



CLINICS IN MEDICAL EDUCATION

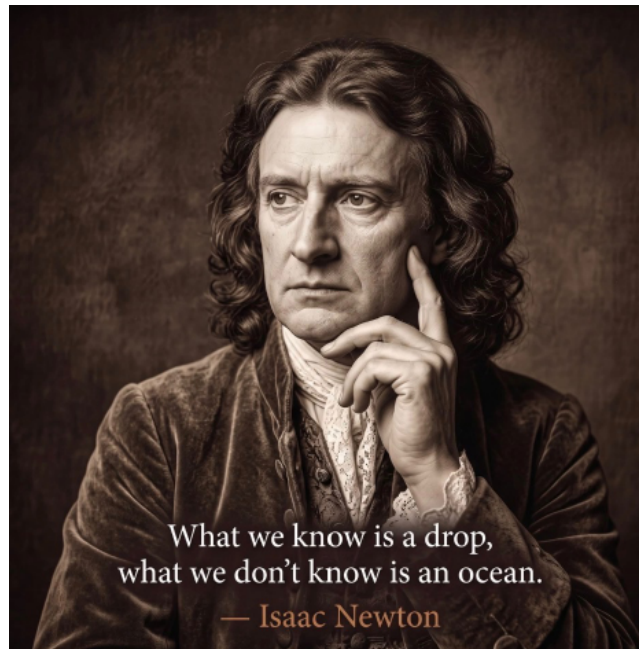
Docendo Discimus

[By Teaching We Learn]



R. Bose

Leaders are developers, team builders, imaginers, culture caretakers, roadblock removers, inspirers. Their success depends on enabling the success of others.



Isaac Newton: English mathematician, physicist and astronomer

Isaac Newton was one of the most influential figures in the history of science, whose work transformed our understanding of motion, gravity, mathematics and the natural world. Despite his wonderful contributions, this quote reflects the humility that accompanies true learning: every innovation reveals how much remains unknown. In medical education, this perspective encourages lifelong curiosity, critical thinking and the willingness to continually question, learn and refine our understanding.



Nyansapo “Wisdom Knot”: A symbol of wisdom, ingenuity, intelligence, and patience. The proverb associated with this Adinkra is “Nyansapo wosane no badwenma” to wit, “A wisdom knot is untied (only) by the wise” <https://www.adinkrasymbols.org/symbols/nyansapo/>



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Check us out online! medicaleducationclinic.com offers the latest updates in research, academia, and pedagogy from the Department of Anesthesia, Critical Care and Pain Medicine at BIDMC. The site features extra content, interactive courses, quizzes, and a of engaging resources. Click here to explore and enhance your learning experience!

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We are thrilled to share Volume 2, Third issue of *Clinics in Medical Education*! This is an interactive education journal that will deliver a summary of clinical and medical education directly to your mobile devices, ipads and computers. We have recently launched our website (<https://medicaleducationclinic.com/>) and look forward to hearing your feedback and suggestions for future content. Our aim is to provide unlimited educational resources to our residents and faculty. Every other month, we present complex and unique cases to enhance your expertise featuring embedded live lectures, quizzes and rich visual aids including ultrasound images, CT scans, X-rays and interpretation of invasive and non-invasive monitoring.

We hope you enjoy this issue!

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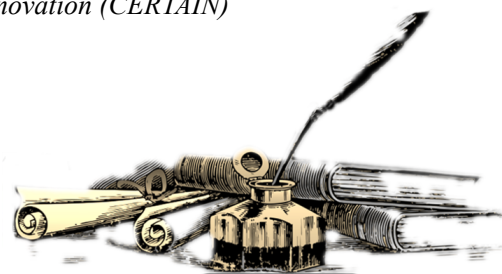


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OUR MISSION

- Empowering scholarly dialogue and advancing knowledge through rigorous research and insightful perspectives.
- Advancing medical education through effective teaching practices and ongoing mentorship.
- Fostering excellence in medical teaching through continuous innovation and professional growth.



Teamwork and Communication in the Perioperative Environment

Jacqueline Hannan, PhD



Modern perioperative care depends on high-functioning interdisciplinary teams. Every surgical procedure requires close coordination among anesthesiologists, surgeons, nurses, perfusionists, surgical technologists, and trainees, all working together in a dynamic environment where patient conditions can change rapidly. While technical expertise is essential, communication and teamwork are equally critical determinants of patient safety. Numerous studies have shown that communication failures contribute to preventable adverse events, making effective teamwork a core clinical skill rather than simply a professional courtesy.

Anesthesia professionals occupy a unique position within the operating room. Unlike other team members whose focus may shift throughout a procedure, anesthesia clinicians maintain continuous responsibility for monitoring the patient's physiologic status while coordinating care across disciplines. This systems-level perspective allows anesthesiologists to recognize emerging problems early, communicate evolving risks, and facilitate coordinated responses when unexpected events occur.

One of the most important communication strategies in the operating room is closed-loop communication. In closed-loop communication, the sender delivers a clear message, the receiver acknowledges and repeats the information, and the sender confirms that the message was understood correctly. Rather than saying, "Can someone give phenylephrine?," an anesthesiologist might direct, "Joe, please administer 100 micrograms of phenylephrine." The nurse responds, "Giving 100 micrograms of phenylephrine." Although this process requires only a few extra seconds, it greatly reduces the likelihood of misunderstanding, particularly during high-workload situations or emergencies.

Communication also extends beyond crisis management. Routine discussions regarding anticipated blood loss, changes in surgical approach, patient positioning, antibiotic timing, anticoagulation management, and emergence planning allow the entire team to maintain a shared mental model of the case. Teams that continuously update one another are better equipped to anticipate future needs rather than simply reacting to problems after they occur. This proactive communication supports coordinated decision-making and improves overall workflow efficiency.

Anesthesia professionals also play an important role in fostering psychological safety within the operating room. Psychological safety refers to an environment in which every team member feels comfortable voicing concerns, asking questions, or identifying potential errors without fear of embarrassment or retaliation. In healthcare, where hierarchy has traditionally been strong, creating psychological safety is essential for patient safety. Junior residents, student nurse anesthetists, circulating nurses, or perfusionists may recognize subtle safety threats before others. Encouraging all team members to speak up helps identify hazards before they result in patient harm.

Speaking up can be particularly challenging when raising concerns to senior clinicians or during stressful situations. Structured communication tools can help overcome these barriers. Frameworks such as SBAR (Situation, Background, Assessment, Recommendation) provide standardized language that allows clinicians to escalate concerns clearly while maintaining professionalism. Consistent use of these strategies reinforces a culture in which patient safety takes precedence over hierarchy.



Safe patient care also depends on effective handoffs, which represent periods of increased vulnerability. Information may be transferred during shift changes, relief breaks, transport to the post-anesthesia care unit (PACU), or admission to the intensive care unit. Incomplete or inaccurate handoffs have been associated with communication errors, delays in treatment, and adverse patient outcomes. High-quality handoffs include: not only the patient's current condition, but also critical contextual information such as airway management, vascular access, medications administered, intraoperative events, anticipated postoperative concerns, contingency plans should complications arise. Standardized handoff protocols and checklists improve consistency and reduce the risk that important information is omitted.

Although technical proficiency remains a cornerstone of anesthesiology practice, the specialty increasingly recognizes that nontechnical skills, such as communication, leadership, situation awareness, and decision-making, are equally important contributors to patient outcomes. These skills are routinely practiced through simulation-based education, crew resource management training, and interdisciplinary team exercises. Such training emphasizes that effective communication is a learned clinical skill that requires deliberate practice and continuous refinement.

Ultimately, anesthesia professionals serve not only as physiologic experts, but also as coordinators of perioperative teamwork. Through clear closed-loop communication, proactive information sharing, willingness to speak up, and structured handoffs, anesthesia clinicians help create a culture in which every member of the perioperative team contributes to safe patient-centered care. As health care continues to grow in complexity, these teamwork and communication skills will remain fundamental components of high-quality anesthesia practice.

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From Lecture Hall to Game stations: Reimagining Anesthesia Grand Rounds

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Special contribution from Yitzhak Sinai Brzezinski, Yunping Li, Phil Hess, Aviva Green

Introduction

Grand rounds are an important part of departmental education, but the traditional lecture format does not always create opportunities for active participation, teamwork, or application of clinical concepts. With this challenge in mind, our department developed a game-based obstetric anesthesia workshop that transformed a regular grand rounds session into a series of interactive learning stations.

The workshop had two complementary goals. First, it provided an interactive review of obstetric anesthesia topics relevant not only to clinicians who regularly practice obstetric anesthesia, but also to anesthesiologists who may encounter pregnant patients in non-obstetric perioperative settings. Second, it introduced game-based learning as an educational strategy that could be adapted to other anesthesia topics.

Rather than replacing educational content with entertainment, the design team used game mechanics to create structured opportunities for discussion, prioritization, clinical reasoning, and teamwork.

Designing the Workshop

The session consisted of four stations focused on crisis resource management, point-of-care ultrasound, anesthesia for non-obstetric surgery during pregnancy, and thromboelastography. Small groups rotated through each station, working in teams and participating in a facilitated debrief before moving to the next activity.

The design process began by identifying what participants should think about or do at each station. The team then selected a game format that required learners to practice that same type of reasoning. This approach, often described as constructive alignment, helped ensure that the game mechanics supported the educational objective rather than distracting from it.

For example, the anesthesia-in-pregnancy station used a structured debate. Participants considered a clinical scenario involving a pregnant patient requiring orthopedic surgery and were assigned to defend either general or neuraxial anesthesia. Teams selected cards representing factors such as aspiration risk, airway changes, uteroplacental perfusion, positioning, and fetal considerations. They then used those cards to organize their arguments and respond to the opposing team.

The purpose was not to identify a single correct technique. Instead, the activity required participants to prioritize competing considerations, explain the reasoning behind their choices, and consider a perspective they might not initially have selected.

The crisis resource management station used charades to explore nontechnical skills. Participants enacted concepts such as leadership, workload distribution, situational awareness, and effective communication while their teammates attempted to identify the behavior. The subsequent debrief connected these sometimes-abstract concepts to observable actions during routine care and clinical crises.

The point-of-care ultrasound station used a matching activity in which teams paired clinical indications with relevant ultrasound applications. The thromboelastography station combined tracing interpretation, visual pattern recognition, and treatment selection through a case-based matching exercise.



Each activity was intentionally different. Some stations emphasized clinical reasoning, while others focused more on recognition, communication, or teamwork. Together, they illustrated that game-based learning is not a single teaching method, but a broad set of approaches that can be adapted to different educational objectives.

Making a Large-Group Workshop Work

Delivering a multi-station workshop during grand rounds required more logistical preparation than a conventional lecture. The workshop was held in the PACU during the existing protected educational block on Wednesday mornings.

Participants were assigned to groups upon arrival and identified by colored team stickers. For late arrivals, the team planned an additional group that could rotate at shorter intervals until joining the main schedule.

Each station was supported by clinical content expertise and experience with education or simulation. Before the workshop, facilitators reviewed the learning objectives, rules, station timing, debriefing prompts, and key teaching points. This preparation was important because differences in instructions or timing could substantially change the experience from one group to another.

Although our workshop used separate content experts and game facilitators, this structure is not required for every setting. In a smaller group, one appropriately prepared individual could perform both roles if they are comfortable with the clinical content, game mechanics, and debriefing process.

Most materials were inexpensive and produced locally, including printed cards, visual aids, clinical scenarios, and team identifiers. This reduced reliance on specialized technology and made it easier to modify the activities during development.

The Central Role of Debriefing

One of the most important lessons from the workshop was that the educational value did not come from gameplay alone. The debriefing transformed the activity into a learning experience.

Each station included predetermined prompts and a small number of take-home points. Facilitators used the debrief to clarify misconceptions, explain the clinical rationale behind the activity, and connect the game experience to practice.

Time management was therefore critical. When gameplay continued longer than planned, debriefing was the component most at risk of being shortened. Future implementations should protect debriefing time explicitly, even if that requires simplifying the rules, reducing the number of rounds, or ending gameplay before every item has been completed.



Practical Lessons for Future Sessions

Several principles may help other departments considering a similar format.

Game mechanics should be selected only after the educational objective is clear. A competitive activity may encourage participation, but participation alone does not guarantee meaningful learning. Activities intended to support clinical reasoning should require learners to prioritize information, justify decisions, or apply concepts to a scenario.

Audience heterogeneity should also be anticipated. Grand rounds may include junior trainees, senior faculty, subspecialists, and clinicians with limited exposure to the topic. Accessible rules, mixed-experience teams, and facilitator-guided debriefing can help support participation across different levels of experience.

Finally, game-based learning should not be viewed as inherently superior to lectures. It requires additional preparation, coordination, and human resources, and competition may not appeal equally to all learners. The format should be selected when its interactive elements meaningfully support the educational goal.





Looking Ahead

This workshop demonstrated how a conventional grand rounds period could be reorganized into an active, team-based educational experience, when deemed beneficial. Educationally, the most transferable lessons were not related to any single game, but to the design process: align the activity with the objective, prepare facilitators carefully, anticipate logistical challenges, and protect time for debriefing.

The approach may be adapted to other anesthesia subspecialties, particularly when the educational goals involve discussion, prioritization, communication, or clinical decision-making. Future sessions can also incorporate more formal assessments of learning and compare game-based formats with traditional instructional approaches.

Disclosure: A detailed peer-reviewed report of this educational initiative has been accepted for publication in the International Journal of Obstetric Anesthesia. This internal article is intended as an educational and departmental feature.

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Curriculum Development: Advanced Models and Design Approaches

Ruma Bose, MD



Introduction

Curriculum development is a systematic process of planning, designing, implementing, and evaluating educational programs. An effective curriculum ensures that educational objectives are aligned with instructional methods, learning experiences, and assessment strategies. Modern curriculum development has evolved from simple content planning to comprehensive instructional design that emphasizes learner outcomes, competency development, continuous improvement, and evidence-based teaching practices.

Several curriculum models have shaped educational practice over the past century. Each model offers a unique perspective on how curricula should be designed, implemented, and evaluated. Understanding these models enables educators to select appropriate frameworks based on institutional goals, learner needs, and educational contexts.

Core Elements of Curriculum

Every curriculum consists of several interrelated components that collectively guide the educational process.

1. **Objectives** — Objectives define the knowledge, skills, attitudes, and competencies learners are expected to achieve. Well-written objectives provide direction for instructional planning and serve as benchmarks for evaluating learning outcomes.
2. **Content** — Content includes the knowledge, concepts, principles, and skills that students are expected to learn. Content selection should be relevant, current, evidence-based, and appropriate for the learners' developmental level.
3. **Learning Experiences** — Learning experiences refer to the activities that enable students to acquire knowledge and develop skills. These may include lectures, discussions, simulations, laboratory exercises, clinical experiences, group projects, and independent learning.
4. **Teaching Strategies** — Teaching strategies encompass the instructional methods educators use to facilitate learning. Effective curricula employ a variety of learner-centered approaches such as problem-based learning, case discussions, collaborative learning, flipped classrooms, and simulation-based education.
5. **Assessment and Evaluation** — Assessment measures student achievement and determines whether curriculum objectives have been met. Evaluation also examines the effectiveness of the curriculum itself and identifies opportunities for improvement. Both formative and summative assessments play essential roles in continuous quality improvement.

The Curriculum Development Process

Curriculum development generally follows a logical sequence of steps.

1. **Needs Assessment** — The process begins by identifying educational needs through stakeholder input, learner assessments, institutional priorities, accreditation requirements, and societal expectations.
2. **Define Objectives** — Based on the identified needs, educators formulate clear learning objectives that specify the expected outcomes.
3. **Select Content** — Appropriate subject matter is selected to support achievement of the learning objectives while ensuring relevance and accuracy.
4. **Plan Learning Activities** — Educational activities are designed to promote active learning and facilitate the development of desired competencies.



5. **Implement the Curriculum** — The curriculum is delivered using appropriate instructional methods, educational technologies, and faculty expertise.
6. **Evaluate and Revise** — Continuous evaluation identifies strengths and weaknesses of the curriculum. Feedback from students, faculty, and outcome measures guides ongoing revisions and improvements.

Major Curriculum Development Models

Tyler's Objective Model

Developed by Ralph Tyler in 1949, Tyler's model is one of the most influential curriculum development frameworks. The model is built around four fundamental questions: (1) What educational objectives should be achieved? (2) What learning experiences will help achieve these objectives? (3) How should these experiences be organized? (4) How can learning outcomes be evaluated? Tyler's model is highly structured and objective-oriented, emphasizing measurable outcomes and alignment between objectives, instruction, and assessment. Because of its systematic nature, it remains widely used in higher education, professional training, and competency-based education.

Strengths: clear organization; strong emphasis on measurable outcomes; easy alignment of teaching and assessment.

Taba's Grassroots Model

Hilda Taba proposed a teacher-centered approach to curriculum development. Unlike Tyler's top-down model, Taba believed curriculum should be developed by teachers because they best understand learners' needs. Her model follows seven sequential steps: diagnose learner needs, formulate objectives, select content, organize content, select learning experiences, organize learning experiences, and evaluate outcomes. This inductive approach encourages teachers to actively participate in curriculum design, making it more adaptable to local educational contexts.

Advantages: encourages teacher ownership; responsive to learner needs; flexible and adaptable.

Limitations: time intensive; requires experienced educators; difficult to standardize across institutions.

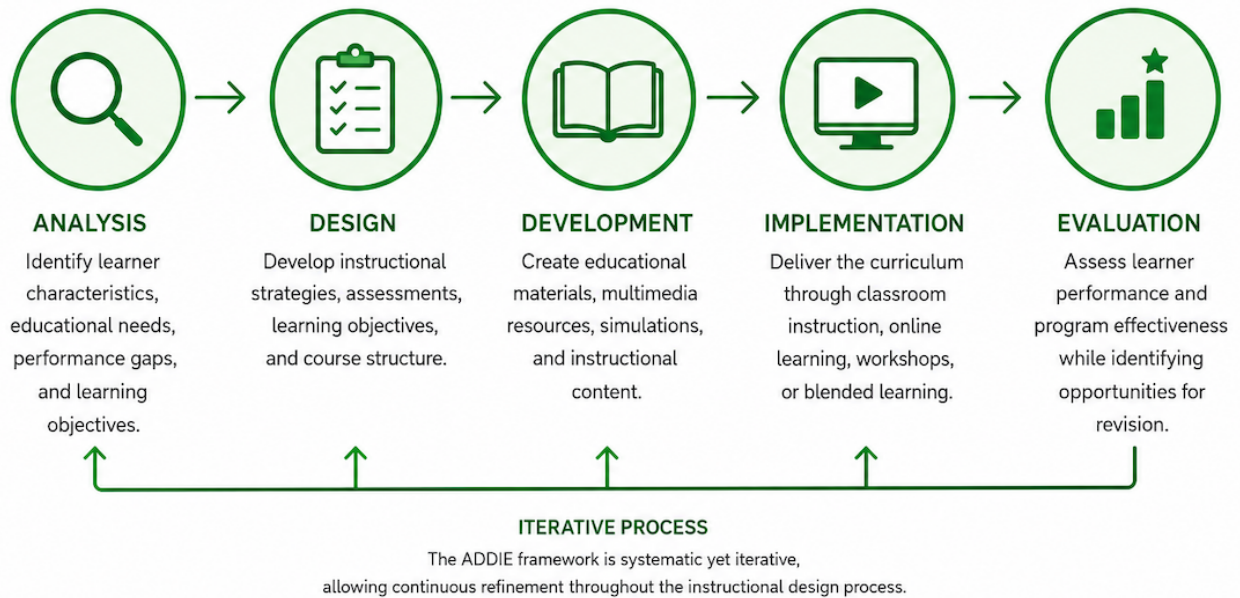
Backward Design Model

Developed by Wiggins and McTighe, the Backward Design model begins with the end in mind. Rather than starting with content, educators first identify the desired learning outcomes; assessments are then designed to measure these outcomes before instructional activities are planned. The three stages are: identify desired learning results, determine acceptable evidence of learning, and plan instructional activities. This model promotes alignment among objectives, assessments, and instructional methods, ensuring that all educational activities support the intended outcomes. Backward Design is particularly valuable in competency-based medical education because it focuses on demonstrable learner performance rather than content coverage alone. **The ADDIE Instructional Design Model.**



The ADDIE Instructional Design Model

The ADDIE model is one of the most widely used instructional design frameworks in education and professional training.

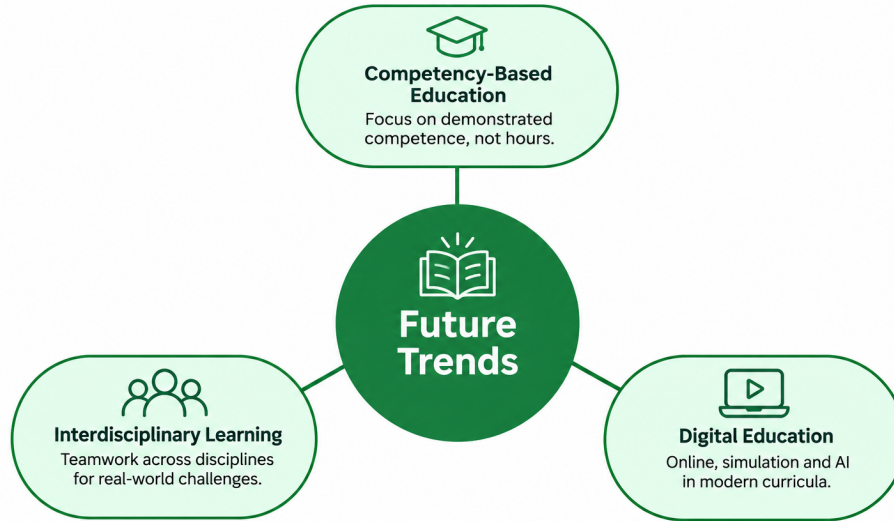


Challenges in Curriculum Development

- **Technology Integration** — Educators must effectively incorporate digital learning platforms, artificial intelligence, simulation, virtual reality, and online educational resources into teaching.
- **Diverse Learners** — Modern classrooms include learners with varying educational backgrounds, cultures, learning styles, and accessibility needs, requiring flexible instructional approaches.
- **Resource Constraints** — Limited faculty time, financial resources, infrastructure, and technological support can hinder curriculum implementation.
- **Balancing Theory and Practice** — Successful curricula must integrate foundational knowledge with practical application to prepare learners for real-world professional practice.



