SAFETY FIRST



CH Preventing Lost Surgical Specimens

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PODCAST

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Imagine a patient undergoes a breast biopsy to rule out cancer, only for the surgical team to discover afterward that the specimen is missing. This situation prompts the critical question, "What went wrong?" The loss of surgical specimens has profound implications for patient care, as these tissues are vital for accurate diagnosis. Without these specimens, treatment may be delayed, potentially exacerbating the patient's condition and adversely affecting their quality of life. Furthermore, such errors undermine diagnostic accuracy and reliability, jeopardize patient outcomes, and impose substantial financial burdens on health care systems.[1]

Surgical specimen management is a complex process involving multiple disciplines, making it susceptible to errors.[2] Recognizing the gravity of these errors, the National Quality Forum classifies the loss of an irreplaceable surgical specimen as a serious reportable event, or "never event."[3] Surgical specimen management allows no margin for error.[4]

The loss of surgical specimens has far-reaching consequences for patients, health care systems, and surgical teams. These consequences include delayed or inaccurate diagnoses and treatments,[5] unnecessary additional procedures,[5-7] poor clinical outcomes,[6] direct patient harm,[5,6] and significant emotional and psychological distress for patients and their families.[5,6] Additionally, missing specimens result in legal and financial repercussions for health care organizations, such as denied reimbursements,[8] loss of institutional credibility,[7] and potential loss of accreditation,[8] all of which can severely affect an organization's financial health.[1,9] Patients affected by such errors may also seek legal action due to misdiagnosis or delayed treatment. Thus, meticulous management of surgical specimens is essential to ensure timely diagnosis and effective patient care.

Authors of a 2024 systematic review examined 36 studies and found that 18.2% focused on lost specimens, 61.3% on specimen mislabeling, and 20.5% on combined errors.[10]

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This comprehensive review highlighted the persistent issue of lost or missing specimens and the urgent need for action among perioperative leaders and clinicians.

Surgical pathology testing encompasses three distinct phases: preanalytical, analytical, and postanalytical.[5,11]

- The *preanalytical* phase involves test selection, specimen collection, labeling, transport, recording, and preparation before testing.[12]
- The *analytical* phase focuses on specimen testing, analysis, and result interpretation.[12]
- The *postanalytical* phase entails the creation, approval, and dissemination of test results to clinicians for subsequent patient management.[12]

Each phase carries the potential for errors that can result in specimen loss, with preanalytical errors accounting for approximately 60% to 70% of errors in the laboratory setting.[13]

AORN emphasizes the critical role of perioperative nurses, particularly in the preanalytical phase of specimen management.[2] To safeguard patient safety, perioperative clinicians should adhere to evidence-based guidance on specimen management,[2] as errors in specimen management are unacceptable. Nurses play a critical role in mitigating risks associated with the potential loss of surgical specimens. This article focuses on ways to minimize the risk of lost surgical specimens during the preanalytical phase of specimen management.

CAUSES OF LOST SURGICAL SPECIMENS

The processes of collection, containment, and transport of surgical specimens are susceptible to potential vulnerabilities during the preanalytical phase. Specimen loss during surgical procedures can occur due to a range of factors that may be categorized into three primary domains: human factors, system factors, and environmental factors.

Human factors can influence the occurrence of surgical specimen errors in the perioperative setting. Ineffective communication, inadequate hand offs, fatigue, and lapses in attentiveness during surgical procedures are major contributors to the risk of specimen-related errors.[2,14] Furthermore, insufficient knowledge and skill in surgical specimen management among perioperative team members further increases the likelihood of such errors.[6]

System factors, often unique to each organization, can also contribute to surgical specimen errors. These factors include specimen management processes,[2,14,15] perioperative workflows,[6,15] physical infrastructure,[9] and electronic health record (EHR) systems.[15] Inadequate and inconsistent workflows or faulty processes in specimen management can result in specimen misplacement or loss.[2,6,14,15] Key contributing elements include the absence of standardized protocols[2,14] and institutional policies[14] governing the collection, processing, and transport of specimens, particularly those concerning chain of custody processes.[6]

The physical structure of an organization further influences the efficiency and reliability of specimen management workflows.[9] Large health care systems, where specimens undergo multiple hand offs, present a higher risk of inadvertent loss.[9] In large health care systems where specimens are transported to central laboratories via ground or air couriers, the potential for misplacement, unintentional discarding, or mixing with other specimens during transit is amplified.[9] These challenges can significantly delay specimen processing and adversely affect patient outcomes.

