

Anesthesia News

Summer 2024



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Hello again and welcome to our latest edition to the Department of Anesthesiology newsletter!

I want to thank those of you who have reached out with comments and suggestions for how we can make these newsletters more interesting. We remain committed to making sure that these provide value and ask that you continue to provide us with your feedback.

As we began working on this, our third edition of the newsletter, we asked ourselves if we have a true structure to the newsletter or rather a collection of topics. Either can work, but as something we hope will become a long term fixture of the department, it makes sense to develop a blueprint for how we will approach this and future editions. Any good newspaper has some predictability to the type and location of its content. To that end, Chris Torres has done an excellent job of crystallizing the values of our department into 4 “pillars” that we feel can guide us in not only the content of our newsletter, but how we think about the trajectory of the department. These pillars will serve as a backdrop for future organization of this newsletter and ideally how we think about our department’s objectives as a whole. These pillars are:



Clinical Excellence- probably our most basic mission: take excellent care of patients, stay current in the literature and hold ourselves accountable to high standards.



Team, Talent and Family- create an environment in which we can recruit and retain well, provide worthwhile education for our teams and support when we need it (and hopefully some fun once in a while!).



Financial Stewardship- in the current environment, every system has budget issues and cranky CFOs. We need to be judicious and thoughtful in where we spend our funds.



Innovation- can be taken in many directions, but the philosophy is: “are we thinking outside the box to deliver on the above pillars?”

We look forward to using these pillars as ways to keep us focused as a department in both our communication and our strategy. We are always looking for help and insights from our teams, so please continue to keep dialogues open with your regional teams! Without your input on the above topics, we will struggle to create the vibrant department we aspire to. Thank you as always for the excellent work and I hope the upcoming summer months will provide you all an opportunity for some rest and relaxation!

- Dr. Matthew Desciak

Journal Club

Title: Effect of subcutaneous carbon dioxide insufflation on arterial pCO₂

Journal: The American Journal of Surgery Volume 171, Issue 5, May 1996, Pages 460-463

Authors: Blair C.D. Rudston-Brown, MD David MacLennan, MD C. Brian Warriner, MD P. Terry Phang

From the Departments of Anaesthesia and Surgery, Pulmonary Research Laboratory, St. Paul's Hospital, University of British Columbia, Vancouver, British Columbia, Canada

Why this paper: We had a patient who underwent a laparoscopic procedure. EtCO₂ after abdominal CO₂ insufflation went up to low 50s mmHg. Subcutaneous emphysema is confirmed when crepitus was detected in the upper chest of the patient. In PACU, the patient was very sleepy. PaCO₂ at 1 h after extubation was 60s mmHg, higher than the intraoperative values. We are not sure how much elevated PCO₂ could be attributed to the subcutaneous emphysema, and how much it is caused by respiratory depression.

Study Design: Five pigs were used for the study. After general anesthesia, each pig was insufflated with 6 liters of CO₂ to produce moderate subcutaneous emphysema. Arterial blood gas (ABG) was measured every 5-10 minutes. Following return to the baseline PCO₂, each pig was re-insufflated with 12 liters of CO₂. ABG was checked as before.

Results:

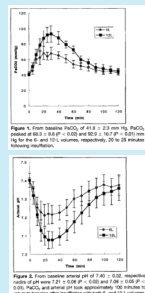
1. As shown in Fig 1, PaCO₂ consistently peaked 30 minutes after the completion of insufflation. There is not difference in peak times between the amount of insufflated CO₂.

2. PaCO₂ and pH returned to baselines 2 hours after the completion of insufflation.

Take home message: In OR, the time of completion of insufflation is the time when the intraperitoneal cavity is deflated. Since the peak time of PaCO₂ from subcutaneous CO₂ emphysema is consistently around 30 minutes, any prolonged elevation of PaCO₂ beyond 30 minutes after insufflation suggest other causes. Respiratory depression, aspiration and pulmonary edema, for example, are common reasons for postoperative hypercarbia. Further diagnosis and more specific treatments may be needed. To our patient, BiPAP was initiated and the patient was admitted into ICU. The patient recovered well next day.

