SOCCA
SOCIETY OF CRITICAL CARE ANESTHESIOLOGISTS

INTERCHANGE

Society of Critical Care Anesthesiologists Newsletter Volume 37 | Issue 3 | September 2026

Artificial Intelligence in Critical Care Medicine

Also in this issue...

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INTERCHANGE

Society of Critical Care Anesthesiologists Newsletter Volume 37 | Issue 3 | September 2026

President's Message

It is a privilege to serve as President of the Society of Critical Care Anesthesiologists (SOCCA) during such an exciting time in medicine. Artificial intelligence (AI) is rapidly becoming part of our everyday work, from clinical decision support and documentation to research and predictive analytics. In critical care, many of us are already seeing the benefits. We can create a discharge summary with a single click, saving valuable time.

Linda Liu, MD
President, SOCCA
University of California
San Francisco, CA

As AI continues to evolve, it has enormous potential to improve patient care and make our work more efficient. At the same time, we need to be thoughtful about how we incorporate these tools into practice. AI should support, but clearly not replace, clinical judgment in the care of critically ill patients. Perhaps the bigger question is how we teach the next generation of physicians to embrace these technologies while still learning the art of medicine.

I believe SOCCA is uniquely positioned to help lead this conversation. Through our educational programs, collaborative research, and our members' expertise, we can better understand these emerging technologies, evaluate their impact, and integrate them responsibly into patient care. The articles in this issue explore many of these topics, and I hope they spark meaningful discussion. I encourage you to enjoy this AI-focused edition of Interchange.

Beyond this issue's theme, SOCCA has had a busy and productive year. Our Board Review Course was another tremendous success. Over 30 members volunteered as presenters or moderators. This remains one of SOCCA's flagship educational programs.

Looking ahead, I'm excited to share one of SOCCA's newest initiatives: the development of a SOCCA ICU Guide, with publication planned for 2027. We were truly overwhelmed by the response to our call for editors. The number of outstanding applicants reflected the remarkable talent and

continued on next page

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CONTENTS

commitment within our Society. After a thoughtful selection process, I am pleased to announce that Dr. Babar Fiza will serve as Editor, joined by Associate Editors Dr. Geoffrey Lighthall, Dr. Dusan Hanidziar, and Dr. Jean Kwo. Together with contributors from across our specialty, they will create what we expect to be an invaluable practical resource for both faculty and trainees working in critical care. I look forward to sharing more as this project progresses.

I'm also happy to report that SOCCA remains on a strong financial footing. This allows us to continue investing in the educational opportunities and resources that benefit our members. In the coming year, we have an outstanding lineup of webinars, journal clubs, ultrasound case conferences, and our Annual Meeting. These programs reflect SOCCA's ongoing commitment to advancing critical care anesthesiology and supporting our members throughout every stage of their careers.

The greatest strength of SOCCA has always been its members. I hope you'll join us during the ASA Annual Meeting for two SOCCA member events on Saturday, October 17, 2026. We'll kick things off with the SOCCA Meet-up from 1:30–2:15 p.m., followed by the SOCCA Social from 4:00–5:00 p.m. These gatherings are a wonderful opportunity to reconnect with colleagues, welcome new members, and simply enjoy spending time together. We'll share additional details as the meeting approaches, and I hope to see many of you there.

Thank you for your continued involvement and support of SOCCA. It is an exciting time for our specialty, and I am grateful to be part of this community alongside all of you.

Clinical Practice Committee (CPC) Update

The SOCCA Clinical Practice Committee (CPC) has continued to build momentum following a successful presence at the 2026 IARS Annual Meeting in Montreal. Highlights included the first-ever SOCCA-sponsored ECMO Bootcamp, featuring hands-on ECMO cannulation and management simulation, as well as the Brain Death Determination simulation. This renewed engagement has also brought several transitions in subcommittee leadership. Across its subcommittees, the CPC continues to translate clinical expertise into practical education, collaborative scholarship, and resources that support SOCCA members in everyday critical care practice.

The Cardiothoracic Critical Care (CCC) Subcommittee (formerly MCS/ECMO/CTICU) has resubmitted the ECMO Bootcamp for the 2027 Annual Meeting building on the successful program presented in Montreal. Subcommittee leadership, Lauren Sutherland, MD (Chair) and Bhoumesh Patel, MD (VC) have been working hard on developing SOCCA members-only ECMO educational modules which will hopefully be launched before the annual meeting. Additionally, there are discussions of a position paper on ECMO competencies for critical care fellowship training along with the PDAC group.

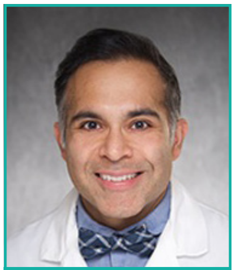
The Neuro Critical Care subcommittee, Vishal Yajnik, MD (Chair) and Kate Rosenblatt, MD (VC) have resubmitted the brain death simulation workshop for the next annual meeting with some adjustments to better match the needs of learners. Additionally, the panel on brain death determination has also been resubmitted.

The Global Critical Care subcommittee, Vannessa Moll, MD (Chair) and Ana Crawford, MD (VC) have also been active. Hopefully you will find their article entitled, “Leveraging Technology to Support Global Critical Care”, in this issue of the Interchange informative. They have also submitted a panel on “Building Critical Care Capacity Without Borders” to the next annual meeting.

The Obstetric CCM subcommittee, Yanni Angelidis, MD (Chair) and Emily Naoum, MD (VC) have been active! There has been a significant amount of collaboration with other groups including a combined SOAP-SOCCA panel at SOAP 2027 entitled, “Maternal Collapse: Rapid Diagnosis and Advanced Resuscitation Across Embolism, ECMO, and Cardiac Arrest.” Additionally, there will be a fireside chat at ASA 2027 entitled, “On the Edge of Life: Navigating the Frontlines of High-Risk Obstetrics.” There have also been two submissions to the SCCM annual meeting by the subcommittee.

Alok Gupta, MD
Chair, SOCCA Clinical Practice Committee
Northwestern University
Chicago, IL

The Quality and Safety subcommittee has also had some changes in leadership with Joy Chen, MD (Chair) and Sean Josephs, MD (VC). They have submitted a workshop for the 2027 meeting entitled, “QI Lab: Design Your Next High-Impact Project.” Additionally, the QI Repository is live on the SOCCA website, and we encourage everyone to submit their QI projects so others may learn from your journey.



Lovkesh Arora, MD
Vice-Chair, SOCCA Clinical Practice Committee
University of Iowa
Iowa City, IA

The Transplant subcommittee has new leadership with Aalok Kacha, MD (Chair) and Peiman Lahsaei, MD (VC). Given this leadership change occurred mid-summer, they worked quickly and submitted panels entitled, “Coordination of Care for Multi-organ Transplantation in the ECMO Era” and “The Anesthesiologist-Intensivist in High-MELD Liver Transplantation: From MICU Optimization to Fast-Track Recovery and Value-Based Care”. With this momentum, we expect great things from this subcommittee.

