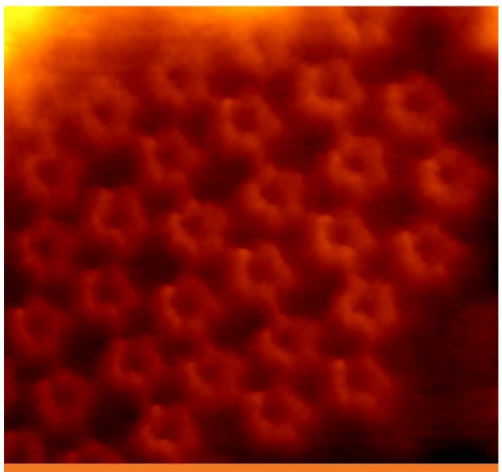
Weill Cornell Medicine
Anesthesiology

12th Annual Research Exposition



Thursday
May 11, 2017

Speakers
3:00 – 4:30 pm
M309

Reception
4:30 – 5:00 pm
P-03-300

Poster Presentations
5:00 – 6:00 pm
P-03-300

Oral Presentations

"High-Speed Atomic Force Microscopy: The dawn of dynamic structural bio-chemistry"

Simon Scheuring, PhD
Professor of Physiology and Biophysics in Anesthesiology
Weill Cornell Medicine
Department of Anesthesiology
Bio-AFM Laboratory

"Insurance status as a marker of peri-operative risk: case studies using HCUP State Inpatient Databases and the AQI National Anesthesia Clinical Outcomes Registry"

Robert White, MD
NewYork-Presbyterian Hospital/Weill Cornell Medicine
Department of Anesthesiology
Van Poznak Scholar
Residency Class of 2018

3:00 – 3:45 pm, M309

Special Research Seminar

"All Available Methods are Wrong: Mapping Anesthetic Sites on GABA-A Receptors"

Stuart A. Forman, MD, PhD
Professor of Anesthesiology
Department of Anesthesia, Critical Care and Pain Medicine
Massachusetts General Hospital, Boston, MA

4:00 – 4:30 pm, M309

Department of Anesthesiology • 525 East 68th Street, P3
For more information contact: **Michele Steinkamp, RN**
212-746-2953 or mls9004@med.cornell.edu

WELCOME TO THE ANESTHESIOLOGY RESEARCH EXPOSITION

May 11th, 2017

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Department of Anesthesiology Research Divisions

Hugh C. Hemmings, Jr, MD, PhD, FRCA
Joseph F. Artusio Professor and Chair of Anesthesiology

Vinood Malhotra, MD
Vice Chair for Academic Affairs

Kane O. Pryor, MD
Director of Clinical Research

Peter Fleischut, MD
Director of Center for Perioperative Outcomes

Anesthesiology Clinical Research

Kane O. Pryor, M.D. Michele Steinkamp, R.N.

Farrell Cooke, B.S. Sonal Jessel, B.A.

Stephen Marcott, B.S. Matthew Henry, B.S.

Rachel Friedlander, B.A. Jesse Gruber, B.A.

Center for Perioperative Outcomes Research

Peter M. Fleischut, M.D. Zachary A. Turnbull, M.D.

Hugh C. Hemmings, M.D., PhD., F.R.C.A.

Anna Nachamie, B.S. Gregory Giambrone, M.S.

Kane O. Pryor, M.D. Christian Tope, B.S.

Paul Christos, M.S., DrPH. Virginia Tangel, M.A.

Bohdan Hawryluk, M.S. Xian Wu, M.P.H.

Licia Gaber-Baylis, B.A. Gülce Askin, M.P.H.

Akshay U. Bhat, MEng. Dahniel Sastow, B.S.

Laboratory of Molecular Anesthesiology

Hugh C. Hemmings, Jr., M.D., PhD., F.R.C.A.

Karl Herold, M.D., PhD. Jimcy Platholi, PhD.

Zhenyu Zhou, PhD Cheng Zhou, PhD.

Yuko Koyanagi, D.D.S., PhD. Christina L. Bonvicino, B.S.

Kenneth Johnson B.S. Anna Adamo, B.S.

CV Starr Laboratory for Molecular NeuroPharmacology

Paul Riegelhaupt, M.D., PhD.

Diany Paola Calderon, M.D., PhD.

Alessio Accardi, PhD. Peter A. Goldstein, M.D.

Crina Nimigean, PhD. Byoungcheol Lee, PhD.

Mattia Malvezzi, PhD. Philipp Schmidpeter, PhD.

Gareth Tibbs, PhD. Jan Rheinberger, PhD.

Lilia Leisle, Ph.D. Kelly Aromolaran, PhD.

Xiaolong Gao, PhD. Nattakan Sukomon, PhD.

Yuan Xie, Ph.D. Maria Falzone, B.S.

Rebecca Joyce, B.S. Jessica Horvath, B.S.

Latrice Goss, B.S.

High-Speed Atomic Force Microscopy Laboratory

Simon Scheuring, PhD. Martina Rangl, PhD.

Nebojsa Jukic, M.S. Grigory Tagiltsev, *Specialist*

Hirohide Takahashi, PhD. Atsushi Miyagi, PhD.

Laboratory for Computational Anesthesia

Kingsley Storer, M.D., PhD.

Neuromuscular Relaxant Research

John Savarese, M.D.

Global Health

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Sheida Tabaie, M.D.
Melanie Witte, M.D.
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Pediatrics Research

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Cardiac Clinical Research

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Pain Clinical Research

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Farida Gadalla, M.D., ChB.
Klaus Kjaer, M.D., M.B.A.
Jeremy Pick, M.D.
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General Clinical Research

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Eric D. Brumberger, M.D.
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Peter Goldstein, M.D.
Marcus Gutzler, M.D.
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Jaideep Malhotra, M.D.
Vinod Malhotra, M.D.
Matthew Murrell, M.D.
Anup Pamnani, M.D.
Kane Pryor, M.D.
Lori Rubin, M.D.
Mahendra Samaru, M.D.
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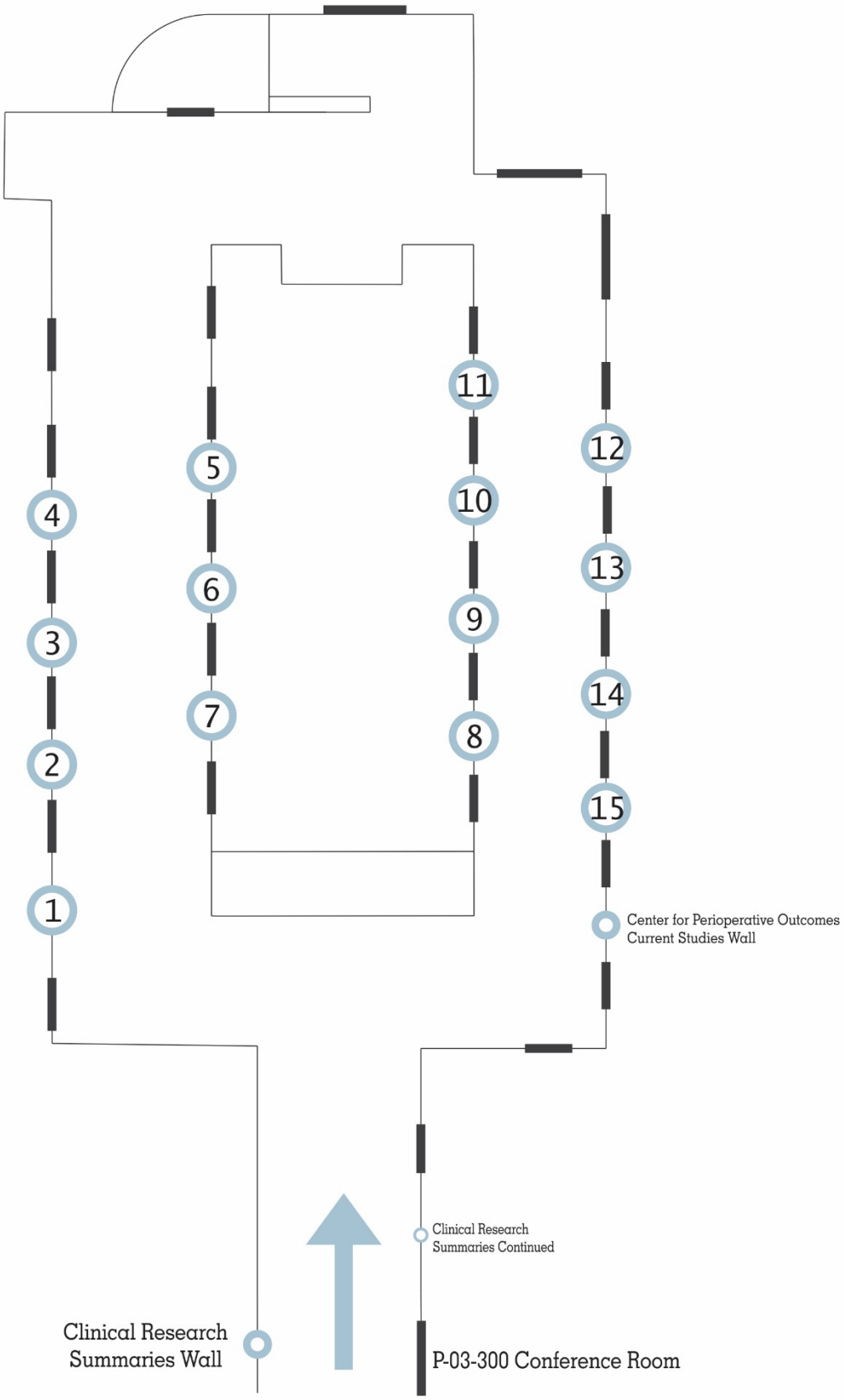
Jacques Scharoun, M.D.
Aarti Sharma, M.D.
Kingsley Storer, M.D., Ph.D.
Kevin Walsh, M.D.
Melanie Witte, M.D.

Regional Anesthesia Research

Tiffany Tedore, M.D.
Eric D. Brumberger, M.D.
Daniel Pak, M.D.
Milica Markovic, M.D.
Minda Patt, M.D.
Angela Selzer, M.D.
Roniel Weinberg, M.D.

P-03 Poster Map



P-03 Poster Map Key

1. NAV SUBTYPES ARE DIFFERENTIALLY LOCATED TO PRE- AND POST-SYNAPTIC SITES IN THE RAT HIPPOCAMPUS
   Authors: KW Johnson, KF Herold, TA Milner, HC Hemmings Jr., and J Platholi

2. IMMEDIATE ANTAGONISM OF CW 1759-50 NEUROMUSCULAR BLOCKADE BY GLUTATHIONE
   Authors: Farrell E. Cooke, B.S., Hiroshi Sunaga M.D., Paul M. Heerdt, M.D., PhD., John J. Savarese, M.D.

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   Authors: Neel Mehta M.D., Daniel Pak, M.D., Jesse Gruber, M.D., Yifan Xu, M.D., Timothy Deer, M.D.

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11. INCREASED MORBIDITY AND MORTALITY OF TOTAL HIP REPLACEMENTS FOR THE UNINSURED AND THE UNDERINSURED
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13. MULTISTATE PERIOPERATIVE OUTCOMES OF CAROTID REVASCULARIZATION: CAROTID ARTERY STENTING VS CAROTID ENDARTERECTOMY
    Authors: Abdullah Rasheed, M.D., Robert S. White, M.D., Tiffany Peng, M.D., Xian Wu, MPH, Licia K. Gaber-Baylis, B.A., Gregory P. Giambrone, M.S., Kane O. Pryor, M.D.

14. DISCREPANCIES BETWEEN DATA FROM AN ANESTHESIA INFORMATION MANAGEMENT SYSTEM AND MANUAL CASE-LOGGING: AN ENDURING THREAT TO DATA QUALITY AND RESIDENT EXPERIENCE
    Authors: Zachary A. Turnbull, M.D., Virginial Tangel, M.A., Dahniel Sastow, B.A., Bohdan Hawryluk, M.S., Kane O. Pryor, M.D.

15. OPIOID PRESCRIBING HABITS AND OPINIONS REGARDING CHRONIC OPIOID THERAPY AT A LARGE ACADEMIC INSTITUTION
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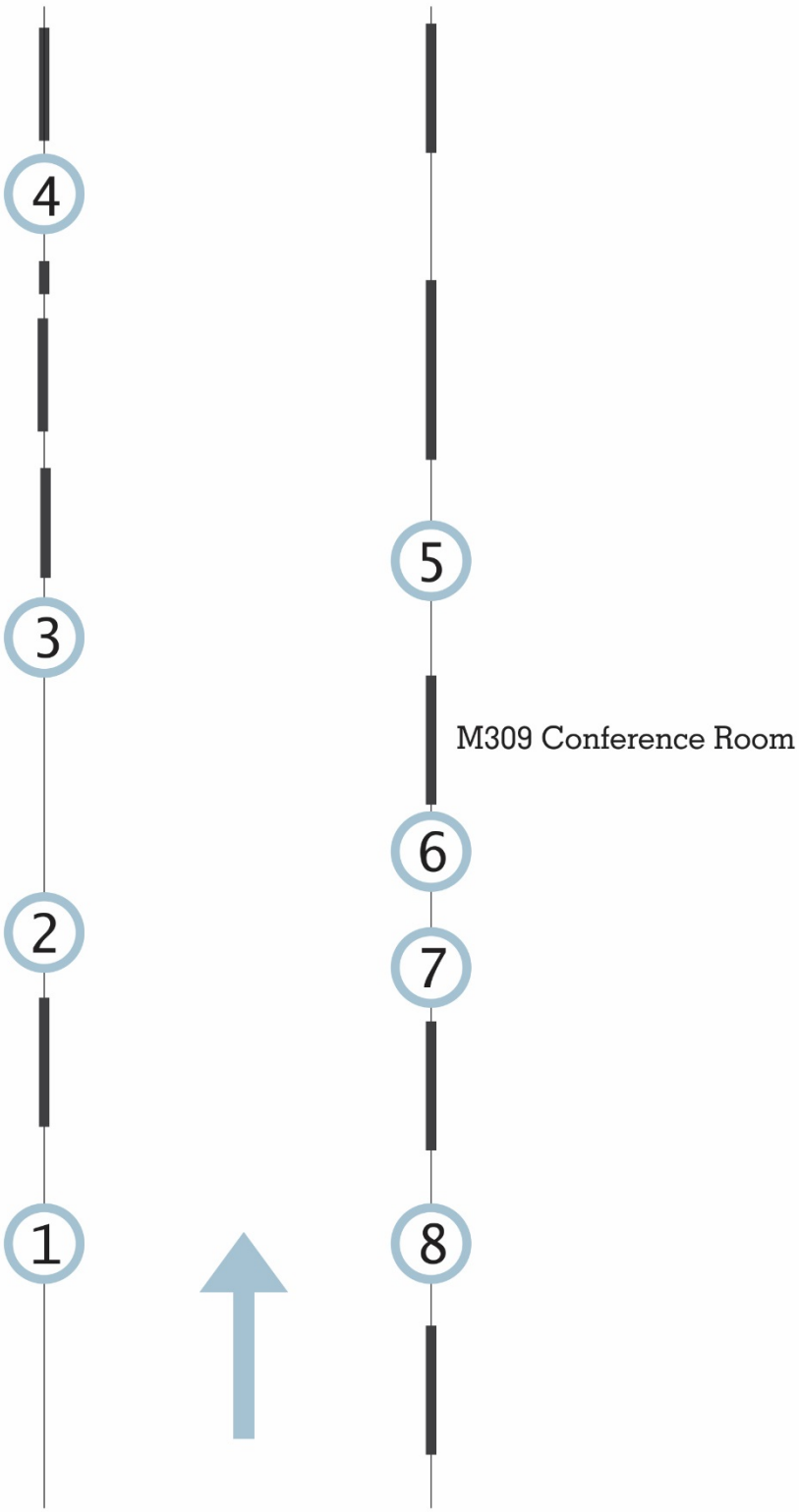
M Corridor Poster Map



M Corridor Poster Map Key

1. SCRAMBLING BY TMEM16 PROTEINS
   Authors: Maria Falzone, Byoung-Cheol Lee, George Khelashvili, Mattia Malvezzi, Harel Weinstein, Anant Memon, Alessio Accardi

2. $GABA_A$ RECEPTOR POTENTIATION PREVENTS LEARNING IN A COMPUTATIONAL MODEL
   Authors: Kingsley P Storer, George N Reeke

3. THE TREK1 TANDOM PORE POTASSIUM CHANNEL: A MOLECULAR SIGNAL INTEGRATOR AND ANESTHETIC TARGET
   Authors: Paul M. Riegelhaupt, Marco Lolicato, Cristina Arrigoni, Kimberly Clark, Daniel L. Minor

4. H-BOND PROPENSITY, MOLECULAR VOLUME AND RING –ELECTONS/PLANARITY DIFFERENTIALLY DETERMING IF PROPOFOL-LIKE MOLECULES ARE INVERSE AGONISTS OF HCN1 CHANNEL OPENEING OR COMPETITIVE ANTAGONISTS THEREOF
   Authors: Rebecca L. Joyce, Nicole P. Beyer, Georgia Vasilopoulos, Adam C. Hall, Roderic G. Eckenhoff, Peter A. Goldstein, and Gareth R. Tibbs

5. GENERAL ANESTHETICS MINIMALLY AFFECT LIPID BILAYER PROPERTIES AT CLINICAL CONCENTRATIONS
   Authors: Herold KF, Sanford RL, Lee W, Anderson OS, Hemmings HC Jr.

6. STRUCTURE AND DYNAMICS OF ENDOCYTOSIS BY HIGH-SPEED STOMIC FORCE MICROSCOPY
   Authors: Grigory Tagiltsev, Frederic Eghiaian and Simon Scheuring

7. MONITORING THE CONFORMATIONAL CHANGES OF INDIVIDUAL CYCLIC NUCLEOTIDE-GATED ION CHANNELS BY HIGH-SPEED ATOMIC FORCE MICROSCOPY
   Authors: Marina Rangl, Atsushi Miyagi, Julia Kowal, Henning Stahlberg, Crina M. Nimigean, and Simon Sheuring

8. IDENTIFICATION OF RESIDUES IMPORTANT FOR ION AND LIPID TRANSPORT IN A TMEM16 SCAMBLASE
   Authors: Byoung-Cheol Lee, George Khelashvili, Maria Falzone, Harel Weinstein, Anant Menon, Alessio Accardi

Research Presented in Anesthesia Conferences, 2016-2017

American Association for Thoracic Surgery (AATS)

1. ARE MINIMUM VOLUME STANDARDS APPROPRIATE FOR LUNG AND ESOPHAGEAL SURGERY?
   Authors: Sebron Harrison, Virginia Tangel, Xian Wu, Licia K. Gaber-Baylis, Gregory P. Giambrone, Jeffrey L. Port, Nasser K. Altorki, Peter M. Fleischut, Brendon M. Stiles

American Pain Society (APS)

1. THE INFLUENCE OF AGE AND GENDER ON OPIOID DOSAGE IN CHRONIC NONCANCER PAIN CLINIC PATIENTS
   Authors: Lisa Witkin, David Zylberger, Neel Mehta, Madeleine Hindenlang, Christopher Johnson, Susan Horn, Charles E. Inturrisi

American Society of Anesthesiologists (ASA)

1. THE IMPACT OF QUANTITATIVE MONITORING ON DOSING AND ANTAGONISM OF RESIDUAL NEUROMUSCULAR BLOCK
   Authors: Anastasia Grivoyannis, M.D., Virginia Tangel, M.A., Christian P. Tope, B.S., Cynthia A. Lien, M.D.

2. WHEN FIBEROPTIC FAILS: BLIND NASAL INTUBATION WITH A STANDARD ORAL ENDOTRACHEAL TUBE AS A RESCURE MEASURE IN A PATIENT WITH DIFFICULT AIRWAY + SYMPTOMATIC CERVICAL MASS
   Authors: Danielle McCullough, M.D., Franklin Chiao, M.D.

3. HEYDE'S SYNDROME: THE RARE CONSTELLATION OF AORTIC STENOSIS, ANGIODYSPLASIA, AND ACQUIRED VON WILLEBRAND DEFICIENCY
   Authors: Selaiman Noori, M.D., Shreyajit Kumar, M.D.

4. PROPOFOL MODULATES THE SENSORY AND INFORMATION THRESHOLDS FOR THE CONSCIOUS DETECTION OF FEAR
   Authors: Kane Pryor, M.D., Anne Blackstock-Bernstein, B.A., Virginia Tangel, M.A., James Root, PhD

5. A SILVER BULLET FOR HEMORRHAGIC SHOCK? THE UTILITY OF THE NOVEL BLOOD PRODUCT, FACTOR EIGHT INHIBITOR BYPASS ACTIVITY (FEIBA)
   Authors: Stephanie Willet, M.D., Daryl W. Banton, M.D., Shreyajit R. Kumar, M.D.

6. UNDIAGNOSED PHEOCHROMOCYTOMA IN A PATIENT UNDERGOING BICEP TENDON REPAIR WITH REGIONAL ANESTHESIA
   Authors: Stephanie Willet, M.D., Stephen C. Haskins, M.D.

7. ANESTHETIC MANAGEMENT OF A PATIENT WITH INTRAPERICARDIAL DIAPHRAGMATIC HERNIA UNDERGOING ROBOTIC-ASSISTED REPAIR
   Authors: Stephanie Willet, M.D., Paul M. Heerdt, M.D.

8. ON THE EDGE OF ECMO: ANESTHETIC MANAGEMENT OF A TRACHEAL FOREIGN BODY IN A CHRONICALLY TRACHED PATIENT
   Authors: Stephanie Willet, M.D., Natalia Ivascu, M.D.

American Society of Echocardiography (ASE)

1. TRANSESOPHAGEAL ECHOCARDIOGRAPHIC IMAGING FOR TOTAL ENDOSCOPIC MITRAL VALVE SURGERY
   Authors: Nikolaos J. Skubas, M.D., F.A.C.C., F.A.S.E., DSc, Christopher W. Tam, M.D., Meghann M. Fitzgerald, M.D., T. Sloane Guy, M.D., M.B.A.

American Society of Regional Anesthesia (ASRA)

1. INCREASED MORBIDITY AND MORTALITY OF TOTAL HIP REPLACEMENTS FOR THE UNINSURED AND THE UNDERINSURED
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International Anesthesia Research Soceity (IARS)

1. EFFECT OF INSURANCE STATUS ON SURGICAL OUTCOMES AFTER COLECTOMIES
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International Neuromodulation Society (INS)

1. DISCREPANCIES IN INTERNATIONAL NEUROMODULATION TRAINING & EDUCATION
   Authors: Neel Mehta, M.D., Daniel Pak, M.D., Jesse Gruber, B.A., Timothy Deer, M.D., Simon Thomson, M.B.B.S.

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1. SPINAL CORD STIMULATOR EDUCATION DURING PAIN FELLOWSHIP: UNMET TRAINING NEEDS AND FACTORS THAT IMPACT FUTURE PRACTICE
   Authors: Neel Mehta M.D., Daniel Pak, M.D., Jesse Gruber, B.A., Yifan Xu, M.D., Timothy Deer, M.D.

New York Academy of Medicine (NYAM)

1. AORTOCAVAL COMPRESSION CAUSING HEMODYNAMIC INSTABILITY IN A MORBIDLY OBESE PATIENT
   Authors: Katherine Arthur, M.D., Jon D. Samuels, M.D.

2. ANESTHETIC MANAGEMENT OF DUODENAL ATRESIA AND AORTO-ENTERIC FISTULA SECONDARY TO VASCULAR PROSTHESIS INFECTION
   Authors: Andrew Fisher, M.D., Jon D. Samuels, M.D.

3. ROTEM®-Guided THERAPY FOR THE PLACENTA PREVIA-ACCRETA PARTURIENT UNGERGOING ELECTIVE CESAREAN-HYSTERECTOMY
   Authors: Danielle McCullough, M.D., Emily Kahn, M.D., Jon D. Samuels, M.D.

4. EPIDURAL HEMATOMA OCCURRING AFTER REMOVAL OF PERCUTANEOUS SPINAL CORD STIMULATOR TRIAL LEADS IN A CANCER PATIENT WITH CHRONIC THROMBOCYTOPENIA
   Authors: Selaiman Noori, M.D., James Yu, B.S., Timothy Connolly, M.D., Amitabh Gulati, M.D.

5. USE OF THE SUPERNO$_2$VA™ DURING PROLONGED INTUBATION IN A MORBIDLY OBESE (MO) PATIENT WITH UNEXPECTED DIFFICULT AIRWAY
   Authors: Catherine Rim, M.D., Jon D. Samuels, M.D.

6. TRACHEAL AGENESIS: A RARE CAUSE OF AIRWAY COMPROMISE IN THE OPERATING ROOM
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7. AIRTRAQ® INTUBATION OF THE PATIENT WITH NECK ABSCESS AND TRISMUS
   Authors: Christopher Sattler, M.D., Ajay Dharmappa, M.D., Jon D. Samuels, M.D.

8. ANESTHETIC MANAGEMENT OF A PEDIATRIC PATIENT WITH OSTEOGENESIS IMPERFECTA TYPE 1
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9. ANESTHETIC CONSIDERATIONS IN A CASE OF CAUDA EQUINA SYNDROME IN THE THIRD TRIMESTER
   Authors: Maria C. Walline, M.D., Farida Gadalla, M.B., Ch.B. Jaroslav Usenko, M.D.

New York State Conference for Anesthesiology (NYSCARF)

1. A CASE OF CENTRAL ANTICHOLINERGIC SYNDROME AFTER DIPHENHYDRAMINE
   Authors: Neeti Arora, M.D., Michael Kiselev, M.D.

New York State Society of Anesthesiologists (PGA)

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   Authors: Jasmit Brar, M.D., Jesse Gruber, B.A., Neel Mehta, M.D.

2. TRANSNASAL SPHENOPALATINE BLOCK FOR TREATMENT OF POSTDURAL PUNCTURE HEADACHE
   Authors: Ajay Dharmappa, M.D., Neel Mehta, M.D.

3. A CASE OF INTRAVENOUS BUPRENORPHINE FOR LAPAROSCOPIC CHOLECYSTECTOMY IN INDIA
   Authors: Jeny Ng, M.D., Milica Markovic, M.D.

4. COGNITIVE RESERVE MEASURES ARE ASSOCIATED WITH REDUCED PAIN INTERFERENCE
   Authors: Robert S. White, M.D., Julie Jiang, B.S., Charles B. Hall, PhD, Mindy J. Katz, M.P.H., Molly E. Zimmerman, PhD, Richard B. Lipton, M.D.

Society of Cardiovascular Anesthesiologists (SCA)

1. INTRAOPERATIVE MANAGEMENT OF PULMONARY HYPERTENSION IN A CARDIAC SURGERY PATIENT
   Authors: John M. Albert, M.D., Nikolaos J. Skubas, M.D., F.A.S.E.

2. UNILATERAL PULMONARY EDEMA DUE TO ACUTE SEVERE MITRAL REGURGITATION
   Authors: Daryl Banton, M.D., Zahra Malik, M.D., Nikolaos J. Skubas, M.D., F.A.S.E, Daniel Lahm, M.D.

3. A FULL LEFT VENTRICLE AT THE ONSET OF BYPASS
   Authors: Corey R. Herman, M.D., Adam Lichtman, M.D., Natalia S. Ivascu, M.D.

4. TRANSESOPHAGEAL ECHOCARDIOGRAPHIC EVALUATION AND GUIDANCE DURING PLACEMENT OF THE LEFT VENTRICULAR PARACHUTE® DEVICE
   Authors: Joshua Kohtz, M.D., Lisa Q. Rong, M.D., Nikolaos J. Skubas, M.D., F.A.S.E

Society for Obstetric Anesthesia and Perinatology (SOAP)

1. ANESTHETIC MANAGEMENT OF PARTURIENT WITH SPINAL MUSCULAR ATROPHY
   Authors: Alaeldin Darwich, M.D., Sharon Abramovitz, M.D.

2. ANESTHETIC MANAGEMENT OF A PARTURIENT WITH SEVERE PREECLAMPSIA AND DIABETIC KETOACIDOSIS FOR EMERGENT CESAREAN SECTION
   Authors: Ajay Dharmappa, M.D., Alaeldin Darwich, M.D., Jon Samuels, M.D.

3. MANAGEMENT OF A PARTURIENT WITH AUTOIMMUNE AUTONOMIC GANGLIONOPATHY
   Authors: Jennifer Landon, M.D., Jaime Aaronson, M.D., Sharon Abramovitz, M.D.

The Society of Critical Care Anesthesiologists (SOCCA)

1. TIA FOLLOWING TAVR SECONDARY TO DYNAMIC LVOT OBSTRUCTION
   Authors: Michael F. Katz, M.D., James A. Osorio, M.D., Christopher W. Tam, M.D.

2. AXILLARY ARTERY CANNULATION DURING VENO-ARTERIAL ECMO FOR RETROGRADE CEREBRAL PERFUSION
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3. MULTISTATE PERIOPERATIVE OUTCOMES OF CAROTID REVASCULARIZATION: CAROTID ARTERY STENTING VS CAROTID ENDARTERECTOMY
   Authors: Abdullah Rasheed, M.D., Robert S. White, M.D., Tiffany Peng, M.D., Xian Wu, MPH, Licia K. Gaber-Baylis, B.A., Gregory P. Giambrone, M.S., Kane O. Pryor, M.D.

4. A CASE OF FATAL CALCIPHYLAXIS
   Authors: Krish Sekar, M.D., James Osorio, M.D.

5. BOVINE HEMOGLOBIN IN PLACE OF HUMAN BLOOD IN JEHOVAH'S WITNESS: A CASE REPORT
   Authors: Gurbinder Singh, D.O., James Osorio, M.D.

6. HYPERKALEMIA MANAGEMENT IN THE ONCOLOGY PATIENT: A CASE OF KAYEXALATE-INDUCED BOWEL PERFORATION
   Authors: Kathleen Sullivan, M.D., Elena Mead, M.D., Meaghen Finan, M.D., Jinru Shia, M.D.

Clinical Posters Presented in Conferences, 2016-2017

American Association for Thoracic Surgery (AATS)

Are Minimum Volume Standards Appropriate for Lung and Esophageal Surgery?

2017 Annual Meeting of the American Association of Thoracic Surgeons

Sebron Harrison, Virginia Tangel, Xian Wu, Licia K Gaber-Baylis, Gregory P Giambrone, Jeffrey L Port, Nasser K Altorki, Peter M Fleischut, Brendon M Stiles | May 2, 2017

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

- Interest exists in whether hospitals who perform "high volumes" of particularly complex surgical procedures have superior outcomes compared to lower volume hospitals.
- Guidelines suggest that low volume centers or surgeons "take the volume pledge" and not perform cases for which their hospital does not meet volume thresholds.[1]
- However, the number of requisite cases that denote "high volume" for lung and esophageal surgery are unclear.
- It is also unclear if volume alone accounts for discrepancies in surgical outcomes, or whether other factors confound this analysis.
- We evaluated multi-state hospital data to determine if yearly hospital volumes of major lung resections and esophagectomies performed each year predict mortality and surgical complications.

Figure 1. Lung resection

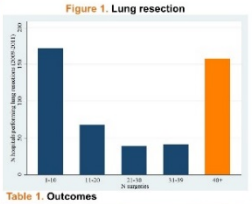

Figure 2: Esophagectomy

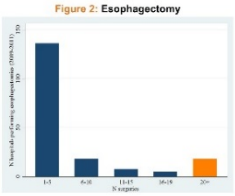

Table 1. Outcomes

	Lung resections				Esophagectomy			
	Propensity score matched		Conditional logistic regression		Propensity score matched		Conditional logistic regression	
	Low volume: 1-39 surgeries/year	High volume: 40+ surgeries/year	OR (95% CI)	P value	Low volume: 1-15 surgeries/year	High volume: 40+ surgeries/year	OR (95% CI)	P value
	n (%)	n (%)			n (%)	n (%)		
Total	6310 (50)	6310 (50)			376 (66.7)	188		
In-hospital mortality	134 (2.1)	113 (1.8)	1.19 (0.93-1.54)	0.17	14 (3.7)	<11		<0.05*
Any cardiovascular complication	1075 (16.9)	1087 (17.1)	0.99 (0.90-1.09)	0.78	118 (31.4)	59 (26.5)	1.28 (0.86-1.91)	0.23
Any pulmonary complication	2224 (35)	2129 (33.5)	1.07 (0.99-1.16)	0.07	156 (37.7)	87 (46.9)	1.16 (0.83-1.62)	0.41
Any infectious complication	313 (4.9)	268 (4.2)	1.16 (1.00-1.46)	0.05	63 (16.8)	32 (17)	0.98 (0.63-1.55)	0.94
Any intraoperative complication	180 (2.8)	181 (2.9)	0.99 (0.81-1.22)	0.96	24 (6.4)	<11	>0.05*	
Presence of any complication	2830 (44.7)	2870 (45.2)	1.02 (0.95-1.09)	0.54	254 (67.6)	110 (62.8)	1.22 (0.90-1.75)	0.27
Length of stay Median[IQR]	5 [4-8]	5 [4-8]	< 0.01*		11.50 (8-16)	12 (9-19)	0.130*	
Total charges adjusted to 2016 dollars Median[IQR]	$82,329 [54,953-126,881]	$76,997 [51,254-104,855]	< 0.01*		$140,849 [99,732-203,377]	$125,882 [77,770-336,590]	0.03	

Methods:

- We utilized inpatient procedures and discharge data from adults using 2009 – 2011 data from California, Florida, and New York from the State Inpatient Databases (SID), Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality[2]. Two analyses were conducted: (1) a comparison between hospitals performing < 40 lung surgeries ("low volume") vs. 40+ lung surgeries ("high volume") each year and (2) a comparison between hospitals performing < 20 esophagectomies ("low volume") vs. 20+ esophagectomies ("high volume") each year.
- The primary outcomes of our study were the rates of in-hospital mortality, the presence of postoperative complications, and hospital length of stay (LOS).
- To account for potential selection bias in the relationship between surgical volume and our outcomes, we applied a propensity score matching analysis. The propensity score is the probability of a patient treated in a high volume hospital given baseline patient demographic and clinical characteristics. Patients were matched 1 to 1 for lung resections and 1 to 2 for esophagectomies.

Results

Lung resection (lobectomy/pneumonectomy)

- Total of 20,138 lung resections: 12,432 (61.7%) were performed at low volume hospitals
- Low volume hospitals had significantly higher in-hospital mortality (2.2% vs. 1.7%, p = 0.01), postoperative complications (45.5% vs. 42.7%, p<0.01), median LOS (6 days [4,9] vs. 5 days [4,7], p < 0.01), and median total hospital charges ($99,097 [$64,846, $150,996] vs. $68,164 [$50,307, $99,729], p < 0.01).
- However, patients operated on at low volume hospitals were older, more likely to be non-white, live in a low income ZIP code, insured by Medicare or Medicaid, and have COPD.
- In a propensity-matched analysis, there was no independent effect of volume on in-hospital mortality, but significant differences in LOS and total charges remained the same; high volume hospitals had lower LOS and total charges (**Table 1**).

Esophagectomy

- Total of 1,324 esophagectomies: 1,087 (82.1%) were performed at low volume hospitals
- No volume effect on in-hospital mortality or median LOS, but low volume hospitals had higher presence of complications (67.8% vs. 60.3%, p=0.02) and median total charges ($178,950 vs. $100,364, p<0.01)
- Patients at low volume hospitals were more likely to be non-white, insured by Medicare or Medicaid, have more comorbidities, and have higher rates of weight loss and anemia after surgery.
- In a propensity-matched analysis, hospital volume was not associated with mortality, postoperative complications, or LOS, although low volume hospitals had higher charges (**Table 1**).

Conclusions

- Most patients undergo lung and esophageal cancer resection at hospitals classified as "low volume" by current recommended guidelines.
- The proposed volume standards for lung and esophageal surgeries are not associated with differences in mortality or complications in this database, although high volume hospitals may have lower charges for both procedures and a shorter length of stay for lung resections.

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American Pain Society (APS)

The Influence of Age and Gender on Opioid Dosage in Chronic Noncancer Pain Clinic Patients

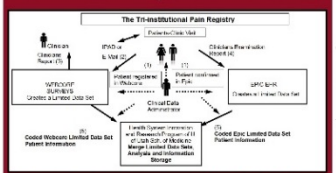
Lisa Witkin[1], David Zylberger[1], Neel Mehta[1], Madeleine Hindenlang[2], Christopher Johnson[3], Susan Horn[3] and Charles E. Inturrisi[2]

Departments of Anesthesiology[1] and Pharmacology[2], Weill Cornell Medical College, NY, NY and the Health System Innovation and Research Program[3], University of Utah School of Medicine, Salt Lake City, UT

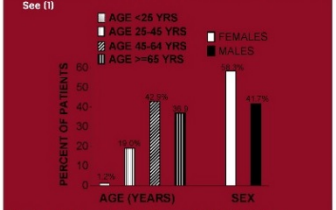
Weill Cornell Medicine
NewYork-Presbyterian

Introduction

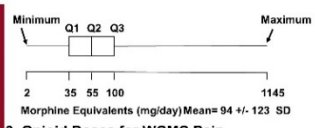
The Weill Cornell Medical College (WCMC) Pain Registry database contains patient characteristics, treatments, and outcomes on 1159 chronic pain patients who were seen at the WCMC Pain Medicine outpatient clinic from Nov 1, 2010 – Dec 12, 2014. The Registry is part of a tri-institutional comparative effectiveness project aimed at identifying patient characteristics and treatments that are associated with better or worse outcomes. Data collection and analysis are described below.



1. Data collection & creation of the TPR Database



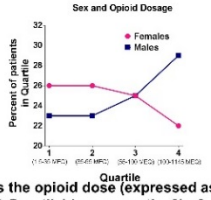
2. Age & Sex distribution of WCMC Pain Registry patients



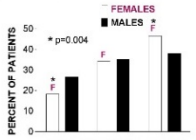
3. Opioid Doses for WCMC Pain Registry Patients

Variable	Opioid Ordered Yes/No Odds ratio	P value	Ordered MEQs Beta (95% CI)	P value
Sex: Male vs Female	1.60*	0.0067	39.0	0.0178

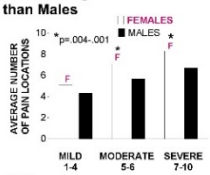
4. Regression analysis at the encounter level revealed that being male (M) was associated with greater likelihood of an opioid ordered than being female (F). Also, males have significantly higher opioid MEQs ordered (39 more MEQs on average) than females.