Knowing the peak and return to baseline times of PCO₂ from subcutaneous CO₂ emphysema is helpful to avoid tunnel vision in diagnosis and to provide timely treatments.

- Dr. Xianren Wu



Recent Departmental Publications:



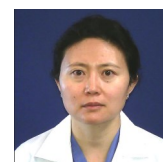
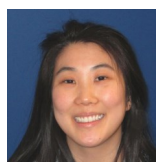
Dr. Li Zhang, Dr. Xianren Wu, & Dr. Xiaopeng Zhang

Comparison of Blood Concentration and Weight-Based Heparin and Protamine Dosing Strategies for Cardiopulmonary Bypass: A Systematic Review and Meta-Analysis

In the realm of cardiac surgery, the management of anticoagulation during cardiopulmonary bypass (CPB) is pivotal. The traditional weight-based approach for heparin and protamine dosing has been challenged by a groundbreaking study that advocates for a tailored strategy based on real-time blood heparin concentration. This systematic review and meta-analysis delves into the efficacy of individualized anticoagulation management, revealing its potential to significantly reduce postoperative blood loss and enhance patient outcomes.

The study meticulously analyzed data from 26 studies, encompassing 22 randomized controlled trials and four prospective cohort studies with a total of 3,810 patients¹². The findings are compelling: individualized dosing not only curtails postoperative blood loss but also lowers the protamine-to-heparin dosing ratio and boosts early postoperative platelet counts. These results underscore the importance of precision medicine in CPB, suggesting that a one-size-fits-all approach may be obsolete.

As we stand on the cusp of a new era in cardiac surgery, this article presents a strong case for embracing machine learning technologies to refine anticoagulation management. The promise of individualized care is within reach, offering a beacon of hope for improved surgical outcomes and patient care.



Dr. Angie Chang, Dr. Lei Li, & Dr. Xiaopeng Zhang

Contralateral Tension Pneumothorax in One-Lung Ventilation: A Case Report and Systematic Review

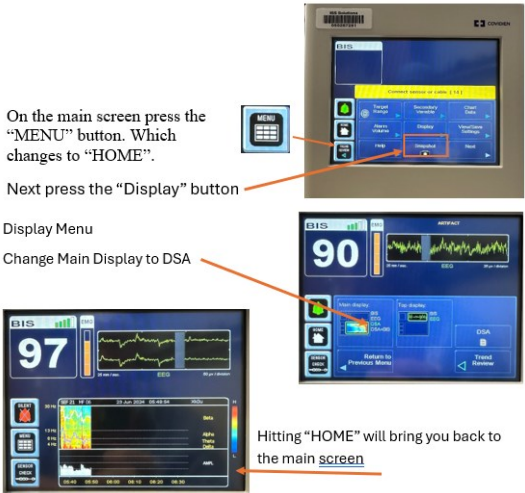
Discover the critical insights on a rare but potentially fatal complication in thoracic surgery: Contralateral Tension Pneumothorax during One-Lung Ventilation. This comprehensive case report and systematic review, published in Cureus, delves into the challenges of diagnosing this condition under general anesthesia, where typical clinical presentations are masked. The article highlights a specific case of tension pneumothorax in a patient undergoing thoracic spine instrumentation, emphasizing the importance of high clinical suspicion and early intervention to prevent cardiac arrest and death. It also explores the role of the esophageal stethoscope, lung ultrasound, and simulator training in improving diagnosis and patient outcomes. With a systematic search spanning three decades, the authors provide a valuable synthesis of 21 case reports and two case series, offering a wealth of knowledge for medical professionals.



Get To Know Your Equipment: BIS Monitoring

BIS Monitor Has integrated a Density Spectral Array (DSA) view the latest upgrade. The DSA is a visual (color) representation of the power of the EEG between 0-30 Hz. that make up in this case an EEG waveform.

Here are some pictures of how to access the menu on the BIS to enable the Spectrogram view.



