Oral Abstracts

Is Discontinuation of Antiplatelet Therapy after 6 Months Safe in Patients with Drug-Eluting Stents Undergoing Noncardiac Surgery?

Mihir Bakhru[1], Wael Saber[2], Daniel Brotman[3], Deepak Bhatt[4], Ashish Aneja[5], Katherina Tillan-Martinez[5], Amir Jaffer[5]
[1]Division of Medicine, Internal Medicine Residency Program, Cleveland Clinic, Cleveland, OH; [2]Department of Hematology, University of Madision, WI; [3]Department of Medicine, Johns Hopkins Hospital, Baltimore, MD; [4]Departments of Cardiovascular Medicine and [5]General Internal Medicine, Cleveland Clinic, Cleveland, OH

Background: Drug-eluting stents (DES) pose a challenge in the perioperative setting. Sirolimus and paclitaxel not only inhibit neointimal hyperplasia, but may also inhibit re-endothelialization of the traumatized vessel, making it vulnerable to platelet-mediated thrombosis. Aspirin (ASA) and clopidogrel (CP) are recommended by the FDA for sirolimus stents and paclitaxel stents for 3 and 6 months, respectively. We conducted a retrospective cohort study to examine the safety of discontinuing antiplatelet therapy for elective noncardiac surgery in patients with recent DES placement.

Methods: We cross-matched the Cleveland Clinic (CC) Heart Center database with the CC Internal Medicine Preoperative Assessment, Consultation, and Treatment (IMPACT) Center database to identify all patients who underwent placement of a DES at CC and subsequently underwent elective noncardiac surgery at CC between July 2004 and July 2006. Outcome measures included 30-day rates of postoperative myocardial infarction (MI), DES thrombosis, major bleeding, and all-cause mortality.

Results: We identified 114 patients who underwent noncardiac surgery a median of 236 days [IQR, 125 to 354] after stent placement. Eighty-eight patients (77%) underwent discontinuation of all antiplatelet agents. ASA was stopped a median of 10 days [8 to 12] preoperatively, and CP was discontinued 10 days [8 to 13] preoperatively. Thirteen patients (11.4%) had CP discontinued within 90 days of the stenting and 35 patients (30.7%) had CP discontinued within 180 days of the stenting. No patients died. Two patients (1.75%; 95% CI, 0.48% to 6.17%) developed MI on postoperative days 3 and 7, respectively. Patient 1 had three DES placed and had ASA and CP stopped 33 days after stenting (17 days preoperatively). Patient 2 had one DES placed and had clopidogrel stopped 287 days after stenting (7 days preoperatively). Neither had DES thrombosis by postoperative catheterization. Another patient developed major bleeding (0.87%; 95% CI, 0.16% to 4.8%).

Conclusion: This is the first series to date looking at the safety of discontinuing antiplatelet therapy in patients with DES scheduled for noncardiac surgery. Our sample was small and most patients underwent surgery > 180 days from stenting. The absence of DES thrombosis and the low rate of postoperative MI may suggest that preoperative discontinuation of antiplatelet agents in patients with DES could be feasible after 6 months, in preparation for surgery. Larger trials are necessary, however.

Initiating a Preoperative Cardiac Risk Assessment Quality Improvement Program: The Hurdles to Changing Traditional Paradigms

Eric Hixson[1], Karl McCleary[2], Vikram Kashyap[3], Vaishali Singh[4], Brian Harte[4], Ashish Aneja[4], Brian Parker[5], Raymond Borkowski[5], Walter Maurer[5], Venkatesh Krishnamurthi[6], Sue Vitagliano[7], Jacqueline Matthews[1], Linda Vopat[1], Michael Henderson[1,7], Amir Jaffer[4]
[1]Quality and Patient Safety Institute, Cleveland Clinic, Cleveland, OH; [2]Department of Health Policy and Administration, College of Health and Human Development, The Pennsylvania State University, University Park, PA; [3]Department of Vascular Surgery, [4]Department of General Internal Medicine, [5]Department of Anesthesiology, [6]Urological Institute, and [7]Division of Surgery, Cleveland Clinic, Cleveland, OH

Background: Recent evidence indicates cardiac risk assessment (CRA) and perioperative beta-blockade improve outcomes in patients undergoing noncardiac surgery. Earlier analysis suggested 45% of eligible patients received beta-blockers at our hospital. We assessed surgeon knowledge, attitudes, and behaviors before initiating a quality improvement program in a diverse, tertiary-care surgical department.

Methods: Surgeons, surgical fellows, and surgical nurse practitioners at a single academic medical center received a questionnaire using the Transtheoretical Model framework. Questions asked about preoperative CRA, perioperative beta-blockers, and readiness to change current practice.

Results: The response rate was 25.1% (86/343; 59% staff surgeons; 11 surgical disciplines). Few respondents considered themselves very familiar with national recommendations (11%) or preferred performing CRA (8%) despite having large numbers of patients needing assessment (>25% of patients in 53% of practices). Surgeons differed in their intention to change CRA practices (50% considered themselves compliant, 18% planned changes, 15% might, and 18% did not intend changes). There was dissonance between perceptions of individual vs institutional intention to change (18% vs 40%). Respondents agreed that beta-blockers improve patient outcomes. Only 14% considered themselves familiar with prescription recommendations, while 4% preferred making prescription decisions.

Conclusion: Knowledge and practice regarding preoperative CRA and prescribing of beta-blockers varied. Despite acknowledging their importance, surgeons do not prefer performing CRAs or initiating perioperative beta-blockade. Individuals are less likely and less ready to change practices than they perceive themselves to be as a group. Successful quality improvement will require standardized institutional goals with significant resources and education.

Impact of a Preoperative Medical Clinic on Operating Room Cancellation Rates in Orthopedic Surgery

Peter Kallas, Anjali Desai, Jeanette Bauer
Department of Medicine, Northwestern University, Northwestern Memorial Hospital, Chicago, IL

Background: A preoperative medical clinic has been in effect for 2 years for patients undergoing surgery at a major academic medical center.

Purpose: To better understand the impact of a preoperative medical clinic on operating room (OR) cancellation rates and hospital costs.

Methods: A cancellation registry created by the OR for "same day" cancellations over a 25-month period was analyzed. "Same day" was defined as a cancellation that did not allow enough time to rebook the OR before the day of surgery. Only cancellations labeled as "medical/cardiac evaluation needed" were included in the study. Also analyzed were the billing records

for the hospital for each case performed by the selected orthopedic surgeons. Lastly, billing records for the preoperative clinic were used to identify which patients passed through the preoperative clinic and which of these patients actually met with a physician. The study was limited to select services within the orthopedic surgery department that most utilize the preoperative clinic.

Results: Twenty-one orthopedic surgeons were included in the analysis. From October 2003 to October 2005, 8,961 cases were performed in the OR. Of these, 5,333 (59.5%) utilized the preoperative clinic, 912 of whom had a medical evaluation. The average net revenue for the hospital for each case performed by these surgeons during this time was $9,821.58. There were 68 same-day cancellations due to medical/cardiac issues. Sixty-two of the 3,628 patients who did not utilize the preoperative clinic prior to surgery had a cancellation, yielding a cancellation rate of 1.7%. Six of the 5,333 patients who did utilize the preoperative clinic had a cancellation, yielding a rate of 0.1%. A total of $668,000 of hospital revenue was lost during this 25-month period due to cancellations among these 21 surgeons. If the cancellation rate of the patients who did not utilize the preoperative clinic (1.7%) was applied to the 5,333 patients who did utilize the preoperative clinic, the hospital would have lost an additional $832,000.

Conclusion: A preoperative clinic staffed by internists can effectively reduce the same-day cancellation rate due to medical issues in an academic medical center and significantly reduce lost revenue due to cancellations.

