8. Preoperative Management

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Risk Assessment and Management

Ambulatory Surgery

- "Ambulatory surgery" is defined as surgical procedures requiring at least local anesthesia, which are more complex than office-based procedures but less complex than operations requiring at least an overnight stay.
- Approximately 90 % of anorectal surgery to treat fissures, condyloma, fistulas, certain early tumors, hemorrhoids, and pilonidal disease may be suitable for the ambulatory setting.
- The Standards Committee of the American Society of Colon and Rectal Surgeons (ASCRS) has developed a Clinical Practice Guideline about Ambulatory Anorectal Surgery, for practitioners and health care workers, to provide current information from the literature upon which decisions can be made.
- Data from many nonrandomized trials suggest that most patients with American Society of Anesthesiologists (ASA) classifications I and II, and some class III, are suitable for ambulatory surgery from an anesthesia risk standpoint.
- Multiple factors must be considered to determine whether this is appropriate, including the estimation of the magnitude of the operation, type of anesthesia, patient compliance, distance of the patient's home from the surgical center, and availability of support once home.
- In general, the need for bloodwork, electrocardiogram (EKG), and other investigations of the ambulatory surgery patient can be predicted by information obtained with a thorough history and physical exam.

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Table 8.1 Operative scoring system

Preoperative	Physiologic
ASA grade	APACHE (I and II)
Goldman cardiac risk index	SAPS
Pulmonary complication risk	Sickness score
Prognostic nutritional index	POSSUM
Hospital prognostic index	P-POSSUM
	Sepsis score
	Therapeutic intervention score

Adapted from Kiran RP, Delaney CP, Senagore AJ. Perioperative management. In: Beck DE, editor. Clinics in colon and rectal surgery. 2003;16(2): 75–84

Table 8.2 Goldman cardiac risk index

Cardiac risk event			Points
Myocardial infarction within 6 months			10
Age >70 years			5
S3 gallop or jugular venous distension			11
Important aortic valve stenosis			3
Rhythm other than sinus, or sinus rhythm, and atrial premature contractions on last preoperative electrocardiogram			7
More than five premature ventricular contractions per minute anytime before surgery			7
Poor general medical status			3
Intraperitoneal, intrathoracic, or aortic operation			3
Emergency operation			4
Class	Points	Life-threatening complication risk (%)	Cardiac death risk (%)
I	0–5	0.7	0.2
II	6–12	5	2
III	3–25	11	2
IV	≥26	22	56

Inpatient Surgery

- Objective assessment of patient risk for inpatient colorectal surgery is necessary for informed consent and favorable surgical outcome.
- Scoring systems have been developed to help differentiate those who are at high risk for perioperative complication from those who are not.
- Scoring systems can be classified as preoperative or physiologic (Table 8.1). Some are specific to colon and rectal surgery.
- The Goldman risk model determines cardiac risk for surgery. Point scores are assigned to each of nine clinical factors; patients are divided into four risk classes based on the total point score (Table 8.2).
- The risk for perioperative respiratory complications can be gauged by combining findings on chest examination, chest X-ray, Goldman cardiac risk index, and the Charlson comorbidity index. Risk reduction strategies initiated preoperatively, such as smoking cessation, lung expansion

Table 8.3 American Society of Anesthesiologists classification

I	Normal healthy patient
II	Mild systemic disease
III	Severe, noncapacitating systemic disease
IV	Incapacitating systemic disease, threatening life
V	Moribund, not expected to survive 24 h
E	Emergency

teaching, chronic obstructive pulmonary disease (COPD) treatments, and asthmatic treatments, may positively influence outcome after surgery.