Spectrogram Graph Nomenclature:

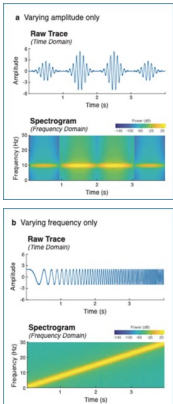
- X-Axis: Time
- Y-Axis: Component frequencies
- Z-Axis: Power of each of the component frequencies for the given time window



By convention spectrograms are plotted in 2 dimensions, with the Z-axis being plotted as colors. Orange/red is higher power & blue/aqua is lower power.

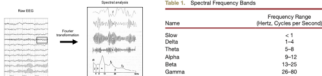
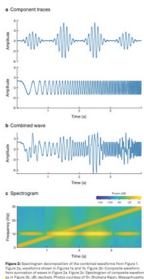
Raw Trace sinusoidal wave with intermittent, high amplitude bursts at a constant 10 Hz frequency. Only the amplitude of the signal changes over time. The spectrogram shows the raw EEG activity at 10 Hz with warmer colors corresponding to the time windows of the high amplitude bursts.

Raw Trace sinusoidal wave with constant amplitude with a steadily increasing frequency. The spectrogram shows a fluctuation of the signal frequency on the Y-axis, but with the same color throughout, as the power (Z-axis) is unchanged over time in the raw signal.



Fourier Transform

Fourier transform decomposes a complex wave in the time domain to its multiple constituent frequencies and their respective power in the frequency domain. Figure 2b is the summation of the component traces present in figure 2a. Figure 2c is the spectrogram revealing the underlying structure as simply

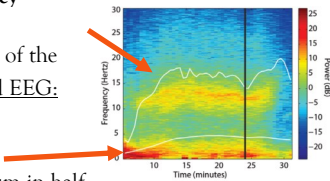


the summation of the two component waves.

Raw to Processed EEG: The Fourier Theorem (YouTube Medtronic)

Median Frequency and Spectral Edge Frequency

Spectral Edge Frequency: The frequency below which 95% of the spectral frequency is located. Youtube: Raw to Processed EEG: What is Spectral Edge Frequency



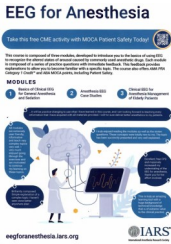
Median Frequency: The frequency that divides the spectrum in half.

Median frequency and Spectral Edge Frequency are used clinically to track whether the spectrogram is trending lower or higher over time.

EEG On-line Course

Here is a free Course through IARS on EEG for Anesthesia. It is a very well-done course that goes into DSA explaining the spectrograms for different types of anesthetic agents helping to build pattern recognition.

- Open access CME course by International Anesthesia Research Society on EEG For Anesthesia
- YouTube Introduction to the EEG for Anesthesiology from IARS



Resource Links

Emery Brown MD, is an Anesthesiologist at MGH who is well known for his research on EEG and anesthetic medications, I highly recommend these 2 videos.

- Emery Brown 1: Unconsciousness Under General Anesthetic is a Dynamic State, Starting at 14 minutes there starts a review of the EEG wave forms at different states of anesthesia. At 19 minutes discusses the spectrogram.
 - Emery Brown 2: The Dynamics of the Brain under anesthesia YouTube
- Podcast/YouTube video series put out by Medtronic (the maker of BIS monitors). Shorter videos than the links above.
- Medtronic Podcast series consisting of 7-part podcast series
 - Medtronic solutions page with training programs for TIVA and ERAS curriculum, and Safe brain resident program

An International Consortium

- International Consortium for EEG Training of Anesthesia Practitioners (ICE-TAP) was created to provide teaching modules for anesthesiologists concerning EEG and its application in the OR setting. Much is to be improved at this point but we hope this website will become a hub for exchange of ideas concerning EEG and brain monitoring for people interested in such topics.

References

Seyed A. Safavynia, Shobana Rajan; Using the Spectrogram to Interpret Electroencephalographic (EEG) Waveforms. ASA Monitor 2024; 88:28-29 doi: <https://doi.org/10.1097/01.ASM.0001016848.91345.5a>

- Dr. Scott Vaughan



GEISINGER ANESTHESIA SPOTLIGHTS

Geisinger Wyoming Valley Hospital – Commitment to Excellence

About Geisinger Wyoming Valley:

In 2021, GWV received 5-star status from the Centers for Medicare & Medicaid Services (CMS), placing it among the top 14 percent of hospitals in the country. It is the only CMS 5-star hospital in northeastern Pennsylvania. US News ranked Geisinger Wyoming Valley Hospital as the 15th best hospital in Pennsylvania and #1 in Northeastern PA. Additionally, GWV has been recognized as high-performing by US News.