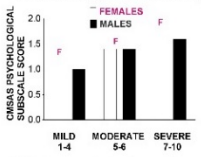
5. As the opioid dose (expressed as MEQ Quartile) increases, the % of females receiving the higher doses decreases while the % males receiving the higher doses increases.



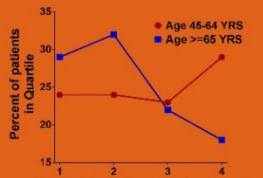
6. Females report lower % Mild Pain and higher % Severe Pain than Males



7. Females report more Pain Locations compared to Males at each Average Pain Intensity.



8. Females do not report significantly more Psychological Distress than Males-although trend is for Females to report more Distress.



9. As the opioid dose increases, the % of patients age 45-64 receiving the higher doses increases while the % of patients age >=65 receiving the higher doses decreases.

Conclusions

We are beginning to identify some of the phenotypes (e.g., age, gender, opioid dosage) that influence the pain management outcomes of both noncancer and cancer chronic pain clinic patients (see poster 386). Our Registry provides a unique opportunity to learn how to treat these phenotypes to improve individualized chronic pain management.

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American Society of Anesthesiologists (ASA)

The Impact of Quantitative Monitoring on Dosing and Antagonism of Residual Neuromuscular Block

2016 Annual Meeting of the American Society of Anesthesiologists

Anastasia Grivoyannis, M.D., Virginia Tangel, M.A., Christian P. Tope, B.S., Cynthia A. Lien, M.D. | 25 October 2016

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

A significant number of patients who receive neuromuscular blocking agents arrive in the PACU with residual paralysis.[1] While routine monitoring of depth of neuromuscular block may decrease the incidence of residual neuromuscular blockade, it is not routinely performed.[2] Anesthesia providers frequently rely on clinical signs of recovery of strength, which are not reliable. Even when using a qualitative monitor, accurate interpretation of the response to train of four (TOF) stimulation is not guaranteed when the train of four count (TOFC) is less than four and when the train of four ratio (TOFR) is between 0.40 and 0.90. These are the limitations in qualitative monitoring. Once the TOFR exceeds 0.40, most clinicians cannot detect the presence of fade with either visual or tactile evaluation of the response to stimulation.[1]

The current standard of acceptable recovery of strength is a TOFR of at least 0.90 as measured at the adductor pollicis. Of the available quantitative monitors, the acceleromyograph is used most commonly in the operating room **(Figure 1)**. While national guidelines do not exist, monitoring depth of neuromuscular block is now part of the Anesthesiology Performance Improvement and Reporting Exchange (ASPIRE) guidelines.[3] As quantitative twitch monitors are becoming better integrated with other monitors in the operating room, and recognition of the risk of residual paralysis is better appreciated, anesthesiology departments are increasingly making them available for use.

This study aimed to determine if use of acceleromyography (AMG) monitoring:

1. **changed the intraoperative dosing of NMBAs**
2. **affected the time interval between NMB reversal agent administration and extubation**
3. **resulted in a greater number of patients with recovered muscle strength upon extubation, as measured by oxygen saturations in the Post-Anesthesia Care Unit (PACU).**

Table 1. Case characteristics

Variable	Overall TOF (N=719)	Other monitor of NMB (N=614)	P
# of cases by resident/CRNA	32 (11)	30 (10)	
Patient ASA status	3 [2-3]	3 [2-3]	0.045
Weight (kg)	77.86 (19.8)	77.59 (21.3)	0.42
Duration of anesthesia (min)	198 [150-282]	177 [126-250]	<0.01
# of times monitor use recorded during case	3 [1-5]	2 [1-4]	0.05
Only volatile anesthetic received (vs. balanced or TIVA) (%)	340 (47.3%)	343 (55.9%)	<0.01
TOFC when last dose of blocking agent was administered	4 [2-4]	4 [2-4]	0.74
TOFC when reversal agent was administered	4 [4-4]	4 [4-4]	0.45
TOFC before extubation	4 [4-4]	4 [4-4]	0.09

Table 2. Selected Outcome Measures

	AMG (N=719)	Other monitor of NMB (N=614)	P
Total rocuronium (mg/kg)	0.93 (0.54)	0.85 (0.45)	0.39
Total vecuronium (mg/kg)	0.13 (0.07)	0.14 (0.08)	0.35
Total cisatracurium (mg/kg)	0.06 (0.03)	0.06 (0.03)	0.81
Last dose of reversal agent to extubation (min)	17.86 (15.0)	18.45 (13.2)	0.49
No O_2 support provided upon PACU arrival (%)	282 (39.2%)	231 (37.6%)	0.45

Mean (SD), median [IQR], or N (percentage) reported, as appropriate.

References

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2. Naguib, M., et al. (2010). "A survey of current management of neuromuscular block in the United States and Europe." Anesth Analg **111**(1): 110119.
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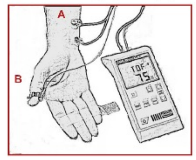
Figure 1. Acceleromyography (AMG) setup



- Two electrodes (**A**) are placed above the ulnar nerve.
- Response to nerve stimulation is measured using a piezoelectrode acceleration transducer (**B**) distally placed on the volar aspect of the thumb.

Methods

Sampling

All general anesthetics at NYP/WCMC in 2013 (N=15,475) & 2014 (N=15,149)

Monitor	N
AMG	N=5,273
Another NM monitor	N=16,137
No NM monitor (excluded)	N=9,194

The sample was limited further to cases:

- that obtained measurements from stimulation of the ulnar nerve (N=7,291)
- age 18 or older (N=6,602)
- no missing value for gender (N=6,601)

To account for variations in provider utilization of the AMG monitor, the final sample contained N=719 AMG cases and N=614 cases using another NM monitor, resulting in a total sample size of **N=1,333**.

Statistical Analysis

- Descriptive statistics
- Wilcoxon rank sum tests
- Propensity score adjustment in multivariable regression models
- Hierarchical mixed modeling

Results & Conclusions

The use of an AMG monitor did not impact the amount of rocuronium nor vecuronium given (p = 0.39 and p = 0.35, respectively) (Table 2)

- When controlling for frequency of use, duration of anesthesia, ASA status, emergency case, CPT classification, age, and provider, multivariate models did not show an effect of the AMG monitor in clinician dosing in any NMBA (not shown).

There were no significant differences in time interval between NMB reversal agent administration and extubation nor in those requiring oxygen supplementation upon PACU arrival (Table 2)

- Reversal of NMB at a TOFC (4/4) reflects conservative practice and may reflect bias introduced by training received by clinicians during Grand Rounds in anticipation of getting the new monitors.

The use of AMG did not affect the likelihood of the patient entering the PACU breathing unassisted (p = 0.45) (Table 2)

- This study may not have been designed to detect a true effect of AMG use on recovered muscle strength in PACU. For example, we did not look at O_2 use over time (weaning vs. escalation) in the PACU.

The frequency of use of the NM monitor was strongly predictive of a higher dose of rocuronium: an additional 0.06 mg/kg (p < 0.01) and vecuronium: an additional 0.01 mg/kg (p < 0.01) *(not shown)*

- Hierarchical mixed models showed evidence of increased *vigilance* (increased frequency of use of any NM monitor) being associated with differences in NMB dosing.

When Fiberoptic Fails: Blind Nasal Intubation with a Standard Oral Endotracheal Tube as a Rescue Measure in a Patient with Difficult Airway + Sympomatic Cervical Mass

Danielle McCullough MD and Franklin Chiao MD

Department of Anesthesiology, New York Presbyterian Hospital-Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Case

52M with HTN and untreated OSA complaining of paresthesia in all four limbs at rest scheduled for resection of spinal cord mass.

PMH: Acute onset upper extremity(UE) paresthesia in 2004 while standing in an elevator.

- Underwent anterior cervical decompression and fusion C6-8 in 2011 with some improvement in symptoms.
- 1 year prior to admission patient experienced worsening of UE paresthesia and numbness of medial fingers bilaterally
- 2015 Cervical spine MRI notable for:
  - Intramedullary nodular enhancement at C6-C7 and cyst formation consistent with ependymoma
  - DJD and congenital narrowing of the canal with moderate stenosis at C3-4 and C4-5
- Neurological exam:
  - Decreased strength 3/5 left hand intrinsics (C8-T1 distribution)
  - Decreased DTRs in bilateral upper extremities
  - Trace DTRs at ankles

Preoperative evaluation was notable for a 95 kg patient with thick neck (> 17 inches), redundant soft tissue of the face, Mallampati IV and severely limited ROM of the neck. Patient denied history of awake or difficult intubation in prior surgery.

Intraoperative Course

- Asleep fiberoptic intubation with succinylcholine planned to minimize neck movement
- Mask ventilation accomplished with two practitioners and williams airway
- Poor visualization of cords on two attempts due to redundant soft tissue; subsequent attempts performed without paralysis
- Unable to pass oral ETT with McGrath 3.0/4.0 blade and gum elastic bougie due to collapse of soft tissue around cords despite grade 2 view
- Blind nasal intubation successful with 7.5 oral ETT; confirmed by fiberoptic bronchoscopy

Postoperative Course

- Successful extubation after confirmation of air leak
- Minor epistaxis; hemostasis achieved with nasal packing
- Initial b/l LE weakness that improved to full strength prior to discharge
- Discharged to acute rehab POD 6

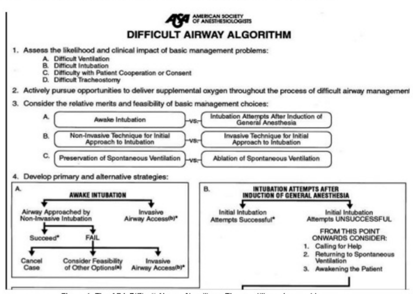


Figure 1: The ASA Difficult Airway Algorithm. The practitioner is urged to consider waking the patient after failed intubation under general anesthesia.

Figure 2: Blind nasal intubation anatomical view[4].

Figure 3: Sagittal T1 image of cervical ependymoma in our patient. The mass is located at precisely the level of neck manipulation for intubation.

Discussion

We describe the case of a difficult airway in which nasal intubation was used as a successful contingency when fiberoptic bronchoscopy failed. Although recent analyses have shown traditional bedside tests to have poor sensitivity in predicting the difficult airway, authors have acknowledged that predictors are more useful in combination.[1] This emphasizes the need for self-reliance and careful clinical inspection in airway evaluation.

This patient had a limited cervical range of motion due to symptomatic cord compression in addition to a difficult airway; backup management plans in the event of fiberoptic failure thus required maintenance of neck neutrality. The fiberoptic bronchoscope has long been known as the "gold standard" for intubation in both cervical spine injury and in known difficult intubations,[2,3] however this case highlights the importance of devising additional airway management strategies in the event of unfavorable anatomy or even equipment failure.

Video laryngoscopes such as the McGrath® or Glidescope® are useful in maintaining head and neck neutrality and can be used alongside adjuncts such as the gum elastic bougie, but did not aid in endotracheal intubation in this case.

As succinylcholine was used to facilitate the initial intubation attempt, the patient regained a spontaneous respiratory drive during the multiple subsequent attempts, which aided in mask ventilation but hindered passing the endotracheal tube due to a (likely OSA-mediated) collapse of soft tissue surrounding the larynx with each exhalation.

A third practitioner called to the room during the first failed attempt was able to blindly pass the oral endotracheal tube via the nare, confirming placement with fiberoptic visualization. Minimal bleeding of the nare and no bleeding of the oropharynx were observed.

Conclusions

Often, emergencies relegate careful planning to the wayside (securing the airway might trump maintaining neck neutrality, for example), but nasal intubation overcomes many problems of the difficult airway (e.g. small mouth opening, limited cervical range of motion, anterior airway), can be performed "blindly" or with fiberoptic guidance, and can be done during spontaneous respiration when necessary. Despite using an oral endotracheal tube through the nasal route, intubation was successful and did not result in nasal trauma.

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Heyde's Syndrome: The Rare Constellation of Aortic Stenosis, Angiodysplasia, and Acquired Von Willebrand Deficiency

2016 Annual Meeting of the American Society of Anesthesiologists

Selaiman Noori, MD and Shreyajit Kumar, MD| October 24, 2016

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

- Degenerative aortic stenosis (AS) prevalence of 2-7% after age 65 years.
- Angiodysplasia is the second leading cause of lower GI bleeding in patients over 60 years.
- The constellation of angiodysplasia, AS, and acquired type 2A von Willebrand disease (vWD-2A) was described in 1958 by Edward Heyde (Figure 1).

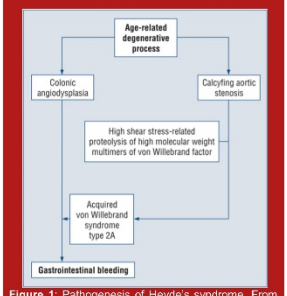

Figure 1: Pathogenesis of Heyde's syndrome. From Gola and Lelonek. Cardiol J 2010.

Case Report:

79M presented with six-week history of increasing dyspnea on exertion. His medical history included hypertension, COPD, and recurrent GI bleeding. Prior workup for GI bleeding included colonoscopy and cauterization of angiodysplasia.

Labs: Hgb 4.5 g/dL, Hct 15.2%, platelets 349 x 103/uL, Cr 0.70 mg/dL, troponin I 0.135 ng/mL, and BNP 1267 pg/mL. ECG was normal sinus rhythm and suggestive of left ventricular hypertrophy. TEE showed moderately reduced left ventricular systolic function with LVEF of 41%, severe AS, aortic valve area 0.7 cm2 and mean gradient 53 mm Hg (Figure 2). Coagulation studies showed prolonged platelet function analyzer (PFA-100) closure time, reduced ristocetin cofactor activity, and absence of HMW multimers of vWF, consistent with vWD-2A.

The patient underwent transcatheter aortic valve replacement (AVR) and was discharged eight days later following an uneventful periprocedural period. At six-month follow-up, there were no further episodes of GI bleeding, dyspnea had resolved, and LVEF increased to 63%. Follow up coagulation study showed no deficit of HMW multimers of vWF.

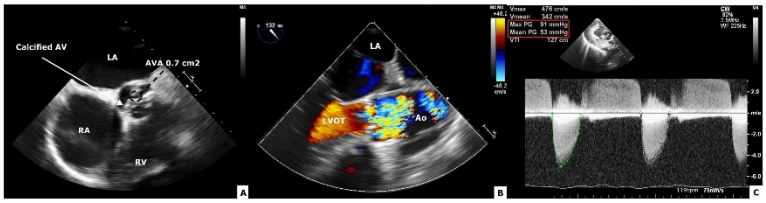

Figure 2: TEE shows (A) severe AS with heavily calcified aortic valve (AV) and aortic valve area (AVA) of 0.7 cm^2; (B) turbulent flow across the narrowed AV; and (C) mean aortic valve gradient of 53 mm Hg. RA = right atrium, LA = left atrium, RV = right ventricle, LVOT = left ventricular outflow tract, Ao = aorta.

Discussion

- Proving an association between AS and angiodysplasia is challenging because both entities are common in older patients.
  - The most convincing link is a deficiency of HMW multimers of vWF (Figure 1).
- Other possible factors: mucosal ischemia, cholesterol embolization, and acquired platelet dysfunction.
- Presence of angiodysplasia should alert the physician to possible aortic valve disease, and Heyde's syndrome should be included in the differential for GI bleeding in which the cause is unclear.
- Sensitivity of tests for vWD-2A: gel electrophoresis > PFA-100 closure time > risocetin factor > bleeding time > vWF antigen.
- AVR improves coagulation abnormalities and provides long term resolution of symptoms in up to 95% of AS patients with GI bleeding due to angiodysplasia.
- Other treatment options (though less effective): endoscopy, selective embolization, and bowel resection.
  - Systemic modalities (e.g., desmopressin, octreotide, supplementation of vWF or factor VIII) are usually ineffective for vWF-2A.

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Propofol Modulates the Sensory and Information Thresholds for the Conscious Detection of Fear

Kane Pryor, MD, Anne Blackstock-Bernstein, BA, Virginia Tangel, MA, James Root, PhD

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Weill Cornell Medicine
NewYork-Presbyterian

Unconscious Fear Processing

Substantial evidence suggests that fear and threat can be detected in the absence of awareness or attention. Neuroimaging studies implicate amygdala-dependent mechanisms. The effects of anesthetic drugs on these unconscious processes are unknown.

Using Subliminal Detection Methods

Subliminal detection procedures are an established and informative technique for evaluating subconscious processes. The methodologic advantage is that they enable a conscious subject to provide behavioral responses that demonstrate processing of the subconscious stimuli.

Threshold of Consciousness

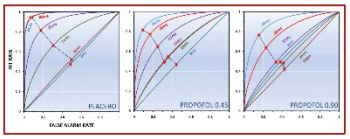
Alteration of stimuli properties in the subliminal masking technique also enables evaluation of the minimal attributes necessary for conscious detection. The effects of anesthetics on the threshold of conscious detection are unknown.

Aim 1: To determine the effect of low doses of propofol on the unconscious detection of fearful information

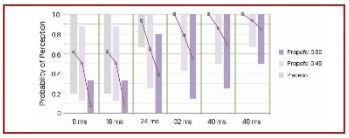
Aim 2: To determine the effect of low doses of propofol on the threshold exposure duration necessary for conscious perception

Aim 3: To determine whether any effects detected in Aims 1 and 2 can be dissociated from drug-induced sedation

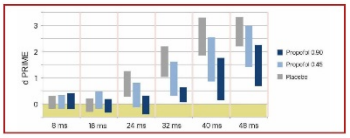
1 | Imputed ROC Curves



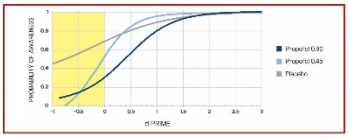
3 | Probability of Sensory Awareness



2 | Bootstrap 95% CI for Discrimination (d')



4 | Information Discrimination vs Sensory Awareness



Subjects and Dosing

61 healthy subjects

Placebo	(N = 21)
Propofol 0.45 μg·mL^{-1}	(N = 20)
Propofol 0.90 μg·mL^{-1}	(N = 20)

Covariates

Sedation (2 observers | self-report)
Spielberger State-Trait Anxiety
Hours Sleep
Age | Gender

Paradigm

Backward masking | Subject informed
Prime | Ekman Faces (fear/happy)
Mask | Abstracted Chinese ideographs
Forced choice | *Nominate prime as fear/happy*
Question | *Conscious perception of prime?*
Sequence | 6 blocks • 28 items/block • random

Analysis

Signal detection analysis | YN detection task
Random and mixed effects | logistic models
Bias corrected/accelerated (BC_a) bootstrap

Propofol modulates the threshold attributes necessary for information detection (Figs 1, 2)

Propofol had dose-related effects on the duration of exposure required before information from the prime could be detected

Propofol also alters the attributes necessary for sensory awareness (Fig 3)

Propofol had strong dose-related effects on visual sensory awareness (independent of information detection), especially at shorter exposure durations

Effects on information detection and sensory awareness are not explained by sedation

Hierarchical mixed effects models showed that d' and probability of sensory awareness were both predicted by strong interactive effects of drug and prime duration, but in both cases there was no independent effect of sedation or other covariates of interest

Effects on information detection and sensory awareness are partially dissociable (Fig 4)

Sensory awareness predicts information detection (d') in all states, but there is a strong interaction effect with drug ($Z = 3.681$, $P < 0.001$)

Propofol modulates the threshold for both sensory awareness and information detection of fear, through mechanisms that are dissociable from its sedative effects

Propofol modulates the relationship between sensory awareness and information detection, suggesting dissociable effects on visual and information processing

A Silver Bullet for Hemorrhagic Shock? The Utility of the Novel Blood Product, Factor Eight Inhibitor Bypass Activity (FEIBA)

Weill Cornell Medicine

Stephanie L. Willet, MD[1], Daryl W. Banton, MD[1], Shreyajit R. Kumar, MD[1]
[1] Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Introduction:

- **Factor Eight Inhibitor Bypassing Activity (FEIBA)** is an activated PCC product containing four coagulation factors (activated VII, inactive II, IX & X)
  - Only activated PCC product available in the United States
- **FDA-approved for spontaneous bleeding** in patients with Hemophilia A, Hemophilia B, and patients with coagulation factor inhibitors[1]
  - *Off-label use* as an **anticoagulant-reversal** agent[2]

Case Report:

- 77 year-old male with CML, undergoing hematologic workup for factor inhibitors, presented to the ICU for dyspnea and pleural effusion.
- A pigtail catheter placed into the right pleural space did not yield fluid return nor relieve symptoms.
  - TPA was administered through the catheter in an attempt to clear potential clot.
- Patient immediately hemorrhaged 3 liters of blood and emergently underwent a VATS, thoracotomy and decortication.
- Systemic TPA toxicity was suspected, and severe coagulopathy and bleeding continued postoperatively.
  - Massive transfusion protocol was implemented without improvement.
- FEIBA (S7,500/vial) was then administered with cessation of bleeding, improved coagulation profile, and resolution of hemorrhagic shock.

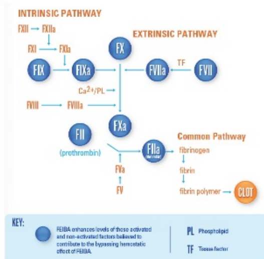


Figure 1: FEIBA contains mainly non-activated factors II, IX, X and activated factor VII. It contains approximately equal unitages of factor VIII inhibitor bypassing activity and prothrombin complex factors.[2]

Figure 2: FEIBA is the only activated PCC product available in the United States, manufactured by Baxter

Table 1 Average Wholesale Prices of Available PCCs, Activated PCCs, and Recombinant Factor VIIa in the U.S.

Brand Name	Product Content Type	Average Wholesale Price
Novoseven	Recombinant factor VIIa	$1.64/mcg
Novoseven RT	Recombinant factor VIIa	$2.06/mcg
FEIBA VH	aPCC	$2.17/IU
FEIBA NF	aPCC	$2.17/IU
Bebulin VH	Three-factor PCC	$1.14/IU
Profilnine SD	Three-factor PCC	$1.19/IU
Kcentra	Four-factor PCC	$2.17/IU

aPCC = activated prothrombin complex concentrate; FEIBA NF = factor eight inhibitor bypassing activity, nanofiltered; FEIBA VH = factor eight inhibitor bypassing activity, vapor-heated; PCC = prothrombin complex concentrate; RT = recombinant; SD = solvent detergent.
Data from *Red Book*, June 14, 2013.

Figure 3: Average wholesale prices of available PCCs, activated PCCs, and Recombinant Factor VIIa in the United States.

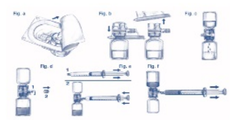


Figure 4: Manufacturer's package insert demonstrating FEIBA's reconstitution. The powder is in a vacuum sealed container at the bottom. The top bottle is a sterile water diluent, which is drawn into the vial when the spiking device is applied. The reconstituted FEIBA can be then drawn out via a syringe.

Conclusions:

- Therapeutic anticoagulation must strike a fine balance between reducing hemorrhage and avoiding thrombosis.
- Emergent reversal of anticoagulants is necessary when hemorrhagic shock occurs.
  - However, there has not been a specific antidote developed for dabigatran and rivaroxaban reversal. Thus, FEIBA, has been recruited off label for this purpose.
- FEIBA is associated with a significantly faster correction of supratherapeutic INR secondary to warfarin, when compared to FFP.
- The dose for severe hemorrhage is 50-100 units/kg, administered at 12 hour intervals.
  - Maximum injection rate must not exceed 2 units/kg/minute.
- Cost considerations cannot be overlooked. The average wholesale price for FEIBA is $2.17/IU.
  - For our 75 kg patient, each dose of FEIBA (3,400 units) totaled $7,378.
- There is an inherent risk of thrombosis:
  - FEIBA does not carry any anticoagulants (Heparin, Protein C, Protein S)
  - 4 to 9 thrombotic events occur for every 100,000 infusions[4]
- Adverse reactions include anaphylaxis, myocardial infarction, DIC, and embolic strokes.

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Undiagnosed Pheochromocytoma in a Patient undergoing Bicep Tendon Repair with Regional Anesthesia

HOSPITAL FOR SPECIAL SURGERY
Weill Cornell Medicine

Stephanie L. Willet, MD[1], Stephen C. Haskins, MD[2]
[1] Department of Anesthesiology, Weill Cornell Medical College, New York, NY; [2] Department of Anesthesiology, Hospital for Special Surgery, New York, NY

Introduction:

- **Pheochromocytoma** is associated with an extremely unpredictable and volatile clinical course during anesthesia and surgical intervention.
- Clinical difficulties and challenges increase exponentially in patients with **undiagnosed or accidental diagnosis** of pheochromocytoma, where mortality can reach up to 50%.[1]
- Perioperative course & anesthetic management have rarely been reported in patients undergoing **regional anesthesia**.

Case Report:

- A 49 year-old healthy male presents for biceps tendon repair with one previous episode of severe headache.
- ***Intra-op:***
  - **Infraclavicular block (ICB)** with 30mL 0.25% Bupivacaine and Propofol infusion were administered.
    - ICB provided sensory, however no motor block.
  - Patient became **hypertensive** to 210/110 and **bradycardic** with agonal respirations.
    - **Labetalol & Hydralazine** were given to achieve a systolic BP below 180.
- ***Post-op:***
  - An **arterial line** was placed and **Nitroprusside** infusion initiated in PACU.
  - **Nicardipine** was substituted for refractory hypertension and chest pain.
  - Pt was transferred to the **surgical intensive care unit** for further work-up.

Intraoperative Hypertensive Crisis *(SBP >180 or DBP >110 mmHg):*

- **Causes** should first be sought and treated
- **Monitoring:**
  - Arterial catheter
  - Possible central venous or pulmonary artery catheter if evidence of LV dysfunction or other end-organ damage
  - Possible transesophageal echo or point of care ultrasound to evaluate cardiac function and intravascular volume status
- **Pharmaceutical intervention:**
  - Antihypertensives
  - Deepen anesthesia via intravenous or volatile anesthetic
  - Maintain MAP within 20% of pre-operative level

Causes of Intraoperative Hypertension
Painful Stimulation
Light Anesthesia
Hypoxia
Hypercarbia
Hypothermia
Hypervolemia
Increased Intracranial pressure
Overdistended bladder
Iatrogenic vasopressors
Emergence delirium
Withdrawal of antihypertensive medications
Preoperative hypertension
Pheochromocytoma

Agent	Initial dose	Onset of action	Duration of action
Esmolol	250–500 µg/kg (followed by 25–50 µg/kg/minute in CI)	1 minutes	10–20 minutes
Labetalol	20 mg	2–5 minutes	6 hours
Clevidipine	0.5 µg/kg/minute (CI)	2–4 minutes	5–15 minutes
Nicardipine	1 mg or 5 mg/hour (CI)	2 minutes, 5–15 minutes	2–4 hours, 4–6 hours
Nitroprusside	0.5 µg/kg/minute (CI)	Immediate	1–2 minutes
Nitroglycerin	5 µg/min (CI)	2–5 minutes	3–5 minutes
Clonidine	150 µg	30 minutes	4–6 hours
Urapidil	25 mg	2 minutes	4–5 hours
Enalaprilat	0.625–1.25 mg	15 minutes	6 hours
Fenoldopam	0.1 µg/kg/minute (CI)	5 minutes	30–60 minutes
Hydralazine	3–20 mg	5–15 minutes	6–12 hours

Figure 1: Parenteral antihypertensive agents for treatment of perioperative hypertension.[3]

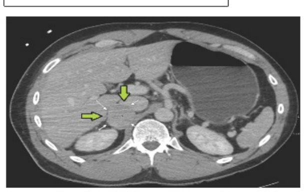

Figure 2: CT abdomen & pelvis (transverse plane) illustrating a large 4 cm adrenal mass (image courtesy of Dr. Rothsburg, Weill Cornell Medical College, Department of Radiology).

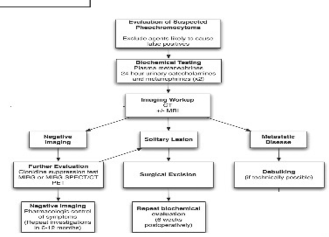

Figure 3: Post-operative algorithm for diagnosing pheochromocytoma.[4]

- ***Post-op:***
  - **CT abdomen/pelvis** revealed an adrenal mass.
  - **Urinary catecholamines** confirmed pheochromocytoma.
  - **Echocardiogram** showed left ventricle hypokinesis (NSTEMI).
    - Underwent left heart catheterization without findings of obstructive CAD
  - Patient then underwent an uncomplicated **laparoscopic adrenalectomy** 3 weeks later.

Conclusions:

- **Management** of pheochromocytoma requires:
  - Advanced clinical knowledge and skills
  - Thorough pre-operative preparation
  - Set-up for advanced surgical and anesthetic interventions
  - Post-operative resuscitation facilities including an intensive care unit
- Of these skills, **high clinical suspicion and early intervention** by the anesthesiologist remain the most important factors in the identification and management of an undiagnosed pheochromocytoma.
- **Excessive intraoperative hypertension & tachycardia *uncontrolled*** by standard treatment should be considered to be a pheochromocytoma. [2]
- As in our case, **prompt control of hypertension, heart rate & arrhythmias with adequate volume expansion** is paramount for reducing mortality & morbidity.

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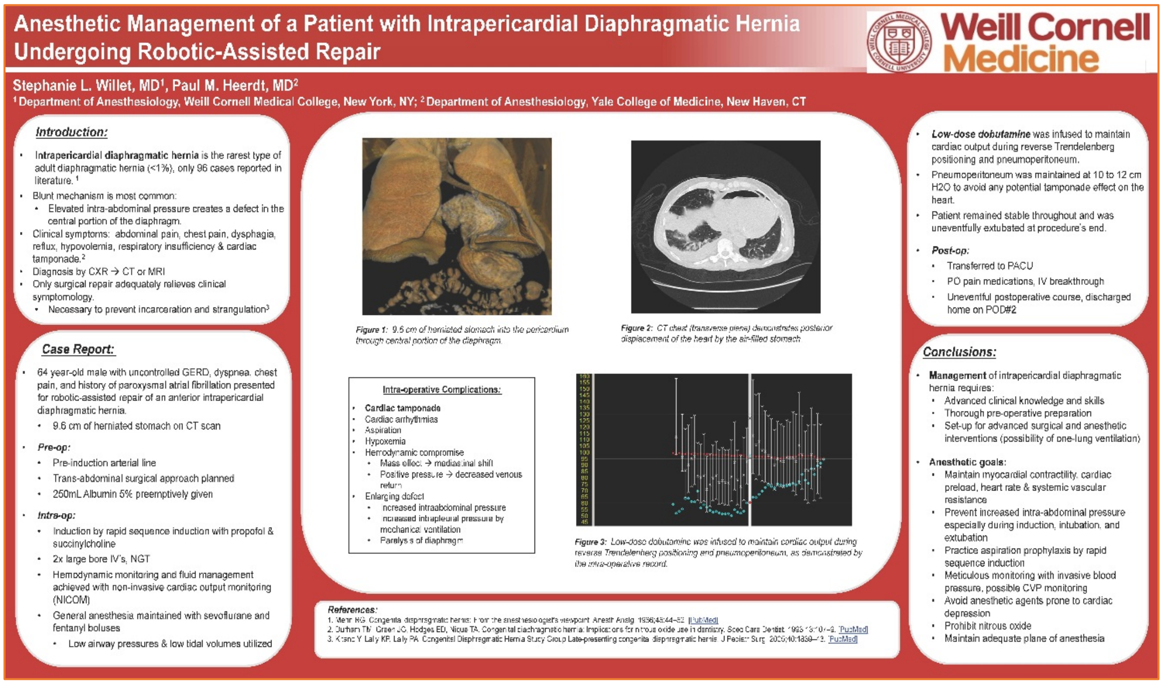
Anesthetic Management of a Patient with Intrapericardial Diaphragmatic Hernia Undergoing Robotic-Assisted Repair
Weill Cornell Medicine
Stephanie L. Willet, MD1, Paul M. Heerdt, MD2
1 Department of Anesthesiology, Weill Cornell Medical College, New York, NY; 2 Department of Anesthesiology, Yale College of Medicine, New Haven, CT
Introduction:
Intrapericardial diaphragmatic hernia is the rarest type of adult diaphragmatic hernia (<1%), only 96 cases reported in literature. 1
Blunt mechanism is most common:
Elevated intra-abdominal pressure creates a defect in the central portion of the diaphragm.
Clinical symptoms: abdominal pain, chest pain, dysphagia, reflux, hypovolemia, respiratory insufficiency & cardiac tamponade.2
Diagnosis by CXR → CT or MRI
Only surgical repair adequately relieves clinical symptomology.
Necessary to prevent incarceration and strangulation3
Case Report:
64 year-old male with uncontrolled GERD, dyspnea, chest pain, and history of paroxysmal atrial fibrillation presented for robotic-assisted repair of an anterior intrapericardial diaphragmatic hernia.
9.6 cm of herniated stomach on CT scan
Pre-op:
Pre-induction arterial line
Trans-abdominal surgical approach planned
250mL Albumin 5% preemptively given
Intra-op:
Induction by rapid sequence induction with propofol & succinylcholine
2x large bore IV's, NGT
Hemodynamic monitoring and fluid management achieved with non-invasive cardiac output monitoring (NICOM)
General anesthesia maintained with sevoflurane and fentanyl boluses
Low airway pressures & low tidal volumes utilized
Figure 1: 9.6 cm of herniated stomach into the pericardium through central portion of the diaphragm.
Figure 2: CT chest (transverse plane) demonstrates posterior displacement of the heart by the air-filled stomach
Intra-operative Complications:
Cardiac tamponade
Cardiac arrhythmias
Aspiration
Hypoxemia
Hemodynamic compromise
Mass effect → mediastinal shift
Positive pressure → decreased venous return
Enlarging defect
Increased intraabdominal pressure
Increased intrapleural pressure by mechanical ventilation
Paralysis of diaphragm
Figure 3: Low-dose dobutamine was infused to maintain cardiac output during reverse Trendelenberg positioning and pneumoperitoneum, as demonstrated by the intra-operative record.
References:
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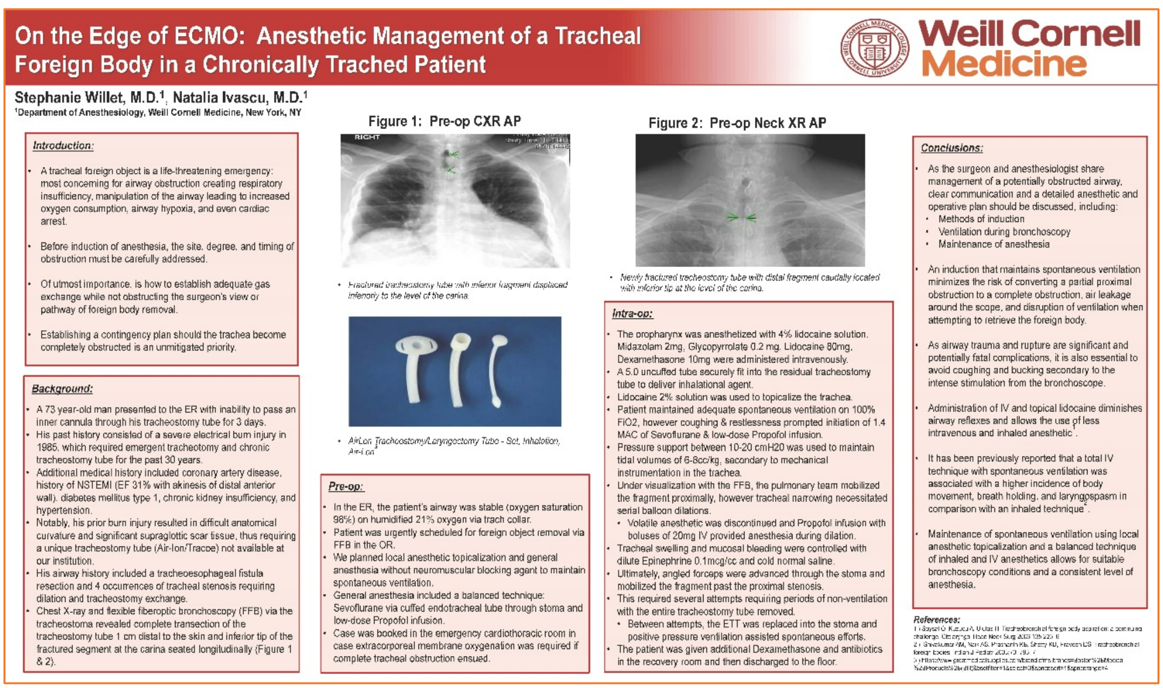
2. Durham TM, Green JG, Hodges ED, Nique TA. Congenital diaphragmatic hernia: Implications for nitrous oxide use in dentistry. Spec Care Dentist. 1993;13:104–8. [PubMed]
3. Kitano Y, Lally KP, Lally PA. Congenital Diaphragmatic Hernia Study Group Late-presenting congenital diaphragmatic hernia. J Pediatr Surg. 2005;40:1839–43. [PubMed]
Low-dose dobutamine was infused to maintain cardiac output during reverse Trendelenberg positioning and pneumoperitoneum.
Pneumoperitoneum was maintained at 10 to 12 cm H2O to avoid any potential tamponade effect on the heart.
Patient remained stable throughout and was uneventfully extubated at procedure's end.
Post-op:
Transferred to PACU
PO pain medications, IV breakthrough
Uneventful postoperative course, discharged home on POD#2
Conclusions:
Management of intrapericardial diaphragmatic hernia requires:
Advanced clinical knowledge and skills
Thorough pre-operative preparation
Set-up for advanced surgical and anesthetic interventions (possibility of one-lung ventilation)
Anesthetic goals:
Maintain myocardial contractility, cardiac preload, heart rate & systemic vascular resistance
Prevent increased intra-abdominal pressure especially during induction, intubation, and extubation
Practice aspiration prophylaxis by rapid sequence induction
Meticulous monitoring with invasive blood pressure, possible CVP monitoring
Avoid anesthetic agents prone to cardiac depression
Prohibit nitrous oxide
Maintain adequate plane of anesthesia