Innovations in Perioperative Medicine

1 Best Safety Practices to Prevent Postoperative Myocardial Infarction

Evan Benjamin, Janice Fitzgerald, Gary Kanter, Michael Rothberg, Gina Trelease
Division of Health Care Quality, Baystate Medical Center, Springfield, MA

Background: Surgical complications are adverse outcomes that may occur after any surgical procedure. They include infection, deep vein thrombosis/pulmonary embolism, cardiac events, and ventilator-associated pneumonia. These complications lead to increased length of stay and increased morbidity, mortality, and patient suffering. This was the basis for the launch of the Surgical Infection Prevention Project (SIPP), which has evolved into the Surgical Care Improvement Project (SCIP). Aspects of SCIP are also part of the Institute for Healthcare Improvement's 100,000 Lives campaign and the Agency for Healthcare Research and Quality's Patient Safety Indicators. Postoperative myocardial infarction (POMI) is associated with a 25% mortality rate as well as increased costs ($14,000 per MI). One of the most effective strategies for preventing POMI is use of perioperative beta-blockade in eligible patients.

Purpose: To decrease rates of postoperative adverse cardiac events using a systems-level approach.

Description: Using a multidisciplinary approach and Plan-Do-Study-Act techniques, we developed standardized guideline and treatment recommendations for perioperative beta-blocker use. CPOE care sets were developed for preoperative, intraoperative, and postoperative use based on Mangano and ACP criteria. Moreover, we developed a formal preadmission evaluation beta-blocker eligibility guideline to screen at-risk patients during their PAE visit. In addition, a clinical effectiveness nurse screens patients for eligibility and prompts anesthesiologists and surgeons to prescribe beta-blockers for at-risk patients. Feedback is given to anesthesiologists and surgeons who do not prescribe beta-blockers for eligible patients. Finally, if a patient does suffer a POMI, the case is reviewed for correct coding and potential preventability. If an event is considered potentially preventable, the surgeon and/or anesthesiologist who cared for that patient is formally notified and reminded of the guidelines.

Results and Conclusions: Our continued efforts and focus on POMI have led to a sustained reduction from 0.55% (2003Q3) to 0.22% (2005Q4). This is associated with an increase in use of perioperative beta-blockade, especially in vascular patients (from 38% to 88%). Reduction of POMI by increasing the use of perioperative beta-blockade is a complex multistep process that fails due to multiple handoffs, lack of physician "ownership," and lack of education. By instituting a multidisciplinary approach at a systems level, we were able to increase perioperative use of beta-blockers and decrease the POMI rate.

2 Blog Web Site as a New Educational and Promotional Medium in Perioperative Medicine

Vesselin Dimov[1], Shahid Randhawa[2], Ajay Kumar[1], Joshua Schwimmer[3], Mitko Badov[4], Amir Jaffer[1]
[1]Section of Hospital Medicine, Department of General Internal Medicine, Cleveland Clinic, Cleveland, OH; [2]Private practice, Fort Lauderdale, FL; [3]Department of Medicine, Lenox Hill Hospital, New York, NY; [4]Lakeland Regional Medical Center, Lakeland, FL

Background: A blog (web log) is a sequential collection of text and pictures posted on a web site. Blogs require only basic computer skills to create and maintain. A commenting feature allows authors to receive immediate feedback from readers. Due to the increased interaction between readers and authors and the decreased time to publication, blogs are more dynamic and interactive than conventional web pages. The collection of blogs on the Internet is called "the blogosphere" and is doubling in size every 5 months. A new web log is created every second. There are only a few studies exploring the effect of this new medium on medical education.

Purpose: Our goal was to evaluate the impact of a blog as an educational and promotional medium in perioperative medicine.

Description: "Clinical Cases and Images" (clinicalcases.org) was created in 2005 at an academic teaching hospital with the goal of furthering medical education by publishing cases in perioperative medicine and other specialties. The authors were members of the Section of Hospital Medicine at the Cleveland Clinic and faculty members at Case Western Reserve University. The blog was provided and hosted free of charge by Blogger.com, a service owned by Google, Inc. All clinical cases were published in strict compliance with HIPAA regulations.

Results and Conclusions: After 1 year, the blog received more than 500,000 page views and 200,000 visitors from more than 97 countries. The source and number of visits to the blog were recorded. Most of the visitors came from the *British Medical Journal* and Medscape.com, which reviewed the blog favorably; from searches on Google and other search engines; and from links posted on other medical web sites.

The blog web site ranks high on the major search engines for many search queries. It has been among the top search results for "Cleveland Clinic Perioperative Summit" for several months, ranking close to or even surpassing the official web site of the summit.

In conclusion, a blog is an easy-to-use medium for publishing that has the potential to enhance education and to promote medical education events in perioperative medicine.

3 Development of a Validated Questionnaire: The Satisfaction with General Anesthesia Scale

Joseph Foss[1], Maria Inton-Santos[1], Marco Maurtua[1], Edward Mascha[2]
[1]Department of General Anesthesiology and [2]Department of Quantitative Health Sciences, Cleveland Clinic, Cleveland, OH

Background: Outcomes in anesthesia have focused on objective measures of morbidity and mortality. Anesthesiologists are interested in measuring patient satisfaction with their perioperative care. Dexter published the Iowa Satisfaction with Anesthesia Scale (ISAS) for patients undergoing monitored anesthesia care (MAC). No comparable instrument exists for patients who have undergone major regional or general anesthesia.

Purpose: To develop a scale that would reflect patient satisfaction with anesthesia care after general or major regional anesthesia for use with patients in the hospital.

Description: As part of the development of a larger postoperative outcomes database, a literature search for a validated patient

satisfaction survey was completed. The ISAS instrument, while not validated in this population, was used to examine the feasibility of using such a questionnaire to assess patient satisfaction. The questionnaire was initially used for patients undergoing major joint replacement, bariatric, major vascular, or liver transplant surgery under either general or regional anesthesia. A nurse visited the patients postoperatively and, after a chart review, asked the patients several questions about their care and then gave the patients the ISAS. Initial data collection was targeted towards acceptance by the patient and successful administration.

Results and Conclusions: In the first 3 weeks, 223 patients were identified as potential candidates and 163 (73.0%) were available for interview. Initial attempts to complete postoperative visits on POD1 yielded a low response, as many patients were not yet able to be successfully interviewed. The visit was moved to POD2 with an increase in the number of successful interviews but a small loss (in this population) of subjects who were discharged prior to the visit. Of the subjects available for interview, 82% answered all the questions. The nurse administering the questions had the best response with the paper format as opposed to verbal presentation of the questions. The ISAS was validated for use by patients who had undergone MAC and were ready for discharge from the recovery room; as expected, some of the items were confusing to patients who had received a general anesthetic. The feasibility of using such a questionnaire has been established, and a questionnaire appropriate for general anesthesia care is being revised for subsequent validation.

4 Perioperative Medicine and Pain: A Required Advanced Core Clerkship for Third-Year Medical Students

Amir Jaffer[1,4], Samuel Irefin[2,4], John Tetzlaff[2,4], J. Harry Isaacson[1,4], Andrew Fishleder[3,4], Michael Roizen[2,4]
[1]Department of General Internal Medicine, [2]Division of Anesthesiology and Pain Management, and [3]Division of Education, Cleveland Clinic; [4]Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH

Background: In the context of clinical curriculum redesign for the Case School of Medicine, a multidisciplinary group of physicians at the Cleveland Clinic Lerner College of Medicine helped develop educational objectives and organizational structure for a 1-month Advanced Core Clerkship in Perioperative Medicine and Pain. The clerkship was designed to build upon the content and skills acquired during experience in core disciplines of internal medicine, surgery, family practice, obstetrics/gynecology, pediatrics, psychiatry, and neurology.

Purpose: To outline the design, learning objectives, and curriculum content for the Perioperative Medicine and Pain Advanced Core Clerkship.

Description: The overall goals of this rotation are to help medical students acquire, develop, and enhance cognitive and technical skills in the medical care of the surgical patient through active learning. This 4-week advanced core curriculum will provide each student with the knowledge, skills, and attitudes necessary for trainees to evaluate and medically manage patients perioperatively and to appreciate the evaluation of acute and chronic pain **(Table)**.

Each student will spend 1 week in the Internal Medicine Preoperative Assessment, Consultation, and Treatment (IMPACT) Center and the Preanesthesia Evaluation Clinic (PACE); 1 week in the operating room and the PACU with anesthesiologists; 1 week on the internal medicine consult service, and 1 week on the acute pain service and the pain management clinic. Each week, students will meet for half a day with staff supervision to discuss cases on topics such as preoperative evaluation and testing, cardiac risk assessment, evidence-based risk reduction strategies, common postoperative complications (fever, VTE, MI, and wound infections), and management of acute and chronic pain. In addition, students will meet weekly to review an original article for journal club.

