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April 2025

CLINICS IN MEDICAL EDUCATION

Docendo Discimus

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New Website

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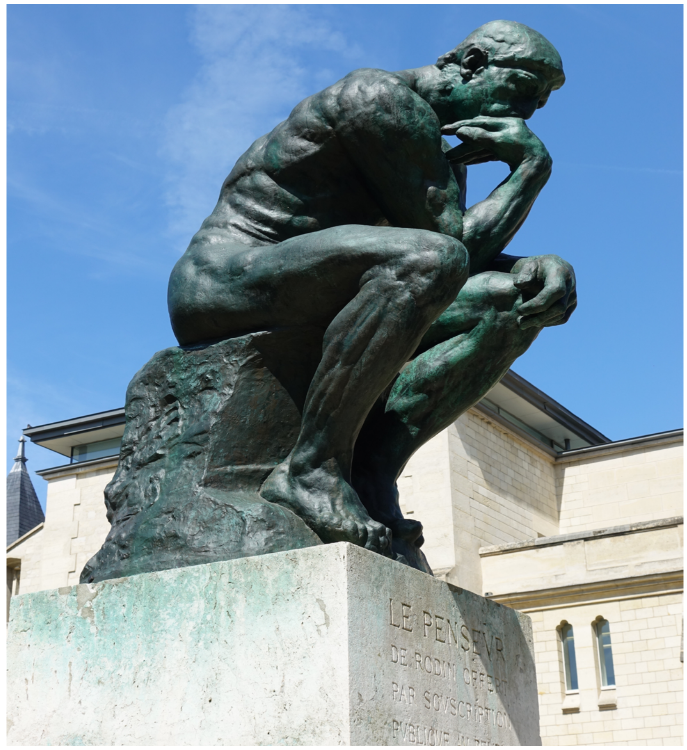
INSIDE

Beth Israel Deaconess Medical Center
HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

Department of Anesthesia, Critical Care and Pain Medicine

Center for Education Research, Technology and Innovation



Le Penseur by Auguste Rodin epitomizing introspection and contemplation.
https://en.wikipedia.org/wiki/The_Thinker

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/

New Website

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

Table of Contents

DOCENDO DISCIMUS

Usman Ahmed

CLINICS IN MEDICAL EDUCATION

Docendo Discimus
[By Teaching We Learn]

EDITOR'S WELCOME

We are thrilled to share our sixth issue of *Clinics in Medical Education*! This is an interactive anesthesia 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://medicaleducation-clinic.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. Each 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 our sixth issue!

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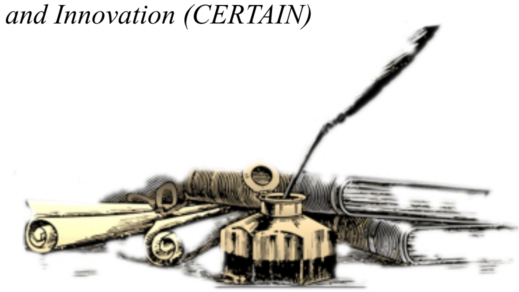

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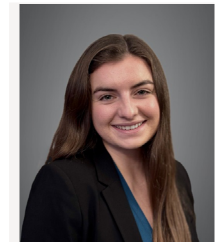
OUR MISSION

- 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.

PEDAGOGY IN EDUCATION



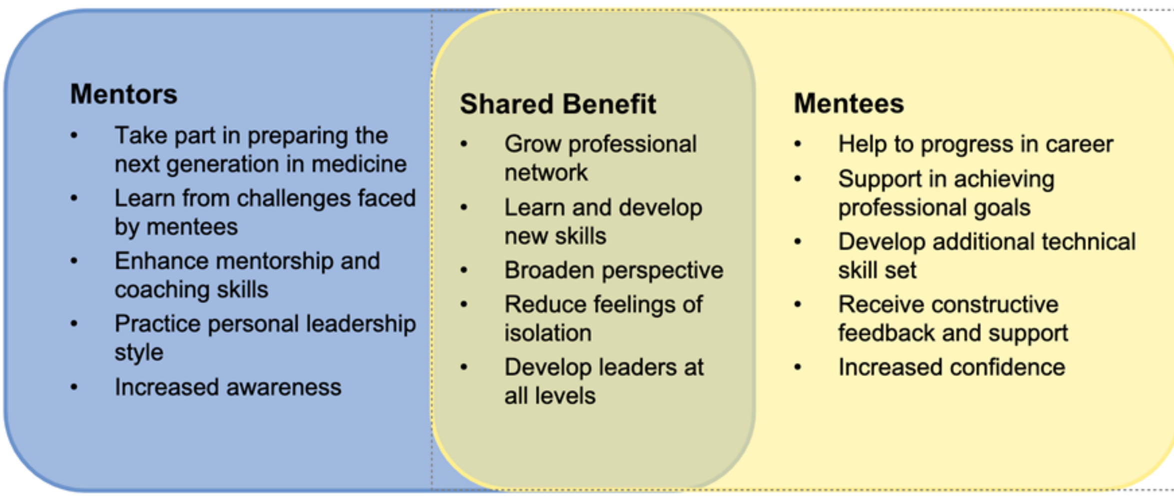
The Personalities of a Mentor: Strengths, Strategies, and Potential Pitfalls

Jacqueline Hannan, PhD

Dario Winterton, MD

Mentorship is a powerful relationship that offers the opportunity for transferring knowledge, guiding personal and professional growth, developing skills and confidence, offering constructive feedback, and cultivating a sense of belonging within a group. A sincere mentoring relationship can provide a variety of benefits for both a mentor and a mentee, while also contributing to positive culture within an organization.

Effective mentors play different roles depending on their strengths, personalities, and the unique needs of their mentees. Understanding different mentoring personalities helps mentors tailor their approach, ensuring they provide the right balance of challenge, support, and guidance. Combining a variety of approaches allows a mentor to uniquely support each mentee in a way that feels authentic and natural. The following examples of a few mentoring personalities highlight the diverse ways mentors can positively impact their mentees, each with distinct strengths, strategies, and potential shortcomings.

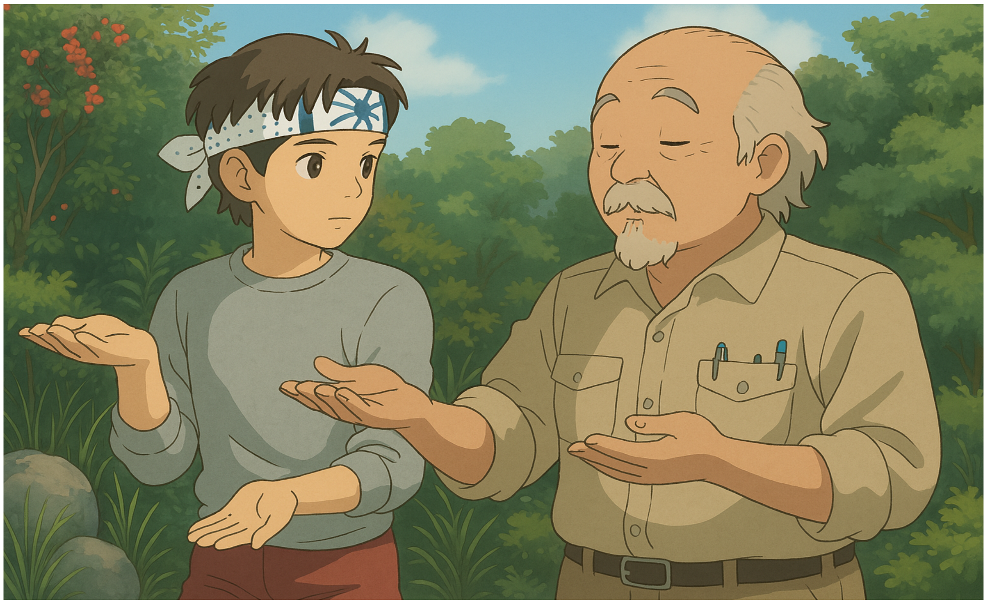


The Cheerleader: The Cheerleader provides consistent encouragement and emotional support, helping mentees build confidence and self-belief. They are quick to celebrate successes and offer positive reinforcement during setbacks. Strategies include encouraging perseverance in the face of challenges, highlighting progress, and reminding individuals of their strength. While their positivity is motivating, cheerleaders need to be mindful of creating unrealistic expectations and avoid indirectly stifling growth by making mentees too comfortable. The goal is to empower mentees to seek continual success, not just to feel good.

The Ideator: The Ideator encourages creativity and innovative thinking by showing mentees how to explore new possibilities. They serve as a thought partner and help reframe perspectives to solve problems and focus on the bigger picture. Successful strategies include encouraging open-ended questions, facilitating brainstorming sessions, and helping mentees to embrace failure as a part of the learning process. However, ideators can overwhelm mentees with too many ideas or struggle to follow through on execution. To be effective, they need to balance creativity with a focus on practical application.

The Connector: The Connector helps mentees build networks and find valuable opportunities by leveraging their connections and knowledge of resources. They introduce mentees to their contacts, guide them toward new experiences, and help them navigate complex systems. Potential pitfalls include focusing too much on connections over personal development or encouraging mentees to rely too heavily on others rather than developing confidence and independent thought. This mentoring personality requires a balance of relationship-building and empowerment for personal growth.

The Challenger: The Challenger pushes mentees to step outside of their comfort zone and face difficult circumstances by setting high standards and encouraging resilience. They believe in the mentees' potential and offer direct feedback, helping mentees grow through discomfort and challenge. Effective strategies include setting ambitious but achievable goals, offering honest feedback, and asking thought-provoking questions. However, challengers must be careful not to become overly harsh or critical, which could discourage mentees or overlook their emotional needs. The key is balancing challenge with encouragement and support.

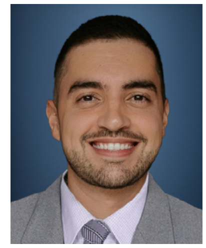


AI Generated Image: Mr. Miyagi from The Karate Kid – an example of a Challenger mentor personality.

The Advocate: The Advocate actively supports their mentee's goals, often helping them gain recognition and access to opportunities. They speak up on their mentee's behalf, ensure they are fairly treated, and help them navigate complex systems. Advocates can support mentees by helping them develop self-advocacy skills, recognizing their strengths, and encouraging them to build visibility. A potential pitfall of this approach is becoming overly protective or fighting battles for their mentees instead of empowering them to advocate for themselves.

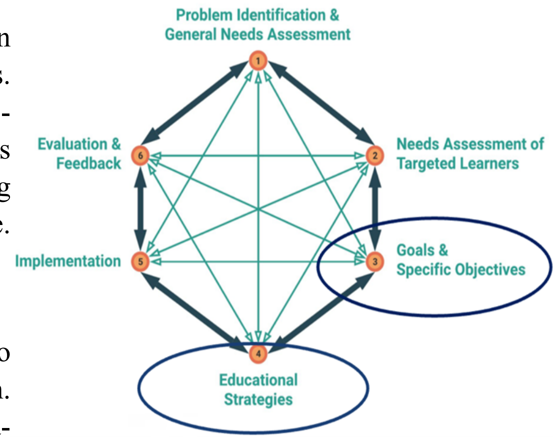
Conclusion - The Multi-faceted Mentor: In many cases, a mentor may leverage different aspects of multiple mentoring personalities to create their unique approach to supporting mentees. Serving as a multi-faceted mentor is a skill that takes time to develop and requires an innate sense of how to adjust the strategy for guidance. Ultimately, the best mentors are those who find a balance of support and challenge to encourage growth, helping mentees to achieve their greatest potential.

Curriculum Development in Medical Education – Part II
Laying the Foundation with Kern's Framework




Federico Puerta Martinez, MD
Dario Winterton, MD

The development of a robust and impactful curriculum is essential in Medical Education for shaping competent healthcare professionals. A systematic approach, such as Kern's six-step model, offers a structured pathway for curriculum design. This article will focus on steps 3 and 4 of this framework. These two steps are crucial for translating identified needs into a tangible and effective educational experience.