On the Edge of ECMO: Anesthetic Management of a Tracheal Foreign Body in a Chronically Trached Patient
Weill Cornell Medicine
Stephanie Willet, M.D.1, Natalia Ivascu, M.D.1
1Department of Anesthesiology, Weill Cornell Medicine, New York, NY
Introduction:
A tracheal foreign object is a life-threatening emergency: most concerning for airway obstruction creating respiratory insufficiency, manipulation of the airway leading to increased oxygen consumption, airway hypoxia, and even cardiac arrest.
Before induction of anesthesia, the site, degree, and timing of obstruction must be carefully addressed.
Of utmost importance, is how to establish adequate gas exchange while not obstructing the surgeon's view or pathway of foreign body removal.
Establishing a contingency plan should the trachea become completely obstructed is an unmitigated priority.
Background:
A 73 year-old man presented to the ER with inability to pass an inner cannula through his tracheostomy tube for 3 days.
His past history consisted of a severe electrical burn injury in 1985, which required emergent tracheotomy and chronic tracheostomy tube for the past 30 years.
Additional medical history included coronary artery disease, history of NSTEMI (EF 31% with akinesis of distal anterior wall), diabetes mellitus type 1, chronic kidney insufficiency, and hypertension.
Notably, his prior burn injury resulted in difficult anatomical curvature and significant supraglottic scar tissue, thus requiring a unique tracheostomy tube (Air-lon/Tracoe) not available at our institution.
His airway history included a tracheoesophageal fistula resection and 4 occurrences of tracheal stenosis requiring dilation and tracheostomy exchange.
Chest X-ray and flexible fiberoptic bronchoscopy (FFB) via the tracheostoma revealed complete transection of the tracheostomy tube 1 cm distal to the skin and inferior tip of the fractured segment at the carina seated longitudinally (Figure 1 & 2).
Figure 1: Pre-op CXR AP
RIGHT
Fractured tracheostomy tube with inferior fragment displaced inferiorly to the level of the carina.
AirLon Tracheostomy/Laryngectomy Tube - Set, Inhalation, Air-Lon3
Pre-op:
In the ER, the patient's airway was stable (oxygen saturation 98%) on humidified 21% oxygen via trach collar.
Patient was urgently scheduled for foreign object removal via FFB in the OR.
We planned local anesthetic topicalization and general anesthesia without neuromuscular blocking agent to maintain spontaneous ventilation.
General anesthesia included a balanced technique: Sevoflurane via cuffed endotracheal tube through stoma and low-dose Propofol infusion.
Case was booked in the emergency cardiothoracic room in case extracorporeal membrane oxygenation was required if complete tracheal obstruction ensued.
Figure 2: Pre-op Neck XR AP
Newly fractured tracheostomy tube with distal fragment caudally located with inferior tip at the level of the carina.
Intra-op:
The oropharynx was anesthetized with 4% lidocaine solution. Midazolam 2mg, Glycopyrrolate 0.2 mg, Lidocaine 80mg, Dexamethasone 10mg were administered intravenously.
A 5.0 uncuffed tube securely fit into the residual tracheostomy tube to deliver inhalational agent.
Lidocaine 2% solution was used to topicalize the trachea.
Patient maintained adequate spontaneous ventilation on 100% FiO2, however coughing & restlessness prompted initiation of 1.4 MAC of Sevoflurane & low-dose Propofol infusion.
Pressure support between 10-20 cmH20 was used to maintain tidal volumes of 6-8cc/kg, secondary to mechanical instrumentation in the trachea.
Under visualization with the FFB, the pulmonary team mobilized the fragment proximally, however tracheal narrowing necessitated serial balloon dilations.
Volatile anesthetic was discontinued and Propofol infusion with boluses of 20mg IV provided anesthesia during dilation.
Tracheal swelling and mucosal bleeding were controlled with dilute Epinephrine 0.1mcg/cc and cold normal saline.
Ultimately, angled forceps were advanced through the stoma and mobilized the fragment past the proximal stenosis.
This required several attempts requiring periods of non-ventilation with the entire tracheostomy tube removed.
Between attempts, the ETT was replaced into the stoma and positive pressure ventilation assisted spontaneous efforts.
The patient was given additional Dexamethasone and antibiotics in the recovery room and then discharged to the floor.
Conclusions:
As the surgeon and anesthesiologist share management of a potentially obstructed airway, clear communication and a detailed anesthetic and operative plan should be discussed, including:
Methods of induction
Ventilation during bronchoscopy
Maintenance of anesthesia
An induction that maintains spontaneous ventilation minimizes the risk of converting a partial proximal obstruction to a complete obstruction, air leakage around the scope, and disruption of ventilation when attempting to retrieve the foreign body.
As airway trauma and rupture are significant and potentially fatal complications, it is also essential to avoid coughing and bucking secondary to the intense stimulation from the bronchoscope.
Administration of IV and topical lidocaine diminishes airway reflexes and allows the use of less intravenous and inhaled anesthetic1.
It has been previously reported that a total IV technique with spontaneous ventilation was associated with a higher incidence of body movement, breath holding, and laryngospasm in comparison with an inhaled technique2.
Maintenance of spontaneous ventilation using local anesthetic topicalization and a balanced technique of inhaled and IV anesthetics allows for suitable bronchoscopy conditions and a consistent level of anesthesia.
References:

American Society of Echocardiography (ASE)

Transesophageal Echocardiographic Imaging for Total Endoscopic Mitral Valve Surgery

Weill Cornell Medicine
NewYork-Presbyterian

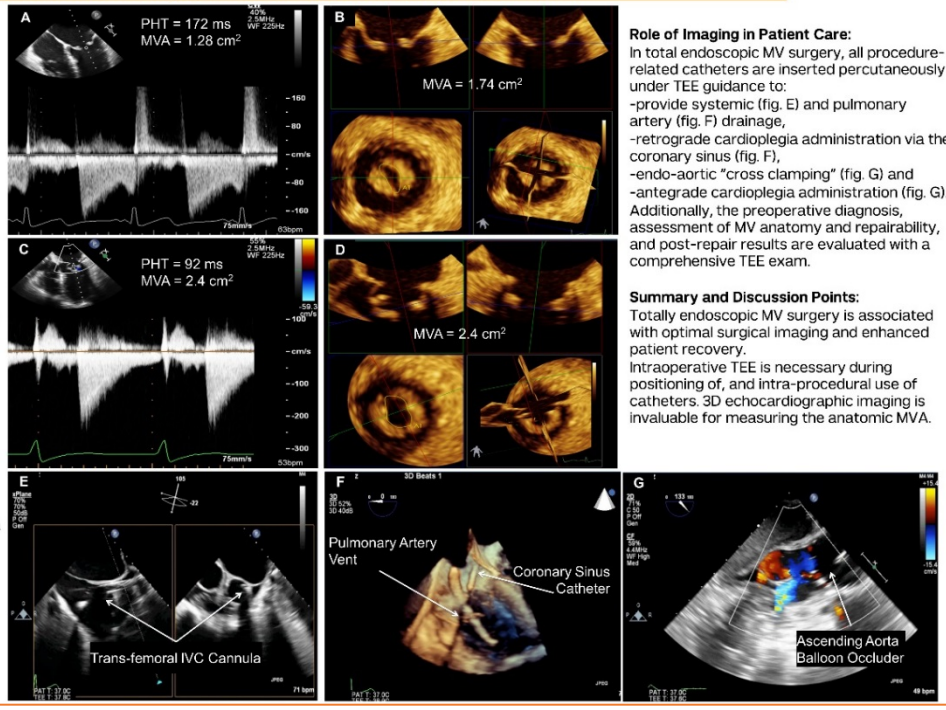
Nikolaos J. Skubas, MD, FACC, FASE, DSc*, Christopher W. Tam, MD*, Meghann M. Fitzgerald, MD*, T. Sloane Guy, MD, MBA¥
Departments of Anesthesiology* and Cardiothoracic Surgery¥, Weill Cornell Medical College, New York, NY

Clinical Presentation:
A 47 year old male with dyspnea on exertion caused by mitral valve (MV) disease was scheduled for elective total endoscopic MV surgery. An outside transesophageal echocardiogram (TEE) reported moderate-severe mitral regurgitation (MR) and moderate mitral stenosis (MS).

Intraoperative TEE Findings:
Intraoperatively, the MV was examined with 2D and 3D TEE. Color flow Doppler and 2D showed mild-moderate (2+) central MR, and restricted leaflet motion in diastole and systole (Carpentier class IIIa). The MV Wilkins score was 4 with minimal sub-valvular thickening, and fused commissures. The MR fraction was 40%, corresponding to moderate (3+) MR. The effective MV area (MVA) was 1.28 cm^2 (fig. A). The anatomic MVA was 1.74 cm^2 by 3D planimetry (fig. B).

Procedure:
Total endoscopic robotic MV surgery included commissural valvuloplasty, augmentation of the anterior MV leaflet with treated bovine pericardium and insertion of a flexible MV annuloplasty band.

Post-procedural TEE Findings:
TEE imaging showed a component MV, with an effective MVA of 2.4 cm^2 (fig. C) and anatomic MVA of 1.9 cm^2 (fig. D).



Role of Imaging in Patient Care:
In total endoscopic MV surgery, all procedure-related catheters are inserted percutaneously under TEE guidance to:
-provide systemic (fig. E) and pulmonary artery (fig. F) drainage,
-retrograde cardioplegia administration via the coronary sinus (fig. F),
-endo-aortic "cross clamping" (fig. G) and
-antegrade cardioplegia administration (fig. G).
Additionally, the preoperative diagnosis, assessment of MV anatomy and repairability, and post-repair results are evaluated with a comprehensive TEE exam.

Summary and Discussion Points:
Totally endoscopic MV surgery is associated with optimal surgical imaging and enhanced patient recovery.
Intraoperative TEE is necessary during positioning of, and intra-procedural use of catheters. 3D echocardiographic imaging is invaluable for measuring the anatomic MVA.

American Society of Regional Anesthesia (ASRA)

Increased Morbidity and Mortality of Total Hip Replacements for the Uninsured and Underinsured

Hannah Xu[1], Robert S. White[1], Dahniel Sastow[1], Michael Andreae[2], Licia Gaber-Baylis[1], Zachary Turnbull[1]
1. NewYork-Presbyterian Hospital, Weill Cornell Medicine, 2. Penn State Health Milton S. Hershey Medical Center

Weill Cornell Medicine
NewYork-Presbyterian

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Introduction

- Insurance status is a marker of socioeconomic standing, and studies show that uninsured and underinsured patients have worse outcomes following medical and surgical care[4,5].
- Our study examined how insurance status affects healthcare outcomes of one of the most commonly performed procedures in the United States: total hip replacements.
- Given the current political climate surrounding healthcare reform, our work brings awareness of ongoing obstacles in bringing quality healthcare to all.

Methods

- We conducted a retrospective study of adults age ≥ 18yrs old from 2007-2011 using the State Inpatient Database (SID) of CA, FL, and NY, Healthcare Cost and Utilization Project (HCUP), and Agency for Healthcare Research and Quality (AHRQ).
- We identified those who underwent a total hip replacement using ICD-9-CM code 8151. Patients were cohorted by insurance type (Medicare, Medicaid, Uninsured, Other, Private).
- Primary outcomes were the rates of in-hospital mortality, postoperative complications, and 30- and 90-day readmission rates.
- Postoperative complications included pulmonary, wound, infectious, urinary, gastrointestinal, cardiovascular, systemic, and intraoperative/ procedural.

Table 1. Bivariate associations by insurance status.

Characteristic	Medicare	Medicaid	Private	Other	Uninsured
Total	164,707 (64.6%)	10,130 (3.9%)	74,190 (27.5%)	8,810 (3.3%)	2,880 (1.0%)
Age [years] (SD)	75.48 (6.04)	62.24 (13.78)	67.27 (9.72)	66.04 (10.08)	63.67 (10.58)
Female	100,236 (60.8%)	5,906 (58.3%)	54,683 (73.8%)	5,208 (59.1%)	1,803 (62.6%)
In-hospital mortality	418 (0.3%)	17 (0.2%)	91 (0.1%)	<11	<11
Postoperative complications	12,036 (7.3%)	824 (8.1%)	4,468 (6.1%)	493 (5.6%)	184 (6.4%)
30-day readmission	10,556 (6.4%)	763 (7.5%)	5,668 (7.6%)	525 (6.0%)	181 (6.3%)
90-day readmission	16,464 (10.0%)	1,100 (10.9%)	7,861 (10.6%)	676 (7.7%)	249 (8.7%)

Table 2. Results of logistic regression models.

Measure	Medicare	Medicaid	Other	Uninsured
In-hospital mortality	2.06 (0.77 - 2.48)	2.09 (1.29 - 4.40)*	1.03 (0.57 - 2.16)	3.61 (2.08 - 4.48)*
Postoperative complications	1.39 (1.31 - 1.51)*	1.12 (1.20 - 1.45)*	1.26 (1.19 - 1.35)*	1.27 (1.09 - 1.37)*
30-day readmission	1.21 (1.15 - 1.28)*	1.21 (1.06 - 1.47)*	1.12 (1.05 - 1.26)	1.08 (0.98 - 1.22)
90-day readmission	1.20 (1.15 - 1.28)*	1.18 (1.03 - 1.39)*	1.15 (1.06 - 1.28)*	1.12 (0.98 - 1.22)

Note: Private insurance is reference. OR =1

Results

- 295,572 patients age >18 yrs old underwent total hip replacements in CA, FL, and NY from 2007-2011.
- Medicaid and other non-Private insurance patients had higher unadjusted rates and risk-adjusted odds of in-hospital mortality, postoperative complications, and 30-day and 90-day readmission rates when compared to patients with Private insurance.

Conclusions

- Our study suggests that insurance status is predictive of perioperative risks.
- With ongoing discussion of healthcare reform, our analysis highlights larger socioeconomic and health system-related issues to be addressed to improve surgical outcomes for all patients.

Discussion

- Medicaid (and having non-Private insurance in general) was associated with worse postoperative outcomes.
- There is a strong association between insurance status and race when investigating healthcare disparities[4,5].
- Healthcare outcomes can be secondary to pre, intra, and postoperative factors:
  - Preoperatively, Medicaid and Uninsured patients have more comorbidities and worse health[5,6].
  - Intraoperatively, neuraxial anesthesia was used in 17% of Blacks undergoing total knee arthroplasty or total hip arthroplasty compared to 25% of Whites, and in 17% of Medicare patients compared to 22% of Private insurance patients[9].
  - Postoperatively, minorities have longer wait times to receive analgesia[10], are more likely to have worse Pain Management Index (PMI) scores[11], and receive fewer days' supply of opioids than Whites[12].
- Not only do most surgeons fail to recognize disparities across healthcare, but they are even worse at recognizing it in their own specialty and practices[13].
- Our study represents the most up-to-date analysis of insurance status vs. postoperative outcomes after total hip replacements.
- Study strength include our ability to analyze a large number of patient records and control for potentially confounding patient and non-patient variables.
- Study limitations include use of administrative datasets with the potential for coding errors, including missing data and misclassified data.

Contact: Hannah Xu, hfx9001@nyp.org

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Association of University Anesthesiologists (AUA)

Discrepancies between data from an anesthesia information management system and manual case-logging: an enduring threat to data quality and resident experience

2017 Annual Meeting of the Association of University Anesthesiologists

Zachary A. Turnbull, MD, Virginia Tangel, MA, Dahniel Sastow, BA, Bohdan Hawryluk, MS, Kane O. Pryor, MD | May 5, 2017
Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

- In the United States, anesthesiology residents are required to self-report their training experiences through the Accreditation Counsel for Graduate Medical Education (ACGME).[1] The reporting method requires residents to manually enter intraoperative details on all cases in which they participated through an online portal. ACGME case log data is subsequently used in accessing residents' competencies based on their experiences with specific procedures, which is used to determine operating room assignments for residents,[2] among other reasons.
- Though logging case information is a valuable tool for resident assessment, the data recorded in the online portal is subject to misreporting. One study determined that more than 50 percent of residents either over or under reported their total case counts by at least 5 percent[3]; case details were similarly subject to misreporting. Potential sources of misreporting include recall bias, in which details of cases performed in the past were difficult to recall, as well as variation between residents on documentation priorities. Due to this lack of standardization in case-logging practices, several researchers have called into question ACGME data as a reliable measure of resident procedural experience.[4]
- Though Sampao et al. (2011) recommended that accreditation organizations, including ACGME, utilize the reliable documentation of resident case information produced via Anesthesia Information Management Systems (AIMS) in order to render the ACGME case logging process more efficient, no such initiative has been implemented as of 2017.

To assess the validity of resident case logging, we sought to compare reports of selected case information from resident case logs reported in 2014-2015 through the ACGME portal to data from our AIMS.

Figure 1. Difference in case volume

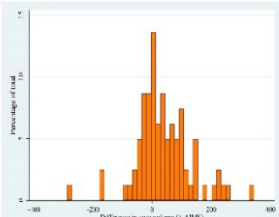
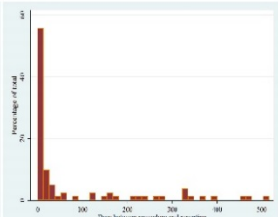


Figure 2. Days between procedure and reporting



Methods

Sampling

We compared 2014-2015 ACGME case log data to AIMS data, treating AIMS as the reference standard. In accordance with current ACGME guidelines,[5] only one resident was given credit for each case, which in our model was assumed to be the resident starting the case. Paper records account for less than 1% of our practice, and were excluded from analysis.

Statistical Analysis

For each resident, we calculated the total number of cases logged in AIMS and ACGME, respectively, and calculated the discrepancy in case volume between the two databases. We also calculated the median number of days between procedure and reporting to ACGME, median ASA score, and median age value (categorical), all by resident.

We conducted a one-sample sign test (on a median-of-medians) to assess if the median discrepancies in resident case volume, days between procedure and submission to ACGME, reported ASA status, and reported age values significantly differed from 0. Unless otherwise indicated, all tests were two-sided with significance evaluated at the 0.05 alpha level.

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Results

- From 2014-2015, 81 residents completed a total of 24,276 cases, with 21,086 cases submitted to ACGME. The median number of cases logged per resident was 295 [IQR: 133-336].
- Nearly two-thirds of residents (58%) underreported case volume by at least 5%, and another 26% over reported by at least 5%.
- For the 81 residents, the median value of case discrepancies between AIMS and ACGME was a surplus of 27 cases in AIMS [IQR: -11 to 91], and the median absolute deviation was 50 cases, $p < 0.01$ (Figure 1).
- The median difference in the number of days between the procedure and case logging was 9 days [IQR: 2 to 88], $p < 0.01$; one-sided (Figure 2).
- Only 6% of residents had discordant median values of ASA status, the overall median discrepancies did not significantly differ from 0 ($p = 0.06$).
- Only 1% of residents had discordant median values of age, the overall median discrepancies did not significantly differ from 0 ($p = 1.0$).

Conclusion

- We identified significant discrepancies between ACGME case logs and reference AIMS data, in a sample substantially larger than previously reported.
- Our results suggest that cases are underreported or over reported at random and are not dependent on age or ASA status.
- Although no inference can be drawn on causality, recall bias, satisficing, and misinterpretation of ACGME reporting guidelines represent potential sources of error.
- Continued misreporting in ACGME case logs underscores the need for alternate methods with higher fidelity. The integration of existing AIMS technology can be leveraged to increase case log accuracy and improve resident assessment.

International Anesthesia Research Society (IARS)

Effect of Insurance Status on Surgical Outcomes after Colectomies

IARS 2017 Annual Meeting

Casey M Chai, MD, Robert S White, MD, Dahniel Sastow, BA, Licia Gaber-Baylis, BA, Kane O Pryor, MD, Peter M Fleischut, MD, Zachary A Turnbull, MD | May 8, 2017
Department of Anesthesiology, New York Presbyterian Hospital/ Weill Cornell Medicine

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

- Insurance status, as well as race and other socioeconomic factors, have been shown to affect surgical and medical outcomes. Specifically, uninsured patients or patients with Medicaid or Medicare have been shown to have worse outcomes after surgeries.
- Our study aims to examine the association between insurance status and surgical outcomes after colectomies, by adjusting for other major socioeconomic factors such as race and income.
- Colectomies are one of the most commonly performed surgeries in the United States with more than 300,000 cases performed per year.
- Given the large population without private insurance and the recent debates in health care policies, our work expands the literature on the effect of insurance status on surgical outcomes.

Methods

- This retrospective study examined mortality and morbidity of adults aged ≥18 who received colectomies in 2007-2011 using State Inpatient Database (SID) from California, Florida, and New York, Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality (AHRQ).
- We identified patients who underwent colectomies with ICD9 codes including open and laparoscopic colectomies.
- Insurance status were categorized into Medicaid, Medicare, Private Insurance, Uninsured, and Other.
- Primary outcomes were rates of in-hospital mortality, post-operative complications, 30-day and 90-day readmission.
- Bivariate and multivariate logistic regression models were run separately, each adjusting for covariates selected a priori (age, race, median income, comorbidities, year of surgery, state of surgery, and hospital level data).

Results:

- A total of 226,162 patients were included in the study.
- Compared to Private insurance, patients with other insurance status such as Medicaid, Medicare, Other insurance, and Uninsured status have higher odds of in-hospital mortality and post-operative complications.
- Patients with Medicaid and Medicare have higher odds of 30-day and 90-day readmission when compared to private insurance patients.

Table 1. Odds Ratio of Primary Outcome Measures of Different Insurance Status Compared to that of Private Insurance

Primary Outcomes	Overall Rate	Medicaid	Medicare	Other	Uninsured
In-Hospital Mortality	6.02%	2.39 (2.19-2.50)	1.61 (1.51-1.71)	1.44 (1.24-1.68)	2.05 (1.80-2.33)
Post-Operative Complications	61.60%	1.45 (1.40-1.51)	1.32 (1.28-1.35)	1.24 (1.17-1.32)	1.22 (1.16-1.29)
30-day Readmission	16.21%	1.33 (1.27-1.40)	1.18 (1.13-1.22)	1.10 (1.01-1.19)	NA
90-day Readmission	26.53%	1.26 (1.20-1.31)	1.12 (1.08-1.15)	NA	NA

*Odds Ratio as compared to Private Insurance

References

Discussion

- Racial and socioeconomic disparities in surgical outcome after colectomies have been observed and described in literature.
  - Most frequently described in the current literature was the higher likelihood of privately insured patients undergoing laparoscopic colectomies, whereas uninsured status or public insurance or African American race is associated with higher rates of open colectomies.
  - Non-private insurance has been reported to be associated with higher in-hospital mortality.
- Our study shows an association of non-private insurance with higher rates of in-hospital mortality, post-operative complications, and readmissions.
- The strengths of this study are the analysis of a large sample size, the use of multivariate logistic regression model to adjust for risk factors such as race and income, and examination of other surgical outcomes beyond in-hospital mortality.
- The limitation of the study is the use of administrative dataset which is limited by data entry errors.
- Further outcome analysis by open versus laparoscopic colectomy, or by disease diagnosis (ie. colon cancer vs diverticulitis vs ulcerative colitis) may be useful in shedding light on the differential effect insurance status has on these different subgroups.

Conclusions

- Our study shows that non-private insurance status is associated with worse surgical outcomes after colectomies, regardless of racial and other socioeconomic factors.

- Contact: Casey Chai, mel2013@nyp.org

Immediate Antagonism of CW 1759-50 Neuromuscular Blockade by Glutathione

Farrell E. Cooke, B.S., Hiroshi Sunaga, M.D., Paul M. Heerdt, M.D., PhD., John J Savarese, M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

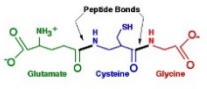
Introduction

We have reported on the antagonism of both CW1759-50 and CW002- induced neuromuscular blockade (NMB) by L-cysteine (L-Cys). L-Cys adducts to the central double bonds of these NMBAs. Formation of the adduct rapidly converts the active NMBAs to inactive derivatives which enables normal function to resume[1].

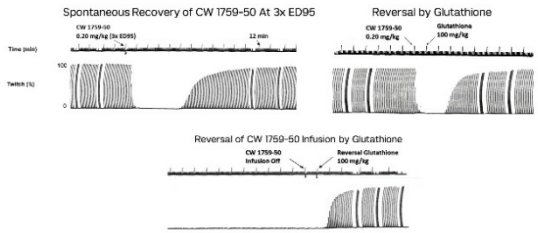
The tripeptide glutathione (GSH) is a mainstay of the body's detoxification systems, and acts as L-Cys by enzymatic conversion to L-Cys. Since GSH is a normal and abundant source of L-Cys in the body, we explored the ability of GSH, given as a bolus, to antagonize NMB produced by CW 1759-50.

Methods

Rhesus monkeys weighing 10-18 kg were anesthetized with isoflurane and studied under IACUC – approved protocols. Circulatory and ventilatory parameters were monitored. Twitch of the Achilles Tendon was evoked at 0.15 Hz via the popliteal nerve. Train of Four (TOF) stimulation was applied and responses were measured at appropriate points before and after recovery of NMB. The total duration of action, 5-95% recovery interval, and 5% twitch to 90% TOF recovery interval were compared following GSH reversal versus spontaneous recovery from NMB after the same dosage of CW 1759-50. In reversal studies, GSH was given as a rapid bolus (15 sec) one minute following CW 1759-50 (0.20 mg/kg, 3x ED95).



Glutathione



Compound and (Dose)	Total Duration (min) ± SD	5-95% (min) ± SD	5% - 90% TOF (min) ± SD	n
CW 1759-50 (0.20 mg/kg, 3x ED95) Control (Spontaneous Recovery)	12.4 ± 1.7	6.6 ± 0.5	8.3 ± 1.1	8
CW 1759-50 (0.20 mg/kg) + GSH Reversal (70 mg/kg) @ 1 min, given over 15 sec	5.0 ± 0.5 **	2.1 ± 0.4 **	2.8 ± 0.3 **	4
CW 1759-50 (0.20 mg/kg) + GSH Reversal (100 mg/kg) @ 1 min, given over 15 sec	4.8 ± 0.3 **	2.0 ± 0.4 **	2.4 ± 0.2 **	4
CW 1759-50 (0.20 mg/kg) + L-Cys reversal (30 mg/kg) @ 1 min, given over 15 sec	4.5 ± 0.9 **	2.0 ± 0.5 **	2.9 ± 0.8 **	8

** = P < 0.01 vs spont recovery by paired t-test

Table 1. Antagonism of CW 1759-50 by Glutathione (GSH) on L-Cysteine (L-Cys) in the anesthetized Rhesus Monkey

Results:

GSH is an immediately effective antagonist of CW 1759-50. The data are summarized in Table 1 and compared with reversal by L-Cysteine.

Discussion:

Glutathione has been given safely to patients for prophylaxis of toxic side-effects of chemotherapy with platinum-containing agents, such as cisplatin. GSH was given in a dosage of 50-70 mg/kg i.v. by infusion over a span of 15-20 min prior to the chemotherapeutic agent. Reduction of such side effects as peripheral neuropathies and decreased renal function were reported benefits of GSH prophylaxis; an improved feeling of general well-being in nearly all subjects was consistently reported by patients who had received glutathione[2].

Glutathione provides an equally effective (versus L-Cys) antagonist of CW 1759-50 NMB. By comparison, L-Cys (30 mg/kg) antagonism of CW 1759-50 – induced NMB yielded total duration and intervals not differing from intervals and duration following GSH or L-Cys reversal (Table 1). Duration and recovery intervals were all very significantly shorter than controls ($P < 0.01$). Very early data suggests that GSH antagonism of CW 002 is also effective.

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Acetaminophen iv reduces hospital length of stay in morbidly obese individuals undergoing elective laparoscopic sleeve gastrectomy

Farrell E. Cooke, B.S.[1], Xian Wu, M.P.H.[2], Alfons Pomp, M.D.[3], Peter A. Goldstein, M.D.[1,4]

Departments of Anesthesiology[1], Biostatistics and Epidemiology[2], Surgery[3], and Medicine[4] Weill Cornell Medical College, New York, NY

INTRODUCTION

Morbid obesity is defined as a body mass index (BMI: weight [kg]/height [m]^2) ≥ 40 or ≥ 35 if associated with comorbidities[1], and it is widely prevalent nationally and globally. Among the many available treatment options, surgical management of obesity has been shown to be the most effective in achieving sustained weight loss and improve glycemic, lipidemic, blood pressure control[2-6], and improve five and ten year survival in contrast to matched controls who did not have surgery[7].

Acetaminophen iv is a mild analgesic which received US Food and Drug Administration (FDA) approval in November 2010. It is approved for the management of mild to moderate pain as a single agent and the management of moderate to severe pain with adjunctive opioid analgesics. With direct relevance to sleeve gastrectomy patients, a retrospective analysis of patients undergoing bariatric surgery (sleeve gastrectomy or laparoscopic Roux-en-Y gastric bypass) found that acetaminophen iv administration reduced opiate consumption and hospital LoS (Song *et al.* 2014) .

We sought to determine prospectively whether 1,000 mg acetaminophen iv administered intraoperatively followed by a dose every 6 hours for 24 hours in subjects undergoing elective laparoscopic sleeve gastrectomy decreased LoS and associated hospitalization costs.

METHODS

- 128 subjects: acetaminophen iv (Group A) or saline placebo iv (Group P)
- First dose of 1,000 mg acetaminophen iv or saline placebo after anesthesia induction; 3 additional doses every 6 hours for 24 hours.
- Anesthetic and antiemetic regimen was standardized between groups
- Postoperative pain management: hydromorphone *via* patient controlled infusion pump (PCA).
- Quality of Recovery – 15 (QoR-15) surveys preoperatively and on postoperative days 1 and 2
- Pre-specified interim analysis at 50% recruitment

Table 1: Preoperative demographics

Characteristic	Acetaminophen IV (n = 63)	Placebo (n = 64)
Age (year ± SD)	42.2 ± 12.2	39.1 ± 12.2
BMI (mean ± SD)	46.6 ± 7.7	47.3 ± 7.9
Female, n (%)	45 (71.4)	47 (73.4)
Male, n (%)	18 (28.6)	17 (26.6)
Race, n (%)		
Caucasian	21 (33.3)	24 (37.5)
Black	16 (25.4)	20 (31.3)
Hispanic	13 (20.6)	7 (10.9)
Other	8 (12.7)	7 (10.9)
Unknown	5 (7.9)	6 (9.4)
ASA Score, n (%)		
1	1 (1.6)	0 (0.0)
2	29 (46.0)	31 (48.4)
3	31 (49.2)	31 (48.4)
4	1 (1.6)	2 (3.1)
Smoking, n (active, %)	7 (11.1)	5 (7.8)
Pre-Op Lab Values (mean ± SD)		
AST	28.9 (12.8)	24.2 (8.1)
ALT	32.0 (16.6)	27.4 (14.3)
Total Bilirubin	0.41 (0.3)	0.53 (0.2)
Serum Creatinine	0.82 (0.2)	0.77 (0.2)
Creatinine Clearance	121.1 (35.7)	129.9 (29.0)
Comorbidities, n (yes, %)		
OSA	26 (41.3)	24 (37.5)
Asthma	12 (19.1)	6 (9.4)
Diabetes	13 (22.8)	19 (27.0)
Depression/Anxiety	10 (15.9)	15 (23.4)

*SD standard deviation, BMI Body Mass Index

Table 2: Intraoperative variables

Outcome	Acetaminophen IV (n = 63)	Placebo (n = 64)
Duration of Procedure Min (mean ± SD)		
Anesthesia Duration	150 ± 37.0	132 ± 24.7
Surgery Duration	96 ± 27.2	90 ± 22.0
Estimated Blood Loss, cc (mean ± SD)	52.9 ± 33.2	41.9 ± 27.0
Fluid Volume cc (mean ± SD)	1544.4 (654.3)	1410.2 (551.3)
Benzodiazepine Given, n (yes, %)	8 (12.7)	17 (26.6)
Narcotic Given, mean ± SD		
Fentanyl (mcg)	293.2 (102.4)	258.2 (100.1)
Dilaudid (mg)	1.15 (0.6)	1.28 (0.6)
Anti – Emetic Dose, n (yes, %)		
Aprepitant (Pre-Op)	33 (52.4)	47 (73.4)
Dexamethasone	39 (59.7)	62 (96.9)
Ondansetron	63 (100)	63 (98.4)
Haloperidol	28 (44.4)	16 (25)

Table 3: PACU pain scores, narcotic & antiemetic requirements.

Outcome	Acetaminophen IV (n = 63)	Placebo (n = 64)
Pain Scores (mean ± SD)	3.0 ± 3.4	3.0 ± 3.5
Narcotic Consumption, n (yes, %)	32 (50.8)	51 (95.3)
Hydromorphone (mg) (mean ± SD)	2.1 ± 1.0	2.5 ± 1.0
PONV Scores (mean ± SD)	2.6 ± 1.8	1.8 ± 2.0
PONV Incidence, n (yes, %)	24 (38.1)	37 (57.8)
Zofran, n (yes, %)	24 (38.1)	28 (71.7)
Reglan, n (yes, %)	2 (3.1)	4 (10.8)
Other, n (yes, %)	0 (0)	0 (0)

Table 4: Hospital costs break down by group

Service Group Cost Breakdown Mean (± SD, $)	Placebo	Acetaminophen
NURSING		
Fixed Direct	177.3 (211.4)	140.0 (138.3)
Fixed Indirect	1198.3 (1387.7)	1211.2 (935.6)
Variable Direct	2392.4 (826.2)	2156.6 (978.0)
Variable Indirect	552.7 (176.7)	566.3 (237.5)
Total Cost	**4320.7 (1685.8)**	**4276.0 (3767.5)**
LABS		
Fixed Direct	4.5 (2.5)	4.4 (2.0)
Fixed Indirect	25.4 (14.7)	25.6 (14.6)
Variable Direct	96.3 (57.9)	90.2 (52.9)
Variable Indirect	12.8 (7.4)	12.9 (7.0)
Total Cost	**141.1 (82.4)**	**141.1 (75.7)**
PHARMACY		
Fixed Direct	4.8 (2.4)	4.6 (2.3)
Fixed Indirect	69.3 (34.9)	66 (31.8)
Variable Direct	330.4 (176.3)	334.4 (166.3)
Variable Indirect	37.3 (18.7)	35.5 (17.6)
Total Cost	**441.7 (232.2)**	**440.6 (219.2)**
OR		
Fixed Direct	933.4 (178.7)	962.2 (231.7)
Fixed Indirect	1388.0 (347.3)	1387.0 (401.9)
Variable Direct	4046.0 (1274.0)	3965.0 (1307.0)
Variable Indirect	609.2 (169.3)	603.4 (189.9)
Total Cost	**6977.0 (1913)**	**6918.0 (2154.0)**
IMPLANTS		
Fixed Direct	41.4 (15.7)	49.1 (31.6)
Fixed Indirect	159.6 (69.6)	189.3 (121.8)
Variable Direct	376.5 (153.2)	1042.9 (676.9)
Variable Indirect	89.4 (34.9)	106.1 (68.4)
Total Cost	**1169.0 (483.2)**	**1386.0 (892.1)**
CUMULATIVE COSTS	**13,414.0 (2466.0)**	**13,634.0 (2883.0)**

Fig. 1: Hospital length of stay

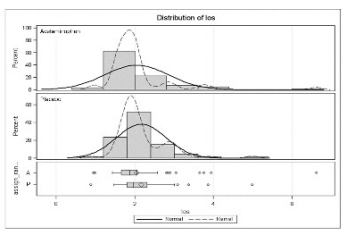
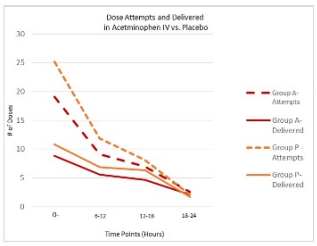


Fig 2: PCA demand attempts and delivery



RESULTS

127 subjects were included for data analysis; 63 subjects in Group A and 64 subjects in Group P. One subject from Group A was excluded due to postoperative respiratory failure. Demographics between the groups were similar (Table 1).

- No differences in the duration of anesthesia, duration of surgery, or anesthetic management-related parameters (Table 2).
- Acetaminophen iv subjects had significantly shorter median LoS than subjects in the placebo group (Wilcoxon Scores (Rank Sums); p = 0.029) (Fig 1).
- PACU course was comparable between groups (Table 3).
- No differences in 24 or 48 hr cumulative narcotic consumption
- PCA demand tended to be greater in Group P than in Group A for the first 18 hours postoperatively (Fig 2).
- No differences in hospital charges during admission (Table 4).

CONCLUSION

In subjects undergoing elective sleeve gastrectomy, acetaminophen iv reduces hospital LoS. The shorter LoS may improve bed utilization on a bariatric surgery service with high volume. Although acute care costs were not different, acetaminophen iv in a comparable patient population reduced indirect costs and ED visits in the first 30 days postoperatively (El Chaar *et al.* 2016). The decision to incorporate acetaminophen iv into routine practice in the perioperative setting should be based on a complete understanding of its impact across multiple areas of patients care.

References

Weill Cornell Medicine
NewYork-Presbyterian

International Neuromodulation Society (INS)

Discrepancies in International Neuromodulation Training & Education

Weill Cornell Medicine
NewYork-Presbyterian

Neel Mehta M.D., Daniel Pak M.D., Jesse Gruber B.A., Timothy Deer M.D., Simon Thomson M.B.B.S.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Introduction

Spinal Cord Stimulation (SCS) is a globally utilized treatment for chronic back and leg pain. There exists, however, discrepancies in the training requirements for the trial and implantation of SCS devices internationally. Knowledge of these discrepancies may help the neuromodulation community implement standard and best practices to facilitate improved outcomes for patients.

Methods

This is a cross-sectional observational study, using descriptive data from a survey sent out through the International Neuromodulation Society's listserv to members practicing outside of the United States addressing various aspects of neuromodulation education.

