SCA NEWS

SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS
Knowledge • Care • Investigation

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February 2023

PRESIDENT'S MESSAGE

Special Thank You to Dr. Gravlee – Contributor to the President's Message

Glenn P. Gravlee , MD
University of Colorado
SCA Founding Officer
Successor

History Task Force Gearing Up for the Annual Meeting

For almost five decades, SCA has been too busy making history to document its achievements. Recognizing that reality, President Andy Shaw appointed a Task Force on History (HTF) last year. Its charge is intentionally open-ended. Several legendary SCA leaders agreed to serve on the History Task Force.

Regular Zoom meetings soon commenced, priorities were established, and projects were initiated. As 2023 marks the 45th Anniversary of SCA's creation, the Task Force suggested a panel at the Annual Meeting to honor SCA history and project its future. Panel co-chairs Mary Beth Brady and Past President Alan Schwartz will introduce Past Presidents George Burgess, John Waller, Jerry Reves, Linda Shore-Lesserson, and Daniel Thys as well as President Andy Shaw, President-elect Kathy Glas, and Early Career Board Member Stephanie Ibekwe, who will present a unique blend of past achievements, stories, ongoing projects, and future initiatives.

Introducing
History Task Force Members

Glenn P. Gravlee, MD *Chair*
Mary Beth Brady, MD, FASE, SPC
Andrew D. Shaw, MD
George E. Burgess, III, MD
Richard F. Davis, MD
James G. Ramsay, MD
Jerry G. Reves, MD
Alan Jay Schwartz, MD, MSEd
Linda Shore-Lesserson, MD, FAHA, FASE
Robert N. Sladen, MBChB, FCCM
Heather Spiess
Daniel M. Thys, MD
Joyce A. Wahr, MD
John L. Waller, MD

With the expert guidance of SCA Executive Director Jim Pavletich, **the HTF has conducted lively discussions and observed demonstrations about engaging ways to document and communicate SCA history.** Jerry Reves laid a strong foundation in his 2014 article "An Essay on 35 Years of the Society of Cardiovascular Anesthesiologists" (Anesth Analg 2014;119:255-65). This article prompted discussion of timeline formats ranging from skeletal diagrams to detailed interactive electronic instruments featuring photos, figures, charts, and tabs with drop-down menus. The upcoming Annual Meeting will feature a banner or roll-out poster highlighting key events along a timeline encompassing 1978-2023. The HTF has nearly completed a detailed template for an interactive timeline that will serve as an accessible dynamic resource going forward.

The Task Force also is developing a series of

"For almost five decades, SCA has been making history."

1-hour Oral History video sessions with key SCA leaders including all Past Presidents. Interviewing pre-2000 SCA Presidents constitutes a priority. Some of these interviews will occur during the Annual Meeting in Portland. Ultimately the Oral Histories and their transcripts will be available on-line to SCA members.

To best utilize history, it needs to be accessible. Accordingly, the HTF initiated a digitization project that has already created digital files for many early SCA documents such as Board of Directors and Annual Business Meeting minutes, Annual Meeting Scientific Programs, Newsletters, and financial statements. Our goal is to make this information available electronically to SCA members. This project has made considerable progress already, thanks to our management company, Veritas, Inc. In the future, we hope to also digitize the popular SCA Monograph series that was published annually from 1987 to 2010.

The History Task Force thanks the Board of Directors for financial support, and Veritas, Inc., for administrative expertise and support. Watch the SCA Newsletter and website for updates.

2023

Access Echo Week Recordings

Missed 2023 Echo Week?

Even if you were unable attend to the 2023 Annual Echo Week, that does not mean you have to miss out on valuable content!

Echo Week was recorded and provides the opportunity to deepen your understanding of ultrasound and perioperative transesophageal echocardiology with access to nationally recognized experts and content that will enhance your practice. You can access the product anytime, anywhere—all while earning CME credits!

Whether you were unable to attend in-person or virtually or want to revisit sessions you missed at the meeting, Echo Week recorded is just what you need.

To obtain enduring content, Click Here

SPECIAL THANKS to the National Board of Echocardiography (NBE) for Sponsoring the 2023 Arthur E. Weyman Lecture at Echo Week!

Left to right:
Dr. Alina Nicoara, Dr. Rebecca Hahn,
Dr. Charles Nyman

SAVE THE DATE

Mark Your Calendars!

Echo Week 2024 is scheduled for **February 15 - 18, 2024 in Atlanta, Georgia.** Watch your email for details.

Join Us to Prepare for the Echo Board Exam Review Course

A panel of experts will lead sessions designed to help prepare Echo Board candidates for the exam. The Echo Board Exam Review Course is designed for Fellows who will be sitting for the exam for the first time and for those who will be taking the exam to recertify their credentials.

The Echo Board Review Course is scheduled for the following days:

Saturday, June 3 • Sunday, June 4

REGISTER HERE

COR-PM

2nd Annual COR-PM Conference

The Scientific Program Committee is thrilled to announce the second-ever Cardiovascular Outcomes Research in Perioperative Medicine (COR-PM) conference to be held in person and online on Friday, May 5th, 2023, in conjunction with the following SCA 45th Annual Meeting and Workshops in Portland, Oregon.

The COR-PM program was drafted by a group of diverse early- and mid-career anesthesiologists from across the U.S. to:

1) Advance our understanding of high-quality clinical outcomes research within the T2-T4 translational spectrum.

2) Provide mentorship capacity for early- and mid-career participants by providing a small-sized conference that permits "face time" with recognized leaders in the field, including Drs. Dan Sessler, Brittney Williams, Anthony Bonavia, Lisa Rong, Kimberly Howard-Quijano, Jochen Steppan and many more.

3) Create a personal, inclusive, and welcoming conference.

Virtual Registration Available

We were glad to have seen so many of you in-person and virtually in 2022, we are thrilled to welcome you to Portland in 2023!

Click here to view the agenda, registration rates, and hotel information.
Virtual Registration is also available!

COR-PM AGENDA HERE

TAS 2023

THORACIC ANESTHESIA SYMPOSIUM & WORKSHOPS

May 5, 2023 ▪ Portland, Oregon

The Thoracic Anesthesia Symposium (TAS) Planning Committee invites you to join the world of non-cardiac anesthesiologists from around the world for the 2023 TAS meeting on May 5, 2023, in Portland, Oregon. Virtual Registration is also available!

Look forward to:

- A focus on dramas, traumas, along with everyday challenges in thoracic anesthesiology
- Exploration of the latest literature and current controversies by international experts in the field
- Hands-on workshop featuring new and updated workshop stations with live models, custom high-fidelity 3D phantom models, and 3D anatomic visualization!

At the SCA Thoracic Anesthesia Symposium you can:

- Choose 3 in-person workshops and register for an optional live PBLD for a conference experience tailored to YOUR educational needs
- Network with 200 other professionals in anesthesiology to help you gain insight into your practice and career
- Connect with our exhibitors to learn about new products and programs

Virtual Registration Available

Thoracic Anesthesia Symposium Highlights:

In-Person Workshops Offered:

- Critical Procedure Skills Workshop
- Lung Isolation
- Regional Anesthesia
- Thoracic Ultrasound: Diagnosis and Management

Problem Based Learning Discussions (PBLDs) Offered:

- Lung Transplantation in Kartagener's Syndrome – Mirror, Mirror, on the Wall
- Setting Up a Regional Anesthetic Service for Thoracic Surgery
- Massive Hemoptysis in Interventional Pulmonology Suite
- It's Only a Simple Procedure – Segmentectomy in a Patient with Severe Pulmonary Hypertension and Right Ventricular Dysfunction
- Anesthetic Management for a Patient with an Anterior Mediastinal Mass – When do You Need Backup?
- Challenges in Acute Pain Management: The Patient with Cancer
- Undergoing Minimally Invasive Esophageal Surgery

Register for this one-day event to maximize your interaction between attendees. and faculty!

TAS AGENDA HERE

AM

Registration NOW Open!

Register NOW for the 2023 Annual Meeting & Workshops!

SCA's 45th Annual Meeting is right around the corner, and we are excited to see you all in Portland, Oregon from May 6 - 9. Virtual Registration is also available!

Join your fellow members for the latest cardiothoracic anesthesia information through fantastic plenary sessions, controversial panel discussions, pro-con debates, hands-on workshops, mentoring sessions, and problem-based learning sessions.

Look forward to:

- Amazing content delivered by experts in cardiothoracic anesthesiology, interventional cardiology, and cardiothoracic surgery.
- Experts will provide didactics, small group breakout teaching, and high yield discussions
- Problem based learning discussions, scientific abstracts, and workshops are planned to optimize attendee learning and connection on critical cardiothoracic anesthesiology topics
- Attendee networking, idea-sharing, and exhibits

This year, in-person you can:

- Attend live discussion sessions to help you discover up to date practice pathways and innovations in the field.
- Register for Workshops and PBLDs tailored for YOUR educational needs.
- Network with 1,200 other professionals in anesthesiology to help you gain insight into your practice and career.
- Connect with industry and exhibiting companies to learn about new products and programs.

AM AGENDA HERE

Meeting Content

In-Person & On-Line

Handy Reference List!

	In-Person Full Annual Meeting Experience	Virtual Track
CME Credits	*Coming Soon!*	*Coming Soon!*
50+ Sessions, Panels, and Refresher Course Lectures	✔	✔ 64% of the Sessions will be available for the Virtual Track!
Featured Lectures: Keynote, Early Wynands Lecture, and ASA Update	✔	✔
Business Meeting & Awards	✔	✔
Plenary Lectures as Highlight Sessions	✔	✔
Hands-On Workshops	✔	✔
Problem-based Learning Discussions	✔	
Best of Meeting / Early Career & Super Echo Abstracts	✔	
400 eAbstracts	✔	✔
Non-CME Education in the Exhibit Hall	✔	
Reception / Happy Hours	✔	
Industry Sponsored Symposiums	✔	
Resident, Fellow, and Medical Student Poster Sessions	✔	
Fellowship Mentor / Mentee Program	✔	
Access to the Virtual Track Recordings through **August 2023**	✔	✔

Speakers

Earl Wynands Lecturer

Philip Jones MD

False Discoveries – How Research Design and Analysis Influence Anesthesia Knowledge

Keynote Speaker

Clyde W. Yancy MD, MSc, FHFSA

Diversity, Equity, and Inclusion

Fellows & Residents

REGISTER NOW

The **Fellow and Resident Program** at the 2023 Annual Meeting & Workshops enables fellows and residents to attend incredible educational sessions specifically designed for the trainee.

Fellow and Resident Highlights

Problem Based Discussion – Mission Possible
Saturday, May 6, 2023
1:00 – 3:30 PM

Mentor and Mentee Session
Sunday, May 7, 2023
5:30 PM – 6:30 PM

Fellow and Resident Poster Sessions
Saturday, May 6, 2023
10:00 AM – 11:00 AM • 11:00 AM – 12:00 PM • 5:00 PM – 5:30 PM

Fellow Complex Cases
Saturday, May 6, 2023
4:00 PM – 4:30 PM

Fellow and Resident Review – Keys to Success – A Crash Course of Critical Cardiac Anesthesiology Concept
Sunday, May 7, 2023
11:30 AM – 2:30 PM

Click Here to view the meeting agenda.

Featured Events

Join Us in Portland for the Return of the SCA Gala!

A "Living Legends Happy Hour" will be held on Saturday, May 6th at 6:00pm Pacific in the Oregon Convention Center (No ticket purchase is necessary to attend the Happy Hour).

The Gala Event will be held immediately following the Happy Hour – and will run from 7:00-10:00pm Pacific.

The Gala will celebrate the History of the SCA as well as raise funds for the ongoing Research Activities of the Society!

Tickets for the Gala are available as part of the TAS/Annual Meeting Registration process online **Click here** or by calling Karen Potempa at 855-658-2828. Individual tickets are $200 each or $150 for Fellows/Residents. Tables of 10 seats are also available for $1,500.

Join Us for These Events

Best of Meeting & Early Career Investigator

Moderators:
Jonathan Ho, MD, FASE
Jochen (Danny) Muehlschlegel, MD, MMSC, FAHA
Lisa Rong, MD

Celebrating 45 Years of SCA! Past, Present, and (YOU ARE!) the Future

Moderators:
Alan Schwartz, MD, MSEd
Mary Beth Brady, MD, FASE

Super Echo

Moderators:
Stephanie Ibekwe, MD
Kelly Ural, MD

Business Meeting and Awards

American Society of Anesthesiologists (ASA) Update

Thank You Industry Partners

Platinum

Edwards

Bronze

HEMOSONICS
A Stago Group Company

NATIONAL BOARD OF ECHOCARDIOGRAPHY, INC.

