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CHAPTER 7.9

Peritoneal Surgery

Jeffrey A. Norton, MD
Harry A. Oberhelman, MD, FACS
Martin Angst, MD
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Exploratory or Staging Laparotomy

Surgical Considerations

Description: Exploratory laparotomy is indicated primarily in patients suffering abdominal trauma or other acute abdominal catastrophes. It is important that a thorough and systematic intraabdominal examination be carried out to prevent missing significant injuries (e.g., ruptured duodenum or transected pancreas). Any active bleeding should be controlled prior to a systematic examination. Other indications for laparotomy include certain patients with fever of undetermined origin or those in whom a specific diagnosis cannot be made, or for staging of selected patients with Hodgkin's disease. A **staging laparotomy** (Fig. 7.9-1) consists of **splenectomy, wedge** and **needle biopsies** of both lobes of the liver, and biopsies of the periaortic, celiac, mesenteric, and portahepatic lymph nodes. In young women, suturing (pexing) the ovaries in the midline protects them from radiation. Indications for staging in Hodgkin's disease and lymphomas vary from institution to institution, but PET /CT scans have limited their use.

Basically, the procedure begins with a midline abdominal incision; then the abdomen is explored, and both needle and wedge biopsies of the liver may be performed. The spleen may be removed by incising the lateral peritoneal attachment and delivering the spleen into the wound. The short gastric vessels are cut and ligated and the splenic vessels exposed. These are cut individually and ligated, and the spleen is removed. Paraaortic nodes are exposed through a left paraaortic incision in the retroperitoneum, and removed for biopsy. Lymph channels are clipped to prevent lymphatic leakage. The nodes dissected extend to the inferior margin of the duodenum. It may be necessary to cross the aorta and biopsy any enlarged nodes on the right side. More recently, laparoscopy is being performed for staging of certain intraabdominal malignancies (e.g., pancreatic cancer); however, its use has decreased with improved multiphasic CT scans.

Usual preop diagnosis: Abdominal trauma; Hodgkin's disease or other lymphomas

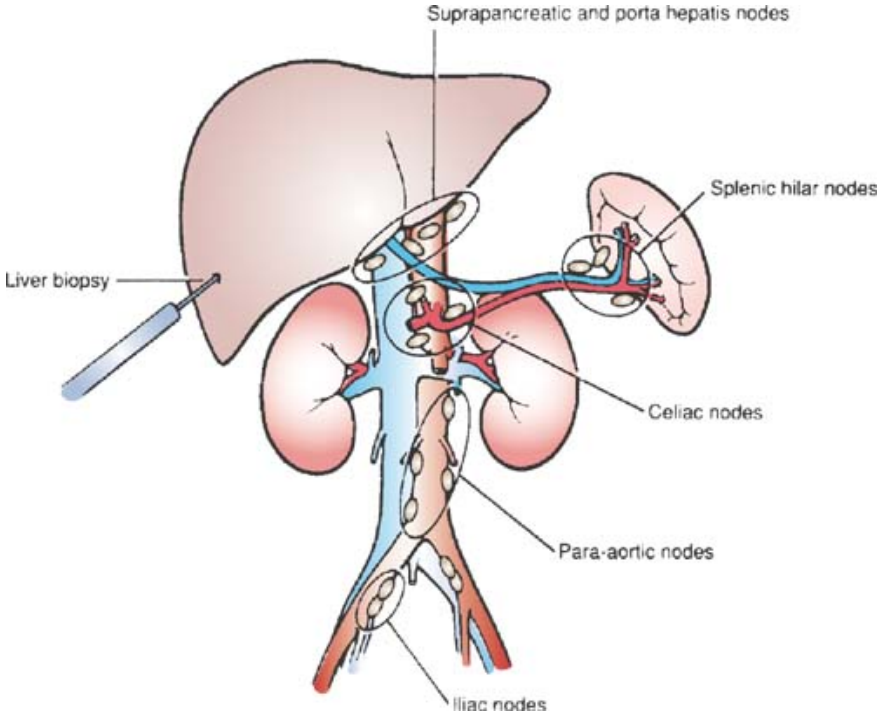

Figure 7.9-1. 1. Staging laparotomy. (Reproduced with permission from Scott-Conner C.E.H., Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

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Summary of Procedures

	Staging Laparotomy	Exploratory Laparotomy
Position	Supine	
Incision	Midline abdominal	or transverse
Special instrumentation	Abdominal retractor	
Unique considerations	Ovarian pexy	Careful monitoring of VS in trauma patients
Antibiotics	Cefoxitin 1 g iv	Cefazolin iv 1 g; 1–2 g iv in trauma patients
VTE prophylaxis	Heparin 5000 units sq	
Surgical time	1.5–2 h	Variable, 1–2 h+
Closing considerations	Splenic bed hemostasis	Hemostasis
EBL	100–200 mL	Variable, 200–500 mL
Postop care	NG decompression; PACU → ward	ICU for trauma patients
Mortality	< 1%	2–5%
Morbidity	Prolonged ileus: 10–15% Pulmonary complications: 5–10% Wound infection: 2–3% Small bowel obstruction: 1% Intraperitoneal bleeding: < 1%	Atelectasis: 5–10% Wound infection: 5–10% Hemorrhage: 1–3% Pneumonia: < 1%
Pain score	6–8	6–8

Patient Population Characteristics

Age range	15–60 yr	15–75 yr
Male:Female	1:1.5	1:1
Incidence	Common	
Etiology	Unknown	Trauma
Associated conditions	Hodgkin's disease (95%); lymphoma (5%)	Other visceral or vascular injuries in trauma

Anesthetic Considerations

(Procedures covered: exploratory/staging laparotomy that is not trauma-related; splenectomy)

Preoperative

Typically, nongynecologic patients presenting for **staging laparotomy** (which may include **splenectomy**) have Hodgkin's disease or other lymphomatous disorder. Apart from the primary disease, these patients are typically in reasonably good health and will not have had radiation or chemotherapy before the staging laparotomy. Patients presenting for **splenectomy** may be divided into two less healthy groups: (a) trauma patients (whose management is described in Trauma Surgery, p. 737) and (b) a more complex group with myeloproliferative disorders and other *(Print pagebreak 628)* varieties of hypersplenism. The periop management of these two groups is more complicated. The latter group may have received chemotherapy and/or radiation therapy, which may affect a variety of organ systems. It is incumbent upon the anesthesiologist to be aware of the periop implications of these adjunctive treatments. The actual extent of a staging or exploratory laparotomy can vary substantially. A good understanding of the surgeon's plan and its

inherent risks (e.g., removing tumor in close proximity to a major blood vessel) is crucial for providing adequate anesthesia care.

