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*The following faculty report no relevant financial interests:* Drs David C Borgstrom, Lorrie A Langdale, Walter E Pofahl II, and Lance E Stuke.
Preoperative Risk Assessment: Scoring Systems

Many new ways are available to preoperatively assess surgical risk. I still believe that it is a surgeon’s responsibility to make an assessment regarding general surgical risk when they are making a recommendation and discussing risks and benefits. I am trying to train my residents and medical students that there is no such thing as “medical clearance.” In a malpractice case, the judge still says, “But doctor, you took them to the operating room.” I ask my medical and anesthesia colleagues to look at patients from the perspective of augmenting their medical condition preoperatively or making it a little more likely that each patient will tolerate a general anesthetic. I look to the anesthesiologist to provide their view on whether a patient can tolerate a general, spinal, or local monitored anesthesia care (MAC) as the anesthetic choice. I still believe it is my job as a surgeon to take an adequate history and to evaluate the patient’s physiology so that I am not asking my medical colleagues whether it’s okay to take someone to the operating room (OR), but rather I am asking them to help me make someone’s baseline better before the patient goes to the OR.

**Scoring Systems:** Some surgeons are enthralled with the American College of Surgeons (ACS) surgical risk assessment scoring system. I am not specifically using that system, although I have tried it and it is extremely useful when someone is contemplating an operation, particularly when the patient wants to move forward with an operation but I have significant concerns. Additional views or information can be gained from looking at a general frailty index, which provides us with an idea about how someone would tolerate surgery. I particularly like looking at this more or less formally and getting a sense of what people are able to do, particularly with activity. Additionally, general nutrition and smoking status are included in this index. At our center, we frequently use the Strong for Surgery screen, especially in preparing people or getting a sense of whether they need additional nutritional support before an operation. This screening tool looks at the various factors that can impact wound healing and tolerance of a high-risk procedure, such as smoking status, diabetes control, general weight, albumin levels, and general activity level. We will actively intervene, particularly in patients who are undergoing neoadjuvant chemotherapy prior to a major resection, to ensure that they have nutritional support prior to going to the OR.

Preoperative Risk Assessment: Albumin

In the early 1990s, the National VA Surgical Risk Study (a VA cooperative study) demonstrated that preoperative nutrition for patients with a serum albumin level ≥3 g/dL was not predictive of operative outcome. At our center, we use serum albumin levels as a general marker of surgical risk. If a patient has ongoing inflammation (high C-reactive protein levels), then a low albumin level is difficult to interpret. Along with weight loss, the use of serum albumin as a general trigger is a reasonable surrogate for indicating the patient’s potential need for additional support. Although albumin is not the only marker we use, it is still part of our quality assurance to ensure that patient’s albumins are at least measured. If their albumins are particularly low, this information certainly seems to make a difference in critically ill patients with regard to how they are resuscitated.

**Albumin Levels:** Is the serum albumin threshold of 3 g/dL still valid? It seems to be the critical level. Can you make the statement that 2.9 is different than 3? No, I really cannot. However, in someone who has undergone neoadjuvant treatment in anticipation of a major procedure, if their albumin is 2.5, I am relatively reluctant to proceed with a major surgery, such as an esophagectomy, without some additional nutritional support. We can certainly proceed with less impactful operations, such as hernia repair or a laparoscopic cholecystectomy, and emergent operations still get done even if someone’s albumin is really low. Nonetheless, if I have the time, I would rather give the patient some nutritional support based on that albumin assessment.
**Case:** A patient needing a low anterior resection has undergone neoadjuvant therapy. Their serum albumin level is 2.6. How long do you try to get that albumin level to budge before you take this patient to the OR?

**Recommendations:** We tend to follow these patients all the way through their neoadjuvant regimen with ongoing nutritional assessments. Fortunately, after completing neoadjuvant therapy for something like a low anterior resection, a window of 8 to 12 weeks exists between the end of neoadjuvant therapy and the appropriate time of operation. Therefore, we have a 12-week window in which to improve the patient’s nutrition and make sure they do not have ongoing weight loss. Usually, this support comes in the form of oral supplements, but on occasion when we have patients who are particularly frail, we have even chosen to give then TPN if they were not tolerating oral supplementation. We provide weeks of nutritional support before taking the patient to the OR because we have learned our lesson. We have had patients whose nutritional status was ignored throughout the neoadjuvant period (oncologists are accustomed to people losing weight), but this is not something we want to see happen prior to a major operation. As a result, we have tended to be very interventional during that neoadjuvant period.

**Preoperative Risk Assessment: Frailty and Cardiac Risk**

Assessing a patient’s frailty to gauge surgical risk is a hot topic. I do not have a specific test that I use to assess frailty. A number of frailty indices have been purported and utilized, but I have not used those on a regular basis. For me, frailty assessment involves almost more of an eyeball test, which is not very scientific. Most of what I am concerned about is activity and what people can do. Are they managing their activities of daily living? How far can they walk with and without assistance? When available, I can discuss the patient’s cognitive status at home by speaking with family members. Prior to embarking on a big operation, all these factors play into my decision to proceed or making a recommendation to proceed. I do not formally use the Mini-Cog™ or Mini-Mental State Examination on a routine basis. However, I will say that there certainly are times, particularly in the ICU, when one of these tests probably does need to be added to our armamentarium.

**Cardiac Assessment:** What prompts you to seek out further cardiac evaluation for a patient preoperatively? Are there key elements of your assessment that will push you down that road? If the patient has active symptoms of cardiac disease (ongoing angina with activity or rhythm changes), I will request further evaluation. Just because someone has had a myocardial infarction or had cardiac surgery, this not a sufficient reason to do something or to intervene, unless they are having ongoing cardiac symptoms (shortness of breath, recent history of failure, recent myocardial event, new rhythm requiring drug intervention, etc). I also make sure that any patient who has a pacemaker has that interrogated before and after surgery to ensure that it is actually working.

**Preoperative Risk Assessment: Patient Expectations and Pulmonary Function**

In my surgical risk assessment of elderly veterans with various disease processes, one of the major factors I address is managing the patient’s expectations. Very often, patients are referred for a procedure that may or may not truly help them, and their other comorbidities put them at a very high risk. This is not always appreciated by untrained people in primary care: what they see as a problem that needs to be fixed may not actually be true because these providers are not well-versed in what happens, such as what happens with a general anesthetic.

**Pulmonary Function:** We do pay special attention to pulmonary function in our surgical risk assessment. As long-term smokers, many of our patients have a significant amount of pulmonary disease. We order pulmonary function tests for patients who are short of breath with relatively little
activity. Any wheezing at the time of the procedure or in the clinic beforehand will potentially abort an operation, even on the day of surgery. The source of this wheezing is mostly cardiopulmonary.

**Renal Function:** In addition, we worry about, people who have significant renal insufficiency, particularly as to how they are going to be resuscitated with a major procedure.

**Other Factors:** Anticoagulation defects, previous seizure disorder, etc are all things that will be impacted by both the drugs and the resuscitative mechanisms chosen by both anesthesia and in the perioperative period.

**Smoking Cessation:** At a VA hospital, the patient population is renowned for its pulmonary concerns. Preoperatively, we focus strongly on smoking cessation. We have been very successful at getting people to stop smoking in anticipation of major procedures. Part of this success is due to the fact that, for some procedures, some of my colleagues refuse to proceed with certain major oncologic procedures without the patient first discontinuing smoking. Another part of our success is that we get patients into cessation counseling. In addition, when a patient undergoes the pulmonary function tests, any bronchodilator therapy that is associated with improvement may be helpful in the perioperative period.

**Nutritional Assessment: Metabolic Carts and Respiratory Ratios**

Metabolic carts seem to be making a comeback. In our VA hospital, we are just starting to pull these carts back into use. Their use has made a comeback primarily for patients who are having great difficulty in being weaned from ventilatory support. Probably the most dramatic patient on whom we recently used a metabolic cart was someone with ongoing air leaks after severe acute respiratory distress syndrome (ARDS) who had had a major urologic cancer operation and was very frail. We spent weeks trying to get him weaned from ventilatory support. We used a metabolic cart to assess whether we were overfeeding or underfeeding him. Metabolic carts are not easy to interpret, so their use is actually somewhat user-dependent, and people need to be savvy on how to interpret the generated curves.

At our VA hospital, we do not use metabolic carts on a regular basis, but we are trying to get better at using them in cases where their use will make a real difference.

**Respiratory Quotients:** The metabolic cart essentially measures the O2 consumed and the CO2 produced by a patient. From this, the respiratory quotient (RQ) is calculated, which is the ratio of CO2 produced:O2 consumed. If we are going to make any intervention based on RQ, then we must relearn how various fuels are utilized as nutritional bases. The RQ gives us some idea about what kind of fuel a patient is utilizing, and, in addition to looking at urine nitrogen levels, we can determine whether we are overfeeding or underfeeding the patient. An RQ >1 suggests that lipogenesis is occurring and that we are overfeeding the patient. An RQ <0.85 suggests that the patient is utilizing their fat stores and is being underfed, so we need to step up the nutritional support. An “ideal” RQ ranges from 0.85 to 0.9, suggesting that the mixture of protein, lipid, and carbohydrate is being utilized at appropriate ratios.

**Applications:** At the University of Washington, metabolic carts are being used for nutritional assessment of bariatrics patients, complicated cases, and patients with an enterocutaneous fistula.

**Enhanced Recovery After Surgery Programs**

Enhanced Recovery After Surgery (ERAS) programs have been developed to enhance early recovery after surgery. ERAS programs have been promoted primarily by the colorectal group. These programs are certainly very well-intentioned and aimed at getting people through their hospitalization and home safely. Nonetheless, they are intended as guidelines to help those patients who really can move forward with their recovery. Epidurals are central to ERAS programs, but many patients either cannot or will not allow an epidural, such as patients with significant back pain. At our VA hospital, many of our patients have benign prostatic hyperplasia (BPH), and, for some of these patients, getting that Foley out on the
first postop day is difficult. We have some patients who do not make it through the whole ERAS process. But that does not mean we should not pay attention to all those elements in an ERAS program and try to move patients forward as quickly as possible.

Esophageal Surgery: I have not used an ERAS protocol for patients undergoing esophageal surgery, although almost all these patients get an epidural. In many ways, these patients fall into the same or similar kind of ERAS program, but they are not specifically on an ERAS protocol. Managing patients with esophageal resections requires a number of surgeon-dependent nuances, without necessarily a tremendous amount of data behind why we might do what we do. I guess the fastest I have gotten somebody discharged after an esophagectomy is 7 days, and that was with an epidural and focusing on a program that was very similar to ERAS for colorectal.

Cost-Effectiveness: One of the purported benefits of ERAS is that, as a systemized approach to patient care, it decreases variation. In addition, it has been suggested that ERAS protocols are a cost-effective approach to patient care. At our VA center, the pressures of insurance coverage are less apparent than the pressures encountered in the private sector. At our university, we use an ERAS program aimed at being both cost-effective and appropriate to patients’ health care. Some programs are so focused on getting people out of the hospital that discharged patients are readmitted because they fail at home without the additional support they were getting from the hospital’s nursing staff. Therefore, we must be mindful that these are guides toward improving outcome. Although they can be cost-effective, we should not lose sight of the patient’s needs so that they do not lose ground after their operation.

Robotic Inguinal Herniorrhaphy

At the University of Washington, we do not use robotics for a herniorrhaphy. The proponents of robotic surgery are very passionate about it and believe that it provides them with not only an excellent view but also with good solid repairs. We have not chosen to use robotics for these procedures, although we do use robotics for many procedures, particularly our urologists, gynecologists, and some otolaryngologists. Our colorectal folks use it for deep pelvis operations. But in general surgery, we view robotics as a tool that can be very useful under certain circumstances. It is not inexpensive, and I am not sure that it has been shown to be any more cost-effective than certain surgeries, such as a laparoscopic hernia repair or an anterior open inguinal hernia repair.

Pulmonary Emboli: Retrievable IVC Filters

In our VA hospital, we use retrievable IVC filters to prevent pulmonary emboli only under very specific circumstances. We use IVC filters in trauma patients and other patients for whom anticoagulation is not considered possible or appropriate. Those are the main people who get them. Some orthopedic trauma cases occasionally need retrievable IVC filters. Nonetheless, placing IVC filters is not something we do as a primary means of treating pulmonary emboli or deep venous thrombosis.