Break Sponsor & Gala Night Table Sponsor

NATIONAL BOARD OF ECHOCARDIOGRAPHY, INC.

Exhibitors

Belmont Medical Technologies
Cerus
Envision Physician Services
Fisher & Paykel Healthcare
Haemonetics
Intersocietal Accreditation Comm (IAC)
Merck
National Board of Echocardiography, Inc.
Octapharma
PAJUNK Medical Systems LP
Safersonic
Somnia Anesthesia
Sound Anesthesia
Werfen

SCA

2023 Elections

VOTING IS NOW OPEN!

The 2023 online elections for SCA leadership positions are open through March 13. The candidates are running for the following positions:

President-Elect
Secretary/Treasurer
Director-at-Large
Continuing Medical Education (CME) Committee Member
Nominating Committee Member

Voting members received a personalized link for the online election system via email. If you did not receive this email and you believe this to be an error, please contact Denise Herdrich at dherdrich@veritasamc.org.

The SCA Nominating Committee, chaired by Immediate Past President Dr. Stanton K. Shernan, is pleased to endorse the following candidates for the 2023 election cycle.

President-Elect Candidate

Amanda A. Fox, MD, MPH
University of Texas Southwestern Medical Center

Dr. Fox has been an SCA member since 2003. She is the SCA's Secretary/Treasurer and previously was a Board of Directors' Director-at-Large. She enjoys working with other SCA members to advance clinical care of cardiovascular and thoracic surgical patients. She has participated as an attendee and as faculty at SCA Annual Meetings, Echo Weeks, and ICCVAs. She served on the SCA's Scientific Program Committee for 10 years and chaired the 2017 and 2018 Annual Meeting and Workshops planning committees. Dr. Fox values the international perspectives of the SCA's members and has served on the SCA's International Committee. She is an advocate for interdisciplinary approaches to cardiovascular and thoracic medicine and served as the SCA's liaison to the AHA. Dr. Fox would be honored to be the SCA's President-Elect and to have the opportunity to serve SCA's members by channeling their ideas and talents to best advance our subspecialty-financial decision-making.

Secretary -Treasurer Candidates

Michael P. Eaton, MD, FASA

University of Rochester Medical Center

Dr. Eaton is the Chair of Anesthesiology and Perioperative Medicine at the University of Rochester. He completed medical school at Michigan State University, residency in Vermont and a cardiac fellowship at the University of Michigan. He has been a cardiac anesthesiologist in Rochester for 27 years, currently focusing on pediatric cardiac anesthesia. He has authored over 40 peer-reviewed publications with primary interest in the hematologic effects of cardiopulmonary bypass. Mike has been an active member of the Society of Cardiovascular Anesthesiologists since 1994, serving in many capacities including the SCA Electronic Communications Committee (ECC) (Chair 2007-2011), the Task Force on Educational Activities, and the Executive and Advisory Boards of the Women in Cardiothoracic Anesthesia SIG. He served on the Scientific Program Committee from 2011-2020, chairing the committee for the 2019 and 2020 meetings. Dr. Eaton was a member of the SCA Board of Directors from 2011-14, 2016-2020 and 2021-2022.

Sasha K. Shillcutt, MD, MS, FASE

University of Nebraska Medical Center

Sasha K. Shillcutt, MD, MS, FASE is a tenured and endowed Professor and Vice Chair in the Department of Anesthesiology at the University of Nebraska Medical Center. Sasha is the founder of Brave Enough, a well-published researcher in cardiac anesthesiology and gender equity. Dr. Shillcutt underwent her residency in Anesthesiology at UNMC and completed an Executive Fellowship in Perioperative Echocardiography at the University of Utah. She is a board testamur in the Special Competence in Adult Echocardiography (ASCeXAM) and certified in advanced perioperative echocardiography (Advanced PTEeXAM). She has been an NIH-funded researcher, is a Board Examiner for the American Board of Anesthesiology and has served on the Board of Directors of the Society of Cardiovascular Anesthesiologists and as Program Chair of the Scientific Program Committee. She serves on the Advanced Writing Committee of the National Board of Echocardiography and been published in the New England Journal of Medicine and JAMA.

Douglas Shook, MD, FASE

Brigham and Women's Hospital

Dr. Shook previously served a two-3-year term on the SCA Board of Directors, was the Co-Director for Echo Week, and is currently the Chair of the Fellowship Program Director's Council. In addition, he co-developed the Kaplan Leadership Development Award to create future leaders in our profession. These roles incorporate his commitment to educating the SCA membership, developing future cardiovascular and thoracic anesthesiologists, and developing future professional leaders. It is essential to Dr. Shook that society anticipates the needs of the SCA membership, is part of the changing professional landscape SCA members are experiencing, and ensures financial well-being and investing in SCA's future is critical to his mission. As Secretary/Treasurer, Dr. Shook will strive to combine education, research, and leadership as a mission for our society, collaborate with other specialties, and represent the needs of the SCA membership.

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Director-at-Large Candidates

Andra E. Ibrahim Duncan, MD, MS

Cleveland Clinic

After 21 years as a cardiothoracic anesthesiologist at the Cleveland Clinic, I have gained a strong appreciation for issues affecting our specialty. I have served on SCA Program and Research committees and ASA, ASE, and AATS cardiac anesthesia committees. I participated as faculty at SCA and ASA meetings. I understand the value of clinical work and the importance of teaching and research. Our field faces many challenges, including growing demand for our services, rising healthcare costs, and physician and nursing shortages. Despite these challenges, I know the strengths of the SCA and our ability to work together to advance our specialty. My servant leader nature allows me to solicit ideas to address important issues and improve SCA member engagement. The privilege of giving back to our society and our field prompts me to seek this role. Thank you for your consideration.

Jiapeng Huang, MD, PhD, FASA, FASE

University of Louisville

Dr. Huang has been an attending cardiovascular anesthesiologist and an SCA member for 15 years. He's an active member of the SCA Research Grant Review Committee, Guidelines and Standards Sub-Committee, Social Media Sub-Committee, and Scientific Program Committee. He has engaged many SCA members to promote our missions. Dr. Huang has accumulated significant governance and finance experiences at multiple national and international societies, including the American Society of Anesthesiologists Board of Directors, Treasurer at the Society for the Advancement of Transplant Anesthesia, and Secretary/Treasurer at the Kentucky Medical Association. He believes the essential purpose of SCA is to serve its members. He will do everything he can to facilitate member engagement and member leadership to guide future SCA directions. Dr. Huang will work diligently for you and with you to improve cardiac anesthesia's safety, elevate cardiac anesthesiology's specialty and advance cardiovascular medicine's science.

David McIlroy, MBBS, MClinEpi, MD, FANZCA

Vanderbilt University

Dr. McIlroy completed his medical education and anesthesia training in Melbourne, Australia (2001) before joining faculty at The Alfred Hospital in Melbourne. He is board certified in perioperative TEE and has an extensive background in clinical research, including the ANZCA Clinical Trials Network. From 2008-12 Dr. McIlroy served as Assistant Professor of Anesthesiology in the cardiac division at Columbia University, New York, before returning to Australia to continue his career in cardiac anesthesia and further develop his clinical trials expertise. In 2019, he was recruited to Vanderbilt University Medical Center in Nashville, TN, where he currently serves as Associate Professor of Anesthesiology and Medical Director of Vanderbilt's Perioperative Clinical Research Institute. He has been a member of the SCA since completing fellowship in 2001, serving as a member of the SCA's Research Committee since 2017 and a member of the AKI Working Group from 2018-22.

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Director-at-Large Candidates

Ludmil (Lou) Mitrev, MD, FASA

Cooper Medical School of Rowan University

Dr. Mitrev practices cardiac anesthesiology and is Associate Professor of Anesthesiology at Cooper University HealthCare (CUH) and Cooper Medical School of Rowan University in Camden, NJ. After graduating medicine from the University of Oslo in Norway, he completed his residency in anesthesiology at St. Luke's Roosevelt Hospital in New York. He then completed a cardiac anesthesia fellowship at Columbia-Presbyterian Medical Center. He serves as the Division Chief of Research at the Department of Anesthesiology at CUH offering strategic planning, oversight and management of the division, and is one of 4 interim medical directors of the Cooper Research Institute. Dr. Mitrev also serves on the Board of Directors of the Society of Cardiovascular Anesthesiologists and is an oral board examiner for the American Board of Anesthesiology. Dr. Mitrev is a diplomate of the Physician Leadership Program at CUH offered in collaboration with the American Association for Physician Leadership.

Jochen (Danny) Muehlschlegel, MD, MMSc, MBA, FAHA, FASA

Brigham and Women's Hospital, Harvard Medical School

Dr. Muehlschlegel attended his first SCA meeting as an intern in 2003 and is still highly passionate about the SCA. It has afforded him tremendous growth, both professionally as well as personally. The Board of Directors' position will enable him to give back and help others by continuing to steer the SCA in a direction that serves all its members, regardless of gender, race, professional designation, country, or seniority. Dr. Muehlschlegel's strengths include his service and leadership experience in the SCA, research, finance, and governance expertise, a long tradition of multidisciplinary collaboration, and a strong sense of the importance of diversity and integrity in leadership. His roles within the SCA have included: Current Chair of the Research Committee, Chair of the Atrial Fibrillation Working Group, member Scientific Program Committee, member of the SCA/STS Database Sub-Committee, and member of the Women in Cardiothoracic Anesthesia (WICTA) Advisory Board.

Jochen Steppan, MD, DESA, FAHA, FASA

Johns Hopkins University School of Medicine

Dr. Steppan is an Associate Professor at Johns Hopkins University, performing both adult and pediatric cardiac anesthesia. He serves as the Director for Perioperative Medicine, High Risk Cardiovascular Disease. After completing medical school at the University of Heidelberg in Germany he did residency and fellowships at the Johns Hopkins University. Dr Steppan has served the SCA for almost 15 years. He is a founding member of the 'Cardiovascular Outcomes Research in Perioperative Medicine (COR-PM) Conference' at the SCA meeting to advance clinical outcomes research in cardiovascular medicine, by focusing on mentorship for junior faculty, and using an inclusive and diverse approach. He served on the Research Committee, the International Committee, and has created multiple sessions for the annual meeting. Dr Steppan has published over 80 peer reviewed publications and delivered over 60 national and international talks. Funded by the NIH, he is studying the molecular mechanisms underlying pulmonary hypertension.

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Continuing Medical Education (CME) Committee Member Candidates

Vaibhav Bora, MD, FASA, FASE, FCCM, FCCP

Medical College of Georgia

Dr. Bora is a Board-certified Academic Physician. His area of practice is Cardiac Anesthesia and Cardiothoracic Critical Care. In his current role as Director of Critical Care Medicine, he is involved with the perioperative care of Cardiothoracic patients in the operating room and the ICU. In addition, he finds it very gratifying to teach and learn simultaneously. Dr. Bora is a Fellow of the American Society of Anesthesiologists and the American Society of Echocardiography and is passionate about Echocardiography education and training.

Pablo Motta, MD

Baylor College of Medicine, Texas Children's Hospital

Dr. Pablo Motta has practiced medicine for more than 29 years. After earning his MD from the UDELAR School of Medicine of Montevideo, Uruguay, he specialized in adult and pediatric cardiac anesthesia, holding positions at the Cleveland Clinic and the Baylor College of Medicine. Now an Associate Professor with Baylor, practicing at Texas Children's Hospital in Houston, Dr. Motta leads in the areas of anesthesia for heart and lung transplantation and adult congenital heart disease, as well resident & fellow education, and research. He has served on the CCAS communications committee and SCA on the international committee. Dr. Motta is the Associate Medical Director of the Heart Center International Program, directing medical mission trips and advising several congenital anesthesia groups worldwide.

Prakash A. Patel, MD, FASE

Yale University

Dr. Prakash A. Patel is a cardiac anesthesiologist and Associate Professor at Yale University in New Haven, CT. He also serves as Program Director for the Yale Cardiac Anesthesiology Fellowship. Dr. Patel completed his medical training at Jefferson Medical College and his anesthesiology residency and cardiac anesthesia fellowship at the University of Pennsylvania. Dr. Patel has strong interests in blood conservation, having led several initiatives to create an algorithmic approach to blood management and transfusion. Further interests include management of post-cardiopulmonary bypass coagulopathy with the appropriate use of factor concentrates in addition to routine clotting factors. Dr. Patel has been an active member within the SCA for several years, with involvement in multiple committees, invited lectures, research and complex case submissions, PBLD's, and writing groups. He looks forward to contributing more to the Society and helping the SCA continue the mission of advancing our profession.

