Dear Reader:

Welcome to our 2015-2016 UNC Department of Anesthesiology Annual Research Report. I hope that this summary gives you a better understanding of the exciting research work being done in the department. Our goal is to serve our patients through discovery, and we have had a very productive year.

The research success summarized in this report is achieved by three main factors. First, we are fortunate to have gathered together an incredible group of faculty and staff in the department. Second, these individuals excel at working together in collaborative, multidisciplinary teams. Research is truly a team sport. The effective collaboration of individuals in each of the projects described in this report accounts for our success, and we are fortunate that our numbers continue to grow. Finally, we have a Chair who fully embraces the mission of the university to reduce suffering and improve outcomes through advances which lead to improved patient health. Dr. Zvara has provided the infrastructure and leadership necessary for transformative research, even during very challenging economic times.

I encourage you to check back often and keep up with our department research activities via http://www.med.unc.edu/anesthesiology/research. Also, if you have any questions regarding our research or work, don’t hesitate to email me any time at smclean@aims.unc.edu.

Sincerely,

Samuel McLean, MD, MPH
Vice Chair, Research, Department of Anesthesiology
The University of North Carolina at Chapel Hill
Chapel Hill, NC
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Areas of Departmental Research Focus

1. **TRYUMPH Program:**
   *Trauma Recovery: Understanding Mechanism and Promoting Healing*

A. **African American CRASH: Applying the Biopsychosocial Model to Post-MVC Pain Development in African Americans (R01AR060852, PI McLean)**

   The goal of this study is to examine genotypic and phenotypic characteristics associated with the development of pain and related outcomes in African Americans experiencing motor vehicle collision. Patients involved in motor vehicle collision are enrolled via a network of study sites including sites in Michigan, Massachusetts, Pennsylvania, New Jersey, Washington D.C., North Carolina, Alabama, and Florida. This study is supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health (R01AR060852), and is enrolling 900 African Americans experiencing motor vehicle collision. Study participants complete a baseline assessment in the ED as well as a follow-up interview 6 weeks, 6 months, and 1 year following the motor vehicle collision. This study completed its 5th year of funding in 2015-2016. An updated listing of abstracts and manuscripts from R01AR060852 is available at:

   http://www.med.unc.edu/anesthesiology/research/tryumph-research-group-1/tryumph-studies/african-american-project-crash

2015-2016 abstracts and publications related to R01 AR060852 (African American CRASH)


2015-2016 Publications Related to Above Study


B. European American CRASH: Genetic Predictors of Acute and Chronic Musculoskeletal Pain After Minor MVC (R01AR056328, PI McLean)

Project CRASH is a prospective cohort study examining genotypic and phenotypic characteristics associated with the development of acute and persistent pain and related outcomes after motor vehicle collision. This study is funded by the National Institute of Arthritis and Musculoskeletal and Skin Diseases. Over 900 patients involved in motor vehicle collision were enrolled in the study at one of nine emergency department study sites in Michigan, Massachusetts, New York, and Florida. Study participants completed a baseline assessment in the ED as well as a follow-up interview 6 weeks, 6 months, and 1 year following the motor vehicle collision. Recruitment and follow-up for this study have been completed. Data analyses and manuscript preparation from this project are ongoing. An updated listing of abstracts and manuscripts from R01AR056328 is available at: http://www.med.unc.edu/anesthesiology/research/tryumph-research-group-1/tryumph-studies/european-american-project-crash
2015-2016 abstracts and publications related to above R01 AR056328


2015-2016 Publications Related to Above Study


TRYUMPH Research Group, August 2016
Back Row (L to R): Dr. Sarah Linnstaedt, Allison Hollowell, Dr. Matthew Mauck, Jenyth Sullivan, Dr. Samuel McLean, Dr. Timothy Platts-Mills, Byron Maltez, Alex Lin
Front Row (L to R): April Soward, Felisha Westbrook, Aditi Borde, Kartik Bhatt, Ken Norman
Not Pictured: Sara Battles, Dr. Andrey Bortsov, Sean Flannigan, Allison Hildebrand, Adeola Keku, Jackie Kostyla, Andrea Liu, Bobby Nichols, Natalie Richmond, Ashley Villard
C. Older Adult CRASH: Persistent Pain in Older Adults after Motor Vehicle Collision (K23 AG038548, PI Platts-Mills)

The Older Adult CRASH study is the first prospective study to examine the incidence, predictors, and etiology of persistent pain among independently living older adults who come to the emergency department for care after motor vehicle collision and are discharged to home. The study has enrolled over 200 patients aged 65 years and older from ten study sites. This project is supported by Dr. Platts-Mills' a K23 career development award from the National Institute on Aging:

http://www.med.unc.edu/anesthesiology/research/tryumph-research-group-1/tryumph-studies/older-adult-project-crash

Related Abstracts 2015-2016


D. Advance Care Planning (ACP):

The Advance Care Planning study investigates the completion and availability of ACP decisions by older adults in the emergency department. Both patient-reported completion of advance directives as well as documentation in the electronic medical record are examined. The results of a cross-sectional study on ACP decisions in UNC’s ED have been accepted for publication in the Journal of Palliative Medicine. Currently, a pilot randomized clinical trial is being conducted to determine the effectiveness of educational ACP materials at increasing end-of-life planning among older adults.

