employs a normative juridical research method to examine the legal status and medicolegal implications of virtual autopsy (virtopsy) within Indonesia's criminal justice system.[29] This method focuses on analyzing legal norms, statutory provisions, and relevant legal principles governing forensic examinations, criminal investigations, and the admissibility of medical evidence in criminal proceedings. The research seeks to determine whether the existing Indonesian legal framework adequately accommodates technological developments in forensic medicine, particularly the application of noninvasive virtual autopsy techniques in determining causes of death and supporting criminal law enforcement. The study adopts two complementary approaches: the statutory approach and the conceptual approach. The statutory approach examines relevant Indonesian legislation and regulations concerning criminal procedure, forensic medical examinations, expert testimony, and the evidentiary requirements applicable to criminal investigations and judicial proceedings. This analysis identifies the legal foundations, regulatory limitations, and potential uncertainties surrounding the recognition of virtual autopsy findings as forensic evidence.[30] Particular attention is given to the relationship between conventional autopsy procedures and emerging digital forensic technologies within the existing criminal justice framework.[31]

The conceptual approach explores the legal principles underlying medicolegal responsibility, evidentiary reliability, scientific validity, and procedural justice.[32] It examines how these principles inform the assessment of virtual autopsy findings and their potential contribution to criminal investigations. This approach also considers the relationship between technological innovation and the legal safeguards necessary to ensure the credibility and accountability of forensic examinations. The research relies on secondary legal materials, including legislation, scholarly publications, legal doctrines, and relevant academic literature on forensic medicine and criminal

[28] Fandy Setiawan and others, 'Regulation of Criminal Sanctions for Physical Domestic Violence Promoting Gender Equality', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 4.2 (2026), 915–52 https://doi.org/10.53955/jsderi.v4i2.402

[29] Khairul Anwar and others, 'When State Ownership Challenges Creditor Justice in Bankruptcy Asset Execution', *Journal of Human Rights, Culture and Legal System*, 6.3 (2026), 111–48 https://doi.org/10.68247/jhcls.v6i3.1112

[30] Muhammad Rustamaji, Shalih Mangara Sitompul and Wan Mohd Khairul Firdaus, 'Regulations on Criminal Sanctions for Bribery in Corruption Cases', *Contrarius*, 1.3 (2025), 172–90 https://doi.org/10.53955/contrarius.v1i3.213

[31] Anis Mashdurohatun, I Made Dwi Jayantara, and others, 'Delayed Justice in Protecting Emergency Medical Workers', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 3.2 (2025), 347–71 https://doi.org/10.53955/jsderi.v3i2.116

[32] Mashdurohatun, I Made Dwi Jayantara, and others.

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evidence. These materials are examined through qualitative legal analysis using systematic interpretation and legal reasoning. The analysis evaluates the compatibility of virtual autopsy with existing legal standards and identifies areas requiring regulatory clarification. Ultimately, the methodology provides a normative foundation for assessing the potential integration of virtual autopsy into Indonesia's criminal justice system.[33]

Results and Discussion

Scientific Development, Diagnostic Reliability, and Medicolegal Significance of Virtual Autopsy in Criminal Investigations

The development of forensic medicine has substantially transformed the methods employed to investigate suspicious deaths, identify traumatic injuries, and reconstruct circumstances associated with criminal conduct.[34] Forensic autopsy has traditionally served as an essential medical procedure for determining the cause of death through systematic external and internal examinations of deceased persons.[35] Conventional autopsy generally involves anatomical dissection, direct observation of internal organs, and the collection of biological specimens for histopathological, toxicological, or microbiological analysis.[36] These procedures enable forensic physicians to identify pathological abnormalities and establish medical findings that may assist criminal investigators. Nevertheless, the application of conventional autopsy frequently encounters practical limitations, including the potential destruction of anatomical structures during dissection, the difficulty of repeating certain examinations, occupational exposure to biological hazards, and objections arising from religious or cultural considerations. Such limitations have encouraged the development of alternative forensic techniques capable of preserving anatomical information while maintaining diagnostic accuracy and professional accountability.[37]

Virtual autopsy, commonly referred to as *virtopsy*, represents an important technological advancement in forensic medicine. The method employs postmortem computed tomography (PMCT), magnetic resonance

[33] Tareq Al-Billeh and others, 'The International Framework for Cyber-Attacks Under the Rules of International Humanitarian Law', *Journal of Human Rights, Culture and Legal System*, 5.2 (2025), 412–41 https://doi.org/10.53955/jhcls.v5i2.534

[34] Alin-Ionut Piraianu and others, 'Enhancing the Evidence with Algorithms: How Artificial Intelligence Is Transforming Forensic Medicine', *Diagnostics*, 13.18 (2023), 2992 https://doi.org/10.3390/diagnostics13182992

[35] Sara Sablone and others, 'Psychological Autopsy: A Powerful Tool in Forensic Investigations', *Forensic Sciences*, 4.4 (2024), 635–46 https://doi.org/10.3390/forensicsci4040044

[36] Sertac Dalgic and others, 'Perinatal Deaths: Autopsy Findings and Medico-Legal Evaluation from a Forensic Medicine Perspective', *Diagnostics*, 16.15 (2026), 2341 https://doi.org/10.3390/diagnostics16152341

[37] Feras Alafer, 'Emerging Imaging Technologies in Forensic Medicine: A Systematic Review of Innovations, Ethical Challenges, and Future Directions', *Diagnostics*, 15.11 (2025), 1410 https://doi.org/10.3390/diagnostics15111410