Step 3: Defining Goals and Objectives

After a thorough needs assessment (steps 1 & 2), the next step is to articulate clear goals and objectives that will guide the curriculum. Goals are broad educational aims, while objectives are specific, measurable statements of what learners should achieve. Objectives guide the selection of educational content and methods and enable evaluation of learners and the curriculum.

Educational objectives can be categorized into three main types:

1. Learner Objectives: These focus on what the learner will know, feel, or be able to do as a result of the curriculum. Learner objectives can be further divided into:

- **Cognitive Objectives:** These relate to knowledge and intellectual skills.
- **Affective Objectives:** These address attitudes, values, and beliefs.
- **Psychomotor Objectives:** Also known as skill or behavioral objectives, these focus on physical skills and actions.

2. Process Objectives: These relate to how the curriculum will be implemented. For example, an objective might be that each learner will complete an online module prior to a workshop.

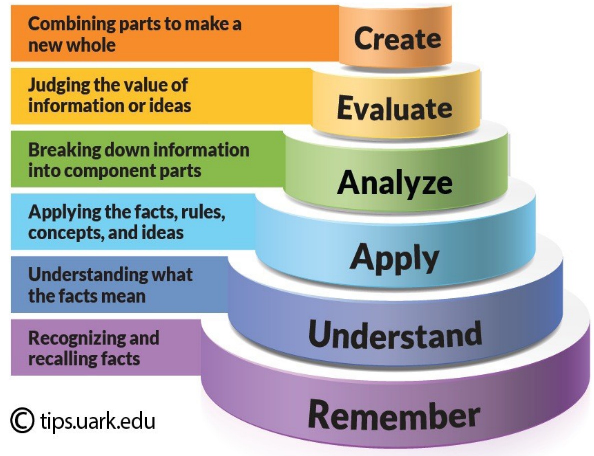
3. Outcome Objectives: These relate to the broader impact of the curriculum on healthcare, patient outcomes, and population health. An outcome objective could be that a higher percentage of graduates from the program will practice in underserved areas.

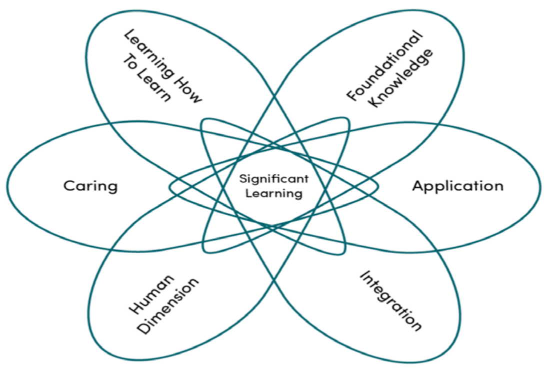
To create holistic objectives, there are some well-accepted frameworks. We will focus on three complimentary ones:

- SMART criteria ensures the objectives are correctly structured
- Bloom's Taxonomy ensures the objectives target appropriate levels of cognitive learning.
- Fink's Taxonomy ensures that the objectives aim to create a meaningful, holistic, lasting impact.

By integrating these frameworks, educators can craft objectives that are specific, measurable, cognitively challenging, and significant, leading to more effective and engaging curricula.

A key characteristic of well-written objectives is that they are specific and measurable. A useful framework for creating objectives is to include five basic elements: Who, will do, how much/how well, of what, and by when. For instance, "By the end of the workshop, each student will describe six fundamental principles of patient safety" includes all five elements. It is also important to use clear and precise verbs that are not open to multiple interpretations. Verbs like "analyze", "evaluate" and "create" are associated with higher-order cognitive skills, while verbs like "list" and "describe" refer to lower-order skills.





Step 4: Educational Strategies

Once clear objectives have been defined, the next crucial step is to choose appropriate educational strategies. This involves carefully considering both the content (what will be taught) and the methods (how it will be taught). Educational strategies are the means by which the curriculum's objectives are achieved and are considered the heart of the curriculum. A variety of methods can be used to achieve educational objectives. These can be broadly categorized into methods for cognitive, affective and psychomotor/skill-based learning.

Strategies for Cognitive Objectives

- **Lectures:** Traditional lectures are useful for presenting information efficiently to a large audience. However, they can be enhanced by incorporating interactive elements and encouraging active learning.
- **Self-paced learning:** This includes the use of online modules, videos, or readings that learners complete independently. Spaced repetition of content and interleaving concepts can improve retention.
- **Concept Mapping:** Learners create visual representations of how concepts interrelate to promote deeper understanding and critical thinking.
- **Case-based Learning:** Learners apply new knowledge and skills to real or virtual patient cases. This promotes active learning and integrates new and prior knowledge.
- **Problem-Based Learning (PBL):** Learners work in small groups to solve complex problems. PBL requires intensive faculty and case development.
- **Team-Based Learning:** Emphasizes collaborative learning and problem-solving within teams. This is useful for large groups.
- **Virtual patients:** These are interactive computer simulations of clinical scenarios that allow learners to develop their clinical reasoning skills.

Strategies for Affective Objectives

- **Role Modeling:** Faculty members serve as exemplars of professionalism and empathy.
- **Reflection:** This involves activities such as writing, and discussions that promote self-awareness and emotional processing.
- **Narrative Medicine:** Using storytelling to foster empathy and deeper connections with patients.
- **Arts and Humanities:** Engaging learners emotionally and intellectually through activities such as theater workshops or visual arts.
- **Exposure/Immersion:** Placing learners into authentic or new practice environments to affect their attitudes.

Strategies for Psychomotor Objectives

- **Demonstration:** Instructors show learners how to perform skills.
- **Supervised Clinical Experience:** Learners apply skills under the supervision of experienced clinicians.
- **Role-Plays:** Learners practice communication and interpersonal skills in simulated scenarios.
- **Simulation:** The use of artificial models or standardized patients to practice procedures.

In addition to these methods, it's also important to consider the use of technology to enhance learning. Digital education, which can include online learning, blended learning, and the use of games and gamification, offers new ways to engage learners.

Practical Application and Conclusion

As anesthesiology educators, we can apply these principles to design curricula that address the unique needs of our learners. For example, a curriculum on patient safety might include cognitive objectives such as "describe the principles of sterile technique," affective objectives such as "appreciate the importance of teamwork in the operating room," and psychomotor objectives such as "demonstrate proper technique for intubation." Educational strategies might include lectures, case-based discussions, simulation scenarios, and reflective writing assignments.

Ultimately, the development of an effective curriculum requires a thoughtful approach that considers the specific needs of the learners, the desired outcomes, and the most effective methods for achieving these goals. By focusing on well-defined objectives and carefully selected educational strategies, we can create curricula that produce competent, compassionate, and capable healthcare professionals. Remember that educational experiences encompass more than just a list of pre-conceived objectives, and the best learning often derives from needs identified and pursued by individual learners. It's important to remain flexible, creative and open to new and emerging educational strategies.

In the next issue, we will be covering the final 2 steps (Steps 5 & 6) of Kern's Curriculum Development Framework.

Advancing Clinical Ultrasound Education: Recognizing the Need for Credentialing and Privileges in Anesthesiology

Robina Matyal, MD

Institutional Responsibility in Clinical Ultrasound Training

Clinical Ultrasound is increasingly recognized as a valuable tool in anesthesiology, enhancing diagnostic accuracy and guiding clinical decision-making. However, a critical challenge remains: how should anesthesiologists be trained, assessed, and credentialed in this evolving technology?

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Anesthesiology (ABA) have recognized ultrasound-guided techniques as essential training milestones since 2013. Despite this, there is no standardized curriculum for practicing anesthesiologists, leading to significant variability in proficiency. This gap highlights the responsibility of institutions and departments to ensure comprehensive ultrasound education through structured, competency-based training rather than relying solely on certification.

A proactive approach is necessary, integrating didactic learning, hands-on practice, and standardized assessments. This includes simulation-based training, supervised clinical applications, and access to ultrasound equipment to ensure quality control in clinical practice. By institutionalizing ultrasound training, departments can bridge the proficiency gap and ensure anesthesiologists meet the evolving demands of modern anesthesia care.

DIDACTICS
ONLINE AND IN PERSON WORKSHOP

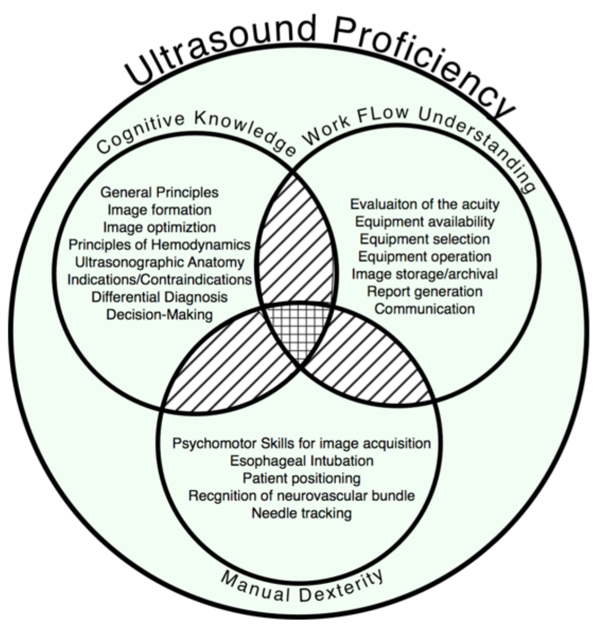
HANDS ON
PRACTICE

INDEPENDENT
PRACTICE

Certification vs. Proficiency in Clinical Ultrasound Training

The adoption of new medical technologies often outpaces formal training guidelines. This has been observed in laparoscopic and robotic surgery, where a bottom-up approach led to structured proficiency pathways. Conversely, transesophageal echocardiography (TEE) followed a top-down model, emphasizing certification without necessarily ensuring hands-on proficiency.

A top-down approach to perioperative ultrasound would define certification as the goal without outlining a structured pathway to proficiency. This model identifies experts but does not necessarily build widespread competency. Additionally, without clear training frameworks, faculty may not fully understand the impact on resident education, leading to inconsistent learning experiences. Patchy training, coupled with a lack of structured monitoring, risks creating variability in skill acquisition and clinical application.



Currently, clinical ultrasound training lacks a standardized approach, particularly for practicing anesthesiologists. While trainees and students are increasingly exposed to ultrasound techniques, those already in practice often lack a formalized curriculum. This raises an important question: Should the field prioritize certification or focus on demonstrated competency for credentialing?

Step 1 (Training) – 3 Months
All US use will be supervised & E-Logged

Step 2 (Supervised Practice) – 3 Months
All US use will be supervised & E-Logged
Requirements
(Performed and Interpreted) – Reviewed by Experts
• Vascular Access: 5 cases
• Regional US: 5 US guided regional blocks
• Critical Care: 5 abdominal & 5 chest wall cases
• Cardiac Cases: 10 TTE & 10 TEE cases

Step 3 (Independent Practice & Review) – 6 Months
(Performed and Interpreted)
• Vascular Access: 10 cases performed
• Regional US: 10 US guided regional blocks
• Critical Care: 5 abdominal & 5 chest wall cases
• Cardiac Cases: 10 TTE & 10 TEE cases

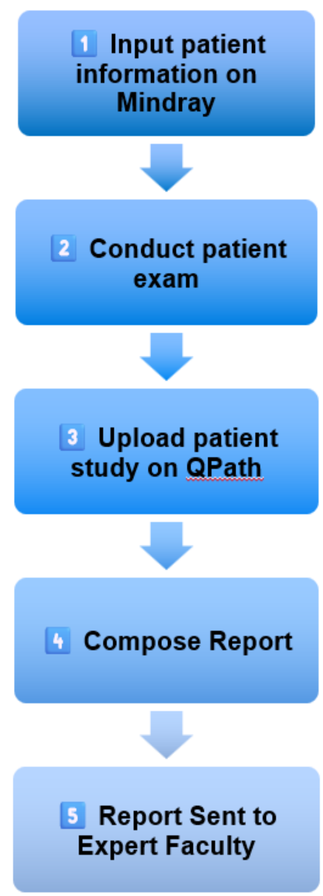
A Model for Clinical Ultrasound Training and Credentialing

At Beth Israel Deaconess Medical Center (BIDMC), a structured curriculum has been developed to bridge this gap. This program includes:

• Didactic Sessions
• Online Self-Training Tools
• Workshops (5-6 per year) and Case-Based Discussions–

However, training alone is insufficient. A comprehensive system for quality assurance, credentialing, and billing must accompany educational initiatives. BIDMC addresses this by utilizing Qpath, a cloud-based, HIPAA-compliant software that securely stores images and reports for review, ensuring standardized quality control and facilitating billing for Clinical Ultrasound exams.