The professionals at GWV deliver high-quality, coordinated, patient-centered care for residents of northeastern Pennsylvania and beyond. The Anesthesia Department covers GWV, OSCP, and GSWB and the team is comprised of forty six CRNAs, twelve flex CRNAs, and twenty one anesthesiologists, with support from GCMC.



America's 250 Best Hospitals Award™ (2024, 2023, 2022)

Top 5% in the nation for consistently delivering clinical quality

HIGH PERFORMING



Recent Achievements & Notable Medical Professionals:

Dr. Akanksha Sharma, recipient of the Golden Laryngoscope Award, leads an initiative to study and improve care for the elderly patient population. Her work with student volunteers has helped propel them into healthcare careers, with one volunteer recently starting medical school and another beginning this year. Prospective physician assistant students are also volunteering and conducting research with Dr. Sharma

GWV has seen a significant decrease in intraoperative hypotension rates. Geisinger South Wilkes Barre (GSWB) incidence dropped from 38% in January to 26%, and GWV dropped from 21% to 16%. Dr. Donald Mauney and Colleen Volpetti, CRNA, collaborated on a plan to prevent and rapidly recognize and treat intraoperative hypotension, which was presented at each campus with insightful feedback from CRNAs and MDAs.

Colleen Daniels, Lenora Lello, Tyler Anderson, and Bryan Kapish not only serve as staff CRNAs but are also instructors for the CRNA program at Bloomsburg University.



Departmental Highlights

Meet Robert Moyer, MD, our Medical Director at GMC:



Robert Moyer, MD, has recently taken on the role of Medical Director for Anesthesia at Geisinger Medical Center. With over 7 years of diverse experience, he is a highly regarded member of the Anesthesia Department. Dr. Moyer's expertise not only ensures high-quality patient care but also contributes significantly to the hospital's anesthesia services. Beyond his directorial responsibilities, he actively engages with our Anesthesia Residency wellness program as their "Well Being Champion" (yes, that's the actual title!), serves as core faculty for resident education, and leads as the charge anesthesiologist. His vision includes fostering better communication among peri-operative teams to create a more cohesive surgical suite, all while prioritizing patient safety.

Future Colleagues:



Dr. Matthew Dowhower, Dr. Taylor George, and Dr. Vincent Martello recently completed their residency at Geisinger and will be joining the Anesthesia Department. Welcome graduates!



Seven SRNAs from the Commonwealth University of Pennsylvania—Bloomsburg Nurse Anesthesia Program are graduating and will be joining Geisinger. The graduates include Derek Duttry, Omar Wijahat, Michael Seldomridge, Lisa Miller, Anthony Forman, Kathleen Fink, and Jonathan Cardinale. Welcome graduates!

Upcoming Speakers:



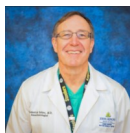
Dr. Sonal Sharma will be speaking our Anesthesia Town Hall on 7/10/2024.

Dr. Sonal Sharma is an anesthesiologist currently serving as an Associate Professor of Anesthesiology at Penn State Health Milton S. Hershey Medical Center. She completed her residency in Anesthesiology at Penn State Health Milton S. Hershey Medical Center, Penn State College of Medicine, Hershey, PA, followed by a fellowship in Neurosurgical Anesthesiology at Northwestern University Feinberg School of Medicine, Chicago, IL.

In her current roles, she serves as the Division Chief of Neurosurgical Anesthesiology and Program Director of the Neuroanesthesiology Fellowship at Penn State Health Milton S. Hershey Medical Center. She is honored to be the recipient of the Donald E. Martin Career Development Professorship in Anesthesia and Pain Medicine at Penn State University College of Medicine.