- The American Society of Anesthesiologists (ASA) classification system (Table 8.3) was initially developed to alert anesthesiologists to preexisting diseases. It has also been used to estimate operative risk and correlates directly with perioperative mortality and morbidity. This classification scheme also correlates with perioperative variables such as intraoperative blood loss, duration of postoperative ventilation, and duration of intensive care unit (ICU) stay.
- Abdominal surgery induces a catabolic response with stress hormone release and insulin resistance; therefore, nutritional parameters should be evaluated in certain chronically ill patients before surgery.
- Protein catabolism may be accentuated by prolonged fasting and bowel preparation. Increased nutritional risk can influence postoperative morbidity and mortality and anastomotic leak rates.
- The prognostic nutritional index (PNI) was devised in the 1970s to predict complications such as sepsis and death after surgery. The PNI evaluates four factors to predict complications (serum albumin, transferrin, triceps skinfold thickness, and cutaneous delayed-type hypersensitivity), but only albumin, transferrin, and delayed hypersensitivity are accurate predictors of postoperative morbidity and mortality. This index can theoretically be used to identify patients who may benefit from nutritional support in the perioperative period.
- The Acute Physiology and Chronic Health Evaluation (APACHE) scoring system was initially designed to assess risk for ICU patients but has been extended to assess patients with severe trauma, abdominal sepsis, postoperative enterocutaneous fistulas, and acute pancreatitis and to predict postoperative outcome.
- Scoring for emergency patients being admitted to the ICU is best performed before surgical intervention. This index does not take into consideration the nutritional status of the patient, extent of surgery, or cardiovascular findings that add to operative risk.
- Several simpler scoring systems have been developed from the APACHE system, including simplified acute physiology score (SAPS), which uses 14 of the 34 variables, and SAPS II, which also takes into consideration the urgency of the procedure and any associated chronic medical illness.

Table 8.4 Parameters for the calculation of the physiological and operative severity score for enumeration of morbidity and mortality (POSSUM) score

Physiologic parameters	Operative parameters
Age (years)	Operative severity
Cardiac signs/chest X-ray	Multiple procedures
Respiratory signs/chest X-ray	Total blood loss (mL)
Pulse rate	Peritoneal soiling
Systolic blood pressure (mmHg)	Presence of malignancy
Glasgow coma score	Mode of surgery
Hemoglobin (g/dL)	
White cell count ($\times 10^{12}$/L)	
Urea concentration (mmol/L)	
Na^+ and K^+ levels (mmol/L)	
Electrocardiogram	

- The Physiological and Operative Severity Score for enUmeration of Mortality and morbidity (POSSUM) calculates expected death and expected morbidity rates based on 12 physiologic variables and 6 operative variables (Table 8.4).
- Another modification of this index, the CR-POSSUM score, is advocated to assess the risk for patients undergoing major colorectal cancer surgery.
- Assessment of specific organ systems may be necessary and should be done for patients with identified preexisting dysfunction. In general, age, history of chronic heart disease, renal disease, emergency surgery, and type of operation are predictors of the risk of mortality.
- Fit, young patients undergoing minor and intermediate procedures do not need routine preoperative investigation, and, in the pediatric age group, a thorough clinical examination has been found to be of greater value than routine laboratory screening.
- A good history and physical examination are more important than laboratory data in the development of a treatment plan for anesthesia.
- Preoperative tests serve to complement the history and physical exam. They have been used to assess levels of known disease, detect unsuspected but modifiable conditions that may be treated to reduce risk before surgery or detect unsuspected conditions that may not be possible to treat, and therefore simply be baseline results before surgery.
- Many patients undergoing minor surgery need minimal investigation, even if they have chronic medical conditions.
- Review of current evidence indicates that routine laboratory tests are rarely helpful except in the monitoring of known disease states. New guidelines have a significant impact on reducing preoperative testing and have not caused an increase in untoward perioperative events.
- Tests that need to be performed prior to major colorectal surgical procedures include hemoglobin for evidence of anemia and as a baseline level for postoperative management.
- Renal and liver function tests are not routinely carried out.

- Preoperative blood glucose determination is obtained in patients 45 years of age or older because current recommendations suggest screening of all over that age. In addition, impaired glucose control increases perioperative risks.
- A urine pregnancy test should be considered for all women of childbearing age.
- Coagulation tests are only indicated in patients on anticoagulation, with a family or personal history of bleeding disorder or those with liver disease.
- Patients undergoing major surgery with a potential for blood loss should have a type and screen, even if transfusion is not expected. This may help to minimize the risk of later transfusion reaction.
- EKG is indicated in male patients older than 40 years and females older than 50 years. Those with a history suggestive of cardiac disorders, myocardial abnormalities, valvular disorders, conduction disorders, and hypertension may benefit from more intensive investigation prior to elective colorectal surgery.
- Chest X-rays are performed on the basis of findings from the medical history or physical examination. As part of preoperative risk assessment, patients found to have medical conditions requiring further specific therapy before surgery should also be considered for more intensive medical supervision. This is important while in the hospital for their surgery and also as part of their post-discharge follow-up.