Click here to read "Point-of-Care Ultrasound Credentialing: Big Picture Principles for Big Health Systems"



Moving Forward: Establishing a Path to Recognition

A clear pathway for Clinical Ultrasound certification is necessary, but until one is established, credentialing based on demonstrated competence and proficiency offers a practical solution. Recognizing anesthesiologists' skills through structured training, image review, and proficiency assessments will help integrate Clinical Ultrasound into standard practice while ensuring patient safety and quality care.

Ultimately, the future of Clinical Ultrasound in anesthesiology hinges on balancing accessibility with accountability. By refining training programs and developing a structured framework for credentialing, the field can ensure that anesthesiologists are both proficient and formally recognized for their expertise in this essential skill.

Relationship Between Doctoral Program Elements and Perceived Academic Quality and Wellness Amongst NARs





Patricia O Connor, CRNA
Sarah Mooradian, CRNA
Sandra Palmer, NAR
Mike Sharma, NAR
Priscilla Robinson, NAR

A recent significant revision in accreditation requirements for nurse anesthesia educational programs mandates a doctoral degree for entry-level nurse anesthesia graduates. This change may limit the validity of previous research, as it assessed the perception of academic quality and wellness of both master's and doctoral candidates. Literature suggests these doctoral requirements increase academic, financial, and clinical obligations, potentially placing greater strain on Nurse Anesthesiology Residents (NARs) but do not specifically examine which aspects of the doctoral requirements have the greatest impact on NARs' educational experience.

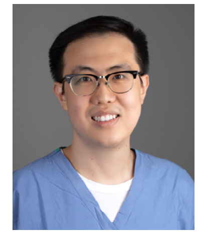
A retrospective cross-sectional mixed-methods study was conducted to assess factors influencing academic quality and wellness in nurse anesthesia programs (NAPs). An electronic survey, including informed consent, was distributed to program directors, who then forwarded it to their respective nurse anesthesia residents (NARs). To encourage participation, respondents could enter a $100 raffle, with email addresses unlinked from survey responses to maintain anonymity. The survey was developed using a combination of an informal poll identifying high-yield elements of NAPs and the validated Dundee Ready Education Environment Measure (DREEM) questionnaire. The identification of high-yield elements (NAP-HYEs) was based on NAR poll responses and a literature review. The survey incorporated the DREEM questionnaire, a validated tool for assessing perceived academic quality and wellness in medical and dental students. Kruskal-Wallis and Pearson correlation tests were used to analyze questionnaire scores in relation to NAP-HYEs, with Dunn's test identifying group mean differences. The survey was distributed to 137 NAP directors, who then forwarded it to their NARs. A total of 373 complete surveys were included in the final analysis.

Results showed a statistically significant difference in perceived academic quality among participants with formal mentorship in the second ($P = .01$) and third year ($P = .02$). However, no significant relationship was found between simulation hours and perceptions of academic quality ($P = .13$). Qualitative analysis identified simulation as a key factor in academic quality. NARs highlighted themes related to improved wellness, including scheduled breaks, faculty support, mentorship, and increased time for personal and fitness-related activities.

Future research should explore whether the decline in perceived academic quality among third-year NARs is linked to the loss of formal mentorship following the graduation of their mentors. Additionally, further investigation into mentorship is needed, as NARs frequently emphasize peer mentorship but may also benefit from connections with experienced faculty and clinicians.

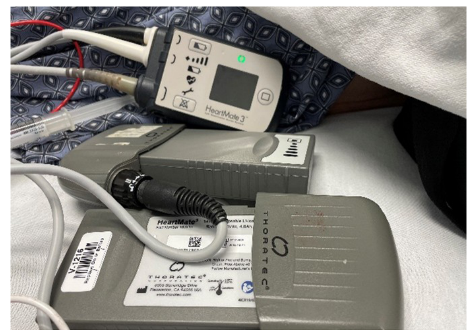
Taking Care Of Patient With LVAD And CRT-D Undergoing Total Hip Arthroplasty

Yifan Bu, MD



A 78-year-old male has a past medical history of TTR amyloid non-ischemic cardiomyopathy with EF of 10% s/p HM3 LVAD implant in 2021. He also has chronic atrial fibrillation and VT s/p ICD with CRT-D upgrade in 2021. He now presented for a left hip arthroplasty. The patient was admitted for bridging his warfarin to heparin before surgery. The Anesthesia plan was general anesthesia with a-line monitoring.

What is a ventricular assist device (VAD)?



Ventricular assist devices (VADs) are mechanical devices inserted to assist cardiac function by offloading part or all of the pumping responsibilities from the ventricle. Placement of a VAD can be done on the left side of the heart to assist in left ventricular function (LVAD) or on the right side of the heart to help with the right ventricle (RVAD). The presence of both an LVAD and an RVAD is referred to as biventricular support (BiVAD). A number of different VAD constructs exist, with major differentiators being pulsatile versus continuous flow, extracorporeal versus intracorporeal, degree of assistance provided, ability to help the left or right sides, and the length of time it can be used.

What type of LVAD does this patient have? What characteristics does this type of LVAD have?

This patient has a THORATEC Heart Mate 3. It is a continuous flow LVAD. Continuous flow VADs are valveless pumps that use a magnetic field to rapidly spin a single impeller supported by mechanical or magnetic, or hydrodynamic bearings. Patients may not exhibit arterial pulsatility due to the continuous blood flow provided by the VAD, but they may still have sufficient residual or recovered ventricular function to generate intrinsic pulsatile flow. Given the continuous-flow pump characteristics, measuring the mean arterial pressure (MAP) is the most reliable measure of perfusion pressure and is the standard of care for VAD patients.

What is our institutional protocol when taking care of patients with VADs? Who should be monitoring the VADs function in pre-op holding, OR, and PACU?

Our department has a detailed protocol discussing how to take care of patients with VADs, which can be found at C8: WORKFLOW FOR PERIOPERATIVE CARE OF THE PATIENT WITH A DURABLE LEFT VENTRICULAR ASSIST DEVICE (VAD).

Pre-op: Patients with VADs are knowledgeable regarding the care of their devices. If the patient is considered VAD competent according to BIDMC's level of education, he or she will manage the device in the preoperative holding area prior to receiving sedation. If a patient is not VAD competent due to current medical or training status, a member of the VAD team will remain immediately available in the preoperative area and be responsible for device monitoring. If a patient requires sedation or is having an arterial line placed (without sedation), he or she is no longer competent to monitor his or her device. The perfusionist assigned to the case will assume the monitoring responsibility.

Intraoperatively, the device monitoring will be provided by a member of the perfusion team. The perfusionist will remain either physically present or immediately available during the entirety of the case.

Procedural recovery area:

In the recovery area, the VAD competent RN/NP is responsible for monitoring the VAD and will continue to perform Doppler blood pressure measurements (if without a-line monitoring). Any concerns regarding VAD function as it relates to the patient clinically will be communicated to the recovery room nurse and the advanced heart failure attending physician if warranted.

One day prior to surgery, we contacted both the perfusion team and the EP team to discuss perioperative LVAD and CRT-D management plans.

For LVAD, we confirmed that a perfusionist was assigned to this case and would meet the patient in the pre-op holding area before the a-line placement.

For CRT-D, EP team was contacted to reprogram his pacemaker settings. Based on patient's recent (02/2025) CRT-D interrogation report, the device was programmed as mode DDD 70-130 w/ tachy therapies on. EP team reprogrammed it to DOO 70 w/ tachy therapies off one night prior to surgery. CRD-T response with magnet is: inhibits therapies, with no effect on the pacemaker. Since the incision site was infra-groin, a decision was made not to use the magnet to suspend the ICD function but to have one available.

In pre-op, we evaluated the LVAD function, drive line, dressing and extra supplies together with the perfusionist. Due to the continuous LVAD flow, obtaining blood pressure readings from non-invasive blood pressure cuffs and oxygen saturations from pulse oximeters may not be feasible or reliable.

What are the key parameters of this LVAD device?

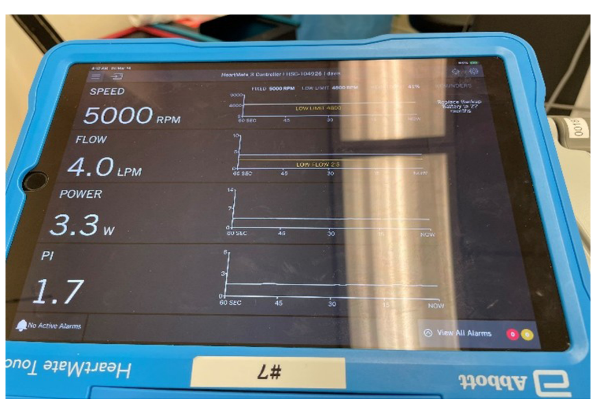
1. **Pump speed:** measured in RPM and relates to how fast the impeller is spinning. This is the only variable programmed by the operator.

2. **Flow:** measured in liters per minute (LPM). This correlates with pump speed, and is dependent on the pressure differential (also known as head pressure) across the pump. This pressure differential is in turn dependent on the ventricular chamber pressure (i.e., preload), vascular tone (i.e., afterload), and factors affecting blood viscosity (e.g., hematocrit).

3. **Power:** the amount of power the VAD consumes to continuously run at a set speed. A sudden or gradual increase in the power can indicate obstruction or thrombus inside the VAD.

4. **Pulsatility Index (PI)**—a measure of the pressure differential within the VAD pump and indicates the proportion of cardiac output provided by the native heart versus the device. In addition to the left ventricular contractility, the PI of an LVAD is affected by the patient's volume status and right ventricular function.

After an uneventful induction with lidocaine, etomidate, fentanyl, and rocuronium, the patient was on 0.7% MAC of sevoflurane. The LVAD monitor showed the parameters below:



Compared with the parameters before induction, what happened to the patient, and how should it be treated?

The patient had a decreased PI from his baseline, slightly increased Flow, unchanged Power and RPM

Interpretation: vasodilation or hypovolemia. The pump is "starving" for volume, resulting in a drop in PI (less pulsatility because the left ventricle is not filling adequately).

Possible Causes: vasodilation under anesthesia.

Management / Treatment: titrated fluid bolus, adjusting anesthetic depth.

What are other possible parameter changes that can happen intraoperatively, and how to interpret them?

Scenario 1. High PI, High Flow, Normal Power, Normal RPM

Interpretation: increased volume return or improved native LV contractility

Possible Causes: potential hypervolemia caused by over-resuscitation with fluids; vasoconstriction or increased venous return (e.g., after administration of vasopressors).

Management / Treatment: check for signs of fluid overload (lung auscultation for crackles, patient's oxygenation), then optimize fluid management; if significantly hypervolemic, consider diuretics or adjusting fluid administration. Monitor hemodynamics to ensure no excessive increase in LV pressures or risk of right heart failure.

Scenario 2. Rising Power, Steady or Slightly Decreasing Flow, Normal/Stable RPM, Unchanged PI

Interpretation: possible pump thrombus or obstruction. The motor works harder to maintain the same speed in the presence of an obstruction (thrombus forming in the pump or partial inlet/outlet obstruction). If the power continues to rise without obvious hemodynamic changes, suspect a device-related issue.

Possible Causes: pump thrombosis (most common suspicion). Kink or obstruction in the outflow graft. Clot formation near the inflow cannula.

