The SAGES Manual

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Perioperative Care in Minimally Invasive Surgery

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This manual is dedicated to the next generation of surgeons who have so enthusiastically embraced minimally invasive methods and who will further develop and refine these techniques in the years to come.

Preface

The second SAGES (Society of American Gastrointestinal Endoscopic Surgeons) manual was intended to be a companion piece for the successful first SAGES manual, edited by Carol Scott-Connor, that was published more than 4 years ago. Originally, the goal was to concentrate on tersely covered or often ignored aspects of the preoperative preparation of the patient and the operating room as well as the postoperative care of patients undergoing minimally invasive operations. It was also our intention to include a section for each procedure where several different port placement schemes would be presented and briefly discussed. Unique to this manual, the impact of the patient's body habitus (short or long, narrow or wide) on port placement is also taken into account for many of the procedures. Also unique are chapters devoted to hypothermia, port wound closure, and the management of subcutaneous emphysema and abdominal wall hemorrhage caused by trocars.

Naturally, the surgeon tends to focus on the technical aspects of the procedure, such as the operative tasks to be carried out, the order of operation, and the position of the surgeon and assistant. However, it is critical that the surgeon be aware that the CO_2 pneumoperitoneum, far more so than laparotomy, results in multiple physiologic alterations that, if not compensated for by the anesthesiologist and surgeon, may endanger the patient or prevent the laparoscopic completion of the procedure. Although most laparoscopic texts, at best, have a chapter or two on CO_2 pneumoperitoneum, a whole section of this manual has been dedicated to discussion of the physiologic ramifications of this exposure method. A well-informed surgeon is better able to work with the anesthesiologist to limit or prevent deleterious physiologic changes. It has also become clear that open and closed abdominal surgery cause immunosuppression and may have oncologic implications for the patient. The issue of port wound tumors has loomed large on the surgical landscape for more than a decade. This manual contains chapters that review the literature in these areas and will, hopefully, prove useful to readers.

The intended audience for this manual are general surgeons in training as well as already trained surgeons who are facing the often daunting task of learning how to perform advanced laparoscopic procedures. It is hoped that this manual will prove useful as a quick "lockerroom" reference for residents with limited experience heading into advanced cases in regard to setting up the operating room, positioning the patient, and selecting the port locations. On another level, we hope that this manual will also be a resource for surgeons interested in developing a thorough and well-thought-out approach to the pre- and postoperative management of minimally invasive patients or to learn more about CO_2 pneumoperitoneum and its implications.

The generation of this manual has involved hundreds of people who generously gave of their time. Although it is impossible to thank each person, I would be remiss if I did not acknowledge a number of people who were critical to the project. First, I am indebted to my co-editors, James W. Fleshman and Dennis L. Fowler, for their Herculean efforts; without them this manual could not have been completed. Their expertise both surgical and literary is greatly appreciated.

There would be no manual if not for the efforts of the expert surgeons who took the time from their busy schedules to write the chapters. Vaune Hatch, the talented artist who did all the drawings and figures for the manual, deserves a special accolade. Without complaint she made countless modifications to the figures until all were satisfied.

Finally thanks go to the SAGES Board of Governors and the Publication Committee, who entrusted this task to me. I am proud not only to have been given this responsibility but also to be part of an organization such as SAGES, which has broken much new ground over the past two decades and has consistently provided leadership and direction during a period of tremendous change in the surgical world. The SAGES family has been patient, helpful, and supportive during the entire, longer than expected, process. It has been an honor to take part in this project and to see it through to its completion.

Richard L. Whelan, MD
New York, NY
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Part I
Perioperative Management and Evaluation

1. Preoperative Evaluation of the Healthy Laparoscopic Patient

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A. General Considerations

1. **The goal** of preoperative evaluation is to identify and modify risk factors that might adversely effect anesthetic care and surgical outcome.
2. **Up to 50% of patients presenting for elective surgery are regarded as "healthy."** These patients typically fall into American Society of Anesthesiologists (ASA) Physical Status I (healthy) and II (mild systemic disease). The ASA Physical Status classification (Table 1.1) is not intended to predict outcomes, nor does it incorporate risks specific to the type of surgery performed.
3. **A patient presenting without established medical diagnoses is not necessarily healthy.** He or she simply may have never previously visited a physician. Consequently, any physician visit, including preoperative evaluation, should be used as an opportunity to address routine preventive care (Table 1.2).
4. Preoperative evaluation should seek to determine absolute contraindications to laparoscopy.
   a. Inability to tolerate pneumoperitoneum
   b. Poor risk for general anesthesia
   c. Uncorrectable coagulopathy
5. The emphasis over the past decade has been a return to the use of the history and physical examination as the primary screening tools. Preoperative testing is used selectively. This approach is especially true in healthy patients.