Appendicitis: Antibiotics for Nonoperative Management

Grant funds have been obtained to determine whether antibiotic management of appendicitis is as effective as appendectomy. Some surgeons are opting to treat appendicitis nonoperatively, and it seems to be something that now, at least ethically, needs to be discussed with a patient as to whether they want to undergo an operation. Nonetheless, in my experience, in someone with early appendicitis, laparoscopic appendectomy seems to be such an easy procedure without a significant downside as long as it is done well. For appendicitis, I generally use antibiotics for the management of someone who has
prolonged symptoms and/or evidence of a phlegmon in the RLQ or someone who I would really like to avoid taking to the OR because I am concerned that they will require a much bigger operation than a laparoscopic or open appendectomy. The ongoing study to randomize patients with appendicitis to medical versus surgical management will provide us with more data in the next few years.

**Postoperative Atrial Fibrillation**

**Case 1:** A patient sails through an operation and is doing well. On postop day 3, they are in atrial fibrillation (AF), although their blood pressure is normal. How should we manage this patient?

**Recommendations:** For operations that are close to a thoracic procedure, the risk of developing AF or atrial flutter is significant. Someone undergoing a thoracotomy, just for a lobe, has about a 10% to 15% risk for AF by postop day 3. This risk is probably closer to 25% after pneumonectomy and is relatively high after esophagectomy. In noncardiothoracic procedures, fluid shifts can occur that are probably the primary instigator of AF developing on postop day 3. In most of these patients, AF is self-limiting after both electrolyte and fluid balances are corrected. The main thing is making sure that the patient has an appropriate rate control — that they are not inciting any cardiac strain that can occur with an abnormal rhythm. Rate control alone may be sufficient. Active cardioversion depends on how much compromise that AF or flutter has on their hemodynamics, particularly if they are hypotensive or their cardiac output falls after a coronary artery bypass. Usually we end up just making sure their electrolytes are okay, getting a sense of what their volume status is, and then providing rate control, usually with metoprolol. Once these issues are addressed, these patients will very often spontaneously convert back.

**Case 2:** On postop day 3, a patient develops AF, is hypotensive, and has a potassium of 3 and a magnesium of 1.4. Should this patient be cardioverted?

**Recommendation:** We would start the electrolyte replacement. If their hypotension is symptomatic, then I would cardiovert them. They may stay in AF, which is all the more reason to correct the underlying etiologies, such as electrolytes. In some cases, we will load them with a fairly rapid load of amiodarone before cardioversion, which gets them more likely to stay out of the arrhythmia.

**Prophylaxis:** Because of the relatively high postop risk of AF in patients undergoing esophagectomy and thoracotomy, do you give them anything prophylaxis to prevent AF? No, we don’t. If one of these patients does not develop postop AF, then they get to whiz through their perioperative period. Therefore, our current approach is to have a high index of suspicion for AF after one of these procedures, watch the patient carefully, and intervene quickly if it does develop.

**Postop Pain: Opioid Use**

For physicians, the Centers for Disease Control and Prevention has created a furor about opioid management with its release of various steps to avoid opioid abuse. Should we manage opioids differently in postop patients who are opioid-naive versus routine users of opioids? At our VA hospital, we try to use patient-controlled analgesia (PCA) whenever possible. For patients who chronically use opioids, we seem to have an underappreciation of what their postop opioid requirements will be. These patients still have postop pain, so they often need a basal rate of opioids in addition to PCA. In some respects, this is like managing breakthrough pain. For patients who have not used opioids prior to operation, their postop pain can often be managed via PCA alone, without that basal rate of opioids. Most PCA systems are programmed to minimize opioid use, which may or may not work in someone who is taking methadone, for example — these patients will certainly have a much higher overall need. For patients who use methadone, additional methadone does not need to be administered in the postop period because methadone has a relatively long half-life: most patients can go without it for at least a few days without any evidence of withdrawal, especially if they have ongoing PCA. One precaution
regarding postop opioid use is that we do want to avoid invoking opioid-induced ileus, which can complicate a substantial amount of general surgeries. If we are not managing someone’s pain sufficiently, we can try to use a drug other than the opioid, such as Toradol®, when appropriate.

Delirium

Postop delirium is an acute-onset intermittent syndrome marked by confusion (abnormal thoughts, perceptions) and abnormal levels of awareness. Both hypoactive and hyperactive delirium states are recognized, each of which are distinct from the other. Hypoactive delirium is probably the most difficult-to-recognize, underdiagnosed problem in the ICU. It is easy to label a patient as “anxious,” especially when they are picking at lines; pulling lines, tubes, and drains; and requiring restraints. We try to avoid the use of restraints, particularly in the elderly. Instead, we prefer to reorient patients, making sure that they have family at the bedside, if possible. In the ICU, delirium in any patient, especially the elderly, is particularly important in terms of pain management and sleep management. In the ICU, we do not manage sleep very well: the lights are always on and the nurses are always in doing their job. Then we wonder why people are a little goofy after 3 or 4 days of having only 45-minute naps every few hours.

Long-Term Effects: Acute delirium increases the postop complication rate and the patient’s length of stay in the ICU. Some different, major cognitive changes happen for people in the ICU that can have a long-term effect, particularly with long hospital stays. Usually, delirium may clear, but there can be actual real cognitive impacts of having both a general anesthetic major operation and an ICU stay.

Prevention: To a limited extent, postop delirium can be prevented. We need to provide the patient with good orientation, keep family members nearby, make sure the patient’s pain is managed, keep clear day/night cycles, and ensure adequate sleep.

Anxiety: One difficult problem, particularly in the ICU, is our tendency to use drugs to manage anxiety. I spend a good chunk of my ICU days getting people off medications commonly used to manage anxiety or delirium, such as Seroquel® or Haldol®. Excess use of these drugs, especially in elderly patients, can result in patients being virtually comatose for days on end.

Benzodiazepines: Some variants of benzodiazepine can be helpful in managing anxiety, particularly for patients being weaned off a ventilator. Many of my patients have a significant degree of liver disease, so I try not to use a lot of benzodiazepines unless I need it to manage conditions such as alcohol withdrawal. My personal preference is to not put someone on a drip, just because they tend to get a lot more drug, which is especially dangerous for patients with liver insufficiency.

Precedex: I have used dexmedetomidine (Precedex®) to good effect in patients who are having difficulty weaning from the ventilator. The drug impacts their relative anxiety but does not cause respiratory depression. We have used it not infrequently for patients with significant pulmonary disease who are stuck on a ventilator. We have not really used it to treat for delirium.

Postop Alcohol Withdrawal

In our VA hospital, postop alcohol withdrawal is something to which we are highly attuned. Fortunately, nowadays, many people have never seen true delirium tremens (DTs), so they do not appreciate its impact and the hyperdynamic state that can occur with alcohol withdrawal. In a timely manner, we put patients on protocols to monitor their anxiety and their hemodynamics as related to alcohol withdrawal after timing the last drink. We are very careful with these patients. Our nurses are very astute at picking up early signs of alcohol withdrawal, and we make sure that these patients are treated very early. We do not want to get someone all the way into DTs: full-blown DTs are associated with a high mortality rate.
**Treatment:** Most of our patients in this setting are unable to take oral medications, so benzodiazepines become our drug of choice. On occasion, in someone who has started to become hyperdynamic, we use clonidine to manage their hemodynamics. We believe that clonidine acts mostly peripherally. In the hyperdynamic state, most of these patients have a tachycardia. Beta blockade can be a helpful adjunct for managing the tachycardia, but the main treatment is to get benzodiazepines on board. Our goal is to avoid the hyperdynamic state by treating the alcohol withdrawal ahead of time.

**Acute Kidney Injury: Rising Creatinine Levels, Patient Evaluation, and Contrast Use**

The definition of acute kidney injury in the literature is relatively vague, but most people define it as a 25% or 50% increase in creatinine levels. The severity of these increasing creatinine levels depends on the etiology of this rise in creatinine. If someone is hypovolemic and they will be responsive to volume, then elevated creatinine can be a marker that the resuscitation needs to be stepped up. Rising creatinine levels is an issue when we have seen someone for whom we have been considering the prospect of giving them drugs that have a renal clearance or a drug that may have a further impact on their renal status, such as vancomycin, Toradol®, and any number of other medications. Changes in creatinine can be impactful enough to give us pause if we are considering giving the patient a diuretic or if we are considering the use of contrast for any kind of imaging study. The bottom line is that changes in creatinine are a big deal.

**Evaluation:** I do not formally use any of the grading systems, such as the RIFLE (Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease) system, to assess the postoperative patient for renal insufficiency. However, our nephrologists use such systems. As the surgeon, I mainly look at the patient on a minute-to-minute basis rather than a long-standing renal insufficiency basis. Therefore, I am looking at acute changes that are happening between yesterday and today. I can determine whether the patient is likely to need dialysis based on an ongoing rise in their creatinine and any associated acidosis, electrolyte abnormalities, and fluid management issues.

**Imaging Contrast:** When our postop patients need an imaging study with contrast, we have protocols that we use to try to prevent acute kidney injury. We try to make sure that people are well-hydrated. The use of Mucomyst® is open to a lot of discussion, so we are not administering that on a regular basis to alkalize the urine. We mostly address the issue by managing hydration appropriately. Obviously if someone has an allergy to the contrast material, then they need to be pretreated with steroids and potentially be given Benadryl® afterward.

**Acute Kidney Injury: Triggers for CAVH, CVVH**

**Case:** A postop patient has a 50% increase in their creatinine levels and their urine output is falling. They have been hypotensive, but our resuscitation is now complete. Should we do anything else for those kidneys at this point, or is it just making sure that the preload is okay and watching them closely?

**Recommendation:** By looking at their urine fractional excretion of sodium (FENa), we can certainly get a sense of whether this is prerenal versus a primary renal injury. We can look at their urinalysis to determine if they have casts or any evidence of actual tubular damage, which will give you an idea of what direction they are probably going to go. We may not want to use full hemodialysis if there is a question of getting fluid off and managing electrolytes — things like continuous arteriovenous hemofiltration (CAVH) are an option. We use CAVH mostly for volume. We are not so much protecting the kidneys as we are trying to prevent progression. For patients who potentially have an acute kidney injury, the trigger for continuous venovenous hemofiltration (CVVH) depends on the kind of procedure they underwent. If they had cardiac surgery or a vascular procedure in which there was some question about showering emboli, the trigger might be lower than for someone who had a total abdominal
colectomy. The trigger is mostly based on whether we able to manage their volume status. The trigger is not based so much on their exact creatinine level, but rather on whether they in high-output versus low-output renal failure. How are we doing at overall management?

**Acute Kidney Injury: Drug-Related Injury**

Surgeons commonly use a number of drugs that affect renal function. **Toradol:** Toradol® is one such drug that is often used in lieu of narcotics, and some surgeons write orders that it be given on a scheduled basis. I prefer to have each dose of Toradol considered, or at worst, to reconsider its use every 24 hours. I have had one patient who required hemodialysis after a single dose of Toradol. Therefore, I am relatively cautious when using it, but I do administer it frequently. As far as dosing, I find that the dose can be reduced: in many cases, you can use 15 mg rather than 30 mg of Toradol. Nonetheless, a certain amount of drug needs to be on board to have an impact, but we can certainly vary the dose in someone for whom we have a concern of relative risk. **Pharmacists:** Many drugs have a significant impact on renal clearance. One of the great things about having a pharmacist round as part of the ICU team is to be able to look at every drug on their medical record that is in active use. When the patient’s creatinine is beginning to rise and ask whether each drug is necessary or whether it needs to be re-dosed. **NSAID Dose vs Patient Age:** For the general use of NSAIDS, the age of the patient is a consideration for determining whether we will use the drug or whether we will reduce the dose. I tend to lower the dose as patients get older — the function of an 80-year-old kidney is probably not the same as that of a 25-year-old kidney. Therefore, I tend to lower the dose for people who are elderly (approximately age ≥60 years).

**Foley Catheters: Postop Removal**

Most ERAS protocols recommend removal of the Foley catheter on postop day 1, but the epidural remains in place for pain management. Some data suggest that the epidural has no relationship to urinary retention. Do you believe this is true? It is certainly true for a thoracic epidural. These patients do remarkably well with their Foley catheter out and the epidural in: they are walking and doing well. For low pelvic procedures, I think the effect of removing the Foley catheter depends on the patient’s age and mobility and whether they have a significant amount of benign prostatic hyperplasia. All these factors will come into play as to whether they can tolerate having the Foley catheter out. Does that mean you should not try to get the Foley out? That depends on how difficult or problematic you think it may be to put the Foley catheter back. I would use that as a general guideline: ask every day, “Do I want to take this Foley out? Does he need this Foley?”