Results and Conclusions: We believe that by actively working with this multidisciplinary group of clinicians and teachers in managing medical problems of surgical patients, students will be better prepared for future resident training in any field. We expect this rotation to be valued highly by students and staff alike.

TABLE
LEARNING OBJECTIVES FOR THE PERIOPERATIVE MEDICINE AND PAIN ROTATION

1. Describe the role of the consultant and the principles and ethics surrounding medical consultation
2. Perform and document the complete preoperative assessment
3. Describe and demonstrate the elements of airway management
4. Describe the various intraoperative stressors
5. Demonstrate the ability to interpret hemodynamic monitoring
6. Apply principles of fluid management and blood resuscitation to the perioperative period
7. Evaluate and admit postoperative patients to the postanesthesia care unit (PACU) and the intensive care unit (ICU)
8. Describe the role of the ICU
9. Describe diagnosis/management of common postoperative complications (postoperative MI, pneumonia, VTE, delirium, and fever)
10. Perform a basic assessment of acute postoperative/procedural pain and develop an analgesic plan
11. Recognize and differentiate acute, chronic, malignant, and nonmalignant pain
12. Describe the principles of safe drug prescribing

5 Optimal Administration of Perioperative Antibiotics Using System Redesign

Gary Kanter[1,2], Janice Fitzgerald[2], Peter Lindenauer[2], Evan Benjamin[2]
[1]Department of Anesthesiology, Tufts University and Baystate Medical Center; [2]Department of Health Care Quality, Baystate Medical Center, Springfield, MA

Background: Surgical infection is a leading cause of injury, mortality, and excess costs. Of the nearly 30 million operations performed annually, 2.6% are complicated by infections. Fifty percent of these infections are thought to be preventable. In 2002 Baystate Medical Center was the Massachusetts representative for the national SIP Collaborative. The goal was to optimize outcomes by improving the use of evidence-based practices shown to reduce surgical infections. Practices included appropriate antibiotic use in terms of timing, correct antibiotic selection, and duration of therapy.

Purpose: To improve compliance with the SIP Collaborative national quality measures.

Description: After evaluation of our existing process improvement technique (Plan-Do-Study-Act [PDSA]), a complete process redesign of the perioperative system was completed. The system was (and is) continuously improved using small tests of change to ensure compliance and rate improvement. On-time antibiotic administration was defined as administration within 60 minutes prior to incision. Correct selection was based on national guide-

lines. Discontinuation was defined as stopping antibiotics within 24 hours of surgical end time.

Changes made included revised order sets in the CPOE system and the addition of prompts and standardized documentation in OR paperwork. Anesthesiologists were identified as most appropriate to administer the antibiotic. Preoperative booking forms were redesigned to simplify ordering. CPOE order sets were modified to limit antibiotic duration. Evidence-based education was provided to all "stakeholders." Physician "champions" were chosen to spread the science behind the measures. Results were displayed as a dashboard in all OR lounges, internal and external benchmarking was used to drive results, and physician report cards were used to identify and educate outliers.

Results and Conclusions: Our baseline rate of patients receiving prophylactic antibiotics within 60 minutes before incision was 29%. After redesign implementation, our most recent result is 97% (4th quarter 2005). The average baseline interval from antibiotic administration to incision was 71 minutes; the current interval is 23 minutes. Appropriate antibiotic selection was 95% at baseline and is now 100%. Discontinuation of antibiotics within 24 hours after surgery started was at 11% and is currently 82%. Use of rapid-cycle PDSA and other quality improvement techniques can improve compliance with evidence-based practices known to reduce surgical infection rates.

6 Blood Conservation Protocol with Erythropoietin in the Preoperative Period of Joint Replacement Surgery

Ajay Kumar[1], Vesselin Dimov[1], Martin Schreiber[2], Robert Helfand[3], Brian Parker[3], Victor Krebs[4], Amir Jaffer[1]
[1]Section of Hospital Medicine, Department of General Internal Medicine, [2]Department of Nephrology and Hypertension, [3]Department of General Anesthesiology, and [4]Department of Orthopaedic Surgery, Cleveland Clinic, Cleveland, OH

Background: Over 3,000 elective major joint replacements are performed at the Cleveland Clinic each year. Several methods to reduce allogenic blood transfusion are available, but utilization remains high. In 2004, 47,456 units of blood products were used in the perioperative period of various orthopedic surgeries at the Cleveland Clinic. Erythropoietin is approved by the FDA for treatment of anemic patients undergoing major joint replacement surgery, but its use has not been overwhelmingly embraced in clinical practice.

Purpose: Allogenic blood transfusions are associated with increases in the rate of postoperative complications and in length of stay. Our blood conservation protocol with erythropoietin provides a safe alternative to transfusion.

Description: We proposed a model of blood conservation using erythropoietin under the supervision of the Internal Medicine Preoperative Assessment, Consultation, and Treatment (IMPACT) Center with support from the Departments of Orthopaedic Surgery, Nephrology, and General Anesthesiology at the Cleveland Clinic.

The protocol for erythropoietin administration starts with a complete blood count ordered by the orthopedics office. If the hemoglobin level is 10 to 13 g/dL, an anemia panel is ordered (iron, total iron binding capacity, ferritin, vitamin B_{12}, and RBC–folate). Patients with iron deficiency anemia are referred to their primary care physician or a gastroenterologist for further evaluation. Patients with normochromic, normocytic anemia with a hemoglobin of 10 to 13 g/dL can benefit from treatment with erythropoietin in the perioperative period. These patients are then selected for the blood conservation protocol with erythropoietin injections on days 21, 14, 7, and 0 before surgery. Reticulocyte count, hemoglobin, and blood pressure should be checked prior to each injection. Patients with hemoglobin less than 10 g/dL, iron deficiency anemia, recent gastrointestinal bleed (within 3 months), uncontrolled hypertension, seizures, blood dyscrasias, or a history of thromboembolism are excluded from this protocol.

Results and Conclusions: Treatment of anemia in the perioperative period of major joint replacement surgery decreases the need for perioperative blood transfusion and improves outcomes. Erythropoietin use in this setting is FDA-approved and leads to significant benefit to qualified patients. Our blood conservation protocol using erythropoietin provides a well-defined framework that will be tested at the Cleveland Clinic shortly and can be further explored at other perioperative centers.

7 Evolution of the Nurse Practitioner (NP) Role in the Center for Preoperative Evaluation (CPE) at Brigham and Women's Hospital

Ellen Leary, Kathleen McGrath, Jeanne Lanchester
Brigham and Women's Hospital, Boston, MA

Background: The JCAHO requires that patients have a complete history and physical exam, nursing assessment, and anesthesia evaluation prior to surgery. It is the responsibility of the providers to make this process as efficient and smooth as possible.

Purpose: To fulfill all necessary preoperative requirements. To improve patient satisfaction, ensure quality, and improve efficiency. To increase the number of surgical services able to take advantage of the preoperative evaluation and preparation offered in the CPE by NP providers.

Description: Hired additional NP staff. Provided education and training to NP staff to care for new patient populations. Provided education to the NP staff in anesthesia assessment and evaluation. Restructured physical setting to improve patient access. Changed patient flow to allow patients to be seen in one location by all needed providers. Followed up with patient satisfaction survey.

Results and Conclusions: NP patients are seen by one provider rather than three. Increased patient satisfaction. Increased efficiency of patient flow. Provided preoperative assessment and evaluation to additional surgical services. Well-prepared patients. Critical and reliable information available at the time of surgery. Decrease in OR delays.

8 Development and Implementation of a Web Site for the Center for Preoperative Evaluation (CPE)

Kathleen McGrath, Susan Crimmins, Margaret Pothier, Jeanne Lanchester
Brigham and Women's Hospital, Boston, MA

Background: A number of patients with access to the Internet come to the CPE without vital information.

Purpose: To make the patient's visit to the CPE more efficient.

Description: Web site (Smartsleep/TM) created by Angela Bader, MD, and Margaret Pothier, CRNA. Web site address included in information sent to all patients with planned surgeries. Information supplied by patients is placed in patient chart prior to CPE visit.