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imaging (MRI), three-dimensional surface scanning, and digital reconstruction to examine deceased persons without necessarily requiring extensive physical dissection.[38] These technologies provide detailed representations of anatomical structures, allowing forensic specialists to identify skeletal fractures, detect certain internal abnormalities, reconstruct injury mechanisms, and document relevant findings. Unlike conventional autopsy, which involves direct anatomical intervention, virtual autopsy generates digital information that can be preserved, reviewed, and independently evaluated. Consequently, virtual autopsy offers potential advantages in forensic investigations where the preservation of anatomical integrity, repeated expert examination, and detailed visual documentation are particularly important.[39]

The scientific validity of virtual autopsy, however, must be established through empirical evidence rather than assumptions concerning technological superiority.[40] Roberts and colleagues conducted a validation study involving 182 adult deaths to compare the diagnostic performance of postmortem CT and MRI with conventional autopsy. The study identified major discrepancies in cause-of-death determinations in approximately 32% of CT examinations, 43% of MRI examinations, and 30% of combined radiological assessments. These discrepancies were particularly associated with conditions such as ischemic heart disease, pulmonary embolism, pneumonia, and certain intra-abdominal abnormalities.[41] The findings demonstrate that postmortem imaging possesses substantial diagnostic limitations in circumstances requiring microscopic tissue examination or direct pathological investigation. Therefore, the existence of advanced imaging technology does not justify the conclusion that virtual autopsy can universally replace conventional autopsy.[42]

Comparable findings were reported by Kasahara and colleagues in their examination of 339 forensic cases using postmortem computed tomography. Their research indicated that PMCT alone could establish the cause of death in approximately 7% of cases, while additional information was required in a substantial proportion of examinations. These findings emphasize the

[38] Samara Ferreira Santino and others, 'A Scoping Review on Virtual Autopsy: Main Concepts, Qualified Professionals and Future Prospects', *Pathology - Research and Practice*, 261 (2024), 155464 https://doi.org/10.1016/j.prp.2024.155464
[39] Yuzhu Li and others, 'Virtual Histological Staining of Unlabeled Autopsy Tissue', *Nature Communications*, 15.1 (2024), 1684 https://doi.org/10.1038/s41467-024-46077-2
[40] Chitra Jangid and others, 'From Traditional to Virtual: The Evolving Landscape of Autopsy Techniques in Forensic Science', *Journal of Indian Academy of Forensic Medicine*, 46.4 (2024), 545–52 https://doi.org/10.1177/09710973251327639
[41] Syarifah Hidayah Fatriah and Aidia Fitri Yeni, 'Virtual Autopsy in Head Trauma: A Case Report', *Forensic Imaging*, 45 (2026), 200713 https://doi.org/10.1016/j.fri.2026.200713
[42] A Dutta and V. Saini, 'Virtual Autopsy and Digitalization of Medico-Legal Records: A Need in Covid Era', *Journal of Indian Academy of Forensic Medicine*, 45.3 (2023), 301–4 https://doi.org/10.48165/jiafm.2023.45.3.22

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importance of combining radiological observations with investigative information, medical histories, laboratory findings, and conventional autopsy when necessary. Accordingly, the appropriate forensic approach should be determined by the suspected cause of death and the diagnostic capabilities of the examination method. A technologically sophisticated procedure may produce valuable anatomical information without necessarily providing sufficient evidence to establish the precise medical mechanism of death.[43]

Nevertheless, empirical research also demonstrates that postmortem imaging offers significant advantages in specific diagnostic circumstances. A systematic review and meta-analysis involving 66 studies and 4,213 individuals reported high diagnostic sensitivity for certain categories of injuries when appropriate imaging modalities were employed. Combined postmortem CT and MRI demonstrated a pooled sensitivity of approximately 97% for skeletal injuries, while postmortem CT angiography achieved approximately 79% pooled sensitivity in identifying causes of death within the studies analyzed. These findings indicate that the diagnostic effectiveness of virtual autopsy depends on the type of examination and the pathological condition under investigation. Consequently, virtual autopsy should be understood as a collection of forensic imaging techniques with different diagnostic capabilities rather than a single universally applicable procedure.[44]

One important contribution of virtual autopsy concerns the preservation and reproducibility of forensic information. Conventional dissection may alter anatomical relationships during examination, whereas digital imaging can document anatomical structures before invasive procedures are performed.[45] This characteristic enables forensic specialists to preserve a record of the deceased person's condition and subsequently review particular findings without requiring repeated physical examinations. Digital information may also facilitate independent assessments by additional forensic experts, thereby strengthening the transparency of scientific interpretation. However, reproducibility depends on the preservation of original imaging data, documentation of examination protocols, and availability of appropriately qualified specialists. Without these safeguards,

[43] Silvia Malerba and others, 'Artificial Intelligence Applications in Gastric Cancer Surgery: Bridging Early Diagnosis and Responsible Precision Medicine', *Journal of Clinical Medicine*, 15.6 (2026), 2208 https://doi.org/10.3390/jcm15062208

[44] Laura Filograna, Guglielmo Manenti, Simone Grassi, and others, 'Health Technology Assessment (HTA) of Virtual Autopsy through PMCT with Particular Focus on Italy', *Forensic Imaging*, 30 (2022), 200516 https://doi.org/10.1016/j.fri.2022.200516

[45] Laura Ambrosi and others, 'Digital Pathology in Forensic Science: A Systematic Review of the Literature', *Forensic Science, Medicine and Pathology*, 22.3 (2025), 1121–36 https://doi.org/10.1007/s12024-025-01146-w

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digital preservation alone cannot guarantee the reliability of forensic conclusions.[46]