**Perioperative Care and Chronic Anemia**

Most surgeons somewhere along the line eventually have to give a patient blood. Some of these patients will have chronic anemia. Surgeons must decide if this is something that constitutes a greater risk factor. Surgeons base this decision on several factors and the data on this are somewhat conflicting. First, you must remember that this is chronic anemia and not acute anemia. So, you know from purely the elective standpoint, there is probably not much of a risk factor. There certainly is no risk if the hemoglobin level is above 7. If you even look at the ACS risk calculator, anemia is not part of the risk calculator. The type of operation you are planning on doing also determines if having chronic anemia is a risk factor. You must look at your anticipated blood loss. I do a fair number of parathyroidectomies in
patients who have secondary hyperparathyroidism due to end-stage renal disease. Virtually all of those patients have chronic anemia and I would not consider them at risk. We do not treat those patients any differently. We do not set up blood for them and we have not had to do any blood transfusions on them.

**Major Abdominal Procedures:** It is a different situation if you have someone who is anemic and you are planning on doing a major abdominal procedure. For example: a colectomy has the potential for major blood loss. Most of those patients do not require blood transfusions. However, something like a liver resection may warrant one. There is no known benefit to preoperative transfusions. Patients having major abdominal surgery, or even major thoracic surgery or non-cardiac thoracic surgery, who are anemic, must be prepared for a transfusion if necessary. There is a fair amount of literature on this subject but you must make sure it is talking about surgical patients versus medical patients and not using restrictive protocols or policies. My interpretation of the literature combined with looking at our practice pattern helps me determine that there is a benefit in terms of blood utilizations and safety balanced patient outcomes.

**Restrictive Transfusion Policies:** The old transfusion trigger was 10 and now it seems to be 7. However, it depends on the patient. If you have a completely asymptomatic patient who is clinically stable with no underlying cardiovascular disease then we do not have a specific threshold. We are less likely to transfuse patients now at a given hemoglobin level than we were 10 years ago. We will have the occasional patient who will drift down to 7 in the postoperative period but if they are otherwise fine, we are comfortable watching them. Institutionally, we do not have a restrictive policy. We monitor blood utilization and closely track the rationale of cross-matched transfusions. This is part of our quality report that each individual surgeon gets on a quarterly basis.

**Single Unit Transfusions Versus Multiple Unit Transfusions**

According to our last quality report, we try to avoid single unit transfusions. We do not track whether or not there is a high incidence of single unit transfusion. However, when thinking through the data and recalling individual surgeons, I do not recall there being issues. Our transfusion thresholds are so high that many patients are going without being transfused. It is common to hear about a GI bleeder needing a transfusion to give them a little buffer in case they re-bleed. This is the case amongst both surgeons and the gastroenterologists caring for these patients. Again, it is important to make sure you are looking at the proper literature and it is talking about chronic anemia versus acute anemia. With acute anemia, it is a little different. Once we have the hemorrhage controlled we feel more comfortable allowing their hematocrit drift lower knowing there is going to be an equilibration as opposed to just keeping them with a hemoglobin of 10, regardless of what they are doing. Despite what the evidence suggests about a transfusion trigger, we are a very conservative profession. We think about the upside of the transfusion like volume, oxygen, and carrying capacity but it is harder to think about the downsides in terms of a higher risk of pneumonia, surgical site infection, and other issues. These are infrequent events so we must make the decision based off of the individual patient, which can sometimes be difficult.

**Cardiac Issues and Risk Benefits**

Let’s say there is an elderly patient who just had an elective colon resection and everything went perfectly well in the PACU. The patient is extubated but then develops a sudden crushing chest pain and elevated ST segments on the monitor. This patient should be given an electrocardiogram and some aspirin. They are immediately taken to the Cardiac Cath Lab. There is not a lot of workup and evaluation for this patient. The goal is to do a heart cath and percutaneous intervention as soon as possible. In cases where there is not a lot of cardiology support, the mainstay is still antiplatelet, antithrombotic treatment. You would still give them aspirin up to a dose of 325mg. This is a big part of the treatment. You cannot
anticoagulate them because of their recent operation. Fibrinolytic therapy is not appropriate but the main thing is getting an intervention. This is equivalent to the catheterization and percutaneous intervention. The fact that they had an operation complicates things but you have to be careful not to get distracted from the care for the acute myocardial infarction.

**Aspirin:** If a patient has a drug eluding stent and is on 2 drugs, usually on aspirin and Plavix, you should first find out what the urgency of the operation is and then find the ideal situation for coming off of at least 1 or both of those antiplatelet agents. The guidelines used to state that a patient should have 12 months of dual anti-platelet therapy: aspirin and something like clopidogrel. Now, the guidelines state that it can be for only 6 months. The risk for thrombosis is equivalent at 6 months as it is with 12 months of dual antiplatelet therapy. So, if someone has a drug eluding stent, and who is on dual antiplatelet therapy and requires an operation, again, if the urgency is such that it can be delayed until they are beyond are beyond that 6-month window then at a minimum, I try to stop the clopidogrel. Depending on the operation will depend on whether or not I continue the aspirin. You should try to continue the aspirin in the perioperative period. Obviously, in an emergency situation, you lose the benefit and you are going to have to operate in the face of those agents.

**New Information Regarding Postoperative Statin Management**

If a patient on a statin comes in urgently we manage that statin postoperatively by trying to get them back on it as soon as possible. Patients who are even at a moderate to high-risk for cardiovascular disease should be on a statin at least 2 weeks prior to any planned elective operations. It is a challenge for surgeons to manage these agents and to determine whether or not patients should be started on these agents and on which agents to start them on. However, like many cardiovascular medications, it is important to avoid acute cessation and disruptions in them. This is especially true for beta-blockers as it is very important to continue them in the perioperative period. We are still learning about statins but they should be treated the same way.

**Acute Myocardial Events:** A risk associated with stopping statins is the development of an acute myocardial event. Acute myocardial events are rare. We have a very rich early recovery after surgery (ERAS) program so we have not seen one in our practice.

**Beta-Blockers:** Data on beta-blockers are ever-evolving. Some surgeons suggest starting a beta-blocker on a patient with some excess cardiovascular risk before taking them to the Operating Room. There have been a couple of trials that show a reduced risk of postoperative myocardial infarction. However, in the trials where one was started, more proximate to the surgery there is an increased risk of stroke, death, hypotension and bradycardia. My interpretation of the guidelines in my practice is to avoid starting these with a month of operation. I have not found any benefits. The downside seems to outweigh the upside if you start them within 45 days of their operation. It is more important to continue them in the perioperative period and to avoid making adjustments with them. If a patient comes in on a beta-blocker they need to stay on them.

**Using the ACS Risk Calculator when Estimating Cardiac Risk**

ACS Risk Calculators should be used when having discussions with your patients regarding cardiac risks. It will depend on the magnitude of the operation as to how helpful it will be. It has some very good graphical depictions and so I find it helpful in dealing with emergency surgical patients. If someone has significant comorbidities or is towards the end of their life and they have a condition that you know may not have a good outcome, it is helpful to use this calculator when talking to family in terms of figuring out what the best pathway is for the patient. It helps to make the situation clearer.
If their risk of dying is 30% and their risk of having a major complication is 50% then sometimes people decide that operating may not be the way they want to go.

Glucose Management in the Perioperative Period

Tight glucose control is considered tight at our institution at about 120-180 mg/dL. If it is ratcheted down too much then you run into the risk of hypoglycemia. In some institutions the postoperative glucose is allowed to drift as high as 200. When you have a non-diabetic and their first glucose is 200 there are standard protocols that are used to give that patient insulin in the perioperative period. If they are newly diagnosed hyperglycemia then the first thing to do is use EndoTool in our intermediate units and ICUs. This allows for rapid weight-based calculations. EndoTool is a commercial product. It is weight based but also has an algorithm based on your response to your last insulin dose. This helps to avoid either over treating or undertreating. It works pretty well. It is a computer-generated thing and is similar to our typical glucometer but it provides dosage and provides the actual dosage once you input the patient’s age and gender. It also looks at what was previously used for management of their blood glucose and factors that into subsequent doses. It is essentially a decision support tool.

Insulin and Elective Surgeries: Depending on when a patient’s operation is scheduled will depend on if we do anything different with insulin the day of surgery. In general, we have the patient take ½ of their NPH or basal insulin in the morning. If someone will be having surgery late in the day we will even nudge it down to about one-third of his or her typical NPH dose. There is a limited set of insulin products available to use as well. Our in hospital management of diabetes is pretty strong. We do suffer from being a large tertiary care institution with big rural underserved areas that more people arrive with very poorly controlled diabetes. Getting their treatment on track, coming up with a discharge treatment plan, and then communicating that back to their primary care physicians in the community that they are going back to is the bigger challenge for us.

Poorly Controlled Diabetes and Elective Surgery: Depending on the operation will depend on the need for delaying surgery if a patient comes in with poorly controlled diabetes. If it is a malignancy, in general, we would not postpone but data are a little fuzzy on this. In general, we would not postpone for things like elective hernia repairs. Patients undergoing weight loss surgery should be postponed. From a standpoint of health and wellbeing, a patient’s diabetes needs to be under control.

Energy Surgery Devices

There has been a big push for educational institutions to teach and expose trainees as they go through their laparoscopic training to understand something about energy surgery devices. There is a free online course called the Fundamental Use of Surgical Energy that we use. It is very similar to The Fundamentals of Laparoscopic Surgery and Fundamentals of an Endoscopic Surgery so it is very well put together. There are 9 to 10 modules.

Actual Operating Room and Energy Surgery Devices: With the novice laparoscopic surgeon, a resident starting out in the Operating Room with the electrocautery devices it is very important that they be in contact with whatever you are going to be coagulating or using them on. Electricity wants to find a home. You want that home, that pathway, to be where you want it to be. If your electrocautery device is sitting there in the middle of the abdomen, not touching anything and you activate it, it can arc to the duodenum, colon, stomach, or actually any structure. This is unusual but it can happen. You must also be careful with the devices being in contact with other instruments that are metallic. They are going to conduct electricity and if you have an instrument that is lying on the duodenum that you happen to contact, it can travel right down the instrument and cauterize the duodenum. You must pay close attention to detail.
Excluding Small Thermal Injuries: Let’s say there is a patient who has had a cholecystectomy 3 days ago, returns with abdominal pain and a RUQ ultrasound shows just a little fluid found. Their white counts are up. It can be difficult to exclude a small thermal injury under these circumstances. We have a pathway for these patients. They all get the routine laboratory studies, receive an ultrasound, get hepatobiliary scans, and HIDA scans. If they show a bile leak we must go down this pathway. If it is negative, then you have a pretty low threshold for just putting a laparoscope back in. If a patient is still obviously not normal then you must start thinking about other things. One of those things is that there could be an undiagnosed thermal injury in there. If there is a problem, you can deal with it as opposed to just ignoring and hoping it will go away. If you have excluded everything and the patient still does not look or feel right, the surgeon’s responsibility is to take a look. You will sleep much better.

Ultrasonic Devices: These tools have the potential to provide safe, efficient, quality surgery. They have their downside and you must be aware of the potential for thermal injury. There is greater heat dispersion, much more so than electrocautery. If you’re intra-abdominal doing laparoscopic surgery, you must be very cognizant and careful of where your instrument is. After your next surgery using 1 of these tools, take the active blade and touch it on a piece of tissue being discarded. You will see the sizzle. We will do this to cool the machine off. We do it before we set it down so that the staff does not get burned.

Perioperative Management and Endocrine Practices

If a patient comes in on an anticoagulant you should try and stop antiplatelet agents before a neck operation. This is true for even aspirin. For Parathyroidectomies you can be a little more lenient. But for thyroid operations it is unusual to continue someone on aspirin. There was a big multi-center trial that looked at neck hematomas. The numbers were such that they had to lump all of the antiplatelets agents and anticoagulants together. So the data on this aren’t strong. There is a 2-fold risk of neck hematoma with antiplatelet drugs. Admittedly, that is still a pretty low risk but if possible you should try to stop the aspirin in patients undergoing thyroidectomy. Certainly, if they have cardiac stents in, or some other compelling reason, then yes, you should continue to operate on aspirin. Parathyroids are a little different. You are not really dealing with the parenchyma, the glad. You are dissecting it free and ligating the pedicles. For these patients, I would keep them on aspirin.

