

Research Article

Utilization of Digital Pathology for Medical Autopsy: A Single Institution Experience

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Abstract

Background: While the frequency of medical autopsies has declined in recent decades, they remain critical for medical education, quality assurance, and understanding disease processes. Digital pathology has gained traction across pathology subspecialties. But its application in medical autopsy workflows remains unrecognized. This study evaluates the utility of digital pathology in the autopsy setting.

Methods: We conducted a retrospective analysis of adult medical autopsies performed from January 2018 to December 2024 at a tertiary care academic institution. Whole-slide imaging (WSI) was utilized for all autopsy specimens during this period. The data collected included patient demographics, time to final report, use of immunohistochemistry (IHC), digital consultation frequency, and use of digital images for educational or publishing purposes.

Results: Fifty autopsies were reviewed. Patient ages ranged from 18 to 88 years. The average report turnaround time was 24 days (range, 2-44 days). Digital pathology facilitated intradepartmental consultation in 36 cases (72%) and supported IHC interpretation in 32 cases (64%). Digital images were used for academic or teaching purposes in 25 cases (50%).

Conclusion: Digital pathology enhances medical autopsy workflow by improving collaborative diagnostics, supporting ancillary testing, and expanding opportunities for teaching and research. These findings suggest that integrating digital tools into autopsy practice enhances its educational and diagnostic relevance in modern pathology.

Introduction

Medical autopsy has long served as a gold standard in confirming clinical diagnoses, identifying diagnostic errors, and revealing unexpected findings. Its role in education and quality control is unparalleled, offering a complete postmortem perspective not attainable through antemortem diagnostic tools [1,2]. Despite its value, the frequency of autopsies has declined worldwide due to changing medical practices, improved diagnostic imaging modalities, family consent issues, and financial constraints [2].

Concurrently, digital pathology has emerged as a transformative innovation in diagnostic medicine, with whole-slide imaging (WSI) enabling remote viewing, quantitative analysis, and digital archiving [3]. While widely

adopted in surgical pathology, its integration into autopsy practice has received limited scholarly attention. This paper presents our institution's multi-year experience with digital pathology applied to medical autopsies, assessing its impact on workflow, collaboration, and educational utility.

Materials and methods

Study setting and design

This retrospective study was conducted at a tertiary care academic hospital equipped with a fully integrated digital pathology system. All autopsies included in this study were performed between January 2018 and December 2024 by board-certified pathologists in accordance with CAP and ACGME standards [4]. Our control set included series of cases from prior years when digital autopsy was not available.

More Information

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Keywords: Digital pathology; Medical autopsy; Whole-slide imaging; Pathology education; Immunohistochemistry; Consultation





Data collection

After receiving Institutional Review Board (IRB) approval, we compiled a database of consecutive adult autopsies. Informed consent was waived. For each case, we collected: Patient age, sex, and date of death, date of autopsy performance and date of final report issuance, type and number of immunohistochemical stains performed, number and context of digital intradepartmental consultations, utilization of digitized images for academic or educational use. WSIs were created using high-resolution scanners. Following routing processing (H&E, special stains, immunohistochemistry) the final prepared glass slides were scanned using Aperio GT 450 scanners (www.leicabiosystems.com/us/digital-pathology/scan/aperio-gt-450-ruo/) at 40x magnification. The files were stored in svx format. All slides of the autopsy cases post 2020 are digitized and stored on a secure institutional server, accessible through a web-based digital pathology viewer Sectra (medical.sectra.com).

Data analysis

Descriptive statistics were used to analyze case characteristics, digital pathology utilization rates, and turnaround time distributions. Observational trends were noted, and representative case studies were reviewed to highlight educational and consultative values.

Results

Demographic and case characteristics

Of the fifty digitized adult autopsies analyzed, patient ages ranged from 18 to 88 years. The cohort represented a broad spectrum of deaths, including cardiovascular, infectious, oncologic, and neurologic causes.