Dr. Sonal Sharma's commitment to education is reflected by her active involvement in teaching residents and fellows, consistently delivering lectures and grand rounds on various anesthesia topics, including neurotrauma, stroke and perioperative care. She has authored numerous articles in peer-reviewed journals, with a particular focus on anesthesia for acute stroke care. Additionally, she contributes to the scientific community as a peer reviewer for esteemed journals such as the Journal of Neurosurgical Anesthesiology and the Journal of Clinical Anesthesia.

She is actively engaged in professional organizations, serving on committees for the American Society of Anesthesiologists (ASA) and the Society for Neuroscience in Anesthesiology and Critical Care (SNACC). At SNACC, she holds the position of Associate Chair of the Trainee Engagement Committee.



Dr. Frederick E. Sieber will be speaking at our Anesthesia Town Hall on 9/25/2024.

Dr. Frederick E. Sieber is a professor of anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine. He serves as chair and director of Clinical Research in the Department of Anesthesiology and Critical Care Medicine. His educational background includes a B.A. in chemistry from Northwestern University and an M.D. from the University of Pittsburgh. After completing a medical internship at the Pennsylvania Hospital in Philadelphia, he pursued a residency in anesthesiology and a fellowship in neuroanesthesiology at the University of Pennsylvania. Dr. Sieber joined the Johns Hopkins faculty in 1985.

His research interests primarily focus on geriatric surgical patients and optimizing their surgical outcomes. Through multidisciplinary clinical research, he studies elderly patients, particularly those undergoing orthopedic procedures. Dr. Sieber is a member of several professional organizations, including the American Society of Anesthesiologists, the International Anesthesia Research Society, and the Society for Advancement of Geriatric Anesthesia. He also serves as president-elect of the Society for Advancement of Geriatric Anesthesia.

One notable clinical trial he is involved in is the STRIDE (Strategy to Reduce the Incidence of Postoperative Delirium in Elderly Patients), which aims to prevent postoperative delirium in older adults. His contributions to the field continue to impact patient care and advance our understanding of anesthesia and surgical outcomes.

Dr. Sieber's dedication to research and patient well-being underscores his significant role in anesthesiology and geriatric care.



Geriatric Anesthesia

Aging Brain, Anesthesia, and Anticholinergic Medications

Anticholinergic medications can have significant effects on the elderly, especially in the context of anesthesia. These medications are known to affect the central nervous system and can lead to increased sensitivity to anesthetic drugs. Anticholinergic drugs can have a more pronounced effect on elderly patients due to several physiological changes that occur with aging. Here is how they can affect elderly patients differently:

Decreased Acetylcholine: The amount of the neurotransmitter acetylcholine naturally decreases with age. Since anticholinergic drugs block acetylcholine, the relative impact is greater in the elderly.

Central Nervous System Sensitivity: The central nervous system and the brain are more sensitive to anticholinergic side effects due to a reduced number of cholinergic neurons or receptors in the brain of older individuals.

Reduced Metabolism and Excretion: The liver and kidneys have a diminished ability to break down and excrete medications, leading to a higher risk of side effects.

Blood-Brain Barrier Permeability: Drugs can cross more easily into the brain in older adults, increasing the risk of cognitive side effects.

The American Geriatrics Society in Beers Criteria has listed anticholinergic medications as potentially inappropriate medication use in older adults and strongly recommend avoiding the use of anticholinergic medications in older adults because they may be more likely to experience unwanted side effects than younger people and hence explain their vulnerability to the anticholinergic side effects of medications. These side effects can include drowsiness, sedation, blurred vision, confusion, disorientation, memory problems, delirium, hallucinations, dizziness, urinary retention, increased heart rate, dry mouth, constipation, reduced sweating, elevated body temperatures, falls and risk of fractures which are particularly concerning in the perioperative setting.

Moreover, there is an association between the use of anticholinergic drugs and an increased risk for dementia, especially with long-term use. Therefore, many guidelines recommend limiting the use of medications with anticholinergic effects in older adults due to their increased risk of cognitive impairment, dementia, confusion, and decline in physical function, including falls.

