SOCIETY OF CRITICAL CARE ANESTHESIOLOGISTS
SOCCA

INTERCHANGE

Society of Critical Care Anesthesiologists Newsletter Volume 36 | Issue 4 | December 2025

Mechanical Circulatory Support – Part I

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SOCIETY OF CRITICAL CARE ANESTHESIOLOGISTS SOCCA

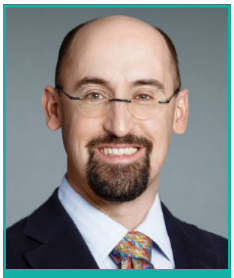
INTERCHANGE

Society of Critical Care Anesthesiologists Newsletter Volume 36 | Issue 4 | December 2025

Editor's Welcome

Welcome to this special two-part edition of the Interchange in which a special focus in presented on mechanical circulatory support (MCS). This topic is near and dear to many of our members, and so it should come as no surprise that this has generated a tremendous amount of interest. As a result, both this and the next quarterly edition will feature a deep dive in the utilization of MCS across the critical care spectrum. The Society is honored to have such an active and knowledgeable membership share their expertise. Lastly, a special recognition is due to the Clinical Practice Committee, members of which have contributed above and beyond to this special two-part edition. Happy reading!

President's Message



Mark E. Nunnally, MD, FCCM
President, SOCCA
The University of Chicago
Chicago, IL

Welcome to the mechanical circulatory support (MCS) edition of the *Interchange*. I will briefly directly address the topic and then, indulge myself in more philosophical musings.

MCS has been "emerging" for decades, but the current situation underscores its permanent role in modern critical care. Various technologies have contributed to solutions for previously irreconcilable problems. Cardiogenic shock, severe cardiomyopathy, acute on chronic decompensated heart failure and malignant arrhythmias are a short list of grave diagnoses for which the unstoppable decline to organ failure and mortality historically seemed a predestined and recognizable pattern, one that an older generation of intensivists learned to palliate and became accepting of death as a common outcome. After some success with costly short-term fixes, innovations have led to systems that allow for rapid deployment and the ability to support patients for longer durations with fewer adverse events. These same devices dusted off great physiology. We now regularly discuss venous return and the right-sided circulation as part of core cardiovascular physiology. There is more to it than that simple curve

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named after an invasive bird species.

Anesthesiologists are well-suited to being MCS experts. Many of us staff busy cardiothoracic ICUs. We love physiology and coagulation issues. This area is a natural fit for our expertise. As a consequence, we have seen growth in interest and educational outreach, including at our own Annual Meeting. For our members, MCS is a big topic. It's likely here to stay.

That said, I am struck by how things come and go in critical care. Look at the pulmonary artery catheter, going from cutting edge to a pariah and now being rehabilitated in our modern era of cardiovascular support. Some of it may be simple fads, but I wonder if our increased abilities, resulting from advances such as MCS, make such monitoring more relevant today than it has ever been. At the end of it all, our field just keeps advancing.

In such an atmosphere, we have to stay relevant. That's why I am pleased to watch our Society grow and become more effective, remaining a premiere educational organization, making the most of networking and providing value to its members.

These are the members I want to see growing in number. Tell your friends, make sure your fellows are on board (it's free), and, importantly, get people to stay with SOCCA. We are a bargain.

Fellows and residents, stay with us once you are done with training. You won't find a better group of peers or more value for your membership dollar. Keep in mind that you will be the leaders and movers in this Society sooner than you think. We can help you develop and get promoted.

We also keep our members in touch with key changes in the specialty of anesthesiology critical care. From staffing to personal wellbeing to innovative technologies (such as MCS), we strive to be the best one-stop society for your needs. These past two years have seen unprecedented growth and reorganization within SOCCA, a trend that reflects our own work with the critically ill, where we are constantly innovating and reinventing. Enjoy this newsletter, enjoy the Society's many offerings and tell all of your friends!

Clinical Practice Committee (CPC) Update

The SOCCA Clinical Practice Committee (CPC), under the leadership of **Dr. Gozde Demiralp (Chair)** and **Dr. Alok Gupta (Vice Chair)**, continues to demonstrate remarkable progress in advancing the clinical, educational, and collaborative missions of SOCCA. The CPC's diverse subgroups have remained active throughout 2025, engaging in national and international initiatives, launching workshops and panels, and driving quality improvement and education within critical care anesthesiology.

MCS/ECMO/CTICU
(in collaboration with SCA)

Led by **Dr. Lovkesh Arora** and **Dr. Lauren Sutherland**, this subgroup has made impressive strides in education and curriculum development. Their **ECMO Workshop** was accepted for **IARS/SOCCA 2026**. The workshop will provide a hands-on learning experience in percutaneous cannulation and ECMO case management through simulation-based sessions, while providing opportunities for subcommittee members to participate in the workshop as faculty.

This workgroup is also working in conjunction with the Program Directors Advisory Council (PDAC) and the Service Chiefs Advisory Council (SCAC) for a position paper regarding MCS competencies for ACCM fellowship. We hope to be able to report more on this soon.

NEUROCRITICAL CARE
(in collaboration with SNACC)

Under the leadership of **Dr. Vishal Yajnik** and **Dr. Kate Rosenblatt**, the Neurocritical Care subgroup continues to bridge the gap between perioperative care and ICU management of this unique patient population. Their **Brain Death Workshop and Symposium**, accepted for **IARS 2026**, will feature case-based learning aligned with the latest clinical guideline updates.

The subgroup also continues its **Perioperative EVD Campaign**, aiming to provide anesthesiologists with practical tools for managing external ventricular drains in the perioperative setting—an important initiative that strengthens cross-disciplinary learning with **SNACC**.

Obstetric Critical Care Medicine
(in collaboration with SOAP)

Chaired by **Dr. Ioannis (Yanni) Angelidis** with **Dr. Emily Naoum** as vice chair, the OB-CCM subgroup has been instrumental in promoting collaboration with **SOAP**. Their **SOCCA–SOAP panel** was accepted for **IARS 2026**, featuring three case-based discussions in obstetric critical care.

Building on this success, the group has also proposed a "**Crushing Postpartum Patient Workshop**" for the upcoming SOAP Annual Meeting and continues to develop refresher courses for the **ASA Annual Meeting**—initiatives that highlight their sustained educational impact.

Gozde Demiralp, MD, FCCM
Chair, SOCCA Clinical Practice Committee
UW-Madison
Madison, WI

Quality and Safety Workgroup

The **Quality and Safety Workgroup**, chaired by **Dr. Somnath Bose** with **Dr. Joy Chen** as vice chair, continues to advance SOCCA's commitment to excellence in patient care. Their major project, the **QI Project Inventory**, is under active development on the **SOCCA website**. Intake forms are about to be launched, allowing members to upload and review quality improvement projects. The repository aims to serve as a living database and educational resource, particularly valuable for fellows seeking project inspiration. Collaboration with **PDAC** is being pursued to expand access and engagement across training programs.

