Postoperative Care

Introduction

The goal of postoperative care is to minimize complications of anesthesia and surgery by early detection and prompt treatment. After receiving anesthesia patients may experience pain, inadequate oxygenation, or adverse physiologic effects of sudden movement.

Recovery from general anesthesia takes longer than induction because the anesthetic is retained in fat and muscle. Fat has a meager blood supply; thus, it releases the anesthetic slowly, providing enough anesthesia to maintain adequate blood and brain levels during surgery. The patient's recovery time varies with his amount of body fat, his overall condition including renal function, his pre-medication regimen, and the type, dosage, and duration of anesthesia.

Physician's Orders

Check the physician's orders for:

- ❖ Pain management
- ❖ Other medication orders
- ❖ IV fluids/diet
- ❖ Wound/drain care
- ❖ Position/activity/C & DB-patients should ambulate as soon as possible
- ❖ Lab work or other tests
- ❖ Other orders

The PACU Record

Obtain and review the patient's PACU record, paying particular attention to:

- ❖ Summary of operative procedures and pertinent findings
- ❖ Type of anesthesia and any other medications given-preoperative, intraoperative, and postoperative
- ❖ Vital signs
- ❖ Medical history, including medications
- ❖ Fluid therapy, including estimated blood loss
- ❖ Type and number of drains, catheters and note amount and characteristics of any drainage
- ❖ The location(s) and condition of the surgical wound

GI Emergencies

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Objectives

- Describe the causes of GI bleed and the clinical presentation of the patient
- Identify diagnostic tests for GI bleed
- Discuss implications and management of GI bleed
- Describe the etiology of bowel obstructions
- Describe the clinical presentation of a patient with a small or large bowel obstruction
- Describe the diagnosis and management of bowel obstruction
- Define abdominal compartment syndrome and causes
- Identify the implications of increasing intra-abdominal pressure
- Define decompression and discuss its use and importance
- Discuss important assessment and observation points in caring for a patient with a GI bleed, BO, or following GI surgery

GI Bleed

Life-threatening GI bleeding:
- Originates most commonly in the upper GI tract
- Requires immediate intervention to prevent complications
- Bleeding stops spontaneously in 80-90% of cases
- Sudden blood loss leads to risk of developing decreased tissue perfusion and O2 carrying capacity
- Lower GI bleeding is generally a disease of the elderly

Upper GI Bleed, Causes

- Peptic Ulcer Disease (most Common)
- Varices
- Pathologies of the Esophagus (tumors, inflammation, Ulcers)
- Pathologies of the Stomach (cancer, erosive gastritis, stress ulcer, tumors)
- Pathologies of the small Intestine (peptic ulcers, angiodysplasia)

Peptic Ulcers

- Caused by hypersecretion of gastric acid coupled with impaired GI tract mucus secretion: Ex: Gastric Ulcer, Duodenal Ulcer
