



Program and Abstracts of the  
**6th Annual**  
**Perioperative Medicine  
Summit 2011**

Using Evidence to Improve Quality,  
Safety and Patient Outcomes

**March 3–5, 2011**

The Eden Roc Hotel  
Miami Beach, Florida

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Amir K. Jaffer, MD, FHM

**SUMMIT CO-DIRECTORS:**

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This publication  
is available online as  
an electronic supplement  
to the *Cleveland Clinic  
Journal of Medicine*:  
[www.ccm.org/content/78/  
Electronic\\_Suppl\\_1](http://www.ccm.org/content/78/Electronic_Suppl_1)

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## Welcome from the Summit Director



Along with my summit co-directors, Darin Correll and Frank Michota, I welcome you to Miami for the 6th Annual Perioperative Medicine Summit. The summit is a collaborative effort between the University of Miami, Cleveland Clinic, and the Society for Perioperative Assessment and Quality Improvement (SPAQI). I urge each of you to join the society at [www.spaqi.org](http://www.spaqi.org) if you are not already a member.

As resources shrink during these tough economic times in the United States and as health care reform looms, I believe that practicing safe, quality, and evidence-based perioperative medicine becomes more important than ever. In addition, the principles of good perioperative medicine may help us identify some longstanding practices with limited benefit that can be eliminated from our current practice. I believe you will leave this summit armed with a wealth of cutting-edge, evidence-based knowledge in perioperative medicine that you can start implementing in your practice right away.

As you can see from the agenda and faculty listings in this booklet, we are fortunate to have many renowned leaders from Miami, the broader United States, and all over the world speaking at the summit. In addition to our speakers, attendees will present 32 abstracts (included in this booklet) as posters and oral presentations. Be sure to visit the poster session and welcome reception at the hotel from 5:15 to 7:00 PM on Thursday.

I also remind you to visit our Web site, [www.periopmedicine.org](http://www.periopmedicine.org), and to register at our Twitter site, <http://twitter.com/PeriopSummit>, for important updates.

We want to make each subsequent summit better than the one before, and we take your feedback seriously, so be sure to fill out the evaluation forms.

Finally, I trust you will love the weather, culture, food, and activities that Miami and its environs have to offer, so have fun while you are here with us at the summit.

Bienvenido!

A stylized, handwritten signature in black ink, appearing to read 'AJaffer'.

Amir K. Jaffer, MD  
Summit Director

# Program and Abstracts of the 6th Annual Perioperative Medicine Summit 2011

Electronic Supplement 1 to Volume 78, March 2011

## SUMMIT DIRECTOR

Amir K. Jaffer, MD, FHM

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# Summit Program

## WEDNESDAY, MARCH 2, 2011

4:00–7:00 PM Registration

## THURSDAY, MARCH 3, 2011

6:45–7:45 AM Registration and Continental Breakfast

7:45–8:00 AM **Welcome**—*Amir K. Jaffer, MD, FHM, Franklin A. Michota, Jr., MD; and Darin J. Correll, MD*

8:00–8:30 AM **Prioritizing Quality Improvement to Decrease Surgical Mortality: What Can the Medical Team Do?**—*John D. Birkmeyer, MD*

8:30–8:45 AM Questions and Answers

8:45–9:15 AM **Preoperative Cardiac Risk Assessment: Implementing the Guidelines into Practice**—*Lee A. Fleischer, MD*

9:15–9:30 AM Questions and Answers

9:30–10:00 AM **Biomarkers and Drugs: Predicting and Decreasing our Most Feared Perioperative Complication**—*Don Poldermans, MD, PhD*

10:00–10:15 AM Questions and Answers

10:15–10:45 AM Break/Visit Exhibits

10:45–11:15 AM **The Role of Imaging in Cardiac Risk Stratification for Noncardiac Surgery**—*Robert C. Hendel, MD*

11:15–11:30 AM Questions and Answers

11:30–12:00 PM **Update in Perioperative Medicine: Review of the Literature 2010**—*Steven L. Cohn, MD; Gerald Smetana, MD; and Amir K. Jaffer, MD, FHM*

12:00–12:15 PM Questions and Answers

12:15–1:30 PM Lunch

1:30–2:00 PM **Preoperative Medical Consultation: Do Our Patients Still Need It?**—*Duminda N. Wijesundera, MD, PhD*

2:00–2:15 PM Questions and Answers

2:15–2:45 PM	<b>Perioperative Management of Warfarin and Antiplatelet Therapy for Noncardiac Surgery</b> — <i>Amir K. Jaffer, MD, FHM</i>
2:45–3:00 PM	Questions and Answers
3:00–3:30 PM	Break/Visit Exhibits
3:30–4:00 PM	<b>Prevention of Venous Thromboembolism After Surgery</b> — <i>Franklin A. Michota, Jr., MD</i>
4:00–4:15 PM	Questions and Answers
4:15–5:15 PM	<b>Simultaneous Evening Breakout Sessions</b>
	<b>Coding, Billing, and Reimbursement Issues</b> — <i>Seema Chandra, MD, and Jessica Zuleta, MD</i>
	<b>Perioperative Management of the Cancer Patient</b> — <i>Sunil K. Sahai, MD</i>
	<b>Medication Management</b> — <i>Christopher Whinney, MD</i>
	<b>Translating Evidence Into Practice in Perioperative Medicine: What Works</b> — <i>Peter K. Lindenauer, MD, MSc</i>
5:15–7:00 PM	Welcome Reception and Poster Session

## FRIDAY, MARCH 4, 2011

6:45–7:45 AM	Continental Breakfast
7:45–8:00 AM	<b>Welcome</b> — <i>Amir K. Jaffer, MD, FHM; Franklin A. Michota, Jr., MD; and Darin J. Correll, MD</i>
8:00–8:30 AM	<b>What Does an Internist or Hospitalist Need to Understand About Anesthesia?</b> — <i>David A. Lubarsky, MD</i>
8:30–8:45 AM	Questions and Answers
8:45–9:15 AM	<b>Perioperative Management of Diabetes</b> — <i>Luigi F. Meneghini, MD, MBA</i>
9:15–9:30 AM	Questions and Answers
9:30–10:00 AM	<b>Emerging Issues in Pulmonary Risk Stratification and Risk for Noncardiac Surgery</b> — <i>Gerald Smetana, MD</i>
10:00–10:15 AM	Questions and Answers
10:15–10:45 AM	Break/Visit Exhibits
10:45–11:30 AM	<b>Perioperative Management of the Patient With Liver Disease</b> — <i>Paul A. Martin, MD</i>

11:30–11:45 AM	Questions and Answers
11:45–12:15 PM	<b>Cases in Postoperative Pain Management—</b> <i>Darin J. Correll, MD</i>
12:15–12:30 PM	Questions and Answers
12:30–1:30 PM	<b>Simultaneous Lunch Breakout Sessions</b>  <b>Anticoagulation and Thromboembolism: Play Jeopardy—</b> <i>Franklin A. Michota, Jr., MD, and Amir K. Jaffer, MD, FHM</i>  <b>Interactive Perioperative Cases: Feel Free to Bring Your Own—</b> <i>Steven L. Cohn, MD</i>  <b>Challenges in the OR—</b> <i>R. LeBron Cooper, MD</i>  <b>Negotiating Co-Management Agreements With Surgeons—</b> <i>Efren Manjarrez, MD, and Andres Soto, MD</i>  <b>Medicine Consult Service: Meeting Service and Teaching Needs—</b> <i>Joshua D. Lenchus, DO, RPh</i>
1:45–2:30 PM	<b>Best Research Abstracts—Presided by the Chair of the Research Abstract Review Committee: Three Abstracts—</b> <i>Darin J. Correll, MD</i>
2:30–2:45 PM	Questions and Answers
2:45–3:15 pm	Break/Visit Exhibits
3:15–4:15 PM	<b>Simultaneous Breakout Sessions</b>  <b>Perioperative Management of Hypertension—</b> <i>Barry J. Materson, MD, MBA</i>  <b>Postoperative Fever—</b> <i>Paul J. Grant, MD</i>  <b>Co-Management of the Hip Fracture Patient—</b> <i>Barbara Slawski, MD</i>  <b>Sharing Your Results With Others: Research Designs for Studies of Quality Improvement Interventions—</b> <i>Peter K. Lindenauer, MD, MSc</i>
4:15 PM	Adjourn

## **SATURDAY, MARCH 5, 2011**

6:45–7:45 AM	Registration and Continental Breakfast
7:45–8:00 AM	<b>Welcome—</b> <i>Amir K. Jaffer, MD, FHM; Franklin A. Michota, Jr., MD; and Darin J. Correll, MD</i>

8:00–8:45 AM	<b>Panel Discussion: Various Models of Delivering Preoperative Care: Which Makes Sense?</b> — <i>Angela M. Bader, MD, MPH; Seema Chandra, MD; Alicia Gruber Kalamas, MD; Ajay Kumar, MD; and BobbieJean Sweitzer, MD</i>
8:45–9:00 AM	Questions and Answers
9:00–9:30 AM	<b>Preventing and Managing Surgical Site Infections</b> — <i>Rafael E. Campo, MD</i>
9:30–9:45 AM	Questions and Answers
9:45–10:15 AM	<b>Predicting Risk and Management of Postoperative Renal Failure</b> — <i>Charuhas V. Thakar, MD</i>
10:15–10:30 AM	Questions and Answers
10:30–11:00 AM	Break/Visit Exhibits
11:00–11:45 AM	<b>Co-Management of the Bariatric Surgery Patient: From Preoperative Management to Surgery and Postop Care</b> — <i>Seema Chandra, MD, and Nestor de la Cruz-Munoz, MD</i>
11:45–12:00 PM	Questions and Answers
12:00–1:15 PM	Lunch
1:15–1:45 PM	<b>How Much Preoperative Testing Is Really Necessary?</b> — <i>David L. Hepner, MD</i>
1:45–2:00 PM	Questions and Answers
2:00–2:45 PM	<b>Medicolegal Issues in Perioperative Medicine: Lessons From Some Real Cases</b> — <i>Franklin A. Michota, Jr., MD, and Matthew J. Donnelly, Esquire</i>
2:45–3:00 PM	Questions and Answers
3:00–3:30 PM	<b>Common Perioperative Hematologic Issues</b> — <i>Ajay Kumar, MD</i>
3:30–3:45 PM	Questions and Answers
3:45–4:15 PM	<b>Perioperative Management of Sleep Apnea Patients for Noncardiac Surgery</b> — <i>Roop Kaw, MD, and Ashwin Mehta, MD, MPH</i>
4:15–4:30 PM	Questions and Answers
4:30–4:45 PM	Concluding Remarks/Conference Adjourns

Abstract 1

**Application of 2007 ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery Using Decision Support Tools**

**BobbieJean Sweitzer, Michael Vigoda, Vicente Behrens, Nikola Miljkovic, and Kris Arheart**  
*University of Chicago, Chicago, IL*

**Introduction:** We previously demonstrated that anesthesiology residents, as well as practicing anesthesiologists, do not correctly apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiac Evaluation and Care for Noncardiac Surgery<sup>1</sup> when evaluating simulated patients in common clinical scenarios.<sup>2</sup> To determine the impact of decision support aids on residents' application of the ACC/AHA guidelines, we conducted a multiprogram, multiarm study. We then estimated the percentage change in anesthesiology residents that correctly apply the testing algorithms based on their use of decision support aids.

**Methods:** In this multicenter study (24 anesthesiology training programs), we assessed the use of a Web-based decision support tool to determine how well anesthesiology residents could apply the ACC/AHA guidelines. We randomly assigned consenting residents to one of three study groups: control, user-initiated decision support (UIDS), or computer-assisted decision support (CADS). Residents evaluated six clinical scenarios with five possible recommendations per scenario.

**Results:** The 386 resident participants included PGY-1s (preliminary year before anesthesiology training), CA-1s (first year of anesthesiology residency), CA-2s (second year), and CA-3s (third year). Level of training was not associated with likelihood of selecting the correct recommendation. Residents in both decision support arms were significantly more likely than residents in the control group to apply the correct recommendation regarding appropriate care as defined by the ACC/AHA guidelines (ie, user-initiated vs control: 66% [95% CI 55–75] vs 47% [95% CI: 36–59];  $P < .001$ ) and computer-assisted vs control: 73% [95% CI 62–81] vs 47% [95% CI: 36–59];  $P < .001$ ) (**Table**).