Respiratory	Patients who have splenomegaly may have a degree of left lower lobe atelectasis and compromised ventilation 2° intraabdominal pathology: ↓ FRC →↑ A-a gradient + ↓ PaO_2 This should be evaluated by physical exam. Some may have been treated with chemotherapeutic agents (e.g., bleomycin at a total dose > 200 mg/m^2) that cause pulmonary pathology including fibrosis. Toxic drug effects are potentiated by smoking, XRT, and high FiO_2 **Tests:** CXR, PFT, and ABG as clinically indicated
Cardiovascular	Patients with systemic disease requiring splenectomy may be chronically ill and have ↓ cardiovascular reserve. Patients who have received certain chemotherapeutic agents (e.g., doxorubicin at a dose > 550 mg/m^2) may suffer from cardiotoxic side effects that can be worsened by XRT. Manifestations include CHF and dysrhythmias. **Tests:** ECG, ECHO, and stress test as clinically indicated.
Neurological	Patients may have neurological deficits from receiving certain chemotherapeutic agents (e.g., peripheral neuropathies caused by vinblastine and cisplatin or CNS pathology caused by 5-fluorouracil and mithramycin). Evidence of neurologic dysfunction should be documented in the preop evaluation.
Hematologic	Patients are likely to present with splenomegaly 2° hematologic disease (e.g., Hodgkin's disease, non-Hodgkin's lymphoma, chronic leukemia, myeloid metaplasia, thrombotic thrombocytopenic purpura, idiopathic autoimmune hemolytic anemia, and sickle cell disease). Cytopenia is very common. Myelosuppression should be anticipated in all patients receiving active chemotherapy. **Tests:** CBC
Hepatic	Some chemotherapeutic agents (e.g., methotrexate and mithramycin) may be hepatotoxic. Evaluation of LFTs should be considered in patients at risk. **Tests:** LFTs including INR
Renal	Some chemotherapeutic drugs (e.g., methotrexate and cisplatin) are nephrotoxic and patients may present with impaired renal function. **Tests:** BUN, creatinine and electrolytes
Laboratory	Other tests as indicated from H&P
Premedication	Consider midazolam 1–2 mg iv. In patients with suspected gastrointestinal stasis the use of a H_2antagonists (e.g., ranitidine 50 mg iv) and metoclopramide (10 mg iv) 1 h preop, and Na citrate (30 mL po) 10 min preop may be used to minimize the risk of pulmonary aspiration. Metoclopramide is contraindicated in patients with bowel obstruction or perforation. A supplemental intravenous steroid dose (e.g., 25–100 mg hydrocortisone) may be required in patients receiving preop steroids as part of their chemotherapeutic regimen.

Intraoperative

Anesthetic technique: GETA ± epidural for postop analgesia. If postop epidural analgesia is planned, placement of catheter prior to anesthetic induction is helpful to establish correct placement in the epidural space (accomplished by injecting 1–2% lidocaine (50–100 mg) via the epidural catheter to elicit a segmental block). The use of epidural anesthetic techniques for postoperative pain control in patients undergoing major, nonvascular abdominal surgery has been shown to provide superior pain control compared with IV-PCA. However, adequate pain control can be achieved with the use of IV-PCA.

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Induction

Standard induction (see p. B-2) except in patients at risk for pulmonary aspiration, who require a rapid-sequence induction (see p. B-4).

Maintenance

Standard maintenance (see p. B-2). High inspired O_2 concentrations (>30%) may aggravate chemotherapy-induced (e.g., bleomycin) lung injuries. Combined epidural/GA: the epidural catheter ideally is placed at a level corresponding to the surgical site (generally, low thoracic). This allows the use of both lipophilic and hydrophilic drugs at the lowest possible dose, adds flexibility to the anesthesiologist's choice of agents, and minimizes the likelihood of side effects. A continuous infusion (after an initial bolus dose) is the preferred mode of administering epidural local anesthetics because satisfactory analgesia can be achieved without major fluctuations in BP. Lower concentrations of bupivacaine (0.125–0.25%) can be infused to provide supplemental analgesia, whereas higher concentrations (0.5%) may improve surgical conditions (complete motor block). The infusion rate is contingent on the desired segmental spread, but often ranges between 4–8 mL/h. Longer-acting hydrophilic opioids (e.g., hydromorphone 0.4–0.6 mg or morphine 2–3 mg for an epidural placement at the lower thoracic spine) can be injected as a bolus along with the initial bolus dose of a local anesthetic. However, hydrophilic opioids tend to spread rostrally within the intrathecal space and may cause sedation and respiratory depression if dosed too aggressively. Vulnerable patients include the elderly, patients with obstructive airway disease and patients suffering from obesity. The use of epidural local anesthetics is associated with sympatholysis and ↓ BP has to be anticipated. Critical ↓ BP is treated with fluids iv and/or vasopressors (e.g., ephedrine 5–10 mg iv). In patients undergoing a surgical procedure with a significant risk for major bleeding, it is prudent to delay administration of epidural local anesthetics until the critical part of surgery has been completed. Systemic sedatives (e.g., opiates and benzodiazepines) should be minimized as they increase the likelihood of postop respiratory depression.

Low-dose ketamine: If the placement of an epidural catheter is not an option, the use of a low-dose ketamine iv infusion may be considered as an adjuvant analgesic regimen (0.5 mg/kg bolus before surgical incision, followed by an infusion of 0.2 mg/kg/h that is stopped 30 min before the end of surgery). Low-dose ketamine provides opioid-sparing effects (30–50%), decreases the incidence of opioid-mediated side effects, reduces wound hyperalgesia, and may decrease the development of chronic pain after surgery. The risk for the occurrence of psychomimetic side effects appears to be low in patients undergoing general anesthesia.