With more than 50 members, the CPC remains SOCCA’s largest committee. We look forward to building on this momentum through continued collaboration, education, scholarship, and clinical practice initiatives as we move toward the 2027 IARS Annual Meeting. We look forward to seeing everyone in Chicago!

Membership Committee Update

A big welcome to new members of the SOCCA membership committee!

Committee members have been working hard to plan virtual get-togethers to provide career development and networking for SOCCA members. Many thanks to those who attended our recent webinar hosted by the ECI (Early Career Intensivists), PPP (Physicians in Private Practice) and WICC (Women In Critical Care) sub-committees. Stay tuned for our next event, the annual jobs fair, on October 1st at 5:00pm EST. Please reference the SOCCA calendar of events for more information about the remainder of the events this year.

We will continue to host SOCCA Socials at anesthesia conferences throughout the year, including at SCA, SCCM, SNACC, SOAP, SOCCA/IARS and ASA meetings. We will also have a presence at student/resident events at major conferences. Let us know if you are interested in helping. Finally, the mentorship program reboot is finalized and will be rolling out soon!

Thank you for renewing your membership and being a part of our growing SOCCA community! Please don't hesitate to reach out to info@socca.org with any additional ideas that you would like us to pursue.

Christopher Choi, MD
Chair, SOCCA Membership Committee
UT Southwestern Medical Center
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Nominations Committee Update

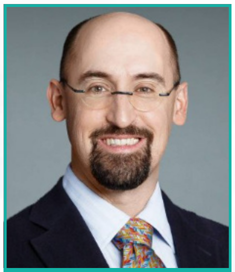
SOCCA is fortunate to have a growing and active membership. Service on our various committees is an excellent way to build experience and prepare for leadership roles in the Society. As we have every year, we will be setting a ballot for our Board of Directors.

This cycle, our Nominations Committee will make a ballot for the election of a Secretary of the Society (from the existing Board of Directors) and 3 Director-at-large positions. Our call for nominations will open this fall, so stay tuned! Executive roles (Immediate Past President, President, President-elect, Treasurer, Secretary) are now 1 year, with a progression through the offices, starting at Secretary. Directors are elected for a 3 year term and may be re-elected for a second term.

To help members better understand SOCCA's evolving governance structure, we've provided resources here: updated Society Bylaws, criteria for evaluating volunteer leaders, and the newly implemented Committee Policy.

We plan to have the ballot ready by early February, 2027.

Keep up that involvement!



Mark E. Nunnally, MD, FCCM
Chair, SOCCA Nominations Committee
The University of Chicago
Chicago, IL

Research Committee Update

The SOCCA Research Committee enters the third quarter of 2026 with strong momentum, and this issue's theme — Artificial Intelligence and Technology in Critical Care — reflects one of the most consequential shifts happening in our field and globally. Across ICUs, AI-enabled tools are moving from proof-of-concept to prospective validation, and our subcommittees have been active partners and leaders in that transition.

A highlight this quarter is the recent publication of the Strategy to Avoid Excessive Oxygen using Autonomous Oxygen Intervention (SAVE-O2 AI) clinical trial in *JAMA Internal Medicine*.[1] The multicenter, randomized SAVE-O2 AI trial evaluated autonomous oxygen titration technology at four U.S. Level 1 trauma centers. Conducted in partnership with the Medical Technology Enterprise Consortium (MTEC), the trial demonstrated that a closed-loop, autonomous oxygen titration system can reduce clinician workload while increasing patient time spent within tight oxygenation targets — technology with clear relevance to combat casualty care as well as civilian critical care medicine. As autonomous titration systems move closer to bedside implementation, trials like SAVE-O2 AI illustrate the rigor our specialty must bring to validating these tools before they're integrated into routine practice.

This theme also frames much of the work happening across our subcommittees this quarter.

Data Subcommittee

Under Dr. Michael Kiyatkin's leadership, with Dr. Sylvia Ranjeva as Vice Chair, the subcommittee has completed analysis of the POCUS/VExUS in De-Resuscitation Practice survey and is preparing results for dissemination. The VV ECMO survey, now closed, generated strong member participation, and the subcommittee is exploring how structured registries and AI-assisted data extraction could streamline future survey and observational work — reducing manual burden while improving data fidelity.

Scientific Writing Subcommittee

Work continues to highlight the contributions of critical care anesthesiologists across subspecialties, including addressing value and reimbursement for anesthesiologist intensivists. Given this issue's theme, the subcommittee is also considering examining the role of AI-assisted literature synthesis and manuscript preparation tools in academic critical care writing — an area of growing interest among members.

Research Collaboration & Dissemination Subcommittee

Shahzad Shaefi, MD, MPH
Chair, SOCCA Research Committee
Beth Israel Deaconess Medical Center
Boston, MA

Preparations are underway for the six awards to be presented at the 2026 IARS/SOCCA Annual Meeting: three Young Investigator Awards and three inaugural Best of Meeting awards. The subcommittee has finalized streamlined submission criteria and an updated adjudication process and continues to expand ORCiD-linked search capabilities to improve visibility of SOCCA member scholarship — itself a technology-enabled effort to connect our members' research output with the broader field.

David J. Douin, MD, MSC
Vice Chair, SOCCA Research Committee
University of Colorado Anschutz School of Medicine
Aurora, CO

Speakers' Bureau Taskforce

The speaker's bureau taskforce completed its charge and was officially sunset in July 2026.

As AI tools increasingly touch clinical decision-making, data collection, and scholarly output, the Research Committee is committed to helping members engage thoughtfully — as investigators, evaluators, and end users. We encourage members interested in AI and technology-focused research, whether through survey participation, manuscript collaboration, or trial involvement, to reach out to the committee.

Thank you for your continued engagement, and we look forward to sharing further updates as these initiatives progress through the remainder of 2026.

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Generative AI in Critical Care Education: Better Questions, Not Faster Answers

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Generative artificial intelligence (AI) has become part of how clinicians learn, organize information, and approach unfamiliar problems. Large language models (LLMs), the most familiar form, produce explanations, cases, and questions by predicting likely word sequences from patterns in their training data [1]. A recent scoping review identified medical education as one of the major areas in which LLMs are entering critical care [2]. The question for educators is no longer whether trainees will use these tools. It is how to help them use them well.

Teaching with it: The Faculty Perspective

From a faculty perspective, generative AI is most useful when the task is productive rather than evaluative. It can help create clinical cases, simulation scenarios, discussion questions, and board-style questions tailored to a learner's level. A prompt specifying the teaching objective, level of training, and desired complexity can generate an initial case with laboratory trends, ventilator settings, or hemodynamic changes.

Simulation preparation benefits similarly. A model can draft scenario scripts, branching decision points, and debriefing questions, which are often the most time-consuming element of scenario design. These applications reduce the time required to build educational material and return that time to discussion, feedback, and clinical reasoning.

Personalization is a further application. Faculty can ask a model to explain the same concept at several levels of complexity, generate follow-up questions based on a learner's response, or build additional practice around an identified knowledge gap. A systematic review of LLMs in medical education found personalized content generation among the most consistently reported benefits and content accuracy among the most consistently reported problems [3].