2016-2017 Related Publications:
Platts-Mills, Timothy F., Natalie L. Richmond, Eric M. LeFebvre, Sowmya A. Mangipudi, Allison G. Hollowell, Debbie Travers, Kevin Biese, Laura C. Hanson, Angelo E. Volandes “Availability of
Advance Care Planning Documentation for Older Emergency Department Patients: A Cross-Sectional Study.” Journal of Palliative Medicine (2016). (Accepted for publication, online publication pending)

Poise Research Group Spring Dinner, April 2015.
Back (L to R): Sean Flannigan, Wesley Holland, Bobby Nicholson, Dr. Tim Platts-Mills, John Butler
Front (L to R): Meredith Hoover, Natalie Yosipovitch, Erin Isenberg, Sowmya Mangipudi, Tiffany Ho, Collin Burks.

E. BETTER: Brief Educational Tool To Enhance Recovery

The BETTER study focuses on the development and testing of a brief interactive video to improve the outpatient management of musculoskeletal pain among older adults. Results from the testing and evaluation of the video were recently published in the Journal of American Geriatrics Society. Currently, a pilot trial is being conducted to determine the feasibility of a clinical trial investigating the effect of this video on outpatient pain management. The pilot trial enrolls patients (aged 50 and older) presenting with musculoskeletal pain to UNC’s Emergency Department and over 50 patients have been enrolled so far.
2016-2017 Related Publications:
Platts-Mills, Timothy F., Benjamin R. Quigley, Joseph P. Duronio, Meredith V. Hoover, Eric T. Burgh, Michael A. LaMantia, Sonia M. Davis, Mark A. Weaver and Sheryl Zimmerman “Development and Validation of a Brief Interactive Educational Video to Improve Outpatient Treatment of Older Adults' Acute Musculoskeletal Pain.” J AM Geriatr Soc (2016); 64(4) 880-1.

F. Malnutrition
Malnutrition is a common problem for older adults and has been linked to decreased quality of life and functional decline. We conducted a cross-sectional study to identify risk factors contributing to malnutrition in geriatric populations. The study enrolled over 200 patients in the emergency departments of UNC, Cooper University Hospital in Camden, NJ, and William Beaumont Hospital in Royal Oak, MI. The findings of this study were presented at this year’s Society of Emergency Medicine conference.

2016-2017 Related Abstracts:
Richmond, Natalie, L., Collin E. Burks, Valerie A. Braz, Robert A. Swor, Christopher W. Jones, Mark A. Weaver, Timothy F. Platts-Mills “Modifiable Risk Factors for Malnutrition Among Older Adults Receiving Care in the Emergency Department.” (Presented as an oral presentation at the Society for Academic Emergency Medicine annual meeting)
G. Emergency Department Senior Abuse Identification (ED Senior AID) study
In 2016, Dr. Platts-Mills was awarded a $1 million grant from the National Institute of Justice to develop and validate a screener to detect elder abuse in U.S. EDs. Elder abuse is a common and deadly problem that is often difficult to recognize. The long-term goal of this project is to increase the identification of elder abuse in U.S. EDs. We conducted a cross-sectional analysis of the prevalence of the diagnosis of elder abuse in U.S. emergency departments, which was recently presented at the Society of Academic Emergency Medicine by medical student Christopher Evans and has been accepted for publication in the Journal of the American Geriatrics Society. Currently, we are working on the development and testing of the screening protocol, an effort that is being co-led by UNC medical student Kayla Krajick.

2016-2017 Related Abstracts:
Evans, Christopher S., Katherine M. Hunold, Anthony E. Rosen, Timothy F. Platts-Mills “Diagnosis of Elder Abuse in U.S. Emergency Departments.”
(Presented as an oral presentation at the Society for Academic Emergency Medicine annual meeting)
H. The BURN Experiences Study  
(Jaycee Burn Center Foundation, PI McLean)

The BURN Experiences Study is a prospective longitudinal pilot study examining the recovery process after major thermal burn injury. Participants requiring tissue autograft surgery after major thermal burn injury are enrolled at the time of initial admission and followed prospectively for one year. The study is being conducted at a network of burn centers including the Jaycee Burn Center at The University of North Carolina at Chapel Hill, the Nathan Speare Regional Burn Treatment Center at Crozer-Chester Medical Center, and the Burn Center at MedStar Washington Hospital Center. Data collected are being used to demonstrate study feasibility and to collect pilot data for a large-scale trial. An up-to-date listing of abstracts and manuscripts from this project is available at:

http://www.med.unc.edu/anesthesiology/research/tryumph-research-group-1/tryumph-studies/burn-experiences