Bowel Preparation

- Bowel preparation for colon and rectal surgery has traditionally involved two components: mechanical cleansing and antibiotics. Mechanical bowel preparation (MBP) before elective colorectal surgery has its roots in history and has long been a cornerstone of surgical practice. Today, however, there remains little evidence that it is necessary.
- Bacteria represent a third of the dry weight of stool; uncontrolled leak of intestinal contents into the abdominal cavity can, therefore, be life threatening.
- The accepted rationale for MBP includes the evacuation of stool to allow visualization of the luminal surfaces as well as to reduce the fecal flora, which is believed to translate into lower risk of infectious and anastomotic complications at surgery.
- While the removal of stool permitting mucosal inspection at colonoscopy is well established and not controversial, the latter rationale – the reduction of infectious and anastomotic complications by MBP – has not been supported by evidence and has recently been challenged in the medical literature.
- Dietary restriction (5 days of clear liquids), cathartics, and enemas formed the original framework of colon preparation. However, patient discomfort, electrolyte problems, and inadequate caloric intake proved cumbersome as well as costly.

- Polyethylene glycol (PEG) lavage solution was first introduced in 1980. PEG solutions are iso-osmotic nonabsorbable electrolyte lavage solutions that cause little to no fluid shifts or electrolyte disturbances.
- Multiple studies have proven these lavage solutions to be safe, effective, and well tolerated when compared with traditional bowel preparative regimens.
- PEG solutions require ingestion of 3–4 L solution. The salty taste and high volume reduce patient compliance. Addition of bisacodyl, senna, or magnesium citrate to traditional 4 L PEG regimens has been shown to improve colonic cleansing for colonoscopy.
- Addition of these adjuncts has also allowed for lower-volume (2 L) PEG solutions to be administered with equivalent or increased efficacy and improved patient tolerability.
- Prokinetic agents and enemas when combined with oral lavage have not been shown to improve efficacy or decrease patient symptoms.
- PEG solutions are contraindicated in patients with any sensitivity to the components of the solution, gastrointestinal obstruction, gastric retention, bowel perforation, toxic colitis, toxic megacolon, or ileus.
- PEG solutions are considered Category C drugs in pregnancy and have not been well studied in this patient population.
- In 1990, sodium phosphate (NaP), a saline laxative, was introduced as a safe, more efficacious, and less costly form of bowel preparation when compared with PEG in initial and subsequent studies.
- A tablet form of NaP was developed in 2000 showing equal or improved efficacy and/or improved tolerance when compared with both liquid NaP, PEG, and PEG plus bisacodyl regimens.
- These tablet preparations offered an alternative to the solution-type NaP formulation.
- The tablet preparation regimen consists of 28–40 tablets given the day prior to the elective procedure or in a split dose manner, similar to the fluid formulation.
- Patients with impaired renal function, dehydration, hypercalcemia, hyperphosphatemia, congestive heart failure, or advanced liver disease could experience severe complications with NaP administration including phosphate nephropathy.
- This is especially true in hypertensive patients taking certain medications, namely, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers.
- This led the Federal Drug Administration to issue a black box warning for the over-the-counter version of this preparation and the manufacturer to voluntarily remove the preparation from the market. As this preparation is hypertonic, significant fluid and electrolyte shifts can occur, and it is necessary to maintain adequate hydration while undergoing the preparation.
- Absolute contraindications to any bowel preparation include obstruction, ileus, perforation, diverticulitis, severe colitis, toxic megacolon, gastric retention, and gastric paresis.

Summary of Trials and Meta-analyses

- MBP need not be considered a "prerequisite of safe colorectal surgery." Despite these data, a 2003 survey of practicing colorectal surgeons revealed that 99 % of respondents continue to employ MBP, though 10 % did question its role in elective surgery (Table 8.5).