Outpatient Surgeries: Parathyroids are almost exclusively outpatient. If they have significant cardiopulmonary disease, then it will require an overnight observation on a monitor. This is really the only exception and is pretty unusual. Thyroids in general end up spending the night. We have the conversation with patients preoperatively to set the expectation. By having the conversation about going home the same day preoperatively instead of 6 hours after the surgery you can set the expectation before they do not feel great and will automatically chose to stay overnight.

Postop Nausea & Vomiting: We obviously try to avoid nausea and vomiting after any operation. We are attuned to this however, because many of these surgeries are outpatient. Anesthesiologists are under the same patient experience pressures that all of us are. They do not want patients being nauseated postoperatively because then that will reflect in the patient’s satisfaction score. Patients who have a history of postoperative nausea and vomiting should all get a scopolamine patch. We are very careful with the inhalational agents. We pretty much use Diprivan, fentanyl, or remifentanil. We oftentimes do not do it exclusively, but a dose of dexamethasone intraoperatively or towards the beginning of the operation. We routinely use Zofran as well. However, we have not found that getting in front of it is very important because postoperative nausea and vomiting happens in about 50% of patients. For reasons that are not completely clear there is a higher incident in patients undergoing thyroidectomy. Anesthesiologists will handle this, as it is protocol driven. Surgeons do not have to request it. If vomiting does happen in the PACU, then Zofran is used. If it persists for more than 4 to 6 hours then the patient will usually spend the night.
Drains Used for Neck Operations: Most commonly a drain used for a neck operation will be for a thyroidectomy. They will be used if there is a large space such as a large goiter. I will use them if I feel like the hemostasis is less than perfect and everything else has been done. It is more of a gestalt but not used routinely. They do not prevent hematomas. We hope they adequately decompress a neck hematoma if someone acutely develops one. The neck is a visible area so you should use as small of a drain as possible and take them out the next day. If they are getting a concomitant neck dissection, a modified radical neck dissection, then they should definitely get a drain. If I am doing a central neck node dissection, in patients with thyroid cancer, I do not leave a drain in them routinely.

Intraoperative Thyroid Surgery and Avoiding Injuring Superior Laryngeal Nerves

The trick to avoiding injuring that superior laryngeal nerve is visualization of it. Absent of that is staying right there on the superior aspect of the thyroid gland. So, not ligating the superior thyroid artery much higher above. When we are dissecting out the branches of the superior thyroid artery we are looking for the nerve. This is an area where you have to be careful with your energy devices so that although you might visualize the nerve you are going to have to be careful with the thermal spread. The nerve is coming in superior and medial. If you have the end that is generating the heat lying up against that area you will cook it. Energy devices make mobilizing the superior pole much easier but you must do everything in your power to avoid injury in that external branch of the superior laryngeal nerve.

Identifying Berry’s Ligament: As you mobilize the superior pole, you do not want to come down below your cricoid thyroid muscle. You can come right underneath the recurrent nerves. The superior external branch of the superior laryngeal nerve is going to be well above that. This nerve controls the patients pitch.

Avoiding Recurrent Nerve Injury: While mobilizing the superior pole, you see the superior parathyroid gland, which can sometimes come up a little high, or if you get toward the bottom of the cricoid thyroid muscle, you should stop the dissection and then have the thyroid lobe eviscerated out. Then, find the recurrent nerve inferior, so caudal, to the inferior thyroid artery. Use intraoperative nerve monitoring in some patients. This can help identify the zone where the nerve is. If you have a larger patient where it is difficult to see, it can help you to identify the zone where to dissect. In general, it has to cross the inferior thyroid artery. If you start caudal to that, along the tracheoesophageal groove, you should always be able to identify the nerve down there and trace it up. You always want the dissection to be between you and the nerve such that you are leaving the nerve down and undisturbed. Again, be very careful with energy devices. It is okay to use clips or ligature I’d rather do that than have a thermal injury to the nerve. Sometimes you may leave a little nubbin of thyroid tissue. It depends on if you are operating on a benign disease or a malignancy. In general, I try to leave as small a remnant as safely possible. For thyroid cancer, you should try to get as much as possible. However, if it is between leaving a very small remnant and injuring the nerve, you should leave a very small remnant. The downside of that is pretty low.

Examining Patients with Direct or Indirect Laryngoscopy in the Postop Period

If a patient is symptomatic, you should examine them with direct or indirect laryngoscopy in the postop period. The intraoperative nerve monitoring allows testing of the nerve and allows for determining whether or not there is an injury to it. The most common problem with the technique is that the endotracheal tube is rotated, which affects the sensors there. There are some pretty good articles outlining the kind of steps you go through for that. Postoperatively if we suspect a recurrent nerve injury, it depends on the symptoms as to whether or not we are going to scope them immediately postoperatively or just when they come back to the office. So, intraoperatively if there is a concern about
a recurrent laryngeal nerve injury, my general practice is that if they are doing okay postoperatively, then when I see them back 2 weeks postoperatively, I will do a laryngoscopy on them.

**Thyroidectomy Complications:** There is a patient who had a total thyroidectomy. They extubated in the PACU and they have immediate stridor, so much so that they become hypoxic. In this case, they need to be re-intubated first. In these situations they need their airway controlled and then typically you would get your Otolaryngology colleagues involved at that point. After 24 to 48 hours they are extubated in the operating room with visualization of the cords and then you would go from there. If their neck swells up after they cough post-operatively then we should re-intubate them and re-explore their neck. Neck hematomas require a trip back to the operating room even if they have no symptoms. About 50% of the time you find a bleeder. There is always something you find that looks like it could be the culprit to where you coagulate it or typically clip it. In my experience, 50% of the time there is a vessel that is actively bleeding. Parenthetically if someone goes back to the OR for a neck hematoma, in general, you would leave the drain in overnight. If it happens the day of the operation that drain should come out and they can go home the next day. If it happens the next day, they would spend 1 more day with us.

**Discharging Parathyroid Patients on Calcium Medications**

Parathyroid patients who are being discharged are normally sent home on 500 mg of calcium twice a day. We educate them by telling them if they do develop any hypocalcemic symptoms to increase that up to 1000 mg 3 times a day and to call our office. Doing this prevents patients from coming to the emergency departments with symptomatic hypocalcemia.

**Parathyroid Hormone Levels:** If a patient comes back to your clinic and is still taking 1000 cc of calcium supplementation 3 times a day and they are still hypocalcemic and minimally symptomatic you should check their parathyroid hormone level. Also make sure their magnesium is at an appropriate level because that can contribute to the hypocalcemia. People often get anxious and they tend to hyperventilate a little which can cause symptoms too. We work with their primary care and/or endocrinologist to wean them off of their calcium supplements. Patients who have had thyroidectomy, who have hypoparathyroidism, have a longer process. We check their calcium and their parathyroid hormone level when they return. If their parathyroid hormone level is still low, we work on getting that balanced. You want enough calcium and vitamin D supplementation to minimize their symptoms but not so much that it suppresses parathyroid hormone production in them again. It can typically take several weeks to months to get them off their calcium supplement.

**Secondary Hyperparathyroidism in an Inoperative Decision:** There are 3 options when you are doing a subtotal parathyroidectomy on a patient with secondary hyperpara. For some people, I will do a total parathyroidectomy without any auto transplantation, which is in very few people. Others will do a total parathyroidectomy with auto transplantation of a fragment. We put it in the forearm opposite the hemodialysis access and just mince it, and put it subcutaneously. You do not have to put it intramuscularly. I put it in the forearm that way if there is recurrence you can easily find it to do a near total parathyroidectomy. Alternatively, a remnant can be left that is about the size of a normal parathyroid gland. It is a very small remnant. We have a protocol for these patients postoperatively to stop their cinacalcet and Sensipar®. Then, postoperatively, they are loaded up on calcium and vitamin D. We have a low threshold for starting them on a calcium drip if their calcium gets low or they develop symptoms.
Laparoscopic Procedures and Bariatric Programs

If a patient’s body mass index (BMI) is <50, then the DVT prophylaxis is 40 units of low-molecular-weight heparin every 12 hours. For patients with a >50 BMI, they receive 60 units. So, we are changing it based on their BMI. We continue this after discharge for those whose BMI is >50. They go home on low-molecular-weight heparin for about 1 month or 2 weeks.

**Tricks to Stop Bleeding Around Port Sites:** Usually the first thing to do is, if it’s large enough, to put a finger in there to try and stop the bleeding. I’ll put a finger in there and pull up against the abdominal wall and then hold pressure there for 5 minutes. That is not going to be a definitive treatment, but just to stop the process right then. If the patient, for example, has a thick abdominal wall and I can’t do that, the trocar can be levered up against the abdominal wall. Finally, if bleeding continues, use graspers or an instrument just to hold pressure to get the process stopped or slowed down.

Once you have done that, gently remove the trocar, remove the finger and then using a suture passer, suture ligate above and below the area of bleeding. A lot of times just holding that pressure there is going to take care of it. That really holds for any trocar site. Then again, judicious use of the suture passer will help assure that the vessel is controlled and they are going to start re-bleeding later.

**Richter’s Hernia after any Laparoscopic Procedure through a Trocar Site:** These are unusual but are seen. They typically tend to be based on the trocar size. So, if it is ≥10 mm, it will have a greater risk. Surgical staplers only fit through a 12 mm trocar. This is typically going to be where it is going to happen. The main thing gets back to its recognition. In the early postoperative period, you did a laparoscopic procedure and the patient has a bowel obstruction, or something else that is not adding up, then that is one of the things that has to be in your differential. When these present remote to their laparoscopic procedure, then the diagnosis is a little tougher. This day and age with the abundant use of CT scans, that is usually what is going to make the diagnosis obvious. If a CT scan identifies something that looks like a Richter’s, a repeat laparoscopic procedure is the most common.

Telehealth Follow-Ups in a Large Rural Area

We have started using telehealth follow-ups for selected patients who undergo elective, relatively straightforward operations. We have people driving 3 hours and it does not make sense for them to drive that far for us to look at their neck incision to say “Wow, that looks really good and your voice sounds great. Your parathyroid hormone level is normal so we don’t need to check your blood or anything like that. See you later!” They have spent 3 hours driving for me to spend 10 minutes with them. We have a telephone app that we just started using. The patients love it. It works well, so we have started using that for selected patients. It is for uncomplicated, straightforward operations. You have a kind of efficiency of clinical care because you are dealing with them one-on-one. They do have to have a physician at home who can work with them. If you need to check labs or something on them, they have to have that capacity. We have an integrated medical record system that is linked in so it works very well. The app is commercial and there are several available. We use one called TouchCare and it is a contract through the medical school. It is visual as well as audio. It is like using Facetime only it is HIPAA compliant.

The first lady we used it with was sitting in her car with her husband. Her voice was fine. We knew that her postoperative hypocalcemia was not a problem because she had a normal parathyroid hormone level. We had already discussed the pathology on the telephone, so she was able to show me her neck and we could have a conversation. It worked great.

**SESAP Positives:** I have used SESAP many times for re-certification and I found that the process for developing the questions was very rigorous. I have written questions many time before but this, in terms of the evidence that goes into it, the discussion we have on these questions, and the way they are vetted is essential for the practicing surgeon to have. I am not a breast surgeon but need this information for re-certification and SESAP is a big part of that preparation. It is a very useful reference.
Anticoagulants are a necessary evil in our practices. We are all familiar with the gold standards from the past — the vitamin K antagonists (VKAs), such warfarin, and the heparin products. A couple of classes of new oral anticoagulants (NOACs) have entered the market: the direct thrombin inhibitors (DTIs) and factor Xa inhibitors. The big name in DTIs is dabigatran (Pradaxa®), which was initially developed to prevent deep vein thrombosis and to prevent stroke or embolism in patients with atrial fibrillation. It is also used for patients with acute coronary syndromes, patients who have had strokes, and patients with other blood clotting issues. The direct factor Xa inhibitors include drugs such as apixaban, edoxaban, and rivaroxaban. Compared to warfarin, these 2 NOACs have a shorter half-life, do not require monitoring of clotting factors, and have a better safety margin overall with respect to intracranial bleeding (reduced risk of spontaneous hemorrhage). The real challenge with these NOACs is reversing their effect when a patient has a bleeding event, has a traumatic event, or needs emergent surgery. Warfarin is relatively quick and easy to reverse in an emergency setting, but these NOACs are much more difficult to reverse. Every trauma surgeon has horror stories of this happening: a patient arrives with a relatively minor injury or a minor traumatic head bleed that worsens significantly due to the effect of one of these NOACs and the inability to reverse them. Therefore, the 2 NOACs are a real challenge facing the surgical community.