B. History

1. **History of pulmonary disease.** Does the patient have decreased pulmonary compliance, due to obesity, scoliosis, or other restrictive lung disease? This factor may result in prohibitively high peak airway pressures after abdominal insufflation or difficulty with oxygenation. Obstructive diseases, such as asthma or chronic obstructive pulmonary

Table 1.1. American Society of Anesthesiologists Physical Status Scale.

Category	Description
I	Healthy patient
II	Mild systemic disease without functional limitation
III	Moderate to severe systemic disease with functional limitation
IV	Severe systemic disease that is a constant threat to life
V	Moribund patient unlikely to survive 24 hours with or without operation

disease, may cause inadequate gas exchange and accumulation of insufflated carbon dioxide.

2. **History of cardiac disease.** Even mild chronic hypertension can result in relative hypovolemia and possibly hypotension with pneumoperitoneum, especially at insufflation pressures greater than 15 mmHg. Carbon dioxide is a sympathetic stimulant, and may cause tachycardia or tachydysrhythmias, particularly when combined with surgical stimulation. Tachycardia may uncover otherwise asymptomatic coronary artery disease. The most significant risk to the patient is undetected aortic stenosis in the setting of potential hypotension. Any history of a murmur should be evaluated.
3. **Risk of pregnancy.** Although pregnancy may not preclude surgical treatment, port site position may need to be changed. If possible, surgery should be performed after the first trimester.
4. **History of previous abdominal operations.** An alternate port site, away from surgical scars, allows the surgeon to examine the abdominal cavity and assess the extent of adhesions.
5. **History of abnormal bleeding.** Patients should be queried regarding nosebleeds, heavy menstrual bleeding, easy bruising, or family history of bleeding disorders.

Table 1.2. Guidelines for routine preventive care.

Preventive measure	Recommended frequency
Blood pressure	Every other year in all adults
Serum cholesterol	Every 5 years for men from age 35, and women from age 45
Pap smear	At least every 3 years following onset of sexual activity
Stool for occult blood	Every year after age 40
Sigmoidoscopy	Every 3 years after age 50
Mammography ± breast exam	Every 1–2 years after age 50
Tetanus-diphtheria booster	Every 10 years
Influenza immunization	Every year after agea 65
Pneumococcal immunization	Once at age 65

6. **Difficulty with prior anesthetics.** Patients undergoing laparoscopy, especially gynecologic procedures, are at increased risk of postoperative nausea and vomiting. Aggressive antiemetic prophylaxis may be warranted, particularly for outpatients. A history of difficulty with intubation should be communicated to the anesthesiologist as well.

C. Physical Examination

1. A thorough physical examination includes assessment of the head and neck, lungs, heart, abdomen (including surgical scars), neurologic system, and vascular system. An anesthesiologist will also perform an airway evaluation.
2. Vital signs should be recorded.

D. Diagnostic Studies

1. **Diagnostic studies should be performed on a selective basis.** There are no definitive rules delineating which tests should be ordered for specific indications. The individual physician best determines this for the individual patient.
2. Test results obtained within 6 months of surgery are generally acceptable if the patient's medical history has not changed substantially. More recent tests may be required to assess a change in medical condition or therapy or to comply with the preoperative guidelines of a particular hospital or anesthesia department.
3. The impulse to routinely test every patient regardless of medical condition should be resisted. Not only is nonspecific preoperative testing expensive, it can result in morbidity when invasive testing is used to pursue false-positive results. The more tests that are ordered, the more likely a falsely abnormal result will appear.
4. Legal liability is actually greater if a test is performed but the result ignored than if it had never been done at all.
5. **Selective testing is supported by a variety of studies.**
   a. A 1985 JAMA study was one of the first to examine the question. The authors determined that 60% of the 2800 preoperative tests examined had no recognizable medical indication, and only 4 (0.2%) of the results may have been potentially significant for anesthetic or surgical management.
   b. Turnbull and Buck examined 5003 tests in 1010 otherwise healthy patients undergoing cholecystectomy. In their opinion, only 4 patients had a conceivable benefit from a preoperative screening test.
   c. Narr et al. retrospectively reviewed mostly ASA I and II patients who underwent surgery without prior laboratory studies. No

intraoperative or postoperative test was found to significantly change the surgical or medical management.