Efficiency should not be confused with accuracy. Generative AI presents incorrect information with the same confidence it presents correct information, and that fluency makes errors difficult to recognize. Fabricated references are the best-documented failure. In one analysis of AI-generated medical content, 47 percent of references did not exist and a further 46 percent were real but cited inaccurately [4,5]. Faculty therefore remain responsible for verifying content, confirming clinical details, and judging whether material suits the learner and current local practice. Identifiable patient information should not be entered into general-purpose consumer tools, and any use involving real cases should follow institutional policy.

One caution applies across all of these uses. If AI becomes the first place a learner turns before attempting to formulate a problem independently, it weakens the reasoning process it was meant to support.

Learning with it: The Trainee Perspective

From a trainee perspective, one of the most useful aspects of generative AI is having an educational resource available at the exact moment a question arises. Critical care training is full of these moments, when physiology does not behave as expected and understanding why becomes an important part of learning.

One of us experienced this during critical care fellowship while caring for a patient supported with venoarterial extracorporeal membrane oxygenation (V-A ECMO) who became progressively hypoxemic despite apparently adequate extracorporeal support. Generative AI helped work through the physiology, consider mechanisms for the worsening hypoxemia, and organize an approach to troubleshooting both the circuit and the patient. The model did not provide a clinical answer to follow. It clarified the problem well enough to permit better questions. The case and the reasoning behind it were then reviewed with the attending, who corrected misconceptions and placed the problem in its clinical context. The combination of independent exploration and supervised discussion is what made the case instructive.

Similar interactions can be used to review physiology after rounds, work through a differential diagnosis, explore an unfamiliar concept, rehearse an evolving intensive care unit scenario, or generate practice questions. Retrieval practice is well established as a strategy for improving long-term retention, and a model lowers the cost of applying it [6].

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Generative AI in Critical Care *continued from previous page*

One practical approach is to request questions on a defined topic with the answers withheld, answer them independently and in writing, then request explanations and verify each against a society guideline or landmark study. Unresolved discrepancies become focused questions for faculty discussion. In this model, AI does not replace the teacher. It brings the learner to the teaching encounter better prepared.

What Does Not Change

Generative AI lowers the cost of producing educational content. It does not lower the cost of good teaching. Clinical judgment, direct observation, feedback, and mentorship remain the work of clinicians.

A model can generate a case, but it cannot recognize when a trainee is struggling, read the dynamics of a clinical team, or know when a recommendation does not fit the patient in front of it. Its greatest educational value lies not in producing faster answers but in bringing trainees to the bedside conversation with sharper questions.

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Disclosure:

ChatGPT (OpenAI) was used in a limited capacity to assist with organizing ideas and refining the structure of the manuscript. All scientific content, interpretations, and conclusions were developed and verified by the authors, who take full responsibility for the final manuscript.

Introducing...

fellow FOCUS

The *Interchange* Editorial Committee is pleased to introduce "Fellow Focus," a new section designed to promote interest in anesthesiology critical care medicine and provide a voice for current fellows in our quarterly newsletter.

Contributors are encouraged to collaborate with an attending mentor. Submissions from residents and medical students with a strong interest in anesthesiology critical care medicine will also be considered.

Topics may relate to the current issue's theme, explore an area of particular interest to the author, or describe the author's path to pursuing fellowship training in critical care medicine. Submissions should not serve as reviews, endorsements, or advertisements for the author's training program.

Artificial Intelligence in Critical Care Education – Panacea or Pandora's Box?

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Medical education is rapidly evolving alongside artificial intelligence (AI), often faster than educators can develop expertise in these technologies. Generative AI can synthesize information, reduce repetitive tasks, and support clinical decision-making. In critical care, where clinicians continuously integrate large volumes of rapidly changing physiologic and clinical data, these capabilities are particularly attractive. Yet the same technologies that may augment clinical performance could also alter how trainees develop the cognitive skills required to care for critically ill patients.

Critical care is characterized by uncertainty, incomplete information, and rapidly evolving scenarios in which established algorithms may not adequately capture the problem at hand. Intensivists must recognize physiologic patterns, construct and revise differential diagnoses, and adapt management when the expected response does not occur. If trainees increasingly rely on AI to interpret data and generate diagnostic or management recommendations, will they develop the independent reasoning and adaptive expertise required when confronted with an unfamiliar clinical scenario - or become proficient at following an algorithm they do not fully understand?

Three distinct risks in competency development have been attributed to unstructured AI integration: deskilling, mis-skilling [1] and never-skilling[2]. Deskilling refers to erosion of competence in a trained physician due to over-reliance on AI. If AI is monitoring hemodynamic deterioration and onset of shock, the clinician might lose the ability to interpret those hemodynamic changes in a time-sensitive manner. Mis-skilling involves reliance on an incorrect AI diagnosis without any cognitive reasoning or critical thinking, thereby internalizing the incorrect logic. Importantly, AI can provide the **correct answer and still produce poor learning**. Repeatedly outsourcing interpretation to AI may allow learners to perform successfully without developing the mental models needed to recognize problems independently. This form of cognitive offloading is particularly concerning in critical care, where the most dangerous situations may be those that fall outside familiar algorithms or the training distribution of an AI system. The biggest concern is never-skilling, where a new learner does not develop foundational reasoning skills due to early introduction of AI supported clinical decision making. As an example, the learner never learns to interpret ventilator waveforms and is thus unable to diagnose and treat hemodynamic collapse from dynamic hyperinflation.

Algorithmic bias in AI training data risks perpetuating disparities in critical care, where AI feedback may generalize poorly or perpetuate disparities if the algorithmic training data overrepresents particular demographics[3, 4]. This is particularly dangerous in diverse ICU settings[5]. Privacy concerns are compounded by questions of confidentiality and consent. Training AI models for critical care education requires rich clinical datasets, making patient deidentification, secure storage, and ethical governance non-negotiable [4]. The infrastructure for such governance may be inadequate or absent in resource-poor settings. The Association of American Medical Colleges (AAMC) has outlined general principles for responsible AI use in medical education, but these are not tailored to the particular challenges of the intensive care unit [6].

None of this argues for banning AI from critical care training. Multiple frameworks have been proposed that allow for more thoughtful and human guided curricular integration of AI. The DEFT-AI framework (diagnosis, evidence, feedback, teaching) guides discussion when educators observe learners interacting with AI tools, encouraging critical evaluation of AI outputs [1]. Ke and colleagues proposed a three-phase framework for AI integration into medical curricula; Foundational competency, Guided integration of AI with awareness of limitations and Integrated Practice, where AI use is collaborative to the task or learning [2]. Another model for AI integration is the FACETS framework proposed by Izquierdo-Condoy and colleagues [7]. The six dimensions of this model include Form (the AI modality used), Application (the specific use case), Context (the learning environment), Instructional mode (how AI is used in teaching), Technology (the particular computational method) and lastly SAMR (the level of pedagogical transformation such as substitution, augmentation, modification or redefinition).