Future Trends in Curriculum Development



Conclusion

Curriculum development is a dynamic and continuous process that requires careful planning, implementation, evaluation, and revision. Foundational models such as Tyler's Objective Model, Taba's Grassroots Model, Wheeler's Cyclical Model, Kerr's Flexible Model, Backward Design, and the ADDIE framework each offer valuable perspectives on designing effective educational programs.

No single model is universally applicable. Effective curriculum designers often combine elements from multiple approaches to create learner-centered, competency-based curricula that meet institutional goals while addressing the evolving needs of learners and society. Continuous evaluation and adaptation remain essential to maintaining educational quality and relevance.

Key Take Away Points

1. Curriculum development is a systematic, iterative process that needs alignment with the learner's needs.
2. No single curriculum model fits the needs of the learner, in an educational setting. Models such as Tyler's objective model, Taba's grassroots Model, Backward Design, and ADDIE offer complementary approaches that can be selected for adapting according to learners, institutional priorities, and educational context.
3. Effective curriculum design begins with clearly defined outcomes and maintains alignment between objectives, learning activities and assessment.
4. Modern curricula must adapt to evolving educational demands, including digital technologies, simulation and artificial intelligence, diverse learner populations, resource limitations, competency-based education, and interdisciplinary learning.



Mirror Mirror, The Art of Non-Verbal Communication in Job Interviews

Shazaan Nadeem, MD
Feroze Mahmood, MD



*Gaze averted, hands folded tight,
voice barely there, thoughts in flight.
Then, hands shaken firm, shoulders drawn back,
I stand tall, and they smile back.
The interview was over before it even started.*

THE PSYCHOLOGY OF FIRST IMPRESSIONS

The impression a candidate creates in the opening moments of an interview is crucial to how the remainder of the encounter is perceived. Being fully present, achieving congruence between verbal and non-verbal signals, and offering a firm handshake are only the beginning of the conversation, interviewers, whether consciously or unconsciously, are already evaluating professionalism, appearance, movement, and tone of voice. (1)

THE SILENT OPENING MINUTE

In medical interviews, the interviewer is continuously gathering the emotional climate of the interaction. A candidate's emotional presence is often assessed more closely than the content of the conversation itself, with interviewers drawing heavily on the non-verbal cues presented to them.

According to dual-process theory, interviewers form impressions through two distinct systems: an initial, intuitive assessment based largely on non-verbal cues, followed by a more deliberate evaluation of the candidate's verbal responses. Candidates who project active engagement, composure, and authentic presence gain an early advantage before a single question has been answered.

One of the most persistent misconceptions among medical students and residents is that interview success depends solely on what a candidate knows or says. Research on "thin slicing" in interviews demonstrates that even a few seconds of silent behavior can meaningfully influence how a candidate is perceived. (21) In reality, interviewers have often already formed an impression of confidence, engagement, and professionalism long before the first clinical answer is complete.

Supporting this, studies published in the Journal of Applied Psychology have identified poise and the expression of positive emotion, both non-verbal factors, alongside interest, a verbal factor, as among the strongest predictors of favorable interview outcomes. (1) Grouped non-verbal cues such as body language, poise, and dress sense were shown to influence interviewer ratings alongside vocal cues including positive emotion and interest. (1)

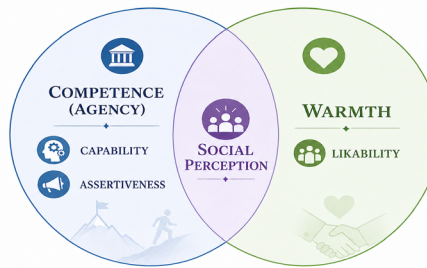
SOMEWHERE BETWEEN WARMTH AND COMPETENCE

Recent studies suggest that competence conveys a stronger impression than warmth alone. (6,7) Candidates who demonstrate professional competence tend to outperform those who rely solely on friendliness. (8) It is worth asking: what does my physical presence convey? Some of the most direct evidence on this question comes from Veit et al. (2022), a cross-sectional field experiment across five European countries (N = 13,162), which found that competence signalling increased re-invitation rates, while warmth signals had *minimal effect on hiring callbacks*. (6)

A visual model of these two dimensions, and of how they combine to shape an interviewer's overall impression, is provided in the figure 1.



Two Fundamental Dimensions of Social Perception



THIN-SLICING: THE INTERVIEW BEGINS BEFORE THE FIRST ANSWER

Thin-slicing research in structured interviews further suggests that early non-verbal impressions can influence hiring recommendations, even from very brief samples of behavior. (21) Early assessments, driven largely by non-verbal cues, have been shown to be consistent with final evaluations made after the complete interview. The conclusion is that early non-verbal impressions shape how later verbal information is processed, hiring recommendations made after only a brief exposure correlate significantly with recommendations made after viewing the full interview. **Verbal content, in other words, is not the whole story.**

MIRRORING AND EMOTIONAL CONGRUENCE

A candidate's emotional presence, and the rapport they build with an interviewer, plays a measurable role in establishing trust. Neuroscientific research using EEG hyper-scanning has demonstrated that inter-brain synchrony, theta-band and beta-band coupling are products of interpersonal social interaction, and they predict trust even in the absence of explicit communication. (12,14)

The value of subtle mirroring - candidates can learn to emulate the conversational rhythm of the interview. If the interviewer is calm and measured, the interviewee should also maintain a moderate speed of responses, if they lean forward to stress an important point, your own slight forward orientation would help communicate reciprocal engagement.

WHAT YOU SAY, HOW YOU SAY IT, AND WHAT'S LEFT UNSAID

Maintaining eye contact, using pauses deliberately, and establishing a natural conversational flow all help build trust and rapport with an interviewer. In Schmidt's structured interview study, observers were given the opportunity to view only 12 seconds of silent interviewee behaviour (22), rather than the full interview. Yet, their hiring recommendations correlated significantly in the end with recommendations based on the fuller, unobserved interview. The study also found that candidates who appeared attentive, competent, confident, optimistic, and professional were more likely to receive favorable hiring recommendations. Thin-slicing means, in practice, that the interview begins before a candidate's first answer is even finished.

DIGITAL INTERVIEWS, BALANCE OF EYE CONTACT

Research shows that professional appearance is the most important predictor of a successful interview. The appropriateness of tailoring your clothing to your organization is the single most important predictor within professional appearance (by Morrow et al.). In the age of digital interviews, it's important to choose carefully the moments you gaze directly at the camera, particularly during opening sentence, and introductions. Other caveats would be ensuring that gestures remain within frame and taking thoughtful well-timed glances away from the screen.

Looking at the interviewer's face helps you read them. Looking into the camera makes *them* experience eye contact.

Look directly at the speaker when listening, and alternate natural focus across interviewers when speaking. Studies demonstrate higher levels of gaze are rated as intelligent, decisive, and socially capable. In interpersonal psychology, direct gaze activates the mutual gaze effect, which increases perceived honesty and sincerity.



THE LISTENER IS STILL BEING INTERVIEWED

An interview is not *alternating periods of speaking and waiting*. You are communicating during both- even as you listen, you are being observed. The listener is still being interviewed. Demonstrating appropriate positive affect, non-verbal engagement and remaining congruent with your expressions and body language should be a priority. This should be a priority especially when the interviewer is communicating their high-leverage requirements to you.

KEY TAKEAWAY POINTS



First impressions form within seconds of an interview and are driven significantly by nonverbal cues. Professionalism, and tone of voice are being interpreted before a single question is answered.



Recognise the emotional register of the interviewer, and coordinate your pace, energy, and tone to match it; subtle synchrony builds trust more than any deliberate gesture.



The power of the pause: a brief, composed pause before answering communicates confidence.



Competence signalling has been shown to carry more weight than warmth alone in producing favourable interview outcomes.

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How to Lecture - The Science of Learning

David Benavides Zora, MD

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Premise of Lectures being Outdated

Medicine has grown remarkably sophisticated in how we manage disease, yet our teaching methods have not kept pace. We glamorize evidence-based medicine but deliver it through fifty-minute lectures and bullet-dense slides that lose most of the room before the fifth slide.

Effective Teaching Begins with the Learner

The problem isn't PowerPoint. The problem is cognitive overload, information delivered faster than the brain can attach it to anything already there. New knowledge doesn't land in empty space; it must connect to neurons that already exist. Until our teaching accounts for that, **PowerPoint will remain the enemy of medical education**, not because slides are the issue, but because we keep filling them as if the mind behind the eyes reading them has infinite bandwidth. The learner's capacity for clinical knowledge and their baseline must be established.

Is Powerpoint a fundamental enemy of Medical Education?

There is little convincing evidence that matching a teaching style to a student's supposed learning preference actually improves retention. What does improve retention is **anchoring** new material to what the learner already knows.

Residents are not empty vessels; they arrive with a foundation of prior knowledge, and the educator's first job is to find it before adding to it.

Teaching cardiac output, for instance, works better as a question than a lecture: *what do you think determines cardiac output?* **Relevance drives motivation, and motivation drives retention.** The same approach applies to mechanical ventilation, the goal should not be to memorize ventilator settings, but to establish why those settings matter, in the context of lung injury, ARDS, and patient outcomes.

Attention Is the New Currency in Education

Today medical students can search up guidelines, watch procedural videos, or ask a large language model to explain hemodynamic physiology within seconds. What becomes a scarce resource is not the availability of information, rather, it is attention. Managing and maintaining the attention of an audience can be considered a cognitive currency, and death by PowerPoint is a real pitfall. Every crowded slide, unnecessary sentence, or competing visual trigger can overload the limited processing capacity we have. The academic educator must learn not simply how to maximize the information delivered within a 45-minute session, but how much mental processing the student can maintain. The parameters to consider include the ability to compound information as a capacity of our audience. We should continue to produce interactive learning materials and tools.

Retrieval ability is another parameter to be consistently tested within our audience, and this is something we must engage students' actively, by testing them, on a timely interval. Recognizing that working memory is limited changes the way we present, as educators. Mayer's Multimedia Principles answer the question we should have been asking all along. They translate learning into practical principles that can be applied to enhance individuals' capacity for learning.

These techniques share a common purpose: they do not overwhelm the limited working memory of the student, rather, they complement learning styles.



Cognitive load can be divided into three categories: 1) Extraneous load, 2) Germane load 3) Intrinsic load. Intrinsic load is defined as the complex nature of the subject itself. Extraneous load, is the mental heavy-lifting the student has to do through irrelevant or competing slide design. Germane load, finally is the effort the student spends on making active connections between different subject matter.

Elimination and exercising an awareness of redundancy--> If something on the slide isn't meaningfully contributing to the student's understanding of it, simply remove it.

Repetition and integration are necessary to consolidate information. The major enemy of student learning is: extraneous cognitive load.

Mayer's Principles of Learning

Mayer's principles of learning include temporal contiguity, which suggests that audio and visual learning should not be competing, rather, complementary.

The slide becomes visual support; the lecturer becomes the vessel for explanation. The audio is the gift, the visual design is the ribbon tying it together.



Figure 1. Mayer's 12 principles of multimedia learning at a glance.

The Importance of Foundational Knowledge and Clinical Context

Foundational knowledge matters because clinical teaching becomes far more powerful when new experiences can attach to existing knowledge. Something learned theoretically may suddenly become meaningful when encountered in the OR and given a clinical context. It is important to provide clinical relevance to each slide, and real-world application of the medical information you are teaching.

Practical Tips

The educator's value lies not only in delivering the most substantial information, but in managing the attention of the student the same way one manages currency. Directing attention is an art, and Educators must learn to understand what is the currency of education? Attention = cognitive currency.

Mayer's principles of learning incorporate the use of temporal contiguity, which underscores how important it is to space visual and auditory cues together when teaching. The use of such tools, synthesizing coherent



and concise information, provides the best foundation for learning.

Following this, context development and the opportunity for further challenging ‘thought exercises’ would increase educational efforts. Prompting a thought process is more valuable than regurgitation of facts at your audience.

Conclusion: The Lecture Is Not Outdated but the Way We Lecture Is

Perhaps the question, then, is not “*Are lectures outdated?*” but “*Have we updated the way we lecture?*” As educators at some of the top institutions in the world, we have a platform designed to enrich students’ lives and expand their thinking.

In conclusion, while we have the tools to enable meaningful learning.

It is simply our duty to apply them.

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[Click here to hear Dr. David Zora explore how engaging teaching strategies can strengthen learning, improve retention, and help learners remember what matters.](#)



Perioperative Challenges in Advanced Diastolic Dysfunction: A Cardiac Amyloidosis

Case

Meghana Badari Narayan, MD



CASE REPORT

A 44-year-old male presented with acute decompensated heart failure secondary to cardiac amyloidosis, with moderate global systolic dysfunction, grade III diastolic dysfunction, and a restrictive filling pattern. He required multiple vasopressors and continuous veno-venous hemofiltration for hemodynamic support. He underwent extracorporeal membrane oxygenation cannulation, complicated by lower extremity compartment syndrome requiring fasciotomy and venous cannula repositioning. He subsequently underwent cardiac transplantation. Diastolic dysfunction is a common yet challenging comorbidity. Anesthetic management in restrictive cardiomyopathy requires careful understanding of physiology of diastole and pathophysiology of diastolic dysfunction.

INTRODUCTION

Diastolic dysfunction (DD) represents a highly prevalent yet frequently underdiagnosed cardiac condition with significant clinical implications, serving as a major contributor to heart failure with preserved ejection fraction (HFpEF). LVDD is common in the general population, affecting approximately one-quarter of adults and 25%-30% of middle-aged and older adults in U.S. community studies. In contrast, HFpEF represents the symptomatic clinical manifestation of cardiac dysfunction and has an estimated general-population prevalence of approximately 1%-5% worldwide and 1%-1.5% in the United States. HFpEF affects up to 32 million people globally and approximately 3–3.5 million Americans, accounting for about half of all heart-failure cases.

The prognosis for HFpEF is poor despite a preserved LVEF, with a 21% 30-day all-cause hospital readmission rate and a 1-year mortality approaching 20% to 29%, comparable with patients with heart failure and reduced ejection fraction (HFrEF). Preoperative DD is an independent predictor of serious complications in non-cardiac surgery, increasing risk for postoperative pulmonary edema and major cardiac events in low and intermediate-risk surgeries. In high-risk vascular patients, DD is associated with significantly increased length of hospital stay and, even when asymptomatic, is a predictor of 30-day cardiovascular events and long-term mortality.

PHYSIOLOGY OF DIASTOLE

The diastole of the cardiac cycle encompasses the time between the closure of the aortic valve and the closure of the mitral valve. From a clinical perspective, normal diastolic function refers to the LV's ability to relax and fill with blood, producing a sufficient stroke volume at low pressures. The ventricle's ability to fill depends on its fixed viscoelastic stiffness and its variable capacity to relax.

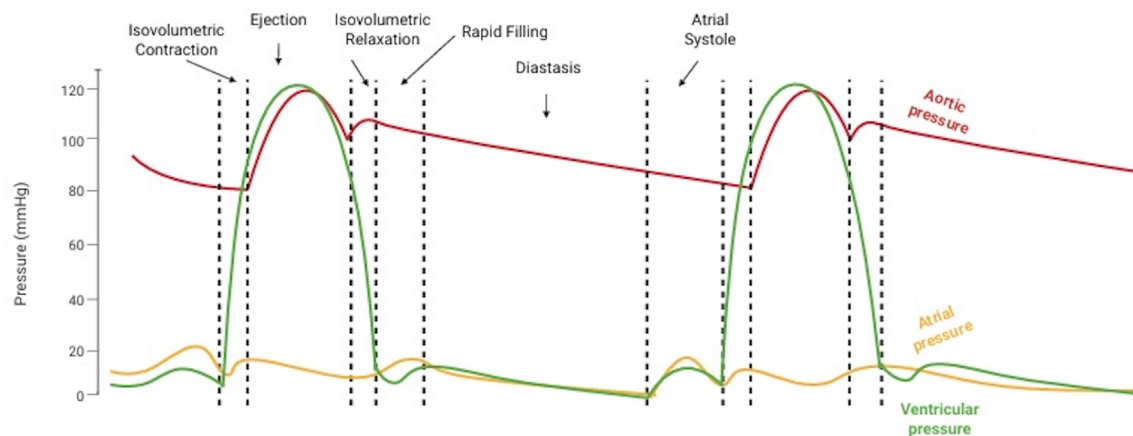




Figure 1: LA, LV and aortic pressure curves during the cardiac cycle.

Diastole consists of four distinct phases: isovolumetric relaxation, where LV pressure drops rapidly while volume remains constant; rapid filling, triggered when the mitral valve opens and blood rushes into the LV due to active ventricular suction; diastasis, a transitional pause of minimal passive filling as atrial and ventricular pressures equalize; and atrial contraction, where the left atrium actively contracts to complete ventricular filling before the mitral valve closes.

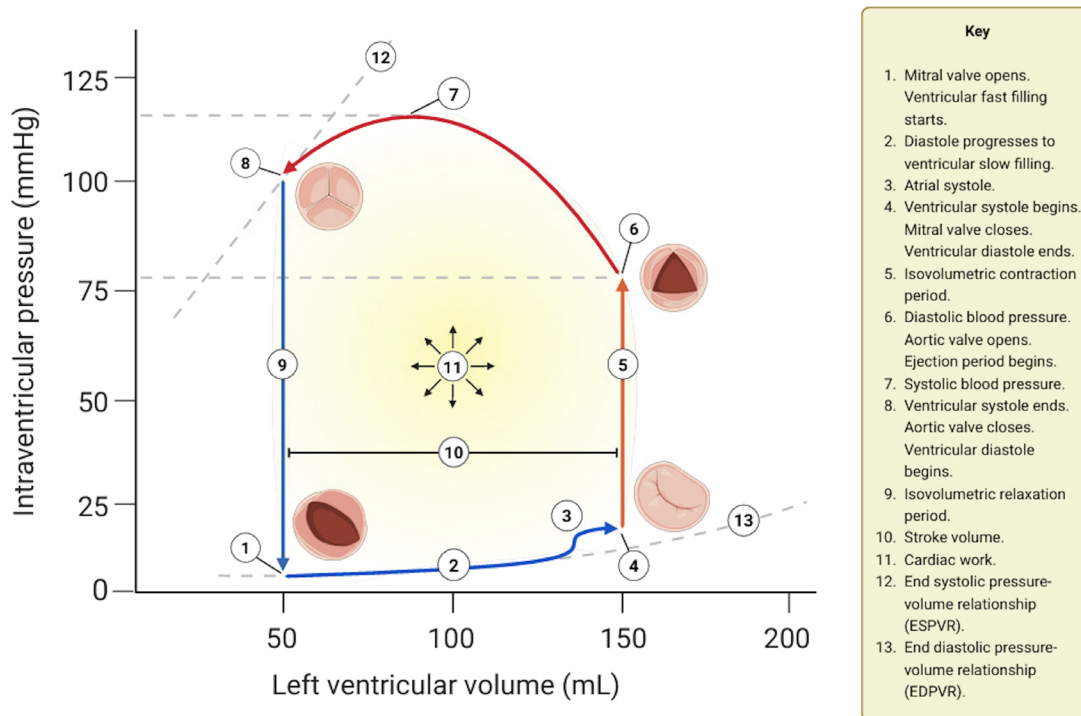


Figure 2: LV pressure-volume loop.



PATHOPHYSIOLOGY OF DIASTOLIC DYSFUNCTION

DD refers to impaired relaxation or filling of the ventricles during the diastolic phase of the cardiac cycle. Increased left ventricular filling pressure (LVFP) is the principal pathophysiological manifestation of LVDD. It arises from impaired myocardial relaxation, increased ventricular stiffness, or both, driven by intrinsic cardiomyocyte abnormalities, extracellular matrix remodeling, and maladaptive neurohumoral and endothelial signaling. Based on the severity of DD, it is divided into grades which represent a physiological continuum of the disease.