Related Abstracts 2015-2016


I. The HELP PAIN Trial (Mayday Fund, PI McLean)

The HELP PAIN Trial is an Emergency Department-based randomized controlled trial. The purpose of this first-in-kind study is to assess the potential efficacy of venlafaxine in reducing acute pain and the transition to persistent pain in high-risk patients that present to the Emergency Department following a motor vehicle collision. Patients presenting to the Emergency Department post-MVC with severe musculoskeletal neck pain will be randomized to receive either venlafaxine or placebo. Data from this pilot study is being used to assess study feasibility and to design a large-scale randomized controlled trial. In May 2015, this study moved to Brown University where co-investigator Dr. Francesca Beaudoin is an Assistant Professor of Emergency Medicine.
J. The Women’s Health Study: Influence of PTSD Symptoms on Chronic Pain Development after Sexual Assault (1R01AR064700-01A1, PI McLean)

The Women’s Health Study is a large-scale prospective study of sexual assault survivors. The five-year study will enroll 900 women who present for emergency care after sexual assault and will follow them prospectively for one year. This study will yield important new insights into sexual assault survivor experiences. In addition, the study will evaluate genetic, psychosocial, and environmental factors influencing adverse outcomes after sexual assault including chronic pain and posttraumatic stress disorder. This past year was spent identifying and developing study sites, and beginning our nationwide study launch.

Related Abstracts 2015-2016

The Linnstaedt Lab has been fortunate to publish/present a number of studies this past year, including data from the first prospective human cohort study to assess microRNA that predict and mediate chronic pain outcomes following motor vehicle collision trauma. This data was published in Molecular Pain and included preliminary evidence that microRNA pathogenic for pain development are expressed in a sex dependent manner and may contribute to increased chronic pain prevalence/severity in women vs. men following trauma exposure. Following this initial observation, the lab became more focused on defining sexually dimorphic molecular mechanisms of chronic pain pathogenesis. It was therefore very exciting to present data at the 2016 American Pain Society Meeting (in a Symposium presentation and poster presentation) showing that one of the main miRNA that regulates pain and PTSD related transcripts differentially predicts chronic pain in humans and animals following stress/trauma exposure. Current experiments in the lab are focused on defining further mechanisms of sex dependent regulation and effects of pathogenic RNA in the context of post-trauma chronic pain and PTSD development.

2015-2016 Related Abstracts:


Linnstaedt SD (moderator), McLean SA, Levine J. Stress-Induced Persistent Pain: Mechanistic Insights from Humans and Animals. Invited Symposium Presentation at the 2016 Annual Meeting of the American Pain Society, Austin TX, May 2016

2015-2016 Related Publications:


From left to right: Sarah Linnstaedt, Alan Wu, Kyle Riker, Parth Patel, Cathleen Rueckeis, Matt Carson, Lindsey Jung, Shan Yu
L. Bortsov Epidemiology Research

Andrey Bortsov is an Epidemiologist with broad interests in genetics, bioinformatics, and predictive modeling. He has been involved in multiple research initiatives including development of a prediction model for chronic pain after trauma, genetic association studies in chronic pain and other posttraumatic sequelae, and genome-wide methylation analyses. Dr. Bortsov has expertise in genome-wide association (GWAS) analyses and GWAS data quality control.

Dr. Bortsov provides biostatistical support for a number of faculty-initiated projects and quality assurance initiatives, and for resident and fellow research projects.

Dr. Bortsov collaborates with McGill University (Prof. Diatchenko Human Pain Genetics Lab) on a number of projects aimed to elucidate genetic determinants of pain sensitivity.

2. Anesthesiology Clinical Trials Research Unit

The UNC Anesthesiology Clinical Trials Research Unit specializes in pain management interventional studies involving medications or devices. Their facilities at the hospital of UNC Health Care and the Pain Management Center at Southern Village allow them to attract a diverse patient population.

They work with Department of Anesthesiology faculty to manage and conduct both industry-sponsored clinical trials and investigator-initiated studies. Their track record is a testament to this outstanding team: UNC is currently a national and international leader in the recruitment and retention of individuals for several clinical trials. Their team of professionals includes a full-time research coordinator and nursing staff, as well as regulatory and other support staff. Individual faculty studies performed in collaboration with the clinical trials team are described below.

A. 3M Antimicrobial Dressing - A Multi-center, Open-label, Prospective, Observational Pilot Study of the Performance of an Investigational Antimicrobial Dressing

The objective of this study is to evaluate performance of an investigational antimicrobial dressing. Performance will be evaluated based on dressing wear time, ease of dressing applications and removals and patient comfort.
3. Quality Improvement/ERAS

A.