R. Alok Gupta, MD
Vice Chair, SOCCA Clinical Practice Committee
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Transplant Critical Care
(in collaboration with SATA)

The **Transplant Critical Care subgroup**, chaired by **Dr. Ranjit Deshpande** and **Dr. Megan Rashid**, has maintained steady progress on the upcoming publication dedicated to **perioperative liver transplant care**. The group continues to explore publication venues to ensure broad dissemination of this vital work. Their recent contribution to *Interchange (2025Q3)*, *"From Bedside to Boardroom: Opportunities in Critical Care—How Anesthesiology Can Drive Innovation, Integration, and Impact Across Health Systems,"* underscores their vision for anesthesiologists as leaders in system-level improvement.

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Global Critical Care Medicine

Chaired by **Dr. Vanessa Moll** and **Dr. Ana Crawford**, the Global Critical Care Medicine subgroup has focused on broadening global engagement and academic exchange. Following member surveys and meetings earlier in the year, the subgroup refined its direction toward education and advocacy for global critical care access. Members have been encouraged to submit abstracts to the **World Congress of Anesthesiologists 2026** in Marrakech, Morocco, and to volunteer with the **World Federation of Societies of Anesthesiologists (WFSA)**.

LOOKING AHEAD

As 2025 draws to a close, the CPC continues to build momentum across educational, clinical, and scholarly domains. Each subgroup's commitment to collaboration, innovation, and education reflects SOCCA's broader mission to elevate the practice of critical care anesthesiology. The committee's growing presence in national and international forums—through IARS, SOAP, SATA, SNACC, and global outreach—demonstrates the strength of interdisciplinary teamwork and shared purpose. If you are inspired by our work and interested in collaborating within CPC, please keep an eye out for upcoming committee membership announcements. Together, we look forward to another year of advancing excellence and shaping the future of critical care anesthesiology.

Education Committee Update: IARS/ SOCCA Annual Meeting Critical Care Track

On behalf of the SOCCA Education Committee, we wish everyone a very joyous festival season. As we head into the New Year, the Education Committee remains committed to enhancing the educational experience for SOCCA members through its various offerings. In addition to our conventional offerings, the committee is working on creating additional educational content for SOCCA members in the upcoming year. The Education Committee offerings include: Board Review Course, Annual Meeting, Educational webinar, Virtual education, Journal Club, and Question bank subcommittees.

The most active subcommittee this year has been the Board Review Course subcommittee, chaired by Dr. Talia Ben-Jacob, with Dr. Veena Satyapriya as the vice chair. The subcommittee conducted the SOCCA 2025 Board Review Course (BRC), which had all new content, and was held in the fall, prior to the critical care board exam with four sessions of 2 hours each. This was a hybrid SOCCA BRC wherein some of the talks were pre-recorded, but the speakers were present live to answer any questions that the audience had. The course covered some of the frequently missed topics from prior exams and other high yield, frequently tested content. It was exclusively taught by SOCCA Member faculty and moderated by the members of the BRC subcommittee. The sessions were recorded, and made available to the registrants after all four sessions were conducted. Kudos to the BRC subcommittee leadership and the members, who worked tirelessly to make this event a resounding success with over 140 registrants. A big thank you to the speakers for their commitment and dedication in helping with this endeavor.

The Annual Meeting subcommittee, chaired by Dr. Kunal Karamchandani, and co-vice chaired by Drs. Ioannis (Yanni) Angelidis, and Jennifer Elia, MD, was tasked with grading the various session and workshop proposals submitted under the Critical Care track for the SOCCA/ IARS Annual Meeting. This year the Critical Care track received the most session proposals amongst all the tracks, and the subcommittee members had a tough task, choosing the best proposals to be included in the Annual Meeting program. The proposals that were highly rated, but could not be accommodated, were then sent to the Webinar subcommittee to be considered for the SOCCA Educational Webinar series for 2026.

The Webinar subcommittee, chaired by Dr. Amit Prabhakar, with Dr. Javier Lorenzo, as the vice chair, has been instrumental in bringing the highest quality educational webinars to our members throughout the year. The subcommittee is in the process of planning the Webinar series for next year, and we look forward to some great educational content for the 2026 Webinar series as well. The Virtual education subcommittee is headed by Dr. Anna Budde and has been working closely with the IARS *Open Anesthesia* platform, curating critical care related content for them. They continue to publish new summaries on *Open Anesthesia*, with the goal of providing a comprehensive repository of critical care topics that would be helpful for medical students, and residents on their ICU rotation. The next step is to collaborate with the Journal Club subcommittee and publish a high yield summary of the important articles that are being discussed during the Virtual journal club sessions on the *Open Anesthesia* platform.

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UT Southwestern Medical Center
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Anna Budde MD
Vice Chair, SOCCA Committee on Education
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Minneapolis, MN

The Journal Club subcommittee, chaired by Dr. Alok Kacha, has been conducting virtual sessions, giving an opportunity to the critical care fellows to present interesting and landmark studies. These Journal Club sessions are moderated by experienced Critical Care Anesthesiologists, and the purpose of these sessions is to critique and comprehensively evaluate each of the studies, thus informing the audience of the key take-aways while also understanding their limitations. The Question Bank subcommittee, which is relatively new, and chaired by Dr. Emily Naoum, with Dr. Hesham Ezz as the vice chair, is in the process of creating a virtual Question Bank, that could be an invaluable resource for the ACCM fellows and junior faculty that are preparing for their Critical Care board exams.

The Education committee update would be incomplete without recognizing Ms. Jennifer Rzepka and her team for all the hard work that they put in. We are hugely appreciative of all the behind-the-scenes work they do with the creation, promotion and dissemination of educational content to SOCCA members.

SOCCA Exchange Update: Service Chiefs' Advisory Council

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The Service Chiefs' Advisory Council (SCAC) continues to advance its role as a national forum for anesthesiology critical care leaders. SCAC brings together individuals with broad oversight of local anesthesiology critical care practices, creating a unified space to share operational insights, compare organizational models, and better understand the forces shaping our subspecialty. The value of SCAC lies in its ability to provide a national perspective into practice environments, staffing needs, and workforce pressures, elements that directly affect both the stability of existing programs and the attractiveness of the field to future critical care anesthesiologists. SCAC addresses the downstream realities of clinical practice and workforce sustainability that ultimately influence whether trainees view critical care anesthesiology as a desirable career path, complementing the ongoing efforts of the Program Directors' Advisory Council.

The Compensation, FTE, and Staffing Survey is now in its final stages of revision. This nationwide, institution-level survey is designed to provide a clearer and more standardized understanding of compensation structures, full-time equivalency definitions, and staffing models across the country. Prior efforts relying on individual respondents limited accuracy and generalizability. By collecting data at the institutional level, SCAC aims to produce a robust and representative national picture of contemporary and future practice environments to be shared amongst the SOCCA membership. A test run of the survey is planned prior to full rollout to ensure clarity and ease of completion. Please reach out if interested in testing the survey.

Recruitment challenges remain common across institutions, and the forthcoming survey is expected to illuminate variations in practice structures nationwide. Aligning with the theme of this issue of the *Interchange*, this work will also help identify opportunities within subspecialty programs, like those in which mechanical circulatory support and cardiothoracic critical care comprise the primary clinical coverage, by clarifying how these high-acuity service lines are organized, staffed, and supported across institutions. This data will support more informed workforce planning and may clarify which elements of practice structure most strongly influence the desirability of a career in critical care anesthesiology.