Environmental factors represent another element that potentiates the risk of surgical specimen loss. Daily environmental stressors include distractions, noise from personnel conversations and machinery, interruptions, high surgical traffic, and emergencies.[11] These factors collectively contribute to lapses in attention and procedural breaches that increase the likelihood of specimen loss. Excessive noise in the OR environment affects surgical performance and undermines team situational awareness,[16] increasing the risk of errors during critical processes such as specimen labeling and transfer. Disruptions during specimen management can compromise staff member focus, resulting in documentation errors and specimen loss. Lastly, a chaotic perioperative environment can impede effective communication among surgical team members,[16] affecting verbal confirmation of specimen names and required fixatives.

STRATEGIES TO CONSIDER

Preventing errors in specimen management demands a collaborative approach where every member of the surgical team exercises caution and attention in identifying,

labeling, storing, and transporting specimens.[2] Generally, prevention involves enhancing staff member performance, standardizing workflows, and integrating adjunct technology. Several strategies can be used to effectively mitigate the risk of surgical specimen loss.

Perioperative nurses can use the AORN "Guideline for specimen management"[2] to support informed clinical decision-making in specimen management, thereby preventing lost surgical specimens. To minimize the risk of lost specimens, nurses can implement a series of measures that includes limiting specimen handling, ensuring accurate labeling, placing specimens in secure containers, maintaining containment, facilitating immediate transport, and verifying receipt in the receiving department.[2] Sidebar 1 provides a comprehensive summary of the applicable AORN recommendations that clinicians may use to prevent specimen loss.

The Academic Medical Center Patient Safety Organization (AMC PSO) outlines key risk mitigation strategies to enhance the surgical specimen collection process, including

- implementing dual time outs to verify the requisition against the patient's identity, specimen, and electronic confirmation via barcoding with hard stops;
- ensuring specimens are labeled immediately during surgery while the patient remains in the OR;
- establishing clear protocols for specimen holding, including postprocedure storage requirements and disposal (eg, trash hold) policies; and
- conducting an intraoperative time out to confirm the quantity, type, and location of collected specimens.[15]

These measures aim to strengthen accuracy, reduce errors, and improve overall specimen management. To mitigate surgical specimen transport errors, the AMC PSO recommends implementing a barcode-based specimen tracking system that integrates with the institution's EHR.[15] This type of system enhances traceability and allows pathology personnel to anticipate incoming specimens. Also, a standardized transport workflow with defined routes and scheduled pickup times should be implemented.[15] This approach not only reduces the risk of lost surgical specimens but also enhances overall operational efficiency. Lastly, creating a dedicated transport team helps reduce variability in handling and ensures competency in specimen transport.[15]

Sidebar 1. Evidence-Based Strategies for Preventing Lost Specimens During the Preanalytical Phase[1]

- Implement measures to minimize risk of specimen loss on the sterile field:
  - Minimize handling
  - Protect tissue from becoming crushed or damaged
  - Keep the specimen moist
  - Contain or cover the specimen
  - Label the specimen
  - Place the specimen in a secure location
- Transfer specimens from the sterile field as soon as possible after excision
- Contain and label each specimen immediately upon receiving it from the sterile field according to the facility's protocol
- During the procedural debriefing, confirm the following:
  - Specimen is in the container
  - Patient and specimen information on the label is accurate, complete, and legible
  - Number and type of specimens are accurate
- Immediately transport specimens to the receiving department (when possible)
- Verify receipt of the specimen at the receiving department
- Document specimen information in the patient's health care record

Reference

1. Guideline for specimen management. In: *Guidelines for Perioperative Practice*. AORN Inc; 2020. Accessed June 20, 2025. *https://aornguidelines.org/guidelines/content?sectionid=173724676&view=book*

Standardizing the collection and transport process is vital to preventing specimen loss.[2,15] Implementing a standardized protocol for specimen collection, labeling, and verification during the presurgical briefing can promote consistency and adherence to evidence-based practices, minimize variability, and enhance patient safety. The standardized protocol can be solidified by creating policies and procedures on specimen collection to delineate the roles and responsibilities of personnel who are directly involved in collecting, containing, and transporting surgical specimens. For example, the policies may designate

ancillary staff members (eg, patient care assistants) as primary transporters of surgical specimens to the pathology department.

Initiating evidence-based quality improvement (QI) projects has been cited as a major initiative for preventing specimen errors according to a 2024 systematic review.[10] In 2023, a team from a large academic center in Baltimore, Maryland, conducted a 15-week QI project that specifically aimed to prevent the loss of surgical pathology specimens.[17] Key actions of the initiative were the use of a barcoding system and optimization of the EHR system to develop a surgical specimen tracking system.[17] The institution's initiative successfully reduced specimen loss. The implementation of a barcoding system supports specimen tracking, which aligns with AORN[2] and AMC PSO[15] guidelines for specimen management.