Management / Treatment: evaluate device function urgently in conjunction with the LVAD team. Anticoagulation check: Ensure therapeutic anticoagulation and/or start intravenous heparin if not contraindicated. Consider imaging (e.g., TEE) to evaluate inflow cannula, outflow graft, and cardiac function.

Possible need for thrombolysis or surgical intervention if a pump thrombus is confirmed.

Scenario 3. Low PI, Sudden Decrease in Flow, Drop in Power, Unchanged RPM

Interpretation: suction event or severe underfilling of the LV. If the left ventricle collapses around the inflow cannula (due to inadequate preload), the pump cannot maintain flow.

Possible Causes: acute hypovolemia or sudden reduction in venous return. Excessive vasodilation or abrupt shift in fluid distribution.

Management / Treatment: stop or reduce ongoing fluid loss (identify surgical bleeding or check if there's a sudden drop in preload). Administer fluid bolus to restore preload. Consider lowering the RPM temporarily if suction alarms are triggering. Re-check the entire circuit (no disconnection or kinking).

References:

[1] WORKFLOW FOR PERIOPERATIVE CARE OF THE PATIENT WITH A DURABLE LEFT VENTRICULAR ASSIST DEVICE (VAD)

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Perspective on Managing Right Ventricular Failure in the Perioperative Environment

Shirin Saeed, MD
Peva Gbagornah, MD
Mark Robitaille, MD



Right ventricular (RV) function is significant for cardiac pump function, as it provides preload to the left ventricle and systemic circulation while maintaining interventricular interdependence. Acute right ventricular dysfunction (RVD) can occur perioperatively, often in patients with chronic ischemic or non-ischemic cardiomyopathies, chronic lung disease, pulmonary hypertension, or valvular conditions. For instance, one-third of heart failure patients with preserved left ventricular ejection fraction (LVEF) also exhibit RVD and the incidence rises to 48% when LVEF is reduced. Acute perioperative RVD may arise from sudden increases in RV afterload due to factors like pulmonary embolism, hypoxia, hypercapnia, or acidemia, or from decreased RV contractility resulting from conditions such as RV infarction, myocarditis, or post-cardiotomy shock. An accurate assessment of RV function is essential for preoperative risk stratification, determining the appropriate care setting, and managing intraoperative and postoperative care. Despite substantial evidence linking perioperative RVD to adverse clinical outcomes, there is a lack of published guidelines or recommendations to aid clinicians in conducting comprehensive, evidence-based assessments of RVD risk during the perioperative period.

Level	Points	Stages	Description	Potential Treatments	Monitoring Tool Considerations
Level 1	1	**Stage A:** "Low risk" for RVD describes a patient without signs or symptoms of RVD but with fewer than two predisposing risk factors.	No RVD risk (1 point) undergoing low-stress surgery (0 points)	Best anesthetic practice	ASA standard monitoring
Level 2	2	**Stage B:** "At risk" for RVD refers to a patient with no clinical evidence of RVD but with two or more risk factors and elevated BNP.	Overall low-risk patients; may have RVD risk factors (2 points) or undergo moderate-risk surgery (1)	Preventative measures; avoid hypoxia, hypotension, hypervolemia, etc.	Consider arterial line
Level 3	3	**Stage C:** "RVD" indicates a patient who appears well but has an elevated BNP and RV dilation on cardiac imaging.	Increased monitoring required; planning for RV decompensation	Diuretics; low-dose inodilators	Consider the arterial line; consider CVC; post-op care in a higher monitoring unit
Level 4	4	**Stage D:** "RV Failing" characterizes a patient with heart failure signs, systemic hypotension, and symptoms such as jugular venous distension and lower extremity edema.	Moderate to high risk of RV decompensation; anticipate RV support	Inotropes; vasopressors; inhaled pulmonary vasodilators; CRRT	Arterial line; CVC; advanced hemodynamic monitoring; TEE; ICU; possible ECMO initiation capability
Level 5	5–7	**Stage E:** "RV shock" describes a patient with RV failure resistant to treatment, requiring mechanical support and exhibiting altered mental status and severely impaired RV function.	In refractory shock or high risk of RV	ECMO; RVAD	Arterial line; CVC; advanced hemodynamic monitoring (PAC); TEE; specialized advanced heart failure team and resources

The POQI-IX group developed a consensus statement and stratified perioperative right ventricle function in five stages to screen and assess right ventricular function during the perioperative period. The “POQI 9 RV Risk Score” can be used to guide monitoring techniques and management.

Diagnostic Indicators on Echocardiography Assessment

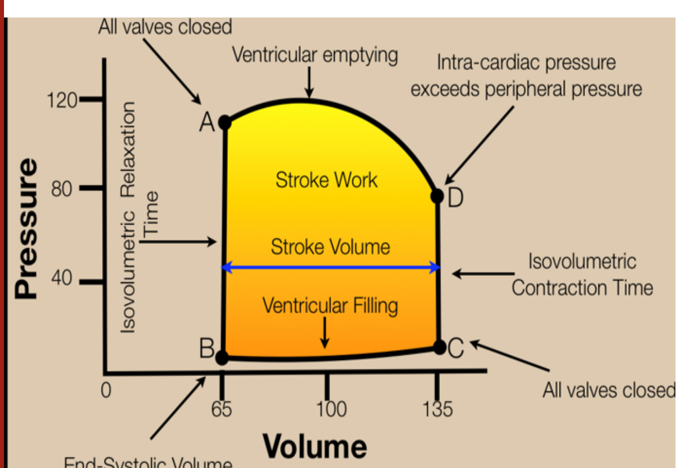
The diagnosis of right ventricular (RV) dysfunction and failure in the perioperative setting involves identifying key indicators of RV failure.

Key Indicators Include:

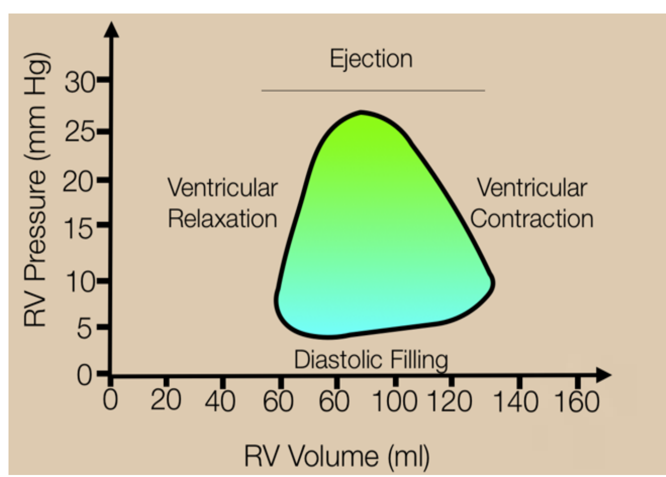
1. Signs of RV Dilation:
    o D-shaping of the interventricular septum (IVS)
    o Increased RV:LV diameter ratio
    o Tricuspid regurgitation (TR)
2. Signs of Impaired RV Systolic Function:
    o Reduced Tricuspid Annular Plane Systolic Excursion (TAPSE)
3. Signs of Elevated RV Preload:
    o Plethoric inferior vena cava (IVC)

RV dilation is characterized by the bulging of the IVS into the LV, known as “D-shaping.” It is important to determine if this D-shaping occurs in diastole, systole, or both. Both systolic and diastolic D-shaping typically indicate RV pressure overload, while isolated diastolic D-shaping suggests RV volume overload. An increased RV:LV diameter ratio greater than 0.6 indicates RV dilation, with ratios above 1 indicating severe dilation. Severe dilation can lead to passive stretching of the tricuspid annulus, resulting in significant functional TR.TAPSE values below 17 mm are considered pathological and suggest impaired RV systolic function. However, in cases of severe TR, TAPSE may overestimate RV systolic function due to reduced afterload. After tricuspid valve annuloplasty, TAPSE may be significantly lower, leading to an underestimation of RV function; in such instances, RV fractional area change (FAC) may provide a more accurate assessment.

LV Pressure Tolerant



RV Volume Tolerant



[Click here to view the full presentation and cases on perioperative RV failure and management]

Implementing Virtual Reality in Procedural Training Curriculums: Using Technology to Improve Clinical Training and Proficiency




Shiri Savir, MD (Moderator)
Robina Matyal, MD (Panelist)
Sara Neves, MD (Panelist)
John Mitchell, MD (Panelist)

Why Immersive Training Matters for Anesthesia Education

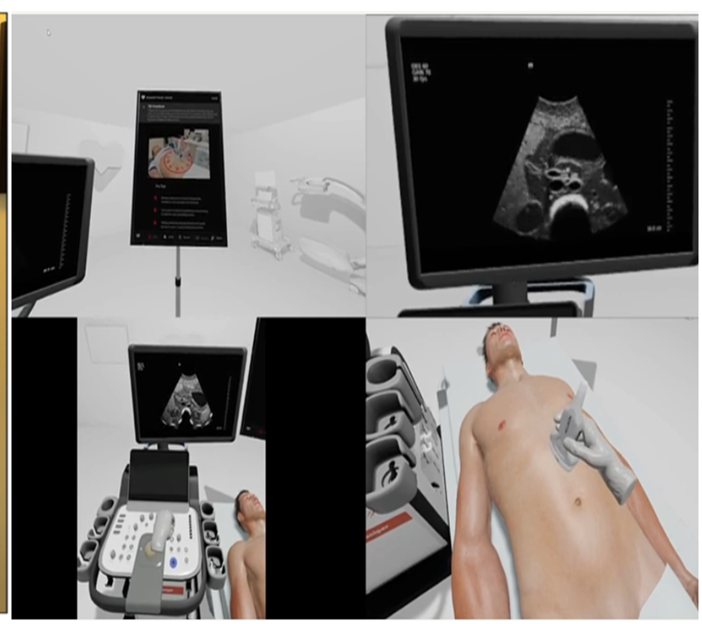
Anesthesia is a high-stakes specialty requiring rapid decision-making and technical precision, often in life-threatening situations. Traditional training methods, such as lectures and protocol reviews, do not fully prepare trainees for real-world emergencies. Immersive technologies, including virtual reality (VR), augmented reality (AR), in situ simulations, and Artifical Intelligence-powered ultrasound are transforming anesthesia education by recreating high-pressure clinical scenarios in a controlled, interactive environment.

Research shows that simulated crisis exposure enhances performance, strengthening both technical and cognitive skills. For example, repeated simulation of rare but critical emergencies, such as a "cannot intubate, cannot ventilate" scenario, build muscle memory and rapid-response capabilities. These advanced training modalities provide real-time feedback, reinforce critical thinking, and cultivate teamwork, ensuring that anesthesia providers respond to high-stress situations with well-practiced, lifesaving interventions.

Limitations of Traditional Anesthesia Training

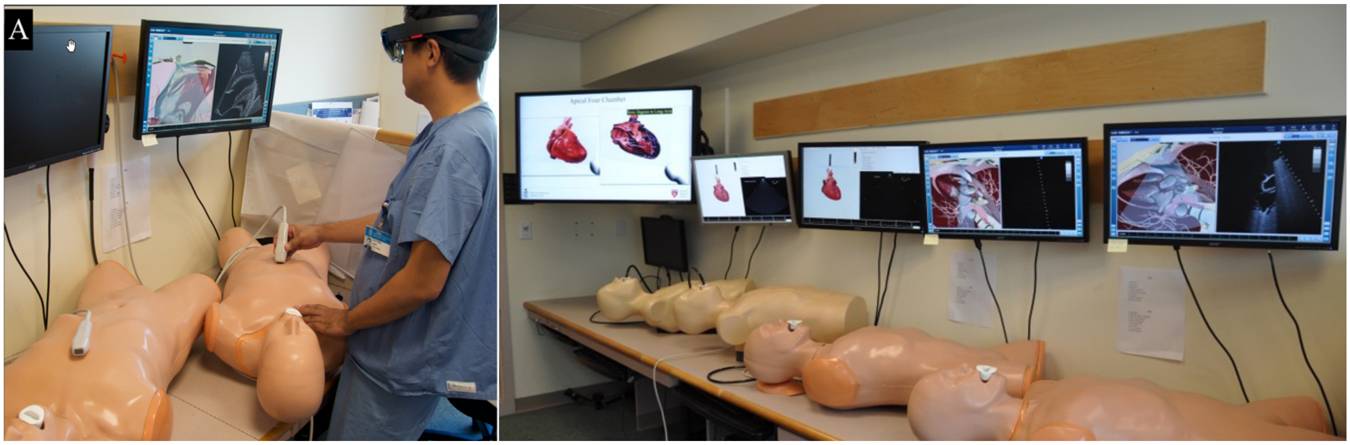
The current model for procedural skills training is largely apprenticeship-based, where learning depends on clinical exposure, case volume, and instructor availability. However, this model presents several challenges:

- Inconsistent learning experiences due to variations in training environments (university vs. community hospitals).
- Limited hands-on opportunities because of clinical workload priorities.
- Patchy exposure to complex cases, leading to variable proficiency levels.
- Difficulty assessing manual dexterity where proficiency is often assumed rather than objectively measured.