Results

We received 40 responses from 18 different countries: Australia (AU, 7), United Kingdom (UK, 7), Italy (IT, 5), Canada (CA, 3), Germany (DE, 2), Greece (GR, 2), Spain (ES, 2), Sweden (SE, 2), Brazil (BR), China (CN), Colombia (CO), France (FR), Ireland (IE), Norway (NO), Poland (PL), Slovenia (SI), Switzerland (CH), and Turkey (TR)

Figure 1: Neuromodulation Training and Education

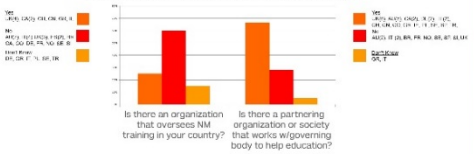


Figure 2: Standardization of SCS

Figure 3: When SCS/ITP Training Occurs

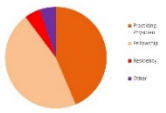
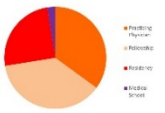


Figure 4: Minimum Level of Training Required to Perform SCS/ITP



Conclusions

There is a wide variation in training requirements for neuromodulation internationally.

There also exists disagreement among respondents from the same country, indicating an absence of a national organization overseeing neuromodulation within these countries, or lack of awareness of such organization.

These results, including the result that 82% believe standardization of SCS procedures is possible, present opportunities for organizations such as INS to coordinate training at a national and global level.

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Deer TR, Thomson S, Pope JE, Russo M, Luscombe F, Levy R. International neuromodulation society critical assessment: guideline review of implantable neurostimulation devices. *Neuromodulation J Int Neuromodulation Soc.* 2014;17(7):678-685.

North American Neuromodulation Society (NANS)

Spinal Cord Stimulator Education During Pain Fellowship: Unmet Training Needs and Factors That Impact Future Practice

Weill Cornell Medicine

Neel Mehta, M.D.[1], Daniel Pak, M.D.[1], Jesse Gruber, B.A.[1], Yifan Xu, M.D.[1], Timothy Deer, M.D.[2]

1 Pain Medicine Division, Weill Cornell Medical College, New York, NY
2 The Center for Pain Relief, Charleston, WV

Introduction

Spinal cord stimulation (SCS) is a required component of ACGME-accredited pain fellowships.

Given the variability of training experiences prior to and during fellowship, we aim to identify the unmet training needs and factors that influence the use of SCS in clinical practice to understand how to improve SCS education.

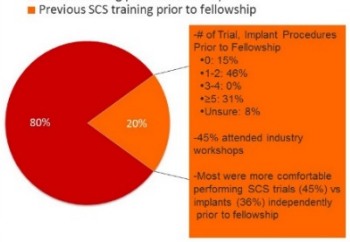
Methods

This is a cross-sectional observational study using descriptive data from a 28-question survey administered via Survey Monkey to all fellows at ACGME-accredited pain fellowships in the United States two-months into their training in 2017.

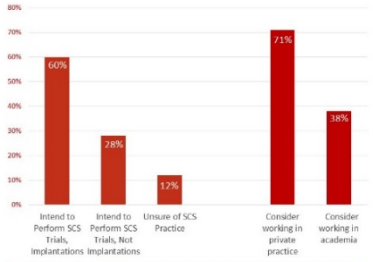
Seventy-six fellows (29% of all current fellows) completed this survey

Seventy-eight percent completed residencies in anesthesiology; 18%, physical medicine and rehabilitation; 2.5%, neurology; 1.5%, neurosurgery.

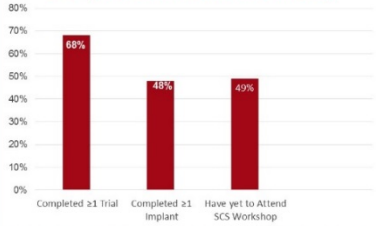
SCS Training History Prior to Fellowship



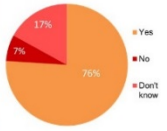
Future SCS Practice Goals



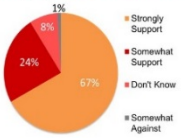
SCS Experiences Two Months into Fellowship



Should SCS Procedures Be Standardized?



How Strongly Do You Support Training By SCS Manufacturers



Conclusions

Most fellows did not have any previous SCS training, but anticipated that they would be conducting SCS procedures following fellowship.

Majority of fellows believed that SCS procedures should be standardized, indicating large roles for organizations such as NANS to promote standardization and education.

Ninety-one percent supported training of fellows by SCS manufacturers

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Deer TR, Thomson S, Pope JE, Russo M, Luscombe F, Levy R. International neuromodulation society critical assessment: guideline review of implantable neurostimulation devices. Neuromodulation J Int Neuromodulation Soc. 2014;17(7):678-685.

Aortocaval Compression Causing Hemodynamic Instability in a Morbidly Obese Patient

Katherine Arthur M.D., Jon D. Samuels M.D.

Department of Anesthesiology, Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

Aortocaval compression is a well-known phenomenon in pregnant patients. It occurs when the patient is supine and the gravid uterus compresses the inferior vena cava and occasionally the abdominal aorta. In severe cases, it can lead to hemodynamic instability and even cardiovascular collapse. This phenomenon has also been observed in several patients with pelvic and abdominal tumors large enough to compress these vessels, but is otherwise rare in non-pregnant patients. We present a case of aortocaval compression in a morbidly obese patient.

Case Details

- 69 year old man with CAD s/p 3 coronary stents, atrial fibrillation, history of rectal cancer s/p resection, obstructive sleep apnea, and super obesity 256.4 kg (BMI: 55.4 kg/m^2).
- Pt brought to ED via EMS, who responded to a 911 call for acute, severe epigastric pain and discovered the patient had SVT to 140's, hypotensive to 70's/40's, and hypoxic to 80's; he was given dopamine, fluid, and O2 pre-hospital.
- On arrival to ED, patient was tachycardic (HR 165) and tachypnic (RR 31) on arrival, but had normal BP (126/83). Soon after, pt became hypotensive to 50's/30's and obtunded, was intubated and placed on norepinephrine.
- Post-intubation CXR demonstrated free air under diaphragm, and patient was taken emergently to OR for exploratory laparotomy.
- Patient was moved from stretcher to OR table and surgeon secured pannus, which had been eccentric, over patient's midline to prepare for surgery.
- As soon as his pannus was midline, the patient experienced an immediate drop in BP from 80/47 to 52/22.
- The OR table was tilted 15 degrees to the right and BP immediately improved.
- Operative report: large gastro-esophageal tear (Mallory-Weiss syndrome) with small bowel obstruction. Peritoneal evacuation of large quantity (> 4 Liters) of feceloid material suctioned.
- Pt was resuscitated with fluids throughout the operation and in the ICU. Hemodynamic stabilization, weaning of vasopressors/inotropes and extubation.

Aortocaval Compression (ACC): Brief History and Current Status

- 1953 Howard *et al.*: significant decrease in blood pressure in term parturients placed in a supine position. *Supine-hypotension syndrome* ascribed to occlusion of the IVC by the gravid uterus. 1960s Bieniarz *et al.* published a series of articles using angiography and upper and lower extremity blood pressure measurements which attempted to show that the abdominal aorta could also be occluded in the supine position, potentially decreasing uterine artery blood flow. *Aortocaval compression. 1972* Crawford *et al.* compared Apgar scores and blood gas measurements between two groups of parturients at cesarean delivery, supine and 15^{O} table tilt. Confounders: general anesthesia, mechanically ventilated with supplemental oxygen (33% O_2/67% N_2O), and the tilt applied was either to the left or right.
- 2015 Higuchi *et al.*: IVC compression until 45^{O}, no aortic compression in any position. Limitations: Low BMI, non laboring, no regional anesthetic. Current status of ACC: controversial. May be related more to BMI and to intravascular volume. Other causes?

Marx GF. Aortocaval compression syndrome: its 50-year history. Internat J Obstet Anes. Jan 1992, 1(2):60-64.

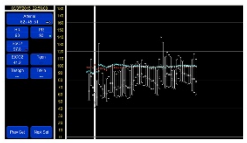

Figure 1: CompuRecord™
Intraoperative anesthetic record demonstrating severe deterioration in hemodynamics in the supine position corrected by 15 degree right operative table tilt. There were no changes in either fluid, vasopressor or inotrope administration.

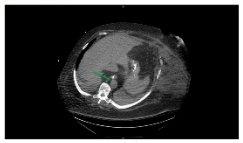

Figure 3: NC CT Abdomen
Patient's scan obtained postoperatively. Note that patient is supine, but his pannus is eccentric at baseline. The weight of his pannus rotates his trunk and abdominal organs such that his abdominal aorta is patent (green arrow). IVC not visualized.

Figure 2: Chest X-Ray
Obtained in the emergency room. Shows free air under the patient's diaphragm, indicating perforated viscus.

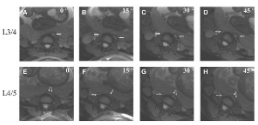

Figure 4: ACC in Pregnancy for comparison
Magnetic resonance images of a supine parturient (A, E), 15^{O} lateral tilt (B, F), 30^{O} (C,G) and 45^{O} (D,H). Inferior vena cava remains compressed and smaller than in non pregnant subject; common iliac arteries remains compressed and band-like. It remains controversial whether aortic volume differs at any angle between parturients and non pregnant women.

Discussion

To our knowledge, this is the first described case of aortocaval compression in a non-pregnant, morbidly obese patient without an intraabdominal mass or other likely explanation for our observations. A few case reports were inconclusive, and not accompanied by imaging studies. Although the patient's perforated viscus and resultant sepsis can partially explain his hypotension prior to arrival to the OR, a precipitous drop in blood pressure was observed at the exact moment the patient's pannus was secured over his midline while he was in the supine position. No other interventions had been performed at that time to explain the sudden and significant worsening of his hypotension. Furthermore, he experienced a similarly instantaneous improvement in his blood pressure when the table was tilted 15 degrees to the right. Again, no other interventions had been performed. Our case has significant implications for future anesthetic management of morbidly obese patients, and highlights an area where more research is needed. Why isn't this phenomenon more frequently witnessed in the morbidly obese population? Physical examination revealed a markedly eccentric panniculus and severe small bowel obstruction. When secured on the midline, there was a midline abdominal gravitational displacement of approximately 100 kg, not present in his native resting position.

Conclusions

Our case illustrates the effect of the pannus in a morbidly obese patient causing aortocaval compression and subsequent hemodynamic instability. Our case also demonstrates that 15 degree lateral tilt can alleviate compression of the aorta, and possibly of the inferior vena cava. Unloading of the pelvic and abdominal vessels would have the effect of restoration of right heart preload and normalization of hemodynamics. There is a need for imaging studies to better define this phenomenon.

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Anesthetic Management of Duodenal Atresia and Aorto-Enteric Fistula Secondary to Vascular Prosthesis Infection

Andrew Fisher, M.D.[1], Jon D. Samuels, M.D.[1]

[1]Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

- Aorto-enteric (AEF) fistulas are either primary (PAEF), only 250 cases described, or secondary (SAEF), occurring as a late complication of aortic reconstructive surgery, or rarely, as a complication of an untreated aortic aneurysm.
- Vascular prosthesis infection rate: global <6%,intra-abdominal 0.4-0.7%, ax-fem 5-8%. Early infections (<4 months post implantation) are distinguished from more common late infections (70 to 85% of cases).
- Early infection < 4-mths *highly virulent*: S. Aureus >> Pseudomonas, Proteus. Late infection: *Biofilm-producing* S. Epidermidis, Enterobacteria.
- Ddx: vascular prosthetic infection vs. enteroprosthetic fistula often difficult.

Case Report

- 37M with PMH of HTN, middle aortic syndrome (MAS) s/p bypass graft from aortic arch to bifurcation (1986), Aortoenteric Fistula s/p endovascular repair
- This admission: bilateral axillary-femoral bypass, aortic stent-graft explant and primary repair of posterior duodenum defect x 2 (D3), pyloric exclusion, gastrojejuno-stomy, feeding jejunostomy, omental flap.
- Presented with temp 38.3 C, intermittent rigors and infected aortic graft for closure of aorto-enteric fistula and repair of duodenal atresia, excision of infected aortic graft, gastrojejunostomy, axillary-femoral-femoral bypass.
- Left sided Ax-fem bypass followed by laparotomy and resection of abdominal aortic graft. Surgeons noted multiple duodenal injuries secondary to adherence to the graft, requiring pyloric exclusion, gastrojejunostomy and placement of feeding jejunostomy. Distal aortic pulses found to be dampened and showing evidence of distal malperfusion without radiographic evidence of graft stenosis, determined to be due to sump effect. Right sided axillary-femoral bypass placed with resolution of proximal-distal pressure gradients and markers of distal malperfusion.
- Post op course: difficult pain control, delayed return of bowel function, marginal anastamotic ulcer, TPN nutrition.

Diagnostic and Therapeutic Considerations of AEF

- **Diagnosis: GI hemorrhage, abdominal pain, and a pulsatile abdominal mass.**
- **Time interval between initial herald bleeding and massive GI hemorrhage: 1h - 2d.**
- **Dx: Abdominal C+ CT. Spiral CT. Technetium-labelled red blood cells. Peri-aortic air bubbles (80%), bowel wall edema around the aorta, loss of a fatty plane between the aorta and GI tract, and visualization of the fistula.**
- **Bleeding control at the time of initial diagnosis. Prevention of late complications associated with bleeding and infection.**
- **Early diagnosis prior to major bleeding, prompt bleeding control by control of the proximal aorta, closure of the enteric fistula without spilling of the bowel contents, arterial reconstruction, prevention of postoperative complications (graft infection, limb loss).**
- **Surgical procedures: aortic resection followed by an axillo-bifemoral bypass (AxBFB), in situ aortic reconstruction using a prosthetic graft, antibiotic-impregnated prosthetic graft, autogenous femoral vein graft, or cryopreserved aortic allograft.**
- **Timing and sequence unimportant.**
- **30-d mortality 26%, Survival rates 12-m 60%, 24-m 50%. Re-intervention rate 18%.**

Figure 1: Pre-Aortic Surgery CT Angiogram. MAS.
Hypoplasia suprarenal aorta, superior and middle mesenterics. Collateral internal mammaries, epigastrics, Riolano arcade.

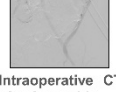

Figure 3: Intraoperative CT Digital Subtraction Angiographic
Image following left axillary-femoral bypass graft. Evidence of patent graft with blood flow to bilateral iliacs and renal perfusion.

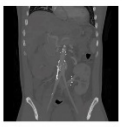

Figure 2: Preoperative CT Thoraco- Abdominal C+
Demonstrating evidence of middle aortic reconstruction.

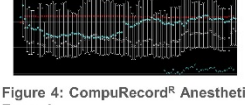

Figure 4: CompuRecord^{R} Anesthetic Record
Intraoperative anesthetic record demonstrates a stable physiologic profile. Of note, there is a hyperdynamic circulation.

Discussion

Anesthetic considerations in this case included proper and adequate access, point of care testing utilization, appropriate transfusion goals, and presence of both SAEF and a vascular prosthesis infection.

Close coordination with surgeons regarding implications of intraoperative surgical reassessments guide proper arterial and central access. Arterial access should be on the anticipated non-bypass upper extremity (allowing surgical access) and should be as distal as possible (to preserve native arterial anatomy if bilateral bypass grafts are necessary). Additionally, central access should be place in the internal jugular vein, as both subclavian and femoral sites are within the sterile field.

Point of care testing was effectively utilized throughout this case. Bedside activated clotting times were used to assure adequate heparinization throughout bypass implantations. Epoc blood analysis system was utilized for goal directed red blood cell transfusions. Transfusing with the anticipation of large volume blood loss preserved hemodynamic stability throughout the case. ROTEM was utilized to assure adequate coagulation in light of the 1.5 L EBL and +6L crystalloid resuscitation in conjustion with 6 units of red blood cells and one unit of platelets.

With regard to the patient's SAEF/infection graft, we anticipated of septic state on manipulation of infected graft. Showering of bacteria, found to be infected with veillonella and klebsiella pneurmoniae, resulted in significant vasoplegia and increased hemodynamic support requirements.

Conclusions

Our case shows that with meticulous anesthetic care and close communication with the surgeon, it is possible to have a successful outcome in these cases.

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ROTEM®-Guided Therapy For The Placenta Previa-Accreta Parturient Undergoing Elective Cesearean-Hysterectomy

Danielle McCullough, M.D[1], Emily Kahn, M.D[1], Jon D. Samuels, M.D.[1]
Department of Anesthesiology[1], Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Abstract

Postpartum hemorrhage is a major contributor to morbidity and mortality in the obstetric population, with abnormal placental implantation responsible for a large proportion of bleeding patients. Abnormal placentation is on the rise in the US, which has led to standardized institutional protocols for the anesthetic management of both planned and emergency cesarean sections. In our institution, a standardized perioperative protocol is followed with a multidisciplinary approach involving Gyn/Oncology for possible hysterectomy and interventional Radiology for placement of bilateral uterine artery catheters. Coordination of the multidisciplinary team is performed by anesthesiology and obstetrics in tandem. ROTEM thromboelastography is routinely used to evaluate accreta patients in the peri- and intraoperative period, a practice which we believe helps to avoid both unnecessary blood product administration and conversion to general anesthesia. We report the case of a 35 year old G2P0010 patient with placenta accreta diagnosed by MRI who was determined intraoperatively to have placenta percreta invading surrounding tissue. The patient underwent planned cesarean/hysterectomy with standardized protocol and ROTEM and epoc point of care testing. EBL was 2800cc with a hematocrit nadir of 21%. The patient received minimal blood product resuscitation (3 units packed cells only). RO TEM analysis revealed a normal coagulation profile throughout; the patient did not require platelets or plasma. postoperative coagulation testing correlated with ROTEM. The patient remained under neuraxial anesthesia for the entire 6.5 hour procedure and was discharged home 4 days later after an uneventful postoperative course.

Case Report

A 34-year-old G3P1011 was admitted for scheduled repeat cesarean section at 34 weeks 3 days. Placenta previa accreta was suspected on 28 week ultrasound. MRI at 29 weeks was consistent with increta/percreta with low anterior implantation. The patient was evaluated by Gyn/Oncology prior to admission for planned hysterectomy. Multidisciplinary meeting with Gyn/Onc, Interventional Radiology (IR), OB/Gyn and Obstetric Anesthesia was convened prior to admission for review of our institutional accreta protocol and patient chart.

On the day of surgery, epidural was placed in the labor and delivery unit, patient was then transported to IR for placement of bilateral uterine artery balloon catheters under continuous fetal monitoring and brought to OR for cesarean and hysterectomy. Radial arterial line was placed prior to procedure start. Baseline ROTEM showed no coagulopathy (i.e., a hypercoagulable profile within normal pregnancy limits) and starting hct on EPOCH was 28%. The infant was delivered uneventfully and uterine artery balloons inflated subsequently.

During hysterectomy the placenta was found to have invaded through the uterine wall and into surrounding bladder tissue; there was acute blood loss of approximately 1L (hct nadir 21% by bedside EPOCH) during uterine dissection for which 3u prbc were transfused with recovery to 23%. ROTEM analysis remained within normal limits throughout the case, demonstrating that no further blood products were needed beyond the packed cells after surgical hemostasis was achieved. The patient remained under neuraxial anesthesia for the 6.5 hour duration of the procedure. Final EBL was 2800cc. Foley was left in place for 2 weeks postoperatively due to bladder laceration. The postoperative course was otherwise uneventful with no further transfusion requirement and the patient was discharged home 4 days later.

Use of ROTEM® in Obstetric Surgery. WCM Placenta Accreta Guidelines and Clinical Pathway.

- Admission day prior to scheduled surgery for type and screen, CBC, fibrinogen, coagulation panel. Blood bank notified of case.
- Patient brought to Labor and Delivery unit 6:30 a.m. on the day of surgery. Epidural catheter placed by anesthesia. 3-way foley catheter placed by nursing.
- Patient transported to Interventional Radiology suite for placement of bilateral uterine artery catheters under neuraxial anesthesia. Labor and Delivery nurse accompanies patient to IR for continuous fetal monitoring.
- Patient brought to general operating rooms for cesarean delivery under neuraxial anesthesia. 4 units PRBC, 4 units FFP, Belmont rapid infuser and EPOC in room.
- Multidisciplinary "huddle" including OB, Gyn/Onc, IR and Anesthesia practitioners. Surgical and anesthetic plan and roles discussed. (E.g., planned hysterectomy? Who will inflate balloons? General anesthesia?)
- Patient positioned in operating room. Uterine artery catheter location confirmed by fluoroscopy. Arterial line and 2 large-bore IVs placed by anesthesia. Patient may have partner present while under neuraxial anesthesia.
- Gyn/Onc attending and IR attending present for cesarean incision. Balloons inflated after delivery of infant. Gyn/Onc scrub for hysterectomy during delivery.
- Balloon catheters/arterial sheaths removed in OR after completion of the procedure.
- Patient recovers in general OR PACU.

Figure 1. ROTEM®. ROTEM flow sheet.

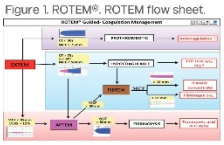

Fig 1. ROTEM interpretation and management guidelines.

Figure 2. ROTEM® TEMograms.

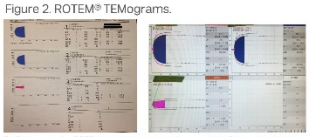

Fig 2. Intraoperative ROTEM thromboelastograms for our patient. Outer red and black lines represent pregnancy reference values.

Figure 3. IR Image.

Figure 3. Interventional Radiology image of uterine artery occlusion catheters. Total placenta previa with low anterior attachment. Placenta accreta extends through uterine scar beyond peritoneal reflection*

Figure 4. Intraoperative Hemodynamics

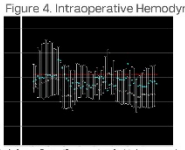

Fig 4. CompuRecord® screenshot. Stable intraoperative hemodynamics and minimal fluid/blood product administration allow for avoidance of general anesthesia.

Discussion

Postpartum hemorrhage due to placenta accreta is a major contributor to obstetric morbidity and mortality, both worldwide and in the United States. The incidence of abnormal placental implantation is increasing in the US, placing a larger segment of the population at risk for hemorrhage. It is difficult to predict which of these patients are most at risk for postpartum hemorrhage and seems prudent that institutions implement a standardized way of approaching the anesthetic management of these patients. Our institution uses a multidisciplinary approach to the care of these patients which allows for minimal blood loss and conservative transfusion strategies. Bedside thromboelastography with ROTEM is routinely used to guide transfusion therapy during planned cesarean sections in our institution in order to rapidly determine whether coagulopathy is present and to minimize unnecessary blood product administration and the inherent risks thereof. Normal reference ranges for ROTEM have been reported for the hypercoagulable state of pregnancy. Our case shows that in the setting of significant hemorrhage bedside thromboelastometry allows for a more conservative approach to resuscitation. Further study should be undertaken to determine whether use of ROTEM decreases the incidence of adverse transfusion outcomes in this population.

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Epidural hematoma occurring after removal of percutaneous spinal cord stimulator trial leads in a cancer patient with chronic thrombocytopenia

Selaiman Noori MD, James Yu BS ,Timothy Connolly MD, and Amitabh Gulati MD

The New York Academy of Medicine – Section on Anesthesiology | May 9, 2017

Weill Cornell Medicine Anesthesiology

Memorial Sloan-Kettering Cancer Center

Introduction

- Spinal cord stimulators (SCS) are considered a relatively safe treatment for intractable chronic pain. Most complications are technical (e.g., lead migration) and biological complications (e.g., epidural hematoma) are rare, but potentially devastating
- According to recent ASRA guidelines, SCS procedures have been identified as high bleeding risk procedures amongst percutaneous procedures
- Actual incidence of hematoma is rare—0.2-0.3% of cases—and can occur during SCS trial, lead removal, or implant
- Cancer patients may be at increased risk secondary to thrombocytopenia as a result of chemotherapy or hematological malignancy
- Platelet count threshold recommended prior to neuraxial techniques varies significantly from country to country, indicating significant uncertainty among clinicians of the correct management of these patients

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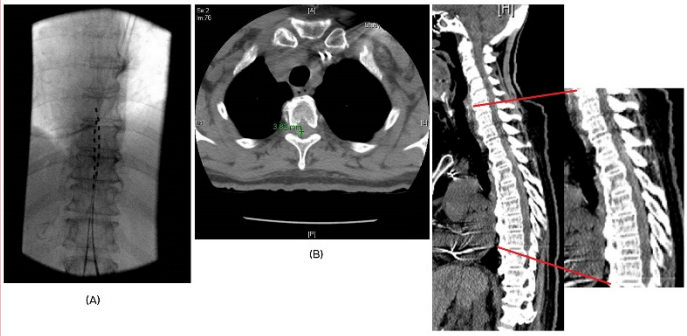
Case

72F p/w weakness and increasing left leg pain one year after L4-L5 laminectomy with foraminotomy & microdiscectomy. After surgical intervention, she had been treated with lumbar ESIs with limited benefit. She also had some pain relief with medications, including fentanyl patches, oxycodone, anticonvulsants, and cyclobenzaprine. PMH was notable for stage II follicular lymphoma & liver mass, PPM, and chronic thrombocytopenia secondary to splenomegaly. Given the constant radicular nature of her symptoms, percutaneous SCS was chosen as the most appropriate course of treatment.

On day of procedure, labs were notable for a platelet count of 84 x 103/uL, which increased to 108 x 103/uL following transfusion of one unit of platelets. Using a 14G Tuohy needle, two trial leads were then introduced into the L1-2 epidural space and placed midline, with distal tips ending at the T8-9 interspace (Figure 1a). Following a three day trial, the patient reported excellent improvement in pain scores and ambulation, however, she was unable to tolerate the paresthesias and deferred permanent implantation. Removal of leads was delayed secondary to thrombocytopenia requiring multiple transfusions of platelets over the course of several days: Day 4: Platelets 76 x 103/uL. Day 5: Platelets 77 x 103/uL after 1 unit of platelets. Day 6: Platelets 97 x 103/uL after 1 unit of platelets. Additional unit given with subsequent increase to 110 x 103/uL.

On the evening of day 6, leads were removed and within 5 minutes, the patient complained of severe, nonradiating back pain associated with new posterior occipital headache. She maintained strength in all extremities and neurologic exam was normal. NSGY was consulted and a CT scan with contrast of the total spine was negative for hematoma on preliminary report. Overnight, the patient's symptoms stabilized and completely resolved by the following morning. On day 7, the team was alerted by radiology regarding a T2-T9 epidural hematoma (Figure 1b,c) on final read. Neurochecks were continued, and given resolution of symptoms and return to baseline, no intervention was performed



(A) (B) (C)

Figure 1: a) Radiograph of thoracolumbar spine showing SCS electrode tips at the T8-9 interspace, b) axial CT of the mid thoracic spine demonstrating blood in the epidural space, and c) sagittal cut with T2-T9 epidural hematoma.

Discussion

- Incidence of epidural hematoma is low, but consequences are potentially devastating. However, there are risks associated with exposure to platelet transfusion without any obvious clinical benefit.
- A recent Cochrane Review identified no RCTs studying the correct platelet transfusion threshold prior to insertion of a LP needle or epidural catheter.
- SCS patients may be at increased risk for hematoma due to:
  - Significant spinal abnormalities may compact the epidural venous plexus within tight epidural spaces
  - Distorted anatomy secondary to previous surgeries
  - Use of large bore needles and rigid catheters that may further contribute to trauma
- High risk factors for bleeding: old age, bleeding tendency, use of anticoagulants / anti-platelets, advanced liver / renal disease, malignancy
- Cancer patients are at further risk and should perhaps get platelet function assays, as well
  - Platelet function analysis (PFA-100) has been shown to identify patients with impaired hemostasis
  - Thromboelastography (TEG) tests for global assessment of the hemostatic process, which is related to platelet count and function, clotting, and fibrinolytic activation
- Should the clinician routinely use tests for platelet function before neuromodulation? These are difficult questions that must be entertained by the implanting physician on a case-by-case basis
- Pain physicians must be vigilant to quickly recognize signs of epidural hematoma (e.g., acute neck / back pain, headache, new weakness, etc) and to intervene immediately

Use of the SuperNO$_2$VA™ During Prolonged Intubation in a Morbidly Obese (MO) Patient with Unexpected Difficult Airway

Weill Cornell Medicine
NewYork-Presbyterian

Catherine Rim M.D., Jon D. Samuels M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Introduction

Endotracheal intubation in the MO patient remains a high-risk procedure, despite the recent advances in airway technology. Video laryngoscopy (VL) has revolutionized this process by allowing for better visualization of the glottis, improving first pass success, and decreasing the incidence of difficult orotracheal intubation.[1,2] VL does not decrease time to intubation or incidence of hypoxemia in high-risk patients.[1-3] In the MO population, apneic deoxygenation occurs from 3 minutes to as little as 30 seconds. Hypoxemia in high-risk patients during laryngoscopy reaches 20%, and accounts for 17% of the American Society of Anesthesiologists (ASA) closed-claims database and 31.8% of the claims in the American Association of Nurse Anesthetists database.

Case Report

- 35M with PMH of obstructive sleep apnea (OSA,) robotic sleeve gastrectomy. BMI 41 kg/m2. PSH: non contributory.
- Airway examination: Mallampati 1, thyromental distance > 6cm, full neck and head range of motion, inter-incisor distance > 5cm, with large neck circumference and full beard. Plan: SuperNO$_2$VA™ device for pre-oxygenation, confirm successful nasal ventilation after induction, followed by paralysis with non-depolarizing muscle blocker and continued SuperNO$_2$VA™ nasal oxygenation and ventilation during laryngoscopy and orotracheal intubation, as well as for extubation and transport to the post-anesthesia care unit (PACU).
- After preoxygenation, intravenous induction and easy volume control ventilation via nasal SuperNO$_2$VA™. Laryngoscopy revealed laryngomalacia. Difficult atraumatic intubation with external external cricoid manipulation and head positioning was successful after 390 seconds. The oxygen saturation remained at 100% throughout. The
- SuperNO$_2$VA™ did not obstruct access to the oral cavity.

The SuperNO$_2$VA Device (*Revolutionary Medical Devices, Inc.* Tuscon, AZ)

- 2014 Cataldo and Pedro described a modified nasal or nasal plus oral pediatric mask and a bag-valve-mask resuscitator. Delivers low leak titratable positive pressure up to 30 L/minute.
- Connected via a 15-22 mm adaptor to standard oxygen equipment (anesthesia circuit, Jackson-Rees modification of the Ayre's T-Piece non-rebreathing system or self-inflating resuscitator). Oxygen source is via anesthesia machine, hospital supply or E-cylinder.
- Ventilation may be either spontaneous, assisted or controlled.
- Nasal ventilation is the preferred route, and works better than either oral or oral plus nasal.

To date the most promising uses are the gastroenterology suite, particularly bariatric pre-surgical screening and the electrophysiology suite for sedation cases. Positive pressure ventilation during the induction sequence is an evolving indication.

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Figure 1: SuperNO$_2$VA™ Device
Modified CPAP nasal or nasal plus oral system. Twin duckbill valves for addition of oral mask, enhanced velcro strap, auxiliary oxygen port, sampling port outlet for CO2 detection, upward-facing oxygen connector.

Figure 2: Positive Pressure Ventilation During Intubation
Frontal view: Modified oxygen inlet and low profile of the SuperNO2VA™ device minimizes steric hindrance.

Figure 3: Positive Pressure Ventilation During Intubation
Lateral view: Displaced auxiliary oxygen port and Velcro strap allow full front-of-neck access during airway maneuvers.

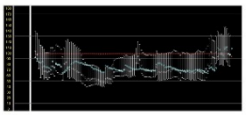

Figure 4: CompuRecord^R Anesthetic Record
Intraoperative anesthetic record demonstrates a stable physiologic profile with 100% oxygen saturation during the prolonged induction sequence.

Discussion

Anesthetic considerations during the induction of this patient include preoperative airway assessment, documentation of OSA severity, presence of adequate access, optimal (ramp) position, full not fast-track preoxygenation, assessment of intragastric volume, presence of additional personnel, including anesthesia and attending surgeon, with identification of back-up equipment, including an appropriate tracheostomy set.

Demographic considerations include monitoring difficulties due to body habitus, higher incidence of difficult mask ventilation due to increased BMI and facial hair, higher incidence of difficult intubation, airway abnormalities "hidden" by facial and neck adipose, positional atelectasis, upper airway soft tissue collapse, increased incidence of positional injury. Gastric emptying in the MO population is unchanged, although pouch size is larger, so that after a controlled fast (liquid diet for 2 days) the stomach should be empty. Apneic deoxygenation occurs much faster, due to increased cardiac output, and decreased functional reserve (FRC).

During bariatric surgical procedures, FRC and atelectasis are further increased from pneumoperitoneum. Minute ventilation is increased 30% from carbon dioxide insufflation. The tracheal tube should be positioned in the corner of the hypopharynx following intubation, because esophageal probes are placed.

Heretofore, ventilation and oxygenation ceased with initiation of laryngoscopy.

Conclusions

Our case shows that the even extremely high-risk patients presenting with an unexpected difficult airway may be safely treated with the SuperNO$_2$™ device.

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Tracheal Agenesis: A Rare Cause of Airway Compromise in the Operating Room

Weill Cornell Medicine
NewYork-Presbyterian

Christopher Sattler MD, Franklin Chiao MD, David Stein MD and Denise Murphy CRNA

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Introduction

Tracheal agenesis (TA) is a rare congenital condition with an incidence of 1:50,000 live births and an estimated 85% mortality[1]. It was first described in 1900 in the case of a cyanotic newborn where tracheal tissue could not be identified during emergent tracheotomy[2].

In 1962, Floyd et al described a similar case and devised a classification system for the variants of this condition[3].

The classic presentation is that of an apneic infant without an audible cry due to the absence of a glottic opening[4]. Difficult intubation often leads to inadvertent endo-esophageal intubation with subsequent respiratory stabilization[3].

Case Details

3 day old neonate with imperforate anus for loop ileostomy creation:

❖ Preoperative history:
- Born at 34 weeks to G1P0 via cesarean section for preterm premature rupture of membranes and failure to progress
- IVF (day 3 embryo transfer)
- Single umbilical artery, velamentous cord insertion and polyhydramnios
- Apneic at delivery
- No improvement with bag mask ventilation
- Difficult intubation but capnographic confirmation of placement
- Cycles of instability and stabilization

❖ Intraoperative events:
- Large intraoperative air leak at 5 cmH_2O
- Low tidal volumes
- $ETCO_2$ from 25-30 mmHg
- Mouth was packed with wet gauze with reduction in air leak
- Direct laryngoscopy unable to visualize ETT passing through glottic opening
- Episode of bronchospasm treated with albuterol and epinephrine 10 mcg x 2 doses

❖ Postoperative course:
- ENT direct laryngoscopy
  - Normal epiglottis with partially formed arytenoid cartilages and fused glottis with no tracheal opening, esophageal intubation
- CT scan showed persistent esophagotrachea with communication between the airway and esophagus at the level of the carina
- Incompatible with independent survival and extubated to demise

Types of Tracheal Agenesis

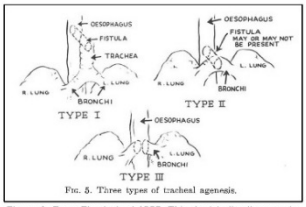

FIG. 5. Three types of tracheal agenesis.

Figure 1. From Floyd et. al 1962. This depicts the three main types of tracheal agenesis.

Chest X Ray

Figure 2. There is absence of the tracheal shadow, the ETT is high in the tracheal region and a large gastric bubble is present.

Coronal Chest CT

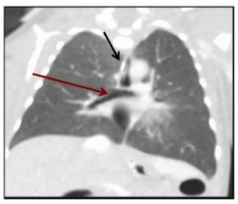

Figure 3:. A CT scan of the chest shows communicating bronchi (red arrow) anterior to the esophagus (black arrow). There is absence of the trachea.

Sagittal Chest CT

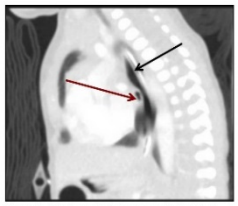

Figure 4. The bronchi (red) are again depicted anterior to the esophagus (black). There is absence of the trachea. Endtracheal tube and repogle are seen in the esophagus.

Management

- Few recommendations for management are currently available given the rarity of this condition
- Esophageal intubation may allow for temporary stabilization
- Surgical repair has been described in several cases with longest duration of life 6 years[7]
- Tracheostomy, cervical esophagectomy, esophageal banding, gastrostomy and esophageal reconstruction have been described[8]
- TA 2 and 3 considered generally unamenable to repair at this time[8]
- Interventions which introduce medications into the gastrointestinal tract or airway should probably be avoided before repair has been attempted

Discussion

We describe a case of intraoperative management of a patient with uncorrected tracheal agenesis.

The patient had a large air leak and intraoperative bronchospasm. Whether these are common findings in these patients is not well known. We managed the air leak by packing the mouth with wet gauze which improved the seal and increased tidal volumes. Bronchospasm was treated in this patient with intravenous epinephrine.

The lungs were ventilated through the esophagocannal connection which allowed the patient to oxygenate, remarkably up to 100% for the surgery.

Rare congenital airway abnormalities such as this one as may be difficult to diagnose and patients may present to the operating room for repair of more obvious malformations.

Conclusion

As the development and implementation of synthetic grafts improves, more patients may be candidates for reconstruction of the trachea and require the care of an anesthesia provider. More experience is needed to determine how else to best optimize these patients for surgical repair and what to expect intraoperatively.

Early recognition and diagnosis of this condition are needed to prevent unnecessary treatment of other, more obvious malformations.

Diagnosis of Tracheal Agenesis

- Most frequently diagnosed after birth
- Apneic infant without audible cry cannot be intubated[4].
- TA may produce signs and symptoms that allow for in utero diagnosis when tracheoesophageal fistula (TEF) is absent[1].
  - Enlarged hyperechogenic lungs, a fluid filled dilated trachea and bronchi with absent flow in the trachea during breathing with or without cardiac dysfunction, diaphragmatic flattening and ascites → Congenital High Airway Obstruction Syndrome (CHAOS).
  - A fetal MRI can confirm the diagnosis
- Polyhydramnios is most common in utero finding, but is nonspecific[1]
- Associated with VACTERL and TACRD syndromes[5]
- A chest x-ray will reveal the absence of tracheal shadowing, a malpositioned ETT and abdominal distention[1].
- CT scan of the neck is the diagnostic test of choice[6]
- Contrast swallow studies should be avoided as they can cause respiratory compromise[1]

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Airtraq® Intubation of the Patient with Neck Abscess and Trismus

Christopher Sattler MD, Ajay Dharmappa MD, and Jon D. Samuels MD

Department of Anesthesiology, Weill Cornell Medicine, New York-Presbyterian Hospital, New York, NY

Weill Cornell Medicine

NewYork-Presbyterian

Introduction

Parapharyngeal abscesses are a relatively common subtype of deep neck space infections (DNSIs)[1]. Though these infections may be amenable to treatment with antibiotics, surgical drainage remains a mainstay of treatment[2].