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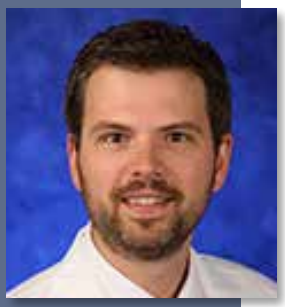
Continuing Medical Education (CME) Committee Member Candidates

Sarah C. Smith, MD, MS

Westchester Medical Center, New York Medical College

Dr. Smith is a cardiothoracic anesthesiologist at Westchester Medical Center and Associate Professor at New York Medical College in Valhalla, NY. Before this position, she had been an Assistant Professor in the Department of Anesthesiology at Columbia University, where she had previously completed her MD, residency, and fellowship training. Dr. Smith has a strong interest in bioethics and completed a master's degree in this subject at the Columbia University School of Professional Studies in 2020; an experience she has applied to the SCA as a member of the Ethics Committee. Dr. Smith has committed her career to education, serving as the Program Evaluation Committee Chair and Cardiac Rotation Director for the WMC Anesthesiology residency program. She serves as the Assistant Program Director for WMC's ACTA fellowship. At the national level, Dr. Smith is Co-Vice Chair for the Continuing Medical Education and Remediation Committee of the New York State Society of Anesthesiologists.

Nominating Committee Candidates



Theodore J. Cios, MD, MPH, FASA, FASE

Penn State College of Medicine

Dr. Cios is an adult cardiothoracic anesthesiologist at Penn State Health Hershey Medical Center. He obtained his medical degree from the Ohio State University after which he completed residency and fellowship training at Penn State. As an Associate Professor, he serves as the Program Director of the Adult Cardiothoracic Fellowship and is heavily involved with teaching and has several peer-reviewed publications on topics pertaining to cardiothoracic anesthesia and echocardiography. Dr. Cios has sat on several committees at Penn State including the University Faculty Senate and Chaired an Institutional Review Board. He has been on SCA committees since 2017 as a member of the Clinical Practice Improvement Project Sub-Committee and will continue to serve on the Guidelines and Standards Sub-Committee into 2023. He has given several national and international lectures and serves as a manuscript reviewer for several journals.

Peter J. Neuburger, MD

NYU Grossman School of Medicine

Dr. Peter Neuburger is an Associate Professor of Anesthesiology at the NYU Grossman School of Medicine and the Chair of the SCA Bylaws Committee. He is a mentor in WICTA's Professional Development Mentoring Program as the Director of Communications for RACER SIG. Dr. Neuburger has previously served the SCA in numerous other roles, including speaker, PBLD moderator, and Task Force member. He is a Fellow of the American Society of Echocardiography and a member of the JCVA Editorial Board. He has been invited to speak at other prominent national society meetings, including the ASA, IARS, and AHA. Dr. Neuburger would be honored to continue his work for the SCA as a member of the Nominating Committee, bringing his knowledge of the Bylaws and Society governance to this position. His record of involvement speaks to his commitment to Society and respectfully expresses his ongoing desire to serve.

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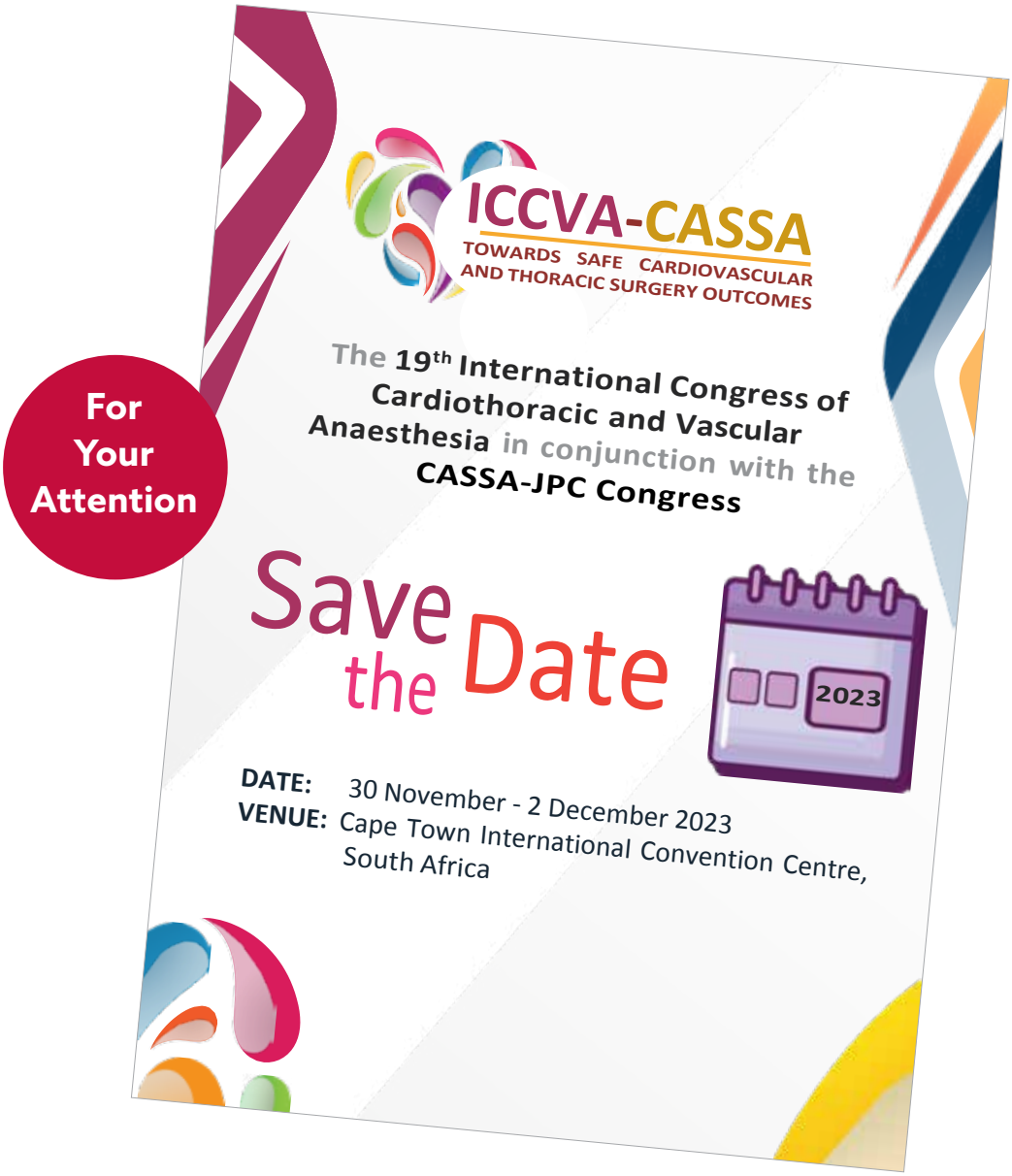
Nominating Committee Candidates

Mathew Varghese Patteril, MD, FRCA, AFFICM, DipClinEdu (RCS)
University Hospitals of Coventry and Warwickshire

Dr. Mathew Patteril is a Consultant Anesthesiologist at the University Hospitals of Coventry and Warwickshire, UK. He qualified from the University of Kerala, India, in 1989. He trained in Anesthesia & ICM in the UK. He completed his Cardio-thoracic and Critical care fellowship at Duke University Medical Center. His clinical interests are mainly cardiothoracic anesthesia. He was the lead for the Regional Anesthesia Research Network and a member of the National CRN Anesthesia Specialty Board (2014-2016). He is currently the national examiner for the British Society of Echocardiography (TEE section). He is an International Committee member of the SCA editorial board of the Journal of Anesthesia. He has held the posts of the CD (chairman) of the department and Deputy lead for revalidation and appraisal. He was a council member of the Association of Anesthetists (2017-21) and chaired the Independent Practice Committee and Core Topics. His hobbies are basketball and culinary pursuits.

MEETING



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RACER SIG:
An Update on Novel Regional Anesthesia Techniques for Cardiac Surgery via Median Sternotomy

Eric R. Simon, MD and Patrick S. Meyer, MD
University of Wisconsin School of Medicine and Public Health

Acute pain after cardiac surgery via median sternotomy is a direct result of surgical manipulation and tissue trauma and may be related to many causes including surgical incision, pericardiotomy, retraction, artery dissection, or chest tubes. A subset of patients experiences severe, debilitating postoperative pain which may increase length of stay, morbidity, mortality, and healthcare costs.[1] In addition, as Cintron and Lin described in the last SCA RACER SIG newsletter,[2] persistent postoperative pain continues to be a challenging problem, as up to 43% of patients experience persistent pain three months after cardiac surgery, and even 10% of patients continue to experience sternotomy-related pain seven years after surgery. Since the greatest predictor of chronic post-surgical pain is poorly controlled acute postoperative pain,3 cardiac anesthesiologists are in an excellent position to make significant improvements in this regard.

Historically, anesthetic techniques for cardiac surgery via median sternotomy relied heavily on high-dose intravenous opioids with delayed extubation. Over the past decade, with the emergence of enhanced recovery after cardiac surgery (ERACS) programs, cardiac anesthesiologists have been exploring unique options for the management of postoperative pain in lieu of high-dose opioids. Neuraxial anesthetic techniques have been used and studied extensively in this context, and while they appear safe and may even improve outcomes,[4-6] persistent concern over the rare, yet devastating risk of spinal or epidural hematoma during full heparinization has limited their use in cardiac surgery. In addition, paravertebral blocks have shown comparable analgesic effects after cardiac surgery compared to thoracic epidural blockade,[7] however similar concerns over epidural hematoma exist.

Alternatively, due to their relative simplicity and perceived low risk of complications, several chest wall fascial plane blocks are gaining popularity for use in cardiac surgery. Thoracic intercostal nerves (T2-T6) are primarily responsible for the sensory innervation of the chest wall. Each spinal nerve exits an intervertebral foramen and divides into a dorsal and ventral ramus. The ventral ramus traverses initially between the pleura and endothoracic fascia and then between the internal and innermost intercostal muscles. As it courses anteriorly towards the sternum, it pierces the internal intercostal muscle, external intercostal muscle, and pectoralis major muscle terminating as anterior intercostal cutaneous nerves providing sensory innervation to the anterior chest wall.

For patients undergoing median sternotomy, targeting the anterior intercostal cutaneous nerves appears logical anatomically. Infiltration of local anesthetic close to the intercostal nerves at the sternal border performed by surgeons right before sternal wire placement, a so-called "parasternal block," was described as early as 2005.[8] However, these nerves can be targeted more directly in one of two different fascial planes: either a deeper plane between the internal intercostal and transverse thoracic muscles [deep parasternal block, previously known as transverse thoracic plane block (TTPB)] or a more superficial plane between the internal intercostal and pectoralis major muscles [superficial parasternal block, previously known as pectointercostal

fascial block (PIFB)]. The utilization of ultrasound by anesthesiologists has allowed the generic "parasternal block" to be more appropriately named depending on which fascial plane is targeted. Of note, a recent international consensus paper has recommended simplification and standardization of fascial plane block nomenclature and readers are encouraged to cross-reference this if not already familiar with it.[9]

The deep parasternal block was first described in 2015 by Ueshima et al. in patients undergoing breast cancer surgery,[10] and the technique was later successfully utilized in two patients undergoing cardiac surgery via median sternotomy.[11] A recent prospective, randomized controlled trial in 48 adult cardiac surgery patients comparing preoperative ultrasound-guided deep parasternal blocks (called TTPB in the study) with bupivacaine vs saline demonstrated significantly reduced postoperative opioid consumption, pain scores up to 12 hours after surgery, and opioid-related side effects in the bupivacaine group.[12] There was no block related complications in either group.

Although this technique has been shown to be safe from complications such as pneumothorax, hematoma, and infection,[13] the internal mammary artery runs within the same plane approximately 1.5cm lateral to the sternal border. If the block is performed before cardiac surgery, both the right and left internal mammary arteries could be damaged rendering them unusable for bypass grafting. If the block is performed after cardiac surgery involving harvesting of the internal mammary artery, surgical disruption of tissues could lead to difficulty identifying the correct fascial plane and potentially affect the spread of the local anesthetic.

Additionally, the transversus thoracic muscle is often very thin, difficult to visualize under ultrasound, and located close to the pleura leading to a theoretically higher risk of pneumothorax. The superficial parasternal block is a more superficial block, located further from the pleura, and separated from the internal mammary artery by the internal intercostal muscle, and so it is the authors' opinion that this is a safer regional anesthesia technique for patients undergoing cardiac surgery via median sternotomy.