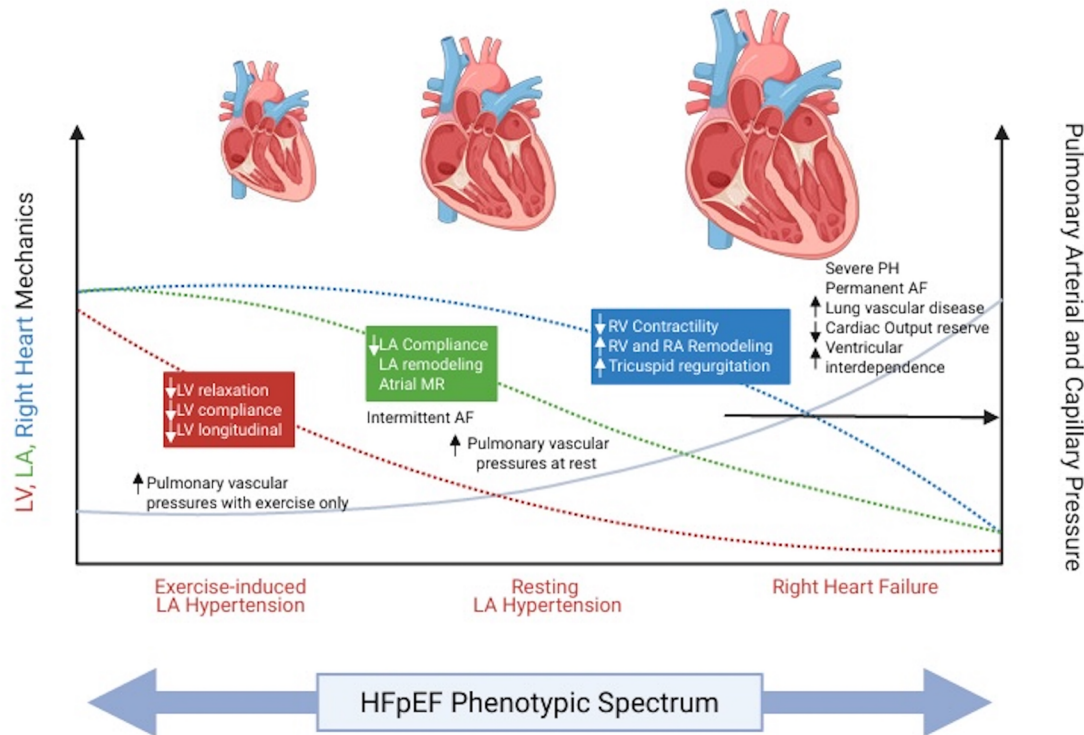


Figure 3: Temporal disease progression in HFpEF

Grade 1: impaired relaxation with relatively preserved compliance.

The earliest abnormality is delayed or incomplete active myocardial relaxation. Ventricular recoil and early diastolic suction are reduced, so the ventricle fills more slowly during early diastole. Passive compliance is usually still relatively preserved, and mean left atrial pressure is generally normal at rest. Filling is redistributed toward late diastole, making the ventricle increasingly dependent on effective left atrial contraction to achieve an adequate end-diastolic volume.

At rest, this compensatory mechanism may preserve stroke volume and the patient may remain asymptomatic. During tachycardia, however, diastole shortens and the slowly relaxing ventricle may not have enough time to fill. Exercise, hypertension, myocardial ischaemia or increased circulating volume may consequently raise filling pressure despite normal resting pressure. The major perioperative considerations are tachycardia, loss of sinus rhythm and reduced venous return. Loss of atrial contraction, particularly with atrial fibrillation, can substantially reduce ventricular filling and stroke volume. Anaesthetic induced venodilation may decrease preload and produce hypotension despite preserved ejection fraction. When true hypovolaemia is present, judicious fluid replacement may improve filling; however, indiscriminate fluid loading can push the patient toward elevated filling pressures.



Grade 2: impaired relaxation with reduced compliance and elevated filling pressure

In grade 2 dysfunction, impaired relaxation persists, but passive ventricular compliance begins to deteriorate. The left atrium must generate a higher pressure to fill the increasingly stiff ventricle. This elevated atrial pressure restores the early atrioventricular pressure gradient and maintains ventricular filling despite poor ventricular suction. This is the physiological basis of the term pseudonormalization. The higher pressure is transmitted backward to the pulmonary veins. Chronic pressure loading promotes left atrial remodelling, impaired atrial reserve and contractile function, pulmonary venous hypertension and, with progression, post-capillary pulmonary hypertension. Stroke volume may remain normal at rest, but cardiac reserve is reduced because increasing filling volume produces elevated filling pressure rather than an appropriate increase in end-diastolic volume.

Patients have a particularly narrow volume tolerance. With fluid excess, left atrial pressure rises rapidly, producing pulmonary congestion. Tachycardia, atrial fibrillation, systemic hypertension and myocardial ischaemia further increase filling pressures. If hypotension after induction is treated with repeated fluid boluses it can correct the blood pressure while worsening pulmonary congestion. Fluid administration should be incremental and guided by repeated assessment rather than by blood pressure alone. For major surgery or anticipated large fluid shifts, closer haemodynamic monitoring is reasonable.

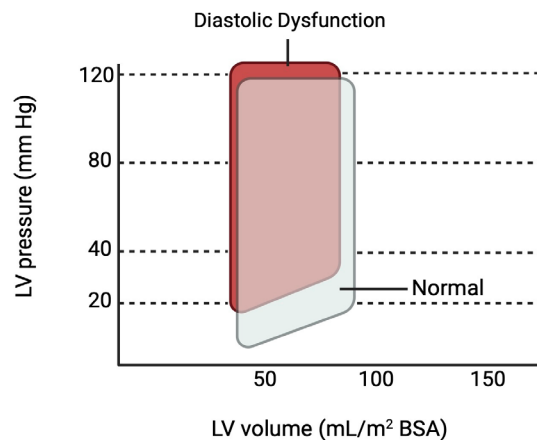


Figure 4: Ventricular pressure-volume relationships in isolated diastolic dysfunction. Adapted from Butterworth JF IV, Mackey DC, Wasnick JD. Morgan and Mikhail's Clinical Anesthesiology 5th Edition.

Grade 3: restrictive physiology with markedly elevated filling pressure

Grade 3 represents advanced diastolic dysfunction. Ventricular compliance is severely reduced, myocardial relaxation is markedly abnormal and left atrial pressure is substantially elevated. The stiff ventricle accepts most of its filling rapidly during early diastole because of the high atrioventricular pressure gradient, but filling terminates abruptly as ventricular pressure rises quickly and equals left atrial pressure. The end-diastolic pressure-volume relationship is markedly shifted upward and leftward. Consequently, a small increase in ventricular volume can produce a large increase in LV end-diastolic and left atrial pressures. Pulmonary venous hypertension, pulmonary oedema, post-capillary pulmonary hypertension and secondary right ventricular dysfunction may develop. Cardiac output becomes relatively fixed because the ventricle cannot meaningfully recruit the Frank-Starling mechanism without an excessive rise in filling pressure.

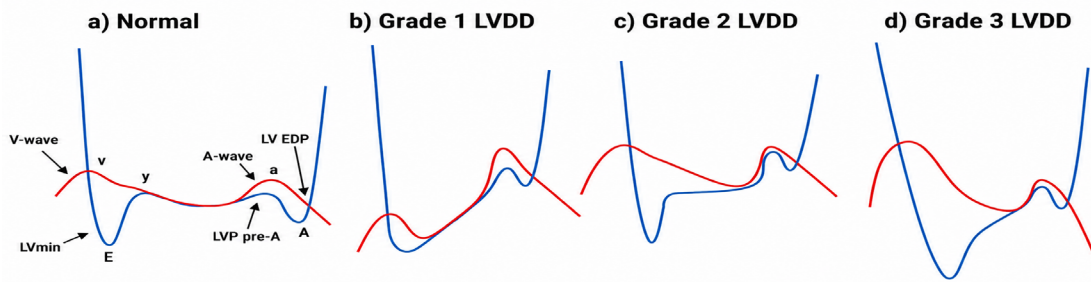


Figure 5: Simultaneous left ventricular (LV) and left atrial (LA) pressure recording showing early and late trans-mitral pressure gradients in each LV filling pattern.

These patients have the highest perioperative haemodynamic risk. They may be preload dependent but simultaneously volume intolerant. Induction related vasodilation can cause profound hypotension even when left-sided filling pressures are already high. Fluid boluses can rapidly precipitate pulmonary edema. Tachycardia, hypertension, atrial arrhythmias, myocardial ischaemia and abrupt sympathetic stimulation can produce acute decompensation. Positive-pressure ventilation may reduce venous return, whereas emergence and spontaneous breathing increase venous return, afterload and sympathetic tone. Fluid shifts after surgery can produce delayed pulmonary edema even when the intraoperative course appears acceptable. Vasopressor and, when appropriate, inotropic support may be preferable to volume administration. An arterial line and perioperative echocardiographic or advanced haemodynamic assessment should be considered for high-risk procedures, substantial blood loss or major fluid shifts.

Across all grades, perioperative management should minimize tachycardia, preserve sinus rhythm when possible, prevent myocardial ischaemia, avoid abrupt changes in afterload and use carefully titrated fluid therapy. Adrenergic surges during laryngoscopy, surgical stimulation, pain, shivering and extubation can worsen relaxation and increase filling pressures. Postoperative monitoring is particularly important because sympathetic activation and redistribution of interstitial fluid into the circulation may unmask congestion.



[Click our BIDMC link to follow a practical approach to diagnosis of diastolic dysfunction during perioperative period in addition to grading](#)

KEY TAKEAWAYS

- Diastolic dysfunction is a common yet challenging comorbidity.
- Preoperative DD is an independent predictor of serious complications in non-cardiac surgery, increasing risk for postoperative pulmonary edema and major cardiac events in low and intermediate-risk surgeries.
- Based on the severity of DD, it is divided into grades which represent a physiological continuum of the disease.
- These patients have the highest perioperative haemodynamic risk. They may be preload dependent but simultaneously volume intolerant.
- Across all grades, perioperative management should minimize tachycardia, preserve sinus rhythm when possible, prevent myocardial ischaemia, avoid abrupt changes in afterload and use carefully titrated fluid therapy.
- Anesthetic management in restrictive cardiomyopathy requires careful understanding of physiology of diastole and pathophysiology of diastolic dysfunction.



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AI EDUCATION CORNER

The Bridge from AI Literacy to AI Competence: Scope for Curriculum Development

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There is no denying that AI is a stakeholder in the clinical landscape in the future of medical practice. The need for safe parameters for AI use is becoming paramount with each passing day. Physicians and medical residents are increasingly using AI in their daily clinical practice, yet, despite this rapid integration into the healthcare ecosystem, there is an unanswered question- Is there a minimum level of AI literacy required to practise safely? [1]

AI literacy should be treated as a core patient safety competency because trainees may begin using AI before they have developed the clinical knowledge required to recognize when its output is incorrect, incomplete, or out of context. For the purposes of this framework, we define AI literacy as understanding the capabilities, limitations, biases, uncertainty, and appropriate applications of AI systems. AI competence extends beyond literacy to the ability to integrate AI safely into clinical decision-making while maintaining independent judgment and professional accountability.

AI adoption is outpacing AI education

Naum et al. surveyed 120 respondents at an academic tertiary care centre and found that 83.5% reported AI use in clinical or educational activities, with 42.6% reporting daily use. Residents and medical students reported particularly high rates of use, while formal AI education was delayed behind adoption. [1] In a separate international survey of 1,049 physicians across 50 countries and territories, Bold et al. found that 27.8% had used AI in healthcare practice, whereas only 17.7% had received formal AI training. [2]

Why trainees may be particularly vulnerable

Clinical reasoning is not simply the ability to identify the correct diagnosis; it is the ability to integrate information from multiple sources, manage uncertainty, adapt to a patient's hemodynamic status, and tailor decisions to the individual patient. These higher cognitive skills are developed through repeated exposure to complex clinical decision-making and cannot be outsourced to artificial intelligence. [4,5]

The increasing use of generative AI in medical education therefore raises an important concern for trainees. Reliance on AI-generated recommendations may encourage cognitive off-loading, automation bias, and, over time, loss of opportunities to develop independent clinical reasoning.[3] Without structured education, automation bias may gradually replace independent clinical reasoning. If AI supplies the initial synthesis, trainees may increasingly practise secondary verification rather than independent clinical reasoning. This shift risks anchoring clinicians to the algorithm's first suggestion, promoting a potentially premature diagnostic plan.

The education concern extends beyond whether AI produces a clinically correct answer, but it is the lack of the bridging clinical reasoning in between.

Lack of AI literacy and understanding of bias

Medical AI systems derive their outputs from human generated data, including clinical, scientific and biomedical information. We must not assume that generative AI systems are validated clinical decision tools, merely because AI outputs appear "medically sophisticated".



The goal should not be to prevent trainees from using AI, but to teach them how to use it without succumbing to giving up the reasoning that clinical training is supposed to help develop. A point to highlight to medical trainees would be- a correct AI generated output does not necessarily represent a successful educational outcome. AI may be most valuable when it supports reasoning rather than replaces its earliest steps, for example, by challenging a differential diagnosis, identifying overlooked considerations, or providing feedback after the trainee has independently assessed the case.

Education should be a priority. For this reason, AI literacy is no longer optional. We argue that every U.S. medical school should incorporate a minimum AI literacy curriculum as a core patient safety competency. [4,5]

Minimum AI Literacy Curriculum

Existing frameworks have begun defining AI competencies. [6] We propose that medical education requires a minimum patient-safety-focused subset centred on clinical reasoning, verification, contextualization, and physician accountability. A core component of this curriculum should address the language of AI itself. Large language models are designed to produce fluent, coherent, and confident responses, even where uncertainty exists. Rather than focusing exclusively on technical proficiency, such a curriculum should teach adaptive expertise [4,5] : AI fundamentals of language, verifying information, and understanding its capabilities and limitations.

In medicine, however, diagnostic reasoning rarely leads to a single unequivocal answer. Clinicians routinely navigate competing differential diagnoses, incomplete information, and evolving clinical evidence. Medical trainees must therefore learn to distinguish linguistic confidence from evidential certainty. One of the most important lessons future physicians can learn is that AI can be confidently wrong. AI literacy should also prepare clinicians to recognize the inherent limitations and biases of algorithmic systems. [8] AI models are trained on historical datasets and may perpetuate existing disparities, underrepresent minority populations, or perform less reliably in patients with multimorbidity or atypical presentations. The American heart Association's (2025) scientific statement warned that AI algorithms are limited by the quality and diversity of datasets, leading to misclassification, incorrect risk prediction, and delayed diagnoses that disproportionately affect underrepresented populations.

Part of our: proposed AI Literacy Framework [6] emphasizes seven patient-safety behaviours: understand, recognize, interrogate, verify, contextualize, preserve reasoning, and own the decision.

Step	What It Means	Example
Understand	Know the limitations, training data, and be aware of uncertainty of the tool.	Before trusting an AI-generated risk score, ask what population the model was used on
Recognize	Identify failure modes such as hallucination, bias, automation bias, anchoring.	E.g. the model confidently suggests a dose that does not match the patient's renal function
Interrogate	Actively think through, question AI output	What information did the model use? Does this answer fit the patient in front of me?

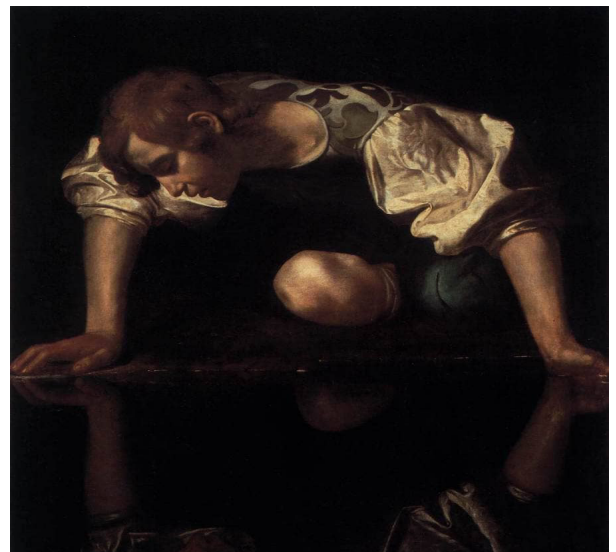


Step	What It Means	Example
Verify	Check the evidence, sources, clinical validity, and applicability	Cross-reference the AI's protocol against a primary institutional guideline
Contextualize	Integrate the clinical picture the model cannot see (comorbidity, social factors)	An AI summary of patient vitals means little without clinical context
Preserve reasoning	Know when an independent assessment should precede AI use.	Be aware that AI is not a factual, validated, clinical decision-making tool
Own the decision	Accountability	Whatever the model suggests, the responsibility for the final decision remains the clinician's.

In conclusion- medicine remains fundamentally a human profession, requiring contextual judgement, ethical reasoning, communication, and longitudinal relationships that extend beyond algorithmic pattern recognition. AI can assist in organizing information and identifying patterns, but responsibility for interpretation, prioritization, and patient-centred decision-making must remain firmly within the clinician's domain.

THE MYTH OF NARCISSUS and How it Mirrors Human Use of AI

The Myth of Narcissus is typically misremembered as a tragedy of excessive vanity. This myth is rather a story of misrecognition of the self in reflection: the young, adored hunter Narcissus, upon witnessing his reflection in a pond, is unable to recognize the image as himself. He perceives the reflection as beautiful and falls in love. The hunter observes himself until his self-recognition, he speaks to himself just as he approaches his dying moments "Iste ego sum" ("I am that one"). Beyond the distortions, general artificial intelligence systems are not validated as clinical tools. The myth of Narcissus serves as a mirror to human medical reasoning and his vanity, a metaphor for our use of AI. Although the final product of AI can appear persuasive or knowledgeable, it may do more harm than good, if not used appropriately. The proposed AI Education Curriculum will enable us to overcome the 'facade' of glamourising AI, risking erosion of autonomy with clinical decision-making. Instead of our focus remaining on consistent limitations, we can empower academic dialogue among Clinicians which will help foster continuous professional growth.



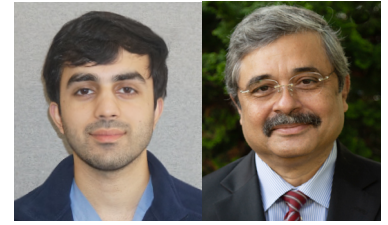


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Do we need memory, or do we need a stable internet connection?



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In 1950, the doubling time of medical knowledge was estimated at 50 years. By 2010 it was 3.5 years. The projection for 2020 was 73 days — a projection whose horizon has already passed.¹ Volume is only half of it. What is known does not merely accumulate; it turns over, and a meaningful share of what is taught as settled will be reversed within the career of the person taught it.² A trainee who memorizes an answer this month may be carrying an expired one by the end of the rotation.

Meanwhile, every one of us walks the corridor holding a device that opens onto more medicine than the libraries our teachers trained in. With a phone in hand, are we not all polymaths? The last individual who could plausibly hold the sum of human knowledge in one head died generations ago. Every resident can now reach all of it in seconds. There are no polymaths left, only people who know what to look for. So it is worth asking, because the trainees are asking it already. Do we need memory, or do we need a stable internet connection?

Here is what the question leaves out. Every search has to be started by someone. Before anyone types a word, a clinician has already noticed that something is wrong. That is the one part nobody can look up.

The operating room makes this visible. It is among the most densely monitored environments in medicine, and every value on the display is available instantly. Not one of them says what is happening. A rising end-tidal carbon dioxide, a climbing heart rate, a rigid jaw. Two of those are on the screen. The third is only available to someone standing close enough to feel it. Reading them together as malignant hyperthermia rather than hypoventilation is not a lookup. No monitor performs it, and no search engine is asked to.

The pattern extends well beyond the operating room. Across 100 cases of serious diagnostic error, the most common contributing factor was faulty synthesis, most often premature closure. Inadequate knowledge was an uncommon cause.³ Those physicians were not short of information, they were short of the suspicion that would have sent them looking for it. The eyes cannot see what the mind doesn't know.

Which raises an uncomfortable question about how we decide who is any good. If retrieval is universally available, then recall is no longer what separates one clinician from another. Yet the instrument we still use to rank them measures precisely that. A systematic review and meta-analysis of USMLE Step 2 Clinical Knowledge pooled 43 studies. It found a moderate positive correlation with in-training examination scores ($r = 0.52$, 95% CI 0.45–0.59) and a very weak positive correlation with subjective measures of how residents actually performed ($r = 0.19$, 95% CI 0.13–0.25).⁴ The examination predicts the next examination.

The eyes cannot see what the mind doesn't know

This is not an argument for abolishing examinations. Knowledge is the substrate of reasoning, and a clinician who knows nothing has nothing to notice with. It is an argument about what a score entitles us to conclude, and about what we intend to do next.

Some of this work has already started. Programmatic assessment replaces the single examination with many small observations gathered over time, judged in aggregate by a committee rather than by a cut



score.⁵ Script concordance testing goes further: it presents a case, adds one new finding, and asks how far that finding moves the working diagnosis, scoring the answer against a panel of experienced clinicians.⁶ Reasoning, not recall, is what gets marked.

Perhaps the trainees are right. Perhaps in 20 years no physician will memorize a dose, and the whole apparatus of recall will look like a historical curiosity — the way we now regard the expectation that physicians compound their own medicines. That would not be a tragedy. Most of what we ask people to hold, they should not have to hold.

The risk was never that trainees would look things up. It was that judgment might be offloaded along with recall.^{7,8} Even looking things up takes skill: the same question put to a guideline, a database and a chatbot returns three different answers, and deciding which of them your patient deserves is a clinical act. Knowing where to look has quietly become part of knowing.

But if we are going to give something up, we should be precise about which thing cannot go. Retrieval can be outsourced, judgment can be assisted, suspicion has to be yours. Noticing takes about a second and leaves no record. A clinician looks at a patient whose numbers are all acceptable and declines to accept them. Every search that follows, every differential, every call for help begins in that second — and there is nothing on the cart, on the screen, or on the network that will begin it for you. A stable connection will answer anything you ask of it. It will never tap you on the shoulder.

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Thyroidectomy for Refractory Amiodarone-Induced Thyrotoxicosis in Cardiac Sarcoidosis with Recurrent Ventricular Tachycardia: A Perioperative Challenge

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INTRODUCTION

Amiodarone-Induced Thyrotoxicosis (AIT) is a well-recognized but challenging complication of long-term amiodarone therapy, occurring in 2–12% of treated patients.¹ Two distinct subtypes are recognized: type 1, driven by iodine excess triggering excess thyroid hormone synthesis in a structurally abnormal gland, and type 2, an iodine-induced destructive thyroiditis resulting in hormone release from damaged follicles.¹ Both subtypes can precipitate life-threatening thyrotoxicosis, and differentiation has important therapeutic implications.