Difficulty securing the airway is a primary concern in the management of anesthesia for these patients. Trismus from pterygoid muscle involvement and anatomical distortions from mass effect may lead to airway obstruction and difficult or impossible ventilation and intubation[1,2]. Furthermore, instrumentation of the airway may lead to rupture of the abscess and subsequent aspiration[2].

Case Details

- 32-year-old female
- 3 weeks prior with headache, pharyngitis and rhinitis that mostly resolved
- Persistent sore throat and odynophagia
- Swollen right palate
- Treated for streptococcal pharyngitis
- CT Scan visualized right sided parapharyngeal abscess with mass effect on medial pterygoid muscle, right nasopharynx and palatine tonsil. Larynx is midline and not twisted or torqued.
- No obvious signs of respiratory distress
- Cranial nerves II-XII normal
- Mallampati IV
- Small mouth opening with trismus, inability to fully protrude tongue
- Small Airtraq®, 6.5 ETT
- No disruption of the abscess

Utilization of the Airtraq® Disposable Optical Laryngoscope (DOL)

- *Primary indications*: C-spine (neutral neck position), TMJ hinge joint dysfunction
- *Secondary indications*: receding mandible, large tongue, advanced periodontal disease
- *Why chosen*: Posterior tongue location. Small size (low profile), right angle design favors small oropharynx/tongue size. Larynx was midline and not extrinsically compressed. No time constraint to secure the airway. Excellent conduit for FOB; peer and decannulate technique is superior to Seldinger technique.
- *Back-up plan*: Wake up. Surgical airway (highly unlikely).
- *Technical notes*: A slight twisting of the device was necessary to bring the glottic opening into the center of view. The endotracheal tube was advanced through the channel under indirect visualization. Using the index finger of the right hand, with the palm facing laterally, the endotracheal tube was peeled laterally from the guide channel. The Airtraq® DOL was removed from the oral cavity and the endotracheal tube secured in the usual fashion. Intubation time = 12 secs.

Figure 1
Reassuring neck mobility, hyomental distance, temporomandibular joint and dentition. IID is 20-mm.

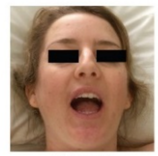

Figure 2
Physical examination significant for trismus and Mallampati Class 4, with only the hard palate visualized. The patient was unable to protrude the tongue.

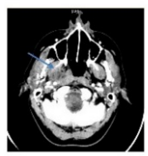

Figure 3
The right-sided parapharyngeal abscess is observed abutting the medial pterygoid muscle, with mass effect on the right nasopharynx.

Figure 4
Small Airtraq® DOL[5]. Original indirect channeled VL. Small (green) preferable for this patient: compact, low profile, accommodates minimal mouth opening (IID 16-mm).

Discussion

Parapharyngeal abscesses are a relatively common occurrence and may present with symptoms of airway obstruction. The mass effect of the abscess may lead to suboptimal intubating conditions including trismus and anatomic distortion. Induction of anesthesia may not improve trismus associated with infection[3].

While stridor and dysphagia are obvious signs of obstruction, they may be late findings; odynophagia and trismus may signify partial obstruction. Inability to protrude tongue is sensitive for sublingual impairment and impending airway obstruction[4].

The Airtraq® device is a single use, optical laryngoscope that comes in a variety of sizes. We used the small adult Airtraq®, which requires a minimum mouth opening of 16 mm and is compatible with size 6.0-7.5 ETT. While a pediatric size Airtraq® can be used for 11.5 mm mouth openings, the largest ETT that can be accommodated is a size 5.5[5].

Conclusions

- Airtraq® device is a safe option for intubation in a patient with parapharyngeal abscess
- Use of the Airtraq® allowed for minimal manipulation of the patients head position
- Good visualization of the airway during insertion
- Minimized disruptions of the abscess
- Endotracheal tube stylet is not needed when the Airtraq® is used
- Airway was secured in a timely fashion without any adverse events
- Small adult size utilized given limited mouth opening

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From Airtraq® instructions for use http://www.airtraq.com/download/IFU/A011-A021-A031-A041_IFU.pdf

Anesthetic Management of a Pediatric Patient with Osteogenesis Imperfecta Type 1

Sebastian Specks M.D., Robert S. White M.D., Jon D. Samuels M.D.

Department of Anesthesiology, Weill Cornell Medicine , New York, NY

Weill Cornell Medicine

Introduction

Osteogenesis imperfecta (OI), or brittle bone disease, is a group of genetic disorders of the connective tissue resulting from abnormalities in collagen formation and structure. There are eight recognized forms of OI, classified as type I through type VIII—type II is the most severe, while type I is the mildest form and will be discussed here. OI type I is the most common form, affecting an estimated 4-5 per 100,000 people worldwide. It is caused by a mutation in one of the genes for collagen (*COL1A1*) resulting in an inadequate amount of normal collagen. Features of OI type I include fractures, blue sclera, hearing loss, brittle teeth, kyphoscoliosis, and triangular face. Fractures typically begin with ambulation and become less frequent after puberty. Individuals with OI type I have minimal bony deformity and near normal stature. Diagnosis is made primarily clinically, though collagen testing of a skin biopsy sample or DNA testing of a blood sample can confirm the diagnosis. Prenatal testing via chorionic villus sampling or amniocentesis is also available. Treatment of OI is primarily focused on preserving mobility, limiting progression of cardiopulmonary complications and prompt surgical correction of fractures. Anesthetic considerations include bone fragility, skeletal deformity, fragile teeth, ligamentous laxity, bleeding diathesis, cardiac anomalies, and altered pulmonary mechanics.

Case Description

- 12M with known osteogenesis imperfecta type I presented to the ED with numerous fractures after a fall.
- Patient was taken to the OR for bilateral olecranon ORIF, left femur CRPP and right ankle casting.
- ASA-mandated monitors were placed. As per recommendation of PICU attending, NIBP monitoring of thigh was limited to every 15 minutes to prevent further orthopedic injury.
- Uneventful IV induction of GA with midazolam, fentanyl, propofol and rocuronium.
- Cervical spine was stabilized during atraumatic endotracheal intubation by the attending anesthesiologist using a size 3 McGrath ®.
- A Bair Hugger on ambient temperature, nasal temperature probe, and HME were placed.
- Additional IV access was obtained in the left internal jugular vein.
- The patient's intra-operative course was uneventful—he was extubated and transferred to the PICU for post-operative care as per institutional protocol.

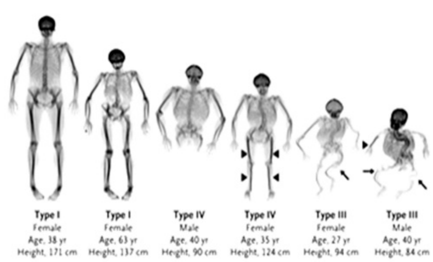

Figure 1 OI classification based on clinical severity and features. I<IV<V<VI<III<II.

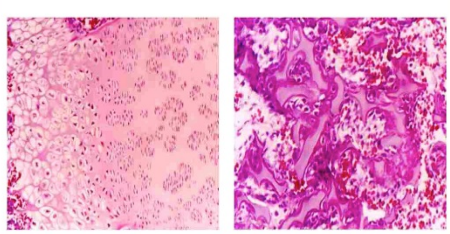

Figure 2: OI Histologic Diagnosis. Proliferation and columnization of chondrocytes. Abundant hyaline cartilage with little endochondral ossification and absent cortical bone formation.

Treatment

Patients with osteogenesis imperfecta present numerous challenges to the anesthesia provider. The airway may be distorted and over-extension of the cervical spine must be avoided, as this could lead to odonto-axial dislocation or fracture. Use of an intubating LMA, FOB or video laryngoscope should be considered and intubation performed by the most experienced provider. Given their predisposition to fractures, meticulous positioning is necessary and extra care should be taken when transferring patients to and from the OR table. Furthermore, when possible, avoid NIBP, tourniquets, shivering, and depolarizing fasiciculations, all of which could lead to fractures.

Patients with OI have a propensity to bleed and bruise easily due to impaired platelet plug formation. Patients should have an active type and cross-match, with blood, platelets and FFP readily available and administered as needed.

Approximately 85% of cardiac muscle is comprised of Type I collagen. OI is associated with increased ventricular compliance and a high incidence of aortic dissection, left ventricular rupture and valve incompetence. When possible, an EKG and echocardiogram should be obtained preoperatively.

OI patients often have pulmonary mechanics reflective of restrictive disease and V/Q mismatching, which can lead to hypoxemia and may require high FiO_2 or PEEP. Pulmonary function testing should be performed whenever possible.

Conclusions

This case highlights a successful anesthetic management of a pediatric patient with OI type I undergoing reduction of numerous fractures. Key elements of management included airway stabilization and intubation by the attending anesthesiologist, as well as meticulous care in positioning and avoiding further orthopedic injury by excessive NIBP frequency or tourniquet use for IV placement

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Anesthetic considerations in a case of cauda equina syndrome in the third trimester

Maria C. Walline, M.D., Farida Gadalla, M.B., Ch.B., Jaroslav Usenko, M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction:

- While low back pain is common in pregnancy (54-75% of pregnancies), lumbar disc herniation is not (incidence 1:10,000) and cauda equina syndrome (<2% of lumbar disc herniations) is seen even less frequently.
- Cauda equina syndrome (CES) is considered a neurosurgical emergency.
- Superior outcomes, including improved motor and sphincter recovery, are generally acknowledged to occur if surgical decompression occurs within 48 hours of onset of symptoms.
- Executing an anesthetic for an obstetric case immediately followed by a neurosurgical case is rare.
- In planning for this procedure in a pregnant woman, effective communication between the obstetric, neurosurgical, and anesthesia teams is paramount for the safety of the mother and baby.

Image 1 (2/14/16):
Sagittal T2 MRI showing **large central disc extrusion at L4-5 which results in severe canal stenosis and compression of the cauda equina nerve roots.**

Image 2 (2/23/16):
Sagittal T2 MRI showing post-operative fluid collections in the subcutaneous soft tissues and **soft tissue extruding from the L4-5 disc space with severe stenosis of the spinal canal consistent with recurrent disc herniation.**

Discussion:

- There are less than five cases reported in the literature of surgical decompression for cauda equina syndrome in pregnancy and even fewer that included delivery by cesarean section as an immediate precursor.
- In the third trimester (particularly after 34 weeks), delivery prior to neurosurgical procedure is recommended.
- Preparation for potential complications is key, including obtaining appropriate intravascular access for both resuscitation and monitoring.
- Positioning is of concern, with different goals for each portion of the procedure. For the initial cesarean section, supine position with a wedge under the right hip is optimal. When turning to the prone position for the laminectomy, care should be taken to ensure adequate padding of the recent abdominal incision.

Conclusion:

The anesthesiologist, particularly with subspecialty experience, can take a lead role in coordinating safe and effective care in complex cases involving multiple surgical teams and considerations.

Case Details:

- 31-year-old G2P1001 with PSH of L4-5 microdiscectomy 6 years ago initially presented at 33w5d with severe back pain, perineal numbness, and incontinence. MRI findings (**image 1**) consistent with CES and she underwent urgent uneventful L L4-5 hemilaminotomy and L4-5 microdiscectomy.
- She re-presented nine days later with acutely worsened radicular low back pain, urinary incontinence, and perineal numbness. MRI findings (**image 2**) consistent with recurrent disc herniation.
- Given the potential length of the required urgent laminectomy and technical difficulty with fetal monitoring in the prone position in addition to the challenge of converting to emergent cesarean section in the event of fetal compromise, the decision was made to deliver via cesarean section prior to laminectomy.
- Because general anesthesia (GA) would be required for the laminectomy, this anesthetic technique was used for the cesarean section as well.
- To minimize exposure of the fetus to GA, the patient was positioned, prepped, and draped prior to rapid sequence induction with propofol and succinylcholine.
- Two minutes after uneventful induction and intubation, a healthy baby girl (APGARS 8/9) was delivered.
- Uterine atony immediately followed, requiring administration of uterotonic agents and maintenance of GA with propofol and remifentanil instead of volatile agents.
- Once hemostasis was achieved and the incision was closed, the patient was turned from supine to prone position, with extra care taken to pad the fresh incision prior to the start of the laminectomy.
- Total IV anesthesia was maintained throughout the neurosurgical portion of the procedure.
- After remaining hemodynamically stable throughout both portions of the procedure, she emerged from anesthesia and was extubated uneventfully.

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New York State Conference for Anesthesiology (NYSCARF)

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A Case of Central Anticholinergic Syndrome after Diphenhydramine

Neeti Arora, M.D., & Michael Kiselev, M.D.

Symptoms of Central Anticholinergic Syndrome after prophylactic diphenhydramine overdose in a 43-year-old female undergoing a transforaminal lumbar epidural steroid injection under fluoroscopy, treated with physostigmine

Introduction

Central anticholinergic syndrome (CAS) is an underdiagnosed condition in which muscarinic cholinergic receptors within the central nervous system are blocked by anticholinergic medications that cross the blood-brain barrier. Manifestations are variable and may include delirium, coma, hyperpyrexia, ataxia, and nystagmus (Table 1). Implicated medication classes include antispasmodics, first generation antihistamines, anti-Parkinsonian agents, benzodiazepines, opioids, multiple classes of anti-depressants, and halogenated inhaled anesthetics (Table 2). We report a case of iatrogenic overdose of diphenhydramine in the setting of a fluoroscopic procedure in a patient with shellfish allergy.

Case Report

A 43 year-old female was admitted for a bilateral L5-S1 transforaminal epidural steroid injection (ESI) under fluoroscopic guidance without sedation. Her past medical history included chronic radiating lower back pain, seizure disorder (off antiepileptic medications for 10 years), obesity, asthma, hyperlipidemia, and poorly controlled hypertension. Her home medications included metoprolol, losartan, duloxetine, gabapentin, diclofenac gel, albuterol, and naproxen. She had not taken her anti-hypertensives the morning of surgery. Her medical history was significant for numerous food and drug allergies, including an anaphylactic reaction to shellfish. Of note, she was pretreated with diphenhydramine for her previous 3 fluoroscopically guided ESI without perioperative complications.

Prior to this procedure patient was given 50 mg of oral diphenhydramine. Intraoperative course was unremarkable. She arrived to the post anesthesia care unit ambulating and conversant. Her vitals were: HR 86, BP 157/97, RR 16 Temp 36.8. Thirty minutes after arrival she complained of nausea, dizziness, flushing and malaise and was treated with an additional 50 mg intravenous diphenhydramine. Shortly thereafter, she became obtunded and horizontal nystagmus was noted.

Her vitals changed to BP186/76, HR 120, and Temperature 37.6. CAS was suspected and treatment with a physostigmine infusion of 2 mg over 15 minutes was initiated. CAS was confirmed upon rapid improvement of mental status and vital signs without residual motor weakness. The patient was transferred to the medical step down unit for close monitoring. Workup of other etiologies for her CNS symptoms, including stroke and seizures were negative.

Table 1
Central and Peripheral Nervous System Signs and Symptoms

Central	Peripheral
Agitation	Cycloplegia
Amnesia	Dysrhythmia
Anisocoria	Flushed skin
Ataxia	Mydriasis
Delusions	Tachycardia
Hallucinations	Urinary retention
Hyperpyrexia	Xerostomia
Myoclonus	
Nystagmus	
Respiratory depression	
Somnolence	

Table 2
Medications Implicated with Central Anticholinergic Syndrome

Anesthetics	Nonanesthetics
Tertiary amine anticholinergics (scopolamine, atropine – most common)	Antispasmodics
Benzodiazepines	Antidepressants
Halogenated inhaled anesthetics	First generation antihistamines
Intravenous anesthetics	Anti-Parkinsonian
Opioids	

Table 3
Differential Diagnosis of Central Anticholinergic Syndrome

Metabolic	Neurologic	Latrogenic
Electrolyte abnormalities	Cardiovascular accident	Residual neuromuscular blockade
Renal failure	Embolus	Distended bladder
Hepatic failure	Seizure	Anesthetic overdose
Malignant hyperthermia	Anoxic/hypoxic brain injury	
Neuroleptic hyperthermia		
Pheochromocytosis		

Respiratory	Psychiatric
Hypercapnia	Acute psychosis
Hypoxia	Catatony
	Narcolepsy

Discussion

CAS is an infrequent, underdiagnosed condition in the perioperative setting partially due to its nonspecific presentation and lack of diagnostic laboratory tests. The differential diagnosis often includes cerebral vascular accidents, seizures, and metabolic derangements (Table 3). Its pathogenesis is rooted in anticholinergic medications crossing the blood-brain barrier and inducing various nonspecific mental status changes.

Physostigmine is the treatment of choice due to its ability to cross the blood-brain barrier and reverse the cholinergic blockade. Pretreatment with first generation antihistamines is routine for patients with mild allergic reactions to iodine contrast, despite the decreasing incidence of allergy with non-ionic iodinated contrast media. Antihistamines with a corticosteroid are given prior to fluoroscopic procedures as prophylaxis, but the pharmacokinetics should be kept in mind as overdosing may occur. We report this case to remind clinicians of CAS, a rare and underdiagnosed condition, and to recognize its potential induction by commonly used perioperative medications such as diphenhydramine.

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Opioid Prescribing Habits and Opinions Regarding Chronic Opioid Therapy at a Large Academic Institution

Jasmit Brar, M.D., Jesse Gruber, B.A., Neel Mehta, M.D.
Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

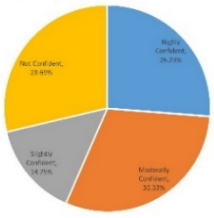
Introduction

Prescription drug abuse is a significant challenge to all healthcare providers as the risk of drug diversion and addiction are increasing, and physicians agree that long-term Opioid therapy is often overprescribed for patients with Chronic Non-Cancer Pain (CNCP)[1]. In 2013, New York State mandated a prescription drug monitoring program (PMP)/Internet System for Tracking Over-Prescribing (I-STOP) to counter potential prescription drug abuse, and included a series of opioid prescribing guideline webinars. The success of PMPs depends on prescriber awareness, education, and routine utilization.[2] The aim of this study was to assess the opioid prescribing habits and prescriber opinions regarding chronic opioid use at a large academic institution.

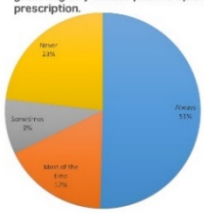
Methods

This is a cross-sectional observational study, using descriptive data from an 18-question quality-improvement survey administered to New York-Presbyterian-Weill Cornell Medicine physicians across 23 departments. Survey questions were designed to assess demographic information, opioid prescribing habits, and opinions regarding opioid addiction and abuse.

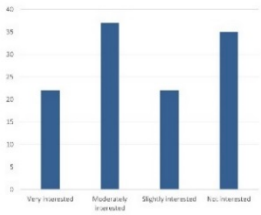
Confidence in chronic opioid therapy prescription



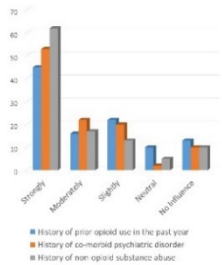
New York Prescription Monitoring Program Registry access prior to opioid prescription.



Interest in receiving additional education on the use of opioid therapy.



Influence of patient historical factors on prescription of opioids.



Results

- 120 physicians and 3 nurse practitioners.
- Internal Medicine Surgery, Neurology, and OBGYN were most prevalent.
- 78% practice in an outpatient setting.
- 51% had 15 or more years of practice experience
- 73% of respondents described chronic pain patients as representing 1-10% of their clinical practice.
- 77% reported treating CNCP in 1-10% of their patients.
- 40% of respondents do not prescribe chronic opioid therapy, while 45% report prescribing chronic opioid therapy for 1-25% of patients.
- A majority of respondents (77%) do not refer to any opioid prescribing guidelines/protocols.
- The use rates of clinical risk tools are as follows: opioid risk tool (22%), urine drug screen (22%), establishing a pain contract (31%).
- 65% of survey responders consider a pain management consult for daily opioid doses of 50mg-100mg morphine equivalents.
- A large fraction of respondents agree the risk of abuse is an obstacle to the treatment of chronic pain, while only 28% agree that lack of guidelines is a barrier to prescribing.
- 39% feel it is difficult to identify drug abuse in patients.
- Only 50% of respondents agree that pain management guidelines are useful while initiating opioid therapy.
- The majority (70%) expressed interest in obtaining additional opioid therapy education.

Conclusions

- Chronic pain represents a limited percentage of the clinical practice of the providers surveyed and routine opioid usage is limited.
- The routine utilization of PMP, or reference to any opioid prescribing guidelines or use of clinical tools is limited.
- There remains a significant opportunity and interest in additional training and education regarding opioid therapy.

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Weill Cornell Medicine NewYork-Presbyterian

Transnasal sphenopalatine block for treatment of postdural puncture headache

Ajay Dharmappa MD, Neel Mehta MD

Introduction

Postdural puncture headache (PDPH) is a common complication after neuraxial anesthesia and lumbar puncture (1). While conservative measures may treat symptoms, epidural blood patch remains one of the most effective treatments for patients suffering from PDPH (2). However, epidural blood patch remains an invasive procedure and is associated with its own set of complications (3). Here we present a case of PDPH that was treated successfully with a minimally invasive transnasal sphenopalatine block.

Traditionally, sphenopalatine blocks have been performed to help patients with headache and facial pain. Recent literature has suggested its role for the treatment of PDPH (1,4). The sphenopalatine ganglia is located in the pterygopalatine fossa, posterior to the middle nasal turbinate (figure 1). The superficial location of the ganglia allows the block to be performed easily with a transnasal approach (5).

Discussion

This case represents a successful treatment of PDPH using a transnasal sphenopalatine block. The technique is minimally invasive, easily performed, and associated with minimal side effects. Recent literature has supported increasing efficacy of this technique for the treatment of PDPH. (1,4) This technique could potentially be used as first line therapy in patients with PDPH and may help patients avoid the need for an epidural blood patch.

Figure 1

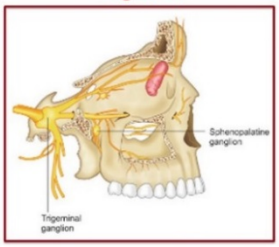
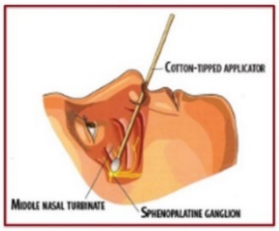


Figure 2



Case Report

34F with no significant PMH presented to emergency room (ER) with symptoms of PDPH. The patient presented to the ER the previous day with complaints of severe headache. A negative diagnostic lumbar puncture was performed by ER physicians, and the patient was discharged home that day.

1 day post lumbar puncture, the patient reported new onset of a fronto-occipital headache with a positional component, 8/10 in intensity and returned to the ER for treatment.

A transnasal sphenopalatine block was performed using 1% viscous lidocaine. The block was performed with the patient supine and assuming a sniffing position. A 10 cm sterile cotton tipped applicator was coated with 1% viscous lidocaine. The cotton applicator was then slowly advanced along the superior border of the middle turbinate until it reached the posterior wall of the nasopharynx (figure 2). The applicator was left in place for 30 minutes. This was subsequently performed on the contralateral nares.

Post block, the patient reported resolution of headache and all positional components. Pain scale was rated as 0/10, and the patient was able to ambulate without difficulty or return of headache. The patient was discharged home with instructions for follow up.

References

Weill Cornell Medicine

A Case of Intravenous Buprenorphine for Laparoscopic Cholecystectomy in India

Jeny Ng, MD, Milica Markovic, MD

INTRODUCTION

In the United States, buprenorphine is commonly encountered in the context of substitution therapy in opioid addiction treatment. Anesthetic concerns are often in regards to whether adequate analgesia can be achieved in patients on buprenorphine for maintenance therapy due to its properties as a partial agonist at the mu-opioid receptor.

However, particularly in the opioid-naïve, buprenorphine possesses analgesic properties and it is the only opioid available for surgical analgesia at a teaching hospital in Amritsar, a district within the state of Punjab, India. The use of intravenous buprenorphine for surgical analgesia and its adequacy for pain control is largely unfamiliar to anesthesia providers in the United States. We herein present a case from our global health elective in India involving the use of intravenous buprenorphine for laparoscopic cholecystectomy in an otherwise healthy 52-year-old female.

CASE

A 52-year-old female with acute cholecystitis was planned for laparoscopic cholecystectomy in Amritsar, India. She was induced with propofol and a single dose of buprenorphine 300 micrograms, and maintained on halothane after intubation. Her vital signs were within normal limits throughout the case, though her heart rate remained slightly elevated above 90 beats per minute. The patient was extubated uneventfully and transferred to the post-anesthesia care unit. However, the patient appeared uncomfortable and exhibited signs of pain, namely sinus tachycardia to 110-115 beats per minute and hypertension. A transversus abdominis plane (TAP) block was then performed under ultrasound with bupivacaine, resulting in better pain control as reported by the patient and as demonstrated by her vital signs.

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DISCUSSION

While buprenorphine can potentially provide adequate perioperative analgesia, our patient who underwent laparoscopic cholecystectomy required additional intervention with a TAP block to achieve adequate pain control. Despite it being 40 times more potent than morphine IV, buprenorphine's limited effectiveness in the treatment of acute pain is consistent with its pharmacokinetics as a partial agonist at the mu-opioid receptor (Figure 1). Due to its ceiling effect and slow dissociation from the mu-receptor, higher dosing and repeat dosing would not have provided additional pain relief.[1,2]

The limitations placed on the availability of pure opioid agonists at SGRD was in response to the growing epidemic of opioid abuse in the state of Punjab, where as high as 20% of the male youth are estimated to be abusing opioids.[3] Although the patient could have benefited from neuraxial anesthesia, the patient opted preoperatively not to have an epidural due to its prohibitive cost. In India where only 5% of all households are covered under any kind of health insurance, choice of treatment is often heavily influenced by cost to the patient.[4] Our case highlights the unique pharmacokinetics of buprenorphine as well as how healthcare systems and their limitations can impact the anesthetic plan.

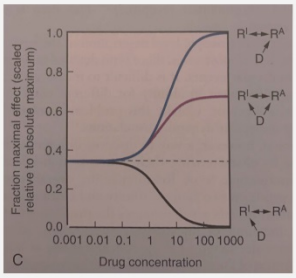


Figure 1: Dose-response curves for full agonist (blue), partial agonist (red), and inverse agonist (black)

Image From *Pharmacology and Physiology for Anesthesia* by Hemmings Jr. HC and Egan TD (2nd Edition, 2013)

Weill Cornell Medicine NewYork-Presbyterian

Cognitive reserve measures are associated with reduced pain interference

Robert S. White, MD[1]; Julie Jiang, BS[2]; Charles B. Hall, PhD[2]; Mindy J. Katz, MPH[2].; Molly E. Zimmerman PhD[2]; Richard B. Lipton, MD[2]

1. Weill Cornell Medical College, New York, NY, USA 2. Einstein Aging Study, Albert Einstein College of Medicine, Bronx, NY, USA

Pain is a multidimensional construct which includes both pain intensity and pain interference. Because pain interference is associated with an increased rate of dementia onset, and because intelligence and education have been implicated as modifying factors for chronic pain, herein we test the hypothesis that higher levels of cognitive reserve may be associated with reductions in pain interference.

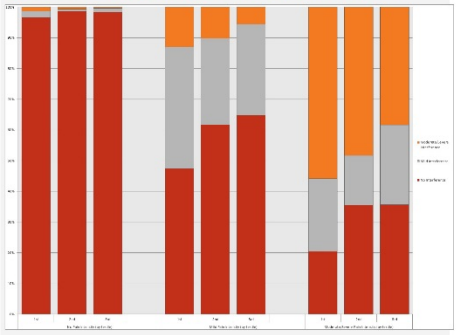
Methods: A representative community sample of 1713 subjects, aged 70 and older, enrolled in the Einstein Aging Study between February 1994 and May 2010 were included in this analysis. Using ordinal logistic regression adjusted for demographic variables and co-morbidities, we examined the cross-sectional association among three indicators of cognitive reserve: reading grade level as estimated by the Wide Range Achievement Test, WAIS verbal IQ, and reported years of education, on pain related outcomes. Pain intensity and pain interference were measured using the Medical Outcomes Study 36-item Short-Form Survey bodily pain questions.

Results: Being female, having a greater medical co-morbidity burden, and having depressive symptoms were associated with both greater pain intensity and greater pain interference. Higher reading level (OR 0.93, 95% CI 0.89-0.97; p<0.001) and higher verbal IQ (OR 0.99, 95% CI 0.98-1.00; p=0.002) were associated with reduced pain interference as hypothesized; higher formal education level showed a similar non-significant trend. No measure of cognitive reserve was associated with pain intensity. As expected, greater pain intensity was associated with greater pain interference.

Predictors of pain intensity and pain interference: Results of ordinal regression models adjusting for demographics, co-morbidities and a cognitive reserve variable (reading grade level per year or VIQ per unit)

	Pain intensity			Pain interference		
	OR	95% CI	p-value	OR	95% CI	p-value
RGL (per year)	1.03	0.99-1.06	0.15	**0.96**	**0.93-1.00**	**0.043**
VIQ (per unit)	1.00	1.00-1.01	0.48	**0.99**	**0.98-1.00**	**0.023**

Bar Graphs of percentage of participants with pain interference by pain intensity category and subdivision by tertile of reading grade level.



Conclusions: In this community-based cohort study of non-demented older adults, our findings show that measures of cognitive reserve have an inverse association with pain interference but not with pain intensity. Further study is necessary to elucidate the bio-psychosocial and causal basis for this relationship.

Intraoperative Management of Pulmonary Hypertension in a Cardiac Surgery Patient

John M. Albert MD, Nikolaos J. Skubas MD, FASE

Department of Anesthesiology, Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction:

- Pulmonary Hypertension (PH) is associated with significantly increased mortality.
- Pulmonary artery catheter derived measurements (PAP, PCWP, trans-pulmonary gradient [TPG] and PVR) are used to characterize PH and determine whether it is reversible.

Case Presentation:

Preoperative:

- 68-year-old male s/p mechanical MVR presents with dyspnea on exertion.
- TTE: severe aortic stenosis.
- Cath: severe PH.
- Patient scheduled for elective AVR.

Intraoperative findings:

- TEE - severe AS, mMVR functioning well.
- PAC - severe PH with elevated PCWP.

Intraoperative goals:

- Analyze right-heart pressures.
- Determine type of PH.
- Pulmonary vasodilator challenge to assess for reversibility.
- Formulate anesthetic and surgical plan.

Postoperative:

- The patient underwent successful AVR with modest decrease in PAP.

	Cath	Baseline	Post-milrinone	Post-AVR
PAP	80/32	56/28	60/30	37/22
PCWP	32	26	28	19
TPG	16	11	12	8
PVR	3.5	2	1.9	0.99
CO	4.59	5.44	6.23	8.08
CVP	25	19	20	15

Table 1: Intraoperative hemodynamic measurements of pulmonary hypertension

Step-wise Intraoperative Management of Pulmonary Hypertension

1. Place PA catheter

sPAP (mm Hg) < 35 | > 35
mPAP (mm Hg) < 25 | > 25

No pulmonary hypertension

2. Measure PCWP

PCWP (mm Hg) < 15 | > 15

Group 1 Pulmonary Hypertension "Pulmonary Arterial Hypertension" | *Group 2 Pulmonary Hypertension* "due to left-sided heart disease"

3. Calculate TPG & PVR

TPG (mPAP - PCWP; mm Hg) < 12 | > 12
PVR (TPG / CO; Wood units) < 2.5 | > 2.5

Passive Pulmonary Hypertension | *Reactive Pulmonary Hypertension*

4. Vasodilator Challenge

(+) Response | (-) Response

Reversible | *Non-reversible*

Discussion:

- Anesthetic and surgical plans require critical analysis of PAC data.
- Not all causes of PH are reversible.
- PAP, PCWP, TPG and PVR should be used to determine the type of PH.
- Vasodilator challenge may be useful to determine reversibility of PH.
- Left-sided heart disease is the cause of group 2 PH and the most common cause of PH in the United States.
- PH is found in 29% of patients with severe aortic stenosis.
- The hallmark of Group 2 PH is PCWP > 15 mm Hg.
- Differential diagnosis of Group 2 PH includes left ventricular dysfunction or mitral or aortic valvular lesions.
- Patients with normal TPG and PVR are unlikely to respond to vasodilators.

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Unilateral Pulmonary Edema Due to Acute Severe Mitral Regurgitation

Daryl Banton, MD, Zahra Malik, MD, Nikolaos J Skubas, MD, FASE, Daniel Lahm, MD

Department of Anesthesiology, Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Case Presentation

- A 79 yo male with a history of ankylosing spondylitis, AF, CHF and moderate MR due to MV prolapse presented with unstable vertebral body fractures after a mechanical fall.
- His radiographic imaging was suspicious for osteomyelitis and he presented for thoraco-lumbar fusion surgery.

Intraoperative Cardiac Arrest

- He was intubated and placed in prone position for surgery.
- At case closure, he became hypotensive and hypoxic with eventual PEA arrest.
- He underwent 3 minutes of cardiopulmonary resuscitation and vasopressor administration with recovery of spontaneous circulation.
- Emergent TEE revealed severe eccentric MR with a posteriorly-directed MR jet directed towards the left pulmonary veins. Anterior mitral leaflet flail and chordae rupture were seen (image 1).
- Additionally there was an irregularly-shaped mobile mass on the atrial side of the anterior mitral leaflet, which was suspicious for vegetation (image 2).
- CXR revealed new left-sided unilateral lung pulmonary edema (ULPE) without major abnormality on bronchoscopy (image 3 and 4).
- A left sided chest tube was placed with return of 250cc of serous fluid.

Unilateral Lung Pulmonary Edema in Mitral Regurgitation

- ULPE has an estimated prevalence of 2% in patients with cardiogenic pulmonary edema and is associated with severe MR (1).
- Less frequent causes of ULPE in this population include vascular or bronchial obstruction, patient position and variations in lymphatic drainage (1, 2).
- In chronic MR, there is a gradual rise in left atrial pressure and compliance, coupled with compensatory mechanisms (increased lymphatic output and alveolar-capillary barrier thickness) that prevent the development of pulmonary edema. This mechanism is absent in acute MR (3).

Right vs Left sided ULPE in MR

- The majority of cases of ULPE associated with MR are localized or predominantly involve the right upper lobe (1, 2, 4).
- Anatomically, the mitral valve orientation in the left atrium is posterior, superior and to the right, favoring a MR jet directed towards the right superior pulmonary vein (5).
- In addition, the regurgitant volume, size of the left atrium and position of pulmonary veins along the left atrial wall determine the direction of blood flow (2).
- Studies have shown substantial variation in pulmonary venous anatomy, particularly on the right side (up to 32%) (6).
- Left-sided ULPE is rarer.

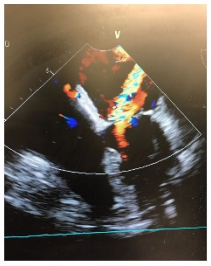

Image 1: ME 4 chamber view with color flow Doppler reveals eccentric, posteriorly directed severe MR jet.

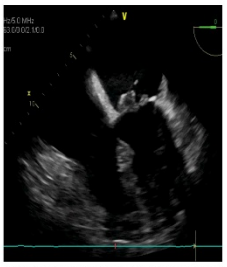

Image 2: ME 4 chamber view revealing mobile echogenic structure associated with anterior mitral valve leaflet flail.

Image 3: Preoperative CXR without focal consolidation or pleural effusion. Mild atelectasis and scarring in the left lower lung noted.

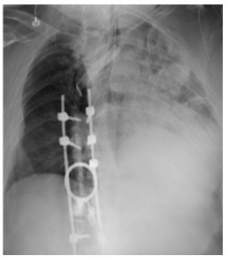

Image 4: Intraoperative CXR reveals scattered left lung opacification. Spinal hardware is visible.

Case Discussion

- In this patient severe acute MR with left-sided ULPE was likely due to endocarditis of anterior mitral leaflet causing a posteriorly-directed regurgitant jet.
- The patient subsequently required placement of an intra-aortic balloon pump and cardiac catheterization, which revealed non-obstructive CAD.
- During his complicated 3 month hospitalization he was treated for ventilator-associated pneumonia, requiring tracheostomy and culture-negative endocarditis.
- He was discharged to rehabilitation with plans to return for elective mitral valve surgery.

Discussion

- Cardiogenic ULPE is a rare clinical entity, but is strongly associated with severe mitral regurgitation and usually involves the right lung.
- Preference for right-sided ULPE is multifactorial and includes factors such as regurgitant volume, left atrial size, variation in pulmonary vein anatomy and orientation of the MV.
- We present a case of severe MR with an eccentric jet directed toward the left pulmonary veins causing preferential left-sided ULPE culminating in hypoxemia and cardiogenic shock.
- Rescue TEE in this setting appropriately guided the intraoperative patient management of a relatively uncommon condition.

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A Full Left Ventricle at the Onset Of Bypass

Corey R. Herman, MD; Adam D. Lichtman, MD; Natalia S Ivascu, MD

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Case Description

75M PMH HTN, CAD, Afib, HFrEF (EF40%), reduced RV function, severe pHTN and severe MR.

- Presented for mitral valve repair.

TEE: EF 40% with mildly reduced RV function, severe MR. Trace AI, no PFO or ASD. Main PA was 3.3cm in diameter.

- Pulse pressure of 43mmHg on CPB
- LV distended with cross clamp and cardioplegia.
- LA vent advanced into LV and additional weighted vent placed in PA.
- Despite CPB pump flows of greater than 5.0L/min, there was systemic hypotension requiring high doses of vasopressors.