Gabapentin: Single dose administration of 600–1200 mg gabapentin po before surgery should be considered as an adjuvant analgesic regimen in patients who are not eligible for an epidural anesthetic technique. Gabapentin provides opioid-sparing effects (30–50%), reduces postop pain (30–50%) and lowers the incidence of opioid-mediated side effects. Gabapentin can cause postop sedation. However, available data suggests that pronounced sedation only occurs in a small fraction of patients.

Emergence

Most patients can be extubated at the end of surgery. Patients undergoing extensive surgery with major fluid shifts may require prolonged intubation until cardiovascular stability and sufficient reduction of soft-tissue edema (compromised airway) is achieved.

Blood and fluid requirements

IV: 14–16 ga × 1–2

Potential for major blood loss. In patients with difficult iv access, postinduction placement of additional access is prudent. In splenectomy patients, Plt transfusions should be given after ligation of splenic vessels (↓ sequestration).

NS/LR @ 6–10 mL/kg/h
T&C for PRBC
Warm iv fluids
Airway humidifier

Intraoperative fluid therapy should be titrated to a patient's particular needs (adequate peripheral perfusion, urine output > 0.5mL/kg/h, no base deficit). Overly generous intraoperative fluid administration may be associated with postoperative morbidity (e.g., delayed recovery of bowl function) and extended hospital stay.

Monitoring	Standard monitors (see p. B-1). ± Arterial line ± CVP UO	Others as indicated by patient's status. To prevent hypothermia during long operations, use warming blanket(s), consider heated humidifier and warming room temperature. Place an arterial line in patients with hemodynamic instability or those at risk for significant intraop bleeding. Consider CVP for guiding fluid management, particularly in patients with concomitant cardiovascular disease. Monitoring UO is mandatory.
Positioning	and pad pressure points eyes	
Complications	Unexpected bleeding	Plt transfusion may be necessary.

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Postoperative

Complications	Bleeding Atelectasis (usually left lower lobe) PONV (see p. B-6) VTE (see p. B-7)	Patient should be recovered in ICU or hospital ward that is accustomed to treating side effects of epidural local anesthetics and opiates (e.g., arterial hypotension, respiratory depression, breakthrough pain, nausea, pruritus).
Pain management	Epidural analgesia PCA (see p. C-3).	Epidural analgesia provides superior postop pain control, compared to other analgesic modalities. In high-risk patients, epidural analgesia may ↓ incidence of respiratory complications, but beneficial effects on other systems have not yet been demonstrated in patients undergoing nonvascular abdominal surgery.
Tests	CXR, if CVP placed perioperatively CBC and Plt count	

Suggested Readings

1. Angst MS, Ramaswamy B, Riley ET, et al: Lumbar epidural morphine in humans and supraspinal analgesia to experimental heat pain. *Anesthesiology* 2000;92:312–24.

2. Bell RF, Dahl JB, Moore RA, et al: Perioperative ketamine for acute postoperative pain. *Cochrane Database Syst Rev* 2006: CD004603.

3. Brown CJ, Buie WD: Perioperative stress dose steroids: do they make a difference? *J Am Coll Surg* 2001; 193:678–86.

4. DeKock M, Lavand—homme P, Waterloos H: Balanced analgesia in the perioperative period: is there a place for ketamine? *Pain* 2001; 92(3):373–80.

5. Ginosar Y, Columb MO, Cohen SE, et al: The site of action of epidural fentanyl infusions in the presence of local anesthetics: a minimum local analgesic concentration infusion study in nulliparous labor. *Anesth Analg* 2003;97:1439–45.

6. Ho KY, Gan TJ, Habib AS: Gabapentin and postoperative pain–a systematic review of randomized controlled trials. *Pain* 2006; 126:91–101.

7. Nisanevich V, Felsenstein I, Almogy G, et al: Effect of intraoperative fluid management on outcome after intraabdominal surgery. *Anesthesiology* 2005;103:25–32.

8. Park WY, Thompson JS, Lee KK: Effect of epidural anesthesia and analgesia on perioperative outcome: a randomized, controlled Veterans Affairs cooperative study. *Ann Surg* 2001; 234:560–9.

9. Rigg JR, Jamrozik K, Myles PS, et al: Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial. *Lancet* 2002; 359:1276–82.

10. Rigg JR, Jamrozik K, Myles PS, et al: Epidural anaesthesia and analgesia and outcome of major surgery: a randomized trial. *Lancet*. 2002; 359:1276–82.

11. Tiippana EM, Hamunen K, Kontinen VK, et al: Do surgical patients benefit from perioperative gabapentin/pregabalin? A systematic review of efficacy and safety. *Anesth Analg* 2007;104:1545–56.

12. White R, Winston C, Gonen M, et al: Current utility of staging laparoscopy for pancreatic and peripancreatic neoplasms. *J Am Coll Surg* 2008; 206:445–50.

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Splenectomy

Surgical Considerations

Description: Through a midline abdominal or left subcostal incision, the spleen is mobilized by dividing the lateral peritoneal attachments while the spleen is retracted medially. (Relevant anatomy is shown in Fig. 7.9-2.) Once the spleen is delivered into the operative wound, the short gastric vessels are clamped, cut, and ligated. The splenic artery and vein are then exposed with care being taken not to injure the tail of the pancreas. By keeping the splenic hilum between the operator's fingers and thumb, inadvertent bleeding can he controlled easily. Accessory spleens (incidence, 15–30%) also should be looked for if the splenectomy is being done for a hematologic disorder. They are found along the cephalad and caudad edges of the pancreas behind the stomach and in the area of the gastrohepatic ligament, greater omentum, and the splenic hilum. All patients undergoing splenectomy should receive polyvalent pneumococcal and H-influenza vaccines. Children may also require vaccination against meningococcus.

Variant procedure or approaches: Following trauma, efforts at splenic salvage (**splenorrhaphy**) may be made, if possible, to preserve all or part of the spleen. This may be accomplished by the use of local hemostatic techniques (electrocoagulation, argon beam coagulator, Surgicel or Gelfoam soaked in thrombin, microfibrillar collagen, and the use of fine sutures or mattress sutures with Teflon felt pledgets). Recently, splenectomy has been performed laparoscopically if the spleen is near normal size (see Laparoscopic Splenectomy, p. 581).