**New Oral Anticoagulants: Reversal**

**Dabigatran Reversal:** A recently approved reversal agent for dabigatran (a direct thrombin inhibitor) is called idarucizumab (Praxbind®). This is a humanized monoclonal antibody fragment that was developed to be a specific reversal agent for dabigatran. It is a relatively quick-acting drug. The 5-gram dose is relatively high for being a monoclonal antibody: usually two 2.5-mL vials are given as a single dose. It is an immediate reversal agent of dabigatran, good for up to 24 hours, and has very few noted side effects. The primary side effect of idarucizumab is actually in the wallet because it is a very expensive drug, costing several thousand dollars per dose. But, early studies have shown it to be an effective reversal agent for dabigatran in patients who have an emergent condition that requires immediate reversal. I have not had the opportunity to use this drug, although it was just added to our formulary. This drug is used so uncommonly that one large ongoing study of the drug is enrolling patients from several hundred centers around the world with the goal of getting 350 patients.

**Factor Xa Inhibitor Reversal:** No reversing agent has yet been developed for factor Xa inhibitors. Some clinicians have described using prothrombin complex concentrates, which can partially reverse the effect, but there is not true reversing agent. One other disadvantage to the factor Xa inhibitors is that they are not cleared renally like the DTIs. For example, one therapeutic option for dabigatran is to use dialysis to remove the drug for a patient who needs immediate reversal when Praxbind is unavailable. But, factor Xa inhibitors are cleared via the liver, so dialysis is not an option. The next big challenge is to try to find an antidote for the factor Xa inhibitors.

**Dialysis:** I have not performed dialysis to reverse a patient on dabigatran. This is more of a theoretical practice than a real-world practice. If a patient is so sick that they need immediate reversal, then dialysis is not truly a fast enough option.

**Under Development:** Andexanet alfa is a drug currently under development for the reversal of factor Xa inhibitors. Perhaps it will be available by the next issue of SESAP, given the great need we have for reversing these anticoagulants.
New Oral Anticoagulants: Predicting Anticoagulant Levels

**Case 1:** A patient presents to your practice and is using one of the NOACs. At some centers, the protocol is to ask when the patient took their last dose. Is this useful?

**Recommendation:** For these patients, the initial treatment in our trauma center is the same as it would be for any other patient who takes an oral medication that you need to eliminate from their system as quickly as possible. If they have taken dabigatran or even a factor Xa inhibitor within 2 hours prior to arrival, then activated charcoal is an option to help prevent absorption. In this case, we still resuscitate the patient with fluid and blood as necessary. If the patient’s surgery can be delayed for 8 to 12 hours, then we sometimes wait and let the drug’s effect wear off. Dabigatran carries a half-life of 8 to 12 hours, and the half-life of factor Xa inhibitors is similar.

**Case 2:** A patient presents at 2 hours after having taken a NOACs. You administer activated charcoal to help prevent absorption. Is there any test we can use to establish how much anticoagulation the patient actually has at that time?

**Recommendation:** For the direct thrombin inhibitors (DTIs), the best test is the ecarin clotting time. We can also measure partial thromboplastin time, but this test can underestimate the level of DTI in the blood. Thrombin clotting time can also be measured, but it can occasionally overestimate the amount of DTI in the blood. For the factor Xa inhibitors, measuring the prothrombin and partial thromboplastin time can be effective in estimating the drug’s level.

**Value of Data:** If those tests are normal, should we assume that the coagulation system is okay? This depends on how long ago the patient took their last dose. None of these are great tests. A disadvantage of NOACs is that it is difficult to get good estimates of a patient’s anticoagulant levels. Therefore, to decide whether I need to take more aggressive action in a patient, I would use the combination of history and laboratory values.

**TEG:** Thrombelastography (TEG) is a useful tool in predicting the anticoagulant levels in patients who have been taking NOACs. TEG machines are very expensive, meaning that TEG is not available in a lot of trauma centers. Although our center does not have a TEG, some centers that use these machines find the results reassuring. The data are not robust on all of them, but they can be reassuring by demonstrating a prolonged clot formation time and a decrease in overall clot strength.

Warfarin: Management of Trauma Patients

**Case 1:** A patient presents to your trauma service after being in a motor vehicle crash. They are receiving warfarin for their atrial fibrillation. Do you have a specific protocol for trauma patients on warfarin?

**Recommendations:** We do not have a protocol for these patients. Treatment is done at the trauma surgeon’s discretion based on their clinical level of suspicion for further ongoing bleeding. If we do not suspect that the patient will bleed further or there is no significant injury about which we are worried (negative head CT, no intracranial bleeding, no accumulating hemothorax, no liver laceration), then we use fresh frozen plasma (FFP). If a patient has an intracranial hemorrhage, a worrisome hemothorax, or a concerning intra-abdominal injury, then we use prothrombin complex concentrates (PCC) to quickly reverse that warfarin effect.

**Case 2:** A patient presents to the trauma service with a Glasgow Coma Scale (GCS) score of 11, has a small subdural hemorrhage, and has no shift as of yet. How much PCC will you give this patient?

**Recommendations:** Each PCC vial is a 20-mL vial, and each dose is 500 International Units (IUs) of the clotting factors. Remember, we have three-factor PCC (factors II, IX, and X) and four-factor PCC (factors II, VII, IX, and X). We use four-factor PCC at our center. If the patient is on warfarin and has an intracranial bleed but we do not yet know the INR, then we initially give 4 vials of PCC (2000 IUs). The effect is very rapid, so we can repeat the INR in 10 to 15 minutes because the response is that fast. If the INR does not normalize after the first dose, this PCC dose can be repeated.
INR: The literature describes a few cases in which the INR normalizes and then increases again. I have not had this experience with the use of PCC.

**Retained Hemothorax: Management**

**Case:** A patient presented to the trauma service with a hemothorax. After putting in a chest tube, the pleural space was never really clear (costophrenic angle continued to be obliterated). Do you use a scoring system to decide whether the patient should undergo video-assisted thoracoscopic surgery (VATS) to remove the retained hemothorax?

**Recommendations:** We do not use a scoring system. However, after the initial chest tube is placed, I am relatively aggressive about placing a second right-angle chest tube over the diaphragm. My logic is this: once the patient sits up in bed and the straight chest tube is going up toward the apex, any additional bleeding will drain down over the diaphragm and accumulate. Therefore, if the initial chest tube does not sufficiently clear the hemothorax or the hemothorax accumulates overnight or the next day, then a second right-angle chest tube is placed over the diaphragm to drain that dependent space. This usually works. If the second tube does not work, then I am aggressive about doing an early VATS within the first 2 to 3 days after injury in an effort to clean out the hemothorax as quickly as I can before it becomes a loculated hemothorax. Right-angle tubes are easy to insert in the operating room, but they are not so easy if you are putting them in at the bedside percutaneously. I do not have any real tricks to share regarding their insertion. Generally, they are inserted at around the sixth intercostal space. The tube will go where it wants to go, so you would like to get it in either the anterior or posterior focus over the diaphragm. But, it is difficult to control exactly where the tube goes. This procedure is usually done by a chief resident or a faculty member.

**rTPA:** Is tissue plasminogen activator (tPA) a good alternative to VATS, and is it useful, especially in a high-risk elderly patient who is going to the OR for a minimal procedure? This is exactly the population in which we are aggressive about using tPA rather than VATS: these are inpatients who have a contraindication to the OR because they are elderly or because they have additional traumatic issues. In my experience, tPA injected into the chest tube to irrigate that clot is successful. We use it at our center quite a bit, and then we often have to repeat it several times (twice daily, three times daily, or daily as needed until chest x-ray clears). We do not insert a separate chest tube for this procedure.

**Empyema: Management**

**Case:** A patient presents to the trauma service with a hemothorax. VATS is performed on the second or third day. The patient seems to be doing okay for 2-3 days, then they suddenly spike a fever, and a residual or new infiltrate fluid level is found in their pleural space. Should we plan on taking this patient to the OR?

**Recommendations:** This is likely a case of empyema. Usually, a trip to the OR is needed. We will often try tPA to see if it works, but often, at this point, tPA is not successful. Some studies describe the use of DNase (recombinant deoxyribonuclease), which is injected into the chest tube along with the tPA. This treatment has some success in the literature. We do not have DNase available at our center, so I have no actual experience with it. Usually at our center, by this time the patient gets a loculated hemothorax (about 7 days out) or an empyema, which buys them another trip to the OR. Surgeons, being optimists, usually attempt it with a VATS, but they almost always have to convert to a thoracotomy at this point. Once I convert to an open procedure, then I perform a standard posterior lateral thoracotomy.
MRSA: Screening and Management

At our institution, we do not do routine screening for methicillin-resistant *Staphylococcus aureus* (MRSA) for our elective surgery patients, with the exception of cardiac surgery patients. In addition, we do not routinely screen for MRSA in our trauma patients who get admitted or our ICU patients. If a patient tests positive for MRSA, he/she is isolated.

**Positive Trauma Patients:** If the MRSA test is positive for a trauma patient, do you do anything differently? A positive MRSA test is associated with a certain risk/benefit aspect. We isolate the patient in the ICU or on the floor that tests positive for MRSA. We do not do routine decolonization of these patients. One thing that I have noticed is that, once the patient is on isolation precautions, they tend to have fewer visits in the room by the health care providers because nobody wants to gown up and go into the room as frequently as before isolation. Therefore, risk/benefit of isolating every patient might be outweighed by fewer visits by the nurse throughout the day. Again, this is my own observation. I think some nursing studies also demonstrate this effect as well. Other than isolation, wearing our standard precautions, and treating the active infection, we do not do much else. With universal decolonization, one of the effects is that it reduces bloodstream infections for any pathogen. Perhaps this is because we do not go into the room as often and contaminate them.

VTE Prophylaxis: IVC Filters

**Case 1:** A patient develops a lower extremity venous thromboembolism (VTE). what is the role of inferior vena cava (IVC) filters in this patient population?

**IVC Filters:** We use an IVC filter in the patient who has a contraindication to anticoagulation. In the trauma population, these are usually patients with an intracranial hemorrhage; a significant solid organ injury that we are observing for bleeding; or a hemothorax that we are draining and hoping will stop on its own. We do not routinely place IVC filters on every patient who tests positive for a DVT. We use removable filters rather than permanent filters. Because we are an urban trauma center, our IVC removal rate is approximately 15%, and removal is done as an outpatient procedure by an interventional radiologist. We are starting a much more active aggressive follow-up program with these patients: we are maintaining a database to help us follow-up and stay in touch with the patient, then, at about 3 to 6 months after injury, we have the patient return for filter removal.

**Anticoagulation:** At our center, IVC filters are inserted early for patients at risk of VTE who have contraindications to anticoagulation. If a week goes by, the liver does not bleed, the patient’s intracranial bleed is improving by CT scan as well as clinical exam, and, by all characteristics, the patient could be treated with an anticoagulant. At that time, the patient is put on an anticoagulant, which is typically a low-molecular-weight heparin. Ideally, if possible, we pull the filter out before the patient is discharged. Otherwise, we will attempt to do it at about 3 months.

**Case 2:** A patient with one lower extremity fracture and a small intracranial bleed is started on prophylaxis for deep venous thrombosis (DVT). After their femur is fixed and they are ready to discharge home, we send them home on DVT prophylaxis (low-molecular-weight heparin) for a goal of 4 weeks. We want them to continue DVT prophylaxis until they are ambulating — the fracture is fixed and they have completed the necessary rehabilitation. We do not switch our trauma patient to any of the NOACs.

VTE Prophylaxis: Preoperative Discontinuation of Anticoagulants

**Case:** A patient with coronary stents is scheduled to undergo an elective laparoscopic ventral hernia repair with some kind of mesh replacement. The patient is on aspirin and clopidogrel (Plavix®).