Enhancing communication and hand offs are two essential strategies that perioperative nurses can use to prevent the loss of surgical specimens.[2] Nurses at a community hospital in Brooklyn, New York, performed a QI project to address surgical specimen errors. They implemented *specimen briefing*, an evidence-based verbal confirmation to discuss and confirm anticipated intraoperative specimens.[2] This strategy was incorporated into the surgical time out as one of the questions on the safety checklist. The specimen briefing facilitated effective communication between nurses and surgeons, ensuring the proper identification of anticipated specimens as well as the necessary fixatives and special tests. Also implemented was a four-step verbal read-back process, which involved confirming the specimen's name and fixative

- when the surgeon transfers the specimen to the scrub person,
- when the scrub person informs the RN circulator of the specimen information,
- before the scrub person transfers the specimen from the sterile field to the RN circulator, and
- during the sign out.

Staff members were also required to verbally confirm the patient's identity using the specimen label when collecting specimens from the sterile field. Lastly, an uninterrupted sign out with the attending surgeon was implemented to properly confirm specimens. The sign-out process required surgeons to affix their signatures to the specimen requisition form to attest that they had verified the correct name, quantity, and fixative of the surgical specimen with the RN circulator. This step of the initiative aligned with recommendations to verify specimens during the postoperative debriefing as another critical step to avoid specimen errors.[2,6,18]

Discussing planned specimens and their management during the presurgical briefing enhances safety measures.[2,6,18] AORN recommends a preprocedure specimen briefing as an evidence-based and proactive strategy to prepare the surgical team and the pathology department for potential specimens.[2] Certain surgical specimens require special tests (eg, frozen-section analysis) and fixatives. Pathology personnel need sufficient time to properly prepare for these specimens.

Practicing correct transfer and containment of surgical specimens is an essential part of preventing specimen loss.[2,18,19] Surgical specimens can be unintentionally discarded from the sterile field. In a nonexperimental study, faulty specimen collections caused 33% (51 of 156) of collection-related errors leading to specimen misplacement.[6] Pathology staff members received empty containers because the specimens were not properly contained, and some of the specimens were inadvertently discarded.[6] AORN recommends that perioperative staff members transfer, contain, and label surgical specimens as soon as possible.[2] The surgical team can collaborate to ensure no unlabeled specimens are left on the sterile field or elsewhere in the OR and also account for all specimens collected during the procedure. Labeling should be performed as soon as any specimen is extracted from the patient.[2]

TAKEAWAYS FOR PERIOPERATIVE NURSES

Perioperative nurses play a pivotal role in preventing surgical specimen errors, as they are directly responsible for managing specimens during the preanalytical phase.[19] Meticulous compliance with established procedures for intraoperative specimen management, including labeling, transferring, and handling, is essential to mitigating the risk of specimen loss.[2] Implementing verbal confirmation protocols, such as read-back processes, further safeguards specimen integrity by verifying critical details, including specimen name, quantity, and required fixatives.

Attention to detail and effective communication among perioperative team members are indispensable for ensuring accurate specimen management.[18] Institutional policies and procedures on specimen management may reduce the incidence of specimen errors.[2] Therefore, consistent adherence among staff members can help prevent unintentional specimen loss. By maintaining standardized practices, the perioperative team can preserve specimen integrity, optimize workflow efficiency, and protect patients from the deleterious effect of lost surgical specimens.

Furthermore, the integration of technological advancements is essential to contemporary perioperative practice. In a descriptive survey study, OR nurses reported increased satisfaction with barcode scanning, especially regarding its effectiveness in preventing specimen errors and improving work efficiency.[20] Familiarity with and proper use of technologies, such as barcode scanning systems for specimen tracking, can significantly enhance the reliability of specimen management processes. Perioperative nurses require sufficient time to build their knowledge and confidence with operating new technology,[21] particularly in understanding the standard operating procedures associated with barcode scanning used to ensure accurate documentation of and accountability for surgical specimens.