6. **Testing guidelines.** As stated previously, these are suggestions that need to be individualized for each patient.
   a. **Hemoglobin** (Hgb): Indicated if significant blood loss may be expected from the operation. Anemia may be sought in women with heavy menstrual bleeding. The lowest acceptable Hgb will vary. Otherwise healthy patients will be able to physiologically compensate for a low Hgb. This is not the case for those with limited compensatory reserve, such as patients with heart or lung disease, or the elderly.
   b. **Serum electrolytes**: Routinely check electrolytes, blood urea nitrogen (BUN), and creatinine for patients with diarrhea, renal disease, liver disease, or diabetes as well as for those receiving diuretics.
   c. **Liver function tests** are indicated for patients with known liver disease, or those undergoing planned cholecystectomy to exclude an obstructive enzyme pattern.
   d. **Coagulation profile**: While routine screening is not useful, a prothrombin time (PT) and partial thromboplastin time (PTT) should be checked in patients with a personal or family history of abnormal bleeding. These tests may also be indicated in patients with liver or renal dysfunction.
   e. **Chest X-ray** (CXR): Routine CXR is rarely helpful for abdominal laparoscopy, but should be done in patients undergoing video-assisted thoracic surgery (VATS) for baseline comparison. CXR may also be indicated in elderly patients undergoing more extensive upper abdominal surgery (e.g., laparoscopic Nissen fundoplication), or patients with recent upper respiratory infection, unstable chronic obstructive pulmonary disease (COPD), or unstable cardiac disease.
   f. **Electrocardiogram** (EKG): Coronary disease becomes more prevalent with increasing age. EKG is typically reserved for men older than 40 and women older than 50, particularly those with other risk factors such as hypertension, tobacco use, obesity, or diabetes.
   g. **Urinalysis** should be performed for urinary tract symptoms, or if a urologic procedure is planned.
   h. **Pregnancy test**: Indicated in female patients of childbearing age who have not undergone sterilization.
   i. **Human immunodeficiency virus (HIV) and hepatitis** testing is not indicated. Universal precautions should be followed in all patients.
7. The preoperative evaluation should also include **patient education.** The patient needs to know what to expect with regard to the surgery, anesthetic, and postoperative pain management. For example, patient satisfaction with same-day discharge following laparoscopic cholecystectomy has been shown to be directly related to preoperative expectations.

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2. Preoperative Evaluation of Complex Laparoscopic Patients

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Karen D. Horvath IV, M.D.

Complex laparoscopic patients require careful preoperative planning for optimal outcome. These patients present unique problems that necessitate special consideration and a surgeon experienced in basic laparoscopic cases. This chapter discusses a number of such patient groups, including patients with previous abdominal surgery, significant cardiopulmonary comorbidity, obesity, and pregnancy. When evaluating any of these patients, *six questions* should be asked:

1. *Are there any contraindications to a laparoscopic procedure?*
2. *Does this patient need any additional preoperative testing? Does the surgeon need additional past medical or surgical information before surgery for planning purposes?*
3. *Does this patient need any additional preoperative medical or anesthesia planning? Will a planned postoperative ICU stay be required?*
4. *Should additional nonroutine issues be discussed with the patient as part of the informed consent?*
5. *Will the standard laparoscopic approach need to be altered in any way?*
   If the answer to the question is yes, it is recommended that the alteration be dictated into the preoperative evaluation note at the time this decision is made and not left to last-minute consideration on the day of surgery.
6. *Will this procedure require any unique equipment or staffing in the operating room that should be arranged in advance?*

A. Patient with Previous Abdominal Surgery

Few situations command as much respect as a laparoscopic procedure in a heavily scarred abdomen.

1. *Contraindications to a laparoscopic approach:*
   The only contraindication to a laparoscopic approach, in regard to patients with a history of prior abdominal operations, is a documented history of a frozen abdomen.
2. *Additional preoperative testing/and pertinent past surgical history:*
   a. Previous operative records
      1. Note the amount and type of adhesions encountered at the previous surgery.