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Panacea or Pandora's Box? *continued from previous page*

AI integration in critical care medicine is rapidly expanding beyond the initial application of this modality as a clinical decision support tool. Training the next generation of intensivists requires recognition of the pitfalls of this technology, along with methodical curricular integration to maintain high standards of clinical competence that does not rely solely on an algorithm to solve complex problems at the bedside.

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SOCCA MENTORING PROGRAM

SOCCA's mission is to support the development of anesthesiologists who care for critically ill patients. Recognizing the key role of mentorship in development, SOCCA is thrilled to offer mentorship resources to its membership.

Members at all levels of experience can now connect with individuals who have elected to volunteer their time and expertise to help others learn and grow in their knowledge about clinical practice, administration, leadership, research, organizational volunteerism, and other domains. These bidirectional relationships are not only mutually beneficial but foster a robust spirit of community within the organization.

Members seeking to identify a SOCCA mentor may navigate directly to SOCCA's Mentor Directory (member login required) where mentors are organized by their primary area of interest. Upon reviewing the directory, mentees are encouraged to identify their preferred mentor via the brief Mentee Submission Form.

You may also navigate to the Mentor Directory from SOCCA's public Mentoring Program page.

Thank you for your interest in becoming a SOCCA Mentee—and thank you to the many SOCCA members who have graciously offered to serve as Mentors.

Visit SOCCA's Mentor Directory today!

SOCCA MENTORING

Leveraging Technology to Support Global Critical Care

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The Global Gap in Critical Care

Critical care remains a privilege, not a right, for most of the world's population. Low- and lower-middle-income countries (LLMICs) face severe shortages of timely, high-quality critical care.[1] They bear a disproportionate burden of critical illness, experience substantially higher mortality and disability-adjusted life years (DALYs) lost compared to high-income countries (HICs).[2-5]

Africa has fewer than 1 ICU bed per 100,000 people. The United States has more than 30.[5] In LLMICs, most critically ill patients are managed on general wards or in emergency units without dedicated ICU infrastructure. Even when essential emergency and critical care (EECC) exist, it's availability is constrained.[6] Trained intensivists and critical care nurses are scarce, nurse-to-patient ratios exceed safe limits, and advanced therapies remain out of reach for most patients.[7]

Traditional strategies to strengthen critical care—including education, research, and policy reform—remain essential but often scale poorly. The settings with the greatest need are precisely those where these strategies struggle most.

Tele-ICU platforms, secure messaging, AI-enabled tools, and other digital innovations can extend specialist expertise, support frontline clinicians, and improve access without requiring major expansion of ICU infrastructure. When thoughtfully implemented, technology transforms resource limitations into opportunities for collaboration, learning, and better patient care.

Tele-ICU as a Force Multiplier

Tele-intensive care unit (tele-ICU) systems connect under-resourced hospitals with experienced intensivists, enabling remote consultation, monitoring, and protocol-driven care. In resource-limited settings, tele-ICU programs have demonstrated feasibility, high clinician satisfaction, and more standardized care.[9-11]

By extending specialist support beyond tertiary centers, tele-ICU can optimize resource use, promote evidence-based practice, and strengthen clinical decision-making during both routine care and crises. Professional societies increasingly recognize telemedicine as a valuable strategy for expanding critical care capacity, particularly during emergencies.[12]

Importantly, effective tele-consultation often requires only reliable communication, visual access, and basic physiologic data, making lower-cost, adaptable models particularly well suited to LLMICs.

Lightweight and Hybrid Communication Tools

In many settings, full tele-ICU infrastructure remains impractical because of bandwidth, cost, or reliability constraints. Consequently, clinicians increasingly rely on lightweight digital tools, such as secure messaging platforms. Messaging applications enable rapid sharing of clinical summaries, laboratory data, imaging, and ventilator settings, supporting both real-time and asynchronous consultation. Although concerns remain regarding privacy, documentation, and the inability to perform bedside assessments, these inexpensive and widely accessible tools have had a substantial impact in LLMICs.

Asynchronous consultation is particularly valuable when connectivity is intermittent or time zones differ, allowing post-event case discussions that reinforce learning and improve future care.[13,14] Many programs now combine scheduled tele-rounds with continuous messaging support, creating a flexible "tele-ICU lite" model that maintains continuity despite technical limitations.[13,15]

Artificial Intelligence as a Force Multiplier

AI-powered early warning systems can identify deteriorating patients hours before clinical signs become obvious. In resource-limited settings,

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Leveraging Technology *continued from previous page*

simpler machine learning models require minimal computational power and can run on basic hardware. Wearable sensors coupled with AI can monitor physiologic variables remotely and predict advanced sepsis in LLMICs, outperforming traditional bedside monitoring.[16–18] The challenge is not technical capability but generalizability. Models trained on data from high-income countries often fail when applied to different populations with different disease prevalence and treatment protocols. For AI to work in LLMICs, it requires local data, local validation, and careful integration into existing workflows.[19]

Ironically, access to generative AI remains limited in the resource-constrained settings where it could have the greatest impact. As availability and affordability improve, large language models may help expand access to evidence-informed critical care by supporting education, clinical guidance, and translation of educational resources.

Beyond knowledge support, AI is increasingly being integrated into bedside clinical practice. For example, point-of-care ultrasound (POCUS) has become a cornerstone of critical care, and AI-assisted image interpretation may help clinicians identify conditions such as acute respiratory distress syndrome (ARDS) and pneumothorax.[20,21] In all ICUs, these tools may enhance diagnostic accuracy, increase clinician confidence, and support timely clinical decision-making.

Global Examples of Technology-Enabled Critical Care

Real-world experience demonstrates that tele-critical care can be adapted across a wide range of settings. During the Syrian conflict, an international tele-ICU network used low-cost video conferencing and secure messaging to connect volunteer intensivists with frontline clinicians, providing remote consultation despite active humanitarian crisis.[22] In Brazil, the TELESCOPE randomized trial and subsequent regional tele-ICU programs showed that structured virtual rounds, shared protocols, and continuous education improved adherence to evidence-based practices, clinician confidence, and workflow integration.[10,23]

Similarly, academic global health initiatives—including CERTAIN, the University of Virginia International Telehealth Program, Vanderbilt International Anesthesia, and the Global Anesthesia & Critical Care Learning Resource Center (STANES)—have expanded tele-education into ongoing clinical mentorship and case consultation, strengthening partnerships between institutions across high- and low-resource settings.[24,27] Collectively, these experiences demonstrate that successful tele-critical care depends less on sophisticated technology than on local ownership, workflow integration, and sustained collaboration.

Navigating Constraints

Implementation challenges are substantial. Mobile and satellite connectivity now reach remote hospitals, yet unstable power supplies, intermittent bandwidth, and outdated equipment remain common barriers. Distance-based support can strengthen local capacity but can also create perceptions of external control. Cultural humility and partnership-based engagement are not optional - they're prerequisites. When feasible, engagement by clinicians who speak the local language or understand local clinical norms substantially improves communication, trust, and effectiveness.

Language barriers, regulatory uncertainty, and funding instability remain significant limitations. Most programs rely on short-term grants or volunteer effort. Long-term sustainability requires different models, including sustained and effective local governance.