TAKEAWAYS FOR PERIOPERATIVE NURSE LEADERS AND EDUCATORS

Nurse leaders and educators can be instrumental in promoting continuous QI initiatives and strengthening safety practices to ensure surgical staff member compliance with facility policies and procedures for specimen management. In collaboration with an interdisciplinary team, they may be involved in establishing and maintaining safe and efficient processes for specimen collection, thereby mitigating the risk of inadvertent specimen loss. Positioned at the forefront, nurse leaders influence staff members' knowledge,[22] performance,[23] and behavior.[23] Their leadership behaviors can affect staff member compliance with specimen management protocols. Therefore, nurse leaders can initiate QI projects to address ongoing challenges related to lost specimens. Monthly audits can serve as valuable tools for assessing staff member compliance and identifying opportunities for improvement.

Emphasizing accountability is crucial in preventing lost surgical specimens.[24] Nurse leaders can emphasize to their teams the importance of adhering to institutional policies and procedures, as these provide a standardized framework and clearly defined tasks for specimen management, helping to minimize the risk of errors.[14] Upholding a culture of safety empowers staff members to report near misses and actual errors.[25] The fear of repercussions for specimen mishandling may lead clinicians to underreport errors and near misses in the perioperative setting. Monitoring near misses and errors in specimen management is recommended and should be used as an improvement metric for patient safety.[2]

Perioperative nurse managers and educators can collaboratively create a QI task force focused on preventing surgical specimen loss. The Failure Mode and Effects Analysis methodology, in which potential failures of a process (eg, specimen management) are unearthed, is a valuable QI tool for perioperative leaders to proactively and systematically identify, assess, and mitigate potential system failures before they occur.[2,26,27] The Failure Mode and Effects Analysis methodology may help leaders engage the surgical team and pathology personnel to identify challenges and opportunities for improvement in the prevention of missing specimens.

Monitoring and tracking actual specimen errors may be a valuable initiative that leaders and educators can employ. Displaying "XX Days Surgical Specimen Error–Free" on the OR bulletin board celebrates staff member commitment to surgical safety and offers them a deeper appreciation of teamwork and collaboration in preventing lost surgical specimens. This metric can be added as a quality indicator alongside standard perioperative efficiency metrics such as first-case on-time starts, turnover time, and OR utilization rates.

Perioperative leaders can tailor interventions according to their facility's specimen management processes and workflows, staffing, structure, and available resources. Nurse leaders and educators can collaboratively recognize that strategies for preventing surgical specimen loss are not universally applicable or a "one-size-fits-all" solution. Tailoring these preventive measures to align with the size and unique needs of their facility should make them more practical and achievable. Effective collaboration between perioperative nurse leaders and educators, surgical team members, and pathology personnel can support the use of preventive measures to strengthen the accuracy and reliability of diagnostic outcomes.[1,2]