**ASER Preceptor Faculty Candidate: Lavinia Kolarczyk M.D.**

**Candidate Title/Position:**
Lavinia Kolarczyk M.D.
Assistant Professor
Cardiothoracic Anesthesiology Division
Department of Anesthesiology
University of North Carolina
Co-Director, Enhanced Recovery Program

**UNC Enhanced Recovery Program: Program Leadership and Structure**

The Enhanced Recovery Program at the University of North Carolina is a multidisciplinary team composed of anesthesiologists, surgeons, and perioperative nursing staff.

- The program is led by three co-directors, Drs. Lavinia Kolarczyk (anesthesiology), Robert Isaak (anesthesiology), and HJ Kim (surgery), who oversee the design, implementation, and sustainability measures for each individual enhanced recovery pathway.
- The full time program manager is Lyla Hance, MPH, who coordinates data collection and administrative tasks.

Each Enhanced Recovery program pathway has champions at every level of perioperative care, including physician and nursing champions from anesthesiology, surgery, and perioperative nursing. (Example shown in Appendix 1)

**UNC Enhanced Recovery Program: Timeline and Program History**

- February 2014: Awarded a seed grant ($50,000) from the Institute for Healthcare Quality and Improvement at University of North Carolina School of Medicine for ERAS Pancreatic Surgery
- July 2014: Pilot program for ERAS Pancreatic Surgery started
- July 2015: ERAS Thoracic Surgery started
- September 2015: ERAS Pancreatic Surgery expanded to ERAS Surgical Oncology which included all intra-abdominal surgeries including hepatic resection, gastrectomy, esophagectomy, proctectomy, and colectomy
- September 2015: ERAS GYN pathway started for laparoscopic gynecological surgery for benign indications in an ambulatory hospital setting
- October 2015: ERAS Colorectal pathway started
- October 2015: ERAS Structural Heart (transcatheter aortic valve replacement, MitraClip) started
- January 2016: Investigator Initiated Research Grant awarded by Mallinckrodt, the makers of Ofirmev (IV acetaminophen), for study in ERAS clinical pathway for outpatient laparoscopic gynecological surgery. The project principal investigator is Dr. Jay Schoenherr at UNC. Co-PI’s are Rob Isaak and Lavinia Kolarczyk.
- May 2016: Smart phone app for UNC Enhanced Recovery pathways to be launched.
- May 2016: ERAS Urology (cystectomy) to be launched
- Future clinical pathways under development for launch in Summer 2016:
  - ERAS GYN Oncology (all surgeries)
  - ERAS Vascular Surgery (below and above the knee limb amputations)
  - ERAS Breast Surgery (mastectomy)
  - ERAS Renal Transplant Donors
  - ERAS OB Cesarean Section
  - ERAS Colorectal Expansion (to include Acute Care Surgery Team)

**ERAS Pancreatic Surgery: Details**

- Designed and implemented with guidance from Dr. Timothy Miller (Duke University)
- Lean Six Sigma (LSS) principles were applied throughout the design, implementation, and sustainment project phases.\(^1\)
- Started in July 2014, enrolling 1-2 patients per week having a Whipple or Distal Pancreatectomy with a single surgeon (Dr. HJ Kim).
- **Key components:** best practice guidelines for major abdominal surgery, ventilator management, and geriatric perioperative care, opioid-sparing multimodal analgesia, intraoperative goal directed fluid therapy using pulse pressure variation (see Appendix 2), postoperative early ambulation strategy and daily ambulation goal setting (illustrated below)

![Image](image.png)

- **Major outcomes and publications/abstracts to date:**
  - LSS design and implementation manuscript\(^1\)
  - Decreased hospital length of stay from 10.9 days to 8.1 days abstract\(^2,3\)
  - Decreased unnecessary blood product administration abstract\(^4\)
  - Decreased unanticipated immediate ICU admissions by 10% abstract\(^5\)
  - Decreased PACU phase I recovery time by nearly 45 minutes for Whipple procedure patients abstract\(^6\)
• **Awards and Accolades:**
  o Best of Clinical Abstracts (Top 8 out of 1500 submitted) at the American Society of Anesthesiologists Annual Meeting 2015: Podium Presentation

• Please click [HERE](https://www.youtube.com/watch?v=Jl36IAsGis) for a special patient experience testimonial video

**ERAS Surgical Oncology: Details**

*Anesthesiology Leads: Lavinia Kolarczyk, MD and Rob Isaak, DO*

*Surgeon Lead: HJ Kim, MD*

*CRNA Lead: Jason Holmes*

*Resident Lead: Hayden Kirby, MD*

• Designed and implemented the pathway using a modified version of our pancreatic surgery pathway

• Launched in September 2015

• Encompasses all major intra-abdominal surgical oncology including hepatic resection, gastrectomy, esophgaectomy, colectomy, etc.