Virtual autopsy also provides important opportunities for reconstructing traumatic injuries. Three-dimensional imaging may assist forensic physicians in identifying fracture patterns, examining projectile trajectories, and illustrating anatomical relationships relevant to suspected criminal conduct.[47] Such reconstructions can be particularly useful when explaining complex forensic findings to investigators, prosecutors, defense counsel, and judges who may not possess specialized medical knowledge.[48] Nevertheless, the evidentiary significance of digital reconstruction must be distinguished from its visual clarity. A three-dimensional representation is an interpretation derived from underlying imaging information, and its accuracy depends on image quality, reconstruction procedures, and expert judgment. Consequently, forensic specialists must explain the scientific limitations and assumptions underlying reconstructed images rather than presenting them as unquestionable representations of historical events.[49]

The medicolegal significance of virtual autopsy is particularly evident in societies where conventional postmortem examinations encounter resistance based on religious beliefs, cultural practices, or concerns regarding bodily integrity.[50] In Indonesia, the diversity of religious and sociocultural traditions may influence family attitudes toward invasive forensic examinations. Virtual autopsy potentially offers a less invasive method of obtaining anatomical information, thereby reducing certain concerns associated with dissection.[51] However, it would be inappropriate to conclude that noninvasive examination automatically eliminates all ethical or legal objections. The handling of deceased persons, collection of sensitive medical information, and use of digital anatomical images continue to require professional

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[46] Baoqing Wang, Noboru Adachi and Issei Fujishiro, 'FORSETI: A Visual Analysis Environment Enabling Provenance Awareness for the Accountability of e-Autopsy Reports', *Visual Informatics*, 6.3 (2022), 69–80 https://doi.org/10.1016/j.visinf.2022.05.005

[47] Aditya Verma, Tanu Rajput and Devesh Tiwari, 'Virtual Autopsy in Entomology: A Digital Perspective on Insect-Based Forensic Investigation', in *Proceedings of the First International Conference on Advances in Forensics and Cyber Technologies (ICFACT 2025)* (Atlantis Press, 2026), pp. 704–18 https://doi.org/10.2991/978-94-6239-610-4_57

[48] Ido Hefetz, 'Integrating AI Systems in Criminal Justice: The Forensic Expert as a Corridor Between Algorithms and Courtroom Evidence', *Forensic Sciences*, 5.4 (2025), 53 https://doi.org/10.3390/forensicsci5040053

[49] Ankita Guleria and others, 'Methods of Forensic Facial Reconstruction and Human Identification: Historical Background, Significance, and Limitations', *The Science of Nature*, 110.2 (2023), 8 https://doi.org/10.1007/s00114-023-01838-9

[50] A. Arul Darshini, S. Intamil Karthika and D. Iyda Jenifer, 'Digital Death Investigation: Uncovering Limitations in Virtual Autopsy and Pathways to Innovation', in *Proceedings of the First International Conference on Advances in Forensics and Cyber Technologies (ICFACT 2025)* (Atlantis Press, 2026), pp. 616–31 https://doi.org/10.2991/978-94-6239-610-4_50

[51] Marc Trabsky, 'Forensic Imaginaries: Visualising the Corpse in Law', *Mortality*, 2025, 1–14 https://doi.org/10.1080/13576275.2025.2556155

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accountability and respect for human dignity. Moreover, virtual autopsy may still need to be supplemented by conventional procedures when imaging findings are insufficient to determine the cause of death.[52]

Another significant issue concerns the relationship between forensic technology and professional competence.[53] The acquisition of radiological images does not independently establish medically reliable conclusions. Appropriate interpretation requires specialized knowledge of postmortem changes, anatomical abnormalities, imaging artifacts, and the distinction between pathological findings and normal postmortem phenomena. Forensic physicians and radiologists therefore perform complementary professional functions in interpreting virtual autopsy findings. Their cooperation is particularly important when imaging results must be correlated with external examination, laboratory analysis, or investigative evidence. Without adequate professional competence, sophisticated imaging equipment may generate information that is incomplete, misleading, or vulnerable to competing interpretations.[54]

The integration of virtual autopsy into criminal investigations should consequently follow a differentiated approach based on the scientific characteristics of each case.[55] Where the principal investigative issue concerns skeletal trauma or particular anatomical injuries, postmortem imaging may provide highly relevant information. Conversely, cases involving poisoning, microscopic pathology, or certain cardiovascular conditions may require conventional autopsy and laboratory examinations. This distinction demonstrates that virtual autopsy and conventional autopsy should not be treated as mutually exclusive methods. Instead, their relationship should be understood through the principle of complementary forensic examination, whereby each method contributes information according to its scientifically established capabilities.[56]

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[52] Abdullah Al-Matrouk and Mohammed Dashti, 'Virtual Autopsy: An Innovative Approach to Determining Cause and Circumstances of Death', in *Advances in Forensic Biology and Genetics* (Singapore: Springer Nature Singapore, 2025), pp. 221–37 https://doi.org/10.1007/978-981-96-4585-5_12

[53] Dilip Vaishnav and others, 'Virtual Autopsy in COVID19 Positive Sudden Death of a Young Adult Male; a Forensic Case Report', *Forensic Imaging*, 28 (2022), 200488 https://doi.org/10.1016/j.fri.2022.200488

[54] Fengxian Chen and others, 'Strategies for the Analysis and Elimination of Hallucinations in Artificial Intelligence Generated Medical Knowledge', *Journal of Evidence-Based Medicine*, 18.3 (2025) https://doi.org/10.1111/jebm.70075

[55] Santino and others.