Future directions and call to action

Disparities in access to critical care persist both within and between countries. In LLMICs, shortages of ICU beds and trained providers place millions of patients at risk. Thoughtfully implemented technology will bridge these gaps, but lasting progress depends on collaboration, mentorship, adaptation, and local ownership.

Anesthesiologists and intensivists in high-resource settings have expertise that can strengthen global critical care capacity. The question is no longer whether technology can improve access and quality of care in resource-limited settings. Rather, it is whether we will commit to building sustainable partnerships that reach those who need them most. Achieving this goal requires vision, collaboration, and a sustained commitment to equity in critical care worldwide.

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Tele Critical Care: Using Technology to Reach More Patients

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Every critically ill patient deserves treatment by an intensivist-led multidisciplinary team. However, intensivists tend to concentrate at large hospitals in densely populated urban areas, leaving patients in some smaller hospitals or geographically remote facilities without access to critical care. Previously, critically ill patients at these remote facilities required transfer to larger hospitals to receive care. These transfers removed patients from their familiar environments and support systems, placed a burden on families who wished to accompany their loved ones, and increased ICU demand at large hospitals where capacity is often tight.

Washington University in Saint Louis and BJC Healthcare launched a tele-critical care (TCC) program in 2016 to provide critically ill patients with an extra layer of support from experienced intensivists and critical care nurses. The program initially launched in three ICUs at the main academic hospital, where an enhanced rounding workflow resulted in improved observed-to-expected mortality when targeted to patients with diagnosis groups that had poorer pre-TCC performance.[1] Since that time, the TCC program has grown to provide around-the-clock support for 332 ICU beds across 11 hospitals including academic, community, and critical access locations. The average daily census is approximately 250 patients.

TCC nurses assess each patient at the time of ICU admission and once per shift to evaluate response to therapy and identify gaps in best practices. TCC physicians round daily and formulate comprehensive treatment plans for each patient who does not have a bedside intensivist, and they respond to acute events or calls for help for all patients. To accomplish these tasks, our clinicians use video monitors and pan/tilt/zoom cameras mounted in each ICU room to have a two-way audio/video teleconference with patients and bedside staff members. Bedside staff can request assistance using a physical button in the patient room, which triggers visual and audible alerts in the TCC center. In 2025, we successfully transitioned these workflows from a third-party software application to a platform within our electronic health record.

Throughout the shift, TCC clinicians use various tools to monitor for clinical deterioration. Our patient census screens include simple prediction models such as the Sequential Organ Failure Assessment score and more sophisticated AI models such as the risk of ICU readmission or mortality model developed by our electronic health record vendor. We also utilize custom-built acuity scores reflecting vasopressor support, oxygen requirements, laboratory results, and other variables. TCC nurses use these data sources in aggregate to identify which patients may need re-evaluation. Additionally, we implemented a structured workflow where TCC nurses review Vital Sign Trend Alerts generated from unvalidated device data sent from bedside monitors to the electronic health record on a minute-by-minute basis. These alerts achieve high sensitivity for prediction of vasopressor initiation or escalation (91%) and moderate sensitivity for code events (66%), initiation of mechanical ventilation (48%), and death (43%) within the next 4 hours.

Inspired by the achievements of TCC at our institution and elsewhere, Washington University also tested the impact of telemedicine on intraoperative care by implementing an Anesthesiology Control Tower (ACT).[2] The ACT was staffed during peak operating room business hours by an attending anesthesiologist, a senior anesthesiology resident, and often a nurse anesthetist. These clinicians performed comprehensive case reviews on selected patients to provide anticipatory guidance to bedside anesthesiology teams, and they also acted on physiologic alerts generated in real time based on vital signs, labs, and other intraoperative data. ACT staff also had access to AI models providing dynamic intraoperative risk predictions for many postoperative complications.[3, 4] Two randomized clinical trials enrolling a total of 98,181 patients demonstrated that the ACT intervention had an inconsistent impact on process measures describing the quality of anesthesiology care and no impact on postoperative outcomes including 30-day mortality, respiratory failure, acute kidney injury, and delirium.[5, 6] Based on these results, the ACT is no longer in operation, although research evaluating the impact of the AI models on postoperative handoffs continues.

In recent years, our TCC program has pushed into new spaces and roles. We have leveraged mobile camera carts to provide tele-critical care consultation for floor patients who are at risk for ICU admission.[7, 8] We have centralized ICU bed triage at our main academic hospital, leading to reduced emergency department boarding times.[9] We have also explored novel ICU staffing models, including one community hospital where an onsite advanced practice provider cares for patients under the

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Tele Critical Care *continued from previous page*

direct supervision of the TCC physician.[10] These strategies are allowing us to use our critical care resources to help the greatest number of patients possible.

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Deliberate Use of AI

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Like everyone else I talk to, I am not sure exactly how to use artificial intelligence (AI)-enhanced clinical resources. At 38 years old, I sit between some older, established clinicians who see generative AI as a threat to the development of scientific literacy, and younger trainees who routinely use AI for knowledge acquisition. Both positions have merit. AI is clearly a powerful tool for finding and summarizing data, but can be misleading, especially when lacking pre-existing content expertise.

I used to give an hour-long lecture to third- and fourth-year medical students about Medical Subject Heading (MeSH) terms and their application to literature searches in PubMed. The students were shocked at this cumbersome process, and they were right to be. They showed me OpenEvidence which I now use almost exclusively for searching the medical literature. I have saved countless hours by switching to the platform. I don't find much use for the summaries, however.

Large Language Models (LLMs) tend to squish nuance from the literature to specifically and exhaustively answer an input. At the extreme ends they hallucinate fallacious data to satisfy this need. UpToDate (written by and for human clinicians) faithfully represents muddy data and clinical uncertainty but can be difficult to interpret for novices. AI's reductive clarity is seductive to an inexperienced practitioner. For an experienced clinician, though, the simplicity can be appropriate and preferable.

I have been grappling with a practical approach to how to rationally integrate AI-powered resources alongside more conventional information. I have provided my approach to the main resources I use (Claude, OpenEvidence, UpToDate, Society Guidelines, primary literature, and expert discussion) in Table 1. I would also like to illustrate my process with two examples—clinical decision making and didactic development.

For a patient with aneurysmal subarachnoid hemorrhage (SAH) and severe vasospasm, I wanted to treat with systemic milrinone. I knew of this general approach from colleagues and superficial reading on the topic. I didn't know specific trials or protocols. I input the prompt "list the trials investigating systemic milrinone use in aneurysmal SAH" into OpenEvidence. I discovered observational trials and a few systematic reviews, which led me to the question "what is the protocol for the RCT of milrinone in aneurysmal SAH." MiVAR, the first RCT to date, was still enrolling but had published its protocol in the British Medical Journal. Using PubMed, I accessed the article and found the exact protocol in the supplemental index. I discussed it with my team, and, given my patient's current vasoactive requirement, we avoided the protocolized bolus and started an infusion at a lower dose to evaluate for a response. This approach incorporates the use of OpenEvidence, PubMed, personal reading of the primary literature, clinical experience, and expert consultation. OpenEvidence alone would have failed to return the specifics of the protocol. PubMed would have required three hours of my life sifting through animal trials of milrinone.