Differential Diagnosis

Aortic Regurgitation
- None seen on TEE

Incomplete cardiopulmonary bypass
- Surgeons ensured that cannulas were properly snared
- Perfusion staff added vacuum assist to their venous drainage

ASD/PFO
- No evidence of this on TEE

Bronchial and Thebesian veins
- Inadequate flow to produce this result

Persistent left superior vena cava with unroofed coronary sinus
- No evidence of this on TEE

Systemic to pulmonary shunt
- B-T shunt, Waterston shunt – no prior cardiac surgery
- Aortopulmonary window – no evidence of this on TEE
- Patent ductus arteriosus (PDA)

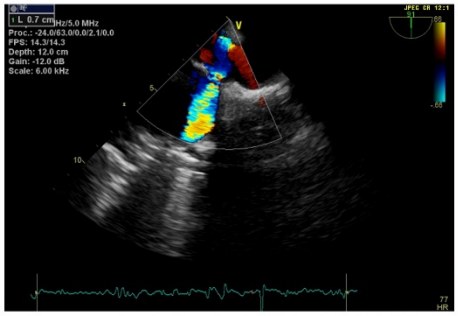

Figure 1: Upper esophageal, descending aorta long-axis. Patent ductus arteriosus with diameter of 0.7cm at the level of the left subclavian artery.

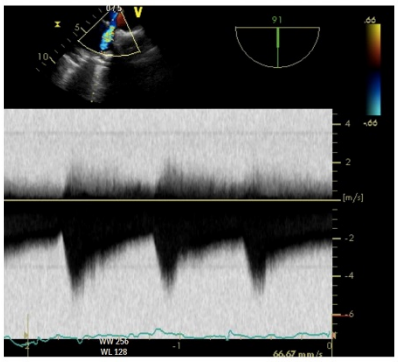

Figure 2: Continuous wave Doppler across patent ductus arteriosus showing aorta to pulmonary flow throughout the cardiac cycle.

Case Description

Following separation from bypass, a PDA was detected by TEE.

- 0.7cm connection at the level of the left subclavian.
- Palpable thrill felt by surgeon.
- Oxygen saturations from RA and PA were 61% and 81%.
- VTI of flow is 121cm = 46mL flow through PDA each cardiac cycle (LVOT SV=83mL)

PDA was not corrected in initial surgery

- Risk of additional CPB time, prior difficulty arresting heart
- PDA banding not sufficient in adults

Patient decompensated in the ICU over the next 18 hours and returned to the operating room for a PDA closure.

- The patient developed multi-system organ failure and expired on POD #3

Discussion

PDA is an essential communication in utero.
- Usually closes within first 72 hours of life, 1:2000 cases of PDA[1]

Symptoms are of LV volume overload
- Pulmonary edema, increased LAEDP and LVEDP, atrial fibrillation, CHF and pulmonary hypertension.[2]

Echocardiography is helpful in making a diagnosis
- Continuous spectral Doppler - a continuous jet that peaks in systole and can be used to calculate left to right shunting.[3]

PDA is an uncommon diagnosis in the elderly.
This unique case describes an incidental finding of PDA in a patient with known severe MR.
- After correction of MR, the reduction in pulmonary venous pressure resulted in increased flow through the PDA
- Symptoms of PDA could also be attributed to severe MR
- Challenging pre-operative diagnosis

Highlights importance of thorough echo exam and systematic approach to distended LV on bypass

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Transesophageal Echocardiographic Evaluation and Guidance During Placement of the Left Ventricular Parachute® Device

Joshua Kohtz, MD, Lisa Q. Rong, MD, Nikolaos J. Skubas, MD, FASE

Department of Anesthesiology, Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

Left ventricular (LV) restoration devices have been developed to reduce LV volume and improve function in patients with symptomatic ischemic heart failure despite optimal medical management.

The accurate positioning of the device, along with detailed LV peri-procedural evaluation in patients under general anesthesia (GA) may be facilitated with transesophageal echocardiography (TEE).

Case Description

A 68 year old male with a history of coronary artery disease, myocardial infarction and coronary intervention experienced postoperative cardiac arrest requiring veno-arterial ECMO and AICD placement.

He was diagnosed with dilated ischemic cardiomyopathy, LV ejection fraction of 15-20% and scheduled for elective insertion of a Parachute® LV restoration device. Under GA and endotracheal intubation, TEE evaluation revealed LV dilation, diffuse segmental wall thinning and akinesis of the anterior and septal apical segments.

The patient underwent percutaneous implantation of a 75mm Cardiokinetix Parachute® device via femoral artery cannulation.

Post deployment LV ejection fraction improved to 42% and LVES volume was reduced by 31%, from 124 ml to 86 ml (Figure 1).

The components of the Cardiokinetic Parachute® device:
- 16 nickle-titanium struts that engage the endocardium
- polymer 'parachute' membrane
- radio-opaque foot that sits in the LV apex

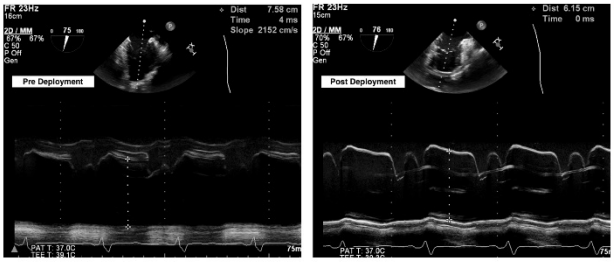

Figure 1: 2D LV ME view with M-mode; pre- and post- deployment of device demonstrating the decreased dimension of the LV long axis.

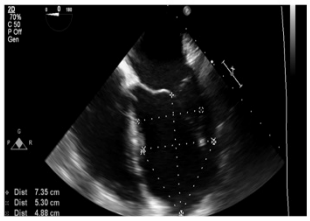

Figure 2: 2D TEE evaluation of LVED chamber size and determination of device landing zone.

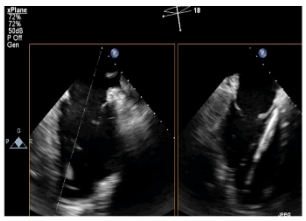

Figure 3: 2D TEE with simultaneous orthogonal imaging demonstrating appropriate positioning of the Parachute® delivery catheter with foot in the LV apex.

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Discussion

The failing heart is unable to preserve systemic cardiac output.

- Compensatory mechanisms do not preserve systolic function indefinitely, necessitating mechanical support.
- Reducing LV size by isolating the dysfunctional apex decreases effective LV volume and improves myocardial contractility.

The Cardiokintetix Parachute® device aims at restoring LV geometry and function in NYHA II - IV patients with ischemic heart failure, dilated LV with decreased LVEF and akinetic or dyskinetic apical wall segments.

- The PARACHUTE IV trial is an open labeld randomized parallel study.
- The device is inserted retrograde, over a trans-aortic valve catheter and positioned in the LV apex.
- Sizing of the device is based on the LV ED size, and ES diameter must not be <60% of the LV ED diameter.
- Attachment zone is at the base of the papillary muscles, free of calcified segments, LV wall thickness must be ≥3mm.

Intraoperative TEE Evaluation

2D ME views:
- Visualization of papillary muscles and measurements of the landing zone (Figure 2).
- Measurement of LV ED and ES diameters.
- Positioning of the device at the LV apex (Figure 3).

3D TEE:
- Quantification of LV size.
- Doppler imaging to exclude significant mitral regurgitation, other valvular pathology, and residual communication, between the LV cavity and its excluded apex.
- Periprocedural TEE imaging of the LV apex is hampered by the acoustic shadowing caused by the device.
- If foreshortening is excluded, the decrease of LVES dimension can be quickly and simply quantitated (Figure 1).

Society for Obstetric Anesthesia and Perinatology (SOAP)

Anesthetic Management of Parturient with Spinal Muscular Atrophy

Alaeldin Darwich, M.D. and Sharon Abramovitz, M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine

NewYork-Presbyterian

Introduction:

Spinal muscular atrophy (SMA) is a rare genetic neuromuscular disorder characterized by degeneration of the neuronal cells of the anterior horn of the spinal cord. There are four types of SMA based on the age of onset. Earlier onset of the disease correlates with the severity and the progression of muscle wasting and motor impairment. The majority of patients with SMA are wheelchair-bound secondary to weakness and atrophy of the proximal muscles of the lower extremities. Pulmonary complications are common due to respiratory muscle involvement. Many patients undergo early spinal instrumentation to correct progressive scoliosis due to weak paraspinal muscles.

Case:

This is a 30 year-old nulliparous female with a history of SMA type III, SLE and anemia. She received a pre-anesthesia consultation regarding options for labor analgesia and anesthesia for CS secondary to extensive back surgery. She was later admitted to the hospital at 37 weeks gestation for dyspnea and preterm labor. Due to failure of induction of labor, she was taken to the OR for Cesarean section (CS). She had a history of severe scoliosis and spinal fusion from T2 to the sacrum at the age of 12, complicated by prolonged tracheal intubation for 2 weeks due to severe atelectasis. General anesthesia (GA) was planned using awake fiber-optic (FOB) tracheal intubation, facilitated by remifentanil intravenous infusion, midazolam and topicalization of the airway with lidocaine. After successful tracheal intubation, GA was induced with propofol; neuromuscular blocking agents were not used. A healthy neonate was born with APGAR scores of 9/9. The patient was extubated at the end of the procedure in the OR and the post-operative course was uneventful.

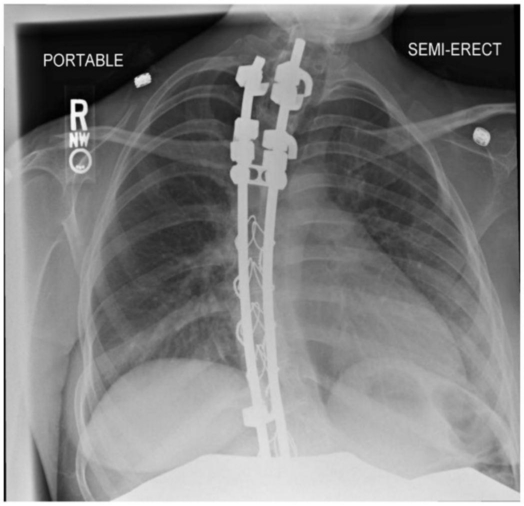

Figure 1: Chest x-ray at 37 weeks gestation.

Discussion:

Regional anesthesia (RA) has been successfully reported in patients with SMA. However, these patients usually present with extensive spinal surgery, making RA technically challenging with a higher chance of failed or inadequate block. Also, the patient presented with dyspnea and RA with high thoracic block can lead to respiratory decompensation. Succinylcholine is contraindicated in SMA because of the risk of life threatening hyperkalemia. In addition, there is increased sensitivity to non-depolarizing muscle relaxants (NDMR), which may require prolonged ventilation, so these are best avoided. Awake FOB intubation was used to manage the airway to avoid NDMR, and remifentanil is useful due to its rapid metabolism in both mother and fetal circulation

Conclusion:

This case highlights the importance of early anesthetic consultation in high-risk parturients and the utilization of FOB skills when regional techniques and muscle relaxants are contraindicated. As less GA is utilized for CS, FOB intubation should be performed regularly in non-obstetric settings or through the use of simulation to maintain skills.

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Anesthetic Management of a Parturient with Severe Preeclampsia and Diabetic Ketoacidosis for Emergent Cesarean Section

Ajay Dharmappa M.D., Alaeldin A. Darwich M.D., Jon Samuels M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine

NewYork-Presbyterian

Introduction

Preeclampsia is a multisystem disease affecting 3-4% of pregnant women. It is a syndrome characterized by hypertension and either proteinuria or end-organ dysfunction.

DKA is commonly seen in patients with uncontrolled diabetes with insulin deficiency, resistance or both. Anion Gap metabolic acidosis, profound intravascular hypovolemia, and metabolic derangements (K+ and Na+) are the hallmarks commonly seen.

Case Details

- 40F G4P3, non English-speaking, EGA 38 weeks primi-gravida, unknown PMH and no prior prenatal care presented with abdominal pain, nausea/vomiting, and severe, non-pulsatile headache. Pt endorsed severe headaches for several weeks.
- Initial BP 160/90, Finger stick glucose > 600, ketones on urine dipstick. No other formal labs available. External fetal monitor revealed a category 3 tracing. Large bore intravenous access was placed, and the patient was hydrated. Labs and type and cross sent. The obstetrician called an emergent cesarean section for fetal distress and for deteriorating maternal condition.
- Anesthetic considerations: Mallampati Class III airway, obese (BMI 35 kg/m^2), OSA by clinical criteria, unknown coagulation values, and full stomach (ingestion of a full meal 1 hour prior).
- Spinal anesthesia induced with resultant T4 level b/l. (1.6cc hyperbaric 0.75% bupivacaine, fentanyl 20 mcg, preservative-free morphine sulfate 0.2 mg) with epinephrine 0.2 mg IT.
- A second large bore intravenous and arterial line placed prior to incision.
- POCT: EPOC showed ABG: pH of 7.20, K +3.5, paCO2 of 15, HCO3- of 9, lactate of 2.5, glucose of 600, Na 128, Cr 1.2, Hgb 7.2, Hct 21%.
- Pt resuscitated with isotonic balanced salt saline, potassium repleted, and insulin bolus/infusion started. MICU consultation called. DKA protocol initiated.
- Baby delivered, APGAR 6/8, Initial fingerstick glucose 500mg/dl. Hemostasis/good uterine tone achieved. Pt transferred to MICU for further management
- Platelet count of 145 measured post operatively.
- Uneventful maternal and neonatal recovery.

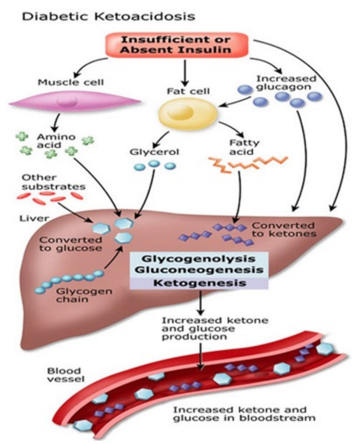

Figure 1: Pathophysiology of DKA

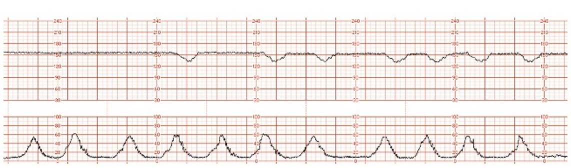

Figure 2: Category 3 FHR tracing demonstrates absent variability and recurrent late decelerations.

Discussion

Preeclampsia management should focus on intravascular hypovolemia, impaired liver function/coagulation abnormalities, thrombocytopenia, CNS disturbances, and potential pulmonary edema. Neuraxial anesthesia may be particularly affected by thrombocytopenia and coagulation disturbances. Increased airway edema may pose challenges to airway management as well. The definitive treatment remains delivery of fetus and placenta. Supportive treatment aims to prevent convulsions (magnesium sulfate), improve organ perfusion, normalize BP, and correct clotting abnormality.

In DKA, profound intravascular hypovolemia, severe electrolyte derangements (Potassium and Sodium), and marked glucose elevations are most commonly seen. Electrolyte disturbances can lead to life threatening arrhythmias if not treated. Sodium and water deficits may cause cerebral/pulmonary edema. Treatment should focus on repleting intravascular volume, normalizing and controlling the metabolic/electrolyte abnormalities, as well as administration of insulin. Patients should be monitored in an ICU setting with serial blood gases/glucose levels.

Unusual features of this case were the long period of maternal decompensation due to late presentation to our facility, extreme derangement of lab values, including anemia, and severe neonatal hyperglycemia. Although pre-eclampsia lab values were unavailable at the time of initiation of anesthesia, we opted for a spinal over general anesthesia, due to the risks associated with aspiration and intracerebral hemorrhage secondary to severe pre-eclampsia.

Conclusions

This case highlights a successful anesthetic management of a parturient with severe preeclampsia and concomitant DKA undergoing an emergent cesarean section. Both preeclampsia and DKA are associated with a significant maternal and fetal mortality. DKA is associated with multiple metabolic and electrolyte abnormalities which need to be judiciously treated and monitored. When combined with severe preeclampsia, anesthetic and intraoperative management becomes even more complex.

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Management of a Parturient with Autoimmune Autonomic Ganglionopathy

Jennifer Landon, M.D., Jaime Aaronson, M.D., and Sharon Abramovitz, M.D.

Department of Anesthesiology, New York Presbyterian- Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction:

Autoimmune autonomic ganglionopathy (AAG) is a disorder mediated by antibodies to nicotinic acetylcholine receptors in autonomic ganglion (Figure 1). Patients with AAG present with a variety of symptoms, including orthostatic hypotension, gastrointestinal dysmotility, and bladder dysfunction. We report the management of a patient with AAG who presented for 2 Cesarean sections (CS) within 2 years.

Case:

The patient is a 37 year-old G1P0 with AAG, migraines, and childhood seizures who presented at 39 weeks for CS. She was diagnosed with AAG at age 21, when she presented with orthostatic hypotension and gastroparesis, which both improved with IVIG and plasmapheresis. Current symptoms included urinary retention requiring catheterization, nausea, and constipation. In the OR, an epidural was placed to avoid abrupt sympathectomy. A phenylephrine infusion was initiated, followed by a test dose of 3 mL 2% lidocaine with epinephrine 1:200,000; then 20 mL lidocaine was given and a bilateral T7 level was achieved. She required an additional 5 mL lidocaine and fentanyl 100 mcg, resulting in a T4 level. The neonate was delivered 9 minutes after incision, when the patient reported sharp abdominal pain. She required nitrous oxide via mask and IV morphine, fentanyl, midazolam, and ketamine for relief. On POD 1 and 3, she received IVIG as planned. Her hospital stay was otherwise uneventful.

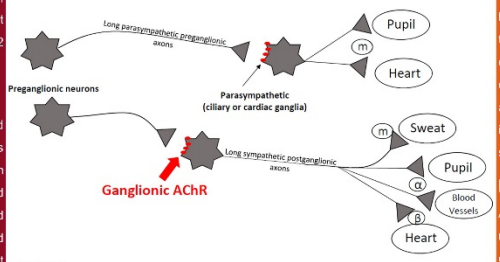

Figure 1.

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Case-continued:

Two years later, the patient again presented for CS. In the OR, a phenylephrine infusion was initiated and CSE was performed using 1.6 mL hyperbaric bupivacaine 0.75%, fentanyl 20 mcg and morphine 200 mcg. An epidural catheter threaded easily, and a bilateral T4 level was achieved. Sixteen minutes after incision, the patient complained of sharp abdominal pain, which persisted despite 10 mL 2% lidocaine with epinephrine via the epidural catheter, as well as epidural fentanyl, IV morphine, midazolam, and ketamine. Patient controlled epidural analgesia was ineffective for post-op analgesia. A hydromorphone IV PCA was started on POD 1.

Discussion:

AAG is a rare disorder with sparse literature regarding anesthetic management. Dysautonomias pose significant anesthetic risks, especially when cardiovascular lability is present. There is no evidence to support either general or regional anesthesia in non-pregnant patients. Although there is a risk of marked hypotension with spinal anesthesia, studies involving non-pregnant patients with Shy-Drager syndrome indicate it may be modulated with adequate pre-operative volume replacement and vasopressor support. Resistance to local anesthetics in patients with autonomic dysfunction due to Shy-Drager syndrome has also been reported, but the mechanism is poorly understood. In our case, the patient remained hemodynamically stable, but required additional analgesics under spinal and epidural anesthesia. Both neuraxial techniques were safe, but less effective at the usual doses.

The Society of Critical Care Anesthesiologists (SOCCA)

TIA Following TAVR Secondary to Dynamic LVOT Obstruction

Michael F. Katz, MD; James A. Osorio, MD; Christopher W. Tam, MD

Department of Anesthesiology, New York Presbyterian Hospital - Weill Cornell Medicine, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

A subset of patients with long-standing aortic stenosis (AS) have asymmetric septal hypertrophy (ASH) that may cause dynamic left ventricular outflow tract (LVOT) obstruction following replacement of the aortic valve. We present a patient who developed stroke-like symptoms due to dynamic LVOT obstruction following a transcatheter aortic valve replacement (TAVR) for severe AS, and responded well to treatment once the diagnosis was recognized.

Case Description

- 97 year old female with symptomatic AS referred for AVR.
- TAVR selected given her advanced age, medical comorbidities, and preference.
- Preoperative CT angiogram demonstrated basal ASH measuring 15 mm and a septal-to-posterior wall thickness ratio of 1.36. Transthoracic echocardiogram (TTE) demonstrated a pressure gradient across the LVOT of < 30 mm Hg at rest.
- Approximately 3 hours postoperatively patient abruptly developed altered mental status, dysarthria, and left-sided weakness. "Stroke code" activated, emergent CT scan.
- Bedside TTE revealed an underfilled and hypertrophied LV with a prominent septal bulge [Fig 1]. Color-flow Doppler revealed turbulent flow in the LVOT during systole [Fig 2] and continuous-wave (CW) Doppler demonstrated high velocity blood flow with late peaking, "dagger shaped" waveforms [Fig 3] - a picture consistent with LVOT obstruction.
- Crystalloid boluses and phenylephrine were administered and symptoms resolved.

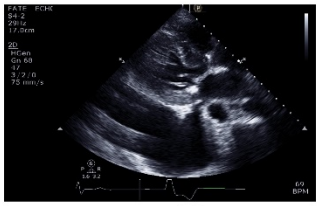

Figure 1

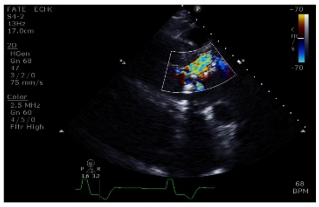

Figure 2

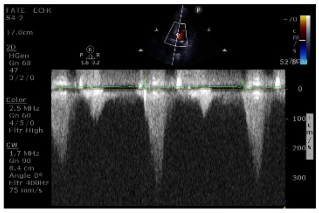

Figure 3

Discussion

- Stroke occurs in 2-5% of patients within 30 days following TAVR.
- A stroke workup proceeded accordingly and a bedside TTE was invaluable in identifying the underlying process.
- The change in blood flow through the LVOT as seen on spectral Doppler display from high velocity, "dagger shaped" waveforms to reduced velocities and parabolic waveforms, coincident with the resolution of the patient's symptoms and hemodynamic status, strongly suggests dynamic LVOT obstruction to be the etiology of this TIA.
- Aortic valve replacement is thought to "unmask" dynamic LVOT obstruction in patients with AS and ASH as a consequence of changes in LV loading conditions.
- Some authors advocate for an open surgical septal myectomy at the time of AVR if the septal-to-posterior wall thickness ratio is > 1.3, or an alcohol septal ablation prior to TAVR if there's any demonstrable LVOT obstruction following discovery of basal ASH ≥ 15 mm or a septal-to-posterior wall thickness ratio ≥ 1.3.

Conclusion

This case demonstrates that despite detailed preoperative evaluation for TAVRs, patients with severe AS scheduled for surgical correction, accompanied with severe concentric or asymmetric septal hypertrophy and diastolic dysfunction may be at risk for dynamic LVOT obstruction in the perioperative period with hemodynamic instability and potentially serious consequences.

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Axillary Artery Cannulation during Veno-Arterial ECMO for Retrograde Cerebral Perfusion

Joshua Kohtz, MD; James Osorio, MD
Weill Cornell Medicine, Department of Anesthesiology

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

Similar to cardiopulmonary bypass, veno-arterial extracorporeal membrane oxygenation (VA-ECMO) can provide full circulatory and oxygenation support to the body.

During VA-ECMO oxygenation occurs via an oxygenator supply source and a pump that returns blood to the arterial system, providing circulatory support.

Ischemic neurological injury in patients treated with ECMO remains an ongoing area of investigation, with a nearly 50% morbidity.

Case reports exist of using a second arterial cannula for perfusion of the extremity distal to the cannulation site.

To the best of our knowledge no published report has described using a second arterial cannulation to improve cerebral oxygenation via retrograde perfusion from the arterial circuit to the axillary artery.

Femoral Veno-Arterial Cannulation

Image 1. Auxillary cannulation for antegrade distal limb perfusion

Case Description

A 73 year old male with a history of biventricular heart failure, diabetes, hypertension, hyperlipidemia, and chronic atrial fibrillation underwent an elective mitral valve ring repair, tricuspid valve annuloplasty and two vessel coronary artery bypass grafting.

Postoperatively the patient was in cardiogenic shock from acute systolic and diastolic heart failure, requiring large volume resuscitation and catecholamine support. An intra-aortic balloon pump was placed on postoperative day 3.

The patient subsequently developed refractory hypoxemia and femoral-femoral VA-ECMO was initiated on postoperative day 5 with removal of the IABP. The patient was kept sedated and paralyzed, with no normal neurological exam since undergoing surgery. He was transferred to our facility for management of his persistent cardiogenic shock and acute respiratory distress syndrome.

The patient developed intrapulmonary hemorrhage requiring bronchial blockers and eventually total cessation of pulmonary ventilation. His course was further complicated by acute renal failure and hyperlactemia acidosis requiring hemodialysis.

To improve cerebral oxygenation a second arterial cannula (6 French) was placed from the ECMO circuit via bedside percutaneous technique into the right axillary artery. This was later upgraded surgically to a right-subclavian artery conduit catheterization.

Despite improvements in cardiac function, the patient developed pulmonary hemorrhage and was unable to wean from ECMO. Ultimately the patient remained comatose and was pronounced brain dead after prolonged cessation from sedation. Care was withdrawn in accordance with the family's wishes.

Discussion

This complex case presented medical and ethical challenges requiring the coordination and multidisciplinary effort of multiple teams.

The bedside insertion of a percutaneous catheter for retrograde perfusion to maintain adequate cerebral oxygenation might prove a valuable tool for reducing neurological injury during ECMO.

Objective measurement of improved cerebral oxygenation via invasive or non-invasive monitoring should be employed. Angiographic studies could be used to determine improvement of cerebral perfusion with the addition of a proximal cannulation site.

With the expanding role of ECMO and the ethical concerns of its use, it remains the responsibility of the healthcare team to treat the patient to the best of his wishes as they are known or expressed through a proxy.

Veno-Arterial ECMO Circuit

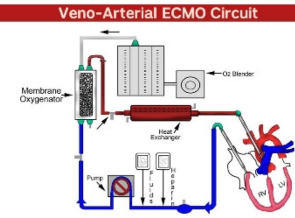

Image 2. Venous drainage, Pump, Membrane oxygenator, Arterial return

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Multistate Perioperative Outcomes of Carotid Revascularization: Carotid Artery Stenting vs Carotid Endarterectomy

Abdullah Rasheed, MD[1]; Robert S. White, MD[1]; Tiffany Peng, MD[1]; Xian Wu, MPH[1]; Licia K. Gaber-Baylis, BA[1]; Gregory P. Giambrone, MS[1]; Kane O. Pryor, MD[1]

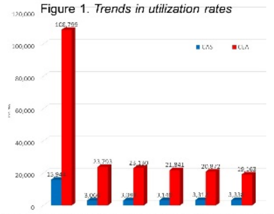
1. New York Presbyterian Hospital – Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Background:

- ~795,000 people experience a stroke[1].
- 134,000 deaths annually[1].
- 5th leading cause of death[1].
- After the perioperative period, RCTs almost unanimously agree that the rates of ipsilateral stroke do not differ significantly between CAS and CEA[2].
- Some RCTs have shown greater peri-procedural (30 day) stroke or death rate with CAS than with CEA[2].
- Retrospective studies have identified CAS as a risk factor for perioperative complications[3].
- Retrospective analysis utilizing administrative databases have shown that for patients undergoing CAS, rates for in-hospital mortality, postoperative stroke, and combined stroke/mortality rates were higher than those who underwent CEA.
- We hypothesized that CAS would be associated with higher post-operative morbidity and mortality rates.

Figure 1. *Trends in utilization rates*



From 2007 to 2011, there was a decrease in utilization of CEA from 88.6% to 85.2% and an increase in the utilization of CAS from 11.4% to 14.8% (p <0.001).

Table 1. *Unadjusted overall outcome rates of CAS and CEA*

Outcome	CAS	CEA	p-value
Mortality			
Overall	1.30	0.47	<.0001
Symptomatic	4.65	0.93	<.0001
Asymptomatic	0.74	0.42	<.0001
Stroke			
Overall	3.42	1.68	<.0001
Symptomatic	5.84	2.95	<.0001
Asymptomatic	3.02	1.55	<.0001
Stroke/Mortality			
Overall	4.26	1.98	<.0001
Symptomatic	9.35	3.62	<.0001
Asymptomatic	3.41	1.81	<.0001

Table 2. *Results of multivariate logistic regression (Referent = CEA)*

Outcome	OR	95% CI	p-value
Mortality			
Overall	2.00	1.68-2.39	<0.0001
Symptomatic	3.58	2.62-4.89	<0.0001
Asymptomatic	1.50	1.20-1.89	0.0005
Stroke			
Overall	1.82	1.65-2.02	<0.0001
Symptomatic	1.86	1.49-2.32	<0.0001
Asymptomatic	1.84	1.64-2.06	<0.0001
Stroke/Mortality			
Overall	1.86	1.70-2.05	<0.0001
Symptomatic	2.35	1.94-2.84	<0.0001
Asymptomatic	1.75	1.57-1.95	<0.0001

Methods:

- Study Population: State Inpatient Databases, Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality in CA, FL, and NY.
- Patients ≥18 years of age undergoing CAS or CEA procedures from 2007-2011.
- Patients identified through ICD-9-CM codes.
- Outcome variables: in-hospital mortality, postoperative stroke, and combined stroke/mortality status.
- Multivariate logistic regression models were fit to our data adjusting for patient demographic information and co-morbidities, including all variables with bivariate results $p \leq 0.25$; or variables, such as age, race, gender, state or year procedure performed in that were selected a priori.
- P values are two sided with statistical significance evaluated at 0.05 alpha level.
- Analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC).

Results:

- 15,944 patients (12.78%) of the total 124,743 patients underwent CAS.
- Rates for in-hospital mortality, post-operative stroke, combined stroke/mortality, and postoperative cardiovascular complications were higher for CAS (p<0.001).
- In multivariate logistic regression CAS was a significant predictor of hospital mortality, postoperative stroke, combined stroke/mortality.
- Similar findings were identified in subgroup analysis of symptomatic and asymptomatic patients separately.

Conclusions:

- No benefit could be shown for the use of CAS vs. CEA.
- Undergoing CAS instead of CEA significantly increases a patient's rates and odds of in-hospital mortality and post-operative stroke.
- Findings hold true after statistical adjustment for patient's demographics, medical co-morbidities, and procedure-level, hospital-level, and state-level factors.
- Stratifying by symptomatology yields similar results.
- Study limitations include those associated with the use of a large administrative dataset and procedure selection bias.
- Additional research is required to further characterize outcomes.

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A Case of Fatal Calciphylaxis

Krish Sekar, M.D., James Osorio, M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
Anesthesiology

Introduction

Calciphylaxis (calcific uremic arteriolopathy – CUA) is a potentially life-threatening syndrome involving vascular calcification, thrombosis, and skin necrosis. While CUA is typically associated with ESRD, other conditions implicated in its pathogenesis include[1]:

- Obesity
- Diabetes mellitus
- Hypercalcemia
- Coagulopathy
- Warfarin use
- Hyperparathyroidism
- Vitamin D supplementation
- Peripheral arterial disease
- Corticosteroid use

Case Description

48yo F PMH morbid obesity, hypothyroidism, sarcoidosis presented to an outside hospital with a small lower extremity ulcer draining malodorous fluid. She was initially diagnosed with cellulitis and received a short course of antibiotics, but continued to have progressive wound non-healing and malaise. The patient was subsequently admitted for septic shock requiring intubation and CRRT.

She recovered from this incident and was discharged to a rehabilitation facility. Her ulceration, however, continued to progress along with the development of large bullae. Prednisone, pentoxifylline, and aspirin were started and two tissue biopsies were obtained. The first revealed small vessel thrombi and non-specific vasculitis; the second established a diagnosis of CUA. The ulcerations continued to enlarge and a green exudate developed. Blood and tissue cultures grew multidrug-resistant (MDR) *Pseudomonas aeruginosa*.

Approximately 4 months after the initial presentation of symptoms, she was eventually transferred to our burn intensive care unit for further management. Upon transfer, the patient was noted to have >20% body surface area ulceration.

Figure 1: Right lateral thigh demonstrating extensive necrosis and MDR *Pseudomonas aeruginosa* super-infection before debridement

Figure 2: Right lateral thigh after surgical debridement

Treatment

- Heparin infusion
- Discontinuation of prednisone, pentoxifylline, and aspirin
- Lactated ringers and albumin resuscitation
- Intravenous sodium thiosulfate, pamidronate, and phytonadione
- Standard wound care in addition to dilute hypochlorite irrigation
- Ceftolozane IV and inhaled tobramycin for MDR *P. aeruginosa*-positive tissue and BAL culture

The patient continued to deteriorate with the development of septic shock and respiratory failure requiring intubation. Successful surgical debridement was performed, however follow-up biopsy revealed recurring CUA in the fresh surgical margins

The patient remained in critical condition for approximately two weeks, but subsequently developed worsening lactic acidosis, hypoxemia, and hypotension unresponsive to multiple pressors. Further debridement was deemed futile and the patient eventually died from cardiac arrest refractory to standard ACLS measures.

Discussion

- Early diagnosis is the key to improving morbidity and mortality. The clinical course of CUA can be unremitting and has a poor prognosis with mortality levels approaching 60-80% once ulceration is present[2]
- Current medical treatments are limited and those that are available suffer from a lack of prospective randomized trials demonstrating their efficacy[3]
- Super-infection of ulcerations with progression to sepsis is a serious problem and contributes significantly to the condition's high mortality
- In patients with severe progression, a multidisciplinary approach involving critical care, dermatology, surgery, and wound care should be considered

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Bovine Hemoglobin in Place of Human Blood in Jehovah's Witness: A Case Report

Gurbinder Singh D.O., James Osorio M.D.

Department of Anesthesiology, Weill Cornell Medical College, New York, NY

Weill Cornell Medicine
NewYork-Presbyterian

Introduction

67 YO Jehovah's witness Female presented with ischemic stroke after exsanguinating from hysterectomy and refusing blood products. Hemoglobin at admission was 4.7g/dl, MRI showed generalized cerebral hypo-perfusion and multiple infarcts. She was hemodynamically stable and bleeding had ceased.

Management at this time included Darbopoetin, Iron, Vitamin B12 and folate supplements. After no improvement in her mental status a hematology consult was obtained and a decision was made to use experimental product containing bovine hemoglobin to maximize oxygen carrying capacity.

Sanguinate was obtained on compassionate use basis from the pharmaceutical company after receiving FDA approval over the phone and receiving emergent IRB approval from the hospital.

Objectives

Introducing Critical Care physicians to Sanguinate as an alternative Hemoglobin Based Oxygen Carrier

Sanguinate is an experimental drug and is composed of PEGylated Carboxyhemoglobin extracted from bovine red blood cells. Manufacturer recommends its use to treat anemia, hypoxia and ischemia caused by stroke, subarachnoid hemorrhage, MI, vaso-occlusive crisis and sickle cell disease.

P50 of normal human RBCs is 24-28 mmHg and that of ischemic tissues could be as low as 3-5 mmHg. P50 of Sanguinate is 7-16 which is lower than healthy tissue but higher than Ischemic tissue which helps it unload Oxygen preferably into the ischemic tissue.

Low dose Carbon-Monoxide facilitates Nitric-Oxide release, which results in vasodilation, and acts as an inhibitor of apoptosis in vascular endothelium.

Carboxyhemoglobin is a more stable molecule than oxyhemoglobin which helps to protect it from degradation during storage. Half-life of this product is between 8-14 hours.

No serious adverse events were noted in the Phase I trial, Phase II trial is currently underway for the treatment of vaso-occlusive crisis in sickle cell disease patients and prevention of delayed cerebral ischemia/vasospasm in patients with subarachnoid hemorrhage.

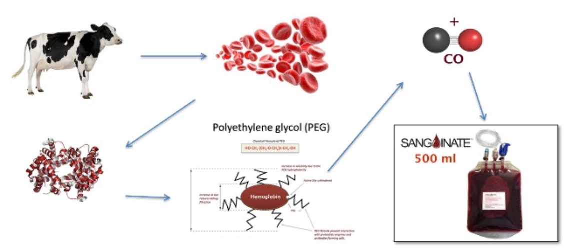
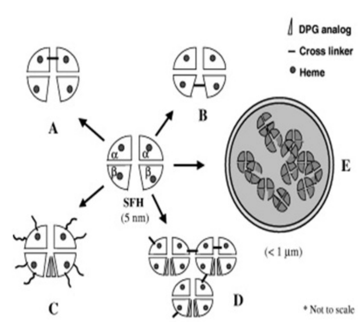


Figure 1



Some of the key approaches of hemoglobin oxygen carriers as red blood cell substitutes are illustrated above. Once stroma-free Hb are prepared from human or bovine red blood cells they must be chemically stabilized in order to become therapeutically useful. (A,B) Tetrameric stabilization is accomplished by intramolecular crosslinking between the two a or ß subunits using a site specific crosslinker. (C) The effective molecular weight of Hb can be increased by conjugating it to polyethylene glycol. (D) Polymerized Hb of molecular weights greater than the native Hb tetramer of 64 kDa may be produced through polyfunctional crosslinking agents. (E) Hb can also be encapsulated into liposomes in order to recreate the natural properties of red blood cells.

Analysis

Experimentation with blood substitutes started in early 20th century when hemoglobin in Lactated Ringer's was used to support cats. In 1947 US Navy tried hemoglobin in 47 anemic and febrile soldiers 17 of which became hypertensive and 12 developed renal dysfunction. Development of ultra-purification techniques to remove cellular debris lead to a decrease in incidence of renal failure.

Modern hemoglobin based oxygen carriers use new approaches to molecularly stabilize and chemically modify hemoglobin. In late 1960s US Army cross-linked hemoglobin with bis (N-maleimidomethyl) ether (BME) to prolong its intravascular retention. Other chemical modifications take place at the 2,3-DPG site, the amino-terminal group, or internally to prevent dissociation. Polymerization with glutaraldehyde or polyethylene glycol is used to prolong intravascular retention.