**Discussion:** Our findings demonstrate that decision support tools increase residents' application of national standard of care guidelines for cardiac evaluation of patients anticipating noncardiac surgery, irrespective of training level. Integrating decision-support aids into clinical practice is a logical next step to facilitate appropriate preoperative care of patients.

**TABLE**  
Percentage of residents with correct recommendation\*

Type	N	Probability	95% Confidence interval		P values
			Lower	Upper	
Control	140	47.4	36.4	58.7	
UIDS	130	65.6	54.5	75.2	< .001
CADS	116	72.5	61.5	81.3	< .001

\* Combined results for all six scenarios.

CADS = computer-assisted decision support; UIDS = user-initiated decision support

1. ACC/AHA Task Force on Practice Guidelines, American Society of Echocardiography, American Society of Nuclear Cardiology, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary. *Anesth Analg* 2008; 106:685–712.
2. Vigoda MM, Sweitzer BJ, Miljkovic N, et al. Do anesthesiology residents correctly apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative cardiac evaluation when evaluating simulated patients? *Anesth Analg*. In press.

Abstract 2

**Prevalence of Obstructive Sleep Apnea in Patients Presenting for Hip or Knee Replacement Surgery**

**Micah Beachy, DO; Jason Shiffermiller, MD; and Chad Vokoun, MD**

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**Introduction:** The care of patients with obstructive sleep apnea (OSA) recovering from surgery has come under increasing scrutiny as the potential for serious pulmonary and cardiac complications was realized. Patients who are older and obese are at increased risk for OSA. These factors also predispose patients to lower extremity osteoarthritis. If OSA is a common comorbidity in individuals planning total joint arthroplasty, the burden of postoperative complications would justify more intense focus on preoperative screening for and postoperative management of OSA.

**Methods:** We performed a retrospective review of prospectively collected data on patients planning lower extremity arthroplasty at an academic medical center. All hip and knee replacement candidates were referred to this clinic regardless of comorbidities or health status. The Berlin questionnaire was completed by all patients at the time of their preoperative evaluation. Patients identified as high risk by the questionnaire were referred for formal overnight polysomnography (PSG). The chi-square test was used to compare our OSA prevalence with the prevalence in a literature control group.

**Results:** A total of 208 consecutive patients undergoing lower-extremity arthroplasty were examined. Thirty-six (17%) patients had prevalent OSA at the time of referral. The Berlin questionnaire categorized 35 additional patients as high risk for OSA. These patients were referred for PSG. Of the 35 high-risk patients screened, 27 (77%) refused testing. Four of the eight patients who underwent PSG were diagnosed with OSA. This yielded a 19% (40/208) prevalence of OSA in hip or knee replacement patients compared with a prevalence of 7% in the literature control group ( $P < .0001$ ).

**Conclusion:** OSA is more common in patients undergoing hip or knee replacement surgery than was previously recognized. Routine screening is supported by the number of high-risk patients in the community who remain untested by PSG. Based on our high rate of PSG refusal, continued efforts should be made to find OSA screening alternatives. Development of best practice guidelines for the perioperative management of OSA is also needed to reduce the profound impact of OSA on patients recovering from lower-extremity arthroplasty.

Abstract 3

**A Protocol to Triage Preoperative Assessments to Either Nurses or Nurse Practitioners/Physician Assistants**

**Anthony Basil, RN; Pamela Pennigar, FNP; David R. Wright, MD; and Ronald P. Olson, MD**  
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**Introduction:** Many patients undergoing anesthesia have complex unoptimized medical conditions requiring careful preoperative assessment and management, whereas others are clearly healthy and/or are undergoing low-risk procedures, and can have that status determined and documented with less expenditure of hospital resources and patient time.

**Methods:** A program was instituted where, instead of the usual appointment in the preoperative medical optimization clinic (PMOC), healthy American Society of Anesthesiologists (ASA) 1 or 2 patients undergoing low- or moderate-risk surgery could instead have the assessment done by nurse screening protocol (NSP). This usually involved a telephone interview, but could, in certain circumstances, be a face-to-face encounter with the nurse in the PMOC (designated a “conversion”).

**Results:** A total of 16,061 patients had surgical procedures in the study period of January 1 to July 31, 2009. The PMOC assessed 13,589 (84.6%); and 2,077 (15.3%) of these were assessed by NSP.

Of the 2,077 patients assessed by NSP, 1,633 (78.6%) involved telephone interviews and 316 (15.2%) were conversions from regular PMOC appointments. In 117 (5.6%) cases, the application failed to meet criteria for NSP. Thirty-one (1.5%) cases had already been cancelled, either by the patient or the surgeon. The nursing time required for NSP by telephone averaged 44.1 minutes (STD 12.3), conversions required an average of 48.2 minutes (STD 12.7) (MS,  $P > .5$ ), and those involving a variance required 55.9 minutes (STD 18.7) (NS,  $P > .5$ ). Time spent in preparation, interview, and charting, respectively, was 10.4, 18.0, and 15.9 minutes for telephone interviews and 8.9, 20.5, and 19.0 minutes for conversions (NS,  $P > .5$ ). Those that were cancelled required an average of 23.3 minutes (STD 8.6) (NS,  $P > .5$ ), and those that failed NSP required an average of 27.6 minutes (STD 14.0) (NS,  $P > .5$ ).

The average number of attempts needed to reach the patients involved in telephone assessment was 1.6 (STD 0.8).

**Discussion:** NSP allows controlled selection of lower-risk patients who can be assessed in an abbreviated fashion, while not missing those patients with significant health issues. It ensures patient education about the perioperative process and produces a consistent electronic admission history and physical document that is similar to that generated by the regular preoperative visit. Perhaps surprising, nurse screening is still a fairly time-consuming process. This is likely because patient education and medication reconciliation take as much time on the telephone as in person.



Abstract 4

**Application of 2007 ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery Using Decision Support Tools\***

**BobbieJean Sweitzer, Michael Vigoda, Vicente Behrens, Nikola Miljkovic, and Kris Arheart**  
*University of Chicago, Chicago, IL*

**Introduction:** We previously demonstrated that anesthesiology residents, as well as practicing anesthesiologists, do not correctly apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiac Evaluation and Care for Noncardiac Surgery<sup>1</sup> when evaluating simulated patients in common clinical scenarios.<sup>2</sup> To determine the impact of decision support aids on residents' application of the ACC/AHA guidelines, we conducted a multiprogram, multiarm study. We then estimated the percentage change in anesthesiology residents that correctly apply the testing algorithms based on their use of decision support aids.

**Methods:** In this multicenter study (24 anesthesiology training programs), we assessed the use of a Web-based decision support tool to determine how well anesthesiology residents could apply the ACC/AHA guidelines. We randomly assigned consenting residents to one of three study groups: control, user-initiated decision support (UIDS), or computer-assisted decision support (CADS). Residents evaluated six clinical scenarios with five possible recommendations per scenario.

**Results:** The 386 resident participants included PGY-1s (preliminary year before anesthesiology training), CA-1s (first year of anesthesiology residency), CA-2s (second year), and CA-3s (third year). Level of training was not associated with likelihood of selecting the correct recommendation. Residents in both decision support arms were significantly more likely than residents in the control group to apply the correct recommendation regarding appropriate care as defined by the ACC/AHA guidelines (ie, user-initiated vs control: 66% [95% CI 55–75] vs 47% [95% CI: 36–59];  $P < .001$ ) and computer-assisted vs control: 73% [95% CI 62–81] vs 47% [95% CI: 36–59];  $P < .001$ ) (**Table**).

**Discussion:** Our findings demonstrate that decision support tools increase residents' application of national standard of care guidelines for cardiac evaluation of patients anticipating noncardiac surgery, irrespective of training level. Integrating decision-support aids into clinical practice is a logical next step to facilitate appropriate preoperative care of patients.

\* Also an oral presentation.

**TABLE**  
**Percentage of residents with correct recommendation\***

Type	N	Probability	95% Confidence interval		P values
			Lower	Upper	
Control	140	47.4	36.4	58.7	
UIDS	130	65.6	54.5	75.2	< .001
CADS	116	72.5	61.5	81.3	< .001

\* Combined results for all six scenarios.

CADS = computer-assisted decision support; UIDS = user-initiated decision support

1. ACC/AHA Task Force on Practice Guidelines, American Society of Echocardiography, American Society of Nuclear Cardiology, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary. *Anesth Analg* 2008; 106:685–712.
2. Vigoda MM, Sweitzer BJ, Miljkovic N, et al. Do anesthesiology residents correctly apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative cardiac evaluation when evaluating simulated patients? *Anesth Analg*. In press.

Abstract 5

**Most Anesthesiologists Don't Correctly Apply 2007 ACC/AHA Guidelines on Perioperative Cardiac Evaluation**

**BobbieJean Sweitzer, Michael Vigoda, Vicente Behrens, Nikola Miljkovic, Kris Arheart, and Richard Dutton**

*University of Chicago, Chicago, IL*

**Introduction:** The 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiac Evaluation and Care for Noncardiac Surgery is an evidence-based standard for perioperative cardiac evaluation. We surveyed practitioners to determine how they apply suggested testing algorithms from the ACC/AHA guidelines when evaluating simulated patients. We then estimated the percentage of anesthesiologists nationwide who correctly apply the guidelines.

**Methods:** American Society of Anesthesiologists (ASA) members were solicited by e-mail to participate in a survey. Participants were presented with six clinical scenarios characterized by surgical procedure and the patient's clinical condition (ie, clinical risk factors and functional capacity). Scenarios and possible recommendations were presented in a randomized order. Anesthesiologists selected the recommendation (from a list of five possible choices) that they considered to be most consistent with the guidelines.

**Results:** A total of 1,595 practicing anesthesiologists participated in the survey. Recommendations for scenario #1 (active cardiac condition) were consistent with the guidelines approximately 80% (95% CI: 78–82) of the time. However, for the remaining five scenarios, this occurred only 18% to 38% of the time (Table).

**TABLE**

**Percent of practicing anesthesiologists with correct recommendation**

Scenarios	% Correct [95% confidence intervals]
Active cardiac condition	80 [78, 82]
No active cardiac condition, low-risk surgery	38 [35, 40]
No active cardiac conditions, intermediate-risk surgery, good functional capacity, one clinical risk factor	29 [27, 31]
No active cardiac conditions, intermediate-risk surgery, poor/unknown functional capacity, two clinical risk factors	18 [16, 20]
No active cardiac conditions, vascular surgery (one or two risk factors)	26 [24, 28]
No active cardiac conditions, intermediate-risk surgery and no clinical risk factors	30 [28, 32]

**Discussion:** The 2007 preoperative cardiac testing guidelines, although well supported by scientific evidence, are not correctly applied by anesthesiologists evaluating simulated patients. The number of years in practice was inversely related to percentage of anesthesiologists providing the correct recommendation, suggesting that current methods for dissemination of the guidelines may need reevaluation. Nonetheless, the generally poor performance indicates that other factors (ie, guideline clarity, logistical considerations, etc.) may also be relevant. Increased efforts by regulatory and societal agencies are needed to encourage evidence-based improvements in care. Further study is needed to determine if decision support tools may increase correct application by practicing anesthesiologists.

1. ACC/AHA Task Force on Practice Guidelines, American Society of Echocardiography, American Society of Nuclear Cardiology, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary. *Anesth Analg* 2008; 106:685–712.