2. Determine the type and number of prosthetic devices used, i.e., mesh for reoperative hernia or number of stitches in a previous laparoscopic Nissen.

b. Radiographic imaging
   1. Standard imaging before reoperative surgery, e.g., UGI for reoperative foregut surgery or CT scan for patient with diverticulitis to determine need for ureteral stenting.
   2. Ultrasound of the abdominal wall may help map adhesions preoperatively.

c. Preoperative physical examination to appreciate the number and location of prior incisions and to look for incisional hernia(s).

3. *Additional preoperative medical/anesthesia planning:*
Patients with a prior history of abdominal operations who are to undergo further surgery present no specific medical/anesthetic issues directly related to their past surgery. Standard evaluation should be performed as dictated by the patient's age and comorbidities.

4. *Special issues for the informed consent:*
Regardless of type of procedure, reoperative laparoscopic surgery carries increased risks and patients should be counseled regarding them.
   a. Increased chance that conversion to an open laparotomy will be necessary.
   b. Additional ports may be required for adhesiolysis.
   c. Increased risk of enterotomy or other visceral injury.
   d. If an incisional hernia is present, patients should be consented for a simultaneous repair, if the primary laparoscopic procedure to be carried out is not classified as contaminated.

5. *Planned alterations from the standard laparoscopic approach:*
   a. Method of establishing a pneumoperitoneum in the reoperative abdomen. Options include:
      1. Veress needle entry with blind trocar insertion.
      One of the more popular methods for gaining entry into the peritoneal cavity. Caution should be used, however, especially in those with history of prior surgery, as evidence suggests a higher complication rate. If this method is to be used, the site chosen for Veress needle insertion should be well away from the prior incisions.
      2. Open/Hasson entry with blunt-tip trocar.
      Allows for a more controlled method of gaining access to the abdominal cavity and of establishing pneumoperitoneum and has been shown to have fewer complications compared with blind entry. The open/Hasson method is the preferred method in a reoperative abdomen. Also allows blunt finger dissection of local adhesions through the initial port site.
      3. Optical trocars.
      Allows visualization of the path of the trocar during insertion (Optiview, Ethicon Endosurgery, Cincinnati, OH; Visiport, USSC/Tyco Corp, Norwalk, CT). This method has not been well studied. The theoretical advantage is that by observing the trocar insertion injuries to the viscera and

vessels can be avoided. This method requires blind Veress needle insertion and insufflation before trocar insertion. This method should be carefully considered in a patient with a history of multiple prior operations or adhesions.

b. Port placement in the reoperative abdomen.
   1. Initial port placement should be well away from all abdominal wall scars, even if this port will not be of much use during the laparoscopic procedure. The right or left upper quadrant in the midclavicular line has proven to be a safe starting point.
   2. Additional ports should be placed under direct observation.

6. *Unique OR equipment or staffing:*
   a. Increased OR time.
      Laparoscopic surgery in a reoperative abdomen often requires additional OR time for establishing the pneumoperitoneum and performing adhesiolysis, similar to reoperative open surgery. If an incisional hernia is found on physical examination, extra time should also be allotted for its repair.
   b. Open instruments may be needed in case of conversion.
   c. Special tools for adhesiolysis.
      1. Additional trocars.
      2. Angled laparoscope.
      3. Ultrasonic scissors or bipolar cautery for adhesiolysis. These tools decrease the incidence of the complication known as "arcing" that can be seen with monopolar cautery, i.e., tissue damage from electrical current at a site remote from the intended area of cauterization.

B. Patients with Significant Cardiopulmonary Comorbidity

An important difference between open and laparoscopic surgery are the CO_2 pneumoperitoneum-related intraoperative physiologic effects. The CO_2 gas used for the pneumoperitoneum raises the intraabdominal pressure from 0 to 15 mmHg, resulting in hemodynamic and pulmonary function alterations. Due to the transperitoneal absorption of the insufflated CO_2 gas into the blood, a hypercarbic acidemic state results. The healthy patient is able to compensate for these changes; however, the patient with significant cardiopulmonary disease may not have the physiologic reserve to appropriately compensate. These minor physiologic stressors can have major implications in high-risk cardiopulmonary patients; thus, these patients need very close monitoring during laparoscopic surgery, even for minor procedures.

Preoperative risk stratification may be accomplished using several methods. Eagle formulated guidelines that help identify patients who are at high risk for cardiac events during noncardiac surgery (Table 2.1).

1. *Contraindications to a laparoscopic approach:*
   There are no absolute contraindications to a laparoscopic approach in a patient with significant cardiopulmonary disease.