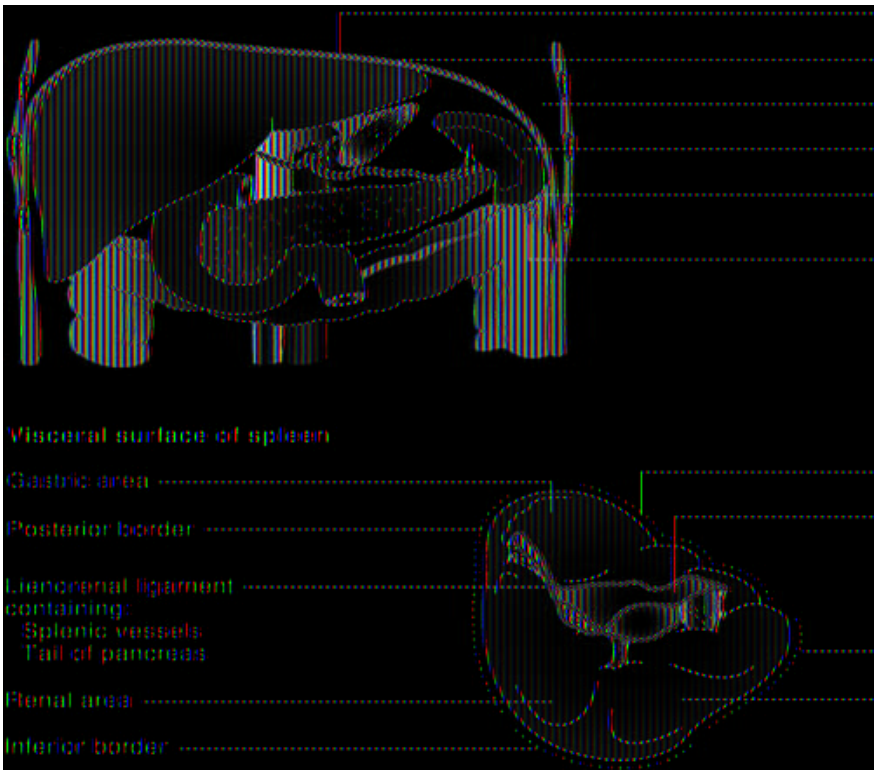

Figure 7.9-2. 2. Anatomic relation of the spleen to the liver, diaphragm, pancreas, colon, and kidney. The stomach is sectioned to illustrate the anatomic relations in situ. (Reproduced with permission from Greenfield LJ, Mulholland MW, Oldham KT, et al., eds: *Surgery: Scientific Principles and Practice,* 3rd edition. Lippincott Williams & Wilkins, Philadelphia: 2001.)

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Usual preop diagnosis: Staging laparotomy results; trauma; immune thrombocytopenic purpura; hereditary spherocytosis; other hereditary hemolytic anemia types; or a variety of myeloproliferative disorders

Summary of Procedures

	Splenectomy	Splenorrhaphy
Position	Supine	
Incision	Midline or left subcostal	
Special instrumentation	Suitable abdominal retractors	
Unique considerations	Potential for major blood loss during procedure; avoid splenic laceration and damage to tail of pancreas.	
Antibiotics	Cefoxitin 1 g iv	
VTE prophylaxis	Heparin 5000 units sq	
Surgical time	1–2 h	1–2 h
Closing considerations	Adequate hemostasis	
EBL	50–100 mL	200–500 mL
Postop care	NG decompression; PACU (nontrauma)	
Mortality	0–3%	
Morbidity	Thrombocytosis: > 1,000,000 → VTE Pulmonary complications: 3–23% Pancreatitis and/or pancreatic fistula: 1–8% Subphrenic abscess: 0–6% Bleeding: 1–5%	

	Overwhelming sepsis: 0.3–2%	
Pain score	5–7	5–7

Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	Common
Etiology	See Usual preop diagnosis, above.
Associated conditions	Blood dyscrasia (30–50%); abdominal or thoracic trauma (25%); Hodgkin's disease (5–10%); tumors (5%)

Anesthetic Considerations

See Anesthetic Considerations following Exploratory or Staging Laparotomy, p. 527.

Suggested Readings

1. Brunt LM, Langer JC, Quasebarth MA, et al: Comparative analysis of laparoscopy versus open splenectomy. *Am J Surg* 1996; 172:596–601.

2. Davidson RN, Wall RA: Prevention and management of infection in patients without a spleen. *Clin Microbiol Infect* 2001; 12:657–60.

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4. Fraker DL: Splenic disorders. In *Greenfield's Surgery, Scientific Principles and Practice,* 4th edition. Mulholland MW, Lillemore KD, Doherty GM, et al., eds. Lippincott Williams & Wilkens, Philadelphia: 2006, 1222–50.

5. Nurden AT, Nurden P. Increasing the platelet count in chronic ITP. *Lancet* 2008; 371:362–4.

Excision of Intraabdominal, Retroperitoneal Tumors

Surgical Considerations

Description: Intraabdominal and retroperitoneal tumors, other than those of visceral origin, consist primarily of sarcomas (liposarcoma, fibrous histiocytomas, mesenteric fibromas, and gastrointestinal stromal tumors). They are usually approached through a long midline incision for adequate exposure and to assess their resectability. Resection of such lesions may require excision of adjacent or involved small bowel or large intestine or other involved abdominal viscera. Care must be taken not to injure the ureters or major vessels, particularly at the root of the mesentery to the small bowel. It may be prudent to have ureteral stents placed to avoid injury to the ureters. If residual microscopic tumor remains, IORT may be indicated. In certain tumors, the patient may still benefit from “tumor debulking” (removing as much tumor as possible and treating the remaining tumor with radiation and/or chemotherapy). Operative approaches are dictated by location of tumor. Although most operative approaches are transabdominal, some retroperitoneal tumors may be approached retroperitoneally via oblique incision on either side of the abdomen. Some require thoracoabdominal incisions.