Results and Conclusions: Use of web site allows patients to gather information at their convenience and provides a forum for patient to list questions or concerns. Information is available for review by staff prior to the patient visit. Positive feedback from patients and staff. Information from the web site currently populates the Cardiac Surgery web site and will populate others in the future. The Internet is a useful vehicle for communication for both patients and providers.

9 Patient Education Tool for the Preoperative Process and the Role of the Medical Consultant

Franklin Michota, MD, Amir Jaffer, MD
Section of Hospital Medicine, Department of General Internal Medicine, Cleveland Clinic, Cleveland, OH

Background: The preoperative process is often confusing for patients and family members. Many physicians may be involved, often with the appearance of redundancy. Patients undergo preoperative testing without a clear understanding as to the rationale or utility. A patient education tool describing the preoperative process and the role of the medical consultant would be expected to ease anxiety in the preoperative period.

Purpose: Develop a patient education tool regarding the preoperative process.

Description: Our patient education tool compares surgery to a plane flight, and the patient is the plane. This comparison helps highlight the preoperative process and clarifies the role of the medical consultant

The surgeon is the pilot, and the anesthesiologist is the copilot. Together, the pilots and the plane will take off and reach a stable cruising altitude so that surgery can take place. Once the surgery is complete, the pilots will need to descend and land the plane safely into the recovery unit. The medical consulant is the chief mechanic for the flight. The job of the chief mechanic is to "check out" the plane and give a report to the pilots so that they may develop their flight plan. The history and physical examination is the preflight checklist. Many patients will have received a preflight evaluation from their local physician; however, our pilots fly different planes everyday, so it is important for our mechanics to review and confirm any prior preflight evaluation. In addition, the chief mechanic may have you see specialty mechanics so that we can "rev your engines" (stress testing). Ultimately, the final decision to fly is up to the patient and the surgeon. Mechanics never tell pilots when or how to fly!

Results and Conclusions: Our patient education tool helps to clarify the role of the medical consultant in the preoperative process. This tool may reduce anxiety and address some commonly asked questions we receive in our preoperative clinic. This allows the medical consultant to spend more time on the preflight checklist as opposed to explaining why we are seeing the patient in the first place.

10 The Internal Medicine Perioperative Assessment Center: An Innovation in the Perioperative Management of Medical Comorbidities at a Comprehensive Cancer Center

Sunil Sahai, Jessica Wobb, Ellen Manzullo
Department of General Internal Medicine, Ambulatory Treatment and Emergency Care, The University of Texas M.D. Anderson Cancer Center, Houston, TX

Background: Cancer care has evolved from single-modality treatment to a multidisciplinary process that involves a team of providers from various oncologic specialties. The importance of medical comorbidities in cancer care is a subject of increasing awareness. In an effort to address the medical comorbidities that impact care of the surgical oncology patient, the Department of General Internal Medicine at the University of Texas M.D. Anderson Cancer Center developed the Internal Medicine Perioperative Assessment Center (IMPAC).

Purpose: We describe the goals, development, and structure of the IMPAC clinic. We also present data on the first 18 months of operation in regards to patient demographics and disease states.

Description: The IMPAC clinic was designed to facilitate the medical evaluation of cancer patients undergoing surgery. The current team consists of a physician, a nurse practitioner, a nurse, and a patient scheduler. Patients are referred for perioperative risk assessment and medical optimization prior to going to the operating room. Using clinical guidelines, patients are risk stratified and appropriate testing is done. Evidence-based risk-reduction strategies are employed such as perioperative beta-blockade and prophylaxis for postoperative venous thromboembolism. Perioperative anticoagulation issues are also addressed. Patients requiring close follow-up in the postoperative period by the inpatient internal medicine service are also identified.

Results and Conclusions: Based on review of billing data, 3,058 patient visits were recorded since inception of the program from November 2004 through May 2006. Of these 3,058 visits, 2,143 were new referrals to the program; the remainder were follow-up visits. Patient volumes increased steadily from 39 patients in November 2004 to 284 in May 2006. Overall, the average age was 67 years for men (46.6%) and 65 years for women (53.3%).

In regards to type of cancer, the analysis reflected the order in which the IMPAC clinic was rolled out to the institution, with head and neck cancer patients representing the largest share of referrals (36%), followed by patients with gastroenterologic (17.5%), breast (12%), and gynecologic (11%) cancers.

In terms of frequency of diagnosis, hypertension was the most frequent diagnosis at 63%, followed by dyslipidemia (24.9%), diabetes (22.5%), coronary atherosclerosis (16.4%), and obesity (10.7%).

Based on the initial success of the IMPAC program, we anticipate further growth in clinical and research activities.

11 PAC Collaborative Practice Model

Donna Sassi, Terry Dagesse, Sharon Dismore, Donna Serafin, Maryanne Rinaldi, Stephanie Laude
MidState Medical Center, Meriden, CT

Background: The preoperative admission process was often rushed because of unnecessary delays in preoperative testing until the day of surgery for unidentified high-risk patients who had been booked for surgery 13 days in advance. This resulted in patient, surgeon, and anesthesia dissatisfaction due to delays, as well as cancellations on the day of surgery due to positive preoperative test results.

Poor communication of patient information between the surgeon's office and pre-admission department resulted in multiple telephone calls, high-risk patients not being identified at the time of booking, and consults not being done in a timely fashion.

Purpose: Our objective was implementation of a collaborative practice model that assures safe and positive patient outcomes.

Description: Process of implementation:

1. Internal assessment of present workflow processes
2. Identify roles for PAC and surgeon's office (as well as patient preparation)
3. Develop an action plan timeline
   a) Pilot program times 6-month duration
   b) Development of a surgical protocol sheet given to patients at time of booking; it directs patients to call us "on a hotline" if they have any high-risk diagnosis
   c) Development of preoperative testing guidelines
   d) Educational meetings with surgeon's office
   e) Each office assigned to PAC coordinator
   f) Develop internal process. Identify key functions for PAC coordinator.

After implementation as stated, testing on the day of surgery was limited to those patients added to the schedule 48 hours prior to surgery (as opposed to patients booked 13 days before surgery).

Results and Conclusions: Patients ready for surgery in a safe and timely fashion; patient, nurse, anesthesia, and surgeon satisfaction.

Development of an infrastructure that provides each patient with the preoperative preparation and testing appropriate to his or her scheduled surgery and medical history, thereby insuring practice standards.

12 Development and Implementation of Beta-Blocker Recommendation

Valerie Watkins, Katie Conyers, Sandy Godcharles, Robert Page
Pre-Procedure Service, University of Colorado Hospital, Denver, CO

Background: We had no current policy or guidelines for the use of beta-blockers. Surgeons and anesthesiologists were not consistent with the use of beta-blockers; due to a lack of policy and changing data, there was even some inconsistency between preoperative NP.

Purpose: Create an updated, thorough, specific guideline on the use of beta-blockers and follow-up monitoring. Educate surgeons, anesthesia, and staff to have an understanding of the use of beta-blockers in the appropriate patient population.

Description: Provide an algorithm along the preprinted preop and postop orders for provider use. Educate appropriate providers, perianesthesia staff, and floor nurses about the guidelines:

—Taken to OR committee meeting for input from physicians
—Surgical service.

Results and Conclusions:

- Successful practice identified:
  —Decreased mortality/morbidity for high-risk patients
  —Feedback and recommendations received from providers as well staff nurses
- Positive outcome achieved:
  —Use of beta-blockers decreases mortality and morbidity in high-risk patients
- Implications for perianesthesia nursing:
  —Consistent use of guidelines/algorithm for preop, postop, and floor nurses to follow.

13 Development of Pre-Procedure Consult Services

Valerie Watkins, Katie Conyers, Jose Melendez
Pre-Procedure Service, University of Colorado Hospital, Denver, CO

Background: Lack of resources makes it difficult to see all surgical/anesthesia patients prior to surgery. Look at a way to be more efficient and cost-effective for the hospital.