Antibiotics

- The use of antibiotic prophylaxis in elective colon surgery is mandatory to minimize infection complications.
- The first principle in prophylactic use of antibiotic administration is to provide coverage for the normal bowel flora [aerobic bacteria (*E. coli*) and anaerobic species (*Bacteroides* sp.)]. Oral antibiotics as used in the traditional Nichols–Condon antibiotic preparation have been shown to reduce intraluminal and mucosal bacterial count, while parenteral antibiotics have been shown to reduce systemic bacterial counts at the tissue level.

Table 8.5 Randomized controlled trials and Cochrane report relating to preoperative mechanical bowel preparation[a]

Author/year	No. of patients	Mechanical bowel preparation agent	Anastomotic leaks	Wound infections	Mortality
Brownson et al. (1992)	179	PEG	11.9 vs. 1.5[b]	5.8 vs. 7.5	0.0 vs. 0.0
Santos et al. (1994)	149	Mineral oil, agar, and phenolphthalein; enema; mannitol (3-day regimen)	10.4 vs. 5.3	23.6 vs. 11	7 0.0 vs. 0.0
Burke et al. (1994)	169	Sodium picosulfate	3.8 vs. 4.6	4.9 vs. 3.4	2.4 vs. 0.0
Fillman et al. (1995)	60	Mannitol	8.7 vs. 4.3	3.3 vs. 6.7	
Miettinen et al. (2000)	267	PEG	4.0 vs. 2.0	4.0 vs. 2.0	0.0 vs. 0.0
Tabusso et al. (2002)	47	Mannitol or PEG	20.8 vs. 0[b]	8.3 vs. 0	
Bucher et al. (2005)	153	PEG	6.4 vs. 1.3	12.8 vs. 4	
Ram et al. (2005)	329	NaP	0.6 vs. 1.3	9.8 vs. 6.1	
Fa-Si-Oen et al. (2005)	250	PEG	5.6 vs. 4.8	7.2 vs. 5.6	
Zmora et al. (2006)	249	PEG	4.2 vs. 2.3	6.7 vs. 10.1	1.7 vs. 0.8
Pena-Soria et al. (2007)	97	PEG	8.3 vs. 4.1	12.5 vs. 12.2	
Jung et al. (2007)	1,343	PEG, NaP, enema	1.9 vs. 2.6	7.9 vs. 6.4	
Contant et al. (2007)	1,354	PEG + bisacodyl or NaP	4.8 vs. 5.4	13.4 vs. 14.0	

PEG polyethylene glycol, *NaP* sodium phosphate
[a]All results as mechanical bowel preparation (MBP) vs. no MBP, %
[b]Significant result

- The dosing of 1 g of oral neomycin sulfate and erythromycin base at 2 p.m., 3 p.m., and 10 p.m. for an 8 a.m. case became and remains a standard oral antibiotic regime for elective surgery. Oral antibiotics may decrease surgical site infection when used in addition to a mechanical bowel prep.
- Unfortunately, the Nichols prep has its drawbacks. While this antibiotic combination is efficacious, it can cause significant gastrointestinal discomfort severely limiting patient compliance with the remainder of the antibiotic preparation and completion of their mechanical preparation.
- The standard for parenteral antibiotic prophylaxis in elective colon resections should include:
    1. *Timing*: Infusion of the first antimicrobial dose should begin within 60 min prior to surgical incision.
    2. *Duration*: Prophylactic antimicrobials should be discontinued within 24 h following surgery.
    3. *Dosing*: The initial dose should be adequate based on weight, adjusted dosing weight, or BMI. An additional dose should be administered, if the operation continues over two half-lives after the initial dose.
    4. *Selection* (*colon surgery*): Cefotetan, cefoxitin, cefazolin/metronidazole, and ampicillin/sulbactam.
        - Options for β-lactam allergic patients: clindamycin + gentamicin, ciprofloxacin, or aztreonam
        - Metronidazole + gentamicin or ciprofloxacin