The second example involves the preparation of a resident lecture on skin tone bias in pulse oximetry. I used Claude to search "racial bias in detection of hypoxemia using pulse oximetry." I consulted UpToDate to confirm my understanding of the technology underlying pulse oximetry as well as the description provided by Claude. I specifically asked Claude for examples from the lay press citing this phenomenon to understand how patients may perceive this problem. Next, I used OpenEvidence to search "error in detecting hypoxemia by pulse oximetry based on patient skin color." I reviewed and downloaded the seven most relevant articles via PubMed. I uploaded them into Claude with the prompt: "confine your analysis to the information contained in the papers and create an approximately 20 slide presentation on the topic of skin tone bias in pulse oximetry including a brief overview of the underlying technology of pulse oximetry, the main manufacturers of the sensors, the potential for bias based on skin pigment including quantitative reductions in hypoxemia detection (where available), as well as a critique of the limitations of the literature." I reviewed the resulting presentation and made limited corrections where I disagreed with the interpretation. This approach incorporates the use of Claude, OpenEvidence, PubMed, and personal reading of the primary literature. Asking Claude in one step to generate a presentation may have resulted in the use of uncontrolled, unknown sources outside of the peer-reviewed literature. Using OpenEvidence and PubMed to feed high quality, relevant articles into Claude allowed me to quickly create a visually appealing presentation requiring only minor edits.

In summary I believe that AI-enhanced searches and

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Deliberate Use of AI *continued from previous page*

summaries are powerful tools which we should embrace with skepticism. Though they should never replace individual scientific literacy or expert opinion, if taught responsibly, they may accelerate our mastery of complex data. We need strategies to understand when and how to use these new tools to assess the explosion of new information without leaving behind the foundations of medical knowledge.

Table 1. *An approach to choosing resources based on the clinical situation.*

Query Type	Resource	Example	Notes
Background Knowledge	Claude	Helping a patient identify a medication, general anatomy/ physiology reminders like “anatomy of sympathetic innervation”	Helps to gather non-medical sources, including social media postings; helps refresh topics with which I’m already familiar
Literature Search	OpenEvidence, PubMed	“That pair of trials from Vanderbilt on balanced crystalloids and AKI” to find SALT-ED and SMART	Occasionally, smaller journals or publications in online supplements aren’t included in OpenEvidence
Clinical Help - General or Undifferentiated Topic	UpToDate	Strategies to screen for vasospasm after aneurysmal SAH	Finding in-text use of words like “opinion,” “our protocol,” “approach,” etc can expedite identifying author recommendations
Clinical Help - Specific Topic	Society Guidelines	ASA Difficult airway algorithm, AHA preoperative cardiac risk stratification	Can use OpenEvidence to find the appropriate society’s guidelines if unsure
Case Discussion	Expert Consultation	“Consult cardiology to discuss minimizing risk of anti-platelet therapy in context of hemorrhagic stroke post-PCI”	I prepare with the above strategies to focus my consult question

Artificial Intelligence (AI) in Critical Care: A Double-Edged Sword?

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Artificial intelligence (AI) has reshaped many functional work systems, and clinical medicine is no exception. It will likely have a major impact on clinical practice in the intensive care unit (ICU) because it can process large volumes of data and perform complex pattern analyses, which are essential in the critical care setting [1]. Specifically, AI may assist with clinical decision-making, predict patient patterns, and support documentation tasks. If an AI system is intended for a medical purpose, it qualifies as a medical device (MD); in the US, the FDA serves as the central approval authority for MDs [2]. For example, using AI systems to optimize ventilator settings or guide fluid resuscitation strategies would fall under this regulation. Administrative and logistical systems, however, would not. These include tools ranging from documentation and communication assistance to tools designed to predict length of stay or inform resource allocation. This will likely be the first "layer" of implementation for many ICUs. Therefore, we think it is prudent to review the pros/cons of these systems.

AI can support documentation and communication by drafting patient responses or summarizing clinical notes [3]. The most promising technology is "ambient listening," which combines transcription with a large language model (LLM)-based summarization to generate a patient note from conversations. In the ICU, adopting this technology could significantly reduce mundane but necessary workload, allowing providers to focus on bedside patient care and freeing up cognitive resources for critical decision-making. If utilized efficiently, AI could help alleviate the high level of burnout seen in our specialty [3]. For example, AI can streamline standardized documentation of narratives such as code events and family conversations, making routine critical care practice more efficient. While LLMs have made it into the popular vernacular, concerns remain regarding bias, hallucinations, interpretability, and lack of real-world validation in the ICU [4]. To date, the FDA has not authorized any stand-alone LLMs for clinical use. More relevant to our academic colleagues, AI clinical documentation raises real concerns about hindering medical teaching. By automating structured note-writing, trainees and students lose opportunities to practice data synthesis and clinical reasoning, which are fundamental in medical training.

Logistical AI aims to improve ICU operations by using historical data to predict patient trajectories or provide insight into staffing, allocation and distribution of resources [3]. By analyzing clinical data, AI can estimate length of stay or length of mechanical ventilation, which can be further extrapolated to predict patient volumes and staffing needs. While these models integrate with hospital information technology and support operational planning, they are often not considered MDs. However, ethical concerns with machine learning cannot be ignored. Physicians have a solemn responsibility to maximize patient benefit and minimize harm, and implementing logistical AI to strategize healthcare can contradict this very commitment. Human oversight/governance is imperative to prioritize this relationship while enhancing operational efficiency [5]. Because many of these AI models are currently developed outside the medical community, we believe multidisciplinary boards consisting of clinicians, ethicists, and patients should review algorithmic behavior before implementation.

Implementing AI in critical care may positively alter the scope of practice by improving patient safety and physician productivity, but its ultimate success depends on maintaining human judgment, accountability, and patient-centered care.

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CRITICAL CURRENTS

A space dedicated to exploring topics of general interest to the SOCCA membership, curated by the Interchange editors to inspire thought, dialogue, and themes for future issues.

Social Vulnerability and Serious-Illness Communication in the ICU

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The communication gap we may miss

Critical care teams often judge a family conversation by familiar signals: the patient or surrogate expresses confidence in the team, can reiterate the information provided, the encounter feels cordial, and a plan is documented. These are important signs, but they may not tell the whole story. A person may trust the ICU team and repeat what was discussed yet still need greater clarity, more time to process uncertainty, an interpreter, family support, or explicit permission to question a recommendation.

That distinction matters because serious-illness communication is not simply the delivery of accurate information. It is the process through which patients and families interpret prognosis, connect treatment choices to what matters most, and become ready to make decisions under extraordinary stress. Prior ICU research found physician-surrogate prognostic discordance in 53% of encounters involving patients at high risk of death, arising from both misunderstandings and differences in beliefs about prognosis.[2]

Social conditions can shape every part of that process. Language access, education, health literacy, financial strain, transportation, caregiving responsibilities, disability, and prior experiences with health care may influence who can be present, what can be understood, and whether a person feels able to speak. Yet these factors remain inconsistently assessed and incorporated into acute critical care.[1]

What we studied

We conducted a prospective convergent mixed-methods pilot in adult ICUs at one tertiary academic center during April and May 2026. Ten patients or surrogates completed structured measures of communication, prognostic understanding, clinician trust, goals-of-care preferences, and goal concordance, followed by a semistructured interview. Participants ranged in age from 41 to 82 years, with a median age of 72 years; ICU length of stay at enrollment ranged from one to eight days.