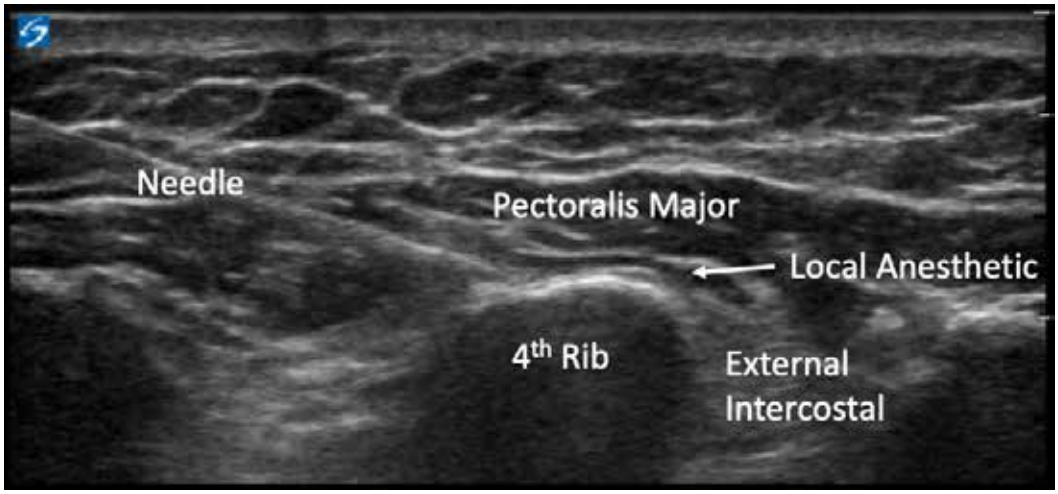

Figure 1. Superficial parasternal block by ultrasound at level of 4th rib.

Figure 1 illustrates the sonographic landmarks and needle approach to perform a superficial parasternal block.

Although the studies are small, recent published literature has supported the use of superficial parasternal blocks for cardiac surgery. Two single-center, prospective, randomized controlled trials utilizing postoperative bilateral ultrasound-guided

superficial parasternal blocks have demonstrated decreased pain scores and opioid consumption after cardiac surgery.14,15 In another randomized trial, Zhang et al performed bilateral blocks preoperatively and not only demonstrated similar decreases in postoperative pain scores and opioid consumption, but also decreased time to extubation, intensive care unit (ICU) length of stay, and hospital length of stay.[16] Interestingly, they were also able to show reduced postoperative insulin resistance and inflammatory response in the group that received this technique. In a follow-up study, the same group showed that continuous bilateral superficial parasternal blocks initiated before surgery reduced ICU and hospital length of stay and provided effective postoperative pain relief for up to three days.[17] Another prospective, randomized, controlled trial recently demonstrated preoperative blocks reduced the maximum concentrations of remifentanil and propofol required to maintain hemodynamic stability and depth of anesthesia during sternotomy while also reducing the postoperative inflammatory response.[18] There was no intervention related adverse events such as pneumothorax, hematoma, or infection in any of these studies.

While both deep and superficial parasternal blocks appear effective and safe, there has only been one study that has compared the two regional anesthetic techniques directly. A small prospective, randomized trial comparing bilateral superficial blocks directly with bilateral deep blocks showed similar postoperative pain scores and opioid requirements between the two groups, with no block related complications in either group.[19] However, larger studies are needed to definitively conclude similar efficacy between the two blocks.

It is clear that regional anesthesia utilizing fascial plane blocks has a role in cardiac surgery, however the optimal technique, timing of the block, and local anesthetic utilized still need clarification. Parasternal techniques appear to provide effective analgesia for median sternotomy with a great safety profile, however, will not provide effective coverage for painful chest tube insertion sites. Future studies could investigate combinations of chest wall blocks to adequately cover both sternotomy and chest tube pain. While preoperative blocks may provide additional intraoperative benefits, the postoperative benefits would be limited by the relatively short duration of action of standard local anesthetics. Given the benefits described with continuous block techniques, additional research should clarify the optimal timing for catheter placement and investigate the role of preoperative liposomal bupivacaine in regional anesthesia for cardiac surgery.

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COMMENTARY

By ASRA RACER Member
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Enhanced recovery after surgery (ERAS) for patient undergoing cardiac operation has required us to change thinking, practices, and protocols that we have clung to for decades. ERAS Expert Recommendations for Cardiac Surgery include a multimodal, opioid-sparing, postoperative pain management plan (class I recommendation, level of evidence B – randomized).[1] While high dose opioids have classically been the mainstay for the perioperative cardiac surgery patient, they are associated with sedation, respiratory depression, nausea, vomiting, ileus,[2] and may exacerbate or increase rates of delirium.[3] These undesirable side effects contradict the goals of postoperative analgesia including improvement in quality of life and acceleration of functional recovery. Inadequately treated acute pain may contribute to chronic pain in one out of five patients, and the reported incidence of chronic postoperative pain is even higher (30-50%) following coronary artery bypass surgery.[3] Thus, multimodal analgesia – the concurrent use of primarily non-opioid analgesics – is an essential component of for ERAS after cardiac surgery. This has stimulated an interest in the routine use of regional anesthesia as to improve postoperative analgesia.

The simplistic nature and low risk of both superficial parasternal intercostal facial blocks (formerly called pecto-intercostal facial plane blocks) and deep parasternal intercostal facial plane blocks (formerly call transversus thoracic facial plane blocks)[4] have made them an attractive option for ERAS after cardiac surgery. Although less evidence was published several years ago, several randomized controlled trials recently demonstrated decreased intraoperative opioid use[5] or improved postoperative outcomes[6-8] for patients receiving parasternal intercostal facial plane blocks. As outcomes differences have not been noted between the superficial and deep approaches,[9] the superficial approach may be preferable to avoid injury to the mamillary vessels. Unfortunately, as Simon and Meyer astutely remind us in their summary, parasternal blocks will not cover the chest tube site, the saphenous vessel harvest area, or the patient's chronic arthritis. Additionally, the majority of publications have focused on single injection blocks with limited durations rather than catheter-based techniques, and liposomal bupivacaine has not demonstrated superior analgesia when compared to ropivacaine or bupivacaine[10] consistent with other publications.[11, 12] Thus, future investigations are still needed.

Although parasternal blocks offer a relatively low risk and possibly high reward component for cardiac ERAS, it is also important that we remember that regional anesthesia is just one aspect of multimodal analgesia. As one with a love and strong belief in the benefits of regional anesthesia, it would be glorious to demonstrate that a simple nerve block solved everything. However, it is important to recognize that regional anesthesia is only one component of multimodal analgesia. Similarly, multimodal analgesia is only one component of ERAS. ERAS requires incorporating smoking cessation, improved nutrition, pre- and postoperative physical therapy, respiratory therapy, and sleep hygiene, to name a few. Thus, it requires engagement and education of the numerous providers, patients, and their families to redesign perioperative care and expectations.

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MEMBER CORNER

AWEsome Woman Interview

Joyce A. Wahr, MD, FAHA

University of Michigan; University of Minnesota

Dr. Joyce A. Wahr is a Professor of Anesthesiology at the University of Minnesota. She completed medical school at the University of Colorado, followed by two years of surgery internship at the University of Michigan. She completed anesthesiology residency at University of California at San Francisco. After two years in private practice in California, she returned to Michigan and joined the faculty at the University of Michigan in 1984.

Dr. Wahr was one of the first at the University of Michigan to specialize in cardiac anesthesiology, and, with her like-minded colleagues, to develop a specialized cardiac anesthesia team. She served as the first Director of Cardiac Anesthesiology, moving on to direct a busy Cardiac Research team from 1990-2003. During those years, the University of Michigan Division of Cardiothoracic Anesthesiology was a founding member of the Multi-Center Study of Myocardial Ischemia (McSPI), a consortium of 25 academic cardiac anesthesiology teams that enrolled over 7,000 cardiac surgery patients in a detailed outcome database.

Her primary focus is improving outcomes of surgical patients. Since 2007, she has served as the Chair of the Society of Cardiovascular Anesthesiologists Foundation, an organization responsible for the FOCUS Patient Safety initiative, bringing together operative nursing, perfusionists, surgeons, and anesthesiologists to tackle the issues of human error in the cardiac OR. She is the Vice-Chair for Quality and Safety in the Department of Anesthesiology and is spearheading development of the Perioperative Surgical Home at UMN.

1. What led you to become a Cardiovascular/Thoracic Anesthesiologist?

When I arrived at Univ of Michigan, there were no cardiac fellowships locally. Mike Roizen tried to talk me into a vascular anesthesia fellowship, but I just wanted to start my non-training life! At U of M, cardiac surgery was just ramping up: one surgeon (Marvin Kirsch) and no anesthesiologists who specialized in cardiac surgery. But there were about 5 of us who loved it, begged for more cardiac cases, and told Dr. Kirsch that he could just call at night if he needed one of us to come in. So over time, we sorta built a cardiac speciality. I loved everything cardiac – on pump, coming off was an adventure every day! And I had been at UCSF when TEE was brought to us (form Germany, a fellow had glued a transducer to a gastric probe, we put it down gyn surgery patients – I was HOOKED). At Michigan, I got them to buy a TEE machine – I used it frequently, but no one else did – they just called cardiology to bring their machine up. So I took it to the dog lab! Then 5 years later, they had me resurrect it from the dog lab – meticulous cleaning, of course! I had the probe "box" to hang them built by a fabricator in town... And I would go to the echo lab reading room when I was post call or had an academic day.

The cardiac surgery program grew by leaps and bounds – I then started a rotation for residents in the cardiac ICU, and started a pseudo fellowship (1987 or so) – Rosalie Bradley was our first, and Mike Eaton maybe #2 or 3. He then became Director of CA (and fellowship director), and built a good program, while I built the cardiac research program (Dennis Mangano, acadesine trial, McSPI and then I SPI).

When I became Dean of Admissions at U of M, I stopped taking cardiac call, so moved into thoracic anesthesia – again, just loved everything about it. Harder than cardiac, as no thoracic patient was healthy, but at that time a lot of cardiac surgery patients were healthy (CABG).

2. How did you hear about the SCA?
Judy Fabien and I met at a meeting in Chicago to promote use of sufentanyl in CA. She and I hit it off, and she brought me to the SCA that same year. I had always felt disassociated from ASA meetings – too big, didn't know anyone – the SCA was this incredible, enthusiastic, energetic, fun group who loved what I did – everything cardiac and thoracic.

3. What roles have you held for the society?
Mike Roizen invited me onto the Research Committee which I did for years. Then just a little bit on Publications, worked for 1 year on the monograph. On the board for 2 terms.

And then there was the Foundation – in 2007, the SCA wanted to raise more money for research, etc, and started a foundation, which they asked me to run. Our advisor told us to get a "BIG" project to generate excitement and thus donations. That was FOCUS, a project to increase patient safety in CVORs. Peter Pronovost won the RFP, and that was the start of my interest in patient safety. FOCUS involved surgeons, CVOR nurses, anesthesiologists, and perfusionists. Although the envisioned continued multi-disciplinary collaboration did not ever get good traction, the friendships and connections built across disciplines was, I think, really impactful. Every year the SCA annual meeting had a 1-2 hour panel session on FOCUS that brought speakers from each discipline. When we realized that FOCUS was not going to generate big donations from the members, a joint decision was make to fold the foundation back into the SCA, and to call it an endowment, and continue to grow donations, but to not take on such a major project again. But the SCA Quality and Safety Committee was born out of FOCUS, adding patient safety to education and research as major efforts of the SCA.

4. What is one of your greatest achievements as a Cardiovascular/Thoracic Anesthesiologist?
Out of the FOCUS project (which itself I consider to be a major achievement), my greatest is probably being lead author (with Nancy Nussmeier as senior author) of the American Heart Association Scientific Statement on Patient Safety in the Cardiac Operating Room. Paul Barash included this manuscript (with surgeons, anesthesiologists, CV nurses, and perfusionists all as co-authors) in his talk on "the top 10 papers of the past decade." This recognition was due to the 1) collaboration of all teams members in the cardiac OR, and 2) was the first major statement about patient safety. I do think it was an awesome paper – 400 some references – with great authors (Jake Abernathy, Bruce Spiess, Tricia Seifert, David Fitzgerald and Nancy as senior author).