What do you do with their antiplatelet drugs?
**Recommendation:** If the patient is at a low risk for bleeding, we next consider the type of stent they have (drug-eluting vs bare-metal stent) and how long the stent has been in place. Our preference is to stop the aspirin and the Plavix 7 to 10 days prior to the procedure. This is not always possible if the stent is relatively new. For our practice, patients with a drug-eluting stent need to be on an antiplatelet agent for $\geq 1$ year. Patients with a bare-metal stent need to be on an antiplatelet agent for $\geq 6$ months. Therefore, our preference is to postpone the surgery, when possible, to get them out of that window. If postponing the surgery is not possible, then we stop the medications 7 to 10 days before surgery. Most of us are relatively comfortable operating on patients who are on aspirin. If we need to keep the patient on aspirin, then we will operate with them on aspirin with just a heightened level of awareness of the bleeding risk.

**Low-Risk Surgery:** If the patient needs to undergo a low-risk procedure, I would actually keep them on both aspirin and Plavix because I have not had any major problems with performing minor procedures with a low risk of bleeding in these patients. This depends on what you are operating and which part of the body you are operating on. If you are doing a directed parathyroidectomy on a patient who is on both aspirin and Plavix, I would consider stopping those drugs at least a week prior to the operation because the risk of bleeding in the neck is still high and is probably too great to justify keeping the patient on that medication. If you are removing a lipoma on an arm, then it is probably much safer to keep them on aspirin and Plavix.

**DVT Screening in High-Risk Patients**

We do not routinely screen for deep venous thrombosis (DVT) in our high-risk patients, such as cancer patients or trauma patients in the ICU. We only investigate when patients are symptomatic. We do not do routine preoperative screening or routine US surveillance in the ICU on our trauma patients. Although screening for DVT may sound like a good idea, it has not been shown to decrease the rate of DVTs.

**Imaging:** When we do investigate for DVT in symptomatic patients, the diagnostic imaging of choice depends on each patient’s condition. If a patient is stable enough to travel to the CT scanner, then we proceed directly with a CTA of the chest. If a patient is too sick to travel to the CT scanner or the risk might be prohibitive, then we start with a duplex US of the lower extremities and proceed from there. For example, if a patient complains of a swollen leg, I would start with US. However, if they have become symptomatic (tachycardia, worsening ABG, increased respiratory effort), then, if possible, I would prefer to proceed directly to CTA and just get the answer. Is there a pulmonary embolus or not? But, for the asymptomatic patient with a swollen leg, whether they are on the floor or ICU, then I would start with an US. When we take a patient directly to CT, we do not scan through the legs. But, if we find a pulmonary embolus, we would follow up with an US of the leg.

**Abdominal Compartment Syndrome**

**Case:** A patient in the OR has required a lot of resuscitation and had their abdomen open for a long time. Can you recognize abdominal compartment syndrome (ACS) in the OR?

**Response:** If the abdomen is already open, then it is decompressed so you cannot recognize ACS. But, we can certainly predict which patients might develop it. The case above is the perfect scenario. For another example, a trauma patient has undergone a massive resuscitation and we start to see early bowel edema in the OR during the case. When we are struggling to bring the fascia together, we can almost count on that patient developing ACS. At this point, we would place a vacuum-assisted closure (VAC) device or other negative-pressure device and return them to the ICU to complete resuscitation, establish a diuresis, and then bring them back to the OR in 24 to 48 hours to reattempt closure. Another scenario that we see not infrequently is the patient with major chest trauma or with a vascular injury.
Although we are not operating in the abdomen at all, the patient is still getting a massive resuscitation, and the surgeon needs to be very cognizant of what is going on in the abdomen even in the OR. At times, we have had to decompress the abdomen with a laparotomy before we left the OR because of the amount of resuscitation that the patient required not because we were ever in the abdominal cavity. We recognize ACS via a mix of subjective parameters and experience. An awareness of the magnitude of the resuscitation the patient has undergone is extremely helpful. I always ask the anesthesiologist, “What are your airway pressures looking like?” Once they start to creep above 40, then our suspicion for ACS should be high. If the urine output has been fine throughout the case and it is starting to drift off toward the end of the case, then my suspicion is also high. The next best test for me in the OR is physical exam of the abdomen. If the abdomen is tight, distended, tense, it is relatively clear at that point what needs to be done. We do not routinely check bladder pressures in the OR. Instead, the nurses will check bladder pressures in the ICU. When bladder pressure gets above 20 or 25, we need to be suspicious. Once it breaks 30, that fact along with clinical suspicion of ACS would really lean me toward opening the abdomen.

**Abdominal Compartment Syndrome: VAC and Wittmann Patch**

When operating on an open abdomen and deciding to manage the abdomen using a VAC, we use a commercial product to dress that open wound. Right now, we use the ABThera™ device for our VAC, and we have had good success with that. The ABThera product puts a soft sponge next to the bowel, which is then covered with a plastic sheet. When ready, we apply 75 to 150 mm Hg of negative pressure to the system. I encourage the residents and the nurses to use the lowest pressure possible to maintain adequate suction to keep the VAC adhered down. This value is approximately 125 mm Hg on the average patient. Then we take the patient to the ICU, complete resuscitation, and start diuresis. Do we have any objective criteria about when to return the OR? I mostly gauge our return to the OR via experience feeling the belly. Our goal is to return in 24 to 48 hours. Usually by that point, we can at least go back and reassess the abdomen, if not close it. Again, we are looking at the other criteria of our airway pressures in the ICU, whether bladder pressures have normalized, and how soft the abdomen is.

**Wittmann Patch:** If we suspect that closing the fascia will be a challenge on that initial take-back operation, then we will place a Wittmann Patch™ and slowly close the fascia during the next several days. The patch consists of 2 different sheets that are sewn to both left and right fascia, and then they are secured together outside of the skin. This provides a way to maintain continuous tension on the fascia to prevent it from retracting and to keep it under tension to start pulling the fascia together as the patient undergoes diuresis in the ICU. Then depending on the patient’s clinical status, the patient can be returned to the OR every day for serial tightening of the patch, or tightening can be done at the bedside in the ICU. Once the fascia is close enough together to where we believe it can be adequately closed, then we return to the OR for a final closure. My favorite way of sewing the patch to the fascia is via running Prolene®. If we have performed the tightening procedure a few times and we get the fascia close but cannot bring it together, my favorite way for closing the wound is to close skin over and leave the fascia open with a planned hernia repair in 6 to 12 months once the patient has recovered from their injury.

**Abdominal Compartment Syndrome: Intra-Abdominal Hypertension**

**Case:** A patient receives massive resuscitation during surgery, but the belly is closed when you leave the OR either because you have closed it or because you never opened it. How do you monitor abdominal pressure? The nurses have a home-grown technique that I cannot begin to describe, but it is their way of transducing the bladder pressures through the Foley catheter, and a monitor measures the pressure as mm Hg. The World Society of the Abdominal Compartment Syndrome talks about intra-abdominal
hypertension beginning at 15 mm Hg, but I do not believe this is accurate. The point of defining intra-abdominal hypertension is to give the clinician a suspicion that it is something to consider and trend. Therefore, at 15 mm Hg, we do not do anything differently except maybe slow down our resuscitation if possible. If we cannot, then we have a high suspicion for soon returning to the OR for a decompressive laparotomy. If the pressure increases to 20 or 25 mm Hg, we have the same situation. We do not absolutely follow a number. If urine output is still adequate, if the abdomen does not feel tight, if peak airway pressures are not rising, if the patient is not showing any signs of end organ dysfunction, then, for me, the bladder pressure is simply one more measure of the big picture that we use to diagnose ACS. Organ dysfunction prompts me to do something more than worry. The two organs that are primarily affected are the bladder and the lungs: the chest cannot expand to allow adequate filling of the lungs, peak airway pressures rise, the bladder pressure gets high, and at that point, the belly is tight. I would probably not return a patient to the OR based on a bladder pressure alone. The decision would have to be based on a global picture of organ dysfunction.

**Medical Options:** Several medical interventions are available to help patients with increased bladder pressure (25 mm Hg), increased peak airway pressures, and over breathing of the vent a little. None of the medical options are necessarily great. Diuresis with furosemide or another agent is an option if the clinical status warrants it. Increasing the patient’s sedation level or sometimes chemically paralyzing the patient can be effective, at least temporarily. Depending on the cause of ACS, placing a percutaneous drain in the abdomen has been described. Certainly for a trauma patient, the pressure is high more due to intestinal distention rather than due to fluid accumulation. Therefore, before placing a peritoneal catheter, a bedside US is needed to confirm that the peritoneal cavity has fluid that can be drained. Primary ACS is related to fluid accumulation (ascites), while secondary ACS is due to trauma or massive resuscitation from some other operation.

**OR Considerations: Intraoperative PEEP and Fluids**

The use of positive end expiratory pressure (PEEP) to prevent respiratory failure in the OR is a more prominent topic in the literature these days. Our anesthesiologists do not routinely use high levels of PEEP for open abdominal operations, so our experience with it is limited. The theoretical benefit of it is it does maintain better pulmonary status for the patient throughout the operation, and it may have a lower incidence of postoperative pulmonary complications, certainly in a patient with any preexisting lung injuries. The downside for PEEP in this setting is vasopressor support is often needed for the patient during the operation. Therefore, all the complications associated with several hours of vasopressor support come into play. One trial looked at this and found no benefit to using high levels of intraoperative PEEP mainly because patients did require that intraoperative vasopressor support.

**Intraoperative Fluids:** For the trauma patient we have altered our protocols for fluid resuscitation. We have minimized our use of crystalloids during resuscitation. We are no longer giving significant liters of fluid challenges before we proceed to blood product administration. We resuscitate our trauma patients with a one-to-one strategy: one unit of packed cells for every unit of fresh frozen plasma that is given. We administer platelets and cryoprecipitate throughout our massive transfusion protocol, and, again, we are very mindful to minimize crystalloid administration. For the patient who does not require a massive transfusion, we encourage the anesthesiologist to minimize crystalloid use in the OR. During the open abdominal operations, one of the things that high PEEP does is generate higher intrathoracic pressure, causing a decreased venous return, so the patient can become hypotensive. The way we used to counterbalance that effect in the OR and ICU is to give more fluids. But now we are discouraging that practice. This one more reason why I am not a fan of using high PEEP in the OR: it likely increases the amount of fluid required during the operation.
Cocaine Use & Surgery Go-Ahead

Drug use is not uncommon, even in elective patients. One SESAP question asks about a patient who is screened and has products that look like cocaine has been used. Does the surgery need to be cancelled at that time? This SESAP question fights the dogma that a lot of us are trained with—if the patient has cocaine metabolites on board, then the surgery needs to be canceled. However, this SESAP question sort of disproves that theory. Cocaine has a short half-life. Metabolites can remain around for several days, but that does not mean the patient is actively experiencing any side effects from the drug. In my practice, if the patient does not have symptoms of an overdose or of active recent use and if they are scheduled for an elective operation, then I will proceed with surgery. I will not proceed with the surgery if the patient admits to using cocaine within the last 12 hours or so or has other symptoms (tachycardia, ECG changes, etc). But, cocaine use in and of itself and a positive test in and of itself does not necessarily mean you need to cancel an elective case. I do not have a consensus on that topic with my anesthesiologists and my partners.

Opioid Prescription Practices: Pharmacy Tracking System in New Orleans

The Centers for Disease Control has issued guidelines for opioid prescription practices to address concerns that physicians do not know how to appropriately prescribe opioid medications and that substance abuse among our patients is much more common than it should be. As medical professionals, our aggressive use of opioids for our patients is a major problem. In New Orleans, where I practice, a very good system is in place among pharmacies to track which patients have prescriptions, primarily of the opioid class, at more than one pharmacy. The physician is notified if they attempt to prescribe an opioid to a patient when the patient already has other prescriptions outstanding at other pharmacies in the area. Once the physician is notified, they can then cancel their prescription. This is a good aggressive way to track the chronic drug seekers that we all see occasionally. I think the aggressive prescription practices for opioid use is something that the medical community needs to be very aware of and to be proactive with before it gets regulated out of our hands.

Training Centers: At our medical training institute, the call from the pharmacist is generally routed to the faculty member rather than the resident who wrote the prescription. Faculty members cosign the prescriptions, and I find that the residents are probably a little stricter about prescribing narcotics than we are for whatever reason.