[56] Yousef Khader and Mohammad Alyahya, 'Beyond Single Cause-of-Death Labels: A Secondary Analysis of Outcome-Specific Latent-Class Phenotyping and Marker-Supported Reclassification of Stillbirths and Neonatal Deaths in Jordan', *Journal of Neonatal-Perinatal Medicine*, 2026 https://doi.org/10.1177/19345798261490604

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Statutory Recognition, Professional Authority, and Procedural Legality of Virtual Autopsy under Indonesian Law

The legal status of virtual autopsy in Indonesia must be examined through the interaction between health legislation, criminal procedure, and the professional responsibilities of forensic medical practitioners.[57] Historically, forensic autopsy was principally associated with the provisions of Law Number 8 of 1981 concerning the Criminal Procedure Code, particularly Articles 133 and 134, which regulated requests for medical examinations and procedures associated with postmortem investigation.[58] These provisions established an important legal foundation for involving forensic physicians in criminal investigations. Nevertheless, the subsequent development of medical technology and legislative reform has substantially changed the normative framework governing forensic examinations. Consequently, contemporary analysis must distinguish the historical regulation of conventional autopsy from the legal recognition of virtual autopsy under more recent legislation.[59]

Law Number 17 of 2023 concerning Health constitutes a significant development because it expressly recognizes postmortem virtual autopsy within medical services for legal purposes. Article 156 paragraph (2) identifies forensic autopsy, laboratory examination, and postmortem virtual autopsy among the examination methods available for medicolegal purposes. Article 156 paragraph (3) further requires such examinations to be conducted by medical professionals acting within their expertise and authority.[60] These provisions establish that virtual autopsy is no longer merely a technological innovation lacking statutory acknowledgment. Instead, it possesses an express legal foundation within Indonesian health legislation. Nevertheless, statutory recognition of a medical procedure should not be equated with automatic recognition of every resulting finding as conclusive criminal evidence.[61]

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[57] Mayur Sudhir Balbudhe and others, 'Integration of Forensic Science Techniques in Psychiatric Legal Assessments: A Scoping Review', *Egyptian Journal of Forensic Sciences*, 16.1 (2026), 61 https://doi.org/10.1186/s41935-026-00559-0

[58] Anis Mashdurohatun, Mahmoud W M Abu Wazna, and others, 'Bridging Formal Legality and Living Law Public Prosecutorial Policies to Achieve Justice', *Contrarius*, 2.2 (2026), 110–36 https://doi.org/10.53955/contrarius.v2i2.272

[59] Bambang Sugeng Rukmono and Sandi Yudha Prayoga, 'Justice A Legal Analysis of Medical Marijuana Regulation', *Contrarius*, 1.1 (2025), 28–40 https://doi.org/10.53955/contrarius.v1i1.81

[60] Paolo Visci and others, 'Digital Surveillance or Objective Evidence? Wearable-Derived Data in Insurance and Legal Medicine: A Narrative Review and Medico-Legal Perspective', *Journal of Forensic and Legal Medicine*, 123 (2026), 103246 https://doi.org/10.1016/j.jflm.2026.103246

[61] Orin Gusta Andini and Muhammad Riyan Kachfi Boer, 'Indonesia's Safeguarding of Human Rights to Achieve Sustainable Development Goals: Insights from Australia's Experience', *Journal of Sustainable Development and Regulatory Issues (JSDERI)*, 3.1 (2025), 1–28 https://doi.org/10.53955/jsderi.v3i1.53

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The distinction between the legality of a forensic examination and the evidentiary significance of its findings is essential. Health legislation determines whether virtual autopsy constitutes a recognized medical procedure and establishes relevant professional requirements.[62] Criminal procedure, conversely, governs the acquisition, presentation, and judicial assessment of evidence. Therefore, the existence of statutory authority to conduct virtual autopsy does not eliminate the need to satisfy applicable evidentiary requirements.[63] A legally authorized forensic examination may still produce findings whose reliability is disputed, while scientifically meaningful information may encounter evidentiary difficulties if obtained through unlawful procedures. These considerations demonstrate the necessity of integrating medical and procedural legal analysis.[64]

Article 157 paragraph (1) of Law Number 17 of 2023 establishes that efforts must be undertaken to determine the causes of death and identities of deceased persons for law enforcement and population administration purposes. Article 157 paragraph (2) expressly recognizes postmortem virtual autopsy as one of the available examination methods. This provision is significant because it accommodates technological diversity in determining causes of death. Rather than prescribing conventional dissection as the exclusive method, the legislation acknowledges that different medical procedures may contribute to the determination of relevant forensic facts. However, the selection of an examination method must remain consistent with professional competence, scientific reliability, and the circumstances surrounding the death.[65]

The relationship between family consent and forensic examination constitutes another important medicolegal issue. Article 157 paragraph (3) of Law Number 17 of 2023 establishes a general family-consent requirement for specified postmortem examinations. However, this requirement must be interpreted together with Government Regulation Number 28 of 2024 concerning the Implementation of Law Number 17 of 2023. Article 472 paragraph (1) of the regulation recognizes several examination methods,

[62] Santino and others.
[63] Camille Reyl and others, 'Factors Associated With the Absence of Fetal Autopsy: Perception of Healthcare Professionals From a French Cross-Sectional Survey', *Prenatal Diagnosis*, 2026 https://doi.org/10.1002/pd.70287
[64] Yordan Gunawan and others, 'The Effectiveness of International Law in Limiting Humanitarian Disasters in the Palestine-Israel Conflict', *Journal of Human Rights, Culture and Legal System*, 5.1 (2025), 217–45 https://doi.org/10.53955/jhcls.v5i1.307
[65] Sam D. Shemie and others, 'A Brain-Based Definition of Death and Criteria for Its Determination after Arrest of Circulation or Neurologic Function in Canada: A 2023 Clinical Practice Guideline', *Canadian Journal of Anesthesia/Journal Canadien d'anesthésie*, 70.4 (2023), 483–557 https://doi.org/10.1007/s12630-023-02431-4