But the second one (if I get another) is the first meeting of the SCA after the Foundation was initiated, I met with Joel Kaplan to ask for a donation. I was shaking in my boots – didn't know him at all – the room was a massive meeting room with 2 chairs and a potted palm in it – and I had no experience asking for money. But I was lucky that he is so terrific – when I asked him what he thought the Foundation should be focusing on, ie, what was the SCA not doing that they should be doing, Joel said that we had great leaders in anesthesiology, who held not just department c hair positions, but dean slots, and running hospitals, etc. But the SCA was funding only 1 path to leadership and that was through research. He said that some great leaders just weren't researchers at heart, and there should be a path for them to get leadership training. The Kaplan Grant program was born! He donated $75,000 to it, and Elise Delfin gave $50,000. That grant program has been a huge success and needs to be expanded – this is something that the endowment committee will (I hope) be focusing on!

5. Do you have any advice for fellows and residents?
This is a difficult life we have chosen – night call, incredibly sick patients, coming off bypass after 2 hours of deep hypothermic circulatory arrest (with the attendant awful coagulopathy), difficult surgeons, and patients who will never remember our names. BUT – we have also chosen one of the most rewarding. Victor Frankl, a Viennese psychiatrist who was sent to Auschwitz (and multiple other concentration camps) wrote an amazing book *"Man's Search for Meaning"* where is describes that the ones who survived (and

thrived after) concentration camps were those who a "will to meaning" – they everyday sought to focus on what they believed their purpose in life was. A great quote: ***"What man actually needs is not a tensionless state but rather the striving and struggling for some goal worthy of him. What he needs is not the discharge of tension at any cost, but the call of a potential meaning waiting to be fulfilled by him."***

All of us chose medicine to fulfill the purpose of "caring for others" – making patients' lives better. If you can get up every day and remind yourself of what your true purpose in life is (focus on the patient, be still in their presence, hear their pain, their joy, their fear) you will avoid burnout. We tend to focus on Epic and the clicks we have to do – that has ALWAYS been there! We filled an 8X11 sheet, handwriting airway information, monitors [laced, medications given, and charting every 5 minutes HR, BP, temp, resp, PIP, on and on. WAY. More effortful than clicks. But we have allowed the clicks to become our purpose in life – it is not – your purpose in life is to reassure patients at the most frightening moment of their life – to assure them in word and in action that you will bring them safely through this surgery. If you every day take that moment to remind yourself of what your purpose is here today, you will be immune to burnout.

6. Have you experienced any difficulties as a woman in the field?
Oh, of course – I have been called awful names ("that jackass", Dr. Whore) and have never gotten true training in either leadership or in research, although I have worked incredibly hard to do both. BUT I have had far more positives than negatives:

- Having John Severinghouse as my first month "minder" when I arrived at UCSF – although a mental powerhouse, he was unfailing encouraging and compassionate, and NEVER saw gender as an issue.
- Meeting Judy Fabian, and then Nancy Nussmeier, Christina Mora-Mangano, and Nannette Schwann who became great friends and a support group. We never had a gripe session, just always talked about what we were doing and supported each other.
- In 1990, I had the most fortunate of all – Kevin Tremper arrived at Chair of the Department of Anesthesiology at Michigan. It was a rag tag group with no All Team players – and he built the most amazing department, now ranked in the top 10 for sure. He gave me every opportunity, offered me positions that I had no clue how to do, and then taught me how to do it without ever becoming a micro-manager. I count him as one of the greatest influences on my career (and life).

7. Do you have any advice for other women in the field?
Resist at all costs the easy way out – when you fail to achieve a goal, do not blame it on sexism, etc. Look it square in the face and ask "what is it that would have gotten me to the goal? More time spent in the lab? Less time scrolling through Panda lists? More time putting together education plans, etc.?

Should/could I have reached out to a more effective mentor? Yes, you like me may have lacked an effective mentor, you may not have been offered leadership training – but sitting and putting the onus on outsiders will not get you what you want and need. Seize opportunities offered by potential mentors, even if it is not what you are passionate about – when KKT arrived at Michigan, I was into myocardial oxygen supply and demand, but I did not have a mentor. He offered opportunities in oxygen monitoring, I took it, and it really made my career. Use what you are given!

But most of all, understand that getting to the speaker's podium, or achieving a leadership position means that you WILL be working harder than your colleagues. I spent every day after calling in the lab, and I never took an academic day and stayed at home. I learned to "work in the interstices", to use minutes when the ORs were quiet, or that hour after I had been relieved to go to the office and do work that had to be done. Some do this after the kids go to bed or get up early – but do not ever think that exceptional success can be achieved with average effort. Yes, it is extra work, you will not be given the time you need –

you will need to carve it out wherever you can – but the results are absolutely worth it!

8. How do you balance work and personal life?
I don't. I far prefer Jeff Bezos' view, which is not balance but harmony. If you think that every day you must balance work and personal life you will fail – when you are on call, your personal life is shot. But if you think about the different parts of your life as an orchestra, developing beautiful harmonies, then it all makes sense. Somedays the violins will take the lead (midnight call to the OR to care for a dissecting thoracic aneurysm), other days it will be the cellos (research paper due), or the oboes (kids in a school play). Balance is impossible, you will fall of the beam continually – but glorious harmony is possible. Let the violins take the lead and predominate – there will be a time that the cellos sing and times that the oboes lament – it is the harmony of your life.

9. What is something you enjoy doing outside of work?
I am the costumer for a grandchild who imagines the most amazing costumes! She has been a pink demon (black leather jacket with pearlescent skirt and 5-inch black nails on a hand holding a skull; an axolotl lizard, you get it). I also am chief cake creator for the same little zany mind (garden of eyeballs birthday cake takes the cake IMHO). I am a hiker and backpacker and work every day to stay in shape to do these walks!

10. Would you change anything about the path you took to get to where you are now?
My path was incredibly convoluted and painful. When we moved to Ann Arbor, I only wanted to be in private practice – I was rejected, even with residency at UCSF and references from Hamilton, Severinghouse, and Roizen (!). So, I took the course I didn't want – and had the best career that I could have imagined. So maybe this is another bit of advice – be open to other paths than the one you imagined. It might turn out to be far more enjoyable than the one you had envisioned!

And I think that imagining "lives not led" is fraught with danger – who says that "only if" you could have gotten that grant or had that mentor that it would have been better. Great book "On not being someone else – tales of our unled lives" – we have had this one, singular life – do not second guess it!

11. What was the best piece of advice you received?
This will be completely bizarre – but in medical school (grad 1978) I smoked – we all did. And when I decided to quit as a resident, it was really hard. One nurse (herself a former smoker) told me to "never quit quitting". By this she meant, the task you have chosen is really hard. You will fail – but when you do, remind yourself of what you have set out to do, and begin again. This has served me well in quitting smoking and in most of my other endeavors.

Regional Anesthesia for Lobectomy and Risk of Pulmonary Complications: A National Safety and Quality Improvement Program Propensity-Matching Analysis

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Background

The Society of Thoracic Surgeons (STS) tracks postoperative pulmonary complications following thoracic surgery by specifically looking at rates of reintubation, need for tracheostomy, initial ventilator support lasting more than 48 hours, acute respiratory distress syndrome (ARDS), pneumonia, pulmonary embolus, and bronchopleural fistula. Studies have cited these complications as occurring in nearly 20% of thoracic surgeries.[1] Regional anesthesia has been used as a mainstay of anesthesia and analgesia in thoracic surgery for decades and is thought to reduce the risk of PPCs and even overall mortality.[2,3] Advances in thoracic surgical techniques have allowed for less invasive procedures such as video-assisted thoracoscopic surgery (VATS) and robotic-assisted surgery which, compared to traditional open approaches, result in less surgical insult and less postoperative pain.[4] In this study, the authors' aim was to assess if regional anesthesia continued to decrease PPCs in the modern era of minimally invasive surgery and enhanced recovery after surgery (ERAS) protocols.

Methods

The authors used data from the American College of Surgeons National Safety Quality Improvement Program database from 2014 to 2017. They gathered data from patients undergoing lobectomy by either VATS or open approach and categorized patients by their anesthetic type (general or general + regional). They did not differentiate between regional types such as epidural versus peripheral nerve block. Patients were identified and propensity matched 1:1 based on several variables known to be associated with PPCs. Primary outcomes were defined as reintubation postoperatively, failure to wean from the ventilator, and postoperative pneumonia. Secondary outcomes include 30-day mortality, reoperation, hospital readmission, hospital length of stay, postoperative acute kidney injury or dialysis, venous thromboembolism, stroke, and cardiac arrest.

Results

Post-propensity matching, there were 2067 patients in the general anesthesia alone (GA) and 2067 patients in the general anesthesia + regional anesthesia group (RA + GA) who had VATS lobectomy. The groups were similar regarding age, demographics, and comorbidities. Post-propensity matching, there were 1556 patients in both GA and RA + GA groups for patients who underwent lobectomy via open approach. These patients were also well-matched and did not have differences in age, demographic data, or comorbidities.

When investigating the primary outcome of incidence of PPCs, there was no difference between the groups for either VATS or open approach. Subgroup analysis also did not

reveal any change in incidence of PPCs. Secondary outcomes were similarly unchanged between the GA and RA + GA groups for both VATS and open.

Discussion

This retrospective propensity-matched cohort study used surgical data to evaluate surgical outcomes including postoperative reintubation, failure to wean from the ventilator, and pneumonia. Comparing GA to GA with any regional technique, the authors did not find a difference in these specified surgical outcomes. The authors suggest that the overall incidence of PPCs has decreased over the past decade as ERAS protocols have emerged; goal-directed fluid therapy has been employed; surgical techniques have advanced; and there is increased use of prophylactic antibiotics and earlier respiratory physiotherapy. They conclude that since these changes have improved the standard of care for patients undergoing thoracic surgery, regional anesthesia is now making less of an impact on overall care and outcomes than it once did. Readers should carefully note that this study only looks at the effect of regional anesthesia on specific outcomes which are mostly related to surgical techniques and patient factors. It does not address the benefits of regional anesthesia regarding pain management, opioid consumption, or effects on chronic pain states. Ongoing research related to ERAS and regional anesthesia continues to advance our care of these very complex patients undergoing thoracic surgery.

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LITERATURE REVIEWS

Mechanical Complications After Central Venous Catheterization in the Ultrasound-Guided Era: A Prospective Multicentre Cohort Study

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Background

Central venous catheter (CVC) placements are invasive procedures performed to provide access to the bloodstream, allow safe delivery of vasoactive drugs and nutritional support, enable monitoring of hemodynamic variables, and be used for hemodialysis.[1] This procedure may be associated with both minor mechanical complications (minor bleeding, self-limited arrythmia, non-persistent nerve injury, arterial puncture, failed catheterization, and catheter tip malposition) and major mechanical complications (major bleeding, arterial catheterization, symptomatic arrhythmia, pneumothorax and persistent nerve injury). With the use of real-time ultrasound, CVC placement success rates have increased, and the number of mechanical complications has decreased, though there is considerable variation in reported complication rates.[2,3]

The authors of this study focus on determining the incidence of mechanical complications within 24 hours of CVC placement in hospitals where the use of real-time ultrasound guidance is the clinical practice for central venous access as well as identifying variables associated with mechanical complications. Their aim is to further explore the current variation in data regarding mechanical complications and identify risk factors for those complications related to ultrasound-guided CVC placement.

Methods

This was a prospective, controlled, multi-center observational cohort study of 12,667 CVC insertions in 8,586 patients from March 2019 to December 2020. Four emergency care hospitals in Sweden participated in this study and each hospital followed the same clinical guidelines for CVC insertion based on national recommendations. Exclusion criteria included CVC insertions with missing insertion date, patients with fictitious social security number, and arterial catheters accidentally recorded as CVC insertions.

A dedicated collaborator from each study site reviewed all registered CVC insertion forms and examined medical records and chest x-rays for mechanical complications that occurred within 24 hours. An independent technician extracted predefined data points from the electronic health record. Information on operator characteristics and mechanical complications were compiled for statistical analysis.

The primary outcome measure was to determine the incidence of minor versus major

mechanical complications within 24 hours after ultrasound-guided CVC placement. The secondary outcome measure was to identify patient-, operator-, and catheter-related variables associated with mechanical complications. Chi test was used to analyze complication rate differences between participating hospitals to ensure internal validity. Multivariable logistic regression was used as the main analysis to determine associations between the predefined variables and mechanical complications

Results

The final study sample was comprised of 12,660 CVC insertions in 8,586 patients, performed by 281 individual operators. Mechanical complications occurred in 978 (7.7% [95% CI: 7.3-8.2]) of all CVC insertions. Forty-eight (0.4% [0.3-0.5%]) CVC insertions were associated with major mechanical complications. Of the major mechanical complications, the most frequent complications were pneumothorax (17 patients), arterial catheterization (15 patients), grade 3-4 bleeding (9 patients), and grade 3-4 cardiac arrhythmias (9 patients).