Purpose:

- Increased appointments for those that need extensive work-up
- Decrease day-of-surgery work-up on complicated patients
- Convenience to healthy patients not having unnecessary appointment
- Be financially independent

Description:

- We developed a Self-Health Assessment (SHA) to be completed by patients at their clinic visit. The SHA reviews medical history related to cardiac and respiratory issues.
- The SHA is faxed to Pre-Procedure Services and reviewed by an RN.
- An algorithm was developed and evaluated for patients at greatest risk of perianesthesia complications.
- NPs order only pertinent labs, ECGs, and tests such as stress tests and cardiology consults.

Results and Conclusions:

- Successful practice identified:
  —Decreased delays on complicated patients
  —Increased satisfaction for healthy patients
- Positive outcome achieved:
  —Generated revenue that covers most of our clinic costs
  —Patients seen have very thorough work-up
  —Healthy patients appreciate consideration of their busy schedules
- Implications for perianesthesia nursing:
  —Decreased frustration for perianesthesia nurses who are trying to see too many patients in too little time.

Perioperative Clinical Vignettes

14 Isolated Left Bundle Branch Block in a Patient Undergoing Elective Noncardiac Surgery

Thadeo Catacutan, Ali Usmani, Amir Jaffer
Section of Hospital Medicine, Department of General Internal Medicine, Cleveland Clinic, Cleveland, OH

Case Presentation: A 55-year-old man with history of hyperlipidemia presents for a preoperative evaluation prior to left total knee replacement. He swims ten laps in an olympic pool three times a week. He denies a history of coronary artery disease (CAD). Family history is significant for hypertension. Physical examination reveals a temperature of 37°C, BP of 118/80 mm Hg, HR 60, RR 14, and a BMI of 22 kg/m^2. The remainder of the physical exam is normal, as are laboratory tests. His ECG shows a left bundle branch block (LBBB) with no prior ECGs for comparison.

What is the best way to proceed?

1. Perform an exercise thallium test
2. Start a beta-blocker perioperatively
3. Proceed with surgery
4. Refer for left heart catheterization

Discussion: The etiology of bundle brunch blocks (BBB) includes age-related degeneration of the conduction system, ischemia, valvular abnormalities, and cardiomyopathy. BBB in the absence of cardiac disease and hypertension may be called isolated BBB. The prevalence of BBB increases from 1.2% at age 50 to 17% at age 80. Isolated right BBB has an excellent long-term prognosis. However, isolated LBBB increases the risk of developing cardiac disease and warrants closer follow-up. Furthermore, in patients with established heart failure (HF) and CAD, LBBB is an independent risk factor for mortality.

The dilemma for clinicians when faced with an incidental finding of LBBB prior to elective surgery is whether to perform additional investigations. Our answer is "no" since the prevalence of ischemic heart disease in asymptomatic patients with BBB is low. As such, those without overt signs and symptoms of HF or CAD do not require extensive preoperative cardiac evaluation. In fact, the ACC/AHA guidelines consider BBB a minor clinical predictor. In patients with LBBB, rare symptomatic bradycardias can occur intraoperatively but can be managed medically. Temporary cardiac pacing is seldom needed since progression into complete heart block is rare.

Conclusion: Our patient has an isolated LBBB without HF or CAD. He has only a minor clinical predictor—ie, an abnormal ECG finding—in the setting of excellent functional class and is undergoing an intermediate-risk surgery. Therefore, additional stress testing would not be required and he can proceed to the planned surgery.

15 Avoiding Delirium

Kathleen Franco, Isabel Schuermeyer, Leopoldo Pozuelo, George Tesar
Department of Psychiatry and Psychology, Cleveland Clinic, Cleveland, OH

Case Presentations: We discuss two elderly patients with severe prior delirium and mild dementia who began treatment with donepezil prior to their next surgery and avoided significant confusion. We believe this can augment other protocols that require added nursing and therapy effort and for which compliance is more difficult to assure.

An 82-year-old male experienced 10 days of severe delirium after CABG. Multifactorial delirium was treated by reducing analgesics, maintaining supplemental oxygen, titrating hydration, and providing low-dose intravenous haloperidol. The patient, family, physicians, and nurses were all concerned about the likelihood of a second prolonged delirium when a valve replacement was recommended. The patient's mini-mental status exam (MMSE) score was 26/30 after the delirium cleared. Anesthesia was notified and donepezil 5 mg was given for 3 days. He was mildly confused on postoperative day 1 but had cleared by the morning and was able to return home with his wife on postoperative day 5.

A 75-year-old female had a history of two prior episodes of delirium postoperatively after CABG. This retired teacher had a MMSE score of 25/30 and was started on donepezil 3 days prior to valve replacement. She did not experience delirium and was discharged on postoperative day 7.

Discussion: Rates of postoperative delirium are reported to range from 11% to 44%. Delirium increases the likelihood of nursing home placement and overall mortality. Aspiration pneumonia, skin breakdown, and falls are common sequelae of delirium that further increase length of stay and costs. Elderly patients with dementia or prior delirium are at particularly high risk. APOe4 polymorphism is less effective in reducing inflammatory responses in the brain and increases risk for dementia and delirium. Specific protocols reduce the frequency and length of mild to moderate cases but are less successful in preventing severe delirium. Although cholinesterase inhibitors are controversial prior to intraoperative succinylcholine, they may help selected patients.

Conclusion: In addition to appropriate levels of mental and physical stimulation, supplemental oxygen, careful monitoring of hydration, nutrition, and sleep, and the use of glasses and hearing aids, cholinesterase inhibitors may be useful to reduce the risk for delirium in patients on a delirium-dementia spectrum. Anti-inflammatory agents may also benefit these patients.

16 Cardiac Sarcoma—The Role of Multimodality Cardiovascular Imaging

Girish Mood[1], Anthony Bavry[1], Manuel Cerqueira[1], Paul Schoenhagen[1], David Strasser[2], Brian Griffin[1]
[1]Department of Cardiovascular Medicine, Cleveland Clinic, Cleveland, OH; [2]Department of Cardiology, Hamot Heart Institute, Erie, PA

Case Presentation: The patient is a 43-year-old Caucasian female who presented with new onset of frequent palpitations for 3 weeks. There was no known history of cardiovascular disease, smoking, or alcohol or intravenous drug abuse. An echocardiogram revealed multiple echo-densities in left and right atria, as well as attached to the mitral valve. Initial concern was possible infective endocarditis.

On examination, the patient was moderately built and in no distress. Her heart rate was 76 beats per minute and regular, and

a 3/6 holosystolic murmur was heard in the mitral area with no "plop." There was no jugular venous distention or extremity edema noted. The rest of the clinical examination was unremarkable. Chest x-ray was normal and electrocardiogram showed normal sinus rhythm.

Discussion: Multimodality imaging is performed for better preoperative definition of tumors. Transthoracic and transesophageal echocardiography remains the primary test done in the diagnosis of tumors of the heart. This is because of its wide availability and its superior temporal resolution and real-time imaging capability with superior identification of valvular structures.

Cardiac MRI provides clinically relevant anatomic and functional information noninvasively and with minimal risk. A distinct advantage of MRI is its superior tissue characterization. The advantage of cardiac CT scanning is its superior spatial resolution and the ability to reconstruct the 3-D data set along any desired plane, almost like performing exploratory surgery on a computer screen. Positron emission tomography (PET) of the heart allows the study and quantification of various aspects of heart tissue function. Its use in research has provided novel observations in cardiac physiology and pathophysiology.

In our patient, an initial echocardiogram suggested the possibility of a tumor but also considered the diagnosis of possible endocarditis. Subsequent multimodality imaging with cardiac MRI, CT, and PET scans provided improved anatomic and physiologic characteristics of the tumor that were suspicious of a malignant process. These findings were confirmed by the operative findings.

Conclusion: A thorough preoperative evaluation of cardiac tumors with the use of echocardiography and cardiac MRI, CT, and PET scans guided us in choosing subsequent treatment.

17 Asymptomatic Bacteriuria before Nonprosthetic Joint Surgery

Anitha Rajamanickam, Vesselin Dimov, Ali Usmani, Saira Noor, Ajay Kumar
Section of Hospital Medicine, Department of General Internal Medicine, Cleveland Clinic, Cleveland, OH

Case Presentation: A 73-year-old female is undergoing a preoperative evaluation for right hip arthroscopy scheduled in 3 days. The urinalysis (UA) ordered by her orthopedic surgeon reveals asymptomatic bacteriuria without leukocyturia. She has has normal vital signs and a normal physical examination, and the rest of the laboratory results are unremarkable.