• **Key components:** Opioid-sparing multimodal analgesia, geriatric-specific best practice guidelines, daily postoperative ambulation goal-setting with nursing staff. (Note: full pathway found in Appendix 3)

• Data analysis of outcomes is ongoing

**ERAS Thoracic Surgery: Details**

*Anesthesiology Leads: Lavinia Kolarczyk, MD and Emily Teeter, MD*

*Surgeon Lead: Jason Long, MD*

*CRNA Lead: Aaron Lemmon*

*Resident Lead: Tim Rohman, MD*

• Designed and implemented using best practice guidelines and best available evidence for thoracic surgery, geriatric anesthesiology, one lung ventilation, and for prevention of chronic post-thoracotomy pain syndrome.

• Launched in September 2015.

• Includes all patients undergoing lung resection surgery (wedge resection, lobectomy, pneumonectomy) through either video-assisted thoracoscopic technique (VATS) or open procedures (thoracotomy).

• **Key components:** Pulmonary pre-habilitation program including incentive spirometry (illustrated below), nutrition screening and education, tobacco cessation program, opioid-sparing multimodal analgesia, postoperative incentive spirometry and ambulation program.

• Data analysis of outcomes is ongoing
ERAS Laparoscopic Gynecology:

**Anesthesiology Leads: Jay Schoenherr, MD**  
**Surgeon Lead: Erin Carey, MD**  
**CRNA Lead: Brad Lewis**

- Designed in partnership with the minimally invasive gynecological surgery team at UNC for patients having laparoscopic hysterectomy and myomectomy surgeries with the goal of same-day discharge and reduction of chronic pain.
- Due to the high incidence of preexisting chronic pain in this population, we incorporated a novel pre-habilitation program that included consultation with a pain psychologist and cognitive behavioral therapy.
- Launched September 2015
- **Key components:** preoperative pain psychology evaluation (as described above), opioid-sparing multimodal analgesia plan, screening and prevention of PONV, total IV anesthetic.
- Data analysis of outcomes is ongoing.

ERAS Structural Heart Program:

**Anesthesiology Leads: Emily Teeter, MD**  
**Surgeon Lead: John Vavalle, MD**

- Designed and implemented in an effort to standardize care for high-risk geriatric patients undergoing transcatheter aortic valve replacement (TAVR) and MitraClip procedures, who are prone to common perioperative complications including changes in mental status/delirium, urinary tract infections, prolonged hospitalization.
- Large multidisciplinary team including cardiologists, cardiothoracic surgeons, cardiothoracic anesthesiologists, interventional cardiology nursing staff, perioperative nursing staff, and cardiac ICU nursing staff.
- **Key components:** best practice guidelines for geriatric perioperative care, preoperative nutrition screening and intervention, frailty assessment, intraoperative fluid and hemodynamic guidelines
• Launched in October 2015.
• Data analysis of outcomes is ongoing.

**ERAS Colorectal Surgery:**

**Anesthesiology Leads: Chris Howard, MD**  
**Surgeon Lead: Timothy Sadiq, MD**  
**CRNA Lead: Laura Niday**

• Designed and implemented based on the principles of many other successful colorectal enhanced recovery pathways.
• The program covers 700-800 patients per year.
• **Key components:** carbohydrate loading, multimodal analgesia (plus Alvimopan), intraoperative lidocaine infusion, euvolemia/eunatremia, protective lung ventilation, early refeeding/Foley removal/ambulation in postoperative period.
• Launched September 2015
• Data analysis of outcomes is ongoing

**B. UNC Enhanced Recovery Programs Accolades:**

**Local Presentations:**

- May 2015: ERAS Pancreatic Surgery Outcomes and Future Directions, UNC Department of Anesthesiology Grand Rounds, L. Kolarczyk, R. Isaak
- November 2015: “Introduction to Quality Improvement Research” Academic Medicine Rotation Lecture, University of North Carolina Department of Anesthesiology. L. Kolarczyk

**C. Invited Regional and National Presentations:**

D. Publications and Abstracts:


E. Appendix 1: UNC Enhanced Recovery Program Leads Table

<table>
<thead>
<tr>
<th>UNC Enhanced Recovery Program: Departments of Anesthesiology &amp; Surgery</th>
<th>Team Leads &amp; Contact Information</th>
</tr>
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<tbody>
<tr>
<td>Team</td>
<td>Anesthesiology Physician Leads</td>
</tr>
<tr>
<td>Surgical Oncology (Major Intra-Abdominal)</td>
<td>Rob Isaak: (919) 923-9216 (c)</td>
</tr>
<tr>
<td></td>
<td>Lavinia Kolarczyk: (919) 914-4591 (c)</td>
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<tr>
<td>Thoracic Surgery</td>
<td>Emily Teator: (919) 923-9063 (c)</td>
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<tr>
<td></td>
<td>Lavinia Kolarczyk: (919) 914-4591 (c)</td>
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<tr>
<td>Colorectal Surgery</td>
<td>Chris Howard: (919) 951-5067 (c)</td>
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<tr>
<td>Lap Gynecologic (Hillsborough Campus)</td>
<td>Jay Schoenherr: (919) 951-5062 (c)</td>
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F. Appendix 2: Surgical Oncology Goal Directed Fluid Therapy Algorithm

**STEP 3: Interpret SVV and blood pressure**

- SVV < 13 or > 13, normotensive: Proceed to Step 7
- SVV < 13, hypotensive: Proceed to Step 5
- SVV > 13, hypotensive: Colloid fluid bolus indicated. Give 250 ml 5% albumin, proceed to Step 4.