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including forensic autopsy and postmortem virtual autopsy.[66] Article 472 paragraph (2) reiterates the general requirement of family consent, while Article 472 paragraph (3) establishes an exception where indications of suspected criminal conduct exist and the examination is requested by law enforcement authorities in accordance with applicable legislation.[67]

This regulatory distinction demonstrates that family objections cannot automatically be treated as an absolute prohibition against every forensic examination associated with suspected criminal conduct.[68] Where the statutory conditions are satisfied, the public interest in investigating possible criminal activity may justify examination without ordinary family consent. Nevertheless, the exception must be interpreted carefully. It does not authorize arbitrary medical intervention or eliminate the obligation to comply with investigative procedures and professional standards.[69] Investigators must act within their lawful authority, while forensic medical practitioners must ensure that examinations are performed for legitimate purposes and according to accepted medical principles. The legality of the examination therefore depends on the relationship between investigative necessity, statutory authorization, and professional accountability.[70]

Article 158 of Law Number 17 of 2023 further emphasizes the importance of respecting religious norms, sociocultural values, morality, and professional ethics in autopsy procedures. These considerations are particularly relevant to virtual autopsy because noninvasive imaging may reduce certain objections associated with conventional dissection. However, the use of virtual autopsy should not be interpreted as removing the need to respect the deceased person's dignity or the legitimate interests of surviving family members. Digital imaging may generate sensitive anatomical information that requires appropriate handling, preservation, and disclosure. Consequently, the ethical implications of virtual autopsy extend beyond

[66] A. Staicu and others, 'Whole-body Non-forensic Fetal Virtopsy Using Postmortem Magnetic Resonance Imaging at 7 Tesla vs Classical Autopsy', *Ultrasound in Obstetrics & Gynecology*, 64.5 (2024), 661–68 https://doi.org/10.1002/uog.29106

[67] Laura Filograna, Guglielmo Manenti, Vincenzo Arena, and others, 'Claimed Medical Malpractice in Fatal SARS-CoV-2 Infections: The Importance of Combining Ante- and Post-Mortem Radiological Data and Autopsy Findings for Correct Forensic Analysis', *Forensic Imaging*, 25 (2021), 200454 https://doi.org/10.1016/j.fri.2021.200454

[68] Zoë Selhi and Thomas G. Gutheil, 'From Diagnosis to Detention: Examining Structural Bias in the Ontario Forensic System', *International Journal of Law and Psychiatry*, 110 (2027), 102289 https://doi.org/10.1016/j.ijlp.2026.102289

[69] Nicole Palmour, Jessica Huang and Yann Joly, 'The Future Is Not the Present: Responsible Pathways for Forensic Epigenetics', *Forensic Science International: Genetics*, 84 (2026), 103514 https://doi.org/10.1016/j.fsigen.2026.103514

[70] Hannah Ruschemeier and Lukas J. Hondrich, 'Automation Bias in Public Administration – an Interdisciplinary Perspective from Law and Psychology', *Government Information Quarterly*, 41.3 (2024), 101953 https://doi.org/10.1016/j.giq.2024.101953

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physical intervention to include confidentiality, professional responsibility, and the protection of forensic information.[71]

The legal framework must also be examined in light of the enactment of Law Number 20 of 2025 concerning the Criminal Procedure Code, which entered into force on 2 January 2026 and replaced Law Number 8 of 1981. This legislative development is particularly important because earlier medicolegal discussions frequently relied on the former Criminal Procedure Code as the principal source of investigative authority and evidentiary rules. Although those provisions remain relevant to understanding the historical development of forensic practice, contemporary analysis must apply the currently operative legal framework. The revised Criminal Procedure Code provides the procedural context within which forensic medical findings, expert opinions, and electronic information must be evaluated.[72]

Article 235 paragraph (1) of Law Number 20 of 2025 recognizes several forms of evidence, including expert testimony, documentary evidence, physical evidence, and electronic evidence. These categories are relevant to virtual autopsy because postmortem imaging produces digital information that may support expert interpretation and forensic documentation. Nevertheless, virtual autopsy should not automatically be classified as a separate category of evidence merely because it employs advanced technology. Its legal position depends on the nature of the information produced, the manner in which the findings are documented, and the procedural requirements governing their presentation. Accordingly, virtual autopsy findings may support different evidentiary forms without necessarily possessing independent or conclusive evidentiary status.[73]

Professional competence represents another fundamental aspect of procedural legality. Article 156 paragraph (3) of Law Number 17 of 2023 requires medical services for legal purposes to be conducted by professionals acting within their expertise and authority. This requirement is particularly important because virtual autopsy involves both forensic medicine and radiological interpretation.[74] The technical ability to operate imaging equipment does not necessarily establish competence to determine causes of