Abstract 6

**Anesthesiology Residents Do Not Agree With Their Training Programs on the Degree to Which the 2007 ACC/AHA Guidelines Are Emphasized**

**BobbieJean Sweitzer, Michael Vigoda, Vicente Behrens, Nikola Miljkovic, and Kris Arheart**

*University of Chicago, Chicago, IL*

**Introduction:** Clinical practice guidelines have been increasingly accepted as the standard of care. However, few studies have evaluated the degree to which they are emphasized by anesthesiology training programs. We hypothesized that there is a discrepancy between residents' perceptions and those of their training programs on the emphasis placed on the 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery.<sup>1</sup>

**Methods:** We designed a Web-based survey instrument to evaluate how anesthesiology residents apply the 2007 ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. Twenty-four anesthesiology-training programs (386 residents) participated. As part of a Web-based survey that determined residents' ability to apply the guidelines, we included a question that related to the emphasis of the guidelines in their training. In addition, each site coordinator was asked to quantify the degree to which the guidelines were emphasized. We determined agreement between residents and their program calculating Cohen's kappa statistic with 95% confidence intervals. Cohen's kappa statistic measures the amount of agreement after adjusting for the expected association due to chance.<sup>2</sup>

**Results:** The 386 trainees included 44 PGY-1s (preliminary year before anesthesiology training), 127 CA-1s (first year of residency training), 104 CA-2s (second year), and 98 CA-3s (third year). Thirteen participants submitted incomplete questionnaires. Of the 24 anesthesiology training programs, 66% of site coordinators indicated that their training programs emphasize the guidelines. However, regardless of resident's training level, there was no statistically significant agreement between the residents and training program coordinators on the degree to which the guidelines are emphasized, as shown by the Cohen's kappa statistic (Table).

**TABLE**  
Interrater reliability analysis

Year of training	N	Kappa	P value	95% Confidence interval	
				Lower	Upper
PGY-1	44	0.114	.445	−0.358	0.130
CA-1	127	0.037	.676	−0.139	0.212
CA-2	104	0.072	.462	−0.121	0.266
CA-3	98	0.145	.152	−0.056	0.345

CA-1, CA-2, CA-3 = first, second, third year of anesthesiology residency; PGY-1 = preliminary year before anesthesiology training

**Discussion:** Our study suggests that residents and site coordinators do not always agree on the level to which the 2007 ACC/AHA Guidelines are emphasized. This may be a factor in residents' inability to correctly apply the guidelines in common clinical scenarios.<sup>3</sup> Adjustments in educational programs may be required to increase awareness of the importance of applying evidence-based guidelines.

1. ACC/AHA Task Force on Practice Guidelines, American Society of Echocardiography, American Society of Nuclear Cardiology, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary. *Anesth Analg* 2008; 106:685–712.
2. Altman DG. *Practical Statistics for Medical Research*. London, England. Chapman & Hall; 1991.
3. Vigoda MM, Sweitzer BJ, Miljkovic N, et al. Do anesthesiology residents correctly apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative cardiac evaluation when evaluating simulated patients? *Anesth Analg*. In press.

Abstract 7

**Prevalence of Obstructive Sleep Apnea in Patients Presenting for Hip or Knee Replacement Surgery\***

Micah Beachy, DO; Jason Shiffermiller, MD; and Chad Vokoun, MD

*University of Nebraska Medical Center, Omaha, NE*

**Introduction:** The care of patients with obstructive sleep apnea (OSA) recovering from surgery has come under increasing scrutiny as the potential for serious pulmonary and cardiac complications was realized. Patients who are older and obese are at increased risk for OSA. These factors also predispose patients to lower extremity osteoarthritis. If OSA is a common comorbidity in individuals planning total joint arthroplasty, the burden of postoperative complications would justify more intense focus on preoperative screening for and postoperative management of OSA.

**Methods:** We performed a retrospective review of prospectively collected data on patients planning lower extremity arthroplasty at an academic medical center. All hip and knee replacement candidates were referred to this clinic regardless of comorbidities or health status. The Berlin questionnaire was completed by all patients at the time of their preoperative evaluation. Patients identified as high risk by the questionnaire were referred for formal overnight polysomnography (PSG). The chi-square test was used to compare our OSA prevalence with the prevalence in a literature control group.

**Results:** A total of 208 consecutive patients undergoing lower-extremity arthroplasty were examined. Thirty-six (17%) patients had prevalent OSA at the time of referral. The Berlin questionnaire categorized 35 additional patients as high risk for OSA. These patients were referred for PSG. Of the 35 high-risk patients screened, 27 (77%) refused testing. Four of the eight patients who underwent PSG were diagnosed with OSA. This yielded a 19% (40/208) prevalence of OSA in hip or knee replacement patients compared with a prevalence of 7% in the literature control group ( $P < .0001$ ).

**Conclusion:** OSA is more common in patients undergoing hip or knee replacement surgery than was previously recognized. Routine screening is supported by the number of high-risk patients in the community who remain untested by PSG. Based on our high rate of PSG refusal, continued efforts should be made to find OSA screening alternatives. Development of best practice guidelines for the perioperative management of OSA is also needed to reduce the profound impact of OSA on patients recovering from lower-extremity arthroplasty.

\* Also an oral presentation.

Abstract 8

**A Protocol to Triage Preoperative Assessments to Either Nurses or Nurse Practitioners/Physician Assistants\***

**Anthony Basil, RN; Pamela Pennigar, FNP; David R. Wright, MD; and Ronald P. Olson, MD**  
*Duke University Medical Center, Durham, NC*

**Introduction:** Many patients undergoing anesthesia have complex unoptimized medical conditions requiring careful preoperative assessment and management, whereas others are clearly healthy and/or are undergoing low-risk procedures, and can have that status determined and documented with less expenditure of hospital resources and patient time.

**Methods:** A program was instituted where, instead of the usual appointment in the preoperative medical optimization clinic (PMOC), healthy American Society of Anesthesiologists (ASA) 1 or 2 patients undergoing low- or moderate-risk surgery could instead have the assessment done by nurse screening protocol (NSP). This usually involved a telephone interview, but could, in certain circumstances, be a face-to-face encounter with the nurse in the PMOC (designated a “conversion”).

**Results:** A total of 16,061 patients had surgical procedures in the study period of January 1 to July 31, 2009. The PMOC assessed 13,589 (84.6%); and 2,077 (15.3%) of these were assessed by NSP.

Of the 2,077 patients assessed by NSP, 1,633 (78.6%) involved telephone interviews and 316 (15.2%) were conversions from regular PMOC appointments. In 117 (5.6%) cases, the application failed to meet criteria for NSP. Thirty-one (1.5%) cases had already been cancelled, either by the patient or the surgeon. The nursing time required for NSP by telephone averaged 44.1 minutes (STD 12.3), conversions required an average of 48.2 minutes (STD 12.7) (MS,  $P > .5$ ), and those involving a variance required 55.9 minutes (STD 18.7) (NS,  $P > .5$ ). Time spent in preparation, interview, and charting, respectively, was 10.4, 18.0, and 15.9 minutes for telephone interviews and 8.9, 20.5, and 19.0 minutes for conversions (NS,  $P > .5$ ). Those that were cancelled required an average of 23.3 minutes (STD 8.6) (NS,  $P > .5$ ), and those that failed NSP required an average of 27.6 minutes (STD 14.0) (NS,  $P > .5$ ).

The average number of attempts needed to reach the patients involved in telephone assessment was 1.6 (STD 0.8).

**Discussion:** NSP allows controlled selection of lower-risk patients who can be assessed in an abbreviated fashion, while not missing those patients with significant health issues. It ensures patient education about the perioperative process and produces a consistent electronic admission history and physical document that is similar to that generated by the regular preoperative visit. Perhaps surprising, nurse screening is still a fairly time-consuming process. This is likely because patient education and medication reconciliation take as much time on the telephone as in person.

\* Also an oral presentation.



Abstract 9

**Do ACEIs on the Morning of Surgery Increase Risk of Intraoperative Hypotension?**

Steven L. Cohn, MD, and Kalia Skeete, MD

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**Purpose:** Several studies have described an increased incidence of hypotension with induction of anesthesia in patients taking angiotensin-converting enzyme inhibitors (ACEIs), and many anesthesiologists recommend withholding them on the morning of surgery. However, this hypotension has not been associated with an increased risk of clinically significant perioperative complications, and continuation of the drug may be beneficial. We undertook this pilot study to evaluate the safety of our current policy of continuing ACEIs on the morning of surgery, hypothesizing that it was not associated with increased risk of intraoperative hypotension.

**Methods:** We performed retrospective observational chart review of 93 consecutive patients on ACEIs seen in our preoperative medical consultation clinic who had elective ambulatory or same-day-admit surgeries (all types of procedures and anesthesia). Patients were instructed to continue ACEIs and all antihypertensive medications (except diuretics) on the morning of surgery. Preoperative blood pressure (BP) levels in clinic upon entrance to the operating room were recorded, as were the highest and lowest intraoperative values. *Primary outcome:* intraoperative hypotension, defined as systolic BP < 90 mm Hg; *secondary outcomes:* postoperative myocardial infarction, heart failure, stroke, or cardiac death.

**Results:** The results are summarized in the **Table**. Six of 93 (6.5%) patients developed hypotension (none within 30 minutes of induction of anesthesia). Four were treated with pressors, and three had blood loss of at least 100 cc. Risk factors associated with hypotension included duration of surgery 3 hours or longer and general anesthesia. There was no significant association with ACEI dose at least 50% maximum dose, use of three or more other antihypertensive medications, American Society of Anesthesiologists class, Revised Cardiac Risk Index, diabetes mellitus, type of surgery, or preoperative BP. There were no in-hospital perioperative cardiac complications or deaths.

**Conclusion:** Continuation of ACEIs on the morning of surgery in our small study was associated with few episodes of hypotension, unrelated to induction of anesthesia, that were easily treated and did not result in any significant adverse outcomes. Future research with larger randomized controlled trials is needed to provide more evidence regarding the risk of hypotension with ACEIs.

1. Rosenman DJ, McDonald FS, Ebbert JO, et al. Clinical consequences of withholding versus administering renin-angiotensin-aldosterone system antagonists in the preoperative period. *J Hosp Med* 2008; 3:319–325.
2. Comfere T, Sprung J, Kumar MM, et al. Angiotensin system inhibitors in a surgical population. *Anesth Analg* 2005; 100:636–644.

**TABLE**  
Selected factors and their association with intraoperative hypotension

	Hypotension (intraoperative BP < 90 mm Hg) (n = 6)	No hypotension (n = 87)
Age (range)	54.7 (39–71)	61.6 (31–88)
Gender (male)	2 (33%)	42 (48%)
Duration of surgery (hr)	4.3	2.1
Surgery ≥ 3 hr	5 (83%)	20 (23%)
Type of surgery		
Vascular	1 (17%)	12 (14%)
Abdominal	1 (17%)	14 (16%)
Other	4 (66%)	61 (70%)
Type of anesthesia—general (vs other)	5 (83%)	38 (44%)
ACEI dose ≥ 50% maximum	3 (50%)	30 (34%)
≥ 3 other BP medications	2 (33%)	15 (18%)
Diuretic use	4 (67%)	52 (60%)
ASA class	3.0	3.0
Diagnosis of diabetes mellitus	1 (16%)	45 (52%)
RCRI score	0.8	1.1
Preop clinic BP		
Systolic/diastolic	134/79	140/77
Mean arterial pressure	98	98
Initial OR BP		
Systolic/diastolic	144/79	139/78
Mean arterial pressure	101	98
Change from clinic to OR systolic BP	+10 mm Hg	–1 mm Hg

ACEI = angiotensin converting enzyme inhibitor; ASA = American Society of Anesthesiologists (physical status); BP = blood pressure; OR = operating room; RCRI = Revised Cardiac Risk Index

Abstract 10

**One-Year Incidence of Postoperative Troponin Elevations in Patients Undergoing Major Orthopedic Surgery**

Michael Urban, MD, PhD; Stephen Wolfe, BS; Niel Sanghevi, BS; and Steven Magid, MD  
*Hospital for Special Surgery, New York, NY*

**Introduction:** Patients who are candidates for major orthopedic surgery, or arthroplasty, are often elderly and have multiple comorbidities. These patients are routinely evaluated for postoperative myocardial damage/infarction (PMI). Using cTnI analysis for evidence of a PMI, we tracked the incidence of PMI preoperative risks and complications associated with major orthopedic procedures over 1 year.

**Methods:** With Institutional Review Board approval, all patients with cardiac risk factors undergoing major orthopedic procedures from 7/1/07 to 6/30/08 were assessed for a PMI using cTnI analysis (reference level 0.02 ng/mL). Patients were identified using an electronic ordering system, SMM Eclipsys. Preoperative cardiac risk factors and postoperative complications were tracked using a Web-based medical information management system, My Medical Files (MMF). Data were entered into SPSS for Windows; multivariate correlation analysis.