Work continues with the SOCCA office to integrate the SCAC directory into MemberClicks to improve accuracy and accessibility. SCAC has transitioned to a quarterly meeting schedule to maintain consistent progress on these and other identified future initiatives.

Over this past year, leadership transitions within SCAC have been completed. Dr. Anne Drewry now serves as Chair, with Dr. Sheida Tabaie as Vice Chair. Dr. Suzanne Bennett has joined the leadership team as Secretary. Dr. Craig Jabaley continues to support the Council as Immediate Past Chair and is leading efforts to update and streamline the contact directory and finalize the survey.

Institutions experiencing leadership transitions are encouraged to share updated contact information to ensure comprehensive national representation.

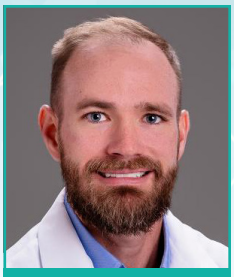
Communication Committee Update

As you may have noticed, we made some changes to *Interchange* this year. These have included: new guidelines for authors, themed editions, Critical Currents, as well as the addition of a cover page and new table of contents. We hope you have enjoyed these new aspects of our Society's newsletter and look forward to continued improvements next year.

Our committee continues coordinated efforts to improve our social media presence. Matt Broyles, MD, social media subcommittee chair, has been leading the charge in maintaining SOCCA's footprint across several social media platforms. We have expanded this reach to include Instagram this year, featuring interviews with members and other video segments. The goal for the variety of social media accounts is to meet our members and potential members where they are, while generating interesting and useful content to engage our broad audience. We remain hopeful that this endeavor will serve as one of many tools to recruit residents to our great field, while also providing members with ongoing updates from the Society and from the field. We continually evaluate the efficacy and necessity of all accounts and over the last six months: Twitter/X has added 59 new followers, LinkedIn has seen a 41% increase in impressions per post, and Facebook has seen the addition of 21 new fans (Instagram analytics were unavailable at the time of this publication). We are pleased with these numbers, but will continue to work toward improvement.

The www.socca.org website has undergone a transition to a different content management system. This will allow us to more easily update the website regularly and enhance its visual appeal. Ron Leong, MD, website subcommittee chair, plans to continue quality assessment of all links and pages across the website. We have already seen an improved landing page with a calendar of upcoming events. The archived issues of *Interchange* have also been edited to provide for easier searching.

While we celebrate our accomplishments of this past year, we also look forward to 2026 with great anticipation for further successes from our committee. While the communications committee may be small, it is mighty! Thanks for reading, and be sure to follow our social media accounts!



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Program Directors Advisory Council (PDAC) Update

While the following is not comprehensive, please allow it to serve as an update to the busy workings of the Program Directors Advisory Council. Led by chair Babar Fiza, the committee members have been actively tracking interest in fellowship programs from residents and the corresponding match data. Other tasks include collaboration with other committees to develop and ultrasound educational curriculum and ensure the ongoing success of SOCCA's Journal Club. Lastly, of special interest to this edition of Interchange is an initiative to define core competencies in MCS for fellowship training programs.

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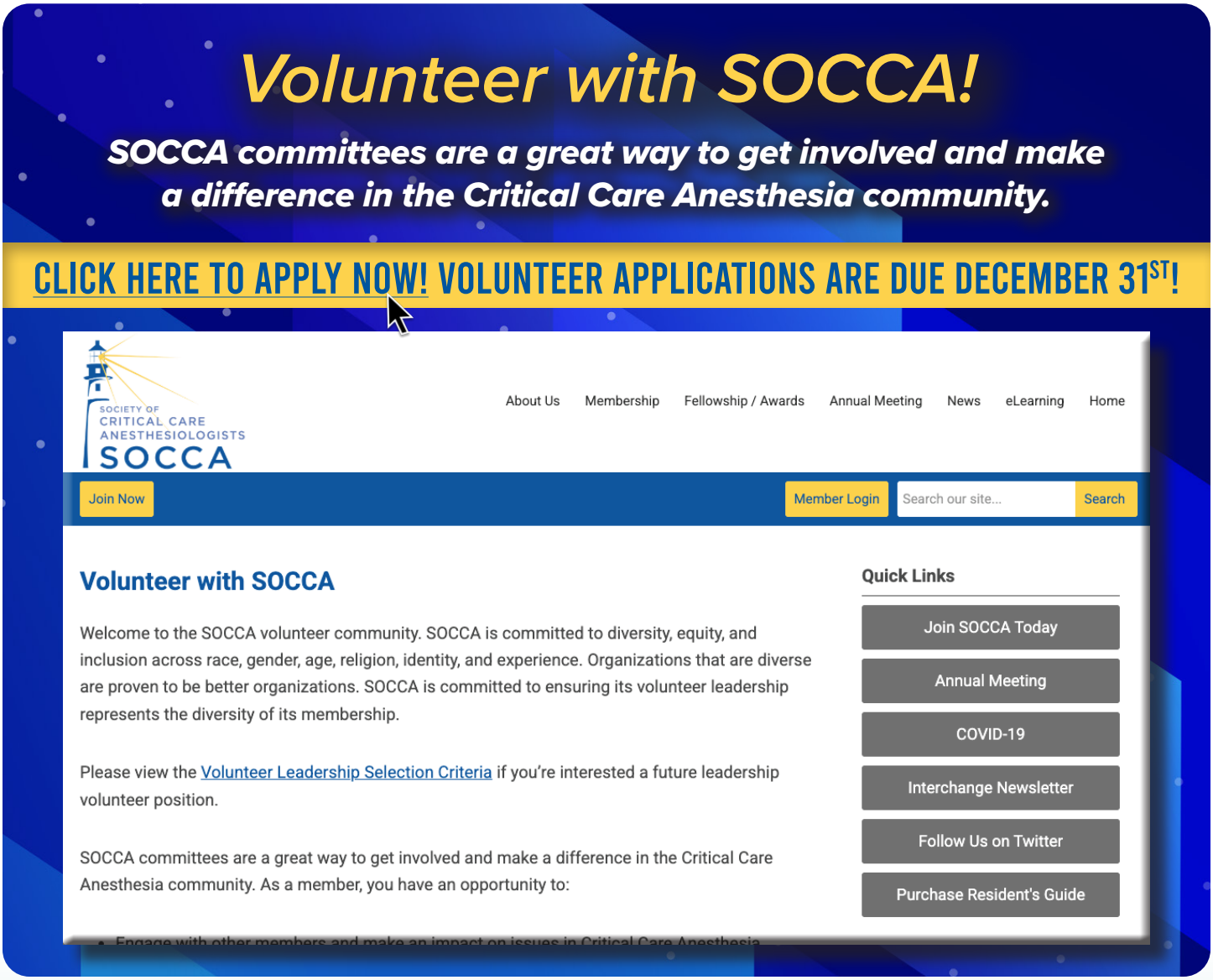

Research Committee Update

As Chair of the SOCCA Research Committee, it is a pleasure to provide an update on the Committee's activities and progress. While not comprehensive, the following reflects the scope and momentum of work currently underway and highlights the engagement of a dynamic and proactive group of volunteers who have brought energy, structure, and a strong sense of purpose to the Committee's efforts. Our work has been organized around clearly defined subcommittees, with an emphasis on projects that are relevant to members, feasible to execute, and aligned with SOCCA's broader mission.