We calculated an individual vulnerability score using 13 social indicators. Scores ranged from 0 to 0.79, and five participants met the pilot threshold for higher vulnerability (0.50 or greater). Quantitative findings were descriptive. Interview data underwent inductive thematic analysis, and we integrated the quantitative and qualitative findings in a joint display. This design allowed us to ask not only whether a score was high or low, but also what the score meant in the participant's own account.

What the data and the stories showed

Trust was generally high, and participants often described their ICU experiences positively. On the surface, this was reassuring. However, participants with higher vulnerability more often reported lower communication ratings and described needing repeated explanations, greater clarity, more time to process information, and greater family involvement.

Five themes emerged: communication access and clarity; trust and relational communication; prognostic understanding and decision readiness; cultural, language, and family context; and goal-concordant care. The joint display revealed a particularly important tension. High trust sometimes reflected active engagement and a strong therapeutic relationship. At other times, it appeared alongside gratitude, deference, or reluctance to question clinicians.

Structured goal-concordance measures showed little variation. The interviews, in contrast, described preferences

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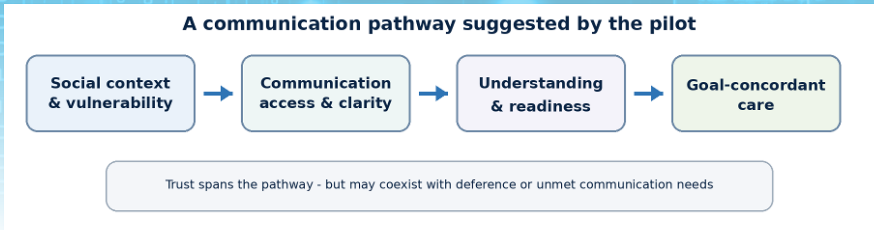
Social Vulnerability *continued from previous page*



as dynamic and conditional - shaped by quality of life, survival, faith, family readiness, language, and financial concerns. In other words, a stable survey response could coexist with an evolving internal decision process. This is consistent with evidence that observational approaches to communication can capture dimensions missed by traditional self-rated measures, including ceiling effects in satisfaction-style ratings.[3]

Why this matters for anesthesiologist-intensivists

Anesthesiologist-intensivists frequently guide time-sensitive decisions after major surgery, neurologic injury, shock, respiratory failure, or escalation to mechanical support. In these settings, communication is itself a clinical intervention. The same explanation may not provide the same access to decision-making for every family.

Our pilot does not establish causality, and a sample of ten participants from one center cannot define population-level differences. It does, however, demonstrate feasibility and expose a measurement problem: communication inequities may remain invisible when we rely on trust, satisfaction, or documented goal concordance alone. The finding is not that high trust is suspect. Rather, it is that trust should prompt a deeper question: does this person also understand, feel ready, and believe that disagreement is safe?

Vulnerability measures should therefore be used as prompts for support, not labels or shortcuts. A high score should never be treated as proof of poor understanding, and a low score should not be taken as evidence that communication needs have been met. The goal is contextualization, not prediction.

Five practices we can use now

1. **Ask about communication conditions.** Begin with: 'What would make it easier for you to understand and take part today?' Ask about preferred language, hearing or vision needs, who should be present, and the best time and format for discussion.

2. **Pace and repeat deliberately.** Separate information-sharing from decision-making when clinically possible. Revisit prognosis after the family has had time to process it, particularly when the situation is changing or the decision is preference-sensitive.

3. **Use teach-back without testing the family.** Try: 'I want to be sure I explained this clearly. Can you tell me what you understand about where things stand?' This places responsibility for clarity on the clinician rather than on the patient's education or health literacy.

4. **Make questions and disagreement safe.** Normalize uncertainty and dissent: 'Many families have questions or see this differently. What does not fit with your understanding?' Gratitude and quiet agreement should not be mistaken for informed participation.

5. **Document readiness, not only the decision.** Alongside the code status or treatment plan, record the supports used, remaining questions, decision-makers who need to be included, and whether the patient or surrogate is ready to decide. Communication curricula that use reflective analysis of real or simulated conversations may help advanced trainees develop this more nuanced practice.[4]

Where we go next

The next phase of this work will enroll a larger and more diverse cohort and test relationships among vulnerability, communication quality, prognostic understanding, trust, and decision readiness. It will also examine whether paced, repeated, culturally responsive, and family-inclusive communication can reduce inequities without stereotyping the people it is intended to support.

For now, the practical lesson is simple: a respectful conversation is not complete merely because it ends without conflict. The more meaningful endpoint is whether patients and families can understand the situation, connect choices to their values, and participate at the level they want. High trust is a foundation for that work - not its final measure.

This article describes preliminary, unpublished pilot findings. Results should be interpreted as exploratory.

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Case Report: Diffuse Alveolar Hemorrhage Secondary to Lung Ischemia–Reperfusion Injury Following Cardiopulmonary Bypass

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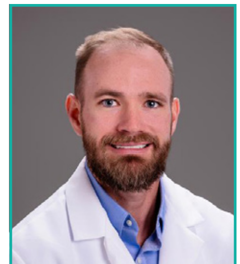
Columbia, MO



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Disclosure
Kyle Bruns serves as an editor of the Interchange newsletter. No other conflicts of interest or relevant affiliations are reported.

Introduction

Lung ischemia-reperfusion injury (LIRI) is a rare but recognized complication following cardiopulmonary bypass (CPB), resulting from restoration of blood flow to previously ischemic pulmonary tissue. It commonly presents as pulmonary edema, hypoxemia, and variable degrees of parenchymal injury.[1] We present a rare case of LIRI manifesting as diffuse alveolar hemorrhage (DAH) following CPB.

Case Description

A 56-year-old female was admitted for planned aortic and mitral mechanical valve replacement with mitral annular enlargement, aortic root enlargement, and tricuspid valve repair via reoperative sternotomy. The patient's past medical history was significant for multivessel coronary disease and mitral regurgitation, for which coronary artery bypass grafting with mitral valve repair had been performed seven years prior. Additional comorbidities included sick sinus syndrome treated with dual-chamber pacemaker implantation, COPD, prior tobacco use disorder, atrial fibrillation, and obesity. The planned procedure, commonly referred to as a Commando procedure, is most frequently performed for infective endocarditis, but was performed here for mixed valvular disease with prosthesis-patient mismatch.