A curriculum-based approach, integrating task training with cognitive learning, has been shown to improve skill acquisition and transferability to clinical practice. Surgical residents trained using structured simulation programs demonstrate greater clinical competence and confidence compared to those relying solely on traditional models.

Augmented and Virtual Reality: The Future of Procedural Training

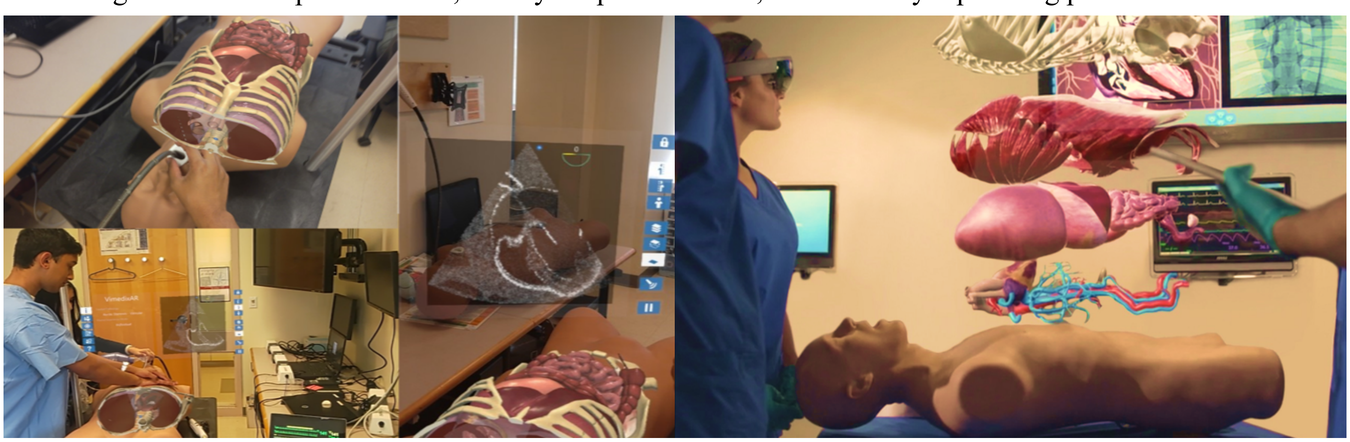


Augmented Reality (AR) Simulation

- Enhances realism and spatial understanding of anatomical structures.
- Allows real-time feedback, error detection, and collaborative learning.
- Easily integrates with existing simulation tools.
- Challenges: Complex setup, faculty training needs, and cost considerations.

Virtual Reality (VR) Simulation

- Provides highly realistic, hands-on practice with immediate feedback.
- Tracks performance, enhances retention, and boosts trainee confidence.
- Cost-effective, portable, and scalable for widespread use.
- Challenges: Limited haptic feedback, faculty adaptation issues, and difficulty replicating patient interactions.



Moving Forward: A Structured Approach to Training and Credentialing

To maximize the benefits of immersive training, institutions must adopt structured curricula that balance cognitive learning with hands-on skill acquisition. Incorporating VR and AR into anesthesia education will not only reduce the learning curve but also improve patient safety and procedural efficiency. By shifting from traditional apprenticeship models to evidence-based, technology-driven training, we can create pre-trained experts rather than pre-trained novices, ensuring anesthesia providers are proficient, confident, and prepared for real-world clinical challenges.

INNOVATION IN EDUCATION

Mechanical Circulatory Assist Devices: Left Ventricular Assist Device




Shirin Saeed, MD
Adil Al-Karim Manji, MD
Maurizio Bottiroli, MD
Dario Winterton, MD

As the number of patients supported by left ventricular assist devices (LVADs) grows, perioperative care involving these patients is no longer confined to cardiac operating rooms. Non-cardiac anesthesiologists are increasingly responsible for managing patients with LVADs yet most receive minimal formal training in device physiology, risk recognition, or emergency response protocols. To address this educational gap, we developed a structured, multimodal curriculum tailored to the unique learning needs of non-cardiac anesthesia providers.

Curriculum Design Principles : Our approach draws from adult learning theory, emphasizing active engagement, case relevance, and multimodal reinforcement. The curriculum is competency-based, with progressive exposure to key concepts in LVAD physiology, clinical management, and troubleshooting. It balances foundational knowledge with hands-on skills, focusing on patient safety and interdisciplinary coordination. An essential pillar of the curriculum is a series of progressively complex, case-based learning modules, designed to promote the application of theoretical knowledge to clinical scenarios. Each case incorporates embedded decision points, multimodal imaging, detailed explanations and debriefing materials.

Educational Components and Structured Modules

Didactic E-Learning Modules: Interactive, self-paced modules provide learners with a structured foundation in LVAD design, hemodynamics, perioperative planning, anticoagulation, and complication recognition.

Case-Based Learning: Clinical vignettes are used to contextualize decision-making. Each case includes embedded questions, device data interpretation, and debriefing content to promote critical thinking.

Simulation-Based Training: High-fidelity simulation scenarios to apply theoretical knowledge in acute, high-risk situations such as right ventricular failure, hypotension, or device malfunction.

Video Lectures: Expert-led lectures offer concise overviews of core topics, with a focus on bridging the gap between cardiology, surgery, and anesthesiology perspectives.

In-Person Workshops: Facilitated workshops create space for interdisciplinary discussion, device demonstrations, and team-based problem-solving. These sessions also emphasize the practical aspects of LVAD assessment and perioperative planning.

Formative Self-Assessments: Quizzes and clinical decision-making questions help reinforce learning objectives and guide individual remediation.

Future Directions

Preliminary implementation of our in person workshop showed improved provider confidence and greater familiarity with device parameters. As part of a larger Mechanical Circulatory Support Devices Series, future modules will include impella, extracorporeal membrane oxygenation (ECMO) and other devices.

Critical Thinking with LVADs: Case Based Learning:

LVAD Emergencies and Case Simulations

GLOBAL HEALTH

Perioperative Cardiovascular Management for Noncardiac Surgery: An African Perspective

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Aaron Sonah, RNA,
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Perioperative cardiac complications account for one-third of all perioperative deaths. Despite this significant burden, there is a lack of robust, evidence-based guidelines for perioperative cardiovascular risk stratification and management of cardiac patients undergoing noncardiac surgery in low- and middle-income countries (LMICs). International guidelines typically determine preoperative cardiovascular risk based on demographic variables (e.g., age), cardiovascular risk factors (e.g., comorbidities), and surgical risk (e.g., intermediate- to high-risk surgery). However, these guidelines may not fully address the unique challenges and resource limitations present in the African context.

The African Surgical Outcomes Study (ASOS) trial provided critical data on perioperative risk in African settings, assessing tools such as the Duke Activity Status Index and frailty scores for preoperative evaluation. These assessments help understand functional capacity and frailty, which are essential for perioperative risk stratification in resource-constrained environments.

Click here to read the paper on African guidelines on "Perioperative Cardiovascular Management for Noncardiac Surgery"

The South African guidelines for the cardiac patient undergoing noncardiac surgery were developed to provide relevant recommendations for Africa. These guidelines were based on an adaptation of the Canadian Cardiovascular Society Guidelines, incorporating literature from African countries and recent research. The recommendations were refined through a Delphi consensus process involving South African anesthesiology and vascular surgery experts.

Key Recommendations:

1. Preoperative Risk Stratification: Elective noncardiac surgical patients aged ≥45 years with a history of coronary artery disease, congestive heart failure, stroke, or transient ischemic attack, as well as vascular surgery patients aged ≥18 years with peripheral vascular disease, require further preoperative risk stratification. Their predicted 30-day major adverse cardiac event (MACE) risk exceeds 5%. This recommendation aligns with international guidelines and remains relevant in both African and U.S. contexts.

2. Non-invasive Cardiovascular Testing: Routine non-invasive cardiovascular testing before elective noncardiac surgery is not recommended. In the U.S., a baseline electrocardiogram (ECG) is commonly performed for postoperative comparison. However, in many African settings, unnecessary testing is avoided due to financial constraints. ECGs are only conducted when indicated by symptoms or a history of heart failure or stroke, as highlighted by a Liberian healthcare professional.

3. Preoperative Natriuretic Peptide (NP) Screening: Preoperative NP screening is recommended for elective noncardiac surgical patients aged ≥45 years with a history of coronary artery disease, stroke, transient ischemic attack, or congestive heart failure, and for vascular surgical patients aged ≥18 years with peripheral vascular disease.

Despite strong evidence supporting this recommendation, its implementation is limited in some African countries due to the unavailability of NP testing in smaller clinics, as noted by Liberian healthcare professionals.

4. Postoperative Troponin Monitoring: Daily postoperative troponin measurements for 48–72 hours are recommended for high-risk noncardiac surgical patients, specifically: i) Patients with a baseline MACE risk >5% at 30 days post-surgery (if no preoperative NP screening was performed). ii) Patients with elevated preoperative BNP (>99 pg/ml) or NT-proBNP (>300 pg/ml).

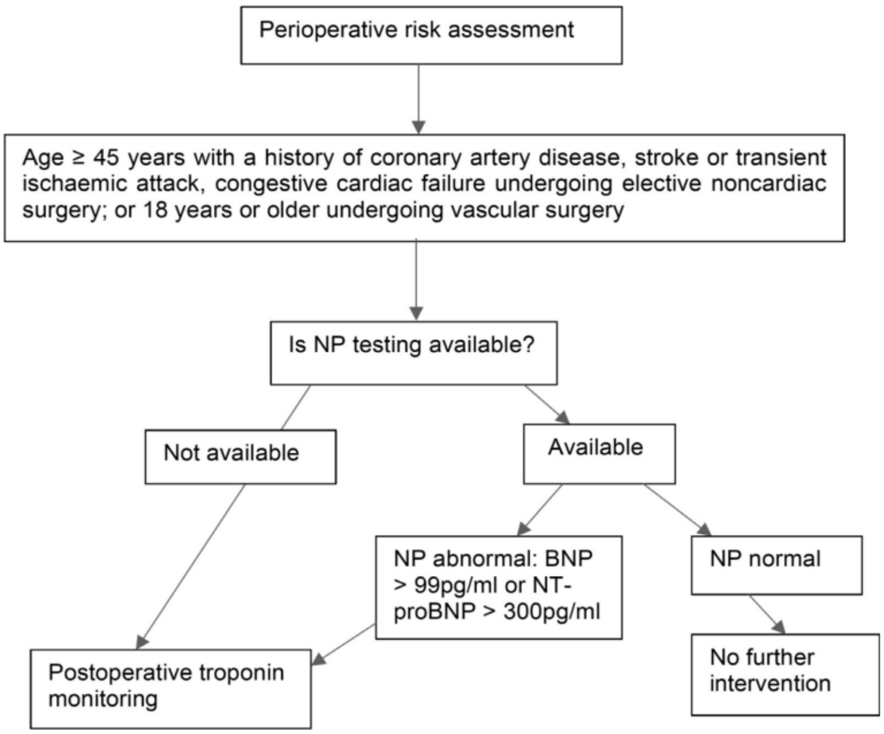

Fig 1. South African cardiac patient for noncardiac surgery practice guidelines algorithm. BNP, B-type natriuretic peptide; NP, natriuretic peptide; NT-pro-BNP, N-terminal prohormone B-type natriuretic peptide.