Adverse events: In a meta analysis reviewing 5 different HBOCs administered to 3,711 patients (HemAssist, Hemopure, Hemolink, Polyheme, Hemospan) there was 30% increase in risk of death and 2.7 fold increase in risk of myocardial infarction. Hemoglobin molecules that are not contained, rapidly scavenge nitric oxide and cause vasoconstriction, decreasing blood flow and increasing release of pro-inflammatory mediators, leading to a loss of platelet inactivation.

PEGYlation increases circulating half life (keeps intravascular), interferes with enzyme degradation and blocks immune recognition. Addition of Carbon-Monoxide prevents chelation of Nitric oxide and hence prevents vasoconstriction. Initially, a small therapeutic dose of CO is released from Hemoglobin, which then preferentially binds oxygen for transport throughout the body.

Conclusion:

In a Jehovah's witness who refuses to accept blood products, Sanguinate can be used to temporarily increase the oxygen carrying capacity. Phase I trials have demonstrated good safety profile and phase II studies are underway to evaluate indication for sickle cell disease and subarachnoid hemorrhage.

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Hyperkalemia Management in the Oncology Patient: A case of kayexalate-induced bowel perforation

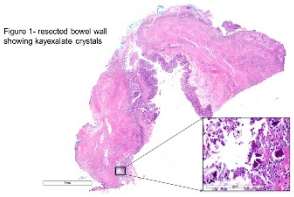
Kathleen Sullivan MD[1], Elena Mead MD[2], Meaghen Finan MD[2], Jinru Shia MD[2]

[1]Department of Anesthesiology, New York Presbyterian Hospital/Weill Cornell Medicine, New York, NY

[2]Care Medicine Service, Department of Anesthesiology & Critical Care Medicine, Memorial Sloan Kettering Cancer Center, New York, NY

Introduction

- Hyperkalemia is a common condition encountered in medical and surgical patients and can induce life-threatening cardiac arrhythmias if left untreated.
- Sodium polystyrene sulfate (SPS) is a cation-exchange resin which is frequently used to treat hyperkalemia. It works by exchanging its bound sodium with potassium in the colon to promote potassium excretion in the stool.
- Although rare, there is a known relationship between SPS administration and bowel necrosis, therefore it is important to consider this in a patient with abdominal pain who has been treated with oral SPS.
- We describe a case of a surgical oncology patient who developed spontaneous bowel perforation in the setting of SPS administration.



Scanning view of full thickness of bowel wall showing areas of transmural necrosis with necrotic and degenerated tissue replacing normal mucosa and muscularis propria.
Insert represents a higher power view of the necrotic tissue, and demonstrates the presence of Kayexalate crystals. These crystals appear violet and have a typical mosaic pattern that resembles fish scales.

Clinical Timeline

POD 0-1

- 60 year old male with locally advanced renal cell carcinoma underwent radical nephrectomy and segmental colectomy with primary anastomosis.
- Postoperative course was significant for severe sepsis requiring vasopressor support and piperacillin-tazobactam, new onset atrial fibrillation requiring amiodarone, and acute kidney injury.
- The patient was started on empiric piperacillin-tazobactam, transiently required phenylephrine infusion which was weaned off overnight, and treated with crystalloids and albumin. He was transferred to the floor on POD1.

POD 3-5

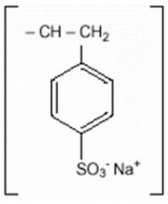
- The patient noted with new hyperkalemia (K 5.8 mEq/l (previously normal), which peaked at 6.8 mEq/l).
- He was treated with oral kayexalate 15grams x6 doses over POD 3-5, and had subsequent improvement in potassium level to 3.6 - 4.5mE/l.

POD 7

- On POD 7, the patient developed acute abdominal pain, with feculent output from surgical drains. He was taken back to the OR for exploratory laparotomy, left colectomy, transverse colostomy and mucous fistula creation.
- Pathology of the colon specimen revealed transmural necro-inflammation, exudative serositis and serosal fibrosis, and basophilic crystalloid particles consistent with kayexalate at the site of perforation, which was proximal to the prior viable appearing anastomosis (Figure 1).

POD 8 -26

- Postoperatively, the patient had continued vasopressor requirement with norepinephrine and vasopressin, he remained intubated and required ICU admission. Antibiotic coverage was broadened to vancomycin, meropenem, and micafungin.
- The patient was subsequently extubated and weaned off vasopressor support on ICU day 3. He demonstrated improvement in renal function and hemodynamics and was discharged to the ward on ICU day 5.
- The remainder of his course was unremarkable and he was discharged home with physical and occupational therapy services on POD 26



Discussion

- This case demonstrates a dangerous complication of kayexalate administration in a postoperative oncology patient who presents with abdominal pain.
- Sorbitol is an osmotic laxative which was added to kayexalate products, however, when linked with bowel necrosis in 2006, the FDA issued a black box warning on kayexalate formulations containing sorbitol.
- The incidence of bowel necrosis linked to sorbitol-free kayexalate formulations is documented as anywhere from 0.27% up to 1.8%, whereas with sorbitol-containing kayexalate formulations, the rate of bowel necrosis is more consistently around 2% during the postoperative period.
- The symptoms of intestinal injury typically occur between 3 hours – 11 days after the administration of kayexalate, and mortality is >30% when intestinal injury is present.
- Patients who develop hyperkalemia are at increased risk for bowel perforation when treated with oral kayexalate. This is thought to be related to elevated renin levels in patients with kidney failure who develop hyperkalemia. Renin activates angiotensin II which causes splanchnic vasoconstriction and can predispose the colon to injury. Additionally, norepinephrine which is the vasopressor of choice in septic shock further reduces splanchnic blood flow which can worsen injury.
- The mechanism of kayexalate induced bowel injury remains unclear, however kayexalate crystals are frequently identified in the colonic mucosa at the site of perforation.

Conclusions

- We recommend the use of alternative treatment strategies for hyperkalemia, particularly in the post operative period and in patients with kidney failure. Alternative treatment strategies include: insulin-glucose, diuretics, calcium, bicarbonate, inhaled beta-adrenergic agonists, and emergent dialysis in severe, life-threatening hyperkalemia

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Lab Posters Presented in Conferences, 2016-2017

Scrambling by TMEM16 proteins

Maria Falzone[3], Byoung-Cheol Lee[2], George Khelashvili[3], Mattia Malvezzi[2], Harel Weinstein[3], Anant Menon[4], Alessio Accardi[5]
[1]Graduate School, Weill Cornell Medical College, New York, NY, USA, [2]Anesthesiology, Weill Cornell Medical College, New York, NY, USA,
[3]Physiology and Biophysics, Weill Cornell Medical College, New York, NY, USA
[4]Biochemistry, Weill Cornell Medical College, New York, NY, USA,
[5]Anesthesiology, Physiology and Biophysics, Weill Cornell Medical College, New York, NY, USA.

ABSTRACT

At rest the phospholipid distribution of eukaryotic plasma membranes is asymmetric. This asymmetry is disrupted by the action of a class of membrane proteins called phospholipid scramblases. These proteins mediate the bidirectional flipping of lipids across the bilayer, leading to the exposure on the cell surface of lipids which are normally sequestered to the inner leaflet, such as the negatively charged phosphatidylserine (PS). Phospholipid scrambling is important for many cellular signaling processes, including apoptosis, cell fusion, and blood coagulation. The TMEM16 proteins are a family of transmembrane proteins, several of which have been identified as Ca^{2+} activated phospholipid scramblases. Specifically, two fungal TMEM16 proteins have been purified and reconstituted to demonstrate in vitro Ca^{2+}-activated scrambling activity and the structure of one of these homologues was solved, providing the first mechanistic insights into phospholipid scrambling.

Using these fungal homologues, I am investigating the mechanism of phospholipid scrambling, which is currently unknown. Based on the close relationship between scramblases and ion channels, we expected that the scramblase activity would be modulated by the lipid environment. We hypothesized that scrambling entails a perturbation of the bilayer, this would then pose that scrambling should be reduced in thicker or less fluid bilayers. Furthermore, since scrambling by TMEM16 homologues is non-selective, we predicted that the lipid headgroup should not regulate scrambling.

Consistent with our hypothesis we found that decreasing membrane fluidity via addition of cholesterol incurs scrambling with near complete inhibition at 30% added cholesterol. Unexpectedly, we found that the lipid headgroups are also key regulators of scrambling. In membranes formed of 100% POPC the TMEM16 scramblases are nearly inactive. While the addition of 20% of the negatively charged POPG is sufficient to confer constitutive, Ca^{2+}-independent scrambling activity. This result suggests that POPG, or possibly negatively charged lipids in general, might function as an activator of these scramblases. To test this hypothesis I am currently testing whether other lipids such as the negatively charged PS or non-substrate lipid PC can substitute for PG. Taken together my results indicate that the lipid environment of TMEM16 scramblases is important for function, not only for the bulk properties including fluidity, but also for lipid headgroups as well.

QUESTIONS

1. Are specific lipid headgroups required for afTMEM16 activation?
2. How is scrambling modulated by the chemico-physical properties of the lipid bilayer?
   i. Does membrane fluidity affect scrambling?
   ii. How does bilayer thickness influence scrambling activity?

RESULTS

afTMEM16 has similar activity in equivalent mixtures of natural and synthetic lipids

afTMEM16 is fully active in 3 POPE: 1 POPG membranes

afTMEM16 is nearly completely inactive in 100% POPC membranes

Addition of POPG rescues afTMEM16 activity in the background of POPC

MD simulations suggest a mechanism for how PG might be required to gate TMEM16 scramblases

Increasing bilayer thickness does not affect scrambling

Membrane fluidity affects scrambling

SUMMARY

1. Scrambling activity is silenced in POPC, but 10-20% POPG can restore activity.
2. MD simulations suggest this is due to the interaction of PG with R432.
3. Scrambling is unaffected by small increases in bilayer thickness.
4. Cholesterol drastically inhibits scrambling activity.

CONCLUSIONS

1. Membrane composition is a key regulator of TMEM16 scramblase activity.
2. Negatively charged headgroups are required for activity
3. Decreased membrane fluidity inhibits scrambling, while bilayer thickness has nearly no effect.

FUTURE DIRECTIONS

1. Test other lipids for POPC rescue (PE, PS).
2. Evaluate the effects of a thicker bilayer (22:1)
3. Titrate cholesterol and evaluate its effect in other lipid backgrounds.

ACKNOWLEDGEMENTS

- NIH grants 5R01GM106717 (to A.K.M. and A.A.)
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General Anesthetics Minimally Affect Lipid Bilayer Properties at Clinical Concentrations

Herold KF[1], Sanford RL[2], Lee W[1], Andersen OS[2], Hemmings HC Jr[1,3]

Departments of Anesthesiology[1], Pharmacology[2], and Department of Physiology and Biophysics[3], Weill Cornell Medicine, New York, NY 10065

General anesthetics are widely used, but their exact molecular mechanisms are incompletely understood. One early model, known as the unitary lipid-based hypothesis of anesthetic action, proposed that non-specific anesthetic interactions with the lipid bilayer altered neuronal function through effects on membrane properties. This model, which is based largely on the Meyer-Overton correlation between anesthetic potency and lipid solubility, has been challenged by more recent evidence supporting direct interactions of anesthetics with a range of proteins, in particular transmembrane ion channels. The available results, however, do not exclude anesthetic modulation of ion channel function through interactions with the lipid bilayer.

We therefore tested the effects of a range of chemically diverse general anesthetics and related nonanesthetics on lipid bilayer properties using a sensitive gramicidin-based assay. We show that none of the drugs tested significantly altered lipid bilayer properties at clinically relevant concentrations.

- Using gramicidin channels to study changes in lipid bilayer properties
- Stopped-flow method

Methods: Gramicidin-based fluorescence assay

Large unilamellar vesicles (LUVs) were formed via sonication, freeze-thaw, extrusion, and dialysis. LUVs (with or without gramicidin D from *Bacillus brevis*) consisted of 1,2-dierucoyl-sn-glycero-3-phosphocholine ($DC_{22:1}PC$) for single-component bilayers and of 1,2 dierucoyl sn glycero 3 phosphocholine ($DC_{22:1}PC$), cholesterol and sphingomyelin (1:1:1) for multi-component bilayers and were loaded with 8-aminonaphthalene-1,3,6-trisulfonic acid, disodium salt (ANTS). ANTS fluorescence is quenched by thallium ions (Tl^+) resulting in a decay in fluorescence intensity. The Tl^+ influx rate is a reflection of the number of conducting gramicidin channels in the bilayer. All anesthetics were tested at equianesthetic concentrations equivalent to 1, 2 and 4 MAC (minimum alveolar concentration).

- Bilayer Effects of Inhaled agents: Ethers
- Bilayer Effects of Inhaled agents: Alkanes
- Bilayer Effects of Intravenous Anesthetics
- Lipid-bilayer effects vs. ion-channel effects
- No anesthetic effects in multi-component lipid bilayers

Single-component lipid bilayers

Multi-component lipid bilayers

Results

- None of the anesthetics or non-anesthetics tested altered lipid bilayer properties at clinical concentrations.
- Even at higher concentrations of 2 and 4 MAC only minimal effects on lipid bilayer properties were detected.
- Similar experiments using multi-component lipid bilayers confirmed the lack of any anesthetic membrane effects at clinically relevant concentrations.

Conclusions

- General anesthetics *do not* alter lipid bilayer properties at clinically relevant concentrations. Membrane effects occur only at very high supra-therapeutic concentrations.
- The effects of the nonanesthetic F6 and anesthetic F3 can be rationalized by the observations of North and Cafiso (1997), that F3 is localized toward the bilayer solution interface (site ② and/or site ③) whereas F6 is more uniformly distributed across the bilayer (site ⑤).
- These findings highlight the importance of choosing appropriate physiological concentrations for studies involving general anesthetics.

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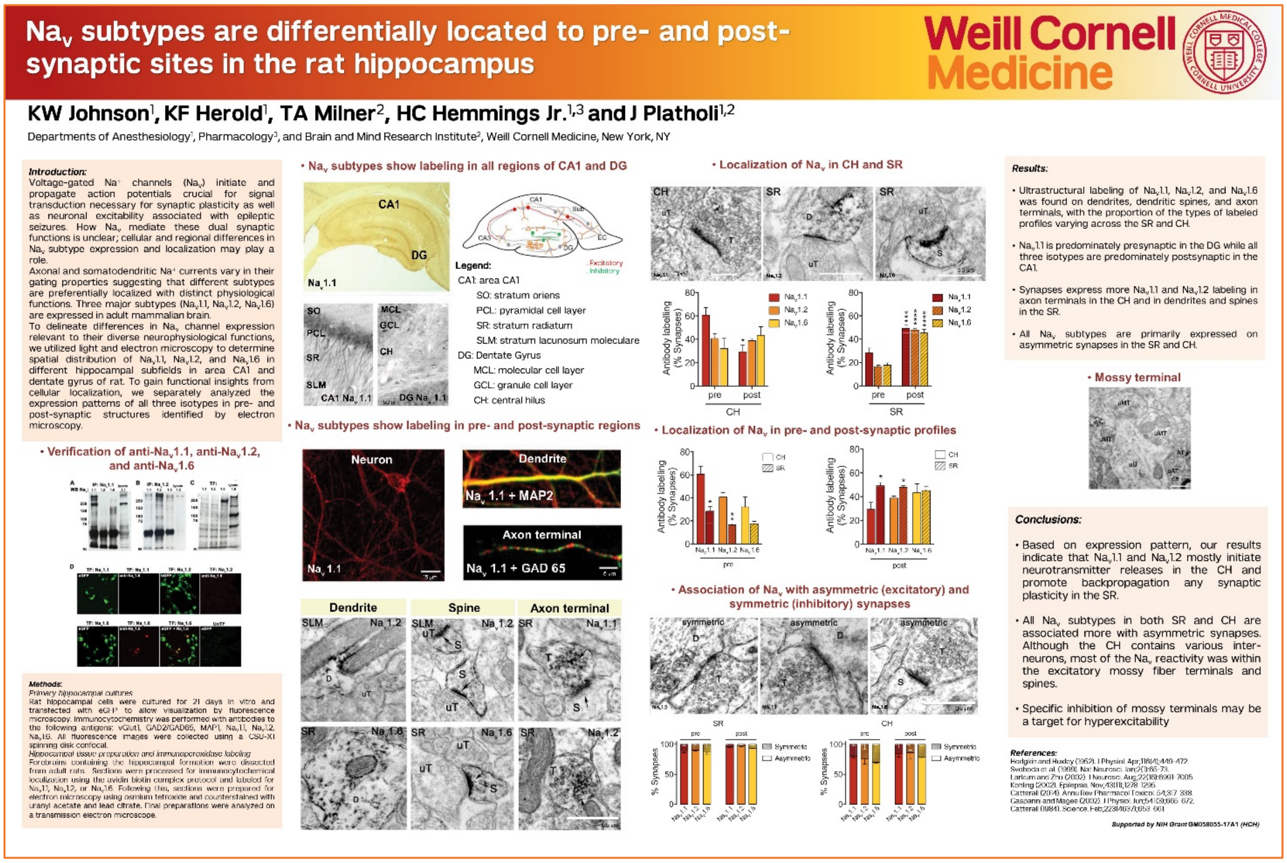
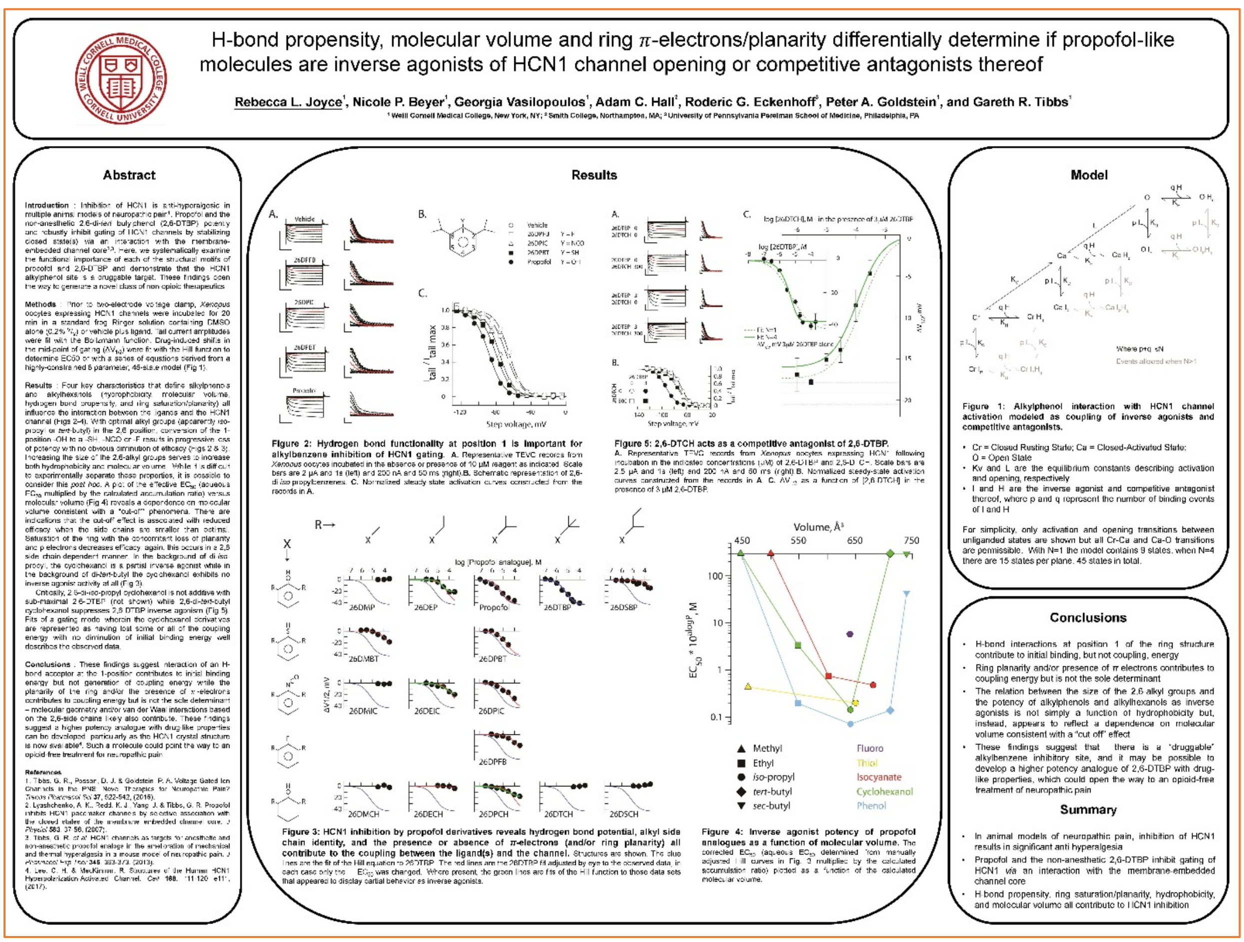
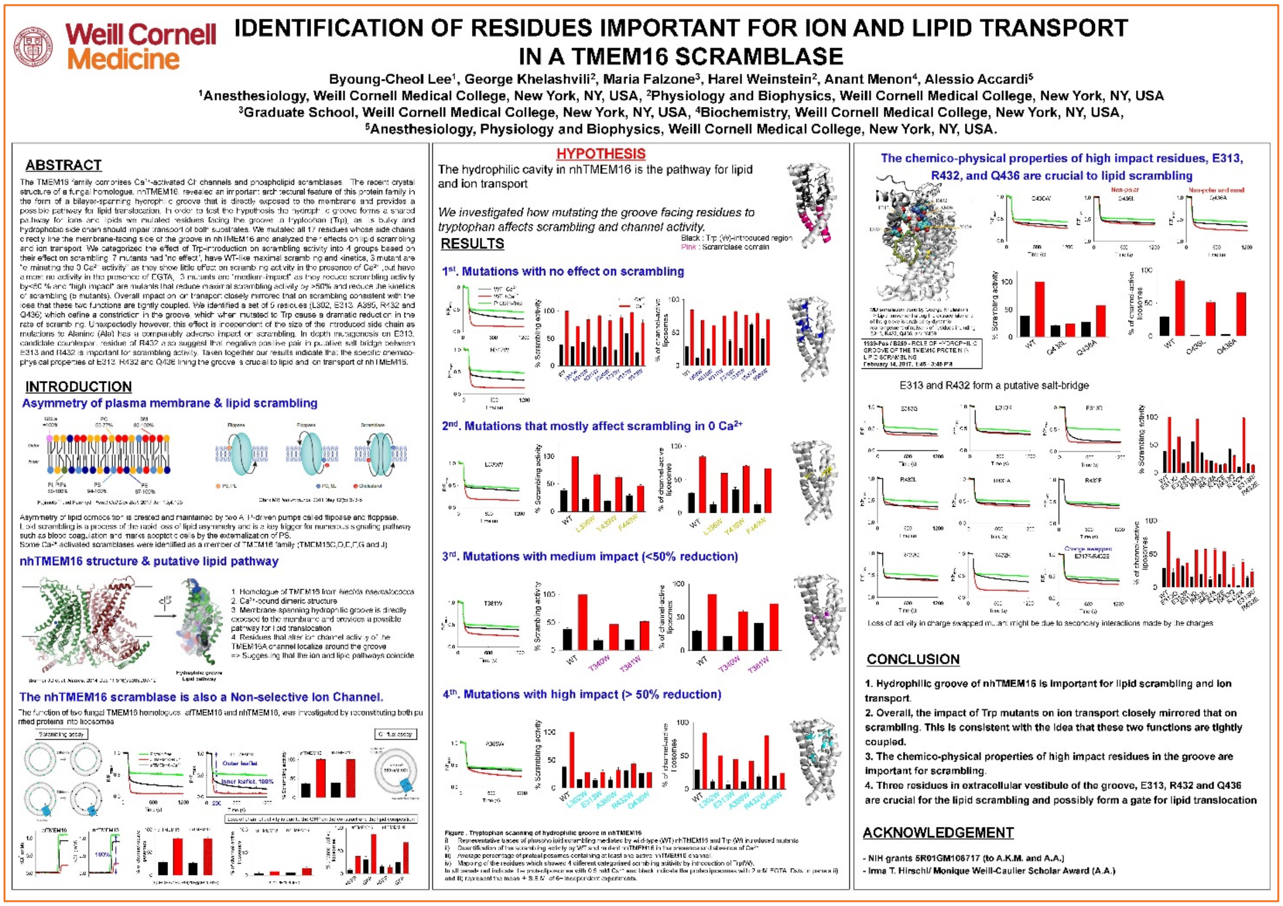


Na$_V$ subtypes are differentially located to pre- and post-synaptic sites in the rat hippocampus
Weill Cornell Medicine
KW Johnson[1], KF Herold[1], TA Milner[2], HC Hemmings Jr.[1,3] and J Platholi[1,2]
Departments of Anesthesiology[1], Pharmacology[3], and Brain and Mind Research Institute[2], Weill Cornell Medicine, New York, NY
Introduction:
• Na$_V$ subtypes show labeling in all regions of CA1 and DG
• Localization of Na$_V$ in CH and SR
• Na$_V$ subtypes show labeling in pre- and post-synaptic regions
• Localization of Na$_V$ in pre- and post-synaptic profiles
• Verification of anti-Na$_V$1.1, anti-Na$_V$1.2, and anti-Na$_V$1.6
• Association of Na$_V$ with asymmetric (excitatory) and symmetric (inhibitory) synapses
Legend:
CA1: area CA1
SO: stratum oriens
PCL: pyramidal cell layer
SR: stratum radiatum
SLM: stratum lacunosum moleculare
DG: Dentate Gyrus
MCL: molecular cell layer
GCL: granule cell layer
CH: central hilus
Neuron
Dendrite
Na$_V$ 1.1 + MAP2
Axon terminal
Na$_V$ 1.1 + GAD 65
Dendrite
Spine
Axon terminal
Results:
• Ultrastructural labeling of Na$_V$1.1, Na$_V$1.2, and Na$_V$1.6 was found on dendrites, dendritic spines, and axon terminals, with the proportion of the types of labeled profiles varying across the SR and CH.
• Na$_V$1.1 is predominately presynaptic in the DG while all three isotypes are predominately postsynaptic in the CA1.
• Synapses express more Na$_V$1.1 and Na$_V$1.2 labeling in axon terminals in the CH and in dendrites and spines in the SR.
• All Na$_V$ subtypes are primarily expressed on asymmetric synapses in the SR and CH.
• Mossy terminal
Conclusions:
• Based on expression pattern, our results indicate that Na$_V$1.1 and Na$_V$1.2 mostly initiate neurotransmitter releases in the CH and promote backpropagation any synaptic plasticity in the SR.
• All Na$_V$ subtypes in both SR and CH are associated more with asymmetric synapses. Although the CH contains various inter-neurons, most of the Na$_V$ reactivity was within the excitatory mossy fiber terminals and spines.
• Specific inhibition of mossy terminals may be a target for hyperexcitability
References:
Methods:



H-bond propensity, molecular volume and ring π-electrons/planarity differentially determine if propofol-like molecules are inverse agonists of HCN1 channel opening or competitive antagonists thereof
Rebecca L. Joyce[1], Nicole P. Beyer[1], Georgia Vasilopoulos[1], Adam C. Hall[2], Roderic G. Eckenhoff[3], Peter A. Goldstein[1], and Gareth R. Tibbs[1]
Abstract
Results
Model
Figure 2: Hydrogen bond functionality at position 1 is important for alkylbenzene inhibition of HCN1 gating.
Figure 5: 2,6-DTCH acts as a competitive antagonist of 2,6-DTBP.
Figure 3: HCN1 inhibition by propofol derivatives reveals hydrogen bond potential, alkyl side chain identity, and the presence or absence of π-electrons (and/or ring planarity) all contribute to the coupling between the ligand(s) and the channel.
Figure 4: Inverse agonist potency of propofol analogues as a function of molecular volume.
Figure 1: Alkylphenol interaction with HCN1 channel activation modeled as coupling of inverse agonists and competitive antagonists.
Conclusions
• H-bond interactions at position 1 of the ring structure contribute to initial binding, but not coupling, energy
• Ring planarity and/or presence of π electrons contributes to coupling energy but is not the sole determinant
• The relation between the size of the 2,6 alkyl groups and the potency of alkylphenols and alkylhexanols as inverse agonists is not simply a function of hydrophobicity but, instead, appears to reflect a dependence on molecular volume consistent with a "cut off" effect
• These findings suggest that there is a "druggable" alkylbenzene inhibitory site, and it may be possible to develop a higher potency analogue of 2,6-DTBP with drug-like properties, which could open the way to an opioid-free treatment of neuropathic pain
Summary
• In animal models of neuropathic pain, inhibition of HCN1 results in significant anti hyperalgesia
• Propofol and the non-anesthetic 2,6-DTBP inhibit gating of HCN1 via an interaction with the membrane-embedded channel core
• H bond propensity, ring saturation/planarity, hydrophobicity, and molecular volume all contribute to HCN1 inhibition


Weill Cornell Medicine
IDENTIFICATION OF RESIDUES IMPORTANT FOR ION AND LIPID TRANSPORT IN A TMEM16 SCRAMBLASE
Byoung-Cheol Lee1, George Khelashvili2, Maria Falzone3, Harel Weinstein2, Anant Menon4, Alessio Accardi5
1Anesthesiology, Weill Cornell Medical College, New York, NY, USA, 2Physiology and Biophysics, Weill Cornell Medical College, New York, NY, USA
3Graduate School, Weill Cornell Medical College, New York, NY, USA, 4Biochemistry, Weill Cornell Medical College, New York, NY, USA,
5Anesthesiology, Physiology and Biophysics, Weill Cornell Medical College, New York, NY, USA.
ABSTRACT
INTRODUCTION
Asymmetry of plasma membrane & lipid scrambling
nhTMEM16 structure & putative lipid pathway
The nhTMEM16 scramblase is also a Non-selective Ion Channel.
HYPOTHESIS
The hydrophilic cavity in nhTMEM16 is the pathway for lipid and ion transport
We investigated how mutating the groove facing residues to tryptophan affects scrambling and channel activity.
RESULTS
1st. Mutations with no effect on scrambling
2nd. Mutations that mostly affect scrambling in 0 Ca2+
3rd. Mutations with medium impact (<50% reduction)
4th. Mutations with high impact (> 50% reduction)
The chemico-physical properties of high impact residues, E313, R432, and Q436 are crucial to lipid scrambling
E313 and R432 form a putative salt-bridge
Loss of activity in charge swapped mutant might be due to secondary interactions made by the charges
CONCLUSION
1. Hydrophilic groove of nhTMEM16 is important for lipid scrambling and ion transport.
2. Overall, the impact of Trp mutants on ion transport closely mirrored that on scrambling. This is consistent with the idea that these two functions are tightly coupled.
3. The chemico-physical properties of high impact residues in the groove are important for scrambling.
4. Three residues in extracellular vestibule of the groove, E313, R432 and Q436 are crucial for the lipid scrambling and possibly form a gate for lipid translocation
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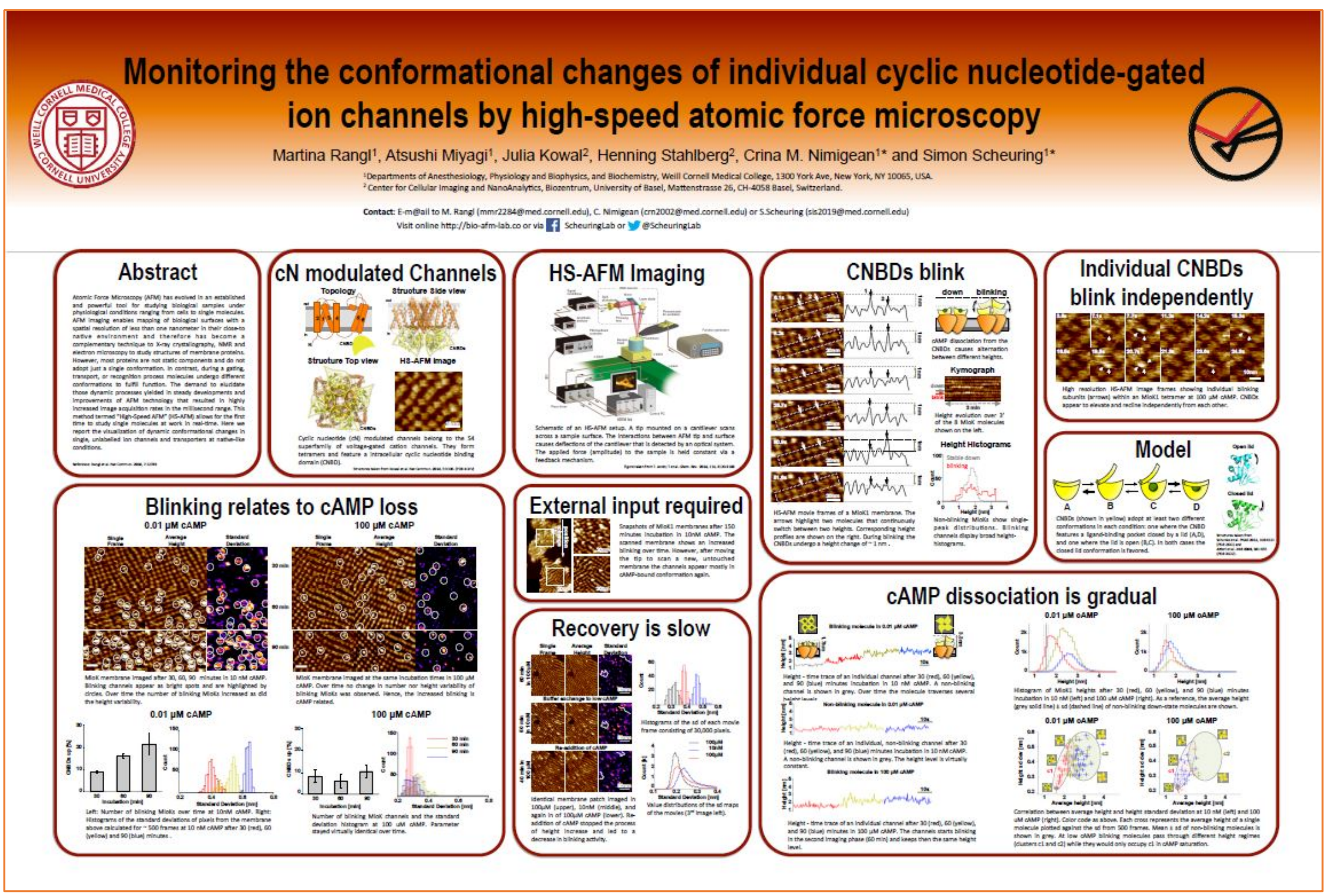
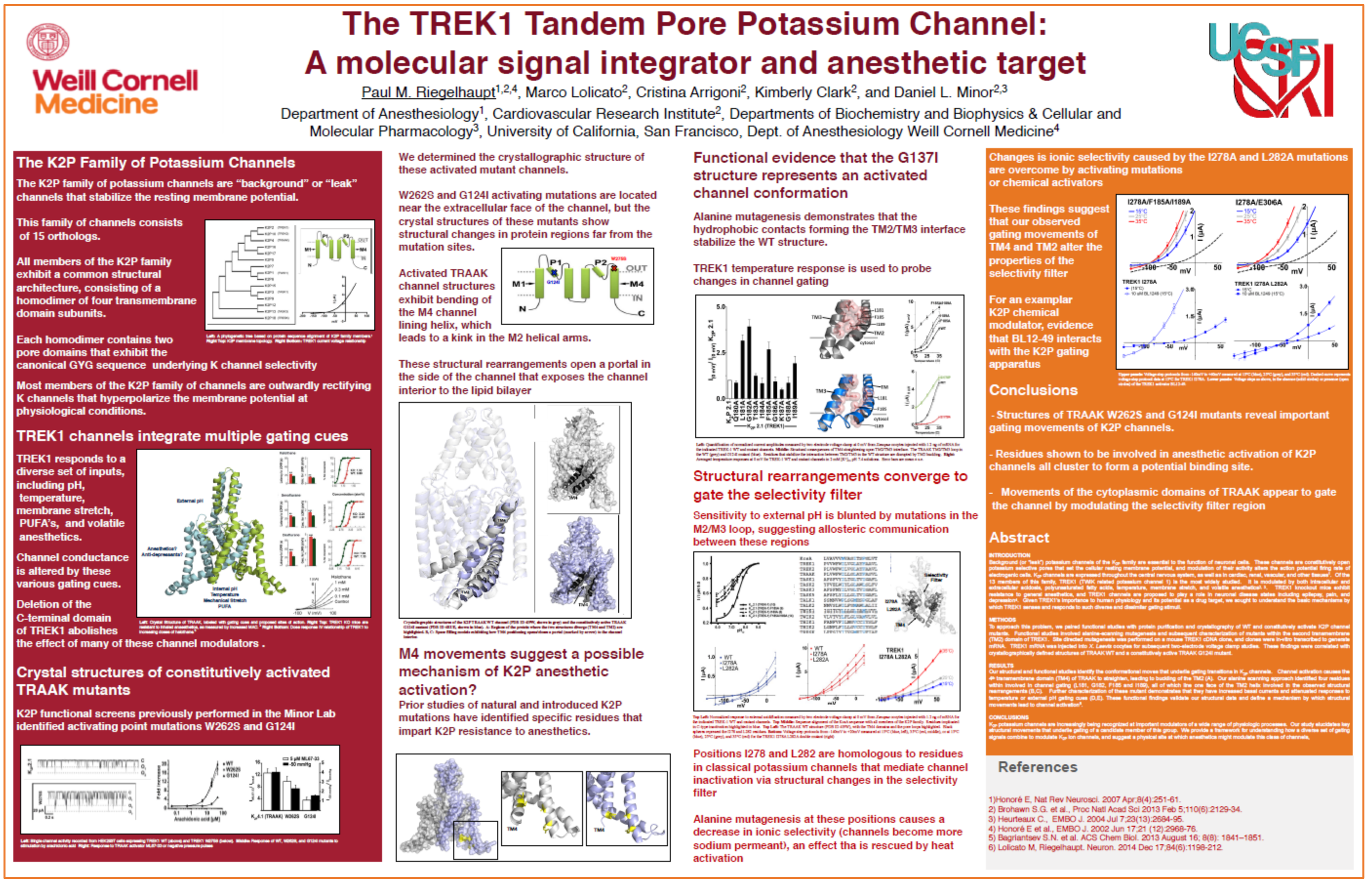