Several initiatives are actively underway. The Committee is currently collecting data for two survey-based projects: one examining approaches to venous congestion assessment using point-of-care ultrasound, including an upcoming survey focused on knowledge and utilization of VEXUS in the ICU, and a second survey addressing contemporary practice patterns and perspectives related to VV ECMO is being explored. In parallel, the Data Subcommittee has formalized a process for reviewing and supporting data and survey requests originating from SOCCA members, SOCCA committees and subcommittees, as well as external individuals and organizations. This structure is intended to improve transparency, ensure appropriate oversight, and facilitate efficient execution of projects that serve the Society.

We have also revived and activated the SOCCA Speaker's Bureau, led by Jarva Chow and ably assisted by Nate Smischey. This growing resource allows members to catalogue and share their areas of expertise and willingness to present, enabling colleagues to more easily identify and connect with speakers for educational forums at the regional, national, and international levels. Beyond its practical value, the Speaker's Bureau represents a tangible benefit for the membership by promoting scholarly exchange and increasing visibility of SOCCA expertise. The Research Committee is also exploring the development of a SOCCA-based forum to further support and coordinate speaking engagements alongside other Society offerings.

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

The Research Dissemination and Collaboration Subcommittee has worked closely with the full Committee and the SOCCA Board to expand recognition of scholarly work presented at the Annual Meeting. Beginning this year, there will be three Young Investigator Awards and three Best of Meeting Awards, with formal recognition planned during the meeting. In addition, efforts are underway to identify time within the meeting program for podium presentations of these prize-winning abstracts, reinforcing the Society's commitment to showcasing high-quality research.

The Scientific Writing Subcommittee continues to advance several longer-term initiatives, including collaboration with other subspecialty groups, exploration of a Society-sponsored white paper, and delineation of work related to ICU billing. These efforts are being led by Mary Jarzebowski, Kate Rosenblatt, and Ken Shelton, with the goal of producing work that is both academically rigorous and practically useful to members.

I would like to thank all members of the Research Committee for their thoughtful contributions and sustained commitment. Particular thanks are due to our subcommittee chairs and taskforce leaders—Vikram Fielding-Singh, Domagoj Mladinov, David Douin, Michael Kiyatkin, Mary Jarzebowski, Kate Rosenblatt, Jarva Chow, and Nate Smischey—for their leadership and dedication.

A Brief History of ECMO

Alex Lucas, MD
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Lukas Matern, MD
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If the place of the heart could be supplied by injection—and if, for the regular continuance of this injection, there could be furnished a quantity of arterial blood, whether natural or artificially formed—supposing such a formation possible—then life might be indefinitely maintained.

– Julien Jean Cesar Le Gallois,
Experiments on the Principle of Life (1813)[1]

Extracorporeal membrane oxygenation (ECMO) represents the highest level of support for cardiopulmonary failure refractory to conventional treatment. Although first successfully introduced in the late 20th century, the concept of extracorporeal support dates back to the dawn of medicine. Here, we outline notable—but certainly not all—highlights in the development of this life-saving technology.

In the second century C.E., the Greco-Roman physician Galen proposed that blood was carried in two distinct systems terminating separately in the arteries and veins. This belief persisted through the centuries until 1628, when Dr. William Harvey published an article describing that blood is pumped through arteries and veins to form a continuous circuit.[2] The scientist Robert Hooke later theorized that simply exposing blood to fresh air—without passage through the lungs—might sustain life.[3] These ideas laid the theoretical foundation for artificial circulation and gas exchange.

During the 19th century, experiments sought to translate theory into practice. In 1849, physiologist Julien Jean Cesar Le Gallois unsuccessfully attempted to perfuse decapitated rabbits by injecting arterial blood, though he was later able to perfuse an isolated kidney. By 1865, a roller pump enabled the continuous movement of blood through artificial circuits. The first oxygenator was later developed in 1882 by W. von Schröder of Strasburg, who bubbled air through venous blood in a reservoir system. These early oxygenators were plagued by challenges related to foaming until a rotating film oxygenator was developed by Max von Frey and Max Gruber in 1885.[4] Their oxygenator provided continuous flow in a closed system. Heating chambers, valves, and syringe pumps were then incorporated to approximate physiologic conditions. The isolation and subsequent clinical use of heparin in the 1930s further proved essential to making cardiopulmonary bypass (CPB) technology a reality.[4]

Extracorporeal support underwent further rapid development into the 20th century. Dr. John Gibbon, motivated by the death of a young woman from a pulmonary embolism, worked for decades to optimize a film oxygenator. His team later performed the first successful procedure involving CPB in 1953 for closure of an ASD.[5] Membrane oxygenators were soon introduced to address the complications associated with direct blood-air contact. In 1963, Dr. Theodor Kolobow developed a silicone spiral coil membrane oxygenator, allowing prolonged CPB use.[6] These systems eventually evolved into the hollow fiber membranes that are still used today.

In 1971, Dr. J. Donald Hill supported a trauma patient who developed ARDS for 75 hours on ECMO—the first veno-venous (V-V) ECMO patient to survive.[7] In the same year, Dr. Robert Bartlett and Dr. Alan Gazzaniga continued to investigate the use of silicone membrane oxygenators for veno-arterial (V-A) applications in children. The two successfully placed a patient in cardiogenic shock following a Mustard procedure on V-A bypass who went on to recover. More success stories followed, notably the rescue of "Esperanza," a neonate in respiratory failure due to meconium aspiration and persistent fetal circulation in 1975. Soon, over 40 infants had been treated with ECMO.[9] Similarly, CPB became firmly established, expanding the field of cardiac surgery.

Dr. Bartlett remained a leading advocate for extracorporeal technology and founded the Extracorporeal Life Support Organization (ELSO) in 1989. Widely known as the "Father of ECMO," he inspired generations to expand ECMO technology and clinical applications.[10] Today, ELSO remains the premier organization for advancing the use of ECMO, maintaining a global registry, and promoting education worldwide.

As ECMO became a viable technology, efforts shifted toward establishing evidence through clinical trials. One of the first rigorous trials, conducted in 1979 by Dr. Warren Zapol and colleagues, examined ECMO in severe acute respiratory failure. Despite its landmark

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A Brief History of ECMO *continued from previous page*

status, the trial showed no survival benefit compared to conventional management and dampened ECMO enthusiasm for decades. However, the paper was upheld as a foundational ECMO trial and highlighted opportunities for further study.[11] Only with the publication of the CESAR trial in 2009 was a mortality benefit found, namely when patients with severe ARDS were transferred to an ECMO-capable center.[12] Although not without criticisms, the study is credited with reviving considerable interest in ECMO. In 2018, the multicenter EOLIA trial compared V-V ECMO to conventional management in ARDS. This study showed no significant mortality benefit but provided evidence of ECMO's safety and potential advantages when initiated early.[13]

More recent studies have evaluated the role of V-A ECMO for the management of cardiac arrest, giving rise to the concept of extracorporeal cardiopulmonary resuscitation (ECPR). The 2020 ARREST trial studied V-A ECMO for out-of-hospital cardiac arrest with refractory shockable rhythms.[14] This study showed an improved survival to hospital discharge for the group placed on V-A ECMO. Today, a growing number of centers are utilizing ECPR.