[Click here to check out all our previous grand round presentations]

This guideline is designed to detect myocardial injury following surgery. A Liberian healthcare worker emphasized that troponin testing is already used in their setting to diagnose and monitor heart failure severity and predict future cardiovascular complications.

While the South African guidelines offer a structured approach, their applicability varies across African nations due to differences in healthcare infrastructure and resource availability. The Liberian medical team highlighted that healthcare systems across Africa are heterogeneous, and a one-size-fits-all approach may not be feasible. Local adaptations of perioperative cardiovascular guidelines must consider the specific healthcare realities of each country, balancing evidence-based recommendations with practical feasibility.

Perioperative cardiovascular management for noncardiac surgery in Africa requires context-specific guidelines that acknowledge resource limitations and healthcare disparities. While international frameworks provide a foundation, African healthcare systems must tailor recommendations based on available resources and local expertise. Collaborative efforts are crucial to improving perioperative outcomes and reducing cardiac complications in surgical patients across the continent.

Healthcare Education Across Borders: Curriculum for Clinical Ultrasound for Anesthesiologists in India


Huma Syed Hussain, MD
Shweta Yemul Golhar, MD

As part of the Global Health Program, Dr. Shweta Yemul Golhar conducted a live virtual "Train the Trainers" workshop on perioperative ultrasound.

Click here to view the second session of "Train the Trainers' workshop

On February 28, 2025, the Global Health team for India, led by Dr. Shweta Golhar, conducted a virtual training session on Clinical Ultrasound at Byramjee-Jeejeebhoy Government Medical College (BJGMC) in Pune, India. Practicing physicians from BJGMC participated in the session.

Dr. Golhar, an alumnus of BJGMC, introduced the Clinical Ultrasound training program at her alma mater to enhance ultrasound skills among practitioners. The program, launched in October 2024, features comprehensive modules covering ultrasound physics and knobology, RUSH/FAST protocols, and organ-specific ultrasound applications for the lungs, heart, and gastric system.

The session focused on cardiac ultrasound, beginning with a live demonstration on a model to showcase normal cardiac anatomy and standard image acquisition techniques. This was followed by a presentation featuring ultrasound images of various cardiac pathologies, which had been acquired from real clinical cases. In addition to the cardiac module, the session also included a review of lung and gastric ultrasound images, reinforcing key concepts covered in previous sessions. Participants engaged in image interpretation exercises, where they received feedback on ultrasound images they had submitted. Additionally, de-identified cases from BIDMC were used to illustrate diagnostic approaches and interpretation techniques.

This session marked the completion of the ultrasound course for the attendees, culminating months of training aimed at strengthening Clinical Ultrasound proficiency. Participants appreciated the structured, interactive learning approach, and the session was well received as another successful milestone in global collaboration and advancing ultrasound education at BJGMC.


DIVISION CORNER

Perioperative Management of Carotid Body Paragangliomas

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Gifty Addae, MD
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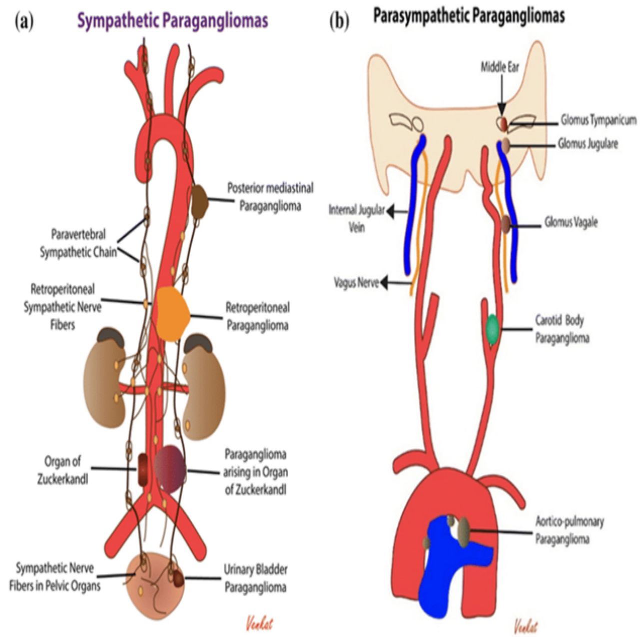
Paragangliomas: Overview and Classification: Paragangliomas are rare neuroendocrine tumors arising from extra-adrenal autonomic paraganglia, composed primarily of neuroendocrine cells derived from the embryonic neural crest. At the cellular level, paragangliomas and pheochromocytomas are indistinguishable. Catecholamine-secreting paragangliomas present similarly to pheochromocytomas, with symptoms such as hypertension, episodic headaches, sweating, and tachycardia.



Approximately 80%–85% of pheochromocytoma-paraganglioma (PPGL) cases are pheochromocytomas, while 15%–20% are paragangliomas. The overall prevalence of PPGL is approximately 6 cases per 1 million person-years. At least one-third of PPGL cases are associated with germline mutations and may be part of hereditary syndromes such as multiple endocrine neoplasia (MEN) type 2, von Hippel-Lindau (VHL) syndrome, and neurofibromatosis type 1 (NF1). As a result, genetic testing is recommended for all patients with PPGL.

The Shamblin classification, first introduced in 1970, is widely used for risk stratification in carotid body tumors (CBTs) before surgery. It categorizes tumors into three groups based on operative risk:
Type I: Small tumors that do not compromise the carotid vessels, allowing for relatively easy excision.
Type II: Tumors that adhere to or partially encase vessels, making excision more challenging.
Type III: Large tumors that intimately surround or encase the carotid vessels, posing significant surgical risk.

CBTs can be classified into three distinct forms: familial, hyperplastic, and sporadic. Familial cases are often associated with germline mutations in three of the four succinate dehydrogenase (SDH) subunit genes.

Case 1

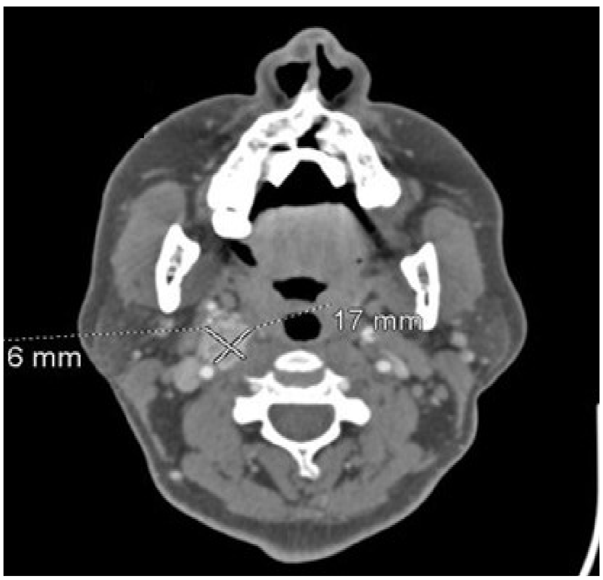
36-year-old male presented with dysphagia, dysphonia and left upper eyelid ptosis for treatment of left carotid body tumor.

PMH: Hereditary paraganglioma pheochromocytoma syndrome, iatrogenic Horner's syndrome and sleep apnea
Family history: Lung cancer and SDH-B mutation
MRI neck showed heterogeneous, enhancing mass at the left carotid bifurcation which splayed the internal and external carotid artery branches. This measures approximately 1.7 cm transverse by 1.7 cm AP by 4.3 cm
CTA head and neck: 2.2x1.7 cm cavernous malformation, left carotid space mass splaying the carotid vessels- 2.2x2.1x3.8cm

24h urine metanephrines and catecholamines were within normal limits.
Fiberoptic laryngoscopy: Clear nasal cavity bilaterally, clear nasopharynx, clear oropharynx, clear hypopharynx. Clear base of tongue, vallecula and bilateral piriform sinuses.
Preop: Successful embolization of the left carotid body tumor using particles and Gelfoam was performed, along with a negative balloon occlusion test of the left ICA, one day before surgery.
Intraop: General anesthesia with invasive arterial pressure monitoring, cerebral oximetry, and SedLine monitoring. The tumor appeared to originate from the sympathetic chain, requiring partial resection of the chain along with the left superficial laryngeal nerve. Lymph nodes were dissected and sent for biopsy to assess for lymphatic invasion.
Postop: Final histopathology report showed the lesion to be a malignant paraganglioma with perineural and lymphatic invasion.

Case 2

65-year-old female presented for evaluation of a right carotid body tumor. She was incidentally found to have a right carotid body tumor 2 years earlier during work-up for jaw pain.
PMH: HTN, HLD, carotid body tumor, sciatica, UTI, eczema
Urine metanephrines were normal.



Case 3

49-year-old Male with carotid body paraganglioma presented for resection of the tumor.
PMH: HTN, HLD, Bilateral carotid artery stenosis, family history of SDHB mutation
Intraoperatively patient had sustained BP of 280/180 for 8 min after induction despite large doses of antihypertensives and preop optimization. Patient had pulmonary edema after repeated spikes of hypertensive episodes.

CT neck: R carotid space mass with additional possible vertebral artery collateral, medialization of internal carotid artery to retropharyngeal location, 3.7 cm (2019: 3.0 cm)
Octreotide whole body scan in 2017: showed no uptake aside from bilateral carotid body tumors

Hgb: 14.7	Plt:316 ,	Cr: 0.8
Na: 139	K: 4.4	Cl: 100
HCO3: 24	AG:15	

Normetanephrines: 1646 (88-640)
Metanephrines: 1720 (180-739)

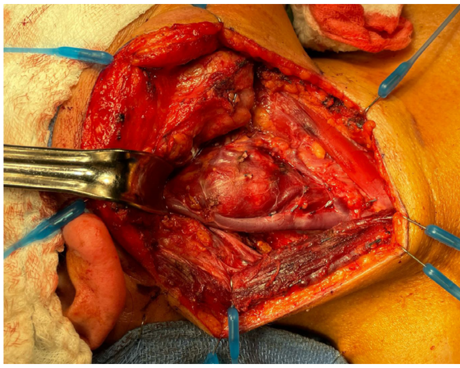


Fig 1. Paraganglioma at the carotid bifurcation during neck dissection

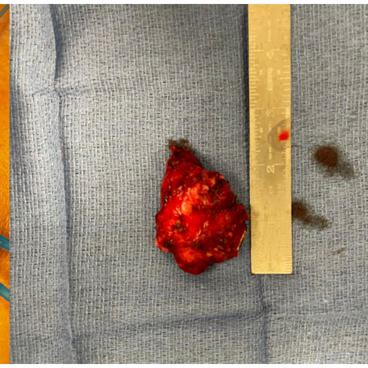


Fig 2. Resected tumor

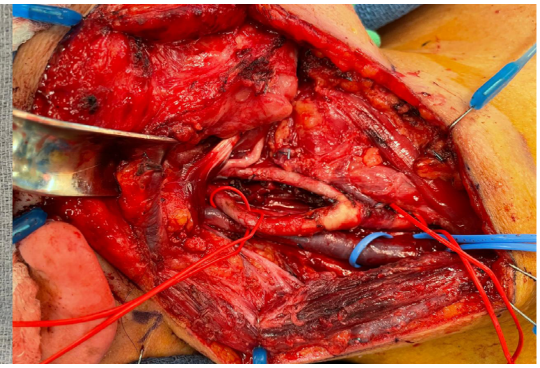


Fig 3. Carotid bifurcation after tumor resection

Postoperative Monitoring and Long-Term Follow-Up

Immediately after surgery, patients should be closely monitored for hemodynamic instability, including hypotension and arrhythmias, due to abrupt fluctuations in catecholamine levels. Postoperative hypotension is common and may require intravenous fluids and vasopressors for stabilization. Biochemical monitoring is essential to assess the completeness of tumor resection. The North American Neuroendocrine Tumor Society recommends measuring 24-hour urine fractionated metanephrines and/or plasma-free metanephrines 2–8 weeks postoperatively. Persistent elevation may indicate residual tumor or metastatic disease.