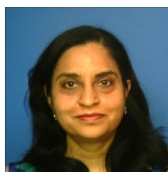
For older patients undergoing surgery, it is important to have a thorough preoperative assessment to evaluate the risks and benefits of anticholinergic use. Anesthesia providers may need to adjust dosages or choose alternative medications to minimize the risk of postoperative

tive complications such as delirium or cognitive dysfunction.

In summary, while anticholinergic medications play a role in anesthesia, in several scenarios particularly for controlling secretions and maintaining heart rhythm with atropine & glycopyrrolate, antiemetics like scopolamine patch, Phenergan & Compazine, treating allergic reactions with Benadryl or treating bladder spasms with oxybutynin their use in the elderly must be approached with caution due to the increased risk of side effects and postoperative cognitive issues. It is crucial and essential to tailor and manage these medications carefully during anesthetic care to the individual needs of older patients to ensure their safety and well-being during and after surgery.

Medication class	Example	Use	Alternatives/ Recommendation
First generation antihistamine and Anticholinergic	Diphenhydramine	Antiallergic	Consider adjusting dose and titration
Anticholinergic and antiemetic	Scopolamine patch,	Antiemetic	Choose alternate medication
Phenothiazine - antipsychotic and Anticholinergic	Prochlorperazine (Compazine),	Antiemetic, antipsychotic and antianxiety	
First generation antihistamine and Anticholinergic	Promethazine (Phenergan)	Nausea or vomiting, sleep aid, allergies and managing secretions	
Anticholinergic and Analgesic	Meperidine	Anti-shivering	Consider alternate methods e.g. , rewarming, possible use of dexmedetomidine. Look into cause of shivering hypothermia, infection, or side effect of medication
Anticholinergic	Glycopyrrolate and Atropine	Controlling secretions and maintaining heart rate	Consider adjusting dose and titration
Anticholinergic and antispasmodics	Oxybutynin	Bladder antispasmodic	Consult urologist for alternate medication

- Dr. Akanksha Sharma



Anesthesiology Residents Class of 2028



Marc Anthony Pajarillo DO



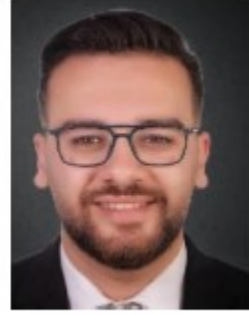
Christian Orr MD



David Fluharty MD



Sean Zacharias MD



Hazem Dahshan MD



Anthony To DO

Commonwealth University of Pennsylvania— Bloomsburg Nurse Anesthesia Program Class of 2026



Jenna Bowersox



Stephen Bressi



Matthew Brown



Mackenzie Clark



Ashley Cooper



Robert Gonzalez



Laura Hoffman



Stephen McNinch



Jayme Mirarchi



Miranda Moser



Dustin Neumann



Chelsie Nolan



Morgan Splitt



Tanner Truitt



Peyton Wilson



Financial Stewardship

Anesthesia Department's Green Initiative: Reducing Our Carbon Footprint and Enhancing Clinical Care

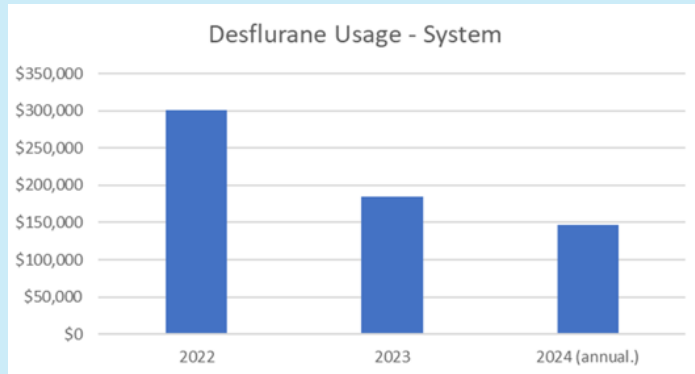
In January 2023, the Anesthesia Department launched a groundbreaking green initiative during a townhall meeting. By embracing sustainable practices, we aim to achieve several critical objectives:

Environmental Impact Reduction: Healthcare contributes significantly to greenhouse gas emissions, accounting for 5-10% of the total. Anesthetic gases, though medically necessary, play a role in this impact. Our initiative focuses on minimizing the use of Desflurane, a potent anesthetic gas with a significant carbon footprint.