What is the best approach to asymptomatic bacteriuria in this patient?

1. Start antibiotic treatment and proceed with surgery as scheduled
2. Start antibiotic treatment and postpone surgery until she completes her treatment course, then repeat UA to ensure that the bacteriuria has resolved
3. Proceed with surgery without any further treatment

Discussion: In most surgical centers, orthopedic surgeons routinely order preoperative UA to detect urinary tract infections (UTI) in the preoperative period of joint surgery. Approximately $7 million is spent annually in the United States on preoperative UA and consequent treatment of bacteriuria and/or UTI. A retrospective study of 200 patients undergoing clean-wound, orthopedic nonprosthetic knee procedures found that 15% of UA results were abnormal. Twenty-nine percent of patients with UA suggestive of UTI were treated. The study found no difference in frequency of wound infections between patients with normal UA and those with abnormal results. A review of the medical literature shows that routine antimicrobial therapy is not justified in asymptomatic patients with bacteriuria, except before urologic surgery, during pregnancy, and possibly in surgeries involving prosthetics.

Conclusion: There is no clinical evidence that preoperative asymptomatic bacteriuria is associated with infective complications in the postoperative period of nonprosthetic joint surgery. Routine preoperative UA in non–urinary tract surgeries seems both unnecessary and cost-ineffective. Our recommendation to this patient was to proceed with surgery without antibiotic treatment.

18 Negative T Waves on the Preoperative Electrocardiogram—A Cause for Worry?

Chetan Shenoy
Department of Internal Medicine, Guthrie/Robert Packer Hospital, Sayre, PA

Case Presentation: A 48-year-old male was seen for preoperative evaluation prior to knee replacement surgery for osteoarthritis. He denied symptoms of coronary artery disease. He had well-controlled systemic hypertension and gastroesophageal reflux disease, as well as a family history of premature atherosclerotic heart disease. His medications included hydrochlorothiazide and lansoprazole. Physical exam was significant only for obesity, with a BMI of 32 kg/m^2. His blood pressure was normal. A preoperative 12-lead resting electrocardiogram (ECG) displayed a sinus rhythm with a rate of 79 bpm with marked negative T waves in the V1–V4 leads. Cardiology was consulted and coronary angiography was performed in view of his cardiac risk factors, which revealed normal coronary arteries. Left ventriculography demonstrated normal function. Repeat ECG a few hours following the cardiac catheterization revealed sinus rhythm at a rate of 100 bpm with a left bundle branch block (LBBB) pattern. The negative T waves on his initial ECG were explained by cardiac memory in the setting of his intermittent LBBB. He was started on beta-blocker therapy and had an uneventful surgery and postoperative course.

Discussion: An ECG is a common feature of the preoperative evaluation. In asymptomatic patients without known coronary artery disease, T-wave abnormalities usually portend cardiovascular morbidity and mortality. An important but underrecognized cause of T-wave abnormalities is the phenomenon of cardiac memory, characterized by persistent but reversible negative T waves on ECG that occur after resumption of normal atrioventricular conduction following a period of altered ventricular activation. Prolonged alteration of the activation sequence has a variety of causes, including intermittent LBBB, ventricular pacing, ventricular tachycardia, ventricular extrasystoles, and ventricular pre-excitation. It is important to identify negative T waves of cardiac memory because they have no clinical or pathological significance and do not predict worse cardiovascular outcome. Cardiac memory is not associated with hypertrophy, hemodynamic abnormalities, or reduction in myocardial perfusion.

Conclusion: Negative T waves on preoperative ECGs in asymptomatic patients without known coronary artery disease should be interpreted keeping in mind the phenomenon of cardiac memory. Causes of altered activation sequence—such as intermittent LBBB—should be excluded before investigating for coronary artery disease, especially in low-risk patients.

19 Preoperative Hypokalemia

Ali Usmani, Priyanka Sharma, Saira Noor
Section of Hospital Medicine, Department of General Internal Medicine, Cleveland Clinic, Cleveland, OH

Case Presentation: A 70-year-old female with history of hypertension, coronary artery disease, and a myocardial infarction (MI) 2 years ago is being seen for preoperative evaluation for open cholecystectomy scheduled for the next day. She exercises on a treadmill for 30 minutes every day. Her last stress test 2 months ago was negative for ischemia. Current medications include metoprolol, hydrochlorothiazide, and aspirin. Physical examination, including vital signs, is unremarkable. Her electrocardiogram shows NSR with Q waves in the inferior leads consistent with a prior inferior MI. Labs are normal except for potassium level of 3.3 mmol/L.

What is the best way to proceed?

1. Give oral potassium replacement and recheck levels before surgery
2. Give intravenous potassium before induction of anesthesia
3. Proceed with surgery
4. Postpone surgery

Discussion: The incidence of perioperative hypokalemia varies depending on definition criteria, comorbidities, and medications, with a prevalence of 2.9% in patients undergoing cardiac bypass surgery. Low potassium (K) levels are thought to predispose to dysrhythmia during anesthesia. After MI, the incidence of ventricular fibrillation increases from 3.5% to 8% in the presence of K levels below 3.5 mmol/L. Wahr et al looked at more than 2,400 cardiac patients undergoing cardiac bypass surgery, showing that K values less than 3.5 mmol/L increase the risk of perioperative and intraoperative arrhythmias and postoperative atrial fibrillation/flutter. Similarly, Shah et al have shown hypokalemia to be an independent risk factor for mortality in patients undergoing noncardiac surgery. No studies have been done to determine if preoperative K replenishment reduces complications.

In a smaller study of 150 patients undergoing cardiac or noncardiac surgery, Vitez et al did not find significant dysrhythmia among hypokalemic patients. Hirsch et al looked at 447 patients and also failed to show an association between hypokalemia and cardiac complications.

Conclusion: Hypertension, diuretic use, female sex, and a history of arrhythmias are commonly associated with hypokalemia. Given that our patient had significant hypokalemia and oral K replacement has minimal risks, we chose to hold her diuretic, replace K orally, and recheck electrolytes.

20 Preoperative Evaluation Can Aid in the Diagnosis of CAD and Risk Assessment and Management

Zdravka Zafirova, Bobbie Sweitzer
Department of Anesthesia and Critical Care, The University of Chicago, Chicago, IL

Case Presentation: A 50-year-old physician with hypertension was seen in the perioperative clinic for laparoscopic cholecystectomy. He denied personal or family history of cardiac disease or smoking and had an exercise tolerance of 8 METs. He was taking lisinopril. He had a BMI of 28.8, BP of 132/83 mm Hg, and HR of 79 beats per minute. ECG revealed a right bundle branch block and inferior infarct of undetermined age. During a subsequent stress test he achieved 16 METs without chest pain, but SPECT imaging showed abnormal wall motion at rest in the RCA distribution, partially reversible exercise-induced ischemia in a multivessel distribution, and a fixed apical inferior defect. Cardiac catheterization showed no significant epicardial disease and an ejection fraction of 45% with posterobasal hypokinesis. His lipid panel was abnormal. Therapy with a beta-blocker, a statin, and aspirin was initiated.

Discussion: This patient had no intermediate or high risk factors, had excellent exercise tolerance, and was scheduled for an intermediate-risk procedure. According to the ACC/AHA guidelines for preoperative testing, he would not need further cardiac work-up. The ECG showed a myocardial infarction—an intermediate or high risk factor, depending on the timing. Further testing would identify myocardium at risk and the need for risk modification. The evidence of a prior cardiac event and of abnormal function prompted the initiation of aggressive medical management.

Reduction in morbidity and mortality associated with ischemia can be achieved with therapy directed at disease progression and at neurohormonal activation with remodeling. Reduction of blood pressure has resulted in a decrease in the risk of death from coronary artery disease or stroke by 30% to 50%. Normalization of lipids and the effects of statins on endothelial function contribute to improved outcomes. ACE inhibitors and angiotensin II receptor blockers attenuate ventricular remodeling in patients with myocardial ischemia. Beta-blockers result in reversal of remodeling and have significant impact on cardiac function and mortality.