Low patient body-mass index (<20 kg m-2) was associated with a lower risk of minor mechanical complications [OR 0.50 [95% CI: 0.30-0.79]) and higher risk of major mechanical complications [OR 2.69 [95% CI: 1.17-5.62]). Invasive positive-pressure ventilation was associated with a lower risk of minor mechanical complications (OR 0.78 [95% CI: 0.63-0.98]). Limited operator experience (<100 individual CVC insertions in the chosen vein) was associated with a higher risk of both minor (OR 1.77 [95% CI: 1.39-2.24]) and major mechanical complications [OR 3.11 [95% CI: 1.64-5.77]). Male operator gender was associated with a higher risk of major mechanical complications (OR 3.33 [95% CI: 1.60-7.38]). Increasing number of skin punctures was independently associated with a higher risk of both minor (OR 1.95 [95% 1.68-2.27]) and major mechanical complications (OR 2.18 [95% 1.59-2.88]). Subclavian vein catheterization (OR 5.91 95% CI: 2.13-17.26)) and limited operator experience (3.29 [1.19-9.61]) were independently associated with pneumothorax.

A total of 142 patients died within 24 hours after CVC insertion; only 9 minor mechanical complications were recorded in these cases and none of the deaths were suspected to have been caused by a mechanical complication. The Chi test showed no difference in complication rates amongst the participating hospitals.

Discussion

This study is the largest prospective observational cohort study to date on the incidence of mechanical complication after CVC placement. Only 2.5% of the CVC insertions were performed with anatomic landmark technique, confirming that ultrasound guidance was the standard of care at the participating hospitals.

Overall, the incidence of mechanical complication was 7.7%, of which 0.4% were major complications. There were several variables that were independently associated with mechanical complications. Notably, low BMI patients were found to be associated with higher risk of major mechanical complications and lower risk of minor mechanical complications. A plausible explanation could be due to accidental puncture of the central vein posterior wall due to shorter skin-to-central vein distance, which would increase risk for major complication, though the shorter distance would make it easier to obtain high-quality ultrasound images, which would minimize risk for minor complications. Also, male operators were associated with major mechanical complications, notably with the highest odds ratio of any variable at 3.33, which could be related to gender differences in risk behavior during invasive procedures4 or the distribution of CVC insertions under emergencies between male and female operators. Furthers studies are needed to investigate explanatory mechanisms for this gender variable.

There are several limitations to this study. Since this is an observational study, additional studies are needed to evaluate the variables associated with mechanical complications. Also, since coagulopathy is typically known before CVC insertion, this may have contributed to biases regarding operator experience or to the choice of giving pre-procedural procoagulants. Other limitations include inaccurate charting, a small sample size for major mechanical complications, and lack of generalizability given that 52% of the CVC insertions were performed in the operating room. Lastly, operator experience was based on the number of individual CVC insertions before the study and not determined via observation during clinical practice.

In summary, the authors show that the incidence of major mechanical complications of only 0.4% highlights the importance of ultrasound guidance for CVC placement. There were four variables found to be independently associated with major mechanical complications: patient BMI (<20 kg m-2), male operator gender, limited operator experience and more than one skin puncture. The findings from this study could be used for risk stratification before catheterization procedures, which may reduce complication rates.

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Table 5 Multivariable logistic regression analysis for major mechanical complication. *Compared with patients with BMI 20–30 kg m−2. †Compared with operators with ≥100 individual central venous catheter insertions in the chosen vein at the beginning of the study period. CI, confidence interval.

Variables	Major mechanical complication (n=45)		
	Odds ratios	95% CI	P-value
Patient BMI <20 kg m^{-2}*	2.69	1.17–5.62	0.012
Patient BMI >30 kg m^{-2}*	0.75	0.32–1.61	0.489
Male operator gender	3.33	1.60–7.83	0.003
Limited operator experience (<100)†	3.11	1.64–5.77	<0.001
Number of skin punctures	2.18	1.59–2.88	<0.001
Observations	7262		

Incidence, Outcomes, and Risk Factors for Preincision Cardiac Arrest in Cardiac Surgery Patients

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Background

Cardiac arrest related to anesthesia for non-cardiac surgery was recently reported to occur in 0.7 per 10,000 anesthetics, with associated mortality <0.1 per 10,000 anesthetics.[2] Patients with preexisting cardiac disease and ASA classification greater than III, who undergo non-cardiac surgery, are at increased risk of developing perioperative cardiac arrest.[1] Perioperative cardiac arrest in cardiac surgery has been reported to occur in 3-8% of cases, but this number includes surgical complications.[3,4] There is no data regarding the incidence and risk factors of anesthesia related intraoperative cardiac arrest in cardiac surgery. In this retrospective review the authors examined records from 41,238 patients who underwent cardiac surgery. The primary goal was to report the incidence of anesthesia related intraoperative cardiac arrest. The secondary goal was to assess whether pre-incision cardiac arrest leads to major adverse postoperative outcomes. Finally, a tertiary analysis was done in order to examine the association between prespecified patient risk factors and pre-incision cardiac arrest in cardiac surgery.

Study Design

The study is a retrospective review of patients who underwent elective or urgent cardiac surgery at the Cleveland Clinic between 2008 and 2019, after institutional review board approval and waiver of consent. The STS database was used for patient demographic characteristics, procedure, comorbid conditions, and outcomes data. The Perioperative Health Documentation System Registry was used to identify patients who sustained pre-incision cardiac arrest. The electronic anesthesia records were also used to identify events of cardiac arrest, medications and hemodynamic data. Patients who did not receive general anesthesia, who arrived in the cardiac operating room sedated and already intubated, on ECMO or during resuscitation efforts and emergent cases (requiring immediate surgical intervention for ongoing or refractory cardiac compromise, non-responsive to other therapies except cardiac surgery) were excluded.

For the primary study objective, which was estimation of the incidence of anesthesia related cardiac arrest in cardiac surgery, records with cardiac arrest indicators between induction of general anesthesia and surgical incision were identified. Indicators of cardiac arrest included: QA indicators or phrases in the anesthesia record such as: cardiac arrest, chest compressions, ventricular fibrillation, asystole, pulseless electrical activity, cardiopulmonary resuscitation and bolus administration of epinephrine >0.5 mg. Event confirmation with correlation of the vital signs from the same time period of the anesthesia record was performed. Other data collected from the anesthesia records included: post induction of anesthesia but pre incision drop in the patient's blood pressure >30% the 5 minutes preceding the arrest, event timing from induction of anesthesia, if ECMO was needed and if ROSC was achieved. T test was used for continues variables and x2 for categorical with confidence interval 95%.

For the secondary study objective, the association of pre-incision cardiac arrest with adverse outcomes (such as prolonged postoperative mechanical ventilation >72 hours, need for postoperative renal replacement therapy, stroke, in hospital mortality and increased hospital length of stay) was assessed using logistic regression models.

In the tertiary analysis the association of certain pre-determined risk factors (reduced LVEF, low- gradient low-flow severe aortic stenosis, significant coronary artery disease of the left main coronary artery, severe pulmonary hypertension, right ventricular dysfunction) among patients that suffered pre-incision cardiac arrest was assessed with multivariate logistic regression models.

Results

TFrom the 44,664 cases identified in the STS database between 1/2008 and 1/2019, after applying the exclusion criteria described above, 41,238 cases were included in the final analysis.

Primary objective analysis: The incidence of pre-incision cardiac arrest was 0.18% 95% CI (0.17-0.26), 75 cases, and remained stable each year of the study period. The median time from induction of anesthesia was 15 (6-33) minutes, but in 18 cases (24%) cardiac arrest occurred before endotracheal intubation. In 32% of the patients who experienced cardiac arrest the MAP decreased by >30% from baseline 5 minutes prior to the event. 39% were re-operations. In 2 patients the precipitating event was hypoxia from difficult intubation, and in 9 patients cardiac arrest occurred during the Swan Ganz catheter placement. Intraoperative mortality was 0.007% (3 of 41,153 patients) in the non-cardiac arrest group vs 1.4% (1 of 75 patients) in the cardiac arrest group. V-A ECMO was required after separation from CPB in 14 of 74 patients in the cardiac arrest group and IABP in 11 of 74 patients.

Secondary objective analysis: The patients who experienced intraoperative pre-incision cardiac arrest were more likely to require renal replacement therapy (odds ratio 3.9) and prolonged hospital stay (odds ratio 0.68) develop respiratory failure (odds ratio 3.9), suffer a neurologic deficit (odds ratio 2.4) or die (odds ratio 4.14, $p < 0.001\%$).

Tertiary analysis: Multivariate analysis identified that reduced left ventricular ejection fraction ($p < 0.006$) and moderate/ severe pulmonary hypertension ($p < 0.001$) are risk factors for pre-incision cardiac arrest.

Conclusions and Discussion

Patients with significant cardiac disease can be vulnerable during induction of general anesthesia, because of the hemodynamic effects of medications and positive pressure ventilation.

In this well-designed study a low incidence, 0.18% (or approximately 2 in 10,000) of pre-incision cardiac arrest among patients who underwent non emergent cardiac surgery was reported. The findings are consistent with the higher incidence of anesthesia related cardiac arrest, observed in patients with advanced ASA status and significant cardiac disease, for non-cardiac surgery. Most of the patients, 99% survived the perioperative period and 87% were discharged. As described by other investigators,[5,6,7] the survival of cardiac arrest in the operating room is significantly higher compared to other in-hospital cardiac arrest, most likely because in the operating room highly trained personnel and advanced techniques such as ECMO or IABP or CPB are immediately available.

In the study, patients who survived pre-incision cardiac arrest demonstrated higher in -hospital morbidity and mortality. Patients with reduced LV EF and/or moderate/ severe pulmonary hypertension are at higher risk to experience cardiac arrest after induction

of anesthesia. Optimizing high risk patients and tailoring the hemodynamic and anesthetic management appropriately may improve outcomes.

The low incidence of cardiac arrest and the high survival observed may also be the result of an organized, experienced, well equipped and highly functional team and thus may not apply in all hospitals and practices. In addition, like all retrospective studies, this large retrospective review is subject to data reliability such as missed or hard to interpret information, which amplifies the selection bias.

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PRO CON

PRO/CON DEBATE

Ketamine: Pro-Con Routine Use for Cardiac Surgical Patients

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Ketamine was born out of the development of Phencyclidine a potent hypnotic with major psychometric side effects that was eventually banned from medical use. The history of Ketamine highlights the ongoing discovery of its mechanisms, actions, and potential uses in both the perioperative and, more recently, the world of chronic pain and psychiatric worlds.

1956	Phencyclidine synthesized as a potent anesthetic but complicated by psychometric side effects: dysphoria and hallucinogenic effects.
1962	Ketamine synthesized from Phencyclidine as an anesthetic medication with 1/10 the potency of Phencyclidine with fewer psychometric effects.
1965	Phencyclidine disallowed in human use the United States due to side effects.
1968	Ketamine approved by Food and Drug Administration and was first used during the Vietnam War.
1978	Phencyclidine disallowed in animal use.
1980s	Emergence phenomenon led to increasing illicit use and withdrawal from mainstream anesthetic use in humans.
2000	Antidepressant effects of ketamine used in resistant cases.
2002	Infusions for intractable complex regional pain syndrome.
2014	Effect of ketamine on suicidal ideation and as treatment of posttraumatic stress disorder.

Ketamine is an possesses a unique place in the anesthesia world. At higher does (> 1 mg/kg) it possesses a hypnotic anesthetic effect while at sub-hypnotic doses (< 0.5mg/kg) it is primarily an analgesic. Ketamine solution consist of multiple isomers; S-Ketamine and S-Norketamine bind 5-8 x the affinity compared to the R-Ketamine counterparts.

Ketamine is a non-competitive antagonist of the excitatory N-methyl-D-aspartate (NMDA) glutamate receptor. Glutamate binds the N-Methyl-D-Aspartate (NMDA) receptor (NMDAR) resulting in the influx of calcium activating cellular processes.

NMDAR are found in the central and peripheral nervous system. Ketamine binds inside the NMDAR channel and blocks calcium entry and cellular activities. In doing so, Ketamine blocks the excitatory functions and produce a hypnotic state and blocks memory formation.