Usual preop diagnosis: Intraabdominal or peritoneal tumor

Summary of Procedures

Position	Supine
Incision	Midline abdominal or transverse
Unique considerations	Availability of blood
Antibiotics	Cefoxitin 1–2 g iv preop
VTE prophylaxis	Heparin 5000 units sq
Surgical time	3–4 h
Closing considerations	Hemostasis
EBL	300–1000 mL
Mortality	1–3%
Morbidity	Respiratory problems: 5–10% Wound infection: 2–4% Hemorrhage: 1–3%
Pain score	8–10

Patient Population Characteristics

Age range	Variable, 20–75 yr
Male:Female	1:1
Incidence	Common
Etiology	Unknown
Associated conditions	Partial bowel obstruction (10–15%); hydronephrosis (10–15%)

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Anesthetic Considerations

See Anesthetic Considerations for Intestinal and Peritoneal Procedures, p. 522, and for Exploratory or Staging Laparotomy, p. 627.

Suggested Readings

1. Sabel MS: Sarcomas of bone and soft tissue. In *Greenfield's Surgery, Scientific Principles and Practice,* 4th edition. Mulholland MW, Lillemore KD, Doherty GM, et al., eds. Lippincott Williams & Wilkens, Philadelphia: 2006, 2151–76.

2. Shukla PJ, Bareto SG, Shrikhande SV: Retroperitoneal sarcoma. *Br J Surg* 2007; 94:1057–8.

Drainage of Subphrenic Abscess

Surgical Considerations

Description: Abscesses may occur in subphrenic spaces, including the right subphrenic, right subhepatic, left subphrenic, lesser sac, or bare area of the liver (Fig. 7.9-3), following peritonitis, abdominal surgery or trauma. It is *(Print pagebreak 635)* important to know the anatomy of these spaces for making a correct diagnosis and for treatment. Most commonly abscesses are drained by interventional radiology (85%), but some may require an open surgical approach.

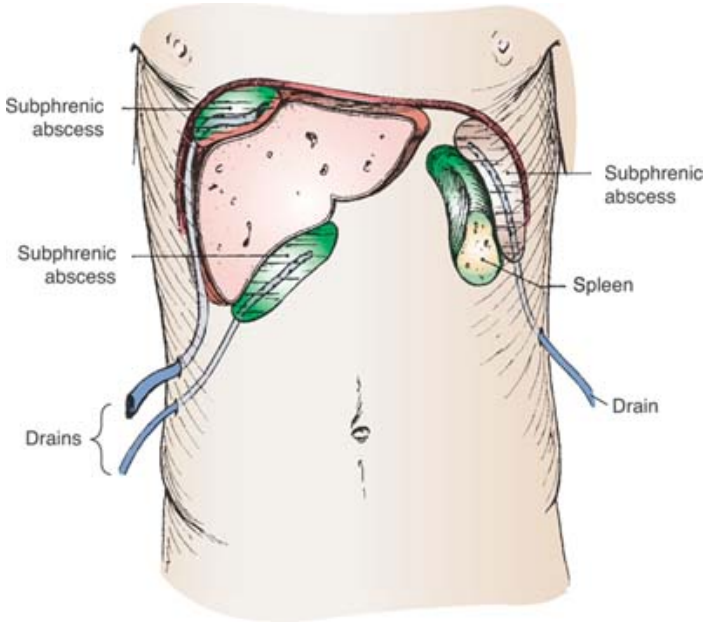

Figure 7.9-3. 3. Anatomy of subphrenic abscess. (Reproduced with permission from Baker RJ, Fischer JE: *Mastery of Surgery,* Vol. I. Lippincott Williams & Wilkins, Philadelphia: 2001.)

Drainage is accomplished by a **posterior** or **anterior extraperitoneal approach** or by a **transpleural approach,** depending on location of the abscess. Lesser sac abscesses are best approached by an **anterior transperitoneal route.** Abscesses in the bare area of the liver are drained posteriorly. After the abscess is localized, the cavity is entered by finger dissection and drained. Loculations are broken up and the cavity thoroughly irrigated with NS or a suitable antibiotic solution. Appropriate drains are placed and the wound is closed in a conventional manner. Cultures are routinely obtained.

Variant procedure or approaches: Percutaneous approaches have become more popular as experience is gained by interventional radiologists. This technique should be reserved for unilocular collections, where sterile cavities are not penetrated and a safe route is available.

Usual preop diagnosis: Subphrenic abscess

Summary of Procedures

	Subphrenic Abscess Drainage	Percutaneous Approach
Position	Supine or lateral decubitus, right or left	
Incision	Subcostal or oblique abdominal	None
Special instrumentation	Drainage tubes	Special catheters; CT guidance
Antibiotics	Zosyn (Piperacillin & Tazobactam) 3.375 g q6h	
VTE prophylaxis	Heparin 5000 units sq	
Surgical time	1–1 h	
EBL	50–100 mL	10–25 mL
Postop care	Maintain patency of the drainage tubes	
Mortality	< 5%	
Morbidity	Inadequate drainage: 5–10% Pulmonary complications: 5–10% Bowel perforation: < 2%	
Pain score	7–9	4–5

Patient Population Characteristics

Age range	Variable, 15–80 yr
Male:Female	1:1
Incidence	Common
Etiology	Postop (70–80%); peritonitis (25–30%); trauma (5–10%)
Associated conditions	See Etiology, above.

Anesthetic Considerations

See Anesthetic Considerations for Intestinal and Peritoneal Procedures, p. 522.

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Suggested Readings

1. Baker RJ, Fischer JE: *Mastery of Surgery,* 4th edition. Lippincott Williams & Wilkins, Philadelphia: 2001, 1075–80.

2. Doherty GM, Way LW: Peritoneal cavity. In *Current Surgical Diagnosis and Treatment,* 12th edition. Doherty GM, ed. McGraw-Hill, New York: 2005, 493–507.