The management of AIT in patients with malignant ventricular arrhythmias presents a therapeutic paradox: amiodarone discontinuation risks life-threatening arrhythmia recurrence, while its continuation exacerbates thyroid dysfunction and its systemic hemodynamic sequelae. Current American Thyroid Association (ATA) guidelines acknowledge this dilemma and recommend individualized, multidisciplinary decision-making.² When medical therapy fails, thyroidectomy offers the only definitive resolution but introduces additional perioperative risk, particularly in patients with advanced structural heart disease such as cardiac sarcoidosis.

The coexistence of cardiac sarcoidosis, a condition predisposing to reentrant ventricular arrhythmias through myocardial granulomatous infiltration and fibrosis, along with a Cardiac Resynchronization Therapy-Defibrillator (CRT-D) device adds substantial complexity to perioperative anesthetic planning. To our knowledge, published reports describing anesthetic management at this specific intersection of refractory AIT, cardiac sarcoidosis, and CRT-D remain limited. This case report describes the comprehensive perioperative anesthetic management of such a patient, with emphasis on preoperative optimization, intraoperative technique, device management, and postoperative complications.

CASE PRESENTATION

Patient History and Comorbidities

A 69-year-old male with a BMI of 44.3 kg/m² presented for elective total thyroidectomy. His past medical history was notable for biopsy-confirmed cardiac sarcoidosis complicated by HFrEF (EF 30–40%), recurrent VT with prior implantable cardioverter-defibrillator (ICD) shocks, high-degree atrioventricular (AV) block previously managed with a permanent pacemaker subsequently upgraded to a CRT-D, atrial fibrillation (AF) on therapeutic anticoagulation, obstructive sleep apnea (OSA) requiring continuous positive airway pressure (CPAP) therapy, and type 2 diabetes mellitus.

Diagnosis and Indication for Surgery

AIT type 2 was diagnosed based on standard ATA criteria.² Despite treatment with methimazole and escalating corticosteroid doses, the patient developed recurrent thyrotoxicosis. In the weeks preceding surgery, he experienced multiple episodes of lightheadedness and dyspnea consistent with VT, all successfully terminated by antitachycardia pacing (ATP) via the CRT-D. Given refractory thyrotoxicosis and an escalating arrhythmia burden attributable to ongoing thyroid hormone excess, a formal multidisciplinary consensus involving endocrinology, cardiology and electrophysiology, anesthesia, and surgery was reached to proceed with thyroidectomy as a definitive therapy.

Preoperative Optimization

Preoperative management aimed to achieve the lowest feasible thyroid hormone burden while minimizing arrhythmic risk. The antithyroid regimen included methimazole, escalated systemic corticosteroids, and Lugol's iodine solution to suppress thyroid hormone synthesis and reduce glandular hypervascularity prior to surgical resection.² Propranolol was continued through the morning of surgery for heart rate control and attenuation of adrenergic manifestations of thyrotoxicosis. A dedicated preoperative electrophysiology consultation and CRT-D device interrogation were completed to confirm appropriate device function and program perioperative settings. The key anesthetic considerations were identified at a multidisciplinary preoperative evaluation as summarized in Figure 1.

Intraoperative Management

Standard American Society of Anesthesiologists (ASA) monitoring was supplemented with continuous invasive arterial blood pressure monitoring, secured before induction. In accordance with AHA perioperative cardiac Implantable Electronic Device (CIED) management guidelines,³ external defibrillator pads were applied before induction, and a programming magnet was applied over the CRT-D to suspend tachyarrhythmia detection therapies while preserving pacing function. Intraoperative management integrated tailored anesthesia without neuromuscular blockade for recurrent laryngeal nerve (RLN) monitoring, and device-specific precautions as detailed in Figure 1. The intraoperative course was uneventful. Hemodynamics remained stable throughout, with no arrhythmic events and preserved bilateral RLN signals.

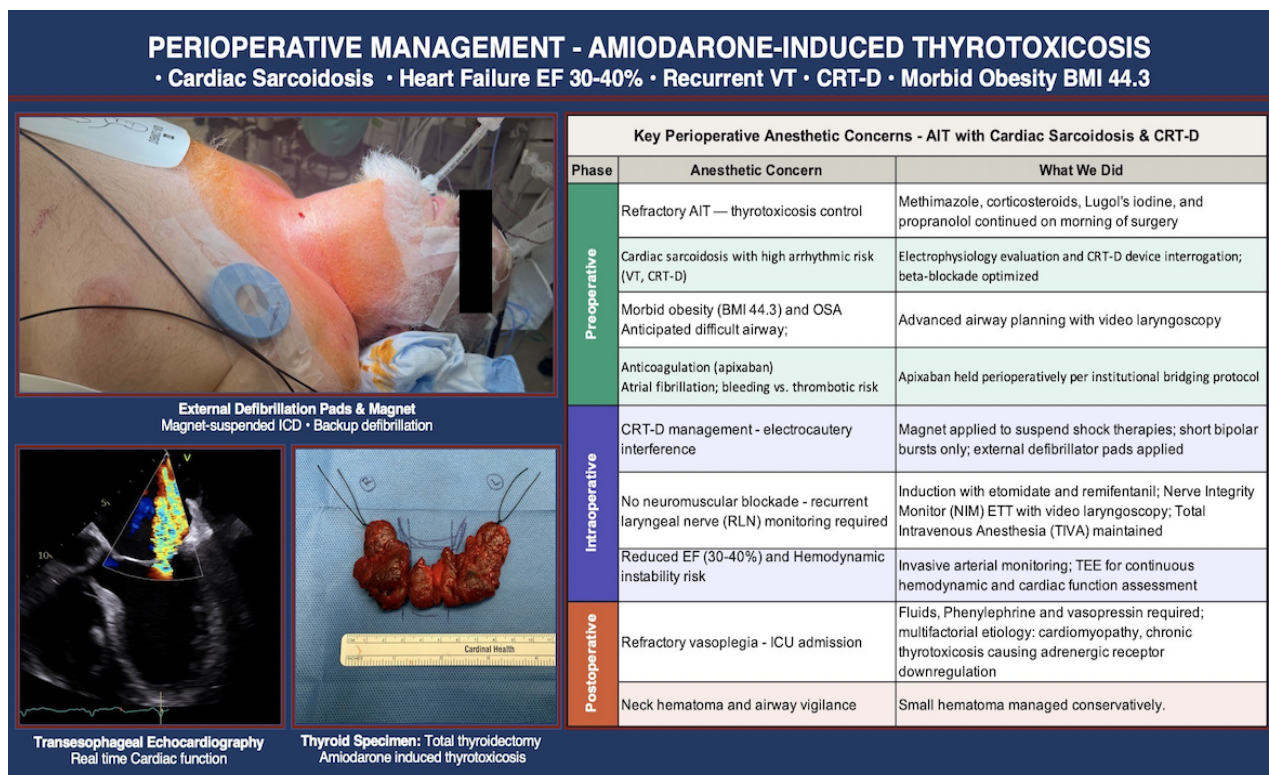


Figure 1. Multidisciplinary summary of key perioperative anesthetic concerns and management strategies for AIT with cardiac sarcoidosis and CRT-D, by phase of care.



Postoperative Course

In the immediate postoperative period, the patient developed refractory vasoplegia despite adequate volume resuscitation, requiring phenylephrine and low-dose vasopressin infusion with medical intensive care unit (MICU) admission for hemodynamic monitoring. Vasopressors were successfully weaned over the ensuing hours, and the patient was transferred to the ward without further cardiorespiratory complications. On postoperative day 1, a small, non-expanding incisional hematoma developed after a coughing episode and was managed conservatively with close wound surveillance. The multidisciplinary team remained prepared to perform immediate bedside wound decompression using the SCOOP protocol (Figure 2) should airway compromise occur. The patient was discharged home on postoperative day 3 on levothyroxine replacement with outpatient thyroid function follow-up.

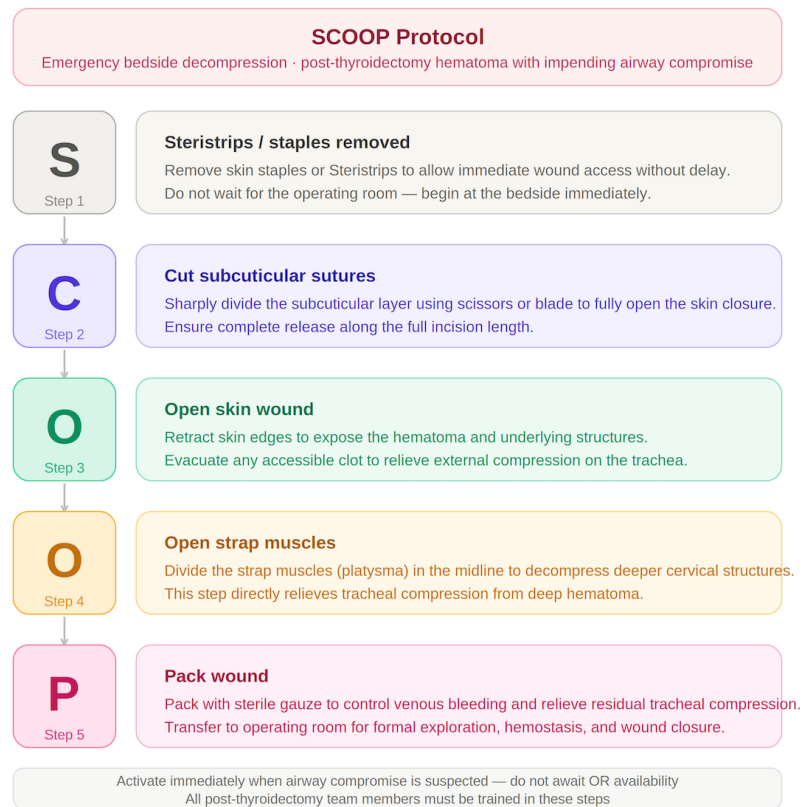


Figure 2. The SCOOP protocol for emergency bedside decompression of post-thyroidectomy hematoma with impending airway compromise.



AIT and the Paradox of Amiodarone Continuation

AIT creates a clinical dilemma that is particularly acute in patients with malignant ventricular arrhythmias. Amiodarone discontinuation risks destabilizing rhythm control in a population where arrhythmia may be life-threatening, while continuation perpetuates thyroid hormone excess with associated hemodynamic consequences.¹ In cardiac sarcoidosis, granulomatous replacement of myocardium and associated conduction system fibrosis creates a favorable electrophysiological substrate for reentrant VT, amplifying this risk substantially. The ATA 2016 guidelines endorse thyroidectomy as the definitive therapeutic option for refractory AIT when medical therapy has failed, particularly when amiodarone cannot be safely discontinued.² However, guidance specifically addressing the perioperative anesthetic management of such patients with concurrent advanced structural heart disease and implantable cardiac devices is sparse. The present case contributes a detailed management framework to this limited literature.

Anesthetic Strategy: Avoiding Neuromuscular Blockade

Intraoperative RLN monitoring has become standard practice in thyroid surgery due to its ability to identify the nerve in real time and reduce the risk of permanent injury, which occurs in 1–2% of thyroidectomies.⁴ Critically, NMBAs abolish the electromyographic (EMG) signal generated at the vocal cord muscle and must be avoided from induction through extubation. This constraint imposed a significant anesthetic challenge in this patient, given the compounding difficulty of morbid obesity, OSA, and the neck-extended surgical position.

Video laryngoscopy was selected as the primary intubation technique to maximize first-pass success and minimize airway manipulation. TIVA with propofol and remifentanyl was employed as the maintenance strategy; remifentanyl's ultra-short context-sensitive half-life enabled precise titration of analgo-sedation without any residual sedative effects at emergence. The combination provided adequate suppression of laryngeal reflexes and hemodynamic responses to surgical stimulation without compromising EMG signal fidelity.

Postoperative Vasoplegia: Pathophysiology and Management

Postoperative vasoplegia, a distributive shock state characterized by low systemic vascular resistance with preserved or increased cardiac output, is an underrecognized complication in patients with thyrotoxicosis undergoing major surgery. Its pathophysiology in the current case was likely multifactorial.

Chronic thyroid hormone excess induces a hyperdynamic, catecholamine-mimetic hemodynamic state characterized by increased heart rate, cardiac output, and vascular compliance. Prolonged adrenergic receptor stimulation leads to receptor downregulation, reducing vascular responsiveness to endogenous and exogenous catecholamines. This adrenergic receptor desensitization may persist acutely in the immediate postoperative period despite surgical correction of the thyroid source. Amiodarone itself contributes to vasodilation through non-competitive alpha-adrenergic blockade and calcium channel antagonism, further blunting vasoconstrictor capacity. These pharmacological effects, superimposed on anesthetic-mediated vasodilation and the reduced cardiac reserve of HFrEF, created a compounded vasoplegic substrate in this patient.

Vasopressin is mechanistically rational in this context as its vasopressor action is mediated via vascular V1 receptors, which are distinct from and independent of the downregulated adrenergic pathway.⁵



Anticipatory planning should include preoperative identification of vasoplegia risk, intraoperative TEE to distinguish distributive from cardiogenic hypotension, early vasopressor initiation, and ICU-level postoperative monitoring. Fluid administration should be judicious in the setting of HFrEF to avoid precipitating acute decompensation.

Post-Thyroidectomy Complications

Post-thyroidectomy hematoma is a potentially fatal complication occurring in 0.3–1.6% of cases, with the incidence rising in patients on anticoagulation or with coagulopathy.⁶ Venous congestion and progressive tracheal compression can precipitate airway obstruction within minutes of hematoma formation, necessitating immediate intervention. The SCOOP protocol (Figure 2) provides a systematic bedside approach to emergent wound decompression for situations in which airway compromise is imminent and return to the operating room is not immediately feasible.⁷

Hypocalcemia secondary to transient or permanent hypoparathyroidism is the most frequent complication following total thyroidectomy, with an incidence of transient hypocalcemia reported at 19–38% and permanent hypoparathyroidism at 1–3%. Routine postoperative monitoring of serum calcium and intact PTH allows timely identification and supplementation.

The Role of Multidisciplinary Coordination

The favorable outcome in this case was underpinned by early, structured coordination among endocrinology, cardiology/electrophysiology, anesthesiology, and surgery. Preoperative planning enabled optimization of thyrotoxicosis, device management, anesthetic strategy, and contingency planning for postoperative complications. This case reinforces a core principle: **in patients with complex, interacting comorbidities, perioperative management should be developed as an integrated multidisciplinary framework rather than a series of isolated specialty-specific decisions, anticipating how concurrent physiologic derangements may interact under the stress of anesthesia and surgery.**

CONCLUSION

Refractory AIT in the context of cardiac sarcoidosis, HFrEF, and a CRT-D represents a rare convergence of anesthetic hazards that demands anticipatory, multidisciplinary perioperative planning. Key management priorities include preoperative thyroid hormone suppression, structured CIED management per society guidelines, NMBA-free anesthetic technique with video laryngoscopy and TIVA, continuous intraoperative TEE, and vigilant postoperative monitoring for vasoplegia, hematoma, and hypocalcemia. This case demonstrates that with comprehensive pre-procedural coordination, even patients with converging high-risk cardiac and endocrine comorbidities can undergo thyroidectomy with acceptable safety.



Key Take Away Points

- Implement proactive multidisciplinary perioperative planning in patients with complex endocrine and cardiac disease undergoing high-risk surgery.
- Recognize perioperative challenges in patients with refractory amiodarone-induced thyrotoxicosis and severe cardiomyopathy.
- Perioperative CIED management must be individualized; magnet application effects are manufacturer-specific and should be confirmed preoperatively with electrophysiology. External defibrillation must be immediately available.
- Apply anesthetic strategies for high-risk thyroidectomy, including airway planning and avoidance of neuromuscular blockade for nerve monitoring.
- Postoperative vasoplegia in thyrotoxic patients with cardiomyopathy is multifactorial; vasopressin acting via V1 receptors independent of downregulated adrenergic pathways may be used as a first-line vasopressor.
- Post-thyroidectomy complications viz. hematoma, hypocalcemia, and RLN injury- require structured postoperative vigilance. The SCOOP protocol should be immediately available and all team members should be familiar with its steps.
- Intraoperative TEE provides essential real-time assessment of hemodynamics, volume status, and ventricular function in high-risk cardiac patients undergoing non-cardiac surgery.

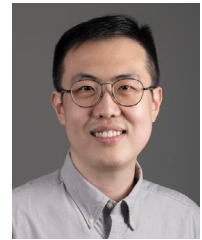
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Rethinking Blood Pressure Management During Carotid Endarterectomy: The Potential Role of Blood Pressure Variability

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BACKGROUND

Perioperative stroke remains one of the most severe complications following carotid endarterectomy (CEA). However, optimal intraoperative blood pressure management remains incompletely defined. Current practice is largely guided by physiologic reasoning rather than high-level evidence. During carotid cross-clamping, cerebral perfusion of the ipsilateral hemisphere shifts from an autoregulated state to a collateral-dependent, pressure-passive circulation, where cerebral blood flow becomes highly dependent on systemic arterial pressure. In this setting, anesthesiologists play a critical role in maintaining adequate cerebral perfusion by manipulating blood pressure, ventilation, and vasoactive medications.

A PHASE-SPECIFIC HEMODYNAMIC STRATEGY

Current guidelines therefore advocate a phase-specific hemodynamic strategy rather than a single universal blood pressure target. Blood pressure augmentation during carotid clamping is widely adopted because increased systemic pressure improves collateral perfusion through the Circle of Willis, increases middle cerebral artery flow velocity, and may reverse potential clamp-induced cerebral ischemia. After unclamping, restoration of perfusion to chronically vasodilated cerebral vessels increases the risk of cerebral hyperperfusion, while thromboembolism arising from the endarterectomy site becomes the dominant mechanism of perioperative stroke. Consequently, blood pressure is generally returned toward baseline after reperfusion to minimize hyperperfusion-related injury.

UNCERTAINTY IN OPTIMAL BLOOD PRESSURE TARGETS

Despite widespread agreement that blood pressure is critical, the optimal target remains uncertain. Existing recommendations are supported primarily by observational studies and physiologic experiments, with no completed randomized trial establishing evidence-based intraoperative blood pressure targets for CEA. Increasing evidence also suggests that relative blood pressure change, rather than an absolute MAP threshold, better reflects cerebral perfusion in patients with chronic carotid stenosis, whose autoregulatory curves are frequently shifted and collateral reserve varies between individuals. Ongoing studies investigating autoregulation-guided blood pressure management further highlight the limitations of fixed MAP thresholds and the movement toward individualized hemodynamic management.

BLOOD PRESSURE VARIABILITY: AN UNDEREXPLORED PHENOTYPE

An equally important but considerably less explored question is whether blood pressure variability (BPV), rather than mean blood pressure alone, contributes to perioperative cerebral injury. BPV has emerged as an important cardiovascular risk marker in hypertension and perioperative medicine, but its role during CEA remains poorly understood. Current evidence is remarkably sparse: only one CEA-specific study has directly evaluated intraoperative BPV, using postoperative headache rather than stroke as the primary outcome, while larger registry studies (based on the VQI data set) describe postoperative “hemodynamic lability” without calculating formal variability indices. Moreover, nearly all available studies reduce an entire operation to a single BPV value, ignoring the fun-



damentally different physiology of the dissection, cross-clamp, and post-unclamp phases. Such whole-procedure metrics cannot distinguish appropriate protocol-driven blood pressure modulation from pathological instability. Important methodological issues, including lack of standardized BPV metrics, dependence on sampling frequency, inability to separate spontaneous instability from vasoactive intervention, and absence of phase-specific analyses, remain unresolved.

STUDY DESIGN

To address these limitations, we analyzed high-resolution intraoperative arterial pressure waveforms from 95 consecutive carotid endarterectomy patients, including more than 200,000 arterial pressure measurements, with blood pressure trajectories normalized into pre-clamp, clamp, and post-unclamp phases. Rather than focusing solely on mean arterial pressure, we characterized BPV using 5 indices, including SD, coefficient of variation, average real variability, RMSSD, and interquartile range, to capture multiple dimensions of hemodynamic instability.

RESULTS

Although baseline characteristics, initial blood pressure, clamp duration, and shunt utilization were similar between patients with and without perioperative stroke (Fig. 1, see companion figures document), mixed-effects and trajectory analyses demonstrated different temporal blood pressure dynamics. Mean blood pressure trajectories alone were not consistently different throughout the procedure (Fig. 2, see companion figures document). In contrast, stroke patients exhibited a reproducible pattern of increased BPV, particularly involving systolic blood pressure and MAP during the pre-clamp and post-unclamp periods, whereas variability during carotid clamping remained relatively similar between groups (Fig. 3, see companion figures document). These findings were consistent across multiple complementary BPV metrics, suggesting that perioperative stroke may be associated with a distinct high-BPV hemodynamic phenotype, independent of differences in mean blood pressure.

MECHANISTIC CONSIDERATIONS

These observations raise several important mechanistic questions. Current concepts of cerebral protection during CEA largely emphasize maintaining adequate collateral perfusion during carotid clamping. However, contemporary hemodynamic studies suggest that cerebral circulation after clamping represents a dynamically reconfigured collateral network rather than simply a low-flow state. Blood pressure fluctuations may therefore influence not only cerebral perfusion but also collateral flow dynamics and embolic transport after reperfusion. The post-unclamp period is particularly intriguing because embolic events become the predominant cause of perioperative stroke while cerebral vessels remain vulnerable to hemodynamic instability. Whether increased BPV alters embolic washout, collateral flow efficiency, or regional cerebral perfusion remains unknown, but these mechanisms provide biologically plausible explanations linking hemodynamic instability with cerebral injury.