Perioperative Care of Prisoners: A Successful Telehealth System

I am a faculty member at the medical school at Louisiana State University (LSU). We have a telehealth system, but this system is not used for the outlying hospitals around Louisiana. Instead, we very successfully use telehealth for the prisoner population. We have telehealth clinics set up in the various prisons around the state. We can see postoperative patients via this mechanism, and some preoperative patients have been evaluated via telehealth and scheduled directly for surgery. Our telehealth system has been very helpful for dealing with this patient population. The remote site has a nurse present during our telehealth sessions. Through this system, we can, for example, follow up with an inmate who underwent outpatient laparoscopic cholecystectomy and then returned to the institution. At follow-up, we can look at the wound and evaluate the patient without any difficulty using the telehealth system. The surgeon has the pathology report, the operative note, and many other pertinent notes on his or her computer, and then they see the patient via the telemedicine link. My experience with this system has been very positive.
Compliance With the SCIP Criteria and Antibiotic Choices for Colorectal Cases

The Surgical Care Improvement Project (SCIP) criteria are used to ensure timeliness of antibiotics preoperatively, to administer the appropriate choice of antibiotic, as well as to ensure they are stopped on time. The hardest part is to ensure that antibiotics are stopped on time. Electronic records help because they give good documentation of when antibiotics are given after surgery. However, we often have difficulty with the third dose of a 6- or 8-hour antibiotic when we are trying to meet the 24-hour mark. Often, especially orthopedic colleagues will try to get 1 last dose, which pushes the antibiotic over the 24-hour mark. There are no good data that suggest that the duration of antibiotics for clean cases is of any value, even with prosthetic placements. Therefore, to stay in compliance, we try to stop the antibiotics even earlier and give only 2 doses postop.

Final Dose: Both surgeons and pharmacists have control over the template used to stay in compliance with the SCIP criteria. Surgeons and pharmacists work together to determine the last dose. Surgeons who put in prosthetics, such as orthopedic implants, hold dear to their longstanding data that suggest that they should have antibiotics for 24 hours, even if that means going beyond the 24-hour marks. There are processes in place, but there is a lot of communication that is ongoing.

GI Cases: The SCIP criteria contain antibiotic choices for colorectal cases and elective colorectal cases, and a section is devoted to the debate about ertapenem versus metronidazole and cefazolin. Cefazolin and metronidazole can also be used. They can be mixed in the same bag, but if the case exceeds 3 hours the cefazolin should be redosed. Again only 24 hours of antibiotic coverage is recommended. Some of the concerns raised with using these 2 antibiotics are that it may delay surgery, or one may not get in in time. Although it has occurred in other places, there has not been a big push for use of ertapenem here. No data suggest that ertapenem is any better than metronidazole, and use of such a broad-spectrum antibiotic raises concerns about selection of more pathogenic bacteria and antibiotic resistance.

Mechanical Bowel Prep and Timing of Antibiotic Use

Over a decade ago, there was a big push to challenge the use of oral antibiotics and mechanical bowel prep before gastrointestinal cases. Some studies suggested that it did not make a difference and that mechanical bowel prep increased the number of adverse consequences. Mechanical bowel preps have been subjected to increased scrutiny as we evaluate any method that might reduce colorectal SSI rates. I have always adhered to the mechanical bowel prep followed by oral antibiotics the day before surgery. There is literature that suggests this is a good common practice. I give patients their mechanical prep the morning before their planned surgery so that their prep is done well before the oral antibiotics are given. They have ample time in the evening to get enough liquids so that they do not arrive volume-depleted, which has been a criticism of the mechanical prep in the past.

Bowel Prep Timing: The patient is given the option for which bowel prep they want to use. MiraLAX is usually given in the morning. It is easy to mix up and is well tolerated. The volume is not great but patients are encouraged to get it done by noon. Then, we are not as rigid about when to start the oral antibiotic. It will have to do with the timing of when their surgery is to occur the next day. It is important to give enough time for the mechanical prep to flush through before giving them the oral antibiotic. Therefore, patients are asked to wait 2 hours after they have finished their mechanical prep to take the first dose of their antibiotic. Neomycin and metronidazole are used. Patients take another dose in a few hours, and 1 more before they go to bed. An IV of cefazolin is given the morning of surgery.
Treatment for Intra-abdominal Infections

New data were published in the last 36 months regarding shorter courses of treatment for intra-abdominal infections. Let’s say that an otherwise healthy individual has a perforated appendectomy. At a minimum, they have contamination of the lower abdomen. Their appendix has been taken out. To determine how long to give this person antibiotics, I use the approach of “clinically well without signs of toxicity,” plus normal temperature and normal white count, before stopping the antibiotics. More recent data suggest that, in virtually all of these patients, 4 days is enough. If they look well without any other specific measures of looking into things, I will stop the antibiotics at 4 days. If someone still looks ill at 4 days, I am a little uncomfortable stopping the antibiotics. If a patient still looks ill but they are tolerating liquids, I will switch them to oral antibiotics. There are enough data to suggest that, oral antibiotics can be used if the patient is tolerating PO intake. Many oral antibiotics have excellent absorption characteristics and cover the most common bacteria found in these types of infections.

Obstructive Sleep Apnea and the STOPBang Program

No rigorous program exists for every patient to be screened for obstructive sleep apnea (OSA) before surgery. Bariatric patients, for example, are virtually all referred to pulmonary and cardiac for preoperative assessment unless they are morbidly obese but extraordinarily healthy, which does not happen often. The STOPBang Questionnaire is something that most surgeons should have available to make OSA assessments for these patients. Surgeons often have a lot going on, and these screenings need to be placed into the preoperative assessments. In many places, these preoperative screenings are being done by Anesthesia.

STOP-Bang: The STOPBang questionnaire assesses patients for specific OSA risk factors, including snoring, the amount of tiredness they have, whether they fall asleep easily, whether they feel tired throughout the day, and any observed episodes of apnea. “P” is for pressure (hypertension). The questionnaire then assesses BMI >35 kg/m², age >50 years, neck circumference of 40 cm, and male gender. Patients who have an increased number of those checkboxes have a greater risk of OSA, and those patients should be identified and assessed preoperatively and plans for post-operative respiratory care made. The 40-cm neck circumference being a risk factor in the STOPBang program is surprising to some, but it certainly seems to have held up under scrutiny. We have a program in which the respiratory therapist completes the checklist for all surgical patients postoperatively. While this can be a pain, it does identify some people with a higher risk that we may have not identified preoperatively.

Preoperative Evaluations for Actively Smoking Patients

There are clear data that show a correlation between smoking and a history of smoking and smoking cessation preoperatively. Patients should be asked where they are in their smoking cessations and if there is ample time to get them to stop before surgery, they should try to do that. The real dilemma is defining what an ample time is. Older literature suggested that 4 weeks was important and that if they stopped soon before surgery, they actually had worse pulmonary complications. Today’s data are a little unclear. So, if there is time to get them to stop before surgery, this is what they should do. They need to stop as far before surgery as possible and hopefully they will not go back to it after surgery.

Pulmonary Function Tests: Not all patients who smoke need to go for pulmonary function tests. Easy metrics can be used for making some assessments of their pulmonary status. Can they walk down a hallway? Do they get short of breath? If they do, their oxygen saturation should be checked to get a better idea of what they do at home. Do they have stairs at home? Do they have trouble going up a flight of stairs? If their driveway is long, can they walk down their driveway easily? Do they have to stop and
do they get short of breath? If patients answer yes to any of these questions, especially for major surgery like intra-abdominal surgery, then more should be done. If the patient is not significantly out of breath during these activities then a pulmonary function test is not necessary.

**Inspiratory Resistance Training:** I do not have experience with inspiratory resistance training. However, the idea is intriguing. The idea is, especially with those patients with a history of COPD, that you can improve their respiratory muscular function by getting them to expire against greater resistances in the preoperative period. There are good data for patients with COPD across the board and there are also good data in the thoracic and abdominal surgery patients. This is certainly something I need to look into further and talk to my pulmonary doctors about.

**Incentive Spirometers:** I am not a believer in things like incentive spirometers. They are effort and coaching dependent. They do not make much of a difference postoperatively. Patients should get out of the bed as soon as they can after their surgery and cough and hold a deep breath the old fashioned way. Patients get hung up with trying to push the little bar up to a certain level with incentive spirometers. You can still do this even with abdominal pain.

**Pain Management for Elderly Patients after Abdominal Surgery**

There are 2 things that are important in elderly patients who have major abdominal surgery. Epidurals are a great benefit, as well as field blocks with a local anesthetic like bupivacaine.

**Foley Catheters:** Foley catheters are not always needed. There are data that suggest that a patient’s risk of having urinary retention after removing a Foley catheter while an epidural is in place is no different than if they did not have the epidural in place. Therefore, I am a big believer in getting Foley catheters early. We need to justify on a daily basis why the Foley catheter needs to stay in place and an epidural is no longer a reason to do that. It is more of a habit that keeps a patient from getting up and out of bed.

**Bupivacaine Toxicity:** You need to make sure that bupivacaine doses are calculated properly. You must make sure that you do not overdose someone, especially when you are giving patients an epidural, catheter with bupivacaine, as well as a field block. 10 percent intralipid has been found to be an antidote if this happens. If a patient develops bupivacaine toxicity it helps to bind the free bupivacaine. It is important to always talk to anesthesiologists about what a patient’s dose is, what their maximum dose is, and to make sure to stay below that.

**Diagnosing and Screening for Deep Vein Thrombosis (DVT)**

In general, I do not screen my patients for Deep Vein Thrombosis (DVT). Those who have a history of a DVT or are on anticoagulants because of a history of DVTs should give a better history of exactly what happened so I can understand whether they truly did have a DVT, how it was documented, and how long they have been anticoagulated. Those patients without a specific antecedent event that led to their DVT are at greater risk of DVT and I will have a higher threshold for screening and making assessments. For those patients who have had an antecedent event, like recent surgery, and who are not in acute inflammatory state, screening can be stopped earlier. Patients on anticoagulants for DVT should have their D-dimers checked a month after they have stopped their anticoagulants. If it is elevated they are likely at an increased risk for DVT and should be treated as such in the perioperative period.

**D-Dimers:** 1-month postop D-dimers can be used if a patient arrives in the emergency room with chest pain and shortness of breath. Any earlier than 1 month, there could be other inflammatory processes going on and a D-dimer would not be used. In these cases, duplex exams should be used.

**Anticoagulant Protocols Used in Patients Diagnosed With a Clot in Their Femoral Vein:** If a patient has no contraindication to low molecular weight heparins, we will start them on those for at least 4 to 5 days. Then at about the third day we will bridge them over to warfarin anticoagulants oral treatments.
Specific circumstances behind their development of the DVT will dictate how long they will stay on the anticoagulant. Anti-Xa and direct thrombin inhibitors are being used more and more in trauma practices. It is a big concern that they are being given out like candy in many places. Many trauma centers in the country say that one of their biggest concerns is that they have a number of elderly patients arriving on these new anticoagulants and there is still little knowledge of any reversal agents for them. The anti-Xa reversal agent is still under investigation.

**High Risk Assessments for Cardiac Patients**

There are 2 components to high-risk assessments for cardiac patients. The first one is to assess what their cardiac history is. More specifically, do they have a history of documented congestive heart failure? There are a variety of screening tools that are available from the American Heart Association/American College of Cardiology. The second assessment is whether or not the procedure the patient is having falls into a category of low, intermediate, or high risk. Most major abdominal surgeries fall into the category of the intermediate risk. Peripheral vascular procedures fall into the high-risk category. It depends on the cardiac patients history. A patient with history of coronary artery disease, coronary artery bypass surgery, or stenting remotely in the past does not necessarily mean a patient is high risk. If their symptom history is minimal and the procedure planned is not a high-risk procedure, then a good history, physical, and EKG in these patients is enough. When a patient has other symptoms or a clearly documented history of congestive heart failure, then a more thorough evaluation is necessary. Oftentimes, a stress test or a thorough preoperative cardiology evaluation should be done.

**National Surgical Quality Improvement Program (NSQIP) and Other Risk Calculators:**
When meeting patients for the first time, I use a NSQIP calculator when initial assessments suggest that they are at a higher risk than expected. The graphic representation in the NSQIP calculator is really helpful for patients who do not have medical backgrounds so that they can better see what their risks are. Patients oftentimes do not understand what the potential consequences are of these procedures when they are at a higher risk level. They can take this information and decide if they want to postpone their surgery so that they can go back and work with their primary care doctors and specialists.