3. Goulet CJ: Endoscopic transgastric drainage of subphrenic abscess. *Gastrointest Endosc* 2007; 65:733–5.

Inguinal Herniorrhaphy

Surgical Considerations

Description: Groin hernias are defects in the transverse abdominis layer, where a direct hernia comes through the posterior wall of the inguinal canal and an indirect hernia comes through the internal inguinal ring (Fig. 7.9-4). Direct hernias are medial to the inferior epigastric artery and vein, whereas indirect hernias are lateral to these vessels. Surgical approach can be either anterior or posterior. In general, an **anterior approach** (Bassini, McVay's, Shouldice, or mesh repair) is used for primary repair of an indirect or direct inguinal hernia. The **Bassini repair** consists of ligation of the hernia sac and suturing the conjoint tendon to the shelving edge of Poupart's ligament. **McVay's repair** sutures the conjoint tendon to Cooper's ligament and usually is reserved for femoral inguinal hernias. **Shouldice** emphasizes the closing of the transverse fascia and transversus abdominal muscle layers. Currently, the interposing of Marlex mesh or insertion of a Marlex plug between the conjoint tendon, the internal oblique muscle, and the inguinal ligament is commonly used. Other modifications are indicated in special situations.

A **posterior approach** is used by some surgeons for the repair of femoral hernias and recurrent inguinal hernias and for treating incarcerated and strangulated hernias. The **posterior preperitoneal approach** is normally performed by suturing the transversus abdominis arch on the superior aspect of the hernia defect to Cooper's ligament and the iliopubic tract on the inferior aspect of the defect.

The **laparoscopic approach** is indicated for the repair of recurrent or bilateral inguinal hernias and utilizes a **preperitoneal patch repair** and results in less postop pain and an earlier return to normal physical activity (see Laparoscopic Inguinal Hernia Repair, p. 595).

Usual preop diagnosis: Groin pain or lump

Summary of Procedures

Position	Supine
Incision	Oblique or transverse

Unique considerations	Avoid damage to nerve structure and spermatic cord. Avoid interfering with blood supply to testes.
Antibiotics	Cefazolin 1 gm iv preop
Surgical time	1–1.5 h
Postop care	PACU → room
EBL	25–50 mL
Mortality	3/100,000
Morbidity	Wound abscess: < 3% Wound hematoma: < 2%
Pain score	4–5

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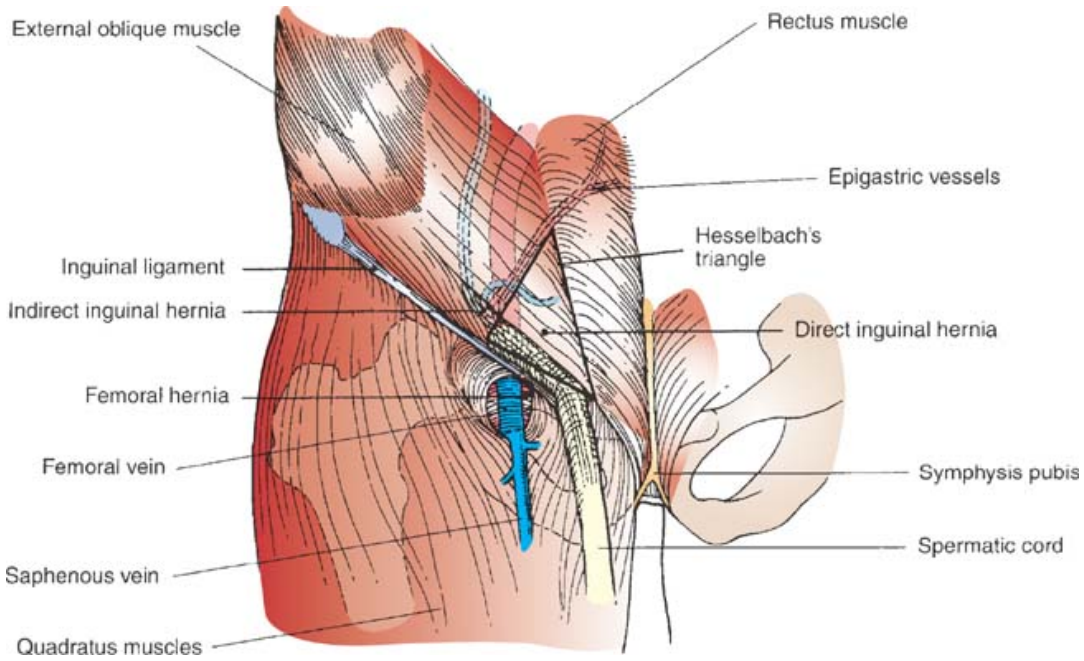

Figure 7.9-4. 4. Inguinal anatomy. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

Patient Population Characteristics

Age range	1–90 yr
Male:Female	85:15
Incidence	15/1000
Etiology	Congenital variants; reduced collagen synthesis in adults
Associated conditions	Chronic cough; urinary retention; chronic constipation

Anesthetic Considerations

See Anesthetic Considerations following Repair of Abdominal Dehiscence, p. 641.

Suggested Readings

1. Gray SH, Hawn MT, Itani KM: Surgical progress in inguinal and ventral hernia repair. *Surg Clin North Am* 2008; 88:17–26.

2. Hallen M, Bergenfelz A, Westerdahl J: Laparoscopic extraperitoneal inguinal hernia repair versus open mesh repair: long-term follow-up of a randomized control trial. *Surgery* 2008; 143:313–7.

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5. Richards AT, Quinn TH, Fitzgibbons RJ: Abdominal wall hernias. In *Greenfield's Surgery: Scientific Principles and Practice,* 4th edition. Mulholland MW, Lillemore KD, Doherty GM, et al., eds. Lippincott Williams & Wilkins, Philadelphia: 2006, 1172–209.

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Femoral Herniorrhaphy

Surgical Considerations

Description: The hernia sac is exposed as it exits the preperitoneal space through the femoral canal (Fig. 7.9-5). If the hernia cannot be reduced, the possibility of strangulation needs to be kept in mind. The peritoneal sac in most cases should be opened proximal to the femoral canal in order to gain control of the intestine before it reduces itself into the peritoneal cavity. If the bowel is ischemic, it may require resection. The repair consists of suturing the iliopubic tract to Cooper's ligament, taking care not to compromise the femoral vein (McVay repair).