[71] Ashraf Mashaly and Mohammed S. Al-Khalifa, 'Exploring the Ethical Dimensions in Forensic Entomology: From Codes of Conduct to Professional Accountability', *Science & Justice*, 64.2 (2024), 243–49 https://doi.org/10.1016/j.scijus.2024.02.003
[72] Muhamad Yofhan Wibianto, Hartiwiningsih Hartiwiningsih and I Gusti Ayu Ketut Rachmi Handayani, 'Real Justice, Real Impact with the Prosecutors in Action', *Journal of Human Rights, Culture and Legal System*, 5.3 (2025), 1015–41 https://doi.org/10.53955/jhcls.v5i3.804
[73] IMOGEN JONES, 'The Medico-legal Autopsy: Medicine, Expertise, and Death Investigation', *Journal of Law and Society*, 53.3 (2026), 474–95 https://doi.org/10.1111/jols.70077
[74] Mikaela Sundberg, 'Why Forensic Pathologists Maintain Uncertainty in Reporting Causes of Death: How Communicative Uncertainty Devices Shape Reasoning', *Sociology of Health & Illness*, 47.8 (2025) https://doi.org/10.1111/1467-9566.70105

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death in criminal investigations. Similarly, expertise in conventional autopsy does not automatically establish proficiency in interpreting every form of postmortem imaging. Consequently, interdisciplinary cooperation between forensic physicians and appropriately qualified radiological specialists may be necessary to ensure scientifically defensible findings.[75]

The implementation of virtual autopsy also requires attention to institutional capacity. Advanced imaging equipment, digital storage systems, trained personnel, and standardized examination protocols may not be equally available across Indonesian regions. These differences may influence the feasibility of incorporating virtual autopsy into routine forensic practice. Nevertheless, the existence of technological limitations should not be interpreted as a justification for disregarding scientific standards. Instead, institutional development should prioritize professional training, appropriate equipment, and transparent procedures for determining when virtual autopsy is medically suitable. Such measures would strengthen consistency while reducing the risk of unsupported forensic conclusions.[76]

The principal legal finding is therefore that Indonesian legislation already recognizes virtual autopsy as a method relevant to medical services for legal purposes. The remaining challenge concerns the practical integration of that recognition into criminal investigations and judicial proceedings. Law Number 17 of 2023 provides the statutory foundation, Government Regulation Number 28 of 2024 clarifies examination procedures and consent requirements, and Law Number 20 of 2025 establishes the contemporary criminal evidentiary framework. These instruments collectively provide a basis for responsible implementation, but their interaction requires systematic interpretation and appropriate operational standards. Consequently, the development of virtual autopsy in Indonesia should focus on strengthening procedural legality, professional accountability, and institutional readiness rather than asserting that the method lacks legal recognition altogether.[77]

Evidentiary Reliability, Judicial Assessment, and the Development of an Integrated Medicolegal Framework

The integration of virtual autopsy into Indonesian criminal justice requires careful examination of the relationship between scientific findings

[75] Enno Fischer and Saana Jukola, 'Bodies of Evidence: The "Excited Delirium Syndrome" and the Epistemology of Cause-of-Death Inquiry', *Studies in History and Philosophy of Science*, 104 (2024), 38–47 https://doi.org/10.1016/j.shpsa.2023.12.009

[76] Iskandar Zakaria and others, 'Assessing Fracture Detection: A Comparison of Minimal-Resource and Standard-Resource Plain Radiographic Interpretations', *Diagnostics*, 15.7 (2025), 876 https://doi.org/10.3390/diagnostics15070876

[77] Muhammad Azam and others, 'Harmonizing Contemporary International Commercial Law with Sharia-Based National Legal Systems: A Comparative Study of Pakistan, Turkey, Indonesia, Malaysia, and Saudi Arabia', *MILRev: Metro Islamic Law Review*, 4.2 (2025), 1074–96 https://doi.org/10.32332/milrev.v4i2.11334

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and legally admissible evidence.[78] In criminal proceedings, the determination of factual circumstances must be based on evidence obtained and presented in accordance with applicable procedural requirements. Forensic medical examinations contribute to this process by providing expert assessments concerning injuries, causes of death, and other medically relevant circumstances. However, the scientific usefulness of an examination method does not automatically establish the legal reliability of its findings. Accordingly, the evidentiary significance of virtual autopsy depends on the interaction between methodological validity, professional competence, lawful acquisition, and judicial evaluation.[79]

Article 235 paragraph (1) of Law Number 20 of 2025 concerning the Criminal Procedure Code provides the contemporary framework for evaluating criminal evidence.[80] The provision recognizes several categories of evidence, including expert testimony, documentary evidence, physical evidence, electronic evidence, and judicial observation. These categories are particularly relevant to virtual autopsy because its findings may be presented through expert medical explanations, forensic reports, digital images, and reconstructed anatomical representations. Nevertheless, the method of examination should be distinguished from the legal form of evidence. Virtual autopsy is a forensic procedure, whereas the resulting medical conclusions and digital records may contribute to recognized evidentiary categories according to their characteristics and the requirements of criminal procedure.[81]

The distinction between forensic findings and judicial proof is particularly important. A postmortem CT image may reveal a fracture or anatomical abnormality, but the legal significance of that finding depends on whether it can be connected to the circumstances of the alleged criminal conduct.[82] Such a connection ordinarily requires expert interpretation, consideration of relevant medical information, and evaluation alongside other evidence. Similarly, a three-dimensional reconstruction may illustrate a possible