**Results:** During the 1-year analysis period, 10,627 nonambulatory orthopedic procedures were tracked and 807 patients with cardiac risk factors were assessed for PMI. Of the 807 patients, 104 (12.9%) had postoperative elevated cTnI levels; the associations with types of surgery were as follows: total knee arthroplasty, 11.3%; total hip arthroplasty, 10%; and posterior spinal fusions, 17%. Among the patients with PMI, 48% had postoperative cardiac complications (PCC); their mean peak cTnI level was 1.51 ng/mL compared with 0.63 ng/mL for those without PCC. More than half (53%) of the PCCs occurred in patients who had had THA.

**Discussion:** For purposes of cardiac risk stratification, orthopedic surgery is considered intermediate-risk (1%–5%). Our analysis reveals a PMI incidence of 0.9% for all nonambulatory orthopedic procedures. The incidence was significantly higher (12%) among patients with cardiac risk factors who were undergoing arthroplasty or spinal fusion. This analysis also was unable to demonstrate a protective effect associated with the administration of statins or beta-blockers. Patients with higher cTnI releases were more likely to have PCCs.

Abstract 11

**A Review of Preoperative Clinic Cardiology Referrals for Adults Undergoing Intermediate- and Low-Risk Surgery**

Susan Calderwood, MD; Jennifer Lee Morse, MS; and Damon R. Michaels, CCRP

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Guidelines for the preoperative evaluation of adult patients undergoing non-cardiac surgery were released in 2007.<sup>1</sup> After obtaining IRB approval, we performed a focused chart review to evaluate application of these guidelines in an adult preoperative clinic over a 3-month period during 2010.

The Vanderbilt preoperative evaluation center (VPEC) is staffed by 16 advanced practice nurses (NPs) experienced in the preoperative evaluation of adults. An attending anesthesiologist is consulted per protocol or at the discretion of the NP regarding the need for additional testing or consultation.

**Results:** During the study, 4,477 adult patients were evaluated in VPEC. Seventy patients undergoing intermediate- (43) or low-risk (27) procedures were referred for cardiology consultations. Sixty-four patients had at least one clinical risk indicator (CRI), and 10 had three or more CRIs.<sup>1</sup> The average age was 61 and 34 of the 70 referred patients were male.

Three patients with known serious heart disease (severe pulmonary hypertension, moyamoya disease, and cyanotic congenital heart disease) were referred for an opinion regarding optimization prior to anesthesia and surgery.

Of the remaining 67 consultations, 43 (64%) were judged to be consistent with the guidelines: 19 for possible unstable coronary symptoms, six for arrhythmias, two for congestive heart failure, seven for possible significant valvular disease, and nine for patients having intermediate-risk surgery with both poor exercise tolerance and at least one CRI.

Three referred patients had stable or atypical chest pain not needing further testing, according to the cardiology consultant.

Of the remaining 21 consultations judged inconsistent with the guidelines, 12 patients were scheduled for low-risk procedures; nine patients undergoing intermediate-risk surgery had either good exercise tolerance (seven patients) or no CRI (two patients).

**Conclusion:** Based on a limited chart review, a significant number (36%) of cardiology referrals from our preoperative clinic are inconsistent with published guidelines and represent an opportunity for improved efficiency, cost savings, and better patient care. We plan to consider measures such as educational initiatives or computerized clinical decision support to decrease unnecessary referrals.

1. Fleisher LA, Beckman JA, et al. ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation* 2007; 116:1971–1996.

Abstract 12

**Patterns of Preoperative Consultation by Risk and Surgical Specialty in a Large Health Care System**

**Stephan Thilen, MD, MS; Christopher Bryson, MD, MS; Robert Reid, MD, PhD; and Miriam Treggiari, MD, MPH, PhD**

*University of Washington, Seattle, WA*

Many patients are referred for a preoperative medical consultation. There are no guidelines applicable to the majority of patients for when such consultations are beneficial. The various surgical specialties provide different approaches to preoperative patient care and collaboration with consultants. Therefore, and not surprisingly, substantial practice variation in requesting consults may be the norm. The purpose of this pilot study was to assess the association between surgical specialty and the utilization of preoperative consultation.

**Methods:** This is a retrospective study using automated administrative and clinical data from Group Health Cooperative, a large integrated health care system in the Pacific Northwest. We studied 13,673 patients in six different surgical specialties who underwent one of the selected common procedures in 2005 or 2006. We identified level 3 to 5 preoperative consultations (CPT 99243-5 and 99253-5) provided by family practitioners, general internists, pulmonologists, cardiologists, or endocrinologists that occurred within a 42 days prior to surgery. We also included level 3 to 5 office visits (CPT 99203-5 and 99213-5) that were associated with a preoperative evaluation (v72.8) code. We stratified the results by the Revised Cardiac Risk Index.

**Results:** The proportion of patients who had preoperative consultations varied significantly by specialty (**Table**). Ophthalmology, urology, and orthopedic surgery had the highest rates of preoperative consultations across all RCRI.

**TABLE**

**Percent preoperative consultations by surgical specialty stratified by RCRI**

RCRI		Surgical procedure type						P value
		Eye	General	Gyn	Ortho	Urology	Vascular	
0	N	164	2,363	1,015	2,805	391		
	%	32.3	15.2	22.7	22.2	30.2		< .01
1	N	2,512	527	108	704	185	71	
	%	40.0	15.6	4.7	18.9	27.6	9.9	< .01
2	N	1,124	187	14	222	59	80	
	%	37.1	12.8	0	19.4	28.8	13.8	< .01
3	N	846	85	5	79	20	107	
	%	35.8	17.6	0	21.5	10	11.2	< .01

RCRI = Revised Cardiac Risk Index

**Conclusion:** These unadjusted findings suggest that there is substantial practice variation between surgical specialties with regard to the use of preoperative consultations. Further, the patterns do not appear to be related to risk. Given the large number of low-risk consultations, it is critical to understand the cost-effectiveness or consequences of current practice.

Abstract 13

**One-Year Incidence for Admission to a Critical Care Unit After Major Orthopedic Surgery**

**Michael Urban, MD, PhD; Steven Magid, MD; and Michele Mangini, DNP**

*Hospital for Special Surgery, New York, NY*

**Introduction:** Unplanned admissions of postoperative patients to an intensive care unit (ICU) after discharge from a postanesthesia care unit (PACU) have a significant impact on surgical outcome. A few studies have documented an increase in length of hospital stay, medical costs, infection, and overall morbidity and mortality (M&M) for these patients. Preidentification of those patients at risk for postoperative ICU admissions and modification of their care might reduce these admissions and subsequent M&M. As a first step in this process, we identified the patients and reasons for admission to the ICU after major orthopedic surgery.

**Methods:** An institutional review board approved prospective descriptive analysis of patients  $\geq 18$  years old admitted to an ICU within 120 hours of discharge from a PACU after major orthopedic surgery. Data were collected by medical chart review and extraction of data from ClinCis (our computerized patient information system). Data were entered and analyzed in SPSS 17.0 for Windows.

**Results:** At one institution, from April 1, 2009, to March 31, 2010, a total of 12,229 patients underwent major orthopedic surgery: 3,469 had primary total hip arthroplasty (THA), 3,365 had primary total knee arthroplasty (TKA), 1,281 had spinal fusions, and 4,114 had other orthopedic procedures. Of these patients, 206 (1.68%) were admitted to an ICU within 120 hours of discharge from the PACU, including 57 with THA (1.6%), 60 with TKA (1.8%), and 43 with spinal fusions (3.4%). Cardiac complications was the major reason for an ICU admission (38%), followed by pulmonary (9.8%) and renal (7.9%) complications. Patients admitted to the ICU after surgery had multiple comorbidities: cardiac (40.3%), diabetes mellitus (18.4%), chronic renal insufficiency (14.1%), and pulmonary disease (12.6%); 8.7% had three or more comorbidities. This population was also older; the mean age of the surgical population was 61 years compared with 68 years for the ICU group. Patients admitted to the ICU were hospitalized for a mean of 32 hours longer.

**Discussion:** After major orthopedic surgery, older patients with multiple comorbidities are at risk for readmission to the ICU. Spinal fusion surgery carried a higher risk than arthroplasty, possibly related to length of surgery, type of anesthesia, blood loss, and postoperative pain. In contrast to published reports, in our orthopedic population, cardiac complications were more common than respiratory complications. Future studies will be directed to identifying a risk index for postoperative admission to the ICU and modification in our management to decrease the ICU admission incidence.

Abstract 14

**Determination of the Causes of Long Patient Wait Times in a Preoperative Evaluation Clinic**

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<sup>1</sup>Massachusetts General Hospital, Boston, MA, and <sup>2</sup>Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA

**Introduction:** Preoperative evaluation clinics face many of the same challenges other outpatient clinics face. Long patient wait times are no longer acceptable in a climate where patient convenience and fiscal constraints are priorities. Commonly cited reasons for long wait times include inadequate personnel and space, large patient load and short appointment times, and patient acuity. However, the real causes of long patient wait times are not always apparent. We undertook a systematic, quantitative study of our clinic workflow to uncover patient and provider characteristics that drive long patient appointment times in our clinic. We also developed a simulation tool to predict the performance of the system with various process changes.

**Methods:** The preadmission testing area (PATA) is an outpatient appointment-based clinic staffed by anesthesiologists (MDs), nurse practitioners (NPs), registered nurses (RNs), and support staff (PCAs). After vital signs are taken, patients are interviewed by either an MD or NP and an RN. They then have laboratory studies drawn and are discharged from the clinic. For a 2-week period, we performed a time-motion study tracking face-to-face patient time at each of these stations as well as total patient time in the clinic. In addition, we tracked the time each practitioner spent in patient care–related activities away from the patient (eg, looking up patient data, charting, etc.). Patient data such as age, American Society of Anesthesiologists physical status classification, number of medications, and whether they receive care within or outside our health care system were also collected.

**Results:** In a 2-week period, we collected data on 555 patients and 38 health care providers. On average, patients spent 82 minutes face to face with a provider and 88 minutes waiting. Provider utilization ranged from 45% to 79% and room utilization was 48%, demonstrating that ours was not a highly utilized system. The key driver for patient wait time was found to be provider variability. Simulation showed that reducing redundant, nonvalue-added work; improving flow of critical communication; and decreasing provider variability through the implementation of guidelines and best practices can decrease patient wait times by 85%.

**Conclusion:** Undertaking a systematic, quantitative approach to analyzing patient flow through a clinic can uncover the drivers of long patient wait times. The effect of different interventions on patient wait times can be demonstrated by the use of a simulation tool before implementation of the intervention.



Abstract 15

**Does Perioperative Statin Treatment Affect Hospital and ICU Length of Stay Following Cardiac Surgery: A Systematic Review**

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**Background:** Studies of patients randomized to preoperative statin treatment have suggested trends towards reduced length of stay (LOS). We searched the literature to evaluate the effect of statin treatment on hospital and intensive care unit (ICU) LOS in those undergoing cardiac surgery.

**Methods:** MEDLINE via PubMed, Embase, and Cochrane CENTRAL Register were searched using Boolean logic to incorporate a variety of terms, including statins, cardiac surgery, and LOS. Filters limited retrieved articles to prospective, double-blind, placebo-controlled, randomized, controlled trials. A total of 176 unique articles and conference abstracts were retrieved from the electronic search. Lengths of hospital and ICU stay were abstracted and tabulated.

**Results:** Five studies met our inclusion criteria.<sup>1-5</sup> The studies were similar in design, methodology, and intervention. All patients underwent coronary artery bypass grafting surgery. In each study, no statistically significant difference was reported among those randomized to statins with respect to comorbidities, age, gender, medication use, etc. The mean hospital LOS for those randomized to statin treatment was 8.3 days (6.3–11.5 days) vs a mean of 9.0 (6.9–11.6), in controls. The mean ICU LOS in statin-treated patients was 2.0 days (1.4–2.5) vs a mean LOS of 2.1 days (1.8–2.4). Absolute differences were 0.7 days and 0.1 days in hospital and ICU LOS respectively (**Table**).

**Conclusions:** High-quality studies of those undergoing cardiac surgery report reduced lengths of hospital and ICU stay in patients randomized to statin therapy. The mechanism for this effect is unclear but may relate to the pleiotropic effects of statins leading to reductions in adverse events and shorter hospitalizations. Alternatively, the “healthy-user” effect or confounding by unmeasured variables may explain this phenomenon. The limited number of randomized studies and the moderate size of this effect warrant careful interpretation of this finding.