Today, ECMO is used in more than 50 countries, with over 250,000 cases now recorded in the ELSO registry.[15,16] Patients are cannulated for ECMO in emergency departments, mobile ECMO units, and even at remote sites of cardiac arrest. New technology is expanding the cohort of survivors to patients once deemed unsalvageable. While much of the evidence around the use of ECMO remains equivocal—and research is complicated by patient, setting, and protocol heterogeneity—it is increasingly clear that ECMO may benefit carefully selected patients with refractory cardiopulmonary failure. The development of ECMO represents a remarkable achievement in medicine and promises to further enhance the care of critically ill patients worldwide.

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Critical Care Anesthesiologists as Members of an Interdisciplinary ECMO Cannulation Team

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As the use of Extracorporeal Membrane Oxygenation (ECMO) to support critically ill patients grows, one challenge of placing patients on this potentially lifesaving therapy is ensuring the availability of trained physicians to perform the cannulations when needed. Percutaneous techniques have been established as a reliable method of ECMO cannulation as compared to a surgical approach, and can be safely performed by intensivists in locations across the hospital including the ICU, cardiac catheterization laboratory, or emergency department.[1,2] As described in the March 2025 issue of the *SOCCA Interchange*, critical care anesthesiologists (CCAs) are leaders in cardiovascular critical care medicine with not only the medical expertise but also the procedural and leadership skills to direct the multidisciplinary teams caring for complex patients in the cardiovascular intensive care unit who require ECMO support.[3,4] With expertise in vascular access and management of acute cardiac and respiratory compromise, CCAs can not only oversee the hemodynamic management of ECMO initiation and maintenance but directly perform percutaneous ECMO cannulation procedures. Several groups have published their experience with the development of training pathways for intensivist-led cannulation teams, with data showing outcomes noninferior to those of surgeon-led cannulation teams.[1,5,6] Here, we will briefly describe our recent and ongoing experience with starting an intensivist-led ECMO cannulation team.

Our institution is a quaternary referral center for patients requiring complex cardiac surgery, advanced interventional and structural cardiology interventions, heart and lung transplant, and placement of temporary and durable mechanical circulatory support, with steadily increasing ECMO volume in recent years. To support the growing clinical need for ECMO while minimizing additional surgeon workload and the associated disruption to operating room availability, we recently established a formal pathway for training and credentialing our multidisciplinary group of Intensive Cardiac Care attendings for ECMO cannulation. The group consists of anesthesia critical care faculty as well as critical care cardiologists. All members are credentialed and experienced in management of patients on ECMO.

Components of the pathway include completion of an Extracorporeal Life Support Organization (ELSO)-certified cannulation course and 10 *in-vivo* cannulation procedures, which are directly proctored by either cardiothoracic surgical attendings or intensivist cannulators who have completed credentialing requirements. Cardioathoracic surgical backup remains available for those cases without a surgeon present. Our standard cannulation approach consists of percutaneous ultrasound-guided femoral access for venoarterial cannulation including placement of a distal perfusion cannula. For venovenous support a femoral vein to internal jugular vein approach is used with availability of TEE guidance. Since formally starting this effort in Spring 2025, six faculty have entered the pathway, with two so far completing the requirements for cannulation credentialing. To date, trainees have been involved in 41 cannulations, of which 85% were venoarterial cannulation for cardiogenic shock and 12% venovenous cannulation for respiratory failure. Of these, only one case involved development of lower extremity ischemia requiring arterial cutdown to re-establish distal flow. There were no cases of major hemorrhage or inability to cannulate. Ongoing outcomes are being closely tracked to allow comparison of intensivist-led cannulation to the standard surgeon-led approach.

The initiation and ongoing success of this effort has required multidisciplinary cooperation. Close collaboration with cardiothoracic surgery is required as they provide ongoing procedural proctoring of cases, which have included peripheral cannulation in the operating room when needed for cardiac bypass to supplement the variable and unpredictable volume of training opportunities.

Significant personal dedication to the effort is required as the often unplanned nature of cannulation opportunities requires trainees to make themselves available for cases on short notice. Once an established cohort of enough trained and credentialed faculty has been achieved, we anticipate our effort will establish a team of intensivist ECMO cannulators who are available around the clock on a formalized call system to provide support to unstable

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ECMO Cannulation Team *continued from previous page*

patients within the hospital. The next logical step will be the development of a mobile cannulation and retrieval team to extend the ability to provide ECMO support to patients at hospitals within our health system and in the local area. Ongoing efforts of the program include development of an in-house cannulation training course using simulation to not only familiarize new providers with the procedure, but also to optimize the team approach to both straightforward and complex cannulation scenarios.

This effort highlights a natural extension of the value anesthesia intensivists can provide in a coordinated multidisciplinary effort expanding the ability to deliver ECMO support to unstable patients whenever it is indicated and wherever they are.

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SOCCA MENTORING

Mechanical Circulatory Support in Advanced Cardiac Life Support

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Introduction

The initiation of mechanical circulatory support (MCS) during cardiac arrest, also known as extracorporeal cardiopulmonary resuscitation (ECPR), is increasingly being utilized in an effort to improve rates of survival with a good neurologic outcome after cardiac arrest. It involves the initiation of V-A ECMO intra-arrest, allowing for restoration of perfusion while reversible causes are sought out and addressed[1,2]. It must be stressed that a successful ECPR program can only exist within a system with a high-quality chain of command, encompassing pre-arrest care, ECPR team mobilization, and high-quality intensive care post-cannulation.[2]

IHCA vs OHCA

Location of cardiac arrest is an important distinction given the inherent differences in recognition and response. Higher rates of an initial shockable rhythm are seen in out-of-hospital cardiac arrest (OHCA) patients, with estimates of 40% of the US and European populations[3,4]. However, despite this, OHCA is associated with lower survival rates than in-hospital cardiac arrest (IHCA).[5,6] Evidence supporting the use of ECPR for OHCA is mixed, largely owing to differences in system performance and patient selection. The first of three randomized controlled trials studying the efficacy of ECPR for OHCA was the ARREST trial. It was stopped prematurely after demonstrating impressive superiority of ECPR over conventional ACLS for patients with refractory shockable rhythms.[7] The subsequent Prague OHCA and INCEPTION trials did not show a statistically significant difference in neurologically favorable outcomes with ECPR.[1,8] However, secondary analyses of these trials and several meta-analyses suggest improved survival with ECPR for OHCA when performed in highly experienced systems and in select patients with favorable prognostic factors, including young age, initial shockable rhythm, witnessed arrest, and bystander CPR[9-11].