[78] John Morgan, 'Wrongful Convictions and Claims of False or Misleading Forensic Evidence', *Journal of Forensic Sciences*, 68.3 (2023), 908–61 https://doi.org/10.1111/1556-4029.15233
[79] Rina Arum Prastyanti and Prattana Srisuk, 'Consumer Dispute Resolution Decision Policies and Business Implications', *Contrarius*, 2.1 (2026), 54–69 https://doi.org/10.53955/contrarius.v2i1.263
[80] Arief Setia Nugroho, Amad Sudiro and Khaoula Bel Haj Ali, 'Reassessing Mass Media Reporting as Criminal Evidence in Indonesia toward Social Media Justice', *Journal of Sustainable Development and Regulatory Issues*, 4.1 (2026), 278–303 https://doi.org/10.53955/jsderi.v4i1.289
[81] Ahmad Dwi Nuryanto and Mohammed AlHadi Ibrahim Bosha Ahmed, 'Does Indonesian Bankruptcy Law Protection for Curators in Bankruptcy?', *Contrarius*, 2.1 (2026), 20–36 https://doi.org/10.53955/contrarius.v2i1.258
[82] Kallirroi Fragkou and others, 'From Fragile Lives to Forensic Truth: Multimodal Forensic Approaches to Pediatric Homicide and Suspect Death', *Diagnostics*, 15.11 (2025), 1383 https://doi.org/10.3390/diagnostics15111383

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mechanism of injury without independently proving the identity of the perpetrator or establishing criminal responsibility. Consequently, courts must avoid treating technologically generated forensic information as conclusive merely because it appears scientifically sophisticated.[83]

The revised Criminal Procedure Code also emphasizes evidentiary authenticity and lawful acquisition. Article 235 paragraphs (3) to (5) establish requirements concerning authentic and legally obtained evidence, judicial assessment of authenticity and legality, and the exclusion of evidence determined to be unauthentic or unlawfully obtained. These requirements have direct implications for virtual autopsy because digital forensic information may be susceptible to alteration, incomplete documentation, or disputes concerning its origin. The reliability of virtual autopsy findings therefore depends not only on diagnostic accuracy but also on the ability to establish that the relevant images and records correspond to the examination actually performed.[84]

An appropriate evidentiary framework should begin with the preservation of original imaging data. Forensic institutions should document the examination date, imaging equipment, examination protocol, responsible medical professionals, and relevant procedures for storing and transferring digital information.[85] Where images undergo processing or three-dimensional reconstruction, the relationship between the original data and the resulting visualization should remain identifiable. Such documentation would support independent expert review and facilitate judicial examination of the reliability of forensic findings. Although specific technical requirements must be developed through appropriate professional standards, the underlying objective is to ensure that digital forensic evidence remains authentic, traceable, and capable of meaningful scrutiny.[86]

The role of expert testimony is equally significant. Virtual autopsy findings require interpretation by professionals possessing appropriate expertise in forensic medicine and relevant imaging techniques.[87] Experts should explain

[83] Magdalene Ng, Rachael Medhurst and Coral J. Dando, 'An "Enlightenment Phase": Police Perspectives on the Contemporary Challenges of Digital Evidence and Digital Forensic Investigations', *Information*, 17.6 (2026), 538 https://doi.org/10.3390/info17060538

[84] Handar Subhandi Bakhtiar, 'The Evolution of Scientific Evidence Theory in Criminal Law: A Transformative Insight', *Media Iuris*, 7.2 (2024), 221–40 https://doi.org/10.20473/mi.v7i2.51095

[85] Tommaso D'Anna and others, 'The Chain of Custody in the Era of Modern Forensics: From the Classic Procedures for Gathering Evidence to the New Challenges Related to Digital Data', *Healthcare*, 11.5 (2023), 634 https://doi.org/10.3390/healthcare11050634

[86] Nataliia Martynenko, 'Digitalisation of Forensic Expert Activity in Ukraine: Organisational and Legal Framework', *Forensic Science International: Synergy*, 10 (2025), 100578 https://doi.org/10.1016/j.fsisyn.2025.100578

[87] Heather M. Garvin, Alexis L. VanBaarle and Lauren N. Butaric, 'Medical Imaging Comparison for Personal Identification: A Primer for Forensic Practitioners', *Humans*, 6.3 (2026), 26 https://doi.org/10.3390/humans6030026

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the examination method, identify the anatomical findings observed, distinguish direct observations from inferential conclusions, and acknowledge relevant diagnostic limitations. This distinction is particularly important where imaging results cannot conclusively establish the cause of death. An expert who presents uncertain findings as definitive conclusions may undermine the reliability of the evidentiary process. Conversely, transparent explanations of methodological limitations may assist courts in assigning appropriate weight to forensic evidence.[88]

The relationship between virtual autopsy and *visum et repertum* also deserves careful consideration. In Indonesian medicolegal practice, *visum et repertum* traditionally provides a written medical report documenting findings obtained through examinations conducted for legal purposes. Virtual autopsy may contribute to such reports by providing radiological observations and digitally preserved anatomical information. Nevertheless, the inclusion of imaging findings does not automatically transform a forensic report into conclusive proof of criminal conduct. The report must accurately distinguish medical observations, expert interpretations, and conclusions supported by the available scientific information. Its evidentiary significance must then be assessed according to the applicable procedural rules.[89]

The scientific literature demonstrates why this distinction is necessary. Roberts and colleagues identified substantial discrepancies between radiological and conventional autopsy determinations of causes of death, while Kasahara and colleagues found that postmortem CT alone could establish the cause of death in only a limited proportion of forensic cases. These findings indicate that courts should consider the diagnostic limitations of virtual autopsy when evaluating expert conclusions. In cases involving skeletal trauma, digital imaging may provide highly relevant anatomical evidence. However, cases involving poisoning, microscopic pathology, or certain internal diseases may require additional examinations. Therefore, the evidentiary weight of virtual autopsy findings should depend on their relevance and scientific adequacy in the circumstances of the individual case.[90]

The presentation of virtual autopsy findings through three-dimensional visualization also introduces important considerations concerning judicial