**TABLE**  
Characteristics of the studies included in analyses

Study author	Size (n)	Type of surgery	Statin type, dose and, administration protocol	Length of stay (days)					
				Control	Hospital Statin	Δ	Control	ICU Statin	Δ
Christenson <sup>1</sup>	77	CABG	Simvastatin 20 mg/d started 28 days preoperatively	11.6	11.5	0.1	2.1	2.0	0.1
Chello <sup>2</sup>	40	CABG	Atorvastatin 20 mg/d started 21 days preoperatively	7.2	6.9	0.3	2.1	1.9	0.2
Patti <sup>3</sup>	200	CABG	Atorvastatin 40 mg/d started 7 days preoperatively	6.9	6.3	0.6	NR	NR	NR
Berkan <sup>4</sup>	46	CABG	Fluvastatin 80 mg/d started 21 days preoperatively	10.4	8.5	1.9	1.8	1.4	0.4
Tamayo <sup>5</sup>	44	CABG	Simvastatin 20 mg/d started 21 days preoperatively	NR	NR	NR	2.4	2.5	0.1

CABG = coronary artery bypass grafting; ICU = intensive care unit; NR = not reported

1. Christenson JT. Preoperative lipid-control with simvastatin reduces the risk of postoperative thrombocytosis and thrombotic complications following CABG. *Eur J Cardiothorac Surg* 1999; 15:394–399.
2. Chello M, Goffredo C, Patti G, et al. Effects of atorvastatin on arterial endothelial function in coronary bypass surgery. *Eur J Cardiothorac Surg* 2005; 28:805–810.
3. Patti G, Chello M, Candura D, et al. Randomized trial of atorvastatin for reduction of post-operative atrial fibrillation in patients undergoing cardiac surgery: results of the ARMYDA-3 (Atorvastatin for Reduction of MYocardial Dysrhythmia After cardiac surgery) study. *Circulation* 2006; 114:1455–1461.
4. Berkan O, Katrancioglu N, Ozker E, Ozerdem G, Bakici Z, Yilmaz MB. Reduced P-selectin in hearts pretreated with fluvastatin: a novel benefit for patients undergoing open heart surgery. *Thorac Cardiovasc Surg* 2009; 57:91–95.
5. Tamayo E, Alvarez FJ, Alonso O, et al. Effects of simvastatin on systemic inflammatory responses after cardiopulmonary bypass. *J Cardiovasc Surg (Torino)* 2009; 50:687–694.

Abstract 16

**Assessment of Patient Satisfaction of Nurse Screening vs Complete Preoperative Assessment**

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Preoperative assessments should be a balance of completeness and convenience, which varies depending on the nature of the planned procedure and the health status of the patient. This project assessed patient satisfaction with a newly instituted screening process.

**Method:** Patients scheduled for elective surgery at an academic hospital underwent preoperative assessment via one of three pathways: history and physical examination in the preoperative medical optimization clinic (PMOC) by a nurse practitioner or physician assistant (H&P), an interview in the PMOC by a nurse (CNI), or telephone nurse interview (TNI). Assessment was done at 30 days via a telephone call by a nurse, using a questionnaire template.

Patients were asked to rate on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) the following statements:

Statement 1: The nurse or clinician addressed my questions and concerns prior to surgery.

Statement 2: The preoperative assessment process prepared me for surgery.

Statement 3: The preoperative assessment was a positive overall experience.

**Results:** During February to June 2010, a total of 250 patients were consented to the study and follow-up by telephone was accomplished in 209. Of these, 104 were H&P, 72 were TNI, and 32 were CNI. The response to the statements is described in the **Table**.

**TABLE**  
**Average scores**

	Statement 1	Statement 2	Statement 3	No.
H&P	4.93	4.92	4.92	104
CNI	4.84	4.88	4.88	32
TNI	4.94	4.95	4.96	72

CNI = clinic nurse interview; H&P = nurse practitioner or physician assistant; TNI = telephone nurse interview

There was no statistically significant difference in the groups.

**Discussion:** Patients have equally high satisfaction with all three methods of assessment. It is somewhat surprising that patients who underwent the more time-consuming options, involving a visit to the PMOC, were not less satisfied.

Abstract 17

**Traumatic Subdural Hematoma: An Update on Morbidity**

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**Background:** Published data on acute traumatic subdural hematoma in adults typically describe small cohorts of patients hospitalized in the 1970s and 1980s, with limited information on functional outcomes and reported in-hospital mortality rates ranging from 21% to 66%. Our goal was to evaluate morbidity in a larger and more recent cohort.

**Methods:** Eligible patients were older than 16 years of age with acute traumatic subdural hematoma evaluated in a Level I trauma center between January 1, 2005, and December 31, 2008. Standardized data were prospectively collected on demographics, past medical history, injury and surgery characteristics, length of stay, functional outcomes at time of discharge, and mortality.

**Results:** The 2,072 patients included in the study were, on average, 52.6 years of age, with the majority (70%) male, an average Injury Severity Score (ISS) of 27.4, and a Glasgow Coma Scale (GCS) > 12 (57%). Average length of stay was 10 days (range 1–142 days). Patients undergoing evacuation of subdural hematoma (N = 315) did not differ significantly in gender or ISS from those who did not have surgery. Significantly more evacuated patients than non-evacuated patients had a GCS < 6 (38% vs 29%), an Abbreviated Injury Scale > 4 for Region 1 (95% vs 38%), a length of stay > 21 days (23% vs 11%), and discharge to a facility other than home (64% vs 35%). Mortality did not differ significantly between groups: 13% in the evacuated group vs 12% in the non-evacuated group.

**Conclusion:** This cohort, which includes patients with polytrauma, shows a markedly lower mortality rate than previously reported in the literature.

Abstract 18

**Lipid Emulsion as a Lifesaving Treatment for Local Anesthetic Systemic Toxicity (LAST)**

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One of the most feared complications of regional anesthesia is local anesthetic systemic toxicity (LAST). Although serious complications secondary to local anesthetic administration are rare, adverse effects do occur and can range from mild central nervous system (CNS) involvement to life-threatening cardiac toxicity, which resists standard resuscitative methods. When such a situation arises, diagnosis is the first step to successful treatment. Once LAST is recognized, having a plan and the necessary tools readily available can save a patient's life. The 2010 American Society of Regional Anesthesia and Pain Medicine Practice Advisory recommends a plan consisting of airway management, seizure suppression, cardiac life support if indicated, and infusion of a 20% lipid emulsion. Evidence for the beneficial effects of lipid infusion in LAST were first published more than a decade ago in a rat model of bupivacaine-induced asystole.<sup>1</sup> Further studies in dogs confirmed the benefits of lipid in reversing bupivacaine cardiac toxicity.

Although not proven, the primary mechanism of action is believed to be a partitioning effect where offending drug is bound to an enlarged, intravascular lipid phase. The new equilibrium forces the toxic agent from the target tissues to a newly formed "lipid sink." This lipid sink is essentially a large reservoir having high affinity for the lipophilic drug which is, in effect, pulled away from the target organ, thereby reversing the toxicity. In 2006, Rosenblatt et al<sup>2</sup> described the first clinical report of lipid emulsion used to reverse cardiac arrest due to LAST. There have been many subsequent reports of successful use of lipid emulsion infusion in reversing severe LAST, including both CNS and cardiovascular signs of toxicity.

Our goal is to make the city of Chicago the first LAST safe zone. We are working with individual hospitals to implement a protocol for effective treatment of LAST, including use of lipid emulsion infusion. An educational "toolkit" will be distributed to hospitals all over Chicago to improve knowledge about the most effective methods for prevention, diagnosis, and treatment of LAST. The overarching goal of this educational program is to decrease or eliminate entirely the morbidity and mortality associated with LAST.

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2. Rosenblatt MA, Abel M, Fischer GW, Itzkovich CJ, Eisenkraft JB. Successful use of a 20% lipid emulsion to resuscitate a patient after a presumed bupivacaine-related cardiac arrest. *Anesthesiology* 2006; 105:217–218.

Abstract 19

**Perioperative ACLS Recommendations Should Be Modified for the Treatment of Local Anesthetic Toxicity**

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**Case 1:** A patient scheduled for a carotid endarterectomy received a preoperative cervical plexus block and 30 mL of 0.5% bupivacaine. Thirty minutes later, three beats of ventricular tachycardia was noted and 100 mg of IV lidocaine was administered. Within minutes the patient suffered a cardiac arrest consisting of ventricular fibrillation (VF) and pulseless wide QRS bradycardia. The patient required more than 25 minutes of chest compressions and multiple vasopressor doses before a stable heart rate and blood pressure returned.

**Case 2:** A patient underwent a total knee replacement. Postoperatively a sciatic nerve block was attempted and 20 mL of 0.5% bupivacaine was administered. Before completion of the procedure, the patient developed seizures, profound hypotension, bradycardia, and a markedly widened QRS complex. As part of her resuscitation she received a rapid bolus of 500 mL 20% intralipid. Within 20 minutes her QRS complex narrowed and her vital signs normalized.

**Discussion:** The large volumes of local anesthetics typically administered during peripheral nerve blocks can lead to local anesthetic toxicity, including malignant cardiac arrhythmias. The onset of cardiac arrest may be instant (intravascular injection) or delayed (systemic absorption). Perioperative care providers should be aware that current advanced cardiac life support (ACLS) recommendations need to be modified when local anesthetic toxicity is suspected. The first consideration is the role of lidocaine, which is classified as a Class IIb treatment for VF/pulseless ventricular tachycardia. While it may seem obvious that a local anesthetic should not be administered to treat cardiac arrest caused by local anesthetic toxicity, a prominent anesthesia publication recently included such a recommendation.<sup>1</sup> The proper designation should instead be Class III, defined as "... a treatment (which) is not useful/effective, and ... may be harmful."<sup>2</sup> The other modification in the treatment of local anesthetic toxicity involves the role of administering intralipid. More than a decade of animal research and many recent case reports suggest the value of initiating this therapy along with standard ACLS recommendations.<sup>3</sup> Intralipid most likely acts as a "lipid sink" for lipophilic local anesthetics and may also have a protective effect at the cellular level.

**Conclusion:** Perioperative caregivers should modify current ACLS recommendations when local anesthetic toxicity is suspected. Lidocaine is contraindicated, and intralipid therapy should be considered

1. Schwartz DA. *Perianesthetic management of the ex-premature infant*. *Anesthesiology News* 2010; 36:41-44. Lesson 289.

2. 2010 AHA Guidelines for CPR and Emergency Cardiovascular Care Science. *Circulation* 2010; 122(suppl 3).
3. Rowlingson JC. Resuscitation of local anesthetic toxicity with intralipid. American Society of Anesthesiologists Web site. <http://www.asahq.org/Knowledge-Base/Subspecialty-Interests/ASA/Resuscitation-of-Local-Anesthetic-Toxicity-with-Intralipid.aspx>. Published October 2007. Accessed January 27, 2011.

Abstract 20

**Preoperative EMR Containing Smart-Set Reminders Improve Accuracy of Documentation by Nonanesthesia Clinicians During Preoperative Assessments**

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**Background:** The preoperative assessment clinic in the Department of Anesthesia at Wake Forest University developed an electronic medical record (EMR) capable of generating preoperative assessments, patient education, and medication reconciliations that also allows for data collection and data sharing with the intraoperative anesthesia record. This clinical application incorporates fields for the collection of preoperative National Surgery Quality Improvement Program (NSQIP) variables, Joint Commission (JC) nursing assessments, medication reconciliation, and “smart-set” reminders for clinicians’ physical assessments. The application contains clinical reminders that define evidence-based “Best Practices” and American Society of Anesthesiologists (ASA) physical status classifications. These components provide teaching tools for nonanesthesia-trained clinicians (nurse practitioners, physician assistants). The incorporation of clinical smart-set reminders ensures that nonanesthesia-trained clinicians remain consistent with evidence-based preoperative medical management guidelines. Further, the creation of patient-specific preoperative medication instructions appropriate for the anticipated anesthetic and procedure facilitates patient compliance with recommendations. Lastly, the incorporation of height, weight, and calculated body mass index categorizing the patient as “overweight, obese, morbidly obese, or super morbidly obese” alerts the operating room staff to the need for specialized equipment prior to the day of surgery.