Our findings therefore should not be interpreted as establishing a causal relationship between BPV and perioperative stroke. Rather, they identify BPV as a previously underrecognized hemodynamic phenotype that may capture aspects of cerebral physiology not reflected by mean arterial pressure alone.

CLINICAL IMPLICATIONS

Although BPV cannot yet be regarded as a therapeutic target, the available evidence suggests several practical strategies that may improve hemodynamic stability during carotid endarterectomy.

First, continuous invasive arterial pressure monitoring should be maintained throughout all operative phases. Unlike intermittent cuff measurements, continuous arterial waveforms permit recognition of short time scale fluctuations that characterize BPV and provide the foundation for timely intervention.

Second, continuous vasopressor infusion may be preferable to repeated manual boluses in patients at high risk of hemodynamic instability. Randomized studies in noncardiac surgery have demonstrated that continuous norepi-



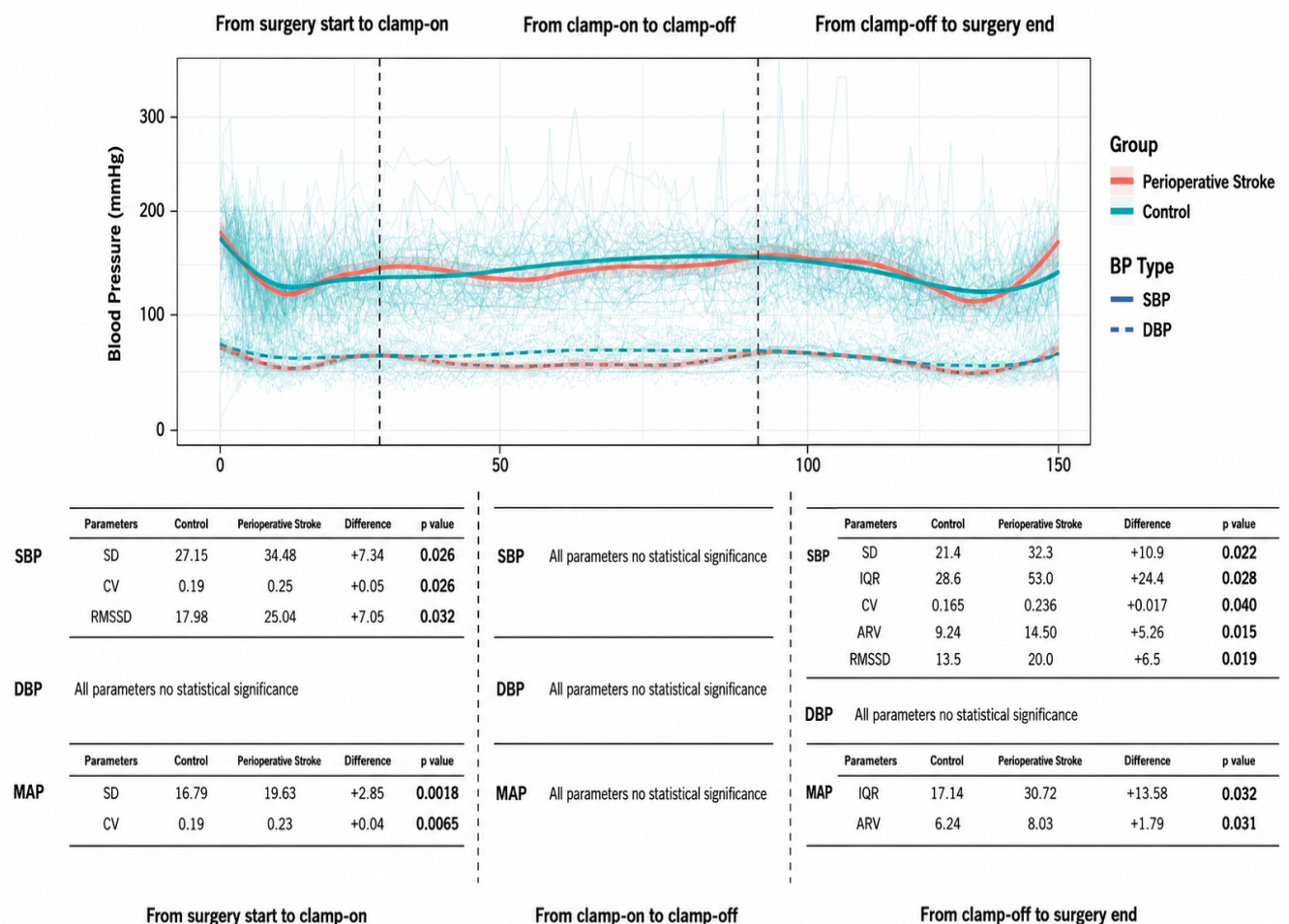
nephrine infusion reduces short-term MAP variability, quantified using generalized average real variability, while preserving cardiac output and microcirculatory perfusion more effectively than intermittent bolus administration.

Third, blood pressure management during CEA should remain phase-specific rather than threshold-based. Current evidence supports maintaining augmented perfusion pressure during carotid clamping while avoiding excessive hypertension after unclamping, when embolic injury and cerebral hyperperfusion become the dominant concerns. Rather than targeting a single MAP value, anesthesiologists should consider maintaining blood pressure within an individualized target band appropriate for each operative phase.

Current evidence does not clearly favor one vasopressor over another for routine management during CEA. The only randomized CEA-specific comparison demonstrated similar cerebral oxygenation after phenylephrine and ephedrine, whereas newer physiological studies in collateral-dependent cerebrovascular disease suggest that norepinephrine may better preserve cardiac output and cerebral oxygen delivery. These observations remain hypothesis-generating, and vasopressor selection should currently be individualized according to the patient's cardiovascular physiology rather than presumed cerebrovascular superiority of any single agent.

FUTURE DIRECTIONS

Future investigations should move beyond conventional mean blood pressure targets toward phase-specific hemodynamic management that integrates blood pressure trajectories, collateral physiology, and individualized cerebral autoregulation. Within this framework, BPV should be viewed not merely as a statistical descriptor of instability, but as a potentially modifiable physiological phenotype reflecting the interaction between anesthetic management and collateral cerebral circulation.

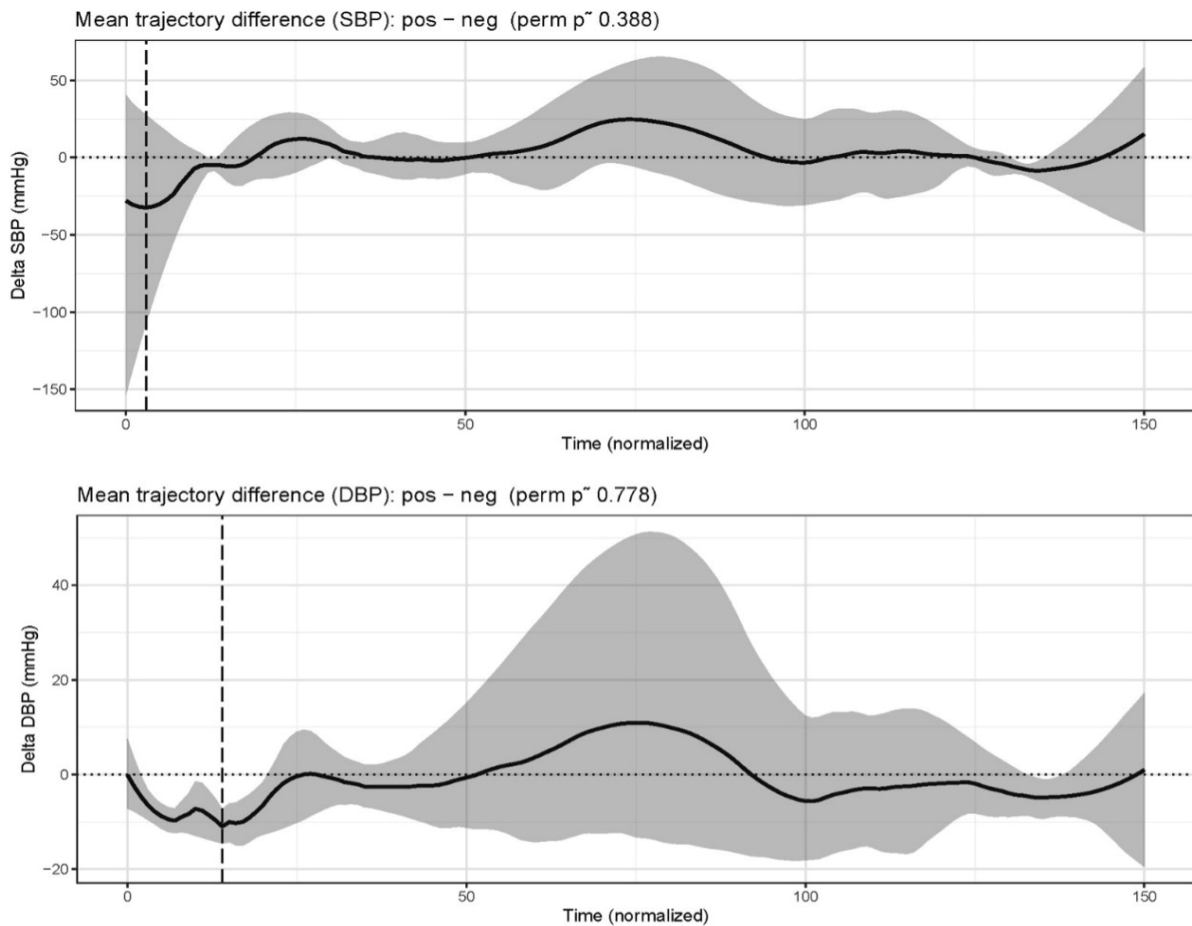


**Table 1. Demographic Data**

	Control n = 90	Perioperative Stroke n = 5	P value
Age	72.61 ± 10.28	73.40 ± 8.85	0.87
BMI	27.25 ± 5.71	30.12 ± 8.35	0.29
Female (%)	39 (43.3)	3 (60.0)	0.65
Current Smoker (%)	28 (31.1)	2 (40.0)	0.64
Symptomatic (%)	46 (51.1)	3 (60.0)	1.00
Comorbidity			
Hypertension (%)	82 (91.1)	5 (100)	1.00
Hyperlipidemia (%)	76 (84.4)	4 (80.0)	0.59
Coronary artery disease (%)	34 (37.8)	0 (0)	0.16
Diabetes mellitus (%)	27 (30.0)	3 (60.0)	0.32
Peripheral artery disease (%)	16 (17.8)	1 (20.0)	1.00
Atrial fibrillation (%)	12 (13.3)	1 (20.0)	0.53
Preoperative Aspirin (%)	74 (82.2)	3 (60.0)	0.24
Other Preoperative Antiplatelets (%)	28 (31.1)	3 (60.0)	0.33
Clopidogrel (%)	26 (92.9)	3 (100)	0.16
Ticagrelor (%)	2 (7.1)	0 (0)	1.00
Preoperative Anticoagulants (%)	24 (26.7)	1 (20.0)	1.00
Heparin (%)	10 (41.7)	0 (0)	1.00
Enoxaparin (%)	1 (4.2)	0 (0)	1.00
Apixaban (%)	10 (41.7)	0 (0)	1.00
Rivaroxaban (%)	2 (8.3)	0 (0)	1.00
Warfarin (%)	1 (4.2)	1 (100)	0.10
ASA			
ASA II (%)	5 (5.6)	0 (0)	1.00
ASA III (%)	77 (85.6)	4 (80.0)	0.56
ASA IV (%)	8 (8.9)	1 (20.0)	0.40
Death (%)	0 (0)	1 (20.0)	0.052

Table 2. Perioperative Blood Pressure, Shunt Placement Rate, and Clamp On – Off Time

	Control n = 90	Perioperative Stroke n = 5	P value
First Preop Blood Pressure			
SBP (mmHg)	146.11 ± 20.21	169.2 ± 20.14	0.061
DBP (mmHg)	75.73 ± 12.1	74.0 ± 11.58	0.76
MAP (mmHg)	99.19 ± 11.93	105.73 ± 10.71	0.25
First OR Blood Pressure			
SBP (mmHg)	170.18 ± 27.55	190 ± 28.37	0.12
DBP (mmHg)	73.86 ± 13.75	74.8 ± 16.22	0.90
MAP (mmHg)	105.96 ± 14.45	114.87 ± 9.23	0.10
Intraoperative Shunt Placement (%)	51 (56.7)	3 (60.0)	1.00
Clamp On – Off Time (min)	52.39 ± 20.69	45.4 ± 7.99	0.14



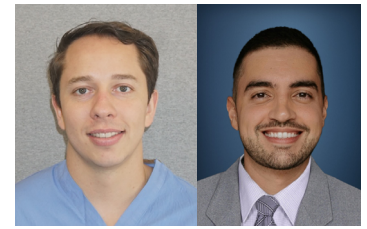
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Pulmonary Aspiration During Anesthesia: Is the Incidence Truly Increasing, or Are We Finally Measuring It Better?

Miguel Magallanes, MD
Federico Puerta Martinez, MD



BACKGROUND

Pulmonary aspiration is uncommon, but when it occurs, it can lead to serious respiratory complications and even death.(2,4,9,12) A recent analysis of nearly one million anesthetic encounters estimated that clinically recognized perioperative aspiration occurs in approximately 1 in 5,500 cases.(3) Although the true burden may be higher, reported cases depend on whether the event is recognized, documented, coded, and captured by the surveillance system being used.(4,9) Studies comparing different reporting methods have identified aspiration events that were missed when only one source was reviewed. As a result, subtle cases, or those that become apparent only after the procedure, may not always be classified as perioperative aspiration.

The 2023 American Society of Anesthesiologists (ASA) Practice Guidelines for Preoperative Fasting reaffirmed the recommended fasting intervals for healthy patients undergoing elective procedures: 2 hours for clear liquids, 4 hours for breast milk, 6 hours for infant formula, non-human milk, or a light meal, and at least 8 hours following a fatty meal.(1) These recommendations continue to serve as the foundation of perioperative fasting for healthy elective patients. At the same time, the guidelines recognize that they are not intended for all patient populations. Individuals with conditions or medications that may impair gastric emptying or increase the risk of regurgitation may still have significant residual gastric contents despite following standard fasting recommendations. For these patients, perioperative assessment should extend beyond fasting duration alone and take individual risk factors into account.(1)

The widespread use of glucagon-like-peptide-1 receptor agonists (GLP-1RAs) has brought renewed attention to the limitations of relying on fasting duration alone to estimate aspiration risk. As evidence regarding their effects on gastric emptying has evolved, perioperative recommendations have shifted from a uniform approach toward one that is more individualized. Current guidance recognizes that most patients can safely continue GLP-1RA therapy before elective procedures, while recommending additional precautions for those at higher risk of delayed gastric emptying. These precautions may include dietary modifications (24-hour liquid-diet only), adjustments to the anesthetic plan, or point-of-care gastric ultrasound when the findings are expected to influence clinical management. More recent consensus statements continue to support this patient-centered approach, emphasizing that perioperative decision-making should be based on the overall clinical picture rather than medication use alone.(5,6,7,8)

Despite these advances in perioperative risk assessment, an important question remains. In daily clinical practice, anesthesiologists are increasingly encountering patients with factors that may delay gastric emptying despite adherence to recommended fasting guidelines. At the same time, large observational studies and national databases have not shown a corresponding increase in documented pulmonary aspiration. This raises an important question: is the incidence of perioperative pulmonary aspiration truly changing, or are improvements in risk assessment, documentation, and diagnostic tools allowing clinicians to identify events that may have previously gone unrecognized?(4,6,9)

WHY ASPIRATION MAY BE UNDERRECOGNIZED

Determining the true incidence of perioperative pulmonary aspiration remains challenging because there is no universally accepted definition of what constitutes an aspiration event. Some studies define aspiration as witnessed regurgitation with visualization of gastric contents below the vocal cords, whereas others include aspiration pneumonia, aspiration pneumonia, or postoperative respiratory complications that develop shortly after anesthesia.(4,9,12) As a result, similar clinical events may be classified differently across studies and institutions, making direct comparisons of reported aspiration rates difficult.

The diagnosis becomes even more challenging when aspiration is not recognized at the time it occurs. Small-volume aspiration may produce few immediate clinical signs, with respiratory symptoms becoming apparent only



hours after the procedure. In these situations, postoperative hypoxemia, fever, leukocytosis, or new pulmonary infiltrates may be attributed to more common postoperative conditions such as atelectasis, pulmonary edema, or pneumonia, particularly when no aspiration event was witnessed.(9,12) Institutional differences in surveillance and reporting practices add another layer of complexity. Hospitals with established quality-improvement programs, standardized adverse-event reporting, or greater use of diagnostic tools such as gastric ultrasound may identify and document more aspiration-related events than centers that rely primarily on voluntary reporting. Therefore, differences in reported aspiration rates may reflect variations in event recognition and documentation rather than a true change in the incidence of pulmonary aspiration.(4,9,12)

WHAT CURRENT META-ANALYSES TELL US

Recent systematic reviews and meta-analyses consistently show that patients receiving GLP-1 receptor agonists are more likely to have increased residual gastric contents and experience procedure delays or cancellations because of concerns about delayed gastric emptying. Despite these findings, the available evidence has not demonstrated a statistically significant increase in documented pulmonary aspiration or aspiration pneumonia. This does not necessarily mean that aspiration risk is unchanged. Most of the available studies are retrospective and rely on inconsistent definitions of aspiration, variable postoperative follow-up, and different reporting practices across institutions, all of which may contribute to underrecognized events and outcome misclassification.(5,6,7,8,10,12) Together, the current evidence suggests that clinicians have become better at identifying patients with delayed gastric emptying, while the true incidence of perioperative pulmonary aspiration remains difficult to define.

WHY ONE INSTITUTION MAY OBSERVE MORE ASPIRATION EVENTS

An increase in aspiration events observed at a single institution should be interpreted in the context of the patient population and local clinical practice rather than viewed as definitive evidence that the overall incidence of pulmonary aspiration is increasing. Centers caring for a larger number of patients undergoing emergency procedures, or those with conditions associated with delayed gastric emptying — including obesity, diabetes, gastrointestinal disorders, or GLP-1 receptor agonist use — may naturally encounter more patients at risk of aspiration.(5,6,7,8,10,12,14,15)

At the same time, increased awareness of aspiration risk, wider implementation of gastric ultrasound, more standardized documentation, and active quality-improvement initiatives may lead clinicians to recognize and report events that might previously have been attributed to other postoperative pulmonary complications.(4,9,14,15,16) These factors, together, may help explain why one institution reports more aspiration events even when large multicenter studies and national databases do not demonstrate a similar trend.

THE EMERGING ROLE OF GASTRIC ULTRASOUND

Recognizing that fasting duration does not always reflect gastric emptying has renewed interest in point-of-care gastric ultrasound. Rather than estimating aspiration risk based solely on the time since the last meal, gastric ultrasound allows clinicians to directly assess gastric contents immediately before anesthesia. This bedside examination can identify an empty stomach, clear fluids, or solid contents, providing information that may be particularly valuable when the patient's aspiration risk is uncertain or when the clinical history is inconclusive.(14,15,16)

Professional societies increasingly recognize gastric ultrasound as a useful adjunct in selected patients, not as a replacement for standard fasting guidelines. Its role is strongest when the results are expected to influence perioperative management, such as in patients with suspected delayed gastric emptying, uncertain fasting status, or other factors associated with increased aspiration risk.(1,5,8,14,16)

Although gastric ultrasound cannot prevent pulmonary aspiration, it provides something that fasting guidelines alone cannot: a direct assessment of gastric contents, which can help clinicians decide whether to proceed with surgery, modify anesthetic technique, extend fasting, or postpone an elective procedure. As it becomes more widespread and operator experience continues to grow, gastric ultrasound has the potential to refine perioperative risk assessment and support more individualized clinical decision-making.(5,8,14,15,16)



Key Take Away Points

1. Aspiration remains rare, but its true incidence is uncertain: Differences in definitions, recognition, documentation, and surveillance make perioperative pulmonary aspiration difficult to measure accurately.
2. Delayed gastric emptying does not equal aspiration: GLP-1 receptor agonists are associated with increased residual gastric contents, yet current evidence has not demonstrated a corresponding increase in documented pulmonary aspiration.
3. We may be detecting risk better, not necessarily seeing more aspiration: Greater awareness, improved reporting, and tools such as gastric ultrasound may identify high-risk patients and events that previously went unrecognized.
4. Fasting time is only part of the assessment: Gastric ultrasound can provide a direct assessment of gastric contents in selected patients, supporting a more individualized approach when fasting history alone does not adequately define aspiration risk.

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The Gibbon-IBM Heart-Lung Machine: Cardiac Surgery's Pioneering Instrument

Noor-E-Saher Ahmed
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"The surgeon who would attempt to suture a wound of the heart should lose the respect of his colleagues." — Theodor Billroth, 1881 (The Father of Modern Surgery)

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As recently as the mid twentieth century, the heart was considered a forbidden zone for surgeons, as there were incredible challenges considered insurmountable for open heart surgery. Most patients with significant congenital heart disease died without treatment.

A key figure in the story of how cardiac surgery became possible was Dr. John H. Gibbon Jr., who was called to action after witnessing a patient die from severe heart failure. This propelled him to invent one of the most fascinating pieces of machinery, the Cardio Pulmonary Bypass Machine (CPB).