Conclusion: The role of the perioperative evaluation is not limited to the optimization of patients for a surgical procedure. It provides an opportunity for risk assessment and interventions extending beyond the immediate anesthetic and surgical issues. The preoperative visit of this patient revealed unsuspected cardiac disease and resulted in appropriate steps for risk stratification and modification with significant potential for reduction in morbidity and mortality.

Research in Perioperative Medicine

21 Needs Analysis for the Development of a Preoperative Clinic Protocol for Perioperative Beta-Blockade

Darin Correll[1], Angela Bader[1], Joshua Beckman[2], Robert Klickovich[1], Kenneth Park[1], David Hepner[1]
[1]Department of Anesthesia, Perioperative and Pain Medicine and [2]Cardiovascular Division, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Background: Successful institutional implementation of perioperative beta-blockade involves the development of an interdisciplinary hospital protocol that is likely to be most effective when implemented prior to the day of the surgical procedure. This can be difficult, however, as it requires education across a number of provider disciplines in the institution, review of preoperative prescriptive privileges, standardization of preoperative processes that may be currently left to individual providers, monitoring, and accountability. Our hypothesis was that a significant number of patients who are candidates for perioperative beta-blockers would not be receiving them adequately in the perioperative period. This study describes a needs analysis for perioperative beta-blockade based on evaluation of consecutive elective noncardiac surgical patients presenting to a preoperative clinic.

Methods: An algorithm of indications and contraindications for beta-blockade felt to be consistent with the existing literature was designed by multidisciplinary group consensus **(Table)**. Complete data were collected prospectively on 1,000 consecutive patients seen between June 1, 2004, and August 31, 2004. Data collected included patient demographics, medication history, risk factors, indications and contraindications to beta-blockade, as well as surgical risk stratification and postoperative complications.

Results: Of the 1,000 patients studied in the preoperative clinic, 960 underwent surgery and had complete information collection; 169 patients (17.5%) were already receiving beta-blockade therapy. Of the patients having high-risk surgery, 89% (42/47) had indications for beta-blockade; 31 (74%) of these did not have contraindications. Of the other patients, 60% (450/744) had indications for beta-blockade; 380 (84%) of these did not have contraindications. Overall, 71% (411/580) of the patients who were candidates for perioperative beta-blockade were not receiving it. Of the 38 patients with postoperative cardiac complications, 23 (61%) who were not on beta-blockers ($P < .001$) would have qualified for therapy.

Conclusion: Development, implementation, and monitoring of perioperative beta-blockade protocols is necessary, as a significant number of appropriate patients were not receiving this therapy. The use of such algorithms requires education, organizational strategies, and study of quality-related outcomes.

TABLE
INDICATIONS FOR PERIOPERATIVE BETA-BLOCKADE

Major indicators	Minor indicators
History of angina	Age > 65 yr
History of coronary artery disease	History of renal insufficiency (Cr > 2)
History of congestive heart failure	Current smoking history
History of cerebrovascular accident	History of hypertension
History of diabetes	History of hypercholesterolemia

22 Improving Efficiency in a Preoperative Clinic

Miriam Harnett[1,2], Darin Correll[1,2], Angela Bader[1,2], David Hepner[1,2]
[1]Department of Anesthesia, Perioperative and Pain Medicine, Brigham and Women's Hospital, [2]Harvard Medical School, Boston, MA

Background: Preoperative assessment testing clinics coordinate preoperative surgical, anesthesia, nursing, and laboratory care and allow for medical optimization of patients preoperatively and transmission of information to the operating room team. Performance of this evaluation is ideally practiced in the setting of high patient and family satisfaction. Previously we demonstrated higher satisfaction scores among patients evaluated by a nurse practitioner (NP) than among patients seen by other providers.[1] As a follow-up we hypothesized that having NPs perform all the preoperative assessment, including the anesthesia component, would increase efficiency.

Methods: A change in provider function was implemented so that a single NP performed the surgical, nursing, and anesthesia assessments in one room while also having the laboratory technician do blood work and ECGs in the same room. Concurrently, we introduced sessions on patient relations and teamwork for our staff. We developed a one-page questionnaire, consisting of questions on satisfaction with clinical and nonclinical providers, and distributed it to all patients in the clinic during two different cycles in 2005 and 2006.

Results: Analysis of results for 2005 revealed that patients reported a high level of overall satisfaction for visits with clinical providers; satisfaction was lowest for nonclinical aspects of the visits, with waiting time having the lowest satisfaction rating, rated fair or poor by 16% and 24% of patients, respectively. Reasons for prolonged waiting times included multiple providers performing assessments in different rooms with waiting periods between each provider.

After implementation of the change, we compared these 2005 data with new questionnaire data from 2006. Waiting time was reduced from 92 minutes to 41 minutes (P ☒ .0001). Responses to all questions shifted in the positive direction. Questions directly addressing waiting time and receptionist interaction with patients demonstrated substantial improvement. The most striking change was in response to the question about waiting time; the percentage of "excellent/good" responses increased from 59.7% to 69.2% **(Table)**.

Conclusion: Analysis of patient flow and clinic operations led to alterations in operational patterns, which resulted in continued high clinical effectiveness and reduced waiting time, characteristics that are likely to improve patient satisfaction and overall efficiency of preoperative assessment testing clinics.

1. *Hepner DL, Bader AM, Hurwitz S, et al. Patient satisfaction with preoperative assessment in a preoperative assessment testing clinic. Anesth Analg 2004; 98:1099–1105.*

TABLE
PERCENTAGE OF PATIENTS REPORTING HIGH SATISFACTION SCORES

Question	2005	2006
Efficiency of receptionist	96.6	99.5*
Length of time waiting	59.7	69.2*
Overall care received	98	98.5†

* $P < .01$; † P = NS

23 Formalized Preoperative Assessment for Noncardiac Surgery at a Large Tertiary Care Medical Center Leads to Higher Rates of Perioperative Beta-Blocker Use

Amir Jaffer[1], Brian Harte[1], Eric Hixson[2], Brian Parker[3], Ashish Aneja[1], Vikram Kashyap[4], Raymond Borkowski[3], Walter Maurer[3], Vaishali Singh[1], Michael Militello[5], Leonardo Rodriguez[6], Daniel Brotman[9], Venkatesh Krishnamurthi[7], Franklin Michota[1], Sue Vitagliano[8], Michael Henderson[2,8]

[1]Department of General Internal Medicine, [2]Quality and Patient Safety Institute, [3]Department of General Anesthesiology, [4]Department of Vascular Surgery, [5]Department of Pharmacy, [6]Department of Cardiovascular Medicine, [7]Glickman Urological Institute, [8]Division of Surgery, Cleveland Clinic, Cleveland, OH; [9]Department of Medicine, Johns Hopkins Hospital, Baltimore, MD

Background: Several randomized and observational trials in the past decade and the more recent ACC/AHA guidelines support the use of preoperative beta-blockers in select patients. National patient quality and safety groups continue to advocate for the administration of preoperative beta-blockers (PBB) for noncardiac surgery (NCS) and measure its use as a marker of quality. We sought to determine the prescription of PBB and the predictors of use in preparation for NCS at a large tertiary care academic medical center.

Methods: We performed a retrospective cohort study of 12,848 patients from January to December 2005 who had an elective NCS requiring at least an overnight admission to the hospital. Patients were identified from the surgery scheduling system. The following data were abstracted from hospital information systems and combined into a single data set for analysis: demographics; preoperative outpatient assessment, functional status, and anesthesia risk; laboratory results; prescribed medications; type of surgery; and hospitalization data . A multilevel model examined factors associated with the probability of preoperative patient assessment in the IMPACT (Internal Medicine Preoperative Assessment, Consultation, and Treatment) Center and, secondly, factors associated with perioperative prescription of beta-blockers.

Results: Overall, the rate of preoperative patient assessment in the IMPACT Center run by hospitalists was 56.2%. The crude rate of PBB use was 25.4%. Patient age, gender, higher anesthesia risk (assessed by our computerized program called Health Quest), and surgical specialty were significant independent predictors of preoperative patient assessment in the IMPACT Center. A formal preoperative assessment in the IMPACT Center was a significant independent predictor of PBB use controlling for patient age, beta-blocker eligibility, and surgical specialty (adjusted OR, 19.4 [$P < .001$]).