Usual preop diagnosis: Bulging of tissues over femoral canal

Summary of Procedures

Position	Supine
Incision	Oblique
Antibiotics	Cefazolin 1 g iv
Surgical time	1–1.5 h
EBL	25–50 mL
Postop care	PACU → room
Mortality	< 1% (6–20%, if strangulated)
Morbidity	Recurrence: 6%
Pain score	5–6

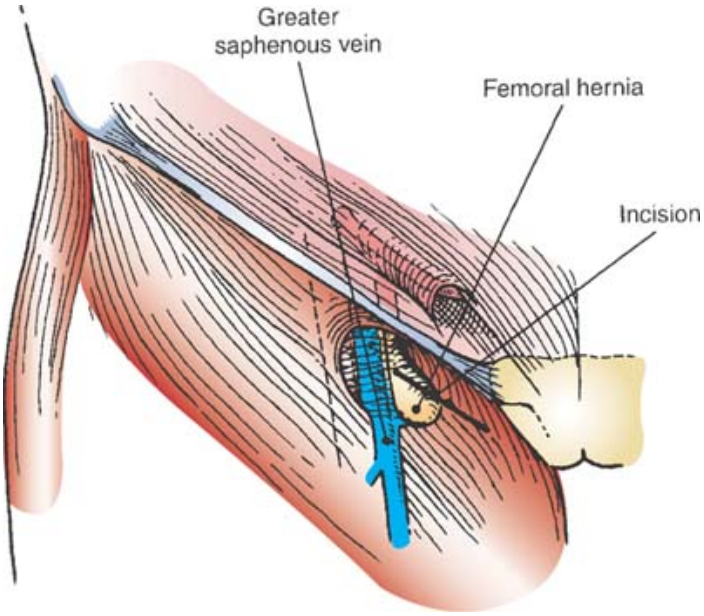

Figure 7.9-5. 5. Femoral hernia repair. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy,* 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2003.)

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Patient Population Characteristics

Age range	Adults; rare in children
Male:Female	1:4
Incidence	1.5% of all groin hernias
Etiology	Failure of preformed peritoneal sac to obliterate; muscle atrophy in older age group

Anesthetic Considerations

See Anesthetic Considerations following Repair of Abdominal Dehiscence, p. 641.

Suggested Readings

1. Javid PF, Brooks DC: Hernias. In *Maingot's Abdominal Operations,* 11th edition. Zinner MJ, Ashley JS, eds. McGraw Hill, New York: 2007, 105–40.

2. Richards AT, Quinn TH, Fitzgibbons RJ: Abdominal wall hernias. In *Greenfield's Surgery: Scientific Principles and Practice,* 4th edition. Mulholland MW, Lillemore KD, Doherty GM, et al, eds. Lippincott Williams & Wilkins, Philadelphia: 2006, 1172–209.

3. Suzuki S, Furui S, Okinaga K, et al: Differentiation of femoral vs inguinal hernia: CT findings. *AJR* 2007;189:78–83.

Repair of Incisional Hernia

Surgical Considerations

Description: Incisional hernias can occur after any abdominal incision, but are most common following midline incisions. Factors

leading to herniation are: wound infection, trauma, inadequate suturing, and ischemia. Following skin incision, the skin edges and subcutaneous fat are retracted and the dissection is carried down to the hernia defect. The redundant hernia sac is excised and the fascia is freed up on both sides of the wound. Primary closure is preferred, if possible.

Variant procedure or approaches: In addition to primary repair, the latter may be reinforced by an onlay mesh prosthesis, or the prosthesis may be used to fill the hernial defect or placed behind the muscle layer. In the repair of incisional hernias, laparoscopic tacking of mesh is gaining in popularity.

Usual preop diagnosis: Incisional hernia

Summary of Procedures

Position	Supine
Incision	Vertical or transverse
Special instrumentation	Mesh prosthesis (when indicated)
Antibiotics	Cefoxitin 1 g iv
VTE prophylaxis	Heparin 5000 units sq
Surgical time	1–2 h
Closing considerations	Retention sutures
EBL	100–200 mL
Postop care	NG decompression; abdominal binder; PACU → ward
Mortality	< 1%
Morbidity	Ileus: 5–10% Respiratory complications: 5–10% Wound infection: 1–2%
Pain score	5–6

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Patient Population Characteristics

Age range	20–70 yr
Male:Female	1:1
Incidence	3–5% of midline abdominal incisions
Etiology	Wound infection; trauma; inadequate suturing; weak tissues
Associated conditions	Obesity; malnutrition

Anesthetic Considerations

See Anesthetic Considerations following Repair of Abdominal Dehiscence, p. 641.

Suggested Readings

1. Condon RE: Ventral abdominal hernia. In *Mastery of Surgery,* Vol II, 4th edition, Baker RJ, Fischer JE, eds. Lippincott Williams & Wilkins, Philadelphia: 2001, 1983–8.

2. Gray SH, Hawn MT, Itani KM: Surgical progress in inguinal and ventral hernia repair. *Surg Clin North Am* 2008; 88:17–26.

3. Javid PF, Brooks DC: Hernias. In *Maingot's Abdominal Operations,* 11th edition. Zinner MJ, Ashley JS, eds. McGraw Hill, New York: 2007, 105–40.

4. Liberman HA, Rosenthal RJ, Phillips EH: Laparoscopic ventral and incisional hernia repair: a simplified method of mesh placement. *J Am Coll Surg* 2002; 194:93–5.

5. Richards AT, Quinn TH, Fitzgibbons RJ: Abdominal wall hernias. In *Greenfield's Surgery: Scientific Principles and Practice,* 4th edition. Mulholland MW, Lillemore KD, Doherty GM, et al., eds. Lippincott Williams & Wilkins, Philadelphia: 2006, 1172–209.

Repair of Abdominal Dehiscence

Surgical Considerations

Description: Dehiscence implies a “splitting apart” or “bursting open” of the abdominal wall fascia. A complete dehiscence is a separation of all layers of the abdominal wall and often is associated with an extrusion of abdominal viscera. If incomplete, the separation of fascial and muscular layers results in an incisional hernia or an obstruction of a herniated loop of intestine. The earliest sign of a wound dehiscence is the presence of serosanguineous drainage from the wound. Minimal disruptions may be treated conservatively with occlusive dressings and an abdominal binder. Major dehiscence requires operative repair using retention sutures.