IHCA represents a different patient population than the OHCA cohort, with hypoxia being the most common etiology for cardiac arrest.[12] The presenting rhythm in IHCA is also much less likely to be shockable, with only a 21.75% incidence of shockable rhythms, likely due to different etiologies of arrest and different patient substrates.[12] Patients with IHCA are more likely to be witnessed and have earlier CPR. In regards to ECPR, in small studies, patients with an in-hospital arrest have a shorter time to initiation, higher wean rates, and higher rates of 30-day survival when compared to OHCA[13]. Perioperative cardiac arrest has been described as a distinct subset of IHCA[14], with etiologies and variables that are unique to this population[15]. The closer hemodynamic monitoring and increased availability of resources in the perioperative space allows for faster recognition and initiation of ECPR. One retrospective study found survival to discharge in the perioperative population to be significantly higher than that of the general IHCA cohort, and associated with shorter CPR duration.[16]

Patient Selection

Inclusion and exclusion criteria for ECPR are program- and center-specific, with each institution determining its own criteria. Factors that are typically considered are presenting rhythm (shockable vs not), age, bystander CPR, duration of downtime, and patient comorbidities.[2,17] Common elements among inclusion criteria include initial shockable rhythm, arrest to CPR time <5 minutes, arrest to ECMO flow <60 minutes, age <70 years, and absence of severe comorbidities such as end organ failure or terminal malignancy[1,2,17]. As previously discussed, IHCA does lend itself to shorter time to identification of arrest and more rapid ECPR, but differences in presenting rhythms as well as comorbidities may change ECPR candidacy depending on institutional practice. The RESCUE-IHCA score has been developed to predict probability of death in IHCA patients receiving ECPR[18], which may help the bedside clinician with patient selection.

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Mechanical Circulatory Support in ACLS *continued from previous page*

Cannulation: Location, Cannulators, and Summary of Approach

Given that ECPR requires time for mobilization of teams and resources, patients with short resuscitation attempts should be considered, to allow for cannulation within the 60 minute mark[17]. Multiple cannulating locations have been successful, including the prehospital setting, emergency department[19], cardiac catheterization lab, ICU, and operating room.[2,17] Percutaneous femoral cannulation via the modified seldinger technique has become the most common method, and has been successfully performed by a wide variety of clinicians including surgeons, intensivists, cardiologists, and emergency physicians.[17]

ACLS Modifications during ECPR

The use of MCS during ongoing resuscitation efforts requires certain modifications to the standard ACLS protocol. For example, many institutions employ devices that provide mechanical chest compressions such as the Lund University Cardiac Assist System (LUCAS) device, to limit movement of the pelvis. These devices come with their own risks, as there have been reports of pericardial effusion, fractures and intra-abdominal injuries with significant blood loss associated[20]. While use of a mechanical CPR device can provide reliable and consistent high-quality CPR without the risk of compressor fatigue, and may minimize the amount of time "off the chest", a recent meta-analysis of OHCA patients showed no difference in outcomes with use of the LUCAS[21]. Other modifications to the ACLS algorithm include avoidance of defibrillations during cannulation in order to minimize movement while arterial and venous access is obtained and cannulas are being placed. Additionally, the code leader should be separate from the ECMO and cannulation team[17] as standard resuscitation should be continued until initiation of ECMO. Judicious use of epinephrine is also recommended, particularly around the time of initiation of pump flow, to minimize abrupt hypertension when circulation is restored with ECMO flow[17].

2025 AHA ACLS Guidelines

In 2025, the American Heart Association (AHA) provided updated ACLS guidelines with some changes to their recommendations regarding ECPR. Current AHA guidelines recommend ECPR "in select patients when provided within an appropriately trained and equipped system of care" (Class 2a, LOE B-R)[22]. The update expands on this by emphasizing careful patient selection, institutional experience, and regional coordination to optimize outcomes and minimize futility[23]. No specific inclusion or exclusion criteria are recommended, though the guidelines highlight the importance of maintaining consistency in patient selection and conducting periodic re-evaluation of selection criteria as new data emerge. Multiple studies have demonstrated improved patient survival in centers with higher ECPR volume,[24,25] supporting the proposal of a regionalized approach to implementation. Favorable outcomes have also been associated with shorter CPR duration.[26-29] The guidelines thus advocate for percutaneous, over surgical, cannulation to reduce time to initiation without increasing procedural complications.

Initial management

Once a patient is cannulated for ECPR, several modifications to post-resuscitation care should be considered. Invasive blood pressure monitoring with a right radial arterial line is recommended and can also be used for monitoring of native circulation and cerebral oxygen delivery. Optimal mean arterial pressure (MAP), oxygenation and temperature targets have not been identified. The Extracorporeal Life Support Organization (ELSO) recommends titrating vasopressors to reach a target MAP of > 60mmHg.[17] Mechanical ventilator settings should target lung protection and sweep gas flow should be titrated to avoid hypocarbia with monitoring of blood gases from the right radial arterial line.

Conclusion

While there has been significant advancement and progress toward a better understanding of how and when to use MCS in ACLS, there remains much to be clarified in terms of specific application, protocols and implementation of this life saving technology.

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Integrating CSU-ALS and Mechanical Circulatory Support in Postcardiac Surgery Resuscitation

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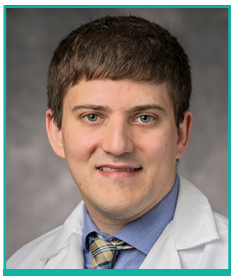

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Post-cardiac surgery cardiac arrest remains one of the most challenging and devastating events in perioperative critical care, with an incidence between 0.7% and 5% of adult cardiac surgical patients[1] and 30-day mortality ranging from 51% to 71.6%. Unlike traditional Advanced Cardiac Life Support (ACLS) scenarios, postcardiotomy arrests often arise from rapidly reversible causes such as tension pneumothorax, hemorrhage, tamponade, graft failure, or conduction issues that can be quickly remedied with interventions not outlined in ACLS. This mismatch between etiology and standard algorithms led to the development of the Cardiac Surgical Unit–Advanced Life Support (CSU-ALS) protocol.[2]

The CSU-ALS algorithm includes escalation to veno-arterial extracorporeal membrane oxygenation (V-A ECMO) as a defined terminal step when conventional interventions fail. This is supported by contemporary evidence showing that postcardiotomy arrest and shock have significantly improved survival when V-A ECMO is initiated early.[3] Many centers, including ours, now incorporate consideration for V-A ECMO escalation into CSU-ALS team activation (open chest code at our institution), ensuring that perfusionists and cardiac surgeons mobilize immediately, with an ECMO circuit primed at all times.

V-A ECMO remains the cornerstone device for postcardiotomy rescue, providing full cardiopulmonary support in refractory arrest or shock. Systematic reviews report survival rates between 25% and 45%, strongly influenced by timing of initiation.[4] Early ECMO initiation—ideally within minutes of failed resuscitative efforts—correlates with lower lactate burden, improved neurological outcomes, and higher rates of myocardial recovery.[5] This aligns with CSU-ALS principles emphasizing decisiveness, rapid pacing/defibrillation, and prompt resternotomy followed by escalation when indicated.