Conclusion: PBB are significantly more likely to be prescribed to patients undergoing NCS when patients are evaluated in formalized preoperative assessment centers staffed by hospitalists or internists such as ours. Further research is under way to investigate whether the higher use of PBB actually translates into better clinical outcomes (with fewer cardiac events) and decreased length of stay.

24 Insulin Errors in Hospitalized Patients

Deborah Ross[1], Amir Hamrahian[1], Mary Beth Modic[2], Byron Hoogwerf[1], Elias Siraj[1], Sethu Reddy[1]

[1]Department of Endocrinology, Diabetes and Metabolism and [2]Department of Nursing Education, Cleveland Clinic, Cleveland, OH

Background: Insulin errors are among the most common medication errors among hospitalized patients. Few data exist on analyses of the type and impact of such insulin errors on patient care. With increasing efforts at intensive glycemic control in the hospital setting, any variable that compromises glucose control must be evaluated.

Aims: To analyze the rate, types, and effects of insulin administration errors on hospital units.

Methods: A diabetes nurse practitioner prospectively reviewed records of diabetic patients recieving insulin on hospital units at a tertiary care center for up to 5 days after endocrine service consultation. Nine types of insulin errors (eg, omission, wrong dose, wrong time) and associated levels of harm were studied. We conducted five surveys of 30 consecutive patients per survey over a 2-year period. Through close collaboration with the Department of Nursing Education, lunchtime in-services were provided on the nursing units and a formal 16-hour diabetes education program for nurses was offered following the first survey.

Results: A total of 150 patients were followed for an average of 4.2 days. The most common type of insulin error was omission error. Through nursing floor focus group discussion, we discovered that the most common reason for omission error was nutrition interruption and fear of hypoglycemia. The **Table** presents the total number of errors, total number of insulin injections, and percentage of injections that involved an error for each of the five surveys.

Conclusion: Careful monitoring of insulin errors and nursing education may reduce the risk for insulin errors on hospital units. Our survey indicates that the most common insulin error on hospital units is omission error due to nutrition interruption and the fear of hypoglycemia. Most insulin errors resulted in no harm or required only temporary monitoring.

TABLE
FINDINGS FROM THE FIVE SURVEYS

	Survey				
	1	2	3	4	5
No. patients	30	30	30	30	30
No. insulin errors	12	16	9	11	9
Duration of survey (days)	3.56	4.46	4.36	3.8	4.76
Total no. of insulin injections	427	535	523	456	571
Percentage error (%)	2.8	3	1.7	2.4	1.6

25 A Survey of Perioperative Beta-Blockade at a Comprehensive Cancer Center

Sunil Sahai[1], Anne Porter[1], Ellen Manzullo[1], Tayab Andrabi[2], Laurence Holmes[1]

[1]Department of General Internal Medicine, Ambulatory Treatment and Emergency Care and [2]Department of Anesthesia and Pain Medicine, The University of Texas M.D. Anderson Cancer Center, Houston, TX

Background: This study seeks to determine the number of cancer patients who qualify for perioperative beta-blockade but for whom the opportunities to prescribe are missed. Additionally, this study will attempt to determine the extent to which preoperative assessment by an internal medicine physician is successful in addressing this problem.

Methods: This retrospective chart review included 300 medical records from the University of Texas M.D. Anderson Cancer Center. Patients were eligible if they attended a preoperative anesthesia consultation during May 2005 and met the following clinical guidelines for perioperative beta-blockade: two or more

minor risk factors (age > 65 years, hypertension, tobacco use, hypercholesterolemia, and non–insulin-dependent diabetes) or one or more major risk factors (high-risk surgery, coronary artery disease, ischemic heart disease, stroke, insulin-dependent diabetes, creatinine > 2.0 mg/dL). The electronic medical record was used to determine whether patients were on beta-blockers at the time of anesthesia assessment and whether they attended a preoperative consultation with Cardiology or with the Internal Medicine Perioperative Assessment Center (IMPAC). The study was approved by the institutional review board at the University of Texas M.D. Anderson Cancer Center.

Results: Overall, 52.7% of patients determined to be eligible for beta-blockade received this therapy. Within this percentage 73.4% were prescribed beta-blockade prior to becoming a candidate for surgery and 26.6% were specifically prescribed perioperative beta-blockade. Patients who attended IMPAC were 49% more likely to have beta-blockade at the time of anesthesia assessment than patients who did not attend IMPAC (OR, 1.49; 95% CI: 1.32 to 1.70).

Conclusion: The percentage of patients in this study who received perioperative beta-blockade was higher than predicted by the literature. However, many of the patients who received beta-blockers at the time of assessment were taking them for long-term treatment of other comorbid conditions. Only 22.8% of the patients who were eligible for perioperative beta-blockade and who were not already on beta-blockers were prescribed such prior to surgery. Among patients who attended IMPAC and who were not previously on beta-blockade, 80.4% were prescribed perioperative beta-blockade by IMPAC. These results strongly suggest that preoperative assessment by an internal medicine physician may increase a patient's chances of receiving therapies known to reduce risk during surgery.

26 Risk Factors for Long-Term Mortality among Heart Failure Patients after Elective Major Noncardiac Surgery

Olivia Cai[1], Christopher Phillips[1], Daniel Brotman[2], Christopher Whinney[1], Franklin Michota[1], Mario Garcia[3], Ashok Panneerselvam[4], Eric Hixson[4], Brian Parker[5], Amir Jaffer[1]

[1]Section of Hospital Medicine, Department of General Medicine, Cleveland Clinic, Cleveland, OH; [2]Hospitalist Program, Department of Medicine, Johns Hopkins Hospital, Baltimore, MD; [3]Departments of Cardiovascular Medicine, [4]Quantitative Health Sciences, and [5]General Anesthesiology, Cleveland Clinic, Cleveland, OH

Background: We sought to investigate risk factors for perioperative mortality among heart failure (HF) patients undergoing elective major noncardiac surgery because determinants of poor surgical outcomes for this patient population have not been well studied.

Methods: We reviewed data for consecutive patients who underwent a systematic perioperative risk evaluation and treatment by hospitalists at a preoperative clinic between January 2003 and March 2006. Patients were subdivided into those with systolic heart failure (SHF) (EF ≤ 40%) or heart failure with preserved systolic function (HFPSF) (EF > 40%). Multivariable logistic regression and propensity analyses of matched cohorts with Cox regression as the final model were used to identify preoperative variables associated with HF mortality.

Results: Five hundred sixty-four HF patients (194 with SHF and 370 with HFPSF) and 10,701 control patients without HF were followed for a median of 1.9 years postoperatively. In univariable analysis, patients with a diagnosis of either HF, SHF, or HFPSF had higher mortality than controls **(Table)**.

In propensity-matched analysis, only SHF but not overall HF or HFPSF was significantly associated with increased mortality **(Table)**. Compared with HFPSF, SHF was associated with increased mortality risk, which persisted after adjusting for age, sex, race, and surgery type **(Table)**. Independent predictors of increased mortality in overall HF were coexisting cancer (P = .001), advanced age (P = .018), and absence of diuretic use (P = .009).

Conclusion: With adjustment for possible confounders, SHF but not HFPSF was significantly associated with increased long-term mortality. Advanced age and cancer, but not the type of surgery, were independent predictors of mortality in HF. Diuretic use was an independent predictor of reduced mortality.

TABLE
COX PROPORTIONAL HAZARDS ANALYSIS FOR MORTALITY IN HEART FAILURE PATIENTS AFTER NONCARDIAC SURGERY

Group	Unmatched hazard ratio (95% CI)	Propensity-matched hazard ratio (95% CI)
HF vs control	2.91 (2.28–3.65)**	1.23 (0.87–1.74)
SHF vs control	4.23 (3.01–5.80)**	1.86 (1.07–3.31)*
HFPSF vs control	2.27 (1.64–3.06)**	1.27 (0.80–2.30)
SHF vs HFPSF	1.86 (1.20–2.88)**	1.60 (1.01–2.52)*†

* $P \leq .05$; ** $P < .001$; † Hazard ratio adjusted for age, sex, race, and surgery type