**STEP 4: Re-Evaluate SVV and blood pressure**

- SVV < 13, normotensive: Proceed to Step 7
- SVV < 13, hypotensive: Proceed to Step 5
- SVV > 13 and remains hypotensive: Repeat 250 ml bolus of 5% albumin. Repeat Step 4***

**STEP 5: Evaluate the heart rate**

- < 60: Give glycopyrrolate 0.2 mg IV +/- ephedrine 5-10 mg IV
- > 60: Give bolus of phenylephrine.

**Did the blood pressure both increase and stabilize?**

- YES: Proceed to Step 7
- NO: STEP 6: Start Vasoconstrictor Infusion

**STEP 6: Start Vasoconstrictor Infusion**

- Titrated norepinephrine (starting dose 0.02-0.04 mcg/kg/min) to target blood pressure. Wean as tolerated.

***If after 4 boluses of 250 ml 5% albumin, rule out other causes of decreased SVV preload (hyperperfusion, excessive PEEP, pneumothorax, PC, etc.). Obtain ABG, consider anemia or electrolyte abnormalities. Consider IEE and other advanced diagnostic modalities.

The “Full Version” includes all aspects of the pathway (preop, intraop, postop), as well as corresponding literature (with hyperlinks to articles). The “Short Version” includes the anesthesiology-specific aspects of the pathway for rapid reference for anesthesiology care teams.

<table>
<thead>
<tr>
<th>PREOPERATIVE COMPONENTS</th>
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<tbody>
<tr>
<td>1. Carbohydrate drink[1]</td>
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<tr>
<td>- Instructions provided by clinic nurse navigator during patient’s clinic visit.</td>
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<tr>
<td>- Patient will consume clear liquids including Gatorade 2 hours before scheduled surgical time.</td>
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<tr>
<td>2. Baseline blood pressure and ideal body weight assessment</td>
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<tr>
<td>- Review patient blood pressures (from clinic visits) and calculate the target blood pressure range:</td>
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<tr>
<td>- Calculate average systolic blood pressure (SBP)</td>
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<tr>
<td>- Calculate target SBP range: +/- 20% Average SBP (see Tip Sheet)</td>
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<tr>
<td>- Ideal body weight is calculated.</td>
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<tr>
<td>- Males: IBW = 50 kg + 2.3 kg for each inch over 5 feet.</td>
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<tr>
<td>- Females: IBW = 45.5 kg + 2.3 kg for each inch over 5 feet.</td>
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<tr>
<td>3. Preoperative fluid bolus[1]</td>
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<tr>
<td>- Fluids: 1 liter of lactated ringers should be given during epidural placement.</td>
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<td>4. Low thoracic epidural:</td>
</tr>
<tr>
<td>- Epidurals should be considered for all open upper abdominal procedures. If a contraindication exists or patient refuses, then EXPAREL will be ordered and infiltrated by the surgical team. Epidurals will be considered on a case-by-case basis for robotic or laparoscopic approaches.</td>
</tr>
<tr>
<td>- Anatomic placement: T8-T9</td>
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<tr>
<td>- Sedation for epidural placement: Fentanyl 25 mcg IV q 2 minutes (max dose 100 mcg)</td>
</tr>
</tbody>
</table>

GERIATRIC CONSIDERATIONS (patient age >/= 60).

Avoid benzodiazepines and scopolamine[2].

- Test dose: 3 mL of 1.5% lidocaine with 1:200,000 epinephrine.
- Do not give additional local anesthetic to attempt to achieve a level of analgesia.

5. Preoperative multimodal analgesia |
|   - Acetaminophen 1 g IV (if liver function tests (LFTs) are not elevated above normal clinical range) |
|   - Pregabalin 100 mg PO |
|   - Celebrex 200 mg PO |
INTRAOPERATIVE COMPONENTS

1. Establish blood pressure goals prior to induction
   • Anesthesia team will review the target blood pressure range that was calculated preoperatively by an anesthesia provider.
   • Evidence-based recommendations for blood pressure target: maintain systolic blood pressure within 20% systolic baseline\(^3\) with a minimum mean arterial pressure of 55 mmHg\(^4\).

2. Antibiotic Prophylaxis (per SCIP guidelines)
   • Given within 1 hour prior to incision.

3. VTE Prophylaxis
   • Heparin 5000U SC must be given two hours after epidural placement\(^5\).
     ▪ Timing of administration coordinated between acute pain service and anesthesia care team.
   • Sequential compression devices will be placed on patient’s legs by nursing staff prior to induction of general anesthesia.