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REFERENCES

1. Nordin N, Ab Rahim SN, Wan Omar WFA, et al. Preanalytical errors in clinical laboratory testing at a glance: source and control measures. *Cureus*. 2024;16(3):e57243. https://doi.org/10.7759/cureus.57243
2. Guideline for specimen management. In: *Guidelines for Perioperative Practice*. AORN Inc; 2020. Accessed June 20, 2025. https://aornguidelines.org/guidelines/content?sectionid=173724676&view=book
3. *Serious Reportable Events in Healthcare—2011 Update: A Consensus Report*. National Quality Forum; 2011. Accessed August 13, 2025. https://cms.qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=69573
4. Reducing specimen errors. Leadership Insights. *AORN J*. 2019;109(4):496-499. https://doi.org/10.1002/aorn.12658
5. Heher YK. Specimen almost lost. Agency for Healthcare Research and Quality: PSNet. November 1, 2017. Accessed June 12, 2025. https://psnet.ahrq.gov/web-mm/specimen-almost-lost
6. Steelman VM, Williams TL, Szekendi MK, Halverson AL, Dintzis SM, Pavkovic S. Surgical specimen management: a descriptive study of 648 adverse events and near misses. *Arch Pathol Lab Med*. 2016;140(12):1390-1396. https://doi.org/10.5858/arpa.2016-0021-OA
7. Santana MF, de Lima Ferreira LC. Errors in surgical pathology laboratory. In: Zaman GS, ed. *Quality Control in Laboratory*. InTechOpen; 2018. https://doi.org/10.5772/intechopen.72919
8. Farb J, Gordon LV, Minter HM, et al. *Clinical Labs: Studies Suggest Biopsy Specimen Misidentification and Contamination Errors Are Infrequent*. US Government Accountability Office. November 2020. Accessed June 12, 2025. https://www.gao.gov/assets/gao-21-59.pdf
9. Tran NK, Liu Y. Pre-analytical pitfalls: missing and mislabeled specimens. Agency for Healthcare Research and Quality: PSNet. February 26, 2020. Accessed June 12, 2025. https://psnet.ahrq.gov/web-mm/pre-analytical-pitfalls-missing-and-mislabeled-specimens
10. Carmack HJ, Lazenby BS, Wilson KJ, Bakkum-Gamez JN, Carranza L. Lost, mislabeled, and mishandled surgical and clinical pathology specimens: a systematic review of published literature. *Am J Clin Pathol*. 2024;162(4):349-355. https://doi.org/10.1093/ajcp/aqae055
11. Kinlaw TS, Whiteside D. Surgical specimen management in the preanalytic phase: perioperative nursing implications. *AORN J*. 2019;110(3):237-250. https://doi.org/10.1002/aorn.12782
12. Fleming KA, Naidoo M, Wilson M, et al. High-quality diagnosis: an essential pathology package. In: Jamison DT, Gelband H, Horton S, et al, eds. *Disease Control Priorities: Improving Health and Reducing Poverty*. 3rd ed. The International Bank for Reconstruction and Development/The World Bank; 2017. Accessed June 12, 2025. https://www.ncbi.nlm.nih.gov/books/NBK525286/
13. Cornes M. The preanalytical phase – past, present and future. *Ann Clin Biochem*. 2020;57(1):4-6. https://doi.org/10.1177/0004563219867989
14. D'Angelo R, Mejabi O. Getting it right for patient safety: specimen collection process improvement from operating room to pathology. *Am J Clin Pathol*. 2016;146(1):8-17. https://doi.org/10.1093/ajcp/aqw057
15. The AMC PSO. *Patient Safety Guidance for Pathology Specimens: Identifying and Mitigating Risks for Specimen Loss and Mishandling Resulting in Diagnostic Error*. Academic Medical Center Patient Safety Organization; 2022. Accessed June 12, 2025. https://www.rmf.harvard.edu/Risk-Prevention-and-Education/Guidelines-and-Algorithms-Catalog-Page/Guidelines-Algorithms/2022/Guidelines-for-Mitigating-Risk-with-Pathology-Specimens-AMC-PSO
16. Mcleod RWJ, Myint-Wilks L, Davies SE, Elhassan HA. The impact of noise in the operating theatre: a review of the evidence. *Ann R Coll Surg Engl*. 2021;103(2):83-87. https://doi.org/10.1308/rcsann.2020.7001
17. Qualey B. Preventing surgical pathology specimen loss. Presented at: Showcase for Hopkins Inquiry and Nursing Excellence (SHINE) Conference 2023. April 18, 2023. Accessed June 12, 2025. https://www.hopkinsmedicine.org/-/media/nursing/documents/cni-documents/jhbmc_podium_qualeyr.pdf
18. Spruce L. Specimen management. *AORN J*. 2021;113(5):505-513. https://doi.org/10.1002/aorn.13378
19. Link T. Guidelines in practice: specimen management. *AORN J*. 2021;114(5):443-455. https://doi.org/10.1002/aorn.13518
20. Yu MH, Lee TT, Mills ME. The effect of barcode technology use on pathology specimen labeling errors. *AORN J*. 2019;109(2):183-191. https://doi.org/10.1002/aorn.12585

21. Stanton C. Keeping up with technology. *AORN J.* 2011;93(1): C1, C8-C9. https://doi.org/10.1016/S0001-2092(10)01271-8
22. Horning MA, Taylor-Pearson ZA. Nurse leaders as influencers of knowledge to practice. *Worldviews Evid Based Nurs.* 2024;21(3):230-233. https://doi.org/10.1111/wvn.12726
23. Alsadaan N, Salameh B, Reshia FAAE, et al. Impact of nurse leaders behaviors on nursing staff performance: a systematic review of literature. *Inquiry.* 2023;60. https://doi.org/10.1177/00469580231178528
24. UC Davis PSNet Editorial Team. Patient Safety Primer. Culture of safety. Agency for Healthcare Research and Quality. September 15, 2024. Accessed June 12, 2025. https://psnet.ahrq.gov/primer/culture-safety
25. Shah PD. Patient safety and quality for office-based procedures in otolaryngology. *Otolaryngol Clin North Am.* 2019; 52(1):89-102. https://doi.org/10.1016/j.otc.2018.08.015
26. Bojic Z. Introduction to FMEA. Systemico. Accessed June 12, 2025. http://www.systemico.ca/quality-and-risk-management/failure-mode-and-effects-analysis-fmea/introduction-to-fmea/
27. Dawson A. A practical guide to performance improvement: Failure Mode and Effects Analysis. *AORN J.* 2019;110(3): 282-287. https://doi.org/10.1002/aorn.12780



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