Central to CSU-ALS is the recognition that the goal is not simply restoring electrical activity but also restoring effective cardiac output. This is particularly relevant because postcardiotomy cardiogenic shock (PCCS) frequently follows resuscitation even after reversible causes are addressed. In these situations, mechanical circulatory support (MCS), and especially V-A ECMO, can become the critical bridge to recovery, allowing time for myocardial rest and stabilization.

However, V-A ECMO is not without challenges. Increased afterload, caused by retrograde flow, may worsen left ventricular (LV) distension, delaying myocardial recovery and a myriad of other complications. Unloading strategies—including *Impella*, intra-aortic balloon pump (IABP), or surgical LV venting—are now widely adopted. Hybrid "ECpella" (ECMO + *Impella*) configurations have shown improved LV decompression and weaning success in several perioperative series.[6] *Impella* may also serve as a standalone device in isolated LV failure with preserved right ventricle (RV) function.

Intra-aortic balloon pump (IABP) continues to play a role as an adjunct or bridge, particularly in cases driven by ischemia or where ECMO is unavailable. Although its hemodynamic effect is modest, it improves coronary perfusion and reduces LV afterload, which can be sufficient to stabilize select postcardiotomy shock patients.

In modern cardiothoracic ICUs (CTICUs), the critical determinant of patient outcomes is often not device choice, but timing. Delayed MCS initiation—particularly beyond one hour of refractory low-output state—correlates consistently with mortality.[5] Within the CSU-ALS framework, cardiac arrest persisting beyond 10–15 minutes after pacing, defibrillation, and resternotomy should trigger immediate ECMO initiation. Likewise, failure to separate from cardiopulmonary bypass despite correction of surgical issues should prompt early MCS, avoiding harmful pharmacologic escalation.

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Postcardiac Surgery Resuscitation *continued from previous page*

Integrating MCS into CSU-ALS requires robust institutional readiness. Centers with established postcardiotomy ECMO pathways and regular team training demonstrate significantly improved survival and lower rates of "failure to rescue" after cardiac arrest.[3] At our institution, we have fully integrated the CSU-ALS framework into CTICU practice through comprehensive training for all clinical staff. We maintain constant readiness with unannounced mock codes that reinforce rapid role assignment and adherence to protocol. Open chest carts and primed ECMO circuits are kept immediately available to expedite mechanical support when needed. A designated open-chest code pathway activates cardiac surgery, anesthesia critical care, perfusion, and OR support within seconds. Together, these measures create a coordinated, high-reliability response that improves outcomes in postcardiac surgery arrest.

Despite these advances, postcardiotomy MCS remains resource-intensive and carries substantial risks, including bleeding, renal injury, stroke, and limb ischemia.[4] Successful programs emphasize meticulous patient selection, early initiation, and dedicated care pathways involving anesthesiologists, intensivists, surgeons, nurses, respiratory therapists and perfusionists.

Future innovations will focus on rapid-deployment ECMO platforms, automated decision-support tools, and biomarker-guided weaning strategies. Artificial intelligence is expected to enhance perioperative MCS by identifying low-output states earlier, guiding ECMO titration, and predicting myocardial recovery through real-time physiologic data analysis. As these systems evolve, critical care anesthesiologists—given their expertise in physiology and perioperative monitoring—are well positioned to lead their integration into CSU-ALS–based resuscitation pathways.

Ultimately, CSU-ALS and MCS are synergistic. CSU-ALS ensures that mechanical, reversible causes of arrest are addressed immediately. MCS ensures that end-organ perfusion is preserved while the heart recovers. Together, they form the foundation of modern postcardiotomy resuscitation—a reference framework that blends surgical precision, physiologic insight, and team coordination to improve survival after one of the most challenging events in perioperative medicine.

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Anticoagulation for ECMO: Indications, Challenges and Future Directions

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As ECMO use continues to rise, optimal anticoagulation management is an increasingly salient clinical concern.[1] Although anticoagulation in ECMO is empirical, the balance between preventing thrombosis and avoiding life-threatening hemorrhage remains a clinical challenge, particularly given the hemostatic dysregulation inherent to ECMO.[2,3] This article will review the rationale, pharmacologic strategies, and urgent clinical questions regarding anticoagulation for ECMO patients.

Anticoagulation: Rational and Indications

Thrombotic and hemorrhagic complications may occur in up to 37% and 47% of V-V ECMO patients, respectively, and 15% and 51% of V-A ECMO patients.[4,5] Hypercoagulability may develop due to clotting-cascade activation at the blood-device interface, critical illness, non-pulsatile flow, hemolysis and transfusions, among many other factors.[3,6] Conversely, bleeding may occur due to vascular complications, fibrinolysis, platelet dysfunction and acquired von Willebrand deficiency, in addition to excessive anticoagulation.[3,6]

Guidelines recommend therapeutic anticoagulation in ECMO patients in order to prevent circuit thrombosis and venous and arterial thromboembolism.[7] However, a growing body of data suggests that certain ECMO patient populations may demonstrate superior outcomes in the absence of anticoagulation. Several retrospective studies report comparable thrombosis rates with fewer hemorrhagic complications and reduced transfusion requirements in patients managed without continuous anticoagulation.[8,9] These conclusions, however, are limited by retrospective design with inconsistent reporting of outcomes. Current guidelines continue to support routine use of therapeutic anticoagulation.[7,22]

Choice of Anticoagulant: Heparin versus Direct Thrombin Inhibitors

Current guidelines recommend therapeutic anticoagulation with unfractionated heparin (UFH) for V-V and V-A ECMO patients.[7,22] UFH is advantageous for its cost-effectiveness, reversibility, ease of monitoring and general familiarity. However, UFH dose-effects are often variable and unpredictable, and patients may develop heparin-resistance due to anti-thrombin III depletion. Heparin also carries a risk of heparin-induced thrombocytopenia (HIT), which may itself be challenging to diagnose given the multifactorial nature of thrombocytopenia and hypercoagulability in ECMO patients, as previously described.[10] In cases of HIT and anti-thrombin III deficiency, direct thrombin inhibitors (DTIs), such as bivalirudin and argatroban, may be used. Even in non-HIT patients, some centers routinely use DTIs due to their predictable dose effect.[11] Disadvantages of DTIs include a lack of antidote and need for dose-adjustment in patients with renal and/or hepatic dysfunction (for bivalirudin and argatroban, respectively). A recent meta-analysis by Hasegawa et al. found significantly lower short-term mortality in EMCO patients receiving bivalirudin compared to heparin, though conclusions remain limited by observational data.[11] Additional retrospective studies report comparable, if not reduced, rates of hemorrhagic and thrombotic complications in patients receiving bivalirudin compared to heparin.[12-14] Kaseer et al revealed the percentage of time activated partial thromboplastin time (aPTT) was within the therapeutic range was higher with bivalirudin than UFH (50% vs 85.7%; $P = .007$) providing a possible mechanism to the reduced rates of hematologic complications.[15] While these findings suggest that DTIs may offer a safe and effective alternative to UFH, prospective controlled trials are needed to confirm these trends.