CPB is a procedure in which crucial functions of the heart and lungs are temporarily replaced by a bypass machine: the Heart Lung Machine (H L Machine). Essentially, it replicates the process of taking deoxygenated venous blood, reoxygenating it to "red" blood, and pumping it into the arterial system, ensuring the cycle of oxygen renewal and delivery. This is done by placing cannulas in major venous channels or chambers of the heart (such as the superior vena cava, inferior vena cava, and the right atrium), collecting the venous blood into a reservoir, which goes through an oxygenator that exchanges carbon dioxide for oxygen. The newly oxygenated blood returns to circulate the body via an arterial cannula inserted in the aorta, completing the CPB circuit. (1) This process, now commonly used in cardiac operating rooms, has been considered one of the most important developments in the history of medicine, as it allowed physicians to operate directly on the heart and major vessels for the first time. Thus, a new era of essential, life saving procedures was born.

Gibbon started developing the heart lung machine after he observed a woman dying from complications due to a massive pulmonary embolism during his research fellowship at Boston's Massachusetts General Hospital in October 1930. He realized that had her venous blood been removed, oxygenated, then returned to the arterial system, the woman could have been saved. (2) Yet, no technology present at the time could perform such a feat. So, Gibbon — with the help of his attending, Dr. Edward D. Churchill, his wife, Mary Gibbon, and the International Business Machines Corporation (IBM) — spent the next 23 years innovating a solution. (3) Gibbon and his wife returned to his hometown of Philadelphia in 1935, where he joined a surgical staff team at the University of Pennsylvania and continued his research on CPB. For such a revolutionary invention, Gibbon and his colleagues made rapid progress. By 1939, a functional heart lung machine had been built, and Gibbon observed that it was able to support cats on heart paralyzing medicine — or cardioplegia — for around 117 minutes. Cats under 10 to 20 minutes of CPB achieved long term survival post surgery. The eruption of the Second World War halted Gibbon's project, whereafter he joined the Army Medical Corps. He served two years on the Pacific Front, then two years at Galesburg Military Hospital in Illinois. Once the war ended in 1945, Gibbon resumed his work at his alma mater, Philadelphia's Jefferson Medical College. By 1952, he developed an H L machine that could support humans, known now as the Gibbon IBM Heart Lung Machine Model II. (2)

The original photographs of the Model II visualize its complex, equipment heavy design. It was a stainless steel, box shaped machine that weighed slightly over one ton. One side of the machine had six small screens lined up on top and four larger ones below them, stacked together in rows of two. Under these screens were knobs used to adjust multiple components within the machine. With it came three DeBakey pumps. Essentially, these pumps are comprised of tubing and a roller within a chamber. The roller compressed the tubing as it rotated in order to propel blood forward and provide its flow to the body. (4,5)

The main component that allowed the Model II to support humans was its vertical oxygenator. The oxygenator, with small screens at the top left of the rectangular prism, was encased with steel sheets that stretched 25 centimeters tall and 40 centimeters wide. In those six sheets, blood would flow down each side, providing a surface for the fluid to be exposed to oxygen — less than the gas exchange surface of a normal lung, but enough to supply 100 percent of the oxygen saturation needed. As suggested by its name, its purpose was to provide an



adequate amount of oxygen in exchange for carbon dioxide in the blood. This part of the machine, paired with the DeBakey pumps, was the most essential in replicating the physiological process by which the heart and lungs respire. (6,7)

In addition to these parts, the Model II included numerous safety features. Electronic devices within the machine constantly monitored the circulating blood's volume and pH. The venous pump's flow would automatically increase or decrease depending on the amount of blood in the reservoir. Moreover, since inflammable anesthetic was used during operations, the machine held cabinets filled with copious amounts of nitrogen. A backup generator battery was also included in the event of a power outage. (7)

Gibbon tested the Model II on dogs until their post operative survival rate reached 90 percent. After that threshold was reached, he shifted his experiments to humans. (6)

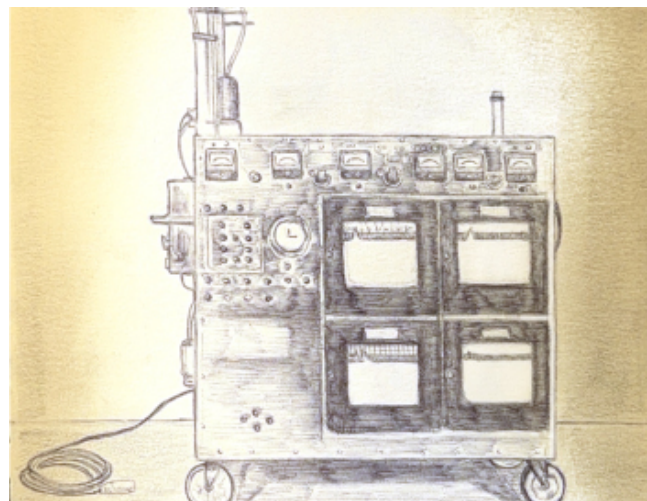
May 6, 1953 marked the day of the first successful cardiopulmonary bypass operation. Cecilia Bavolek, an 18 year old patient, underwent an atrial septal defect (ASD) repair. After 26 minutes of full asystolic bypass (meaning the patient's heart was completely stopped) and 45 minutes total of CPB, the atrial hole was sewn closed. The procedure was risky, intense, expensive, and almost disastrous. The team encountered a significant issue: blood clots. For every 500 mL of blood, only 10 mg of heparin was used. Consequently, the oxygen saturation fell, and blood began to clot on the oxygenator as Gibbon prepared to close the defect. The decision was made to seal the ASD as quickly as possible with a continuous suture rather than a pericardial patch so that Bavolek could be taken off bypass immediately. Gibbon's team still managed to make this monumental breakthrough work, and Bavolek made a full and "uneventful" recovery post op. However, the surgery was unsuccessful on the next two patients: one died of cardiac arrest, and the other of severe blood loss alongside a separate, undiagnosed septal defect. Anthony Dobell, a resident under Dr. Gibbon, stated that these deaths were, in part, attributable to a lack of expertise in anesthesia and pediatric cardiology — essentially, human factors resulting from an inadequately prepared, competent team. Six other teams between 1952 and 1954 attempted open heart surgery using the new H L machine, but unfortunately only one procedure was successful. This instilled hopelessness in Gibbon, who declared a cease in the use of his creation even though the causes of these losses were misdiagnoses and technical issues. (2)

[Model II (Gibbon Jr., "Double Portrait," 1963; "Heart Lung Machine," 1953, Thomas Jefferson University Archives & Special Collections)]

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Dr. Gibbon's invention, despite his later pessimism about its efficacy, became the eventual blueprint for the modern heart lung machine. Physicians essential to the history of CPB, such as John Kirklin of the Mayo Clinic, saw its potential and expanded upon it, recognizing the Model II for its worth and combining it with Dr. Walter Lillehei of the University of Minnesota's essential work on cross circulation. The failures that occurred after its first success not only led to improvements in the machine itself but also pioneered the field of cardiovascular perfusion. Furthermore, the expansion of cardiac anesthesia research became crucial to eliminating errors during these procedures. As these aspects progressed in efficiency and safety, the heart lung machine was increasingly integrated into cardiac surgery. Today, the modern version of the instrument is an essential tool used daily for a wide range of complex cardiac repairs, from atrial and ventricular septal defect repair, to coronary artery bypass grafting, general valve repair, and groundbreaking heart transplantation surgery. None of it could have been possible without the ability to perform CPB. (8)

A precedent was set by the Gibbon IBM Heart Lung Machine Model II, as it fundamentally engineered the way open heart surgery would be safely performed. Despite its successes and failures, physicians sought to utilize its technology, acknowledging that, risks aside, the tool could be refined. Now, multiple times a day, skilled teams of surgeons, anesthesiologists, perfusionists, nurses, and physician assistants work cohesively alongside the H L machine to achieve what was only recently considered impossible.

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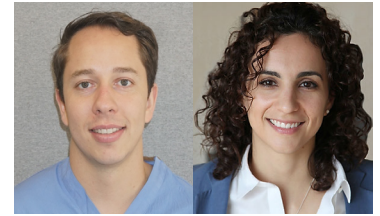
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Educational Workshop- Gastric Ultrasound

Miguel Magallanes Esqueda, MD

Liana Victoria Zucco, MD



OVERVIEW

The department's workshop series has drawn on faculty, fellows, and residents across several subspecialties.

Dr. Liana Victoria Zucco coordinated the major gastric ultrasound workshop, which had promising stations and consisted of a dynamic and interactive day.

May 22: Ultrasound workshop led by Michael Li.

June 24: Ultrasound workshop spearheaded by Michael Li.

July 8: Education Resources Workshop.

Additional contributors: Peter Santer, Matthew Gao, Matthew Heron, Sahil Amin

Simulation colleagues: Nadav Levy, Federico Puerta Martinez, and Yitzhak Brzezinski Sinai contributed on the day as well.

The Center for Education Research, Technology and Innovation (CERTAIN) within the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center hosted a multidisciplinary educational workshop on perioperative gastric ultrasound on July 22, 2026. The workshop was developed to strengthen learners' understanding of gastric ultrasound as a point-of-care tool for aspiration risk assessment by combining foundational educational material with hands-on image acquisition, clinical decision-making, and immersive simulation.

PARTICIPANTS AND FORMAT

Participants included anesthesiology interns, residents, fellows, faculty anesthesiologists, and medical students. Before attending the workshop, learners completed introductory educational content through the department's learning management system (Docebo), including interactive Articulate Storyline modules and foundational presentations covering gastric anatomy, image acquisition, and the clinical application of gastric ultrasound. During the workshop, participants rotated through five educational modules designed to reinforce both technical and clinical competencies. These modules focused on assessment of clear gastric contents, dynamic evaluation of gastric emptying, and clinical management of aspiration risk and GLP-1 receptor agonist therapy, together with immersive virtual reality simulation. The workshop concluded with three five-question knowledge assessments that allowed participants to reinforce key concepts and receive immediate feedback.

WORKSHOP MODULES

Module 1. Model With Empty Stomach

Attendees first examined a volunteer with an empty stomach to establish the baseline appearance of the gastric antrum. Faculty guided learners through probe positioning, optimization of image acquisition, and identification of key anatomical landmarks, including the left lobe of the liver, gastric antrum, pancreas, aorta, and inferior vena cava. This module established the normal reference examination that served as the foundation for subsequent modules. Faculty also demonstrated common scanning pitfalls and techniques to optimize image quality, allowing participants to recognize how subtle changes in probe position could significantly alter image interpretation. Emphasis was placed on developing a systematic scanning approach that learners could consistently reproduce in clinical practice.



Module 2. Model With Full Stomach (Clears)

Using the same volunteer, participants first reviewed the empty stomach examination and then repeated the scan immediately after ingestion of clear liquids. Comparing the two examinations in real time allowed learners to appreciate the characteristic ultrasound appearance of clear gastric contents and understand how gastric findings change following liquid intake. Faculty emphasized interpretation of these findings within the context of perioperative aspiration risk assessment. Participants were encouraged to identify the changes in antral appearance and discuss how these observations correlate with normal gastric physiology and current fasting recommendations. The real-time comparison reinforced the importance of integrating ultrasound findings with clinical history rather than relying solely on reported fasting intervals.

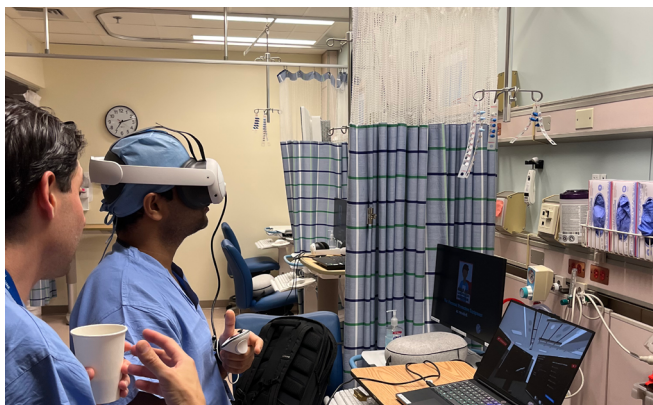
Module 3. Model With Full Stomach (Solids)

Participants evaluated a volunteer following ingestion of a standardized meal to identify the ultrasound appearance of solid gastric contents. Faculty encouraged comparison with the empty stomach and clear liquid examinations, reinforcing recognition of distinct imaging characteristics associated with each gastric content state. Discussion focused on how these findings influence aspiration risk assessment and perioperative planning. Participants reviewed qualitative features that distinguish solid from liquid gastric contents and discussed how these findings may alter anesthetic management in patients with uncertain fasting status or conditions associated with delayed gastric emptying. This comparative approach strengthened learners' confidence in differentiating clinically relevant gastric content patterns during point-of-care assessment.

Module 4. GLP-1 and Management of Aspiration

This discussion-based module focused on integrating gastric ultrasound findings into perioperative decision-making through review of departmental quality improvement data and current clinical guidance. Faculty presented findings from an ongoing quality improvement initiative examining perioperative aspiration events within the department, using local incident reviews to identify clinical settings associated with a higher risk of aspiration and to illustrate how institutional experience has informed current practice. These data provided participants with practical insight into how aspiration events are recognized, analyzed, and translated into quality improvement initiatives. Building on this foundation, participants reviewed the department's updated recommendations for perioperative management of patients receiving GLP-1 receptor agonists, including the rationale behind recent changes in practice. Faculty emphasized how gastric ultrasound can complement clinical assessment when aspiration risk is uncertain and discussed its role alongside patient history, fasting status, and procedural urgency when planning anesthetic care. Participants also received a concise reference guide summarizing the department's recommendations for future clinical use.

The workshop also included immersive virtual reality simulation developed by Vantari Systems. Attendees practiced probe orientation, spatial anatomy, and image acquisition in a three-dimensional environment that allowed real-time visualization of ultrasound images alongside probe movement. This simulation complemented the hands-on modules by providing additional opportunities to reinforce technical skills, improve anatomical understanding, and strengthen confidence in gastric ultrasound examination.





Module 5. Virtual Reality Gastric Ultrasound Simulation

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Module 6. A Crisis

The workshop concluded with a high-fidelity simulation designed to integrate gastric ultrasound into perioperative crisis management. Set in the post-anesthesia care unit (PACU), the scenario required learners to evaluate aspiration risk as the patient's condition evolved and to use gastric ultrasound findings, together with the clinical presentation, to guide perioperative decision-making. The simulation was conducted using a Rapid Cycle Deliberate Practice (RCDP) approach, allowing participants to receive immediate feedback, refine their management strategies, and reinforce key clinical actions through repeated practice. This module provided participants with an opportunity to apply the knowledge and skills developed throughout the workshop in a realistic, time-sensitive clinical setting.

CONCLUSION

The educational workshop provided attendees with a structured and interactive approach to learning perioperative gastric ultrasound through progressive, clinically relevant experiences. By combining image acquisition, interpretation of normal and pathologic findings, simulation, and evidence-based clinical discussion, learners strengthened both technical skills and clinical reasoning while building confidence in applying gastric ultrasound to perioperative decision-making. The integration of immersive technologies, departmental quality improvement initiatives, and simulation-based education further emphasized the practical application of gastric ultrasound in modern anesthetic practice. Educational programs that incorporate multiple complementary teaching strategies may enhance learner engagement while facilitating the translation of knowledge into perioperative patient care.



[Click here to learn how to evaluate aspiration risk with gastric ultrasound](#)



A Percutaneous Alternative to Surgical Excision of Atrial Tumors

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Ruma Bose, MD



ABSTRACT

Cardiac masses include a broad range of neoplastic and non-neoplastic conditions, with myxoma representing the most common primary cardiac tumor. Surgical excision has long been standard of care. This review introduces the Simplified Extraction of Atrial Tumor with Targeted Loop Electricity (SEATTLE) procedure, a percutaneous technique that combines electrosurgical resection with endovascular retrieval to remove intracardiac masses without sternotomy. We provide a classification framework for cardiac masses and outline the technical steps of the SEATTLE procedure.

INTRODUCTION

Cardiac masses range from benign, incidentally discovered lesions to malignant tumors. Myxoma is the most common primary cardiac tumor in adults and typically arises from the interatrial septum. Surgical excision has been considered the definitive treatment. However, less invasive catheter-based techniques are emerging as potential alternatives. Understanding the broader classification of cardiac masses, along with minimally invasive treatment options, is increasingly relevant for trainees in cardiology, cardiac surgery, and structural heart disease. This review summarizes the classification of cardiac masses and introduces the SEATTLE procedure, a percutaneous technique for intracardiac tumor removal.

CLASSIFICATION OF CARDIAC MASSES

Cardiac masses are broadly divided into neoplastic and non-neoplastic categories (Table 1). Neoplastic masses are further subdivided into primary tumors — which may be benign or malignant — and metastatic tumors. Non-neoplastic masses, including thrombus and vegetations, are frequently encountered in clinical practice and must be distinguished from true tumors using multimodality imaging.

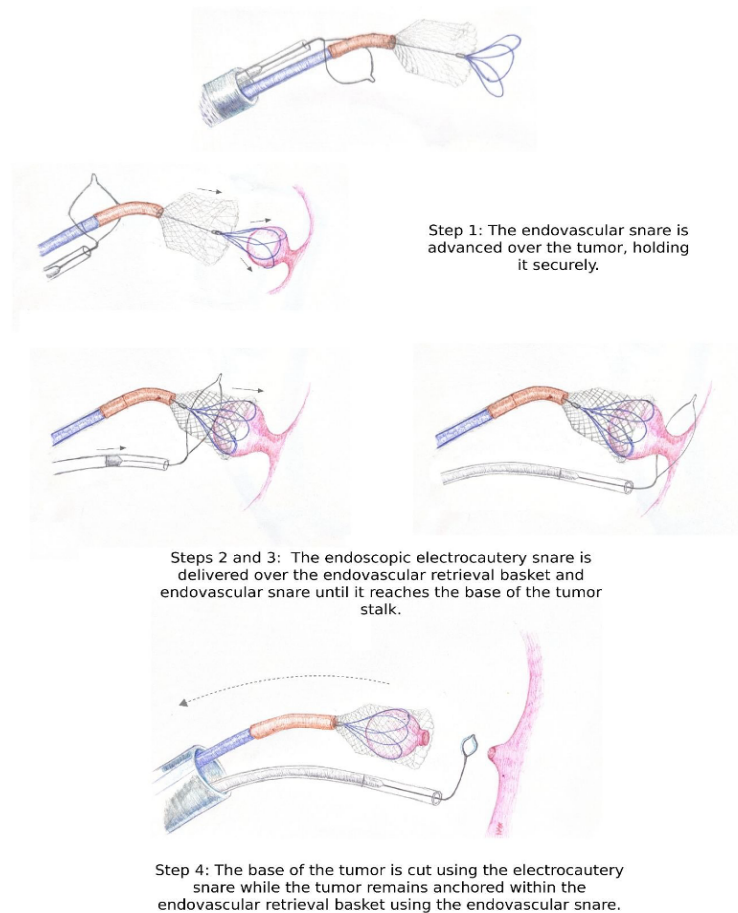
Table 1. Classification of cardiac masses

Category	Examples	Typical location	Standard management	Gold standard imaging
Benign neoplasm	Myxoma, fibroma, lipoma, papillary fibroelastoma, rhabdomyoma, angioma, schwannoma, cystic tumor of the atrioventricular node	Left or right atrium (myxoma); ventricle and ventricular septum (fibroma); valve leaflets (fibroelastoma)	Surgical excision (traditional); percutaneous excision emerging for select myxomas	Echocardiography & cardiac MRI (myxoma); echocardiography (fibroelastoma); cardiac MRI (lipoma)
Malignant neoplasm	Angiosarcoma, rhabdomyosarcoma, myxosarcoma, fibrosarcoma, malignant peripheral nerve sheath tumors	Right atrium (angiosarcoma); ventricles (rhabdomyosarcoma)	Surgery, chemotherapy, and/or palliation depending on stage	Cardiac MRI, biopsy
Metastatic tumor	Melanoma, lung, breast, renal cell carcinoma, lymphoma, leukemia	Epicardium, myocardium, endocardium	Treatment of primary malignancy; palliative measures	Cardiac MRI, cardiac CT, PET, biopsy
Thrombus	Left atrial or left atrial appendage thrombus, left ventricular thrombus	Left atrial appendage, left ventricle apex	Anticoagulation ± percutaneous or surgical removal	Cardiac MRI
Vegetation	Infective endocarditis	Valve leaflets	Antibiotics ± surgery	Transesophageal echocardiography
Pericardial cyst	Simple pericardial cyst	Cardiophrenic angle	Observation	Cardiac MRI, cardiac CT
Lipomatous hypertrophy	Lipomatous hypertrophy of the interatrial septum	Interatrial septum	Observation	Cardiac MRI



TECHNIQUE AND PROCEDURAL STEPS

The Simplified Extraction Of Atrial Tumor with Targeted Loop Electricity, or SEATTLE, procedure was first described by Zachary L. Steinberg, James M. McCabe and colleagues in 2023 as a percutaneous approach to atrial myxoma removal. The technique pairs transcatheter electrosurgery with a dedicated endovascular retrieval system, avoiding the need for surgery. The procedure is performed under general anesthesia with continuous transesophageal echocardiographic guidance. Vascular access is obtained, typically through the femoral vein. Echocardiographic imaging is used throughout the procedure to visualize the mass, confirm catheter position, and monitor for complications such as embolization or pericardial effusion. Once access to the tumor has been established, a steerable sheath is passed through the loop of an endoscopic electrocautery snare. An expandable endovascular retrieval system is then introduced through the steerable sheath, and an endovascular snare catheter is directed through the central lumen of the retrieval basket. The assembled system is pushed forward through the femoral venous sheath, with the electrocautery snare remaining outside and encircling the steerable sheath. Under echocardiographic guidance, the endovascular snare is passed over the atrial mass to capture and stabilize it. The expandable retrieval basket is then advanced over the mass to provide additional containment. Once the mass is secured, the electrocautery snare is advanced over the retrieval basket and endovascular snare to the base of the tumor stalk. The stalk is severed by retracting the electrocautery loop into its protective casing while delivering electrocautery energy, thereby separating the tumor from the atrial wall while it remains secured within the retrieval system. The detached tumor and retrieval basket are subsequently withdrawn together into the steerable sheath and removed through the femoral venous access. The extracted mass is then sent for pathological evaluation.