Long-term follow-up is critical, particularly for patients with hereditary syndromes, due to the risk of recurrence or new tumor development. The National Comprehensive Cancer Network (NCCN) recommends regular biochemical testing and imaging, with follow-up intervals tailored to tumor characteristics and genetic risk factors. For sporadic, solitary tumors ≤5 cm, biennial follow-up is advised, whereas patients with larger, multiple, or hereditary tumors should undergo annual surveillance.

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2. Perioperative Hemodynamic Instability in Pheochromocytoma and Sympathetic Paraganglioma Patients. Kim JH, Lee HC, Kim SJ, et al. Scientific Reports. 2021;11(1):18574. doi:10.1038/s41598-021-97964-3.

Perioperative Management Protocol Of Paragangliomas And Pheochromocytomas

Induction

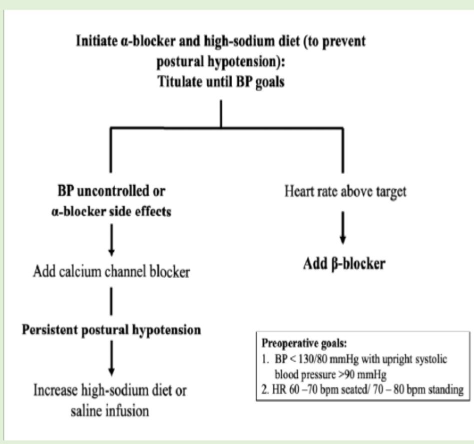
- Previous administration of 1,5-2,5 lts of fluids
- Intraoperative use of magnesium sulfate 40 to 60mg bolus/kg before tracheal intubation continuous infusion of 2g/h
- Avoid HTN
- Have Nitroglycerine, Nicardipine and esmolol ready
- Slow induction

Avoid

Table 2. Trigger factors of catecholaminergic crisis

Drug class	Examples of drugs
Anesthetics	Succinylcholine, pancuronium, halothane, ketamine
Antidepressants	Amitriptyline, nortriptyline bupropion, duloxetin, paroxetine, fluoxetine
Unopposed ß-blockers	Propranolol, metoprolol
Dopamine-2 antagonists	Metoclopramide, haloperidol, olanzapine, chlorpromazine
Opioid analgesics	Morphine, tramadol
Peptide hormones	Glucagon
Sympathomimetics	Ephedrine, amphetamine, sibutramine, phentermine

Pre-op medications



Tumor manipulation

Anesthetic management:

- Increase in BP is expected
Anticipate profound hemodynamic changes
- Nitroglycerine and nicardipine boluses if tachycardic and hypertensive
- Titrate Fentanyl
- Fluid bolus from hot line and titrate to invasive/non-invasive parameters (CVP/PPV/LiDCO/TTE/TEE)
- Have antiarrhythmics (Lidocaine, Beta blockers, Amiodarone)
- **Ensure communication with surgical team regarding phases of the procedure.**

Ligation of the venous drainage

o The key factor to avoid this complication is to keep an adequate blood volume from the beginning of the surgery
o If no preparation, there will be a significant decrease in BP

o Maintain MAP > 65 mmHg through IVF resuscitation as guided by invasive/non-invasive measurements.

o Be liberal with fluids if no cardiac disfunction

o Titrate vasoactive agents if required
Vasopressin could be used since this drug does not depend on adrenergic receptors for its action

o Monitor urine output

Table 3 Preoperative blockade regimens in pheochromocytomas and PGLs [1, 4, 46, 47, 49]

Drug	Initial and maximum doses	Considerations
Alpha blockade		
Phenoxybenzamine	Initial doses: 10 mg/12 h Maximum doses: 1 mg/kg/day	Treatment adjustment every 2–3 days until the objectives of blood pressure are reached Secondary side effects (SSE) are common (postural hypotension and nasal congestion) Long duration of action: > risk of postoperative hypotension High cost
Doxazosin	Initial doses: 2 mg/24 h Maximum doses: 4 mg/8 h	Less SSE than phenoxybenzamine Low cost
Prazosin	Initial doses: 2 mg/12 h Maximal doses: 5 mg/8 h	Similar to doxazosin
Terazosin	Initial doses: 1 mg/24 h Maximal doses: 4 mg/24 h	Similar to doxazosin
Complementary drugs to alpha blockade		
Calcium-antagonists [38]	Amlodipine: 10–20 mg/24 h Nicardipine: 60–90 mg/24 h Nifedipine 30–90 mg/24 h Verapamil 180–540 mg/24 h	Useful for the prevention of coronary spasm induced by catecholamines, in paroxysmal hypertension or orthostatic hypotension
Methyrosine	250–500 mg/6 h	Maximum effect 3 days after its onset. High cost SSE: gastrointestinal, extrapyramidal, and lethargy
Beta blockade		
Propranolol	10 mg/8 h Maximum doses: 25 mg/8 h	Start after adequate alpha blockade (at least 3–4 days of alpha treatment)
Atenolol	12.5 mg/8 h Maximum doses: 25 mg/8 h	Start after adequate alpha blockade (at least 3–4 days of alpha treatment)
Metoprolol	50 mg/24 h Maximum doses: 200 mg/24 h	Start after adequate alpha blockade (at least 3–4 days of alpha treatment)

ECHO CORNER

Case by Case Insights into Advanced Echocardiographic Diagnostics

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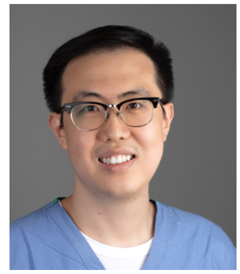
Sumeeta Kapoor, MD
Yifan Bu, MD
Maurizio Bottiroli, MD



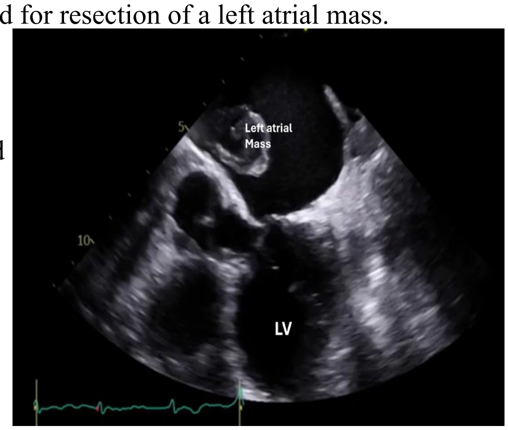



A 79-year-old male with a history of atrial fibrillation on warfarin, COPD, and GERD presented with acute limb ischemia of the left lower extremity (LLE). He underwent LLE cutdown, thrombectomy, percutaneous transluminal angioplasty (PTA), and four-compartment fasciotomies. A large left atrial thrombus was identified in the extensive workup. The patient subsequently presented for resection of a left atrial mass.

Intraoperative Findings:

Echocardiogram (TEE) - Initial Assessment:

- Severe biatrial enlargement with normal biventricular size and preserved function (EF: 55%).
- No significant valvular regurgitation or stenosis.
- Large (3 × 2 cm) left atrial mass attached to the interatrial septum, appearing hyperechoic with two hypoechoic areas in its center.
- No obstruction of the mitral valve; normal gradients.
- No abnormalities in the aorta, no patent foramen ovale (PFO), no effusion, and no left atrial appendage (LAA) thrombus.



Left Atrial Mass

Unexpected Intraoperative TEE Findings:

- Just minutes before incision, repeat TEE (2D and 3D) no longer showed evidence of the left atrial mass.
- No mass detected in the mitral valve or left ventricle.
- Detailed inspection of the aortic valve, ascending aorta, distal aortic arch, and descending thoracic aorta showed no evidence of the mass.
- Carotid ultrasound also did not reveal any mass.

The patient was transferred intubated to the ICU and subsequently underwent CTA.

CTA Findings:

- Superior Mesenteric Artery: Non-occlusive thrombus located ~4.5 cm from the takeoff.
- Right Lower Extremity: Occlusive thrombus extending from the right popliteal artery to the anterior and posterior tibial artery bifurcation.
- Left Lower Extremity: Occlusive thrombus in the left external iliac artery with minimal flow in the distal deep femoral artery. No opacification of the left lower extremity distal to the popliteal artery, possibly due to contrast bolus timing and/or occlusive thrombus.

Clinical Considerations:

The left atrial thrombus has the potential to embolize to the femoral, popliteal, brachial, mesenteric, and renal arteries.

It's vital to rule out brain, gut, and renal ischemia immediately.

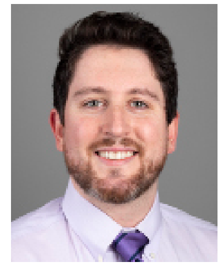
Cardiac emboli account for approximately one-third of all ischemic stroke cases.

Click here to view the TEE images and findings

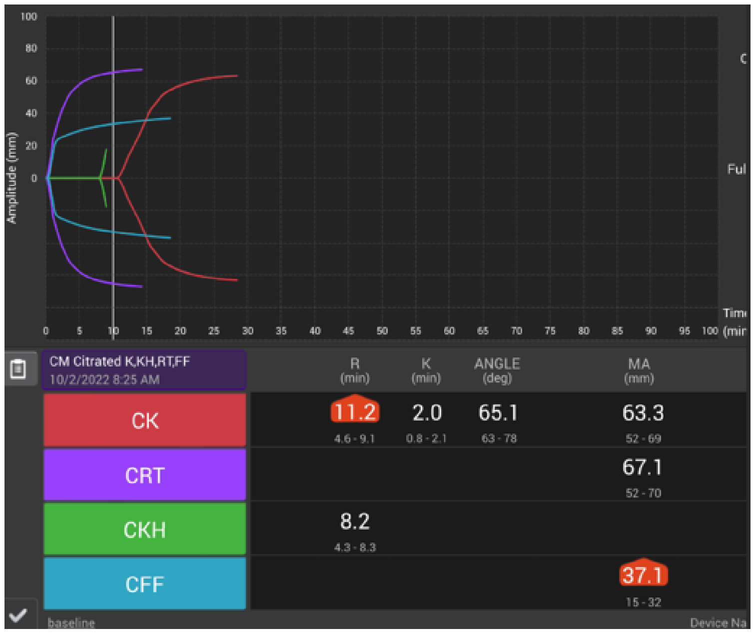
COAGULATION CORNER

A Comprehensive Analysis of Coagulation Dynamics and Clinical Applications

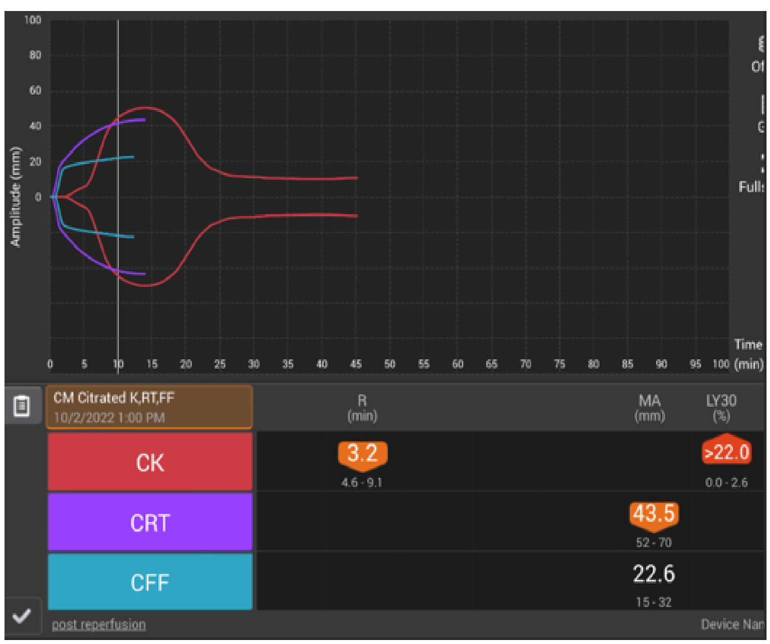
John Bellamante, MD, MS



This is a 66 y/o man with alcoholic cirrhosis who presents for combined liver/kidney transplant. Baseline TEG was normal. After reperfusion, the following tracing was obtained.