Deep Venous Thrombosis Prophylaxis

- Deep venous thrombosis (DVT) and its embolic corollary and pulmonary embolism (PE) are a significant source of morbidity and mortality in the perioperative period.
- Due to the predominance of abdominal and pelvic surgery, colorectal surgery confers a higher risk of these postoperative complications than other general surgical procedures. Yet despite so much emphasis, DVT and PE continue to be the most common cause of preventable deaths during in-hospital admission, accounting for one out of every four hospitalized patients' deaths.
- Over 50 % of all DVTs are asymptomatic, while the vast majority of PEs are detected only after death.
- Symptomatic venous thromboembolism in the perioperative period is associated with male gender, malignancy, trauma, immobility, COPD, sepsis, low hematocrit, low albumin, and major surgery.
- Prophylaxis of venous thrombotic events centers on both mechanical and medical means. Mechanical methods include intermittent pneumatic compression stockings, while the current mainstays for chemical thromboprophylaxis are unfractionated and low-molecular-weight heparin.

- Unfractionated heparin works through antithrombin III to inactivate thrombin and other factors in the clotting cascade. Concerns about its increased bleeding events as well as its dose–effect relationship have led many to be wary of its use.
- Low-molecular-weight heparin has enhanced antifactor Xa activity and more predictable dose–effect relationships.
- Risk stratification is the mainstay for DVT prophylaxis recommendation. Young healthy patients undergoing routine anorectal surgery with minimal patient-specific risk factors do not require any additional therapy other than mechanical means via graduated compression stockings and/or intermittent pneumatic compression boots and early ambulation.
- Those patients with multiple risk factors and undergoing high-risk surgery such as pelvic operations warrant more aggressive means such as unfractionated or low-molecular-weight heparin in addition to the mechanical devices. Timing has been somewhat controversial with some studies demonstrating higher bleeding without undue increase in thrombotic events when given after the surgery and others stating that dosing should begin preoperatively.
- A concern in colorectal surgery is how to manage anticoagulated patients who require colonoscopy. Recent guidelines suggest that aspirin and other nonsteroidal anti-inflammatory drugs (NSAIDs) do not need to be withheld, with the rate of postpolypectomy bleeding around 2 %.
- Coumadin and other more potent antiplatelet medications (i.e., clopidogrel) are commonly held for 5–7 days prior to the procedure, especially when it is known that a polypectomy or other procedures are likely.

Beta-Blockade

- Preoperative beta-blockade is indicated in patients having intermediate risk surgery with one or more clinical risk factors or any patient having vascular surgery. It is not indicated in patients for low risk surgery or intermediate risk surgery without clinical risk factors.

Transfusion and Hematologic Evaluation

- Most patients with anemia tolerate operations well unless they have associated disease, and therefore anemia rarely changes management unless operative blood losses are expected to be great.
- Risk of thromboembolism and bleeding disorders can be assessed by a detailed history and by tests that measure coagulation factors (prothrombin and partial thromboplastin time) and that assess platelet count and function (bleeding time).

- Measures to reduce the risk of thromboembolism have been well documented and are part of the practice parameters available from the ASCRS.
- Blood grouping and crossmatching are obviously critical when planning major surgery in which significant blood losses may occur.
- An important consideration is to have a routine sample for blood type on file for patients undergoing major surgery, even if transfusion is not expected, and crossmatching would not usually take place. This allows a double level of security when urgent samples are sent if bleeding occurs during surgery. This may help to avoid the risk of transfusion reaction, if there is concern about errors with sample labeling or source at any time.
- Anemic patients who are scheduled for elective surgery may be treated preoperatively by allogenic transfusion, but consideration is also given to autologous donation, erythropoietin, intraoperative hemodilution with autotransfusion, or cell salvage techniques which are still being evaluated in colorectal surgery. Preoperative autologous donation (PAD) has been criticized recently because of cost-ineffectiveness, large wastage of PAD units, and the potential for leaving patients more anemic after surgery than without PAD.71 techniques including acute normovolemic hemodilution and cell salvage may be more efficient; however, investigations still continue into their use.

Communication with the Patient and Establishing the Expectations for Postoperative Recovery

- No preoperative visit is complete without providing information on expected postoperative outcomes. This discussion helps the patient to build confidence and trust in the surgeon. Such discussion is likely to be an important component of any postoperative care pathway, and this may help lead to significant reduction in postoperative stay.
- Patients can be advised of the surgery they will undergo, their expected milestones in recovery, and possible complications, including issues such as readmission, which may occur in 10 % or more of these patients undergoing major abdominal surgery.

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