Monitoring the conformational changes of individual cyclic nucleotide-gated ion channels by high-speed atomic force microscopy
Martina Rangl1, Atsushi Miyagi1, Julia Kowal2, Henning Stahlberg2, Crina M. Nimigean1* and Simon Scheuring1*
1Departments of Anesthesiology, Physiology and Biophysics, and Biochemistry, Weill Cornell Medical College, 1300 York Ave, New York, NY 10065, USA.
2 Center for Cellular Imaging and NanoAnalytics, Biozentrum, University of Basel, Mattenstrasse 26, CH-4058 Basel, Switzerland.
Contact: E-m@il to M. Rangl (mmr2284@med.cornell.edu), C. Nimigean (crn2002@med.cornell.edu) or S.Scheuring (sis2019@med.cornell.edu)
Visit online http://bio-afm-lab.co or via ScheuringLab or @ScheuringLab
Abstract
cN modulated Channels
HS-AFM Imaging
CNBDs blink
Individual CNBDs blink independently
Model
Blinking relates to cAMP loss
0.01 µM cAMP
100 µM cAMP
External input required
Recovery is slow
cAMP dissociation is gradual



The TREK1 Tandem Pore Potassium Channel:
A molecular signal integrator and anesthetic target
Paul M. Riegelhaupt1,2,4, Marco Lolicato2, Cristina Arrigoni2, Kimberly Clark2, and Daniel L. Minor2,3
Department of Anesthesiology1, Cardiovascular Research Institute2, Departments of Biochemistry and Biophysics & Cellular and Molecular Pharmacology3, University of California, San Francisco, Dept. of Anesthesiology Weill Cornell Medicine4
Weill Cornell Medicine
The K2P Family of Potassium Channels
The K2P family of potassium channels are "background" or "leak" channels that stabilize the resting membrane potential.
This family of channels consists of 15 orthologs.
All members of the K2P family exhibit a common structural architecture, consisting of a homodimer of four transmembrane domain subunits.
Each homodimer contains two pore domains that exhibit the canonical GYG sequence underlying K channel selectivity
Most members of the K2P family of channels are outwardly rectifying K channels that hyperpolarize the membrane potential at physiological conditions.
TREK1 channels integrate multiple gating cues
TREK1 responds to a diverse set of inputs, including pH, temperature, membrane stretch, PUFA's, and volatile anesthetics.
Channel conductance is altered by these various gating cues.
Deletion of the C-terminal domain of TREK1 abolishes the effect of many of these channel modulators .
Crystal structures of constitutively activated TRAAK mutants
K2P functional screens previously performed in the Minor Lab identified activating point mutations W262S and G124I
We determined the crystallographic structure of these activated mutant channels.
W262S and G124I activating mutations are located near the extracellular face of the channel, but the crystal structures of these mutants show structural changes in protein regions far from the mutation sites.
Activated TRAAK channel structures exhibit bending of the M4 channel lining helix, which leads to a kink in the M2 helical arms.
These structural rearrangements open a portal in the side of the channel that exposes the channel interior to the lipid bilayer
M4 movements suggest a possible mechanism of K2P anesthetic activation?
Prior studies of natural and introduced K2P mutations have identified specific residues that impart K2P resistance to anesthetics.
Functional evidence that the G137I structure represents an activated channel conformation
Alanine mutagenesis demonstrates that the hydrophobic contacts forming the TM2/TM3 interface stabilize the WT structure.
TREK1 temperature response is used to probe changes in channel gating
Structural rearrangements converge to gate the selectivity filter
Sensitivity to external pH is blunted by mutations in the M2/M3 loop, suggesting allosteric communication between these regions
Positions I278 and L282 are homologous to residues in classical potassium channels that mediate channel inactivation via structural changes in the selectivity filter
Alanine mutagenesis at these positions causes a decrease in ionic selectivity (channels become more sodium permeant), an effect tha is rescued by heat activation
Changes is ionic selectivity caused by the I278A and L282A mutations are overcome by activating mutations or chemical activators
These findings suggest that our observed gating movements of TM4 and TM2 alter the properties of the selectivity filter
For an examplar K2P chemical modulator, evidence that BL12-49 interacts with the K2P gating apparatus
I278A/F185A/I189A
I278A/E306A
Conclusions
- Structures of TRAAK W262S and G124I mutants reveal important gating movements of K2P channels.
- Residues shown to be involved in anesthetic activation of K2P channels all cluster to form a potential binding site.
- Movements of the cytoplasmic domains of TRAAK appear to gate the channel by modulating the selectivity filter region
Abstract
References
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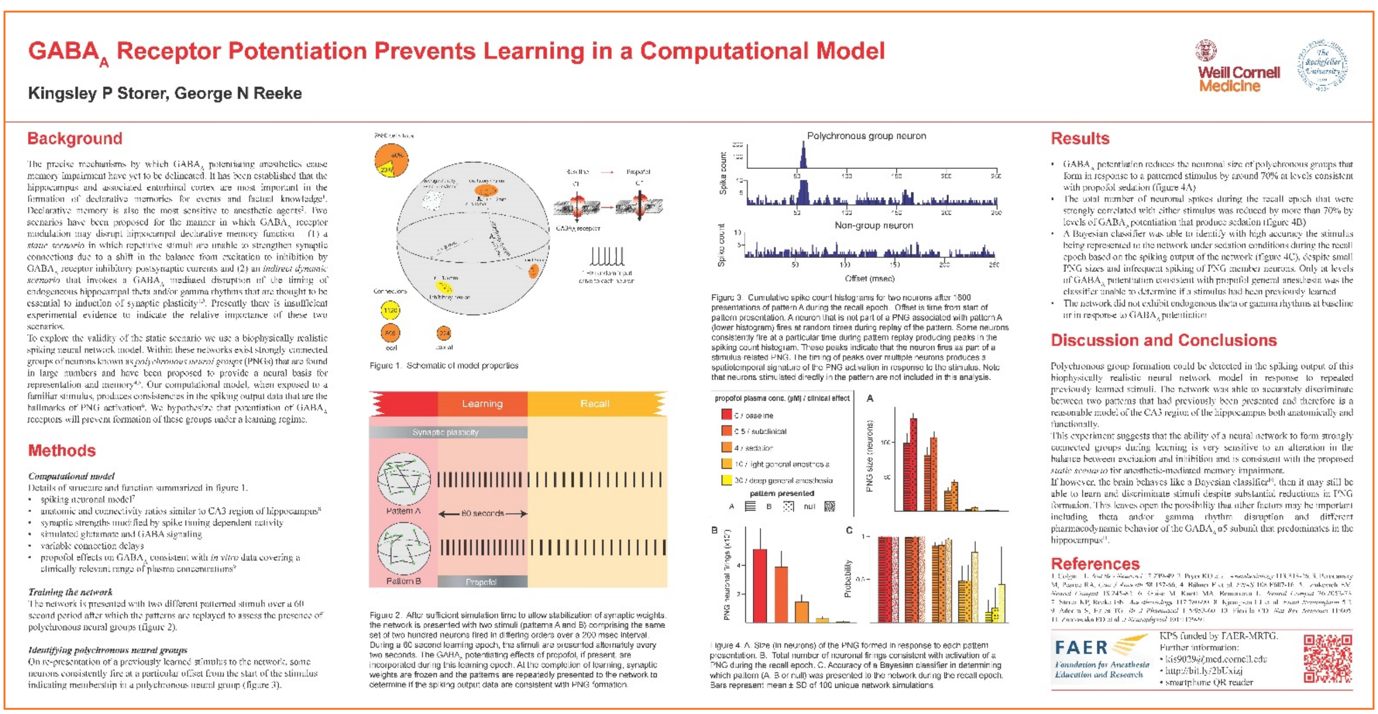

GABAA Receptor Potentiation Prevents Learning in a Computational Model
Kingsley P Storer, George N Reeke
Weill Cornell Medicine
The Rockefeller University
Background
The precise mechanisms by which GABAA potentiating anesthetics cause memory impairment have yet to be delineated. It has been established that the hippocampus and associated entorhinal cortex are most important in the formation of declarative memories for events and factual knowledge1. Declarative memory is also the most sensitive to anesthetic agents2. Two scenarios have been proposed for the manner in which GABAA receptor modulation may disrupt hippocampal declarative memory function — (1) a static scenario in which repetitive stimuli are unable to strengthen synaptic connections due to a shift in the balance from excitation to inhibition by GABAA receptor inhibitory postsynaptic currents and (2) an indirect dynamic scenario that invokes a GABAA mediated disruption of the timing of endogenous hippocampal theta and/or gamma rhythms that are thought to be essential to induction of synaptic plasticity1,3. Presently there is insufficient experimental evidence to indicate the relative importance of these two scenarios.
To explore the validity of the static scenario we use a biophysically realistic spiking neural network model. Within these networks exist strongly connected groups of neurons known as polychronous neural groups (PNGs) that are found in large numbers and have been proposed to provide a neural basis for representation and memory4,5. Our computational model, when exposed to a familiar stimulus, produces consistencies in the spiking output data that are the hallmarks of PNG activation6. We hypothesize that potentiation of GABAA receptors will prevent formation of these groups under a learning regime.
Methods
Computational model
Details of structure and function summarized in figure 1.
• spiking neuronal model7
• anatomic and connectivity ratios similar to CA3 region of hippocampus8
• synaptic strengths modified by spike timing dependent activity
• simulated glutamate and GABA signaling
• variable connection delays
• propofol effects on GABAA consistent with in vitro data covering a clinically relevant range of plasma concentrations9
Training the network
The network is presented with two different patterned stimuli over a 60 second period after which the patterns are replayed to assess the presence of polychronous neural groups (figure 2).
Identifying polychronous neural groups
On re-presentation of a previously learned stimulus to the network, some neurons consistently fire at a particular offset from the start of the stimulus indicating membership in a polychronous neural group (figure 3).
Figure 1. Schematic of model properties
Learning
Recall
Synaptic plasticity
Pattern A
60 seconds
Pattern B
Propofol
Figure 2. After sufficient simulation time to allow stabilization of synaptic weights, the network is presented with two stimuli (patterns A and B) comprising the same set of two hundred neurons fired in differing orders over a 200 msec interval. During a 60 second learning epoch, the stimuli are presented alternately every two seconds. The GABAA potentiating effects of propofol, if present, are incorporated during this learning epoch. At the completion of learning, synaptic weights are frozen and the patterns are repeatedly presented to the network to determine if the spiking output data are consistent with PNG formation.
Polychronous group neuron
Non-group neuron
Spike count
Offset (msec)
Figure 3. Cumulative spike count histograms for two neurons after 1800 presentations of pattern A during the recall epoch. Offset is time from start of pattern presentation. A neuron that is not part of a PNG associated with pattern A (lower histogram) fires at random times during replay of the pattern. Some neurons consistently fire at a particular time during pattern replay producing peaks in the spiking count histogram. These peaks indicate that the neuron fires as part of a stimulus related PNG. The timing of peaks over multiple neurons produces a spatiotemporal signature of the PNG activation in response to the stimulus. Note that neurons stimulated directly in the pattern are not included in this analysis.
propofol plasma conc. (µM) / clinical effect
pattern presented
PNG size (neurons)
Probability
Figure 4. A. Size (in neurons) of the PNG formed in response to each pattern presentation. B. Total number of neuronal firings consistent with activation of a PNG during the recall epoch. C. Accuracy of a Bayesian classifier in determining which pattern (A, B or null) was presented to the network during the recall epoch. Bars represent mean ± SD of 100 unique network simulations.
Results
• GABAA potentiation reduces the neuronal size of polychronous groups that form in response to a patterned stimulus by around 70% at levels consistent with propofol sedation (figure 4A)
• The total number of neuronal spikes during the recall epoch that were strongly correlated with either stimulus was reduced by more than 70% by levels of GABAA potentiation that produce sedation (figure 4B)
• A Bayesian classifier was able to identify with high accuracy the stimulus being represented to the network under sedation conditions during the recall epoch based on the spiking output of the network (figure 4C), despite small PNG sizes and infrequent spiking of PNG member neurons. Only at levels of GABAA potentiation consistent with propofol general anesthesia was the classifier unable to determine if a stimulus had been previously learned
• The network did not exhibit endogenous theta or gamma rhythms at baseline or in response to GABAA potentiation
Discussion and Conclusions
Polychronous group formation could be detected in the spiking output of this biophysically realistic neural network model in response to repeated previously learned stimuli. The network was able to accurately discriminate between two patterns that had previously been presented and therefore is a reasonable model of the CA3 region of the hippocampus both anatomically and functionally.
This experiment suggests that the ability of a neural network to form strongly connected groups during learning is very sensitive to an alteration in the balance between excitation and inhibition and is consistent with the proposed static scenario for anesthetic-mediated memory impairment.
If however, the brain behaves like a Bayesian classifier10, then it may still be able to learn and discriminate stimuli despite substantial reductions in PNG formation. This leaves open the possibility that other factors may be important including theta and/or gamma rhythm disruption and different pharmacodynamic behavior of the GABAA α5 subunit that predominates in the hippocampus11.
References
FAER
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Further information:
• kis9039@med.cornell.edu
• http://bit.ly/2bUxiaj
• smartphone QR reader

Structure and dynamics of endocytosis by high-speed atomic force microscopy

Grigory Tagiltsev[1], Frederic Eghiaian[2] and Simon Scheuring[1]

1 - Weill Cornell Medicine, Department of Physiology & Biophysics, 1300 York Avenue, 10065 New York, NY
2 - JPK Instruments AG, Colditzstrasse 36, 12099 Berlin, Germany

Email: grt2006@med.cornell.edu (Grigory Tagiltsev); fred@jpk.com (Frederic Eghiaian); sis2019@med.cornell.edu (Simon Scheuring)
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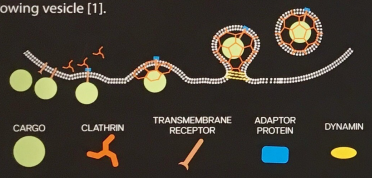
INTRODUCTION

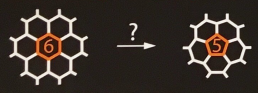
Clathrin-mediated endocytosis is one of the major endocytosis pathways. Formation of clathrin coated vesicles (CCV) begins from relatively flat plasma membrane regions. Clathrin molecules bind to the CCV budding sites and assemble into a lattice covering growing vesicle [1].



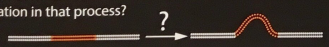
Initial flat clathrin lattice displays a hexagonal honeycomb (6) architecture whereas the final CCV displays a mixture of hexagons and pentagons (5). No dynamic structural analysis of the detailed mechanisms during CCV budding was achieved so far.

QUESTIONS

Mechanism of the transition from flat hexagonal clathrin lattice (6) to a curved mixture of hexagons and pentagons (5)?



Relation between clathrin lattice formation and curvature generation in that process?



METHODS

High-speed atomic force microscopy (HS-AFM) permits observation of structural dynamics in biological processes [2, 3].

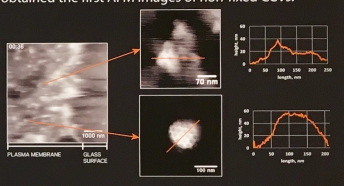
To study the CCV transformation by HS-AFM, we use a cell-free endocytosis assay based on plasma membrane patches [4].

Combination of HS-AFM together with cell-free assay should permit direct, real-time observation of clathrin lattice rearrangement during CCV budding.

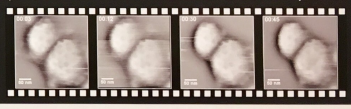
RESULTS

New bright spots appear after addition of cytosol, ATP, and GTP on a fluorescently labeled plasma membrane patch that may correspond to CCVs.

We obtained the first AFM images of non-fixed CCVs:



We performed the first live observation of clathrin dynamics:



CONCLUSION

- Cell-free assay was applied to the plasma membrane patches;
- Cell-free assay was adopted for HS-AFM application;
- HS-AFM images of clathrin-coated vesicles were obtained;
- First observation of clathrin dynamics was done.

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CLINICAL REARCH STUDIES

1. A GLOBAL REGISTRY TO EVALUATE LONG-TERM EFFECTIVENESS OF NEUROSTIMULATION THERAPY FOR PAIN (RELIEF)
   PI: *Shakil Ahmed, M.B.B.S., F.R.C.S.*
   Protocol #: 1309014281

   Prospective, multi-center, global registry of BSC neurostimulation systems for pain. The endpoints of this registry are intended to provide a broad evidence base to assess long-term clinical and economic outcomes of BSC neurostimulation systems in a large number of subjects representing real-world use patterns.

2. A RANDOMIZED CONTROLLED TRIAL OF REGIONAL VERSUS GENERAL ANESTHESIA FOR PROMOTING INDEPENDENCE AFTER HIP FRACTURE (REGAIN TRIAL)
   PI: *Tiffany Tedore, M.D.*
   Protocol #: 1511016763

   Multicenter, randomized clinical trial of two standard of care approaches to anesthesia (spinal vs. general) for hip fracture surgery. Will assess recovery of ambulation at approximately 60 days.

3. PROSPECTIVE, RANDOMIZED STUDY OF MULTICOLUMN IMPLANTABLE LEAD STIMULATION FOR PREDOMINANT LOW BACK PAIN (PROMISE)
   PI: *Neel Mehta, M.D.*
   Protocol #: 1209013020

   Prospective, multi-center, randomized, open-label, parallel-group design to compare Medtronic neurostimulation systems to optimal medical management in treating patients with chronic pain.

4. TWO DOSE NEURAXIAL MORPHINE FOR PREVENTION OF POSTDURAL PUNCTURE HEADACHE (NEMO FOR PDPH)
   PI: *Jamie Aaronson, M.D.*
   Protocol #: 1509016603

   Multi- Institutional randomized, control trial to determine the efficacy of two doses of neuraxial (either epidural or intrathecal) preservative –free morphine (PFM) to prevent headache after ADP in patients.

5. THE INFLUENCE OF ANESTHETIC DEPTH ON PATIENT OUTCOME AFTER MAJOR SURGERY (THE BALANCED ANESTHESIA STUDY)
   PI: *Kane O. Pryor, M.D.*
   Protocol #: 1405015113

   Prospective, randomized clinical trial of ‘deep’ versus ‘light’ anesthesia to examine whether anesthetic depth alters perioperative outcome.

CHART, OBSERVATIONAL, & SURVEY STUDIES

1. INTRAOPERATIVE MEASUREMENT OF CARDIAC OUTPUT DURING CARDIAC SURGERY: WHICH TEE METHOD IS BEST?
   PI: *Nikolaos Skubas, M.D., F.A.C.C., F.A.S.E., D.Sc.*
   Protocol #: 1612017772

   Comparing the cardiac output measurements between TEE and PAC thermodilution technique and assess intra- and inter-observer reproducibility for quantifying left ventricle stroke acquired by TEE

2. RISK OF POST-PARTUM HEMORRHAGE (PPH) FOLLOWING CESAREAN SECTION IN RELATION TO INTRAPARTUM OXYTOCIN USE
   PI: *Jeremy Pick, M.D.*
   Protocol #: 1601016952

   This study aims to determine the efficacy of two doses of neuraxial (either epidural or intrathecal) preservative-free morphine (PFM) to prevent headache after ADP in parturients.

3. ANESTHESIA RELATED FACTORS AFFECTING PARENTAL SATISFACTION IN PEDIATRIC AMBULATORY SURGERY
   PI: *Aarti Sharma, M.D.*
   Protocol #: 1512016819

   Utilizing a survey questionnaire comprising 6 satisfaction questions and a comment section to gather information about a parents' satisfaction with the care provided for the child before, during, and after surgery.

4. SPINAL CORD STIMULATOR EDUCATION DURING PAIN FELLOWSHIP: UNMET TRAINING NEEDS AND FACTORS THAT IMPACT FUTURE PRACTICE
   PI: *Neel Mehta, M.D.*
   Protocol #: 1507016431

   Examining how current ACGME accredited pain fellowships are educating their fellows about spinal cord stimulators (SCS) in order to identify unmet training needs for teaching about SCS, assess SCS training practices in current and past fellows, and measure opinions about the role of industry in SCS training.

5. THE ASSOCIATION BETWEEN OBESITY, PAIN SEVERITY, PAIN INTERFERENCE, AND OPIOID CONSUMPTION
   PI: *Lisa Witkin, M.D.*
   Protocol #: 1701017853

   Analyzing data collected from a longitudinal observational cohort of chronic pain outpatients seen in the Weill Cornell Medicine (WCM) pain medicine clinic, studying the association of obesity as a risk factor for pain outcomes, as a predictor of opioid consumption, and as a predictor of high risk opioid use.

6. THE UTILIZATION OF MOBILE PHONE TECHNOLOGY TO QUANTITATIVELY ASSESS FUNCTIONAL OUTCOMES OF CHRONIC PAIN PATIENTS- A FEASIBILITY STUDY
   PI: *Lisa Witkin, M.D.*
   Protocol #: 1409010349

   Assessing the feasibility and value of using smart phone applications to collect objective, quantitative functional data from patients under active treatment for chronic pain.

7. THE NEW GENERATION OF ANESTHESIOLOGISTS: THE RISE OF GLOBAL CONSCIOUSNESS THROUGH RESIDENCY EDUCATION
   PI: Gunisha Kaur, M.D., M.A.
   Protocol #: 1512016839

   This study evaluates the impact of a global health experience on a physician's global awareness via survey method.

REGISTRY STUDIES

1. CHRONIC PAIN REGISTRY
   PI: *Lisa Witkin, M.D.*
   Protocol #: 90401349

   The purpose of this study is to establish a retrospective chronic pain patient data registry for patients with chronic pain, and to use the patient data registry and Practice Based Evidence (PBE), and Clinical Practice Improvement (CPI) methodology to identify specific pain management interventions that are most effective for specific patient types with chronic pain.

2. PEDIATRIC DIFFICULT INTUBATION (PEDI) REGISTRY - IMPROVING SAFETY AND QUALITY OF AIRWAY MANAGEMENT IN CHILDREN WITH DIFFICULT AIRWAYS
   PI: *Franklin Chiao, M.D.*
   Protocol #: 1602016988

   Observational, multi-center study data collection to establish a registry that will allow participating institutions to assess the outcomes of care of children with Difficult Direct Laryngoscopy (DDL) and to facilitate comparison to the other institutions' difficult airway management practices and outcomes.

3. PEDIATRIC CRANIOFACIAL SURGERY PERIOPERATIVE REGISTRY (PCSPR)
   PI: *Franklin Chiao, M.D.*
   Protocol #: 1504016130

   Multi-center registry to capture information relating to the perioperative course and management of children undergoing craniofacial reconstructive surgery. The aggregate multi-institutional data set will be used for benchmarking for national quality improvement efforts.

4. ANESTHESIOLOGY EDUCATION RESEARCH REGISTRY
   PI: *Kane O. Pryor, M.D.*
   Protocol #: 1403014915

   To design and establish a retrospective and prospective data registry of anesthesiology residents' performance on a variety of examination metrics. All data will be de-identified. The aim of this registry is to assess the utility of various metrics in predicting resident performance outcomes. These metrics will include but not be limited to: clinical rotation performance assessments, United States Medical Licensing Examination (USMLE) scores, and Anesthesia Knowledge Test (AKT) scores. Performance outcomes will include but not be limited to scores on the In-Training Examination (ITE) and American Board of Anesthesiology (ABA) board examination.

RETROSPECTIVE STUDIES

1. ANESTHESIA READY TIME FOR HEMODIALYSIS PATIENTS UNDERGOING CARDIAC SURGERY
   PI: *James Osorio, M.D.*
   Protocol #: 1701017927

   Retrospective chart review evaluating “anesthesia ready time.” We hypothesize that line placement (i.e. central, arterial) in renal failure patients on hemodialysis is time consuming, and therefore the "anesthesia ready time" will be longer for hemodialysis patients having cardiac surgery relative to other critically-ill patients.

2. THE EFFECT OF EARLY EXTUBATION ON POST-OPERATIVE OUTCOMES IN PATIENTS UNDERGOING TRANSFEMORAL AORTIC VALVE REPLACEMENT
   PI: *Nikolaos Skubas, M.D., F.A.C.C., F.A.S.E., D.Sc.*
   Protocol #: 1601016899

   Retrospective analysis of patients who underwent a TAVR and NYP-WCMC after January 2015. The purpose is to determine the association between early extubation and length of stay in patients undergoing transcatheter aortic valve replacement for aortic stenosis.

3. EARLY VS LATE STROKE AFTER CARDIAC SURGERY: VARIABILITY IN LOCATION AND OUTCOME
   PI: *Natalia Ivascu, M.D.*
   Protocol #: 1504016129

   This is a retrospective chart review looking at cardiac surgery patients and the association between timing of stroke onset and anatomic location of CVA.

4. ECHOCARDIOGRAPHIC PREDICTORS OF RECURRENT AORTIC VALVE INSUFFICIENCY AFTER VALVE SPARING AORTIC SURGERY
   PI: *Nikolaos Skubas, M.D., F.A.C.C., F.A.S.E., D.Sc.*
   Protocol #: 1604017133

   Retrospective review study to identify potential echocardiographic predictors of recurrent aortic valve insufficiency in patients who have undergone valve sparing aortic root surgery.

GLOBAL HEALTH STUDIES

1. THE IMPLEMENTATION OF A NOVEL PAIN – SCREENING TOOL IN THE DIAGNOSIS OF PAIN SYMPTOMS AND SYNDROMES IN REFUGEE TORTURE SURVIVORS (PainT)
   PI: *Gunisha Kaur, M.D., M.A.*
   Protocol #: 1608017472

   Evaluating if standard protocols for the assessment of survivors of torture result in under or missed diagnosis of pain and pain symptoms. A validated pain screening tool, the Brief Pain Inventory, will be used in addition to current protocols to adequately indicate the need for a referral to a pain physician for survivors of torture.

2. ANALYSIS OF FARMER SUICIDE IN PUNJAB, INDIA
   PI: *Melanie Witte, MD*
   Protocol #: 1611017749

   Retrospective review studying deceased farmers from Punjab, India. We hypothesize that farmer suicide in Punjab, India is correlated with amounts of agricultural debt and land holdings.

CENTER FOR PERIOPERATIVE OUTCOMES STUDIES

1. DATA REGISTRY
   PI: *Peter M. Fleischut, M.D.*
   Protocol #: 1208012815

   To establish a retrospective and prospective pre-, intra-, and postoperative anesthesiology data registry for patients who have received anesthesia services at New York-Presbyterian Hospital/Weill Cornell Medical College since 2001.

2. THE EPIDEMIOLOGY AND IMPACT OF MEDICATION ERRORS IN THE PERIOPERATIVE SETTING
   PI: *Zachary A. Turnbull, M.D.*
   Protocol #: 1507076373

   Perioperative medication errors occur not infrequently, and may result in meaningful incremental healthcare resource consumption and patient harm. This study is looking to investigate the anesthesia medication error rates and consequences at large academic hospitals, where providers-in-training are concentrated.

3. ANESTHESIA QUALITY INSTITUTE
   PI: *Peter M. Fleischut, M.D.*
   Protocol #: 1208012821

   The Anesthesia Quality Institute (AQI), established by the American Society of Anesthesiologists, is home of the National Anesthesia Clinical Outcomes Registry (NACOR). NACOR is a registry of anesthesiology data that includes billing/administrative data, quality/perioperative events data, anesthesia information management system (AIMS) data, and electronic medical record (EMR) data. The Department of Anesthesiology at Weill Cornell Medical College (WCMC) Participated in this registry and produced two peer-reviewed publications utilizing these data.

4. MULTICENTER PERIOPERATIVE OUTCOMES GROUP (MPOG) AND ANESTHESIOLOGY PERFORMANCE IMPROVEMENT AND REPORTING EXCHANGE (ASPIRE) PERFORMANCE SITE
   PI: *Hugh C. Hemmings Jr., M.D., Ph.D., F.R.C.A.*
   Protocol #: 120812817

   The Multicenter Perioperative Outcomes Group (MPOG) is a consortium of anesthesiology departments of academic medical centers with electronic perioperative information systems. The purpose of MPOG is to allow multi-institutional collaboration for the purpose of accelerating outcomes research in perioperative medicine.

5. OUTCOMES RESEARCH UTILIZING THE HCUP STATE INPATIENT SAMPLE
   PI: *Peter M. Fleischut, M.D.*
   Protocol #: 1308014181

6. Outcomes research studies are performed using existing Health Cost and Utilization Project (HCUP) State Inpatient Sample Databases, an existing publicly available de-identified database. This Protocol has resulted in the creation of collaborations with Anesthesiology, Thoracic, and General Surgery resulting in three publications in top-tier Thoracic surgery journals and three additional studies in the submission phase.

7. RETROSPECTIVE IDENTIFICATION OF PREDICTORS OF POSTOPERATIVE RESPIRATORY OUTCOMES
   PI: *Peter M. Fleischut, M.D.*
   Protocol #: 1208012815

   Building upon previous research efforts, the proposed retrospective case-control study is designed to identify demographic characteristics, procedure types, anesthesia medications, and PACU medications associated with post-operative respiratory complications.

8. RESIDENT CARE LOGS: AN ACCURATE REFLECTION OF TRAINING?
   PI: *Zachary Turnbull M.D.*
   Protocol #: 1602016986

   ACGME case log data is used in assessing residents' procedural competencies, specific case type experiences, and to help determine future resident operating room assignments. The aim of this study is to highlight the inaccuracies in the ACGME self-reported data and to suggest the use of anesthesia information management systems (AIMS) to improve upon these inaccuracies and relieve the burden on residents to self-report.

COMPLETED STUDIES (SOME NOW IN DATA ANALYSIS)

1. STUDY OF ACETAMINOPHEN IV ON HOSPITAL LENGTH OF STAY IN MORBIDLY OBESE INDIVIDUALS UNDERGOING ELECTIVE LAPAROSCOPIC SLEEVE GASTRECTOMY
   PI: Peter A. Goldstein, M.D.
   Protocol #: 1503016056

   Prospective, double blind, placebo control, study to determine the efficacy of acetaminophen iv on reducing hospital length of stay and hospital costs in morbidly obese patients undergoing a sleeve gastrectomy for weight loss.

2. RATE OF GENERAL ANESTHESIA USE FOR CESAREAN DELIVERY AMONG ANESTHESIOLOGISTS WITH AND WITHOUT FELLOWSHIP TRAINING IN OBSTETRIC ANESTHESIA
   PI: *Klaus Kjaer, M.D., M.B.A*
   Protocol #: 1410015567

   This is a retrospective chart review to look at all cesarean cases between 2009-14, restricted to those occurring during non-routine operating hours to consider the problem that general anesthesia presents a higher risk for morbidity/mortality compared to neuraxial anesthesia during cesarean section deliveries (10-fold higher risk for pregnant patients compared to non-pregnant patients), but it is nevertheless sometimes used, perhaps for poor reasons. The hypothesis is that ob-fellowship trained anesthesiologists are better trained to make this decision and that non-fellowship trained attendings over-use general anesthesia.

3. TRIAL OF RIASTAP VS. CRYOPRECIPITATE TO LOWER OPERATIVE TRANSFUSIONS (TOP-CLOT)
   PI: *Nikolaos Skubas, M.D., F.A.C.C., F.A.S.E., D.Sc.*
   Protocol #: 1408015402

   This pilot study aligns with the strategic plan to reduce allogeneic blood product use and decrease unnecessary laboratory costs, and to improve the appropriate use of transfusion guidelines and reduce unnecessary RBC transfusions. Further, this study will help to answer whether RiaSTAP is a more effective product to treat bleeding than cryoprecipitate. This study involves the use of a safer therapeutic, fibrinogen concentrate, to improve patient care and patient safety. This product does not require the time-intensive process of thawing; therefore, delays in patient care can be avoided by having the product readily available in the OR.

4. RESTRICTIVE VERSUS LIBERAL FLUID THERAPY IN MAJOR ABDOMINAL SURGERY (RELIEF)
   PI: *Kane O. Pryor, M.D.*
   Protocol #:1405015112

   Multicenter, randomized clinical trial assigning subjects to “Restrictive” and “Liberal” IV fluid regimens. Fluid is regulated from the start of surgery until 24 hours post-op, after which disability-free survival is tracked for one year.

5. VALIDITY OF PRISM-5-OP INTERVIEWS FOR USE IN STUDIES OF PRESCRIPTION OPIOIDS (PRISM)
   PI: *Neel Mehta, M.D.*
   Protocol #: 1410015582

   Determining the validity and reliability of the Psychiatric Research Interview for Substance and Mental Disorders, DSM-5 version (PRISM -5), and the feasibility of using PRISM-5 to get a better understanding of patients’ experiences with opioid pain medications.

6. NEUROIMAGING THE EFFECT OF INTRAVENOUS ANESTHETICS ON AMYGDALA-DEPENDENT MEMORY PROCESSES
   PI: Kane O. Pryor, M.D.
   Protocol #: 0710008933

   An fMRI study to establish whether intravenous anesthetics cause a common change in amygdala and hippocampal function during memory processes, or whether the effects on these brain structures are dissociable.

7. THE PREVENTION OF DELIRIUM AND COMPLICATIONS ASSOCIATED WITH SURGICAL TREATMENTS (PODCAST) CLINICAL TRIAL
   PI: Kane O. Pryor, M.D.
   Protocol #: 1209013008

   This is a multi-institutional, randomized control study that tests whether a low dose of ketamine can prevent post-operative pain and delirium.

8. THE EFFECT OF INTRAVENOUS ANESTHETICS ON FEAR LEARNING AND MEMORY
   PI: Kane O. Pryor, M.D.
   Protocol #: 0710009434

   130 healthy adult volunteers were given a very low dose of an anesthetic drug intravenously. While they were receiving the drug, subjects performed a series of memory tests and a fear conditioning experiment, which are set up like a very simple computer game. To create the fear response, subjects occasionally received a mildly uncomfortable shock to their arm. The subject is able to determine the highest level of shock that they will receive. This study was conducted to learn exactly how the drugs affect the way people process fear and emotion. This knowledge might one day be used in the treatment of psychiatric disorders.

9. A DESCRIPTIVE STUDY OF PEDIATRIC PAIN MANAGEMENT RESOURCES IN NEW YORK STATE AMONG CHILDREN'S AND MIXED-PRACTICE HOSPITALS IN LOWER AND HIGHER SOCIOECONOMIC AREAS
   PI: Franklin Chiao, M.D.
   Protocol #: 1410015621

   This is a survey study to examine a new medical issue related to pediatric pain management. This study will address how many hospitals have a pediatric pain management service in New York State, and the differences in the presence of pain management services within the pediatric population, between mixed practice and children's hospitals, and between hospitals in lower and higher socioeconomic areas.

10. A SURVEY OF INTRAVENOUS (IV) REMIFENTANIL USE FOR LABOR ANALGESIA AT ACADEMIC CENTERS IN THE UNITED STATES (US)
    PI: Jamie Aaronson, M.D.
    Protocol #: 1410015621

    Comparing current clinical practice between anesthesia providers at academic centers in the US, this survey was sent to assess if there is variation in clinical practice amongst academic centers in the US that use remifentanil for labor analgesia, specifically in delivery, dosing and monitoring.

UPCOMING STUDIES…

1. ROTEM: SIGMA PERFORMANCE EVALUATION- METHOD COMPARISON WITH PREDICATE DEVICE AND REFERENCE INTERVALS
   PI: *Hugh C. Hemmings Jr., M.D., PhD., F.R.C.A*
   Protocol #: 1406015207

   Performance evaluation of the new ROTEM sigma coagulation analyzer relative to the current ROTEM delta thromboelastometry system.

2. A NOVEL MODEL OF GLOBAL HEALTH EDUCATION IN ANESTHESIOLOGY
   PI: *Gunisha Kaur, M.D., M.A*.
   Protocol #: 1702017955

   This study will assess a novel model of global health education in anesthesiology residents.

3. DOSE-RESPONSE RELATIONSHIPS FOR HEMIDIAPHRAGMATIC PARESIS FOLLOWING ULTRASOUND-GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKADE
   PI: *Tiffany Tedore, M.D.*
   Protocol #: 1609017547

   Clinical trial investigating the dose-response relationship between local anesthetic volume and ipsilateral hemidiaphragmatic paresis (HDP) in patients getting ultrasound guided supraclavicular brachial plexus block.

4. PROTECTIVE VENTILATION WITH HIGH VERSUS LOW PEEP DURING ONE-LUNG VENTILATION FOR THORACIC SURGERY - PROTHOR: A RANDOMIZED CONTROLLED TRIAL
   PI: *Matthew T. Murrell, M.D. Ph.D.*
   Protocol #: 1707017890

   Multi-center, randomized controlled trial investigating the use of a higher or lower PEEP strategy in reducing postoperative pulmonary complications in patients undergoing thoracic surgery with one lung ventilation.

5. PROTECTIVE VENTILATION WITH HIGHER VERSUS LOWER PEEP DURING GENERAL ANESTHESIA FOR SURGERY IN OBESE PATIENTS
   PI: *Peter A. Goldstein, M.D.*
   Protocol #: 1701017891

   Multi-center, randomized control trial investigating the use of a higher or lower PEEP strategy in reducing postoperative pulmonary complications in obese patients undergoing surgery with general anesthesia.

6. EFFECTS OF METHYLENE BLUE ON PULSE OXIMETRY AND SPEINAL NIRS IN THORACOABDOMINAL SURGERY
   PI: Lisa Rong, M.D.
   Protocol #: 1703018032

   Retrospective chart review of the effects of methylene blue on both pulse oximetry and spinal NIRS. This study will expand on the current literature describing the ability of dyes, such as methylene blue, to cause erroneous oxygen saturation readings.

7. RATE OF GENERAL ANESTHESIA USE FOR CESAREAN DELIVERY AMONG ANESTHESIOLOGISTS WITH AND WITHOUT FELLOWSHIP TRAIING IN OBSTETRIC ANESTHESIA
   PI: Klaus Kjaer, M.D.
   Protocol #: 1703018074

   Retrospective chart review to determine whether obstetric anesthesia fellowship-trained attending anesthesiologists are more or less likely to provide general anesthesia for non-routine cesarean deliveries compared to non-fellowship trained staff.

Thank you for joining us!