Doses between 2 and 20 mg/kg provides an anesthetic/analgesic/hypnotic state independent of gamma-aminobutyric acid (GABA) receptors, which is the primary effect of other sedating/anesthetic medications. Since its initial development and through observation and research, Ketamine has also been shown to have, either direct, or indirect, through interaction with NMDAR, agonist effects on opioid , , and μ receptors, dopamine and serotonergic receptors. It reduces reuptake of monoamines (dopamine, norepinephrine, serotonin). In addition, either directly or through NMDA receptors it

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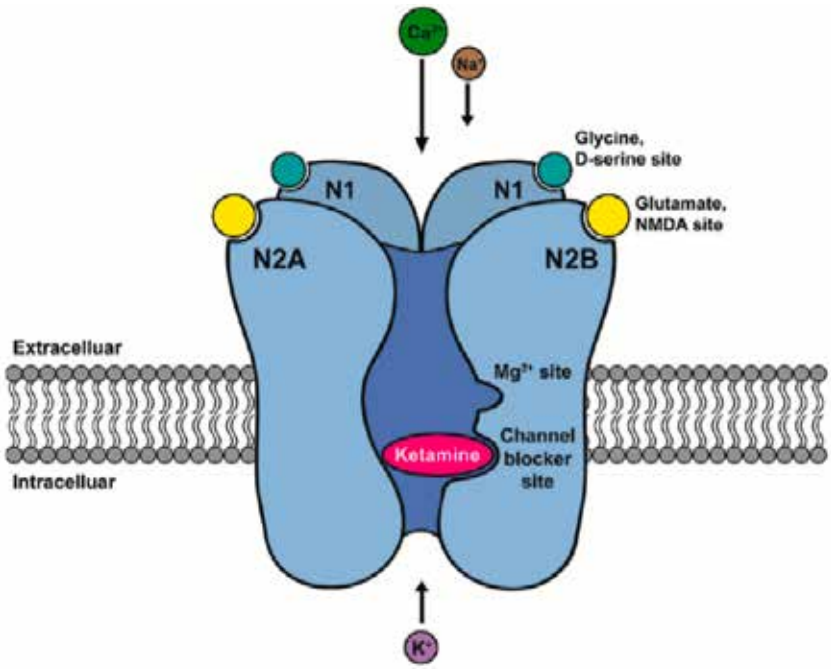

Schematic showing the non-competitive antagonism of Ketamine on the NDMAR. Reprinted with permission from: Das, J. Repurposing of Drugs-the Ketamine Story. J. Med. Chem. 2020, 63 (22), 13514–13525.

displays antagonism at muscarinic and nicotinic acetylcholine receptors, blocks sodium and potassium channels, and may enhance gamma-aminobutyric acid (GABA) activity.

Through continued research, the role of Ketamine and/or related NMDAR antagonists (Memantine) has expanded. Perhaps the more recent advances of NMDAR antagonism in the neuromotor and neurocognitive sciences may prove to the most important role. Interestingly, while it blocks excitatory activity of Glutamate and NMDARs, its actions result in higher glutamate levels in the CSF activating -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor (AMPAR), a transmembrane receptor for glutamate (iGluR) that mediates excitatory synaptic function in frontal cortex and hippocampus improving synaptic life, function, and interaction. These effects on synaptic plasticity and preservation improve memory and learning with possible therapeutic applications to chronic pain states, post-traumatic stress disorder, depression, and even Alzheimer's disease.

Ketamine is metabolized in the liver to produce Norketamine, an active metabolite, which is 1/3 the potency. Ketamine has a redistribution half-life of 10-15 minutes and an elimination half-life of 2 hours. Urine excretion accounts for more than 90% of Ketamine and its metabolites.

Ketamine dosing varies depending on the desired effect and route, including oral, intravenous, and intramuscular injections, either as one-time administrations, continuous infusions, or both. As stated above there are sub-hypnotic/analgesic and hypnotic (anesthetic) doses. These relate to serum levels of 200ng/ml and 2000 ng/ml respectively. The lethal dose (LD50) of Ketamine is > 40 mg/kg in experimental animals tested and not affected by co-administration of midazolam.

The following Pro-Con debates whether the benefits of Ketamine are significant and, if so, whether they outweigh the side-effects to support its routine administration for cardiac surgical patients.

Goal	Route	Dose	Onset	Duration
Anesthetic Induction	Intravenous	1-4.5 (typically 1-2) mg/kg	< 1 minute	5-15 minutes
	Intramuscular	5-13 mg/kg	< 5 minutes	0.5-2 hours
Sub-hypnotic	Intravenous	0.1-0.5 mg/kg	1-2 minutes	
Sub-hypnotic	Oral	2-6 mg/kg	20-25 minutes	1-6 hours
Infusion	Intravenous	0.1-0.5 mg/kg/hr		

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PRO

DEBATE

Ketamine Should Be Used Routinely to Improve Analgesia for Cardiac Surgical Patients

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Introduction

The on and off-label uses of Ketamine include an array of applications from the battlefield to the emergency room, the perioperative arena, the intensive care units, and even to the chronic pain clinics, and the world of neurocognitive and neuromotor dysfunctions including major depressive syndromes, chronic pain syndromes, and post-traumatic stress syndrome[1,2,3,4,5,6]. Ketamine is a hypnotic, sedative, amnestic, anesthetic, analgesic, an anti-depressant, all while causing minimal or no respiratory depression. Its broncho-dilating properties have been used for refractory asthmatics, and, for most patients, it provides a stable hemodynamic environment[1].

There is no confusion as to the powerful benefits of Ketamine's role as a sedative and analgesic for painful procedures. In 1970 Ketamine was approved for use as a general anesthetic and was used extensively during the Vietnam war for managing battlefield injuries and procedures. Since then, its use has expanded. The myriad of uses and effects of Ketamine are due to the multiple receptors affected and the varying dose regimens.

Mechanism

Ketamine's actions are mainly due to a noncompetitive antagonism of the N-methyl-D-aspartic acid (NMDA) receptor. It was discovered in later research that ketamine also targets other receptors, such as muscarinic receptors, serotonin receptors, opioid receptors (mu, sigma, delta), and -amino-3-hydroxy-5-methyl-4- isoxazolepropionic acid (AMPA) receptors.

Ketamine is a non-competitive inhibitor of the NMDA receptor (NMDAR) blocking the influx of cations, e.g., calcium, thereby reducing the excitatory effects of glutamate. NMDA receptors are found centrally in the cerebral cortex, and the limbic system including the hypothalamus, the amygdala, the thalamus, and the hippocampus. Receptors are also found peripherally in the spinal cord especially in the dorsal horn. The anesthetic or dissociative effects are believed to be due to the reduction in excitatory glutamate activity and interruption in memory formation.

Analgesia

Ketamine has analgesic properties through supratentorial and spinal cord NMDAR and opioid receptors and is not only effective as a primary treatment of pain but may be especially useful for refractory pain management[2,3,4,5,6]. At higher doses (> 1mg/kg) it is "unique" in that it can simultaneously combine hypnosis (sleep-producing), analgesia (pain-relieving) and amnesia (short-term memory loss).[2] Studies have demonstrated that Ketamine as bolus doses with or without a continuous infusion lowers pain scores and reduces narcotic consumption with minimal side effects especially at lower sub-hypnotic/subanesthetic doses (< 0.5mg/kg).[7,8,9] Analgesic benefits have been reported after a single intravenous dose (1mg/kg) for patients undergoing thoracotomy without an increase in psychedelic side effects.[10] The authors reported a reduction in pains scores, morphine consumption, and inflammatory markers (CRP), perhaps linking inflammation and pain.[10] At 0.3mg/kg dose of ketamine was found to be equivalent or superior to 0.1mg/kg morphine in patients with

a painful sickle cell crisis.[11] To balance sedation, analgesia, and to minimize side effects, authors recommend a Ketamine bolus of 0.35mg/kg and infusion rates of 1mg/kg/hr.[7,8,9] The acute analgesic effect is relatively short lived for approximately two hours after the infusion is stopped which is consistent with a elimination half-life of 2-4 hours.[12]

The benefits of Ketamine extend beyond its acute situational analgesic effects. A single dose as low as 0.25-0.5 mg/kg with or without an infusion of 0.1-0.3 mg/kg/hr, Ketamine has been shown to reduce tolerance, central sensitization, and hyperalgesia associated with opioids.[2,4,5,6] Ketamine can help manage chronic and/or neuropathic pain reducing or stopping central sensitization and wind-up phenomenon thereby preventing or stopping development a state of high reactivity central and spinal pain fibers and/or activation otherwise dormant cells, which may subsequently develop chronic pain, allodynia, and hyperalgesia, all related to NMDAR activation.[4] NMDAR antagonism using Ketamine reduces these pain issues.[13] For spinal cord injured patients suffering allodynia despite several days of a multi-modal analgesic regimen, a 5 mg test dose of Ketamine resulted in a 50% reduction in pain.[14] This was followed by several days of slow 50 mg intravenous administration 2x/day and then an oral dose of 50 mg 3x/day for up to 3 months (mean 17 days). At the termination of Ketamine administration, pain reduction was 75%, and 97% on follow-up (mean 14 months).[14] From the data it is reasonable to consider, at a minimum, that a multimodal approach, including Ketamine, would increase the success at managing acute pain, while preventing hyperalgesia, allodynia, wind-up phenomenon, and persistent pain.[15]

There is not an abundance of data specifically targeting cardiac surgical patients, however, available data report improved pain control and higher satisfaction scores.[16,17,18] Ketamine doses ranging from a single 0.5 to 1.5mg/kg dose during induction with or without a continuous infusion of 0.15 mg/kg/hr result in lower pain scores, reduced opioid use with minimal or no depression on hemodynamics or respiration, and greater patient satisfaction.[16,17,18] In a study comparing Pregabalin (150mg q12 hours x 14 days) with or without Ketamine (0.1mg/kg/hr x 48 h) to saline significant pain (> 4/10) at 3 months and 6 months was significantly greater in the placebo group (34 and 28% respectively) compared to the Pregabalin alone (6 and 6%) and Pregablin+Ketamine group (2% and 0% respectively).[19] The placebo group consumed greater amounts of morphine in the postoperative period, while the ketamine group reported better sleep and higher satisfaction scores.[19]

Enhanced Recovery After Surgery (ERAS) protocols are designed to minimize or even eliminate narcotics to facilitate early extubation, patient mobilization, awareness/reduced delirium all while maintaining analgesia with a multimodal approach.[20,21,22,23,24] While institutions have individualized protocols, many include Ketamine.[23] Whether ERAS represents an actual protocol, or a mindset is difficult to discern, however, it has been associated with lower pain scores, a lower incidence of complications, early extubation, less need for noninvasive ventilation.[23]

Respiratory

Pulmonary dysfunction is expected after cardiac surgery. Ketamine provides analgesia with minimal respiratory depression. A dose of 0.44mg/kg Ketamine given intramuscularly was an effective analgesic in volunteers without any changes in respiration or hemodynamics.[25] While ketamine provides sedation and analgesia, an intravenous dose of 1.5 mg/kg or an intramuscular dose of 4 mg/kg resulted in 0% respiratory depression.[26] Ketamine has broncho-dilating properties. A review of 20 manuscripts including 244 patients (age 5 months to 70 years) concluded that ketamine improved outcome for severe asthma compared to conventional therapies.[27] Ketamine dosing ranging from boluses of 0.1 to 2mg/kg and infusions ranging from 0.15 to 2.5 mg/kg/hr for 1 hour to 5 days.[27] Benefits included improved gas exchange, reduced oxygen requirements, and lower airway pressures and greater success in weaning from mechanical ventilation.[27]

Cardiovascular

The cardiovascular effects of ketamine are mixed, however, for the majority of patients Ketamine administration is associated with minimal or no cardiovascular depression.[28] For critically ill patients needing sedation and endotracheal tube intubation, sedation with Etomidate or Ketamine resulted in similar hemodynamic profiles.[29] Sympathomimetic stimulation appears to be indirect. These effects may represent brainstem receptor inhibition to reduce parasympathetic activity.[30] By contrast, in catecholamine deplete patients, or patients with heart failure and high serum catecholamine levels, Ketamine may result in cardiac depression. Ketamine's cardiac depression is due to direct vagal properties, which was demonstrated in an animal study receiving a dose of 100mg/kg/hr.[31] The cardiac effects may be stereoselective with the S-Ketamine increasing cardiac output while S-Norketamine decreases it. R-Ketamine has little or no cardiovascular effects.[32]

The combination of Ketamine and Dexmedetomidine may have cardioprotective effects. When compared to Sevoflurane-Sufentanil, Ketamine (1-2mg/kg followed by 2-4 mg/kg/hr infusion) and Dexmedetomidine (1 ug/kg followed by 0.5-1.5 ug/kg/hr infusion) was associated with lower cardiac troponin I, creatine kinase (CK-MB) levels the morning after cardiac surgery.[33] Similarly, Ketamine has shown to lower the levels of the inflammatory marker interleukin-6 (IL-6). It has been suggested that elevated IL-6 level is secondary to myocardial ischemia, reperfusion injury and surgical stress,[34,35] and it is directly linked to higher incidence of postoperative mortality and morbidity.[36]

There has been controversy regarding the administration of Ketamine for patients with pulmonary hypertension and/or congenital shunts and the balance between pulmonary and systemic vascular resistance.[37] However, clinical data do not support a blanketed statement that Ketamine increases pulmonary artery pressure, pulmonary vascular resistance, or the ratio of pulmonary to systemic vascular resistance.[38,39,40,41,42] Multiple studies report the absence of change or any significant change in mean pulmonary artery pressure, pulmonary vascular resistance, or its ratio to systemic vascular resistance in either spontaneous breathing or mechanically ventilated patients with the administration of intravenous Ketamine up to 2mg/kg to patients with and without elevated pulmonary pressures and resistance.[38,39,40,41,42] Instead, Ketamine inclusion is described as an important component of the hemodynamically stable anesthetic induction.