**Results:** Once implemented (October 2009), our preoperative EMR improved the accuracy of NSQIP data collection and ASA physical status coding, as well as compliance with preoperative clinical best practices. Better collection of preoperative NSQIP variables changed institutional patient severity scores which, in turn, impacted “expected” surgical outcomes. This resulted in an overall improvement in comparison with other NSQIP participating institutions (improved “O/E” ratio). Further, smart-set reminders containing ASA class definitions facilitated consistent physical status coding, which resulted in improved coding and billing. Lastly, improved compliance was observed with Surgical Care Improvement Project measures such as continuation of perioperative beta-blocker therapy and medical management of comorbid disease states. Inclusion of smart-set reminders to “always take beta-blockers, statins, and aspirin” on the day of surgery improved compliance with such measures.

**Conclusion:** The EMR, created specifically for the preoperative assessment clinic at Wake Forest University, with the inclusion of smart-set reminders, improved quality improvement data collection, coding ASA classification, and compliance with perioperative best practices.



Abstract 21

**POET: Procedure Outcomes Evaluation Tool**

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**Background:** Surgical patient safety depends on several key factors, including the patient's preoperative assessment, ready access to the best available medical evidence, appropriate application of clinical knowledge, and the technical outcomes of the surgical intervention. This information is managed and presented to health care providers at the point of care through locally available knowledge management systems. Clinical decision support systems (CDSS) have the potential to generate timely case-specific advice that may influence surgical recommendations, especially in patients with multiple comorbidities presenting for complex surgical procedures. Moreover, CDSS supports evidence-based practice, which can potentially improve perioperative patient safety by facilitating pertinent clinical assessment of the risks and benefits of procedural outcomes.

**Purpose:** The procedure outcomes evaluation tool (POET) is a health informatics assessment tool that provides clinicians with rapid access to national clinical data related to inpatient surgical procedure outcomes. The evaluated outcomes include: mortality, length of stay, and the patient's disposition status. The tool presents a repeatable procedure outcomes assessment process that links the patient's demographic and comorbidity information to procedure-specific information and hospital characteristics. POET can also be used to understand the national impact of comorbidities on the probability of selected outcomes for specific procedures to provide a patient-specific assessment of surgical risk.

**Description:** POET follows a flexible three-tier architecture that provides a user-friendly interface for preoperative practitioners to submit ad hoc queries about inpatient surgical procedures from prepopulated menus. The ad hoc query will access POET's database, which includes the largest inpatient discharge data from the Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), and Agency for Healthcare Research and Quality.<sup>1</sup> The tool's logic-tier extracts meaningful user-oriented results about procedural outcomes that can inform the practitioner's decision-making process.

**Results:** The database contains approximately 8 million hospital stays each year. POET is performance-tuned to analyze and evaluate surgical procedure outcomes within a few seconds. Five-year mortality rates are generated and presented to the user in less than 10 seconds to facilitate patient risk assessment at the point of care. The execution time of repeated queries is significantly less as results are cached for future use.

**Conclusions:** POET provides a potential means to better inform surgical risk for both practitioners and patients. It supports evidence-based medicine and surgical patient safety and provides a mechanism for personalized risk assessment. Future work involves the incorporation of additional clinical databases and the addition of outcomes prediction models.

1. Overview of the Nationwide Inpatient Sample (NIS). HCUP Web site. <http://www.hcup-us.ahrq.gov/nisoverview.jsp>. Updated July 21, 2010.

Abstract 22

**Results of a Multidisciplinary Preoperative Assessment Process for High-Risk Orthopedic Patients**

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**Background:** Preoperative evaluation prior to elective orthopedic surgery is important to understand risk and facilitate optimal surgical planning. An evaluation process was implemented to improve risk assessment of patients with high-risk clinical characteristics under consideration for elective intermediate-risk orthopedic procedures.

**Purpose:** Patient characteristics and preoperative clinical evaluation data were reviewed by a multidisciplinary group that included internal medicine, anesthesia, and orthopedics. Surgical provision outcomes are presented for total knee/hip arthroplasties in the first year of the high-risk process.

**Description:** Patients considered for total knee or hip arthroplasty were screened (patient evaluation, chart review, or both) to identify clinical comorbidities associated with adverse surgical outcomes. High surgical-risk characteristics of referred patients included cardiopulmonary factors, wound healing concerns, liver cirrhosis, and other comorbidities. Identified patients received chart review and preoperative medical evaluation by select providers. Subsequent multidisciplinary panel reviews provided recommendations, such as: delay surgery for additional evaluation, do not offer surgery based on clinical risk, or proceed to surgery with patient-specific surgical planning. Recommendations were communicated to patients for surgical or conservative management.

**Results:** The Table shows results for the 50 patients considered for hip/knee replacement who completed high-risk evaluations in year 1 of the quality improvement project.

**TABLE**  
Results of multidisciplinary preoperative screening

Procedure (N)	Surgery offered	Surgery received	Medical cancellations	Patient cancellations
Total hip (19)	18 (94.7%)	12 (66.7%)	1 (5.6%)	5 (27.8%)
Total knee (31)	24 (77.4%)	14 (58.3%)	2 (8.3%)	8 (33.3%)

**Conclusions:** A significant number of patients were not offered surgery; the denial rates were higher among patients assessed for knee replacement. Similar percentages of knee and hip arthroplasty patients actually received surgery with a small number canceling due to new medical problems. Most cancellations were due to patient choice with the majority stating that the surgical risks outweighed potential benefits.

Abstract 23

**Practical Algorithm for Preoperative Evaluation of Patients With Liver Disease**

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**Background:** Chronic liver disease is prevalent, but is frequently overlooked as a perioperative risk factor. Treatment modalities have improved, leading to increasing numbers of patients with chronic liver disease and cirrhosis presenting for elective surgeries. It is known that patients with liver disease who require surgery are at greater risk<sup>1</sup> for perioperative complications compared to those with healthy livers because of the stress of surgery and effects of anesthesia.

**Purpose:** Identification of surgical risk is imperative for therapeutic decision-making and informed treatment choices. Patients are often screened preoperatively by midlevel practitioners who need guidance for appropriate evaluation.

**Description:** We have introduced a simple algorithm for evaluation and management of patients with known or suspected liver disease to guide midlevel practitioners, nurses, and physicians in the preoperative clinic. The algorithm includes history, physical, and laboratory findings,<sup>2</sup> as well as the use of the validated Child-Pugh score.<sup>3</sup> More detailed explanatory information is appended by footnotes.

**Results:** Early use of the tool has led to increased recognition, improved history and physical examination skills, and appropriate laboratory test interpretation. As severe liver cirrhosis is rare, we are not able to demonstrate globally improved outcomes, but we are able to show institutional improvements in perioperative management.

**Conclusions:** A well-designed protocol, aided by clinical pathways, improves screening efficiency and outcomes. We present our algorithm for the preoperative evaluation of the patient with liver disease.

1. Ziser A, Plevak DJ, Wiesner RH, Rakela J, Offord KP, Brown DL. Morbidity and mortality in cirrhotic patients undergoing anesthesia and surgery. *Anesthesiology* 1999; 90:42–53.
2. Hanje AJ, Patel T. Preoperative evaluation of patients with liver disease. *Nat Clin Pract Gastroenterol Hepatol* 2007; 4:266–276.
3. Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R. Transection of the oesophagus for bleeding oesophageal varices. *Br J Surg* 1973; 60:646–649.

Abstract 24

**Evaluation and Management of Isolated Elevated aPTT**

Sheila Hassan, MSN, NP<sup>1</sup>; Patricia Kidik, MSN, NP<sup>1</sup>; Catherine McGowan, MSN, NP<sup>1</sup>; and Angela M. Bader, MD<sup>2</sup>

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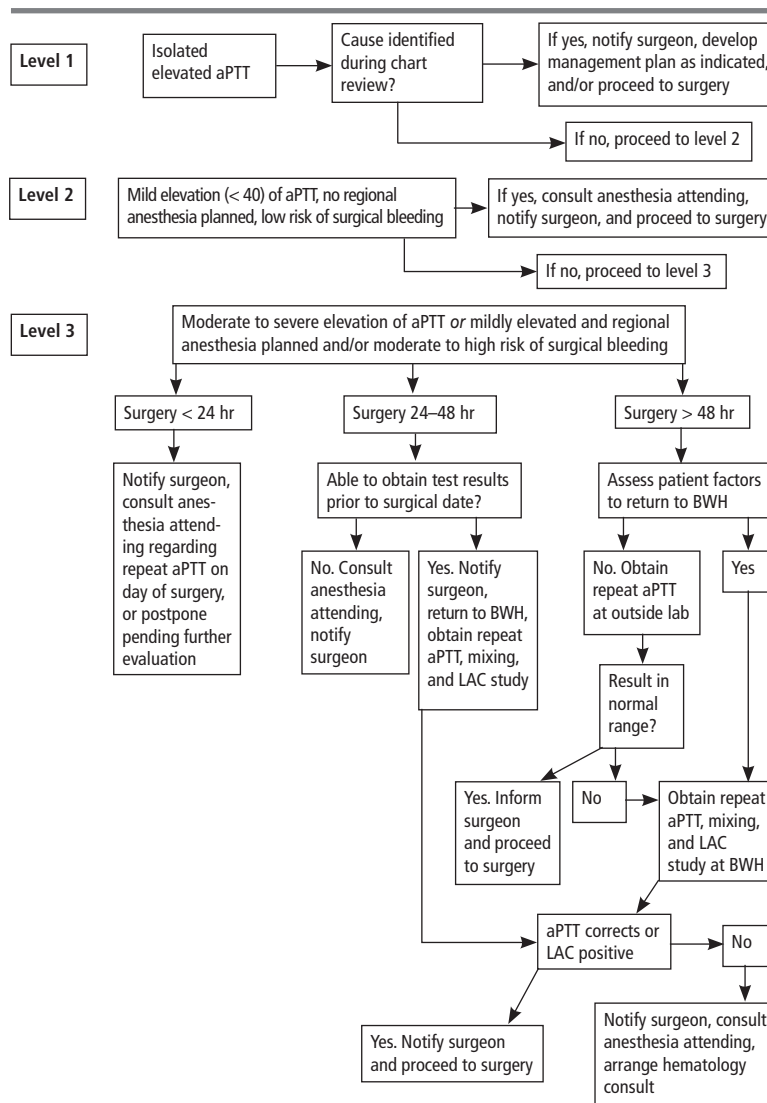
**Background:** Coagulation tests are frequently ordered for preoperative evaluation more as a routine procedure rather than based on clinical judgment. A significant percentage of these results may be abnormal but not imply a bleeding tendency during surgery. The nurse practitioners at Brigham and Women's Hospital's Weiner Center for Preoperative Evaluation evaluated the results of these tests to facilitate safe surgery. Inconsistencies were noted in both the preoperative ordering and management of these abnormal test results.

**Purpose:** This abstract presents an algorithm (**Figure**) to standardize management of patients with isolated elevated activated partial thromboplastin time (aPTT), thereby minimizing unnecessary delays or cancellations of procedures.

**Description:** A literature review was undertaken. Isolated elevated aPTTs were recorded for a 2-month period. The etiology of each abnormality was investigated to determine false positives, those attributed to lupus anticoagulant (LAC), and true positive results.

**Results:** Initial results suggest many false positives are related to laboratory issues, which can be identified by repeat testing. Limiting factors such as time until procedure, specialty testing expense, and patient concerns (medical condition and availability of further testing) determine which tests are performed in this phase. This algorithm identifies the presence of factors such as LAC and provides a guide for obtaining hematology consultation. Patient and surgery risk factors are identified that will streamline test ordering and reduce the resources spent pursuing false-positive results. The complete results of the data analysis are still pending at the time of this abstract submission. The algorithm is presented on page 38.

**Conclusions:** Standardization of protocols in the preoperative clinic can optimize resource utilization, eliminate unnecessary testing, and ensure appropriate evaluation prior to surgery. This identifies patients truly at risk for bleeding so that an appropriate plan is developed. Algorithms serve as a useful tool in this process.