Variant procedure or approaches: Variations in the type of closure depend on surgeon's preference. Interrupted, nonabsorbable sutures and skin bridges are often used.

Usual preop diagnosis: Wound dehiscence

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Summary of Procedures

Position	Supine
Incision	Closure of previous incision
Unique considerations	Adequate muscle relaxation essential
Antibiotics	Cefoxitin 1–2 g iv
VTE prophylaxis	Heparin 5000 units sq
Surgical time	1–2 h
EBL	50–100 mL
Postop care	Abdominal binder to relieve tension on suture line; PACU → ward
Mortality	5–10%
Morbidity	Recurrent incisional hernia: 5–10% Wound infection: < 5% Wound ischemia: 1–2%
Pain score	4–5

Patient Population Characteristics

Age range	25–90 yr
Male:Female	1:1
Incidence	1.3% in patients < 45 yr 5.4% in patients > 45 yr
Etiology	Wound infection; excessive coughing or sneezing; excessive abdominal distention; weak tissue; poor nutrition; hematoma

Associated conditions	formation; poor surgical technique with tissue ischemia Malnutrition (25–30%); ascites (20–25%); hypoproteinemia (20%); chronic anemia (5–10%); vitamin C deficiency (< 5%)

Anesthetic Considerations

Procedures covered: inguinal herniorrhaphy; femoral herniorrhaphy; incisional hernia repair; repair of abdominal dehiscence

Preoperative

Predisposing factors for hernia often include increased abdominal pressure 2° chronic cough, bladder outlet obstruction, constipation, pregnancy, vomiting, ↑BMI, and acute or chronic muscular effort. These factors should ideally be managed preop to avoid postop recurrence. The patient population may range from premature infants to the elderly, who have the potential for presenting with multiple medical problems.

Musculoskeletal	Pain is likely to be present in area of hernia; evaluate bony landmarks if regional anesthesia is planned.
Gastrointestinal	Hernias may become incarcerated, obstructed, or strangulated, requiring emergency surgery. Fluid and electrolyte imbalance is likely. **Tests:** Electrolytes, if indicated from H&P
Hematologic	For regional anesthesia, patient's coagulation status, if indicated from H&P. **Tests:** As indicated from H&P
Laboratory	Other tests as indicated from H&P
Premedication	If necessary, standard premedication (see p. B-2).

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Intraoperative

Anesthetic technique: GA, regional, or local anesthesia ± iv sedation (MAC) may all be appropriate anesthetic techniques for uncomplicated cases (e.g., without incarceration or obstruction). Choice depends on factors such as site of incision, patient physical status, and preference of both patient and surgeon. Profound muscle relaxation may be necessary to facilitate exploration and repair.

Regional anesthesia:

Spinal	**Single-shot vs continuous:** Patient in sitting or lateral decubitus position (operative site down) for placement of hyperbaric subarachnoid block. Doses of local anesthetics are as follows for T4-T6 level: 0.75% bupivacaine in 8.25% dextrose (10–15 mg); 0.5% tetracaine in 5% dextrose (12–16 mg). Consider adding fentanyl (10–20 mcg).
Epidural	Patient in sitting or lateral decubitus position for placement of epidural catheter. After locating the epidural space, administer a test dose (e.g., 3 mL of 1.5% lidocaine with 1:200,000 epinephrine) to determine whether the catheter is subarachnoid or intravascular. Titrate local anesthetic (e.g., 1–2% lidocaine or 0.5% bupivacaine or ropivacaine) until desired surgical level is obtained (5–7 mL at a time), usually 20 mL. Consider adding fentanyl (25–100 mcg).
Local	Requires gentle surgical technique. Surgical field block, plus ilioinguinal and iliohypogastric nerve blocks, using 0.5% bupivacaine with 1:200,000 epinephrine. Usually performed by surgeon.

General anesthesia:

Induction	**LMA vs ETT:** Standard induction (see p. B-2). LMA may be suitable for the patient who presents with a simple chronic hernia. If there is obstruction, incarceration, or strangulation, however, a rapid-sequence induction (see p. B-5) with ET intubation is indicated. GETA also may be indicated in the patient with wound dehiscence.	
Maintenance	Standard maintenance (see p. B-3). Muscle relaxants may be necessary to facilitate surgical repair.	
Emergence	Consider extubating the trachea while patient is still anesthetized to prevent coughing and straining. Patients who are at risk for pulmonary aspiration and require awake intubation or rapid-sequence induction (see p. B-4) are not candidates for deep extubation.	
Blood and fluid requirements	Minimal blood loss IV: 16–18 ga × 1 NS/LR @ 5–8 mL/kg/h	
Monitoring	Standard monitoring (see p. B-2).	
Positioning	and pad pressure points eyes	
Complications	↓↓ HR + ↓ BP	Vagal reflex evoked by bowel traction.

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Postoperative

Complications	PDPH after neuraxial block Urinary retention, common with regional anesthesia Wound dehiscence with coughing/straining	Patients with urinary retention may require intermittent catheterization until urinary function resumes.
Pain management	PO analgesics: Acetaminophen and codeine (Tylenol #3 1–2 tab q 4–6 h) or oxycodone and acetaminophen (Percocet 1 tab q 6 h)	Surgical field block or regional anesthesia should provide sufficient analgesia postop.

Suggested Readings

1. Abbott DE, Dumanian GA, Halverson AL: Management of laparotomy wound dehiscence. *Am Surg* 2007; 73:1224–7.

2. Cousins MJ, Bridenbaugh PO, eds: *Neural Blockade Pain Management,* 3rd edition. Lippincott-Raven Publishers, Philadelphia: 1998.

3. Ellis H: Incisions, closures and management of the wound. In: *Maingot's Abdominal Operations,* Vol. I, 10th edition. Zinner MJ, ed. Appleton & Lange, Stamford, CT: 1997, 395–426.

4. Horlocker TT, McGregor DG, Matsushige DK, et al: A retrospective review of 4767 consecutive spinal anesthetics: central nervous system complications. Perioperative Outcomes Group. *Anesth Analg* 1997; 84(3):578–84.