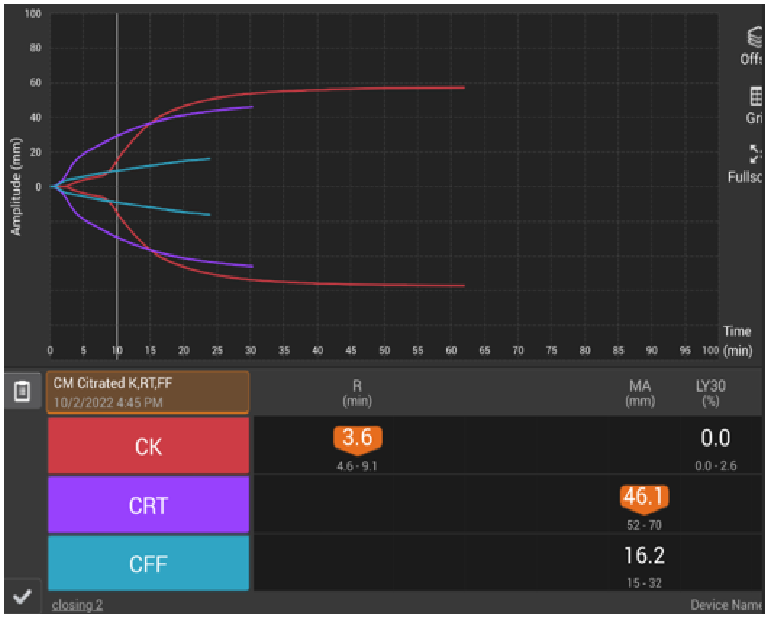
What do you notice about this tracing?
Would you give products? What else could you give?



Later on, the surgical team observed worsening oozing from the retroperitoneum.

What should be given here? What if the surgical team asks for more FFP?

The bleeding improves. A few hours later, a repeat TEG is done as oozing has resumed.



Click here to view the lecture on thromboelastography.

Did our prior therapy work?

What should we do now?

What is Thromboelastography (TEG)?

Traditional coagulation tests do not show the mechanical properties of clot over time because PT and PTT both terminate at low thrombin levels and before fibrin is polymerized. TEG provides a comprehensive view of a hemostatic profile, assessing the hemostatic potential of whole blood, as compared to a traditional coagulation monitoring. TEG measures viscoelasticity of whole blood from initiation of fibrin formation to maximal platelet clot strength and through fibrinolysis.

Variable	Definition	Normal Value	Deficiency
R Time (R)	Time to start forming clot	1-14 mins	Coagulation Factors
K Time (K)	Speed of stable clot formation	1-3 mins	Fibrinogen
Alpha Angle (AA)	Speed of fibrin accumulation	45-55°	Fibrinogen
Maximum Amplitude (MA)	Maximal strength of clot	50-60 mm	Platelets
Fibrinolysis	Reduction of clot strength after 30 minutes	0-8%	Excess Fibrinolysis

Which parameters are used to measure clot strength?

TEG measures clot strength over time, focusing on:

- Clot rate (R, in mins) - time it takes for first measurable clot to form.
- Clot strength (max. amplitude MA, in mm) - Strength of the clot.
- Clot stability (lysis LY30, in %): breakdown of the clot.

Graphical tracing and numerical results are reported for each measurement and results are highlighted orange if they fall outside the reference range.

Citrated Kaolin (CK): An intrinsic pathway activated assay identifies underlying hemostatic characteristics and risk of bleeding or thrombosis.

Citrated Kaolin with Heparinase (CKH): Eliminates the effect of heparin in the test sample and used in conjunction with Kaolin assessed the presence of systemic heparin.

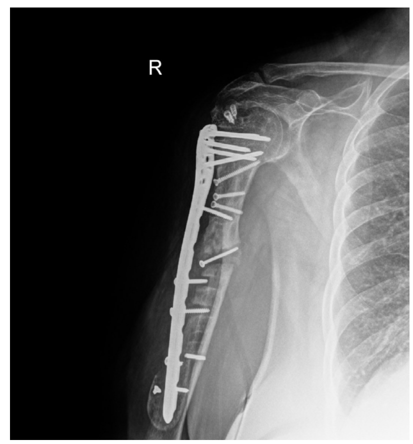
Citrated Rapid TEG (CRT): An intrinsic and extrinsis pathway activated assay speeds the coagulation properties.

Citrated Functional Fibrinogen (CFF): Used in conjunction with Kaolin or RapidTEG can assess relative contribution of platelets and fibrin to overall clot strength.

REGIONAL CORNER

Regional Anesthesia and Acute Compartment Syndrome

Huma Syed Hussain, MD
Thy Vo, MD
Lisa Kunze, MD



Case Summary:

A 66-year-old individual with a complex medical and surgical history presented for right humerus open reduction and internal fixation (ORIF) due to a nonunion. The patient had undergone multiple prior attempts at ORIF, including an initial surgery performed at another facility, followed by a revision which was also unsuccessful.

Intubations for previous surgeries (hernia repair, humerus surgeries) had been uneventful, utilizing video laryngoscopy (McGrath) and a 7.0 endotracheal tube, with Grade 1 views achieved.

The patient had been evaluated preoperatively and cleared for surgery. The planned procedure was a repeat ORIF of a persistent nonunion of the right humerus.

A right supraclavicular peripheral nerve block was performed for postoperative pain management at the request of the surgical team. The procedure had been conducted under ultrasound guidance using a single-shot technique, and 17 mL of 0.5% bupivacaine had been administered. The injection had been completed without complications, with negative aspiration for blood, no paresthesia during injection, and appropriate visualization of local anesthetic spread around the nerve on ultrasound.

Acute Compartment Syndrome:

Acute compartment syndrome (ACS) is a surgical emergency in which rising pressure within a muscle compartment compromises tissue perfusion, potentially leading to irreversible muscle and nerve damage within hours. Prompt recognition and fasciotomy are essential to prevent long-term functional loss or limb-threatening complications. The diagnosis can be particularly challenging, as hallmark signs such as pain out of proportion to injury, tight compartments, and paresthesia are nonspecific and may be masked in certain settings.

The use of regional anesthesia (RA) for analgesia in trauma or orthopedic surgery has traditionally raised concern due to its potential to obscure the early signs of ACS, particularly in alert patients who would otherwise report disproportionate pain. However, this association remains controversial. Although case reports link prolonged nerve blocks with delayed ACS diagnosis, evidence also shows that ACS has been diagnosed and successfully managed in patients receiving single-shot or catheter-based RA.

Upper limb fractures, including those of the humerus (proximal, shaft, and distal), are considered to have a low risk of ACS, largely due to the relatively compliant fascia and anatomical communication with the shoulder girdle, which accommodates swelling more easily than the lower limb.

Nevertheless, clinicians should remain vigilant postoperatively, especially in the setting of high-energy trauma, and ensure protocols are in place for timely reassessment should symptoms suggestive of ACS arise.

Fracture Type	Risk of ACS	Notes
Tibial Shaft Fractures	High	Reported incidence 3–30%; most associated with ACS
High-energy Tibial Plateau Fractures	Moderate to High	ACS incidence 1.7–17%, up to 53% in fracture dislocations
Foot Fractures (e.g. calcaneal, Lisfranc)	Moderate to High	Calcaneal: 3.8–23%; Lisfranc/Chopart dislocations: >20%
Tibial Plafond Fractures	Moderate	Incidence around 2–2.6%
Femoral Shaft Fractures	Moderate	ACS is rare but can be missed; high morbidity
Dual Forearm Bone Fractures	Moderate to High	Incidence 15% in dual bone cases
Distal Radius Fractures	Low to Moderate	Overall ~0.25%, higher in <35 years and high-energy trauma
Ankle Fractures	Low	Very few cases reported may occur in high-energy settings
Hip Fractures	Very Low	Rare reports, mainly due to prolonged leg positioning during surgery
Elbow Dislocations/Fractures	Low	Rarely associated with ACS
Proximal/Distal Humerus Fractures	Low	Fascia more compliant, low risk
High Tibial Osteotomy	Moderate	Incidence of ACS ~0.9%; vascular injury is main concern
ACL Reconstruction, Knee Arthroscopy	Low	ACS is very rare; more likely with vascular injury or knee dislocation
Elective Foot/Ankle Surgery	Low	Rare unless revision/extensive correction
Hip Arthroscopy	Very Low	Isolated reports of abdominal ACS due to fluid extravasation

Clinical Consideration:

While regional anesthesia (RA) offers effective and opioid-sparing analgesia for orthopedic procedures, its use in settings where acute compartment syndrome (ACS) is a potential complication must be approached thoughtfully. Although RA is not absolutely contraindicated in these scenarios, certain high-risk fracture patterns, high-energy trauma, or complex surgical interventions may warrant caution. In such cases, RA should only be administered after a thorough risk-benefit discussion with the surgical team.

In the context of elective upper limb surgeries such as arthroscopic or open procedures of the shoulder, elbow, and wrist, the overall risk of ACS is considered very low. The large and anatomically connected compartments of the upper arm, such as the deltoid and arm compartments, help accommodate postoperative swelling. ACS in this setting is exceedingly rare and typically reported only in isolated case studies, often in the context of unusual surgical complexity or hematoma formation.

Given the low incidence of ACS in elective upper limb procedures, RA is considered safe and appropriate for most patients. However, providers should remain mindful that surgical complexity, anticoagulant use, and individual patient factors can still influence the risk profile. As with any anesthesia plan, clinical vigilance and close postoperative monitoring remain essential.

NEWSWORTHY

IARS 2025 Meeting

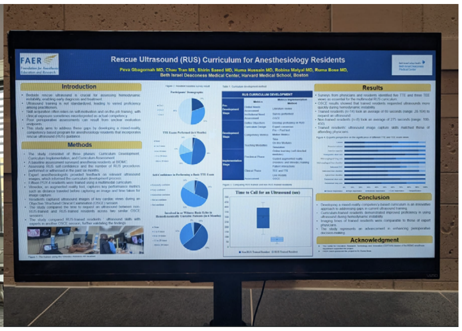
At the 2025 IARS/SOCCA Annual Meeting, Drs. Shiri Savir, Sara Neves, and Robina Matyal showcased how virtual and augmented reality are reshaping procedural training in anesthesiology. Dr. Savir moderated a session on VR's role in invasive procedural education, emphasizing its safety, scalability, and realism. Dr. Matyal advocated for simulation-based curricula that integrate motion metrics to assess skills and reduce trainer burden. Dr. Neves shared promising early results from BIDMC's VR-based residency training, with interns reporting high realism and improved confidence. The BIDMC team also addressed advancements in POCUS training and the need to shift from certification to true proficiency.

SEA 2025 Meeting

"How to Do Less with More": In-Situ Simulation Workshop at SEA

At the recent Society for Education in Anesthesia (SEA) meeting, an in-situ simulation workshop titled "How to Do Less with More" took center stage. Led by Nadav Levy, Dario Winterton, Federico Puerta, Matt Gao, and Huma Syed Hussain, the workshop demonstrated how impactful, high-quality simulation training can be conducted using available materials. Participants explored strategies to adapt simulation-based education to their own environments making training more accessible and scalable.

As part of the same SEA session, Huma Syed Hussain, Postdoctoral Research Fellow, also presented an innovative lab idea titled Recognition, Evaluation, Resuscitation (RER). This concept is designed for implementation in Pakistan and Liberia and focuses on building core clinical competencies in rapid patient assessment, resuscitation, and team management. Through interactive case-based scenarios and structured review content, RER aims to equip healthcare workers with the tools to conduct efficient primary surveys and apply early interventions to stabilize critically ill patients.

Quiz Yourself

Audio & Visual Lesson

[Check out case six here.](#)

We have compiled cases for quick review of ***ECG and rhythm interpretations*** for efficient learning and skill enhancement.

ECG and Rhythms Interpretation