**FIGURE.** Algorithm. aPTT = activated partial thromboplastin time; BWH = Brigham and Women's Hospital; LAC = lupus anticoagulant

Abstract 25

**A Perioperative Triage Plan for Obstructive Sleep Apnea Patients**

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Our institution, like many others, has sought to determine the appropriate postoperative care for patients with a diagnosis or signs of obstructive sleep apnea (OSA). Historically, OSA patients who maintained normal oxygen saturation postoperatively were admitted to the floor or discharged home at the discretion of an attending anesthesiologist. On the other hand, OSA patients who did not maintain a patent airway and sufficient oxygenation were admitted to a monitored or intensive care unit (ICU) for observation on supplemental oxygen. Clearly, the routine use of ICU beds for this patient population was expensive and utilized valuable resources.

As such, members of several departments (anesthesiology, perioperative medicine, sleep medicine, otolaryngology, respiratory therapy) reviewed recent literature regarding postoperative care of OSA patients in an effort to develop a single standard for triage of such patients after surgery.

The result of this collaboration was an OSA scoring system incorporating several criteria: (1) severity of OSA (mild, moderate, severe based on sleep study results) or high risk for OSA based on Berlin Questionnaire screening with no prior sleep study; (2) invasiveness of surgery and anesthesia; (3) postoperative opioid requirement; and (4) additional criteria (home continuous positive airway pressure [CPAP]/bilevel positive airway pressure, arterial blood gas results, cardiac dysfunction, and postanesthesia care unit [PACU] respiratory events). Safety and efficacy of incorporating the overall OSA score with remote monitoring on hospital floors were tested at our institution and deemed appropriate for this patient population.

The OSA scoring tool was added to the patient electronic medical record for completion by health care providers. The patient's OSA information is transparent and can be updated at any time to reflect changes in patient activity.

Based on the overall OSA score, a standard triage plan is now followed. For example, OSA patients who use CPAP at home are started on their usual home settings in the PACU using a standard hospital CPAP machine. On the other hand, OSA patients not using CPAP at home are observed on room air for 2 hours postoperatively and placed on CPAP autotitration if they experience oxygen desaturation. Outpatients may be discharged to home or transferred to a continuous pulse oximetry unit based on the overall OSA score. Inpatients are admitted to a continuous pulse oximetry unit depending on the overall OSA score and oxygen saturation values in PACU.

This plan translates to anesthesiologists, internists, and surgeons all having similar expectations about a particular patient's postoperative disposition.

Abstract 26

**Quantitative Evaluation of Handoff Checklists**

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**Background:** Handoff checklists have become a paradigm for implementing quality improvement (QI) in novel handoff models. Despite the checklist's wide acceptance as a QI technique, few tools exist to reliably determine the extent of true utilization or effectiveness of the checklist in achieving the desired goal of the handoff.

**Purpose:** Our objective is to create a quantitative tool to measure the effectiveness of a novel handoff checklist and correct any underutilization. Rather than rely on informal, impromptu means to adjust the handoff checklist, an iterative method that incorporates resident behavior patterns into the adjustment process provides more accurate evaluations and better elucidates opportunities for improvement.

**Description:** A model that quantifies the checklist items will provide data that can identify trends in effective utilization over time through regression analysis. A QI team with domain expertise in the specific perioperative context will quantify the handoff checklist as a function of determinable parameters such as compliance, actionability, time to completion, or importance. Each QI team member assigns a scale-weighted value to each checklist item. Overall scores are then averaged and arranged by parameter to create an iteration matrix. Finally, in piloting the handoff, residents will complete only the part of the handoff deemed useful in enhancing the handoff.

**Results:** The aggregate data compiled from the checklists will create a time series regression that evaluates trends in usage by recording and scoring items completed. Trend analyses will gauge resident behavior by determining which aspects of the handoff checklist are utilized more often. The QI team then recognizes which checklist items need to be adjusted to improve the effective utilization.

**Conclusion:** Iterative quantitative methods allow for a more effective evaluation of the handoff checklist. Our model measures the checklist's utility as a function of key scaled parameters, as valued by a given department, through time series regression analysis.

Abstract 27

**To Deflate or Not to Deflate: Lap-Band® Management in Subsequent Surgeries**

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**Case Presentation:** A 42-year-old woman with a history of gastric banding 6 years earlier presented to the preoperative clinic prior to elective abdominoplasty. Her past medical history was significant for mild asthma, hypertension, hyperlipidemia, and rare, mild episodes of gastroesophageal reflux disease (GERD).

Our institution traditionally follows the Lap-Band AP® guidelines, which state that “elective deflation of the band is advisable” prior to general anesthesia.<sup>1</sup> Our patient’s bariatric surgeon wanted her band to remain inflated for her subsequent procedures. This conflict with our current policy stimulated discussion (and delay on the morning of surgery) among the anesthesiology and surgical services regarding the most appropriate management for this patient.

We followed our patient’s surgeon’s advice, kept the band inflated, and used a rapid-sequence induction with general endotracheal intubation and aspiration precautions. The surgery proceeded without complications, but the question about appropriate band management remains unresolved.

**Discussion:** Our academic institution does not place gastric bands, but several patients who have undergone gastric banding previously present each month to our perioperative services.

Management of the gastric band perioperatively takes the following into consideration:

- (a) Two separate, but aspiration-related, concerns:
  - 1. Pouch dilation
  - 2. GERD
- (b) Risk of band malposition
- (c) Risk of mucosal ischemia
- (d) Need for esophageal instrumentation.

As consensus seems to be lacking on how to manage subsequent patients, our preoperative service has created a clinical consult form to be completed by bariatric surgeons addressing their recommendations for each patient. This innovation has been well received and has led to uniformity in the preoperative assessment process.

**Conclusions:** Our poster discusses the appropriate anesthetic management of patients with gastric bands undergoing subsequent surgeries. We present our consult form and review different opinions for gastric band management and the evidence behind the varying clinical practices. Our form promotes consistency in care, improves efficiency and communication between services, minimizes health care costs from cancellations on the day of surgery, and improves quality of patient care and, most importantly, patient safety.

1. *Lap Band AP® Adjustable Gastric Banding System [package insert]*. Santa Barbara, CA: Allergan; 2010.



Abstract 28

**Takotsubo Cardiomyopathy and Resultant Cardiogenic Shock After Mitral Valve Repair**

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**Case Presentation:** A 51-year-old woman was diagnosed with asymptomatic severe mitral regurgitation (MR) in August 2009 on routine physical exam. She was found to have posterior leaflet prolapse due to P2 chordae rupture and was followed by serial echocardiograms. In September 2010, she was found to have elevated right ventricular systolic pressure of 84 mm Hg by exercise echocardiography. Subsequent diagnostic catheterization revealed normal resting hemodynamics, angiographically normal coronary arteries, and confirmed severe MR. The patient underwent minimally invasive mitral valve repair with annuloplasty ring placement. Her operative course was uncomplicated and she was transferred to the intensive care unit (ICU) on no vasopressor agents. She was extubated on postoperative day (POD) #1. Two hours later, the patient developed chest pain. An echocardiogram demonstrated an ejection fraction (EF) of 50% to 55%, a hypokinetic anterior septum, no MR, and no pericardial effusion. Fifteen minutes later, chest pain recurred and the patient developed nonsustained ventricular tachycardia. An electrocardiogram demonstrated anterolateral ST-segment elevation and the patient became hypotensive, requiring vasopressors. Emergent coronary arteriogram revealed no significant coronary stenosis. Left ventriculogram revealed no MR, an EF of 25%, and normal contraction of the base with hypokinesis of the rest of the left ventricle with apical ballooning. Hemodynamics (right atrium 20 mm Hg, pulmonary artery 40/20/26 mm Hg, pulmonary capillary wedge pressure 28 mm Hg, and cardiac index 1.8 L/m/m<sup>2</sup>) were consistent with cardiogenic shock. An intra-aortic balloon pump (IABP) was placed. The patient improved clinically and the IABP was removed on POD #3. The patient was discharged home on POD #9. An echocardiogram performed at that time revealed recovery of left ventricular function with an EF of 55% confirming the diagnosis of takotsubo cardiomyopathy.

**Discussion:** The occurrence of acute-onset transient left ventricular dysfunction in patients with electrocardiographic abnormalities suggestive of myocardial ischemia in the absence of significant coronary disease has been referred to as takotsubo cardiomyopathy, stress-induced cardiomyopathy, or catecholamine-induced cardiomyopathy. This condition is now considered a well-known entity, often occurring in postmenopausal women during stressful physical and emotional situations. While takotsubo cardiomyopathy has been found to commonly occur preoperatively, intraoperatively, and postoperatively after general surgery, only rare cases involving cardiac surgery have been reported in the literature.

**Conclusion:** Practitioners must have a heightened index of suspicion for takotsubo cardiomyopathy in the perioperative period. Furthermore, strategies need to be developed for the management and education of individuals who develop this syndrome and require future surgery.

Abstract 29

**Intravenous Vitamin K: Rapid Reversal of Warfarin and Lack of Subsequent Warfarin Resistance**

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**Case:** An elderly man was admitted with choledocholithiasis. He was taking warfarin 3.75 mg/d, and his international normalized ratio (INR) was 3.17. Semiurgent reversal of warfarin to INR < 1.6 was requested for an endoscopic retrograde cholangiopancreatogram (ERCP) 10 hours later. Six hours after he received 10 mg of IV vitamin K, the INR fell from 2.87 to 1.86. Three hours after an additional 5 mg of IV vitamin K, the INR was 1.5, then 1.17. Warfarin was restarted at 2.5 mg/d. A single dose of 2.5 mg of warfarin resulted in an INR of 1.5, so warfarin was held. The next day the INR was 4.6.

A 57-year-old woman taking warfarin 6 mg/d with an INR of 3.17 needed semiurgent reversal of warfarin for ureteral stent within 8 hours. Six and one-half hours after 10 mg of IV vitamin K, her INR was 1.5. Two days later her INR was 1.08 and warfarin 6 mg was restarted. After three 6-mg doses of warfarin, her INR was 2.3.

An elderly woman was admitted with vertebral compression fracture. She was taking warfarin 4 mg/d. Her INR was 3.94. Kyphoplasty was planned in 12 hours, requiring rapid reversal of warfarin. Seven hours after 10 mg of IV vitamin K, her INR was 1.47, then 1.08. Warfarin was reinstituted at 4 mg/d; after seven doses, her INR was 1.6.

**Discussion:** Despite a lack of randomized trials, persistent claims in the literature suggest that IV vitamin K has a slow onset of action, high rate of anaphylaxis, and potential for warfarin resistance. These three cases illustrate that high-dose IV vitamin K results in rapid warfarin reversal (within 6–8 hours) without significant warfarin resistance. No anaphylaxis was seen and current literature suggests a very low rate of anaphylaxis when IV vitamin K is given by slow infusion. In fact, vitamin K may be safer and more effective than plasma, a commonly used alternative.

**Conclusion:** IV vitamin K is underutilized to reverse warfarin in patients needing semiurgent procedures. It is effective in reversing warfarin INR to desired levels within 6 to 8 hours and may not cause significant warfarin resistance as current literature suggests.

Abstract 30

**Cervical Spine Surgery: When Not to Extubate Postoperatively**

**Carlos Mateo Mijares, MD<sup>1</sup>; Doris Debs, ARNP, MSN-BC<sup>2</sup>; Nicole Martin, MD<sup>1</sup>; and Ronald Lee Samson, MD<sup>1</sup>**

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**Case Presentation:** A 57-year-old man presented to Jackson Memorial Hospital for elective anterior cervical decompression and fusion (ACDF) and related procedures. The indicated surgery was proposed to alleviate chronic, intractable pain related to cervical spine myelopathy. The past medical history included smoking, depression, and myelopathy of upper and lower extremities with chronic pain syndromes. Past surgical history included knee arthroscopy, lumbar spine surgery, and cervical spine surgery. Past anesthesia history included general endotracheal anesthesia with uneventful direct laryngoscopy and fiberoptic laryngoscopy for difficult airway for lumbar and cervical spine surgery. Medication history included an antidepressant agent. Informed consent had been procured for surgery and informed consent had been discussed for anesthesia. The patient had undergone an uneventful intravenous (IV) induction along with IV dexmedetomidine infusion, which facilitated the fiberoptic laryngoscopy-intubation sequence to secure his airway. Monitoring was conducted for somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) throughout to warning of surgical encroachment.