The operative course was notable for return to CPB on two occasions due to left atrial dome dehiscence. During the first attempt to separate from bypass, blood was noted to be erupting from the endotracheal tube. Bronchoscopy revealed pooling of blood at the level of the carina with diffuse hyperemia throughout the bronchopulmonary tree (Figure 2-3). In the setting of repeated CPB runs, a working diagnosis of LIRI leading to DAH was made. The cardiac anesthesiologist considered other etiologies including: surgical clamping of the pulmonary artery - did not occur, inappropriate advancement of the Swan-Ganz catheter - was replaced to correct position after tricuspid repair, DIC - no systemic signs of bleeding, iatrogenic fistula creation - none observed on bronchoscopy. Additionally TEE did not demonstrate a loss of pulmonary vein integrity after the repair of the left atrial dome dehiscence.

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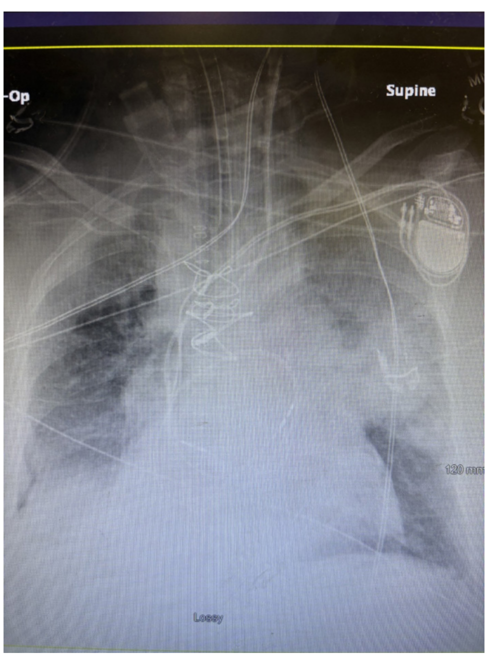

Figure 1: *Chest radiograph obtained on the day of admission.*

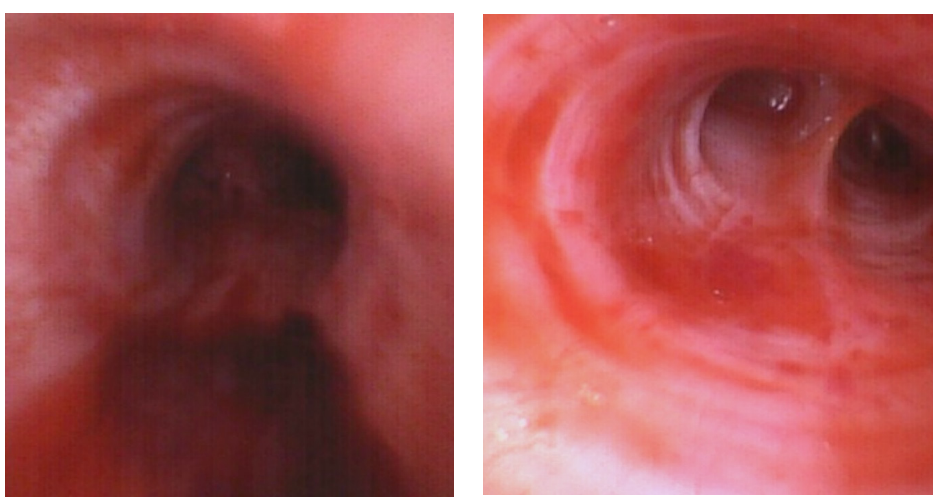

Figure 2-3: *Bronchoscopy images showing diffuse mucosal hyperemia with blood pooling consistent with DAH.*

Case Report continued from previous page

In the ICU, the patient developed severe hypoxemia and ultimately required paralysis for ventilator management. Chest x-ray revealed bilateral hazy opacities with a left upper lobe predominance (Figure 1). Additional therapies included nitric oxide and renal replacement therapy for management of anasarca secondary to massive intraoperative resuscitation. Oxygenation gradually improved, and the patient was extubated on postoperative day (POD) 4. By POD 14, the patient was discharged to an inpatient rehabilitation facility on room air.

Discussion

LIRI is characterized by oxidative stress and inflammatory activation after restoration of pulmonary blood flow, leading to endothelial dysfunction, increased vascular permeability, and disruption of the alveolar-capillary barrier.[2-4] This process results in pulmonary edema, hypoxemia, and variable degrees of parenchymal injury.[1] DAH occurs when acute disruption of the alveolar–capillary barrier allows blood to enter the alveolar spaces.[5] The underlying mechanisms of DAH include immune-mediated pulmonary capillaritis, coagulopathy or hemodynamic disturbances, and direct alveolar injury from toxins, infections, or acute respiratory distress syndrome (ARDS).[5,6]

DAH secondary to LIRI following CPB is rare and not well described. While pulmonary edema or transient dysfunction are well recognized after bypass, overt alveolar hemorrhage is uncommon and diagnostically challenging. To date, only one similar case has been reported by Malhi et al., describing a 61-year-old male who developed bilateral DAH from LIRI during weaning from bypass after coronary artery revascularization.[7] Our case expands the limited literature and highlights the need for increased clinical awareness of LIRI as a potential cause of acute pulmonary hemorrhage following CPB.

The mechanism by which LIRI progresses to DAH remains incompletely understood, though this case leads to considerations of risk factors which may include tobacco use and a history of COPD. In this context, extensive endothelial injury and increased microvascular permeability likely allow red blood cell extravasation into the alveolar spaces, producing a form of bland hemorrhage rather than immune-mediated capillaritis.[5]

Intraoperative findings such as bloody endotracheal secretions with diffuse bronchial hyperemia should raise suspicion for reperfusion-related alveolar hemorrhage. The differential diagnosis for pulmonary hemorrhage during CPB includes mechanical trauma, transfusion-related acute lung injury, coagulopathy, pulmonary venous obstruction or anastomotic leak, and infection or drug-induced alveolar injury.[8,9] In our patient, these etiologies were unlikely based on clinical and laboratory findings.

The timing of bleeding immediately after separation from bypass, lack of contributory TEE findings, along with bronchoscopy finding of diffuse mucosal hyperemia without focal vascular disruption, supported a diagnosis of LIRI presenting as DAH.

Management of DAH, including secondary to LIRI, is mainly supportive, and focuses on optimizing oxygenation and hemodynamic stability. In our patient, oxygenation improved with conventional management of acute respiratory failure and fortunately no further escalation of therapy was required. While there is no known data to support a recommended practice, early recognition of LIRI and avoidance of factors that may worsen lung injury, such as excessive fluid administration or recurrent ischemia, may help improve outcomes. Clinicians should maintain awareness of LIRI, particularly when unexpected pulmonary bleeding is encountered during CPB separation. Further work is needed to better characterize patients at risk, refine perioperative monitoring, establish clearer diagnostic criteria, and guide management strategies in the postoperative period.

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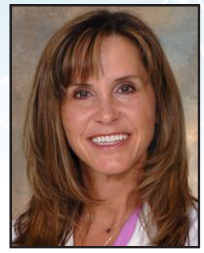

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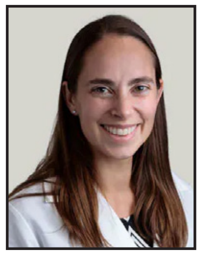

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