Anesthetic Gas Emissions: Running Desflurane at 2L/min flow for an 8-hour day emits greenhouse gases equivalent to driving from Wilkes-Barre to Cancun, Mexico. Recognizing this, our green initiative focuses on minimizing our use of Desflurane.

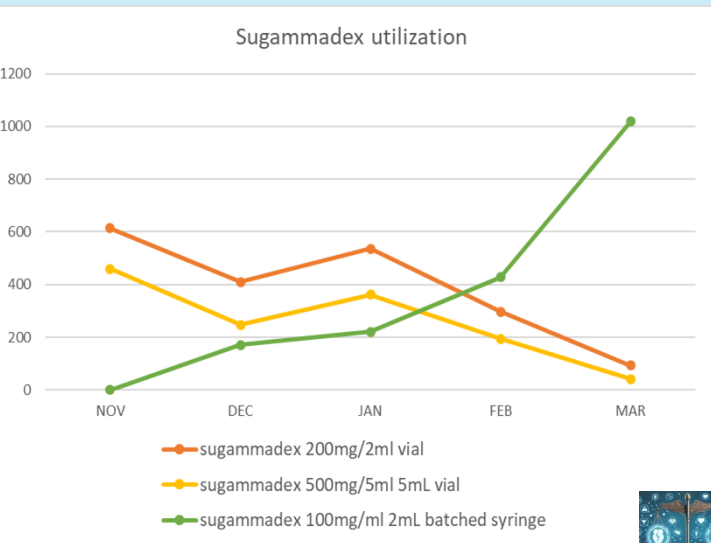
Financial Implications: In 2023, the Pharmacy Department incurred \$64k in penalties for failing to meet required Desflurane usage relative to the number of cylinders owned. Our goal is to phase out all but two vaporizers by the end of 2024, with those retained for educational purposes at GMC.

By adopting sustainable practices, we not only reduce our carbon footprint but also enhance our ability to provide high-level clinical care. Together, we're making a positive impact on both patient health and the environment.



Sugammadex Utilization

Pharmacy began compounding Sugammadex 5mL vials into 2mL syringes in December 2023. Given their limited resources, the compounded syringes are currently available at GMC only. Through their compounding initiative pharmacy quantified a savings of \$64k in the first quarter of 2024. More to come on this!



Innovation

Surgical Optimization

Surgical optimization is a robust, system-wide initiative aimed at better preparation of our patients prior to surgery, which will ultimately lead to better patient outcomes. The idea of surgical optimization has been talked about for years, but rubber really hit the road in September 2023 when Vascular surgery pioneered a significant workflow change and began placing an order for surgery. Over the last few months, the other specialties have followed suit, and more than half of our non-emergent surgeries are being scheduled via an order (14,000 as of early June!). In parallel, many multi-disciplinary groups have been developing phase two of this project, which includes risk stratification and procedure pass. Once the order for surgery is placed, Epic assigns a risk score based on the surgical procedure and patient comorbidities. The risk score and how far in advance the surgery is scheduled automatically determines and defaults required labs and other testing, along with the necessary pre-anesthesia testing pathway. A large part of this initiative is the development of a new visit type in our pre-anesthesia testing clinics. The nurse practitioner led RPAS (rapid preparation for anesthesia and surgery) visits will target high-risk patients with a surgery scheduled less than 28 days in advance, focusing on high yield areas, such as cardiac risk and diabetes education.

Artificial Intelligence — Opmed.ai

Geisinger is exploring a potential partnership with Opmed.ai, a company comprised of experts in healthcare, artificial intelligence, network science, and technology. We know the Surgical Suite is a very complex area, and surgical scheduling is a very complex process. Opmed.ai has several available features that tackle challenges in key areas such as surgical case length, block releases, and equipment, resource, and location optimization. Combining the expertise and experience of our teams with the advanced technology capabilities of Opmed.ai allow us to take ideas and problems and develop solutions that we can put into action. We expect to begin engaging our teams soon as we develop stakeholder workgroups, so stay tuned for opportunities to participate!