Turnaround time

The overall average interval from autopsy to final report issuance was 24 days, with a range of 2 to 44 days. Longer delays were often attributable to ancillary testing, additional reviews, complex grossing and outside consultations. The study showed overall similar turnaround times with the use of digital pathology and conventional microscopy. Annual workflow metrics, including turnaround time, consultation frequency, and educational presentations, are summarized in Table 1.

Table 1: Annual autopsy workflow metrics in the conventional and digital pathology (2018–2024).

	Conventional microscopy			Digital microscopy				Average
	2018	2019	2020	2021	2022	2023	2024	
Turnaround time (TAT) Days	2-46**	1-54**	2-29	16-35	21-44	23-43	27-42	-
TAT Average	23	22	23	27	25	25	26	24
Interdepartmental Consultation	3	2	4	5	10	18	3	6
Presentation	8	8	8	7	4	7	7*	7

*Include cases presented after abstract submission;
 **Outliers due to external consultations (MCR)

Use of digital pathology

Intradepartmental consultations: Digital pathology enabled real-time consultations in 36 cases (72%), enhancing diagnostic consensus, especially in neuropathology and oncologic autopsies where subspecialty input was essential. Specifically, it eliminated the need and logistical issues associated with sending whole slides to outside centers, when there was need for additional consultation.

Immunohistochemistry interpretation: IHC stains were digitally reviewed in 32 cases (64%). Digital interpretation of IHC stains was validated according to the College of American Pathologists (CAP) guidelines by comparison with conventional glass-slide review, demonstrating greater than 95% concordance. Stains were typically used for lymphomas, infections, and metastatic tumors. Pathologists reported no loss of diagnostic accuracy compared to traditional glass slide reviews.

Educational applications: Digitized images were used for internal conferences, resident teaching, and external academic presentations in 25 cases (50%). This digital archive facilitates ongoing education and supports departmental knowledge sharing. Importantly integration of digital imaging with EPIC, enabled clinicians to view digital slides as well.

Discussion

Our findings support the integration of digital pathology in the autopsy setting as both feasible and beneficial. By enabling rapid, remote consultations, digital pathology enhances collaborative diagnostics and improves access to subspecialty expertise, particularly valuable in academic institutions. The successful use of digital pathology in IHC interpretation also addresses concerns about diagnostic fidelity in the digital space. Prior studies have shown high concordance between digital and traditional slide review for most histologic features, and our experience corroborates these findings in the postmortem context [5,6]. Our findings are consistent with prior validation studies demonstrating non-inferiority of digital pathology for primary diagnosis [5]. These findings further support the growing role of digital pathology as a standard-of-care modality across pathology subspecialties.

Perhaps most notably, the archiving and use of digitized images in education bridges the gap created by reduced autopsy volumes. Digital platforms provide trainees with enduring access to high-quality case material, reinforcing autopsy's pedagogical role even in institutions with limited caseloads [1,7,8].

Despite these advantages, some limitations remain. Turnaround time was variable and did not improve drastically compared to prior years, partly reflecting case complexity and the time required for IHC processing or multi-disciplinary review (Table 1). Another aspect of digitized autopsy cases,



although difficult to quantify, was pathologist satisfaction and ease of review, as noted during discussions with multiple pathologists. Additionally, while digital pathology infrastructure is increasingly available, upfront costs and workflow adjustments remain a barrier for some institutions.

Conclusion

Digital pathology enhances the value, reach, and efficiency of medical autopsies. In our experience, it facilitated timely consultations, supported advanced histologic analysis, and enriched educational content. As the discipline continues to evolve, integrating digital tools into autopsy workflows is not only viable but essential for maintaining the relevance and rigor of postmortem examinations.

Future studies should explore prospective, multi-institutional data to further validate these findings and examine long-term educational outcomes associated with digital autopsy archives.

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