Anticoagulation Monitoring

Optimal monitoring strategies and therapeutic targets for ECMO anticoagulation remain debated. An international survey of ECMO centers found that the three most commonly-used methods were activated partial thromboplastin time (aPTT) (41.8%), activated clotting time (ACT) (30%), and anti-factor-Xa (anti-Xa) activity (22.7%).[16] Current ELSO practice guidelines recommend targeting anti-Xa level of 0.3-0.5 U/mL, or alternatively a aPTT of 50–70 seconds, for UFH therapy. [7] However, aPTT is influenced by coagulation factor levels (II, VIII,

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Anticoagulation for ECMO *continued from previous page*

antithrombin), circulating inhibitors, and assay variability, complicating standardization.[17]

Furthermore, discordance between aPTT and anti-Xa levels has been noted to occur in one third of cases, suggesting opportunity for under- and over-anticoagulation.[17] This discordance may be particularly likely in the setting of liver dysfunction and hyperbilirubinemia; in this scenario, Xa is often unreliable.[18,22] In all cases, clinicians must interpret results within the context of the patient's physiology and coagulation profile. Additional point-of-care testing such as ACT and viscoelastic testing (e.g. ROTEM, TEG) have also been explored for anticoagulation monitoring. At heparin doses typically used in the ICU, ACT has shown limited sensitivity and poor correlation with UFH dose, aPTT, and anti-Xa levels.[16,19] Viscoelastic testing, while useful for rapid assessment of global coagulation dynamics, has shown only nonsignificant trends toward reduced bleeding, thrombosis, and in-hospital mortality.[20] These findings suggest that ACT and viscoelastic testing may serve best as adjunctive, rather than primary, monitoring tools.

Future Directions in Anticoagulation for ECMO

Overall, the current evidence underscores significant variability in anticoagulation strategies, monitoring methods, and clinical outcomes among patients receiving ECMO support. While emerging data suggest potential benefits of alternative anticoagulants such as bivalirudin and adjunctive monitoring modalities, the absence of robust prospective trials limits definitive conclusions. Standardized, evidence-based protocols are urgently needed to optimize anticoagulation management, balance bleeding and thrombotic risks, and ultimately improve patient outcomes

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Sex Disparities in Mechanical Circulatory Support: Implications for Critical Care Anesthesiologists

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"Life it is not just a series of calculations and a sum total of statistics, it's about experience, it's about participation, it is something more complex and more interesting than what is obvious."

-Daniel Libeskind

Women are less likely to receive mechanical circulatory support, regardless of modality: extracorporeal cardiopulmonary resuscitation (ECPR), extracorporeal membrane oxygenation (ECMO), *Impella*, and intra-aortic balloon pump (IABP).[1]

It is a long-standing anecdote within the scientific community that statistics can be manipulated to fit an agenda. It is nonetheless concerning that healthcare disparities regarding advanced cardiac life support are consistent and reproducible, with statistically significant P- values demonstrating disparities in the numbers of women, compared to men, placed on mechanical circulatory support (MCS). Conversations among critical care physicians regarding the "why?" and "how can this be modified in the future?" need to begin. From the mid-2000's onward, a growing trend of articles describing sex disparities among patients receiving MCS have been published. While the etiology of cardiogenic shock refractory to medical therapy varies among men and women, when controlling for confounders, a multitude of databases conclude that there is a disparity in utilization of mechanical circulatory support according to sex, including the Journals of the Canadian Cardiovascular Society, American College of Cardiology, Annals of American Thoracic Society.[1,3-10]

In Sex-Based Disparities In Mechanical Circulatory Support Usage Among Postmenopausal Patients with Cardiogenic Shock, a sample group from the National Inpatient Sample database for 2018-2021 demonstrated a statistically significant disparity in the application of mechanical circulatory support; including IABP, *Impella*, and ventricular assist devices.[10,14] Specifically, when compared to men, women tended to be slightly older with lower comorbidity index, and lower MCS usage. Despite adjusting for age, Elixhauser index, race, type of insurance, and income, women still had 27.5% lower odds of receiving MCS and 17% higher odds of inpatient mortality.[14] According to one study of patients with cardiogenic shock due to acute myocardial infarction (AMI-CS), women placed on MCS were on average older, more likely to be Black, and had a higher burden of comorbidities as defined by the Charleson comorbidity index. These patients also experienced higher in-hospital mortality, palliative care, and DNR status.[10]

Why?

The negative medical outcomes associated with gender disparities beg us to evaluate the differences in morbidity and clinical management in the subset of AMI-CS patients. The understanding that these gender disparities are rooted in variations of pathophysiology may be imperative to quickly and safely implementing the changes needed to save lives.

In the AMI-CS population, women initially present at older ages and with different comorbidities than their male counterparts. Diabetes and hypertension contribute to a frequently-silent coronary artery disease (CAD) process in women, whereas men predominantly present with symptomatic CAD, resulting in interventions prior to their cardiogenic shock.[7] The delayed presentation of AMI in women results in longer ischemic times and higher baseline acuity as measured by CardShock scores.[11] It is unclear whether this leads to the higher incidences of heart failure and subsequent hemodynamic instability, which in turn decrease their rates of percutaneous coronary intervention.[10] Women with AMI-CS receive fewer MCS devices, less escalation to ECMO support, and have a higher incidence of respiratory failure leading

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Sex Disparities in MCS *continued from previous page*

to mechanical ventilation. Ultimately, women show higher inpatient mortality and a more frequent use of palliative care consultations. These higher mortality rates mirror the gender disparity trends noted in all areas of acute cardiovascular care.[10]

How can we bring change? Moving forward, how can teams address implicit bias?

Should we extrapolate the risk factors seen in AMI-CS women to our preoperative considerations and intraoperative management? Based on the current literature, we can say that women with a known history of diabetes and hypertension may warrant greater caution when clinicians assess their cardiac risk for adverse intraoperative cardiac events due to their silent and delayed presentations. Understanding that women with non-ST-elevation myocardial infarctions (NSTEMIs) may present in a more critical state and deteriorate faster, allows us to advocate for MCS devices earlier in the perioperative period or temporarily defer cases until a shock team has evaluated the patient's candidacy for MCS. There remains a need for sex-specific considerations in cardiogenic shock management, including recognition of unique presentations in pregnancy-related conditions, spontaneous coronary artery dissection, and Takotsubo cardiomyopathy.[12] Vascular access planning becomes particularly crucial to reduce femoral vessel complications in women with smaller anatomy.[13] Lastly, highlighting these gender differences in pathophysiology may allow quicker recognition of a decompensating cardiogenic shock patient in the perioperative period. Information is powerful when it comes to saving lives. Truly understanding the issues of gender disparities in the MCS population can be an asset to our practice as anesthesiologists.

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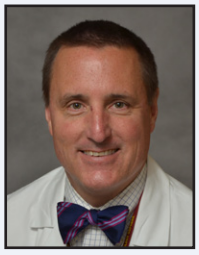

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