Anti-inflammatory Effects

As mentioned before, there is accumulating data correlating inflammation with adverse outcome after cardiac surgery, inflammation with NDMAR activity, and reduced inflammatory markers and mediators with the administration of ketamine.[43,44,45,46,47] Ketamine, administered at 1-3 mg/kg during induction followed by a 2-3 mg/kg/hr infusion, and was associated with lower interleukins levels (IL-6, IL-8, and IL-10) at 6-24 hours after surgery.[43] Inflammatory markers, including interleukins (IL-6, IL-8, IL-10), tumor necrosis factor- (TNF), and C-reactive protein (CRP), are associated with vasoplegia, arrhythmias, cardiac injury, acute kidney injury, prolonged mechanical ventilation, and neurocognitive dysfunction.[16,17,33,43,44,45,46,47]

Neuroprotection

As mentioned before, there is accumulating data correlating inflammation with adverse Perhaps a less appreciated benefit of Ketamine NMDAR-antagonism is its effects on neurocognitive outcome, for which dysfunction occurs in up to 50% of cardiac surgery patients and may persist beyond 12 months.[48,49,50] A dose of 2.85mg/kg Ketamine reduced neurologic dysfunction and biomarkers of injury in a dog model of hypothermic circulatory arrest.[51] Remacemide, an NMDA antagonist resulted in neuroprotection during cardiac surgery by reducing cerebral ischemic injury [50] and improves 'cognitive health' based on measured learning abilities.[52] Hudetz et al reported that Ketamine 0.5mg/kg, during anesthesia induction, was associated with better cognitive performance and lower CRP

when compared to saline.[16,17] Delirium was lower in the Ketamine group compared to saline (3 vs 31%).[16,17]

Depression

Although the 'mood' and psychologic state of the patient is beyond the scope of this discussion, adverse outcome, and depression in patients with cardiac disease/dysfunction is well known.[49,50,51] Depression after cardiac surgery occurs in up to 40%.[53,54,55] Hence a comprehensive approach to reduce depression would benefit patient recovery and rehabilitation. The neurocognitive effects and benefits of ketamine are not straightforward and still being discovered. Although not necessarily a perioperative benefit, Ketamine has anti-depressant effects. A single dose of Ketamine resulted in improved mood and reduced depression within 1-2 hours and benefits lasted 1-2 weeks including those with depression and suicidal ideation that were refractory to traditional anti-depressants.[56,57] The NMDA receptor is important for synaptic plasticity and survival, learning and memory formation.[58] These changes reduce chronic stress, post-traumatic stress disorder, and depression, all conditions that are associated with synaptic atrophy/death.[59,60]

Side Effects

Ketamine is 1/10 the potency of phencyclidine (PCP) with less confusion, dysphoria, and hallucinations. The incidence of these side effects after an intravenous dose of 2mg/kg drops from 27% to 6.7% with the co-administration of 0.07 mg/kg of midazolam.[26,61] Despite the side effects the patient satisfaction was 97%.[61,62] For adult patients receiving a ketamine dose of 1-3 mg/kg intravenously, 1-2.5 mg of midazolam-controlled emergence phenomenon.[63] For pediatric patients, Ketamine provided sedation and analgesia with excellent patient satisfaction and < 1% confusion, dysphoria.[62] Lower Ketamine doses results in less side effects. There is a distinct clinical difference between hypnotic/general anesthetic doses (> 1.0mg/kg) and analgesic doses (< 0.5 mg/kg), which is supported by finding that plasma levels for the former are 10x higher than the latter.[64] It is possible that sub-anesthetic doses contribute toward multimodal analgesia while reducing development of hyperalgesia and chronic pain.

Regarding delirium, a review of multiple studies show that delirium was associated with benzodiazepines, opioids, and poor pain control, perhaps more so in the elderly.[65,66] In fact, Ketamine results in comparable analgesia to fentanyl and morphine having equivalent emergence delirium and confusion, all while maintaining better hemodynamics and less respiratory depression.[67]

Conclusion

When considering the comorbidities of the cardiac surgical patient, the impact of surgery on the cardiopulmonary systems, and the high incidence of multiorgan dysfunction, perioperative management by the anesthesiologist requires a multi-modal thought process and approach.[66,66,68,69,70] The process of enhanced recovery should involve both physical and mental recovery and extend beyond the operating room and after hospital discharge. Surgical stress response, pain, delirium, sleep, prolonged ventilation, and ICU stay are inter-linked in cause and effect.[66,66,68,69,70] From what is described above, perioperative Ketamine is an important component that favorably impacts on multiple physiologic functions of the patient that may very well extend beyond the hospital admission. In addition to maintaining stable cardiovascular and pulmonary functions, attenuating inflammatory and neuro-behavioral dysfunction are major predictors of outcome.

PRO

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CON

DEBATE

Ketamine Should Not Be Used Routinely to Improve Analgesia for Cardiac Surgical Patients

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Introduction

Ketamine is a phencyclidine derivate that provides analgesia, hypnosis, and amnesia. Initially synthesized in the 1962, the hypnotic effects of ketamine are distinct from other central nervous system (CNS) depressants in that it causes a feeling of detachment from reality rather than merely sedation. Early researchers, Corssen and Domino, coined the term "dissociative anesthesia" to describe this phenomenon.[1,2,3,4] Compared to other anesthetic induction agents, ketamine causes little respiratory depression and maintains hemodynamic stability in healthy subjects.

At lower doses, ketamine is a potent analgesic, often incorporated into multimodal postoperative pain management plans. Recently, many have advocated expanding this use to the cardiac surgical population, purporting that ketamine can reduce post-operative delirium, decrease opiate consumption, and mitigate some of the deleterious effects of cardiopulmonary bypass, while maintaining hemodynamic stability. While ketamine may role in the pain management of certain patients undergoing cardiac surgery, we would assert that many of these claims are not supported by high quality evidence and ignore the potential adverse effects of ketamine in this patient population.

Potential Adverse Hemodynamic Effects of Ketamine in the Cardiac Surgical Patient

Unlike other anesthetic and analgesic agents, ketamine exhibits sympathomimetic properties mediated by both direct activation of the sympathetic nervous system and decreased reuptake of neuronal and extra-neuronal monoamines.[5,6] Notable hemodynamic changes in healthy subjects include increases in heart rate (HR), cardiac index (CI), systemic vascular resistance (SVR), pulmonary artery pressure (PAP) and mean arterial pressure (MAP).[4] Subsequently, ketamine's sympathomimetic properties are highly desirable in the presence of certain conditions such as hypovolemic shock and cardiac tamponade.

Because these hemodynamic effects culminate in an increase in myocardial oxygen demand (MVO2) and myocardial work, ketamine has the potential to precipitate myocardial ischemia in patients with significant coronary artery disease (CAD) or aortic stenosis. Tachycardia from ketamine can also exacerbate left ventricular outflow tract obstruction (LVOT) in patients with hypertrophic cardiomyopathy. Therefore, ketamine is not a typically used induction agent in these patient populations. Indeed, a study in which patients undergoing coronary artery bypass grafting (CABG) were randomized to receive either ketamine (2mg/kg) or midazolam for induction, a decrease in stroke volume was observed in the ketamine group.[7] While proponents of ketamine following cardiac surgery would argue that analgesic doses are much lower, and therefore, unlikely to cause ischemia, there are other reasons to use ketamine cautiously in cardiac surgery patients.

While the sympathomimetic effects of ketamine are predictable in healthy test subjects, the same is not true in the critically ill. A study by Lippmann and colleagues showed that ICU patients had highly heterogeneous responses to ketamine, with some displaying even paradoxical bradycardia and hypotension.[8] These unpredictable responses to ketamine in the critically ill may be a result of catecholamine depletion, decreased catecholamine sensitivity, adrenal suppression, or acidosis. Pagel and colleagues demonstrated in a

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canine model of sympathetic blockade, that ketamine had vasodilating as well as negative inotropic and lusitropic effect.[9,10]

Ketamine for Post-cardiac Surgery Analgesia: No Clear Benefit, Too Many Risks

Ketamine psychotropic effects on emergence delirium are well known amongst anesthesiologists and well documented.[11] Neurocognitive dysfunction occurs in up to 50% of cardiac surgical patients.[12] Although some have proposed ketamine's may be 'neuroprotective', these data are incomplete and the dose of such a benefit is not known.[13,14] A randomized study conducted by Hudetz and colleagues concluded that ketamine attenuates postoperative delirium concomitant with an anti-inflammatory effect.[15] Dose is important regarding neurocognitive dysfunction. Ketamine anesthesia (2 mg/kg) produces a dose-related increase in cardiovascular stimulation and psychotomimetic disturbances after surgery.[16]

Pain control and reduced post operative neurocognitive dysfunction and delirium are goals of modern-day ERAS. The data arguing that ketamine improves post analgesia or neurocognitive function is limited. The PODCAST trial, a multicenter, international, randomized double-blind trial that included adults older than 60 undergoing major cardiac and non-cardiac surgery under general anesthesia.[17,18] One-third of cases were cardiac surgical procedures. In this study single dose ketamine (0.5 or 1.0 mg/kg) was administered before surgical incision and not found to improve postoperative analgesia, reduced opioid consumption, prevent postoperative delirium, nor prevent or reduce depression.[17,18] Age, a history of depression, and cardiac surgery were predictors of adverse outcome e.g. delirium.[17,18] These authors also observed a dose-dependent increase in the risk of hallucinations and nightmares as a result of ketamine infusion and found no difference in the incidence of depression at either post-operative day (POD) 3 or 30.[17,18] Administration of 2mg/kg of Ketamine during induction failed to improve neurocognitive function or demonstrate any neuroprotection in children undergoing cardiac surgery with cardiopulmonary bypass.[19] It can be argued that single dose administration should not be expected to improve an outcome occurring hours after. Cameron et al administered a Ketamine bolus 0.5mg/kg on induction followed by a 0.5mg/kg/hr infusion until the end of cardiac surgery.[20] The authors reported no improvement in pain control, opioid consumption at 6,12,24, and 48 hours postop.[20]

Unsubstantiated Anti-inflammatory Effects of Ketamine

Data is still limited regarding these findings and there are still concerns that ketamine, given its sympathomimetic properties, should be used with caution in patients with coronary artery disease (CAD).[21] Several studies have found an association between IL-6 and CRP and other inflammatory markers with adverse outcome during CBP.[1,22,23] IL-6 may be a sensitive indicator of the degree of myocardial damage after myocardial infarction.[24] Investigators have studied the effects of ketamine's anti-inflammatory properties as a potentially valuable outcome for cardiac surgery potentially attenuating postoperative cognitive dysfunction. Although an association between reduced inflammatory markers and Ketamine has been described, the data to support the use of ketamine to prevent inflammation is limited. In a review of seven manuscripts only one reported an association between Ketamine administration and reduced delirium associated with an inflammatory response.[1] In off-pump coronary artery bypass graft surgery pro-inflammatory markers and cardiac enzymes, except TNF- , were all increased after the surgery in Ketamine groups compared to control groups.[25] In this study they used 0.5 mg kg of ketamine bolus at induction of anesthesia.

Conclusion

There is no data to support the routine administration of Ketamine for cardiac surgical patients. While we don't dismiss the potential value or role in refractory pain patients, for all others the incidence of psychedelic side effects, e.g., hallucinations, confusion,

defeats the goals of the perioperative period of having an alert and comfortable patient. Furthermore, the optimal dosing regimen is yet to be determined including whether to administer Ketamine continuously after a single bolus dose. Finally, the dose of ketamine, or more specifically whether a sub-anesthetic or sub-hypnotic dose is preferred or do the proposed benefits of Ketamine required larger doses, the latter of which result in greater adverse neurocognitive effects. Perhaps ketamine should be reserved for the cardiac surgical patient with chronic pain syndrome or postoperative refractory pain.[26,27]

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