4. Anesthetic maintenance\(^2, 6\)
   • Isoflurane should be used as first line agent.
   • Titrade volatile agent to a target BIS reading of 50-60.

GERIATRIC CONSIDERATIONS (patient age \(\geq 60\)).

*Do not use sevoflurane or desflurane, as both have been shown to cause post op delirium and cognitive dysfunction.*

5. Epidural Management\(^1\)

**GOAL IS TO MINIMIZE IV OPIOIDS.**

*Special exceptions and dosing considerations may be made for patients who are chronic opioid users.*

- Hydromorphone 0.4 mg-0.6 mg given through epidural catheter after induction of anesthesia for all cases.
- To achieve adequate spread of local anesthetic to cover long vertical or low abdominal surgical incisions, bolus epidural catheter with 5 mL of 0.25% bupivacaine shortly before or shortly after surgical start for the following cases:
  ▪ Distal pancreatectomy
  ▪ Colonic resection
  ▪ Low anterior resection / pelvic
  ▪ Rectal surgery
- Run epidural infusion of 0.25% bupivacaine throughout case (3-6 ml/hour).
- Consult attending anesthesiologist if moderate to severe hypotension develops to evaluate and/or discuss altering epidural infusion rate.
- Change the epidural infusion to postoperative bupivacaine 0.125%/hydromorphone 10mcg/ml when fascia closure started.
6. **Multimodal Analgesia (for patients who do NOT have an epidural)**

**GOAL IS TO MINIMIZE IV OPIOIDS.** IV opioids may be judiciously given. Special exceptions and dosing considerations may be made for patients who are chronic opioid users.

- Ketamine infusion (0.25 mg/kg/hr) unless contraindicated.
- Precedex infusion (0.2-0.3 mcg/kg/hr) unless contraindicated (consider titrating up to 0.7 mcg/kg/hr if not using ketamine).
- Exparel (liposomal bupivacaine) will be infiltrated along incision by surgeon at end of case.
- Ketorolac 15 mg IV x 1. Discuss with surgeon prior to administration.

7. **Generalized Fluid Management Principles (all patients)**

- Generalized principles to limit excess crystalloid administration.
- Intraoperative maintenance fluid based on **IDEAL BODY WEIGHT**:
  - Open cases: Lactated ringers infusion at 5 ml/kg/hour.
  - Minimally invasive / robotic / laparoscopic: Lactated ringers infusion at 2 ml/kg/hour.
- Obtain a baseline arterial blood gas prior to incision and then as needed for ongoing evaluation of blood chemistries, hemoglobin, and glucose.

8. **Goal-directed fluid therapy algorithm (patients with an arterial line) (GDFT)**[3, 4, 7-10]

- **If patient has an arterial line**, please follow the “goal directed fluid therapy algorithm”, which is based on pulse pressure variation (PPV) interpretation.

9. **Mechanical Ventilation Strategy**[11, 12]

- Volume control ventilation (8mL/kg) for accurate PPV interpretation.
- 8 mL/kg per evidence-based standard of care.
- PEEP 4 cm H2O per evidence-based standards of care.
- Recruitment maneuvers every 30 minutes per evidence-based standards of care.
  - Apply continuous positive airway pressure of 30 cm of water for 10 seconds. Repeat two more times and resume mechanical ventilation.


- Per American Society of Anesthesiologists practice guidelines and discretion of attending anesthesiologist.
- Discuss transfusion with surgeon before administration of blood products.
- Maintain goal hemoglobin > 7 g/dL. For patients with acute coronary syndrome, maintain hemoglobin > 8 g/dL.[15]
- Discuss transfusion with surgeon before administration of blood product[15]
- Administer 1 unit at a time (unless clinical condition dictates otherwise)[15]

11. **Gastric tube**

- Nasogastric tube placed in OR. Place bright pink “ERAS” label on NG tube.
- Nasogastric tube to be left in-situ postoperatively for all cases unless the surgeon states otherwise.
POSTOPERATIVE

1. Extubation in OR
   • If unable to extubate patient, please document clearly in EPIC (“Q” note) why patient was not extubated.

2. Anesthesiology PACU Orders
   • No long acting opiates. Special exceptions and dosing considerations may be made for patients who are chronic opioid users.
   • PACU dose of fentanyl limited to 100 mcg IV. (Must change max default dose from 250 mcg to 100 mcg). Special exceptions and dosing considerations may be made for patients who are chronic opioid users.
   • Exception: If epidural is presumed to be non-functional, rescue fentanyl (in excess of 100mcg) may be ordered in PACU until epidural is replaced.

3. Disposition
   • PACU for initial recovery phase, then to floor bed or step-down unit (per surgical team).
   • ICU if patient requires post-op mechanical ventilation.