[88] Ali Md. Ayub, Ferdous Robayet Syed and Haiqing Peng, 'Breaking Barriers: The Admissibility of Forensic Evidence in US Courts and the Struggles with Cutting-Edge Science', *Science & Justice*, 65.6 (2025), 101355 https://doi.org/10.1016/j.scijus.2025.101355

[89] Imroatul Azizah and others, 'Digitalization and Cyberfeminism: Reinterpreting Islamic Criminal Law for Gender Equality and Women's Rights', *Volksgeist: Jurnal Ilmu Hukum Dan Konstitusi*, 2026 https://doi.org/10.24090/volksgeist.v9i1.15378

[90] Julia Francesca Gilbert and others, 'Veterinary Forensic Pathology in the Investigation of Animal Cruelty: Post-Mortem Insights, Forensic Tools, Case Studies, and Legal Perspectives', *Animals*, 16.5 (2026), 785 https://doi.org/10.3390/ani16050785

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understanding.[91] Digital reconstruction may assist judges, prosecutors, and defense counsel in examining complex anatomical information. Such visualizations may improve communication between forensic experts and legal practitioners by illustrating injury patterns or anatomical relationships that are difficult to explain through written descriptions alone. Nevertheless, reconstructed images should be accompanied by explanations concerning their underlying data, technical assumptions, and possible limitations. Their visual clarity should not be confused with scientific certainty. Judicial evaluation must remain grounded in the reliability of the underlying examination and its relationship to other admissible evidence.[92]

These considerations support the development of an integrated medicolegal framework for virtual autopsy in Indonesia. The framework proposed in this study consists of three interconnected dimensions: statutory legality, scientific reliability, and evidentiary accountability.[93] Statutory legality concerns the authority to conduct examinations, compliance with applicable legislation, and professional competence. Scientific reliability concerns validated imaging techniques, appropriate examination protocols, and recognition of diagnostic limitations. Evidentiary accountability concerns the preservation of digital information, authentication of forensic findings, transparent expert interpretation, and judicial assessment of their probative value. These dimensions should operate collectively rather than independently because weaknesses in one dimension may undermine the effectiveness of the others.[94]

The implementation of this framework requires interdisciplinary institutional cooperation. Forensic physicians and radiologists should determine the appropriate examination techniques according to the medical circumstances of each case.[95] Investigators must ensure that examinations are requested and conducted pursuant to lawful authority. Prosecutors should assess the relevance and reliability of forensic findings when constructing criminal cases, while judges must evaluate the evidentiary

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[91] Mikkel V. Petersen, Asser H. Thomsen and Kasper Hansen, 'FATAL: A Forensic AuTopsy Annotation TooL for Digital Recording of Autopsy Findings', *Computers in Biology and Medicine*, 182 (2024), 109170 https://doi.org/10.1016/j.compbiomed.2024.109170

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significance of expert conclusions without disregarding methodological limitations. Defense counsel should also have meaningful opportunities to examine the scientific basis of forensic evidence and challenge interpretations that may be incomplete or unreliable. Such cooperation would strengthen procedural fairness and reduce the risk of excessive reliance on technological representations.[96]

Institutional development is also necessary to support consistent implementation. The responsible authorities should consider establishing standardized forensic imaging protocols, professional training requirements, procedures for preserving digital evidence, and mechanisms for interdisciplinary consultation.[97] These measures would facilitate more consistent examination practices and improve the transparency of forensic findings. However, standardization should remain responsive to the circumstances of individual cases and should not impose virtual autopsy as a mandatory substitute for conventional procedures. The appropriate examination method must continue to depend on scientific necessity, available expertise, and the evidentiary requirements of the investigation.[98]

The principal contribution of this study is the recognition that virtual autopsy already possesses a statutory foundation within Indonesian health legislation, but its effective integration into criminal justice requires more than formal legal acknowledgment.[99] The relationship between Law Number 17 of 2023, Government Regulation Number 28 of 2024, and Law Number 20 of 2025 provides a legal basis for developing more coherent forensic examination practices. Nevertheless, the reliability and evidentiary significance of virtual autopsy findings must be established through validated scientific methods, lawful procedures, and transparent judicial evaluation. Accordingly, virtual autopsy should be understood as a legally recognized

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forensic method whose practical value depends on the quality of its implementation rather than the novelty of its technology.[100]

Conclusion

In considering the benefits of the virtual autopsy in post-mortem imaging, various researchers highly recommend this method, as it can extensively be implemented in the medical and legal sectors. Apart from the issue of the principle values of a virtual autopsy in the face of the law, the analysis of the legality aspect of this technology also concerns the protection of the patients' data. The law and ethics to protect privacy and confidentiality must be enforced. Confidentiality concerns the professional obligation of various parties involved in the practice or the virtual autopsy to not disclose personal information to third parties. After death, families have some privacy rights, concerning the right to control the physical leftovers, memories, and images of their deceased family member to be protected from exploitation by third parties. This is an inseparable part of undergoing the virtual autopsy (*Virtopsy).* The virtual autopsy cannot yet be accepted as a substitute for conventional autopsy. The latter is still a standard in determining the cause of one's death that is acknowledged in Indonesian law. The virtual autopsy is still deemed complementary to conventional autopsy. Even with its various advantages and efficiency as one of the forms of sophistication in the science of medical forensics, in the medicolegal perspective in Indonesia, there still needs to be further research by multidiscipline experts on its application in court, so that it may obtain equal acknowledgement with conventional autopsies (surgeries on bodies), and so that it may be applied to support the process of law enforcement in the future.

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