The patient was extubated after a leak test of cuff deflation showed exhaled tidal volumes of 600 mL. Ten minutes after extubation, the patient complained of severe pain from his Foley catheter, difficulty breathing when sitting upright, and discomfort from the Miami J Cervical Collar. The patient began to desaturate and the clinical decision was made to reintubate immediately. The patient was placed on dexmedetomidine infusion, the arterial line had to be replaced, and fiberoptic intubation was made, noting hypopharyngeal edema and nonedematous vocal cords.

**Conclusion:** Hypopharyngeal edema has several etiologic factors, including moderate to severe myelopathy, multilevel corpectomy, lengthy procedure (average, 5 hours), preexisting pulmonary disease, and a history of heavy smoking. This patient's history was positive for all these. The risk of this complication can be reduced by maintaining the endotracheal tube for 24 to 72 hours with sedation while on the mechanical ventilator, and then monitoring the patient in the ICU, with extubation when the patient fully meets extubation criteria.

Abstract 31

**Total Occlusion of Oral Cavity by Mandibular Sarcoma for Resection:  
To Intubate Nasally or Proceed to an Awake Tracheostomy?**

**Carlos Mateo Mijares, MD, and Maria DeLapena, MD**

*University of Miami Miller School of Medicine*

**Case Presentation:** A 70-year-old man presented for elective resection of a large mandibular sarcoma. The patient had been sitting upright for the last 6 months secondary to total occlusion of the oral cavity. Nasal obligate breathing and marked bedside halitosis were evident. He had received nutrition via a percutaneous endoscopic gastrostomy tube. Other significant medical history findings included marked hypovitaminosis B complex, various individual low vitamin levels, smoking two packs per day for 60 years, and syphilis. The anesthesia-surgical team made the decision to proceed with awake nasal fiberoptic intubation with a dexmedetomidine infusion and postoperative mechanical ventilation until the patient could be weaned and successfully extubated. Awake intraoperative tracheostomy by an otolaryngologic surgeon was a backup surgical option.

The nasal passages were prepared with 4% xylocaine, with surgical packing of the nose. A transtracheal induction of 4% xylocaine was performed, since the tumor did not extend into the trachea. The nasal passages had been vasoconstricted with neosynephrine and oxymetazoline spray. A loading dose of dexmedetomidine 1 µg/kg over 20 minutes was followed by a basal target-controlled infusion of 0.7 µg/kg. The right nasal passageway was visualized with a fiberoptic scope, which had the added safety benefit of the patient's spontaneously breathing, thus avoiding apnea. When the endotracheal tube had achieved safe passage through the vocal cords and into the trachea, the carina was visualized. The cuff inflated, providing positive evidence of end-tidal carbon dioxide. The operative estimated blood loss was greater than 1 liter, and was replaced with 4 units of packed red blood cells. The dexmedetomidine infusion was continued when the patient was transferred to the surgical intensive care unit, where he remained intubated until controlled extubation was achieved.

**Discussion:** Oral cavity cancers represent 4% of malignancies and involve anterior and posterior tonsillar pillars as well as lips, tongue, cheeks, and tonsils. They are more common in older men, where the incidence is four times greater than in women. Chronic smoking, B complex global hypovitaminosis, and syphilis are all relevant features in the history. The use of controlled dexmedetomidine infusion loading and maintenance permitted safer perioperative endotracheal intubation, postoperative management, and extubation in this patient.

Abstract 32

**Perioperative Fatal Embolic Stroke Associated With Iron Deficiency Anemia and Thrombocytosis**

**Carlos Mateo Mijares, MD; Nicole Martin, MD; and Ricardo Martinez-Ruiz, MD**

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**Case Presentation:** A 66-year-old man, American Society of Anesthesiologists physical status class 4, presented for revision of an open reduction internal fixation (ORIF) of the left clavicle. The patient had undergone a left apical chest desmoid tumor resection with clavicle osteotomy and ORIF 1 month prior. Other significant past medical history included hypertension, coronary artery disease, atrial fibrillation on anticoagulation, chronic obstructive pulmonary disease, obstructive sleep apnea, noninsulin-dependent diabetes, obesity, and hypothyroidism. Preoperative laboratory testing revealed iron-deficiency anemia with hemoglobin of 8.6 g/dL and hematocrit of 26% with reactive thrombocytosis of 433,000 platelets per  $\mu$ L. Induction of anesthesia was achieved using fentanyl 1  $\mu$ g/kg, etomidate 0.4 mg/kg, and rocuronium 0.6 mg/kg followed by endotracheal intubation with Glidescope®. Anesthesia was maintained using sevoflurane 1 minimum alveolar concentration (MAC) with controlled ventilation. Vital signs remained stable throughout the procedure, with the exception of transient hypotension following induction of anesthesia; this responded to intravenous (IV) fluids and 100  $\mu$ g IV phenylephrine. ORIF was completed uneventfully with estimated blood loss of 50 mL. After complete neuromuscular reversal with train-of-four > 0.7, the patient was spontaneously breathing approximately 20 breaths per minute with exhaled tidal volumes of 2 to 4 mL/kg. The patient remained intubated postoperatively because of poor respiratory effort and was transported to the surgical intensive care unit.

Approximately 3 hours later, the patient was noted to have evidence of left hemiplegia and right gaze preference. Further workup revealed a right internal carotid artery occlusion and an ischemic stroke in the right middle cerebral artery distribution with significant mass effect. The patient expired on postoperative day 5 with profound, progressive, intractable bradycardia unresponsive to current advanced cardiac life support protocol.

**Discussion:** Stroke in the perioperative period is an uncommon event with an estimated risk of 0.2% to 0.4% in patients aged 50 to 70 years. Larsen et al<sup>1</sup> demonstrated that stroke typically occurred within 5 to 26 days following non-cardiac surgery and that these cases were *not* directly correlated to surgery and to anesthesia. Reactive thrombocytosis secondary to iron deficiency anemia is a rare *but* recognized cause of thrombosis and stroke. Cerebrovascular events in the presence of thrombocytosis may be the result of thrombosis, platelet emboli, or vasospasm, although the exact mechanism remains unknown.

**Conclusion:** Thrombocytosis is a well-known complication of iron deficiency

anemia. Although the exact mechanism is unknown, anemia and thrombocytosis may act synergistically to promote thrombus formation. Assessment of iron profile should be considered when microcytic anemia is found preoperatively, as evidence shows that platelet counts decrease to normal level with improvement of the anemia. Iron deficiency should be treated vigorously, especially in patients with other significant thrombotic risk factors. The unique aspect of this patient's perioperative management raises the question of whether intra-arterial invasive blood pressure monitoring might have been indicated. Considering the patient's many comorbidities and the potential benefit of avoiding frequent cycling of a noninvasive blood pressure cuff, preoperative placement of intra- and postoperative blood pressure monitoring might have been helpful.

1. Larsen SF, Zaric D, Boysen G. Postoperative cerebrovascular accidents in general surgery. *Acta Anaesthesiol Scand* 1988; 32:698–701.

Abstract 33

**Conservative Approach Saves the Day Anesthesia-Wise and Surgical-Wise**

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**Case Presentation:** A 79-year-old man presented for an elective C1-C2 decompression and fusion. His significant medical history included a 60-pack-year history of tobacco use, alcoholism until 15 years ago, hypertension, less than 4 metabolic equivalents (METs) exercise tolerance, neck range of motion limited with transglottic mass presumed to be T3 glottic cancer, recent right basilar pneumonia, dementia, and current urinary tract infection (UTI) with gram-negative rods. The patient was malnourished and cachectic, and had refused percutaneous endoscopic gastrostomy tube placement. Magnetic resonance imaging revealed an odontoid fracture and C1 on C2 anterior subluxation. A right vocal mass was presumed. Because of the patient's many unresolved medical issues, including an untreated UTI and pneumonia related to aspiration, a multidisciplinary team decided to perform the minimally necessary surgical procedure to stabilize the patient's neurologic status. Following thorough informed consent, the patient underwent halo placement under monitored anesthesia care light sedation with local anesthesia to the scalp. The patient was treated with American Society of Anesthesiologists physical status class 1 and 2 standards. He did well perioperatively and was moved to a nursing unit after 2 hours in the postanesthesia care unit.

**Discussion:** Extensive C1-C2 decompression and fusion might have represented a terminal event for this patient because of his aspiration pneumonia history, significant vocal cord tumor, cachexia, and dementia. Avoiding major surgery with a conservative approach afforded him a month of improved quality of life.

Abstract 34

**Predictors of Acute Kidney Injury in Patients Undergoing Total Knee Replacement Surgery**

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**Background:** Very few studies have focused on patient characteristics that affect acute kidney injury (AKI) after total knee arthroplasty (TKR). The primary goal of this retrospective cohort study was to identify patient characteristics associated with AKI.

**Methods:** Between January 2008 and December 2009, a total of 659 patients (442 female) with a mean age of 67.1 (39–99) years underwent TKR surgery at Mercy Hospital Knee and Hip Institute. Retrospective chart review was done to identify patient characteristics associated with AKI after TKR. Logistic regression was used to evaluate AKI. The significance level was set at  $P < .05$ .

**Results:** AKI occurred in 20.8% of patients. AKI risk increased with age ( $P < .001$ ), diabetes, and angiotensin-converting enzyme inhibitor (ACEI) use (OR 1.6, 95% CI 1.0–2.5; OR 1.5, 95% CI 1.0–2.3, respectively.) However, the effects of diabetes and ACEI use were not independent; when both were included in the regression model, neither was statistically significant, and both odds ratios were smaller.

**Conclusion:** When examined separately, both diabetes and preoperative ACEI use increased the risk of AKI. However these factors were correlated, and were not independent predictors of significantly increased risk. Patients with diabetes tend to develop more AKI; hence, preoperative evaluations of diabetic patients should include a careful evaluation to prevent postoperative AKI.



Abstract 35

**Perioperative Medical Management of the Marfan Patient Undergoing Repeat Cardiothoracic Surgery**

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Marfan syndrome is an autosomal-dominant connective tissue disease that impacts multiple organ systems (including the cardiovascular system), various tissue properties, bone calcification, and pulmonary parenchyma. Common cardiothoracic surgical procedures in this population include repair of the aorta, cardiac valves, and coronary arteries. These patients undergo multiple procedures leading to scarring and poor wound healing, which further complicates medical management. Often, these surgeries are emergent, without any opportunity for perioperative medical clearance.

**Case Presentation:** A 30-year-old man with a history of Marfan syndrome presents to the hospital with a 40-pound weight loss over 9 months and complaints of shortness of breath on exertion. He is found to have a subtherapeutic international normalized ratio. His past medical history is significant for type A aortic dissection requiring aortic valve replacement with a St. Jude mechanical valve and mitral valve prolapse. On physical examination, the patient's appearance was remarkable for marfanoid body habitus; fingers demonstrated arachnodactyly; chest examination revealed pectus carinatum; and there was extreme laxity of joints in all limbs. A grade 5/6 systolic ejection murmur was auscultated at left sternal border.

Initial management included intravenous heparin drip, serial electrocardiograms, transthoracic echocardiogram and transesophageal echocardiogram. The patient was found to have a flailing mitral valve leaflet. After expert cardiology and cardiothoracic surgery consultations, the patient underwent valve repair surgery and was placed on cardiopulmonary bypass. After an unsuccessful attempt at repair, a St. Jude mechanical valve was placed in the mitral position with an intra-aortic balloon pump inserted to ensure adequate cardiac output.

The patient's perioperative and postoperative courses were complicated. Immediately following surgery, the patient went into atrial fibrillation and was found to be in cardiogenic shock with an ejection fraction of 20%. Four days after surgery, he started to experience altered mental status and left arm weakness. Radiographic imaging of the brain revealed a right-sided infarction. Other complications included a right groin hematoma at the surgical catheterization site, persistent hyponatremia, and poor oral intake requiring insertion of a feeding tube. After a prolonged period of mechanical lung ventilation, a tracheostomy was required. Once the patient stabilized, he was transferred to an inpatient rehabilitation unit. More than 1 month following his admission, he was finally discharged home.

**Conclusion:** Appropriate perioperative medical clearance is vital in all patients undergoing cardiothoracic surgery, especially those predisposed to anatomic and physiologic aberrancies such as Marfan patients. This case highlights the need for appropriate perioperative evaluation in patients with Marfan syndrome undergoing repeat cardiothoracic surgery.

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