A step-by-step illustration of the SEATTLE procedure is provided in the companion figures document (Figure 1).



CONCLUSION

The SEATTLE procedure represents a percutaneous approach for the removal of selected atrial myxomas. This technique may offer patients an option that does not require sternotomy or cardiopulmonary bypass. Although the initial case demonstrated technical feasibility, further studies are needed to establish its safety, long-term outcomes, and role compared with conventional surgical excision.

Key Take Away Points

1. Cardiac masses include both tumors and non-tumor conditions: They may represent benign or malignant tumors, thrombi, vegetations, or other lesions. Multimodality imaging is important for accurate diagnosis and treatment planning.
2. Surgery remains the standard treatment for atrial myxomas: However, percutaneous removal may provide a less invasive option for carefully selected patients, particularly those at high surgical risk.
3. The SEATTLE procedure combines tumor resection and retrieval: An electrocautery snare cuts the tumor stalk while an endovascular snare and basket secure the mass for removal through femoral venous access.
4. The technique is promising but remains investigational: Early experience has shown that percutaneous removal is technically feasible, but larger studies are needed to establish its safety, long-term outcomes, and role compared with surgery.

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Anesthesia for Transvaginal Cervical Cerclage

Maria Borrelli, DO, Cecilia Uong, MD, and Yunping Li, MD



Background

Spinal anesthesia is the preferred anesthetic for transvaginal cervical cerclage due to risks associated with general anesthesia in the pregnant patient. The rate of spinal failure varies from <1% to as high as 17%^{1,2}. This may be due to procedural experience, different medications/doses, as well as patient characteristics.³ While this is typically a scheduled ambulatory procedure, it may need to be performed more urgently (during off hours). At Beth Israel Deaconess Medical Center, cervical cerclage is performed in the main operating room and parturients may be managed by any anesthesia provider. Important to note, we found significant variability in the choice of anesthesia and spinal medication dosing for cerclages performed at our institution. We developed a comprehensive and standardized guideline for anesthetic management of cervical cerclage to help ensure patient safety, optimize clinical outcomes, and minimize complications associated with anesthesia administration.⁴

Preoperative Assessment

A thorough preoperative assessment is essential before anesthetic management. This should include review of the pre-surgical evaluation as well as any obstetric and/or maternal-fetal medicine consultations. Patients should also be evaluated for factors that may complicate neuraxial anesthesia: history of spinal surgery, scoliosis, obesity, or previous difficult neuraxial placements. In addition, laboratory results and anticoagulation status should also be reviewed to ensure that neuraxial anesthesia can be performed safely.

Patient Preparation

Patient preparation includes obtaining standard informed consent and establishing intravenous access. Patients should be counseled on what to expect during the procedure, including the anesthetic plan, positioning, anticipated sensations, and postoperative recovery. Aspiration prophylaxis should be administered with a non-particulate antacid and/or famotidine to reduce the risk of aspiration. Midazolam is not contraindicated during pregnancy and may be administered in small doses (1–2 mg) for pre-procedure anxiolysis when clinically indicated. A pre-procedure fetal heart tracing (FHT) should be documented to establish fetal well-being before surgery. Intravenous acetaminophen (1 g) may also be administered as part of a multimodal analgesic strategy.

Intraoperative Anesthetic Management

In the operating room, standard ASA monitors should be applied before neuraxial placement, and laboratory results/anticoagulation status should be re-confirmed prior to procedure start. We recommend using the smallest feasible non-cutting (atraumatic) spinal needle (e.g., 25-gauge Sprotte needle) to reduce the risk of post-dural puncture headache. Intravenous fluid co-loading should also be initiated during spinal placement to help minimize spinal-induced hypotension. In cases of technical difficulty, neuraxial ultrasound may be utilized, and assistance should be requested early.

Cerclage surgery requires sacral coverage, so an intrathecal hyperbaric solution is the ideal choice — bupivacaine 0.75% in dextrose 8.25% (preservative-free), 1–1.2 mL. We also recommend intrathecal fentanyl 15–25 mcg for improved analgesia (particularly for visceral pain) and increased duration of block. Intrathecal chloroprocaine 2% (preservative-free) may also be considered, which may provide shorter block duration and potentially shorter PACU discharge time; however, there is less data on its safety and effectiveness intrathecally. After spinal administration, the patient should remain seated (approximately 2 minutes) to achieve an adequate saddle block.

Left uterine displacement is required if gestational age is >18 weeks (or the uterus is at the level of the umbilicus). It is important to maintain physiologic pregnancy homeostasis, specifically normotension, to preserve placental blood flow; we recommend phenylephrine as the first-line vasopressor for hypotension. If the patient requires sedation, midazolam or propofol may be administered in small doses with close monitoring of oxygenation, ventilation, and blood pressure. If a propofol infusion is required, we recommend a low-dose infusion (20–80 mcg/kg/min), with priority given to avoiding deep sedation.



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Postoperative Care

A postoperative fetal heart tracing (FHT) should be documented to establish fetal well-being after surgery. Patients usually have minimal pain but may benefit from acetaminophen (if not given pre-operatively).

Category	Recommendation
Preparation	Apply ASA monitors: re-confirm labs and anticoagulation status before starting.
Needle and technique	Smallest atraumatic needle (e.g. 25 G Sprotte). Use ultrasound and call for help early if difficult.
Fluids	IV co-loading during spinal placement to limit hypotension.
Intrathecal drug	Bupivacaine 0.75% in dextrose 0.25% (PF), 1-1.2 mL, for sacral coverage.
Adjunct	Fentanyl 15-25 mcg for analgesia and longer block duration.
Alternative	Chloroprocaine 2% (PF): shorter block, faster PACU discharge, less safety data.
Positioning	Sit upright ~ 2 min for saddle block; left uterine displacement if GA > 18 weeks.
Hemodynamics	Maintain normotension for placental flow: phenylephrine first line.
Sedation	Small-dose midazolam/propofol with close monitoring: if infusion, 20-80 mcg/kg/min, avoid deep sedation.

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Key Take Away Points

- Spinal anesthesia is preferred over general anesthesia for transvaginal cervical cerclage in pregnant patients; reported failure rates range from <1% to 17%.
- A standardized institutional guideline for anesthetic and spinal medication dosing was developed to reduce variability and optimize safety.
- Intrathecal hyperbaric bupivacaine 0.75% (1–1.2 mL) with fentanyl 15–25 mcg is the recommended spinal regimen to achieve the sacral coverage cerclage requires.
- Left uterine displacement is required at ≥ 18 weeks gestation, and phenylephrine is recommended first-line for spinal-induced hypotension.



Evidence in Focus: Clinical Advances in Anesthesiology

Rafai Babar, MBBS
Robina Matyal, MD



Ketamine or Etomidate for Tracheal Intubation of Critically Ill Adults [\[Read the article\]](#)

doi:10.1056/NEJMoa2511420.

Ketamine and etomidate are commonly used for induction during emergency tracheal intubation, particularly when hemodynamic instability is a concern. Etomidate has traditionally been favored for cardiovascular stability but remains controversial because of adrenal suppression and concern that this might adversely affect outcomes in critically ill patients. Ketamine is frequently considered an alternative, in part because its sympathomimetic effects are thought to provide greater hemodynamic stability. This multicenter randomized trial directly compared the two agents in 2,365 critically ill adults undergoing emergency tracheal intubation across 14 emergency departments and intensive care units in the United States.

In-hospital mortality by day 28 (the primary outcome) did not differ significantly between ketamine and etomidate (28.1% vs. 29.1%; 95% CI, -4.5 to 2.9; $P=0.65$). Cardiovascular collapse during intubation, however, occurred more frequently with ketamine (22.1% vs. 17.0%; 95% CI, 1.9-8.3). Cardiovascular collapse was defined as systolic blood pressure <65 mmHg, initiation or escalation of vasopressor therapy, or cardiac arrest during the peri-intubation period.

The trial provides no evidence that choosing ketamine instead of etomidate improves survival in critically ill adults and challenges the assumption that ketamine is necessarily the more hemodynamically stable induction agent. The findings do not establish etomidate as the appropriate agent for every critically ill patient, but they provide strong randomized evidence against selecting ketamine solely on the expectation of superior cardiovascular stability during emergency intubation.

Commentary

This is the largest randomized comparison of ketamine and etomidate for emergency intubation and helps resolve uncertainty left by earlier trials. Matchett and colleagues randomized 801 critically ill patients at a single center and reported higher 7-day survival with ketamine than with etomidate (85.1% vs 77.3%; $P=0.005$), although the difference was no longer significant by day 28.¹ The present trial, nearly three times larger and conducted across 14 sites, found no mortality advantage with ketamine.

The cardiovascular-collapse signal may be more clinically informative. Ketamine's sympathomimetic effects can support blood pressure, but this benefit may be less predictable in patients with severe physiologic stress or depleted catecholamine reserve. The current trial does not establish a specific mechanism for the higher collapse rate, and induction dose, baseline shock severity, vasopressor use, and pre-intubation optimization remain important potential modifiers. The practical message is therefore not that etomidate is universally preferable, but that ketamine should not be assumed to provide superior hemodynamic protection simply because the patient is critically ill. Recent pooled randomized evidence has reached a similar conclusion, showing comparable mortality but greater peri-intubation hemodynamic instability with ketamine.²

Videolaryngoscopy versus direct laryngoscopy for double-lumen tube intubation: the DOLVI multicentre randomised trial [\[Read the article\]](#)

doi:10.1016/j.bja.2026.02.048.

The DOLVI trial compared videolaryngoscopy with direct laryngoscopy for double-lumen tube placement in 916 adults undergoing surgery requiring lung isolation at four hospitals. First-attempt intubation success (the primary outcome) was 84.7% with videolaryngoscopy compared with 76.9% with direct laryngoscopy, an absolute differ-



ence of 7.9 percentage points. Videolaryngoscopy also provided better glottic views and reduced airway manipulation, esophageal intubation, and initial tube malposition, without increasing intubation time.

These findings provide multicenter randomized evidence supporting videolaryngoscopy for double-lumen tube placement. The reduction in tube malposition is particularly relevant because it suggests that the advantage extends beyond improved visualization of the glottis to successful passage and positioning of a technically challenging airway device. The study was necessarily unblinded and was performed in centers experienced with videolaryngoscopy, and it was not powered to detect differences in uncommon complications such as airway injury or severe hypoxemia. Nevertheless, the improvement in first-pass success and multiple procedural outcomes supports videolaryngoscopy as a preferred initial approach to double-lumen intubation.

Commentary

The main challenge with videolaryngoscopy for double-lumen tubes is not obtaining a good view, but advancing and positioning a large, relatively rigid tube. DOLVI is therefore clinically useful because videolaryngoscopy reduced loss of glottic view during tube passage and initial tube malposition, suggesting an advantage beyond visualization alone. Airway trauma remains an important concern with double-lumen tubes, particularly after difficult or repeated manipulation.^{3,4} Although DOLVI was not powered to detect rare injuries such as tracheobronchial rupture, fewer attempts and fewer malpositions are directionally reassuring. Videolaryngoscopy also offers a practical teaching advantage by allowing the trainee and supervisor to share the same airway view.

Anesthesia Type during Cancer Surgery: Results of the GA-CARES Randomized, Multicenter Trial

[\[Read the article\]](#)

doi:10.1097/ALN.0000000000005769.

GA-CARES tested whether propofol-based total intravenous anesthesia improves long-term oncologic outcomes compared with volatile anesthesia. The hypothesis had been supported by laboratory and observational studies suggesting that propofol might better preserve antitumor immunity. Patients undergoing resection of malignancies at relatively high risk of recurrence were randomized to propofol-based or volatile general anesthesia. In the intention-to-treat population of 1,763 patients, mortality was 26.1% with propofol and 22.9% with volatile anesthesia (HR, 1.16; 95% CI, 0.96-1.41; $P=0.115$). Disease-free survival was also not significantly different (HR, 1.10; 95% CI, 0.90-1.36).

The trial therefore does not support choosing propofol-based anesthesia specifically to improve cancer survival or reduce recurrence. Mortality was higher with propofol in a secondary per-protocol analysis, but this should not be interpreted as evidence that propofol causes harm because exclusions occurring after randomization compromise the causal protection provided by randomization. GA-CARES is important because it subjects a biologically plausible hypothesis, previously supported predominantly by mechanistic and observational evidence, to a large randomized comparison and finds no oncologic advantage from propofol.

Commentary:

This study builds on two previous randomized trials that found no oncologic advantage from propofol-based anesthesia. Sessler et al found no reduction in breast cancer recurrence with propofol-paravertebral anesthesia compared with sevoflurane-opioid anesthesia, while the CAN study found no difference in 5-year overall survival between propofol and sevoflurane.^{5,6} Both studies, however, involved breast cancer populations with relatively favorable prognoses and consequently low rates of recurrence and death.

GA-CARES addressed this limitation by enrolling patients with malignancies at higher risk of recurrence and mortality, providing more outcome events with which to detect a clinically meaningful difference. Despite this higher-risk population, propofol again provided no survival or disease-free survival benefit. Taken together, these randomized trials provide increasingly consistent evidence that anesthetic technique should not be selected on the expectation that propofol will reduce cancer recurrence or improve survival.



Liposomal Bupivacaine, Plain Bupivacaine, and Saline for Transversus Abdominis Plane Blocks: The CLEVELAND Randomized Trial [\[Read the article\]](#)

doi:10.1097/ALN.0000000000005869.

The CLEVELAND trial tested whether transversus abdominis plane (TAP) blocks provide meaningful analgesia after abdominal surgery and whether liposomal bupivacaine offers an advantage over conventional bupivacaine. Patients undergoing open and laparoscopic abdominal surgery were randomized to pre-incision bilateral four-quadrant TAP blocks with liposomal bupivacaine, plain bupivacaine, or saline. Among 261 patients in the modified intention-to-treat analysis, median opioid consumption during the first 24 hours was 26, 33, and 31 morphine milligram equivalents, respectively. Neither treatment significantly reduced opioid consumption compared with saline. Pain scores and opioid requirements during subsequent postoperative assessments were also similar.

The findings question the routine use of pre-incision, single-shot four-quadrant TAP blocks in a heterogeneous abdominal surgical population and provide no evidence of additional benefit from liposomal bupivacaine in this setting. The results should not be generalized to every application of TAP blockade: the surgical population was heterogeneous, all patients received multimodal analgesia, and the study did not evaluate continuous catheter techniques or procedure-specific approaches. Nevertheless, the inclusion of a saline control makes this an important reassessment of an intervention whose efficacy has often been inferred from comparisons between different local anesthetic formulations rather than against placebo.

Commentary:

One question raised by CLEVELAND is whether block adjuvants might have produced a different result. Perineural dexamethasone and dexmedetomidine can prolong analgesia after peripheral nerve blocks, although most supporting evidence comes from conventional peripheral nerve blocks rather than fascial-plane techniques. Perineural dexamethasone provides only a modest prolongation compared with intravenous administration, while dexmedetomidine can extend analgesia but is associated with increased bradycardia and hypotension.^{7,8}

Whether either would improve the results of a TAP block remains uncertain. Adjuvants primarily prolong an effective block; CLEVELAND found no significant analgesic advantage of the underlying single-shot four-quadrant TAP technique over saline. The more important question raised by the trial is therefore not how to prolong the block, but whether this particular TAP-block strategy provides sufficient analgesic benefit to justify its routine use.

Key Take Away Points

- **Emergency Intubation:** Ketamine offered no survival advantage over etomidate and was associated with more cardiovascular collapse during intubation.
- **Double Lumen intubation:** Videolaryngoscopy improved first-pass success and reduced initial tube malposition without prolonging intubation time.
- **Cancer Surgery:** Propofol-based anesthesia did not improve survival or disease-free survival compared with volatile anesthesia, challenging a long-standing oncologic hypothesis.
- **TAP blocks:** Neither plain nor liposomal bupivacaine provided a significant analgesic advantage over saline, questioning routine use of this single-shot TAP-block strategy



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Introduction

The R-on-T phenomenon is a form of ventricular ectopy in which a premature ventricular depolarization occurs during the vulnerable phase of ventricular repolarization. Since this period represents a transition between refractory and excitable myocardium, an R-on-T beat can precipitate malignant ventricular arrhythmias.

Mechanism

During the T wave, ventricular recovery is heterogeneous, leaving some myocardial fibers refractory while others have regained excitability. If a premature ventricular impulse falls within this vulnerable window, it may encounter areas of conduction block and areas capable of conducting, promoting re-entry and potentially degenerating into polymorphic ventricular tachycardia or ventricular fibrillation.

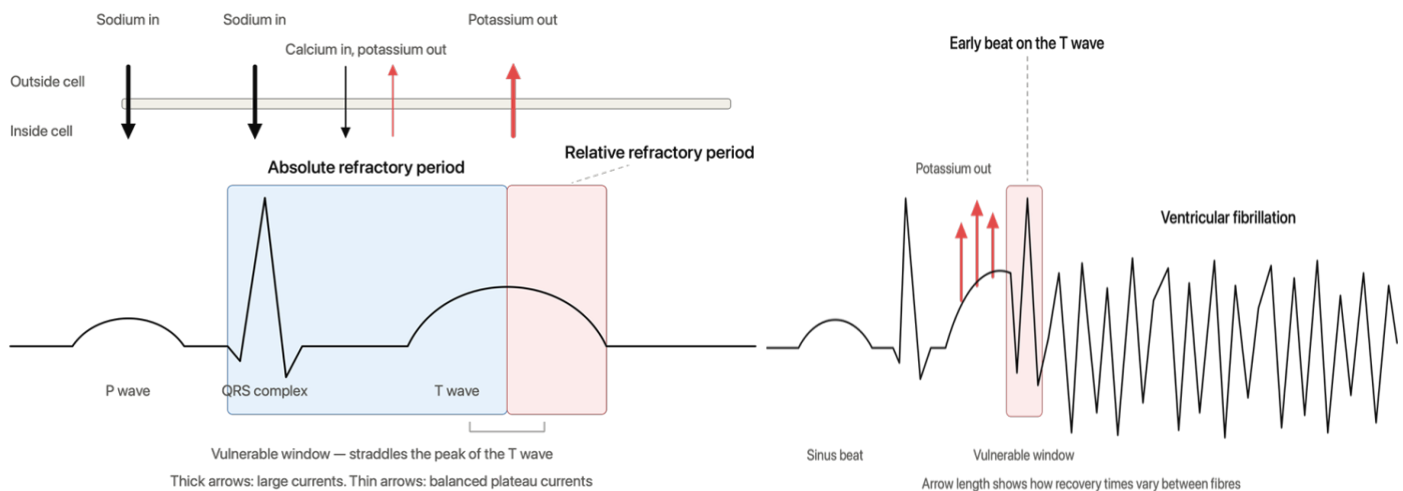


Figure 1. Pathophysiology of R-on-T Phenomenon and Ventricular Fibrillation.

Left: Cardiac ion movements (Na^+ influx, Ca^{2+} influx, K^+ efflux) aligned with ECG refractory periods, highlighting the vulnerable period during repolarization (T wave).

Right: An early premature ventricular contraction (PVC) landing precisely on the vulnerable T-wave phase initiates disorganized ventricular fibrillation due to inhomogeneous tissue recovery.

Causes

Any depolarization arriving in the vulnerable window can cause it: a short-coupled ectopic, a paced beat following undersensing, or an ectopic in a heart with a prolonged QT interval from hypokalemia or hypomagnesemia. The important iatrogenic cause is a cardioversion shock delivered without synchronization, which lands wherever it falls in the cycle - including on the T wave.

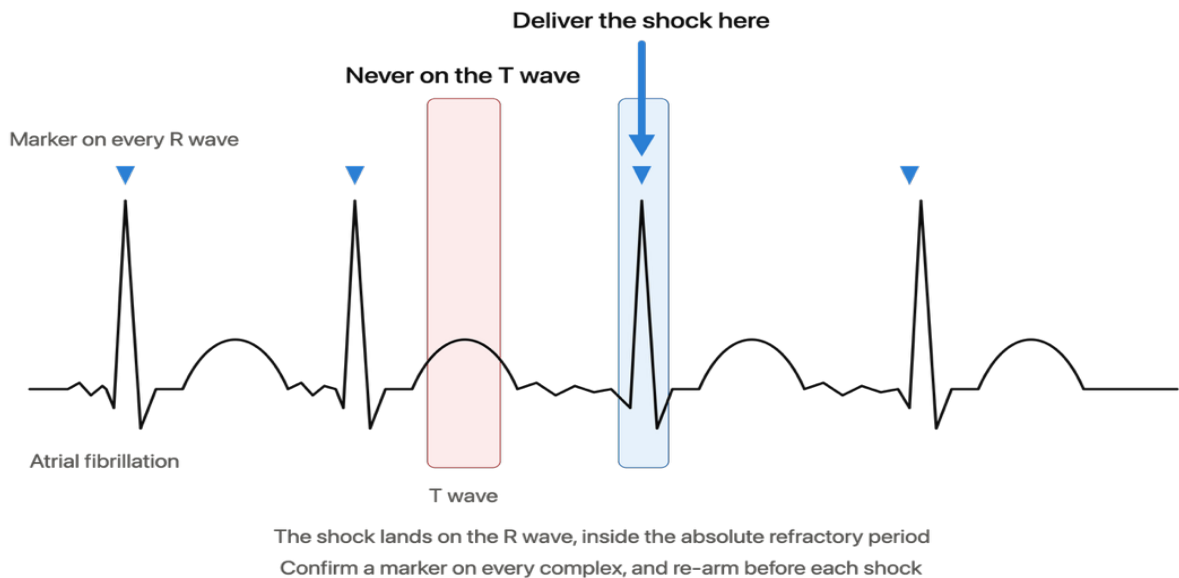


Figure 2. Synchronization Timing in Cardioversion.