4. Postoperative Pain Management
   • Epidural catheter management per Acute Pain Service
   • Scheduled Tylenol x 72 hours (if LFT's are not elevated above clinical ranges)

5. Nasogastric tube
   • Removed on postoperative day one unless specified directly by surgical team.

6. Foley catheter
   • Removed on post-operative day one, unless clinically indicated by surgical team (e.g., for strict monitoring of intake and output).

7. Postoperative mental status / memory assessment (for patients age ≥60)
   • Daily CAM-ICU assessment by nursing staff and recorded in EPIC.

8. Patient activity (e.g., out of hospital bed)
   • Out of bed and ambulation on post-operative day one.
   • Daily ambulation goals encouraged by nursing staff.
   • Daily ambulation distances recorded by nursing.
References


## H. Resident Conference Presentations

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1. **Published Abstracts (in alphabetical order of first author)**


   **Frangopoulous C, Penwarden A, Bowling B, Schoenherr J.** Adductor canal versus femoral nerve catheters: a retrospective comparison in total knee arthroplasty patients.


pain after motor vehicle collision than European Americans. Accepted for publication/presentation to the 2016 meeting of the American Pain Society.


**Linnstaedt SD (moderator), McLean SA, Levine J. Stress-Induced Persistent Pain: Mechanistic Insights from Humans and Animals. Invited Symposium Presentation at the 2016 Annual Meeting of the American Pain Society, Austin TX, May 2016**


**Selassie M, James D.** Spinal drains in aortic surgery: a case of successful lumbar drain use after prior epidural hematoma. Accepted for publication/presentation to the 2016 meeting of the American Pain Society.


2. Journal Articles (in alphabetical order of first author)

Arora H, Kumar PA. Aortic dissection masquerading as a bicuspid aortic valve. Accepted for publication in the Journal of Anesthesiology and Clinical Pharmacology. 2015


Passannante A. Who needs a preoperative evaluation? Audiodigest Anesthesiology. 58(20); 2016 May.


Platts-Mills, Timothy F., Benjamin R. Quigley, Joseph P. Duronio, Meredith V. Hoover, Eric T. Burgh, Michael A. LaMantia, Sonia M. Davis, Mark A. Weaver and Sheryl Zimmerman. “Development and Validation of a Brief Interactive Educational Video to Improve Outpatient Treatment of Older Adults’ Acute Musculoskeletal Pain.” J AM Geriatr Soc (2016); 64(4) 880-1.


Platts-Mills, Timothy F., Natalie L. Richmond, Eric M. LeFebvre, Sowmya A. Mangipudi, Allison G. Hollowell, Debbie Travers, Kevin Biese, Laura C. Hanson, Angelo E. Volandes “Availability of Advance Care Planning Documentation for Older Emergency Department Patients: A Cross-Sectional Study.” Journal of Palliative Medicine (2016). (Accepted for publication, online publication pending)


3. Books


4. Grants and Grant Funding Salary Support

Title: The HELP PAIN Trial: Healing with Venlafaxine after motor vehicle collision
Sponsor: Mayday Fund
Project Dates: 12/8/2010-12/31/2016
Principal Investigator: Samuel McLean

Title: Applying the Biopsychosocial Model to Post-MVC Pain Development in African Americans
Award Number: R01AR060852
Sponsor: National Institute of Arthritis Musculoskeletal Skin Disease
Principal Investigator: Samuel McLean

Title: Future Leaders in Pain Grant
Award Number: N/A
Sponsors: American Pain Society
Project Dates: 11/01/2014-05/30/2016
Principle Investigator: Sarah Linnstaedt

Title: Influence of PTSD Symptoms on Chronic Pain Development after Sexual Assault
Award Number: R01AR064700
Sponsors: NIAMS, NINDS, OD, NINR, NIMH, NICHD
Project Dates: 2014-2019
Principle Investigator: Samuel McLean

Title: Diversity Supplement for Influence of PTSD Symptoms on Chronic Pain Development after Sexual Assault
Award Number: R01AR064700-02S
Project Dates: 2015-2016
Principal Investigator: Samuel McLean
Title: Flipped Classroom Preferred to Traditional Classroom in Resident Education
Award Number: REG-02/15-2014 MARTI
Project Dates: 07/01/2015-06/30/2016
Principal Investigator: Susan Martinelli
Title: Decision Support to Prevent Premature Closure and Delayed Diagnosis
Award Number: 15016441
Sponsor: Greater Kansas City Community Foundation
Project Dates: 09/01/2015-08/31/2017
Principal Investigator: Marjorie Stiegler
Title: Medtronic Pain Fellowship 2016-2017
Award Number: 33703
Sponsor: Medtronic, Inc.
Project Dates: 07/01/2016-06/30/2017
Principal Investigator: Manoj Wunnava
Title: Boston Scientific Fellowship 2016-2017
Award Number: NM_23210
Sponsor: Boston Scientific Neuromodulation
Project Dates: 07/01/2016-06/30/2017
Principal Investigator: Manoj Wunnava