**Beta-Blockers:** The most important thing to remember about beta-blockers is that whatever the patient is currently doing should be continued. Patients who come in on a beta-blocker should continue it through the perioperative period. Those who are not on a beta-blocker should not start them. About 10 years ago there was a large push to put all elderly patients with any cardiac risk on beta-blockers. After about 3 or 4 years of this practice, we learned that it was not the best idea. The principles are that if they are on a beta-blocker then you should continue it at the same dose they are on as their baseline and make whatever clinical adjustments are needed throughout the perioperative time. If they are not on a beta-blocker, do not start them on 1.

**Managing Statins in Elderly Patients Undergoing Surgery**

Patients who are on statins should stay on them. Data suggest that if you stop them in the perioperative period you have a fairly significant increased risk of cardiac complications. Plaques being broken up could cause this. We do not fully understand what the protective benefit is but if a patient is on a statin they should remain on a statin if at all possible. If they are not on a statin then we are unsure that there is any benefit to starting them in the perioperative period. For example: If an elderly patient comes in with broken ribs or a grade 1 spleen and have been on statins we would keep the patient on them. The potential risks are greater by stopping them than they are by leaving them on them.

**Using Nasogastric Tubes in Surgical Patients:** I have never been a big fan of using nasogastric tubes in surgical patients. The logic of a nasogastric tube having any benefit to a patient who has a colon
anastomosis or ileocolic anastomosis is hard to understand from a scientific or logical standpoint. The tube is approximately 20 feet to wherever the anastomosis is. It is hard to imagine that we are doing much benefit to that. As I have gotten more comfortable and experienced, I use them less and less. If I do use them it must be closer and closer to their stomach. For example, I do not use them for bowel resections. The only benefit in those circumstances is if a patient who has a significant ileus with concerns about their ability to protect their airway if nauseous. NG tubes are not used very much in Europe and their patients seem to do just as well as ours do for management of bowel problems and bowel surgery. If they are used, we make sure to justify on a daily basis why it is there. It must be scientifically supported or at least logically supported.

**Nasogastric Tubes Versus Feeding Tubes for Postpyloric Feeding**

Someone needing feeding is pretty unusual. However, if a patient needs feeding, and they do not have other access for feeding enterally, a nasogastric tube can be used to feed through the stomach. I will check residuals, but am pretty comfortable with this. The biggest issue is a patient’s ability to protect their airway. Nasogastric tubes are not going to keep someone from aspirating.

**Postpyloric Feeding Tubes:** The only postpyloric feeding tubes I use are those that are put in surgically as a surgical jejunostomy. This is fairly unusual. They were used a lot more often earlier in my career but I have become much more comfortable in not only defining who needs them, but in those who do need feeding tubes to feed them through their stomach. I use an old fashioned Witzel tunnel for a surgical jejunostomy tube. Proximal jejunum is the first part of the jejunum that comes up easily in the abdominal wall. There are proprietary J-tubes out there now but I usually use a 12- or 14-French red rubber catheter. Interestingly, the 14-French red rubber catheters often time have the same luminal size as the 12s. They have a thicker wall. Any larger than that and I worry about the Witzel tunnel and the size of the catheter limiting the diameter of the small bowel. I cut in some extra side holes down the end and I cut the tip of it off so that if it does get plugged I have a way to get a guidewire through the end. This is now pretty unusual.

**Cholecystostomy Tubes:** Cholecystostomy tubes are making a comeback. It is another tool to manage the elderly debilitated patient. One of the most presumed benefits of surgery would be far outweighed by the risks. To easily decompress the patient’s gallbladder to a percutaneous cholecystostomy tube at least in the short term, may help to exclude that variable in the equations of whatever is going on with the patient. A radiologist puts the cholecystostomy tube in through the liver. Interestingly, I think that what has mostly evolved beyond the increased frequency of use is the comfort with removal of them without the inherent need to perform cholecystectomy in each and every one of these patients. The specific circumstances by which it was placed will help to dictate that. Clearly, a patient who has gallbladder pathology as the primary culprit needs to be considered much more seriously for a cholecystectomy. In those patients that we are trying to confirm that the gallbladder is unlikely to be part of the issue, I have some comfort with removing them. It is important that before you remove them you make sure that the cystic duct is patent and in order to do so our routine practice is to do a cholangiogram through the cholecystostomy tube prior to removal. If the tube has already backed its way out and is still not in the gallbladder, you have to go by the clinical picture. However, it is best practice to make sure you have a patent cystic duct before any consideration of removal and then the subsequent discussion about what the needs are for the patient regarding their gallbladder. It is not inherently necessary to follow a cholecystostomy tube with a cholecystectomy.
**French Pigtail Catheters**

IR places French pigtail catheters. We do not, as surgeons, put a lot of them in but we do take a lot of them out because it is fairly easy for our IR colleagues to do so, whether it is for the gallbladder or some other intra-abdominal abscess. Taking them out is fairly straightforward. There is usually a string that helps to curl the pigtail inside which needs to be released. In most of the catheters, this is easy to do. They are silastic and nowhere near as big as the old fashioned Malecot catheters we are used to.

**Clamping a Cholecystostomy Tube:** I would not pull out a cholecystectomy tube right away on a patient who is 81 years old, is draining nice bile, has had a cholangiogram that shows a few stones, has an open cystic duct, and is now tolerating enteral feedings. I would clamp it first to make sure that there are no consequences to clamping it. Clamping is functionally like removing it from the standpoint of you are no longer decompressing the gallbladder with this catheter. Remember that the bile flow into the cystic duct and the gallbladder is a 2-way street. We need to make sure that there is ample evidence that this 2-way street works. So, in those circumstances, clamping the tube first, as well as doing a cholangiogram, are both appropriate and necessary before I would consider removing the tube. I usually leave the tubes in until they come back after they leave the hospital. I need to make sure they are doing well before making a determination of removal of the tube.

**Cardiac Management of Elderly Patients on Anticoagulation**

The guidelines from the American College of Cardiology has a long protocol of stopping the anticoagulation, bridging them with heparin, completing the operation, and then restarting the anticoagulation. This should be the protocol for patients who by specific discussion with the cardiologist give reasons why patients cannot be drifted to normal coagulation parameters. Patients may be on anticoagulation because they have a history of Afib. These patients, in confirmation with the cardiologist, should oftentimes be allowed to drift down to normalcy preoperatively. The number of patients who we currently admitted for transition from oral anticoagulants to a short-term intravenous or injectable low-molecular-weight heparin is uncommon. An example is a patient with a mechanical heart valve. These patients should be limited to the amount of time that they are not fully anticoagulated. These patients who come in to be converted from their oral to IV anticoagulant in the 48 to 72 hours before surgery. The oral anticoagulant is restarted postoperatively again usually within 48 to 72 hours.

**Rapid Reversal of Anticoagulants:** There is only 1 new oral anticoagulant on the market with a known reversal agent. That is dabigatran. The cost is significant at $3000 to $4000 per dose. Patients who need a rapid reversal are rare. The best example of a patient who would need this is an elderly patient who is on that drug and has a head injury. They need the best most effective rapid reversal of anticoagulant because of risk of continuing bleeding in their head in the trauma population. An antidote for the anti-Xa drugs is in evaluation. From the standpoint of elective surgery, these agents allow a shorter period off anticoagulation than the warfarin-heparin transition.

**Dehiscence or Evisceration After an Abdominal Incision in High Risk Patients**

If I think about using retention sutures in a patient I used to go ahead and use them because I thought I would regret not doing it. The literature is clear now that there is not any evidence that retention sutures reduce their risk of dehiscence or evisceration. Some surgeons think that they may not reduce the risk of dehiscence but it will reduce the risk of evisceration. I do not think that the literature suggests that. So, I have primarily abandoned the practice. When I close someone, I try to adhere to the small stitch philosophy of healthy tissue bites just of the fascia. There are studies in Europe that suggest that 5 mm bites of fascia, 5 mm apart, have a lower incidence of would complications, hernia formation,
and dehiscence. I am not sure that our European colleagues see the same patents that we see in America where their fascia is somewhat thinned out. But, I try to adhere to that. I certainly adhere to the 4-to-1 ratios and use a running monofilament suture. There are patients who are at greater risk due to bowel edema, increased intra-abdominal pressure, and other mechanical factors. However, I try to close them primarily while taking into consideration their bladder and airway pressure. If I cannot close them, I will bridge them with something simple as a covering, usually Vicryl, and I use that because it is my intent in virtually every patient to get them back to the operating room as often as necessary and get them closed primarily. There are not any great agents out there to keep people from developing hernias. Neither biologics nor synthetics are the answer, in my opinion. If they do develop a hernia it is going to likely be a lot smaller and easier to manage in patients who are managed with an open abdomen from the get-go. If a patient has a dressing that gets wet and about one-third of the incision is open, the sutures have pulled away from the fascia, and the patient is hemodynamically normal, I would take them back to the operating room to explore the wound again and close it. Patients who have “early hernia formation” after cesarean incisions for a hysterectomy, for example, are very challenging hernias to fix. I would much prefer to be there when initially discovered, as there are many more options to get them closed and closed primarily than if a repair is delayed.

**Challenges in Rural Surgery in America Today**

The challenge in rural surgery is 2-fold. Number 1 is that there are 60 to 80 million Americans who would consider themselves to be rural. In fact, there are an increasing number of them as time goes by, and at the same time there is a further reduction in the number of surgeons who are going out into rural practice. Only about 20% of general surgery residents leave their 5-year program and go into practice. Not all of them are going into rural locations. We have a great disparity between what the need is and the number of residents or surgeons who are interested in those practices. In any hospital of any size it is the procedurally based care that is the engine that drives that system. It is even more evident in smaller locations. If critical access hospitals lose their ability to provide surgical care, even outpatient procedurally based care, the hospitals end up closing. When these hospitals fold, so do the communities because they are usually the largest employer. They are the economic engines of the community.

Any strategies that we have to stabilize those environments provide resources, and to keep surgeons here should be looked into.

**Regionalization:** Some studies suggest that small hospitals do not need a surgeon because most things can be taken care of by other specialists who are already there. When patients need surgery they will be moved up the road to the big medical center. The problem with this solution is that current studies that look at this are cherry picking some of the diseases and operations they want to look at. These patients do not want to go to the big city. They are in towns that are 2 to 20 thousand in population. They look at going to a city of 50,000 as being the big city. These patients like being rural and so they like their care to be rural. They deserve to have that care and deserve the same quality of care that is done in larger academic centers. Studies that suggest everything should be regionalized are self-serving and are market driven. Larger centers should be helping to facilitate the care that can be done in rural communities by helping them with resources.

**Telesurgery Programs:** We are going to see further use of telemedicine in surgery to provide rural hospitals with these needed resources. There are countless surgeons in rural America who would love to have better relationships with their regional academic health centers. We need to come up with mechanisms that forge these relationships. We need to be able to communicate for advice and guidance. Telemedicine and telesurgery will provide a way to do this in the future.

**Itinerant Surgery:** A potential solution to help rural hospitals is for the expertise from the academic medical centers to go out into the community, help another surgeon perform surgeries, and then leave the postop care to the surgeon in the rural setting. The itinerant surgeon name has bad connotations.
However, we should break away from this bias. If we could establish better programs to provide expertise that would be ideal. There are a lot of surgeons who would be happy to provide these services. One of the biggest barriers to something like this is that we need a license in every state that we practice in. It takes a long time to get a license and it can get expensive. We need to break down some of these barriers that are in the way of providing these services.

The Benefits of SESAP and Ongoing Learning

I have been involved with SESAP for almost 20 years. I think I learn much more by participating as an author that if I was just taking it. The collaboration that I receive as an author is immeasurable in improving my understanding of new things that come along in surgery. I am also really proud when I see comments on the various communities in the American College of Surgeons, for example, where people reference the value that they get from the time that they put into SESAP. The things that were talked about today were not discussed 3 to 6 years ago. The ability to challenge what is out there and to find what current leading surgical involvement is really a testament to SESAP. It is not about controversy. It is about making sure that we are looking into what is out there so that we can provide the best perspective. The fact that we do these in collaboration groups to give people a fairly well thought out understanding of why it is relevant, I think, is immensely valuable.