Illustration of an ECG tracing showing synchronized shock delivery on the R wave peak. Precise timing prevents electrical discharge during ventricular repolarization (T wave), preventing the R-on-T phenomenon and subsequent malignant arrhythmias.

Management

Prevention is the priority: restoring sinus rhythm, by synchronized cardioversion or pharmacological conversion, removes the short–long–short sequences that generate the substrate, whereas rate control leaves them intact. When performing electrical cardioversion, activating synchronization mode is vital to prevent the R-on-T phenomenon (Figure 2). Potassium and magnesium should be corrected, since a deficit widens the vulnerable window. Once ventricular fibrillation has developed, unsynchronized defibrillation is the only option.

Key Takeaways

1. In atrial fibrillation the ventricular arrhythmia risk comes from the irregularity, not the rate, short–long–short sequences generate the R-on-T substrate beat to beat.
2. The one cause of R-on-T fully under the clinician's control is the shock itself - confirm synchronization markers on every complex before discharging, and correct potassium and magnesium.
3. Timing is protective only while an organized rhythm persists. Once R-on-T has degenerated into ventricular fibrillation, unsynchronized defibrillation is the only option.

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NEWS CORNER

Celebrating Our Education Fellows



Congratulations to Dr. **Dario Winterton** and Dr. **Federico Puerta Martinez** on completing their Education Fellowships. Both were also recognized with **departmental teaching awards**, highlighting their contributions to education and teaching within the department. Congratulations to Dario and Federico on these well-deserved achievements

Simulation Education Recognized at Shapiro Education Week

Our department was also represented by Jacqueline Hannan at **Shapiro Education Week**, where a faculty-led simulation education project by Jacqueline was presented as a poster and received an **Honorable Mention for Best Simulation Education Project**. This recognition highlights the department's continued commitment to innovation in simulation-based medical education.

Gamification in CA-1 Simulation Training

Noor Dirini recently led a training session and full-day simulation experience for **CA-1 residents during Bootcamp Month**. The session incorporated **gamification as an educational strategy to teach residents about ventilation alarms**, providing an interactive approach to learning and responding to important intraoperative scenarios.

Rabkin Award Recognition

Congratulations to Dr. Maria Borrelli on her participation in the Rabkin Fellowship in Medical Education. Through seminars, educational scholarship, and project-based learning, fellows strengthen their skills in teaching, education research, leadership, and creating meaningful educational change. The program also brings together a community educators committed to advancing medical education.

Recent Education Workshops

The department has also continued its educational workshop series over the past several months. Recent sessions have included:

May 22: Ultrasound workshop led by **Michael Li**

June 24: Ultrasound workshop led by **Michael Li**

July 8: Education Resources Workshop



Introducing Directorship for CERTAIN

Dr. Daniel Walsh



We are delighted to introduce Dr. Walsh as the new Clinical Director of CERTAIN. Dr Walsh has demonstrated a depth of academic leadership and clinical direction as he begins his ninth academic year as faculty here at BIDMC. After completing anesthesia residency at the University of Nebraska Medical Center, he came to BIDMC for his fellowship in Critical Care, where he has remained a central figure in both clinical care and education within the department. In 2024, he was appointed Assistant Professor of Anaesthesia at Harvard Medical School, further cementing his role as an academic leader in the field.

Dr. Walsh recently passed off the torch for his role as Medical Director of the ICU at Beth Israel Deaconess Hospital, Plymouth. A role he began in January of 2020, mere months before the world was over taken by a once-in-a-century pandemic.

He continues to serve as Associate Program Director of the Anesthesia Residency at BIDMC, which he began in 2019. Through this role he has become a driving force in educating the next generation of physicians towards best clinical practice. We are excited for the perspective Dr. Walsh brings as Director of CERTAIN- Center for Education Research, Technology, and Innovation (CERTAIN). His priorities for CERTAIN are to continue the support of education research within the department, work to create an internal certificate program in medical education, and support effective continuing education for the department through the Tuesday Scholarly Program and education division focused grand rounds sessions.

Introducing Residency Program Director

Dr. Aidan Sharkey



Dr. Aidan Sharkey graduated from the School of Medicine at Trinity College Dublin and completed his anesthesiology residency through the College of Anaesthesiologists of Ireland. He subsequently completed fellowship training in Cardiac Anesthesia at Toronto General Hospital, Canada, before joining Beth Israel Deaconess Medical Center as a staff anesthesiologist in 2018. His clinical practice focuses on adult cardiothoracic anesthesia, with particular interests in perioperative transesophageal echocardiography (TEE) and structural heart disease imaging.

Previously, as Clinical Associate Director of the Center for Education, Research, Technology and Innovation (CERTAIN), Dr. Sharkey helped develop simulation-based and technology-enhanced educational initiatives while supporting curriculum development and faculty innovation in medical education. He also serves as Program Director of the Adult Cardiothoracic Anesthesiology Fellowship and is actively involved in national education through the Society of Cardiovascular Anesthesiologists.

Dr. Sharkey is now the Program Director of the Anesthesiology Residency Program at Beth Israel Deaconess Medical Center, where he oversees the curriculum, education, and professional development of the department's anesthesiology residents.



NEWS CORNER

Introduction to Members of the CERTAIN Team



Daniel P. Walsh, MD



Maria C. Borrelli, DO



Mona Hedayat, MD



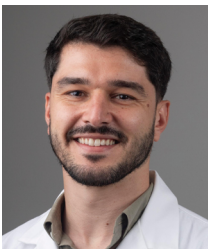
**Christopher Mallard,
MD**



Matthew H. Gao, DO



Vahid M. Kiarad, MD



Noor Dirini, MD



Introduction to the CERTAIN Team

Sumeeta Kapoor, MD



Sumeeta Kapoor, MD completed a fellowship in Perioperative and Advanced Clinical Anesthesia from October 2024 to September 2025 at Beth Israel Deaconess Medical Center (BIDMC). She subsequently pursued a fellowship in Anesthesia for Ambulatory Surgery from October 2025 to June 2026. She has accepted an offer to join the team of Staff Anesthesiologists at BIDMC, beginning July 1, 2026.

Prior to her fellowships at BIDMC, Dr. Kapoor completed a fellowship in Obstetric Anesthesia at University Hospitals, Case Medical Center, Cleveland, Ohio. She previously practiced as an anesthesiologist at multiple teaching and private hospitals in India before relocating to the United States.

Meghana Badari Narayan, MD



Dr. Meghana Badari Narayan joins the Department of Anesthesia, Critical Care and Pain Medicine as an Advanced Perioperative Clinical Anesthesia Fellow. She received her medical degree from Sathagiri Institute of Medical Sciences and Research Centre in Bengaluru, India, and completed her anesthesiology residency at ESI Medical College and Postgraduate Institute of Medical Sciences and Research, also in Bengaluru, where she subsequently practiced as an attending anesthesiologist.

Following her ECFMG certification, Dr. Narayan completed a clinical observership within the BIDMC Department of Anesthesia. Her academic interests center on perioperative ultrasound utilization and medical education.

Mansi Arora, MD



Dr. Mansi Arora completed her anesthesiology training in India, followed by a fellowship in Critical Care Medicine at Fortis Escorts Heart Institute, New Delhi. She subsequently served as an attending anesthesiologist in India and later at Queen Elizabeth The Queen Mother Hospital (NHS), United Kingdom.

After joining the department as a Clinical Research Fellow, Dr. Arora made significant contributions to several clinical trials in perioperative medicine over the past three years. The department is pleased to welcome her to her new role as an Advanced Perioperative Clinical Anesthesia Fellow in Vascular Anesthesia.

Siraj Ahmad, MBBS



Siraj Ahmad is a Research Fellow in the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center, Harvard Medical School. He earned his MBBS from Aga Khan University Medical College (Karachi, Pakistan) in 2025 and works within the Echo Lab, where his work centers on transthoracic and transesophageal echocardiography with a focus on mitral valve imaging. Outside of work, he enjoys football and tennis.



Rafai Babar, MBBS

Rafai is a Research Fellow in the Matyal Lab at Beth Israel Deaconess Medical Center. He earned his MBBS from Aga Khan University in Karachi, Pakistan, where he later worked as a research associate. In the Matyal Lab, his primary research focuses on the cellular and molecular mechanisms underlying perioperative cardiovascular dysfunction and their potential translation into improved outcomes after cardiac surgery. His interests also include digital innovation and medical education; he has co-developed a smartphone-based antimicrobial stewardship platform and is currently developing a searchable platform consolidating perioperative and anesthesia guidelines into a single point-of-care resource. His goal is to bridge bench science, clinical research, and digital innovation to accelerate the translation of evidence into improved patient care.



Shazaan Nadeem, MD

Shazaan is a Research Fellow at BIDMC and a GMC-registered Foundation Year 2

Doctor. She is currently developing her academic and research portfolio following her clinical training at Leicester Royal Infirmary, where she completed medical and surgical rotations at SHO level. Her academic work includes publications spanning artificial intelligence in medicine, ENT, and cardiology. She has a particular interest in medical education and scientific education, including hosting a podcast on Spotify, alongside developing her scientific writing and pursuing research in basic science.



Miguel Magallanes Esqueda, MD

Miguel is a Research Fellow at Beth Israel Deaconess Medical Center and a Master of Public Health candidate in Epidemiology and Biostatistics at Boston University School of Public Health. He earned his MD from Universidad Cuauhtemoc in Aguascalientes Mexico, where he later joined the faculty as an instructor in medical simulation and pathophysiology. In this role, he developed and delivered simulation-based educational activities and pathophysiology instruction, fostering a deeper understanding of physiology, clinical reasoning, and multidisciplinary patient care. His current work focuses on the development of innovative educational resources for anesthesiology trainees, and becoming actively involved in departmental teaching and academic initiatives. He looks forward to contributing to collaborative research projects on clinical and educational research.



Fatima Noor, MBBS

Fatima is a graduate of Foundation University Medical College (Islamabad, Pakistan) and has been a valued and integral member of our research lab at BIDMC since 2025. During this time, she has contributed to a range of research and medical education activities, including supporting ongoing research projects, assisting with the planning and delivery of educational workshops, and developing and organizing educational content for anesthesiology residents. She has also helped coordinate the Boston 3D ECHO Workshops and contributed to other academic initiatives. Through these experiences, she has developed a strong interest in research, medical education, and collaborative academic work.



Amna Irfan Ansari, MBBS

Amna is a Research Fellow with the Center for Education Research, Technology, and Innovation (CERTAIN) within the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center. She completed her MBBS at Aga Khan University Medical College in Karachi, Pakistan, in 2025, where she later trained as a House Officer. During her time at Aga Khan University, she was involved in curriculum development and innovation in assessment for undergraduate medical education. Her current work focuses on medical education and developing evidence-based protocols in perioperative medicine. Outside of work, she enjoys reading historical fiction.



Jacqueline Hannan, PhD

Dr. Jacqueline Hannan is a Staff Scientist in the Center for Education Research, Technology, and Innovation (CERTAIN) within the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center (BIDMC), where she supports ongoing anesthesia education research. Her research interests focus on the use of sensors for quantifying performance and enhancing feedback for clinical procedural training. She aims to develop objective, data-driven metrics that can better guide learners and instructors throughout the training process, helping to bridge the gap between skills training in a simulation environment and patient outcomes in the clinical environment.

Prior to working at BIDMC, Dr. Hannan completed her Bachelor of Science in biomedical engineering at the University at Buffalo and her PhD in industrial and operations engineering with a focus in human factors at the University of Michigan. Her dissertation research focused on the use of sensor technologies to evaluate neonatal ventilation strategies and to incorporate additional quantitative feedback into resuscitation training. nd digital innovation to accelerate the translation of evidence into improved patient care.



Peva Gbagornah, MD

Peva F. Gbagornah, MD, MSc, PMP, is a Research Project Manager in the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center and a physician with expertise in clinical research, medical education, and global health. He holds a Master of Medical Sciences in Global Health Delivery and Social Medicine from Harvard Medical School, an MSc in Diabetology from the University of Cardiff, and a Project Management Professional (PMP) certification. His research interests include perioperative ultrasound education, simulation-based training, mixed and augmented reality applications in anesthesia, and innovative approaches to procedural education. Dr. Gbagornah has previously held leadership roles in tuberculosis and infectious disease programs in Liberia and is actively involved in developing and implementing educational technologies to improve patient safety and clinician training.



Aviva Green, MD

Dr Aviva Green earned her medical degree from the Hebrew University of Jerusalem and completed her residency in anesthesiology at Hadassah University Medical Center. Her passion for medical education started during residency when she began mentoring groups of medical students on their anesthesia rotation. Since completing residency she has been a core member of the education team in the department of Anesthesia in Hadassah University Medical Center. We are delighted to welcome her in her new role as Medical Education Fellow.



Boston 3D Echocardiography Workshop 2026

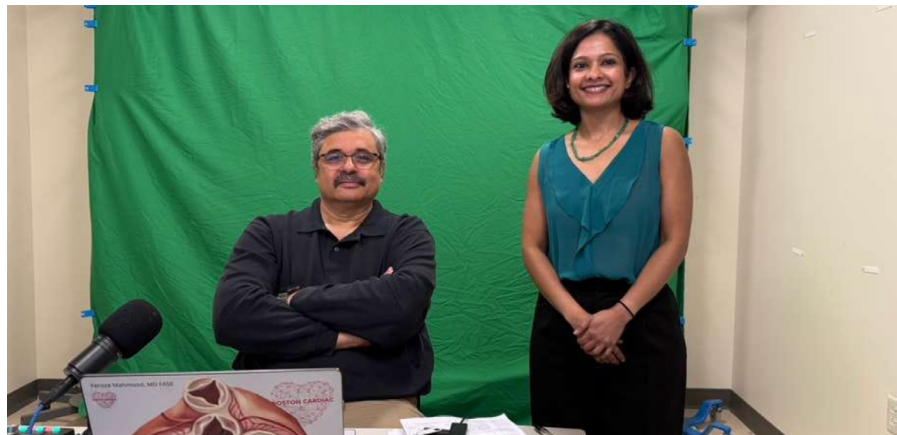
Dr Feroze Mahmood and Dr. Shweta Yemul Golhar

One of the highlights of 2026 was a landmark three-day course spearheaded by Dr. Feroze Mahmood on structural cardiac imaging. The Boston 3D Echocardiography Workshop drew more than 100 registrants from around the world to Beth Israel Deaconess Medical Center from June 12 to June 14, 2026, for an interactive 3D echocardiography imaging “boot camp” delivered as a hybrid live and virtual event.

The workshop was led by Dr. Feroze Mahmood and Dr. Shweta Yemul Golhar. The scale of participation reflected both the department’s renowned cardiology expertise and its in-house production capabilities, including live video recording, live production, and live course webcasting. Every lecture was paired with a hands-on workshop and an interactive Q&A session with a 16-member faculty panel, giving participants direct access to the clinicians shaping the field.

Day One covered the foundations of 3D imaging, filmed live within BIDMC’s cardiac imaging suites. The afternoon workshop translated the morning’s principles, the underlying physics of 3D echo imaging and transducer design, into practice, covering image acquisition optimization, multiplanar reconstruction review, and automated valve analysis. Participants observed imaging techniques exactly as practiced at the bedside, with faculty-led panel discussion throughout the day. Day Two focused on advanced valve and chamber assessment, and Day Three addressed procedural and structural heart applications.

This year’s response to the Boston 3D Echocardiography Workshop demonstrated how the department’s cardiology expertise, paired with in-house production and live delivery from within the hospital itself, can elevate the quality of cardiology education. The next annual 3D Echocardiography Masterclass is set for summer 2027.





Neuroanesthesia and Cerebral Perfusion

Siddhartha Reddy Janga, M.D.

Neuroanesthesia Fellow

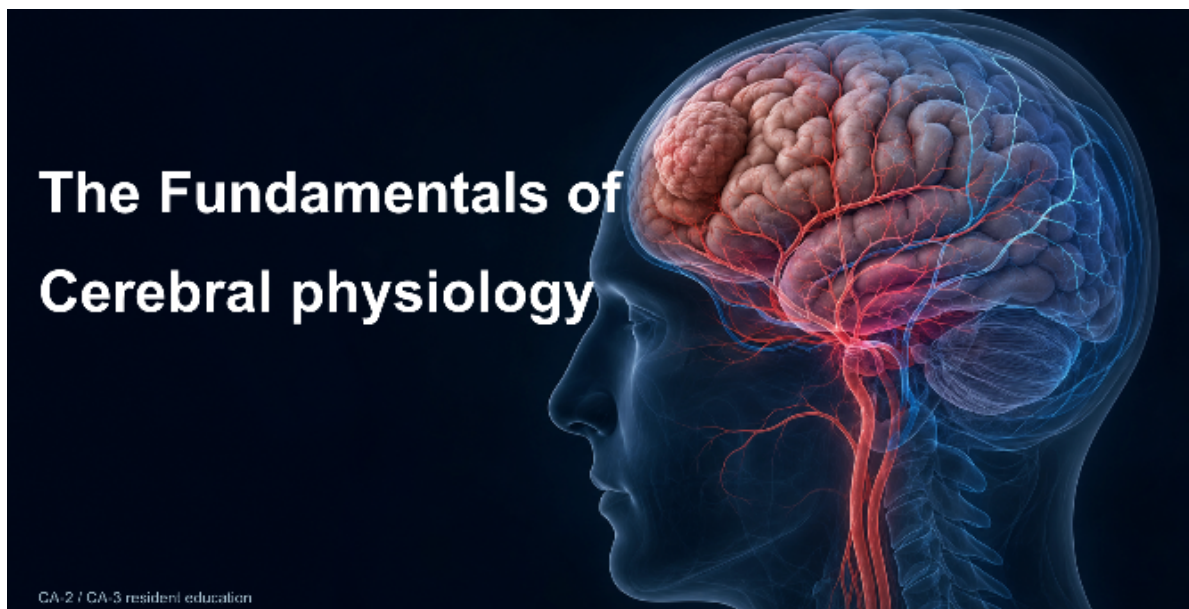


Introduction

Understanding cerebral physiology is fundamental to neuroanesthesia. Every decision we make in the operating room, from adjusting ventilation and blood pressure to choosing anesthetic agents or positioning the patient, can influence cerebral blood flow, intracranial pressure, and ultimately brain perfusion. The challenge is not simply knowing these concepts, but understanding how they interact in real clinical situations.

This educational session was designed to move beyond memorizing physiologic values by placing residents in a realistic intraoperative scenario. Through a progressive case, participants are asked to think through the physiologic consequences of common anesthetic interventions and apply core principles to the management of patients undergoing intracranial surgery.

By combining foundational physiology with clinical decision-making, the session aims to help anesthesia residents develop a practical framework for approaching neurosurgical cases and making thoughtful, physiology-based anesthetic decisions.



[Click here to click our Problem Based Learning!](#)



CLINICAL CORNER · PBLD

Carotid Endarterectomy

A Clinical Overview

Carotid endarterectomy (CEA), i.e., the surgical removal of atherosclerotic plaque from the internal carotid artery, is one of the most commonly performed vascular procedures and remains the gold-standard surgical treatment for selected patients with significant carotid artery stenosis at elevated risk of ischemic stroke. Landmark trials: including the North American Symptomatic Carotid Endarterectomy Trial (NASCET), the Asymptomatic Carotid Atherosclerosis Study (ACAS), and the Asymptomatic Carotid Surgery Trial (ACST-1) have firmly established its efficacy, cementing CEA as a cornerstone of stroke prevention in appropriately selected patients.

Anesthetic Considerations

From an anesthetic perspective, CEA presents challenges that extend well beyond routine perioperative care. It operates at the intersection of cerebrovascular physiology, significant cardiac comorbidity, and intraoperative neurological monitoring, all demanding a thorough understanding of cerebral autoregulation, hemodynamic targets, and real-time decision-making during critical phases of the surgery. The brief window of intentional cerebral ischemia during cross-clamping represents one of the most physiologically consequential moments in vascular anesthesia, requiring continuous vigilance and structured, evidence-based management.

About This PBLD

This Problem-Based Learning Discussion (PBLD) uses a structured clinical case to guide a learner-driven, interactive exploration of the perioperative anesthetic management of CEA. Topics include anesthetic technique selection (regional versus general anesthesia), neuromonitoring modalities, intraoperative hemodynamic management, shunting indications, emergence considerations, and recognition of procedure-specific postoperative complications — including cerebral hyperperfusion syndrome and cranial nerve injury. Summary tables and key hemodynamic targets are included as structured reference tools, designed to be immediately applicable in the operating room and to serve as a concise resource throughout anesthesia residency training.



[Click here to view: Carotid Endarterectomy PBLD](#)



CLINICAL CORNER · PBLD SPOTLIGHT

Atrial Fibrillation: A Tachyarrhythmia PBLD

Background

This spotlight introduces a Problem-Based Learning Discussion (PBLD) case on tachyarrhythmias developed for departmental teaching, built around a single evolving patient scenario with an embedded audience-response question and staged case progressions. The excerpt below reflects the point in the case where the patient develops hemodynamic compromise; it is presented here as a preview of the interactive module rather than a stand-alone case report.



[Click here to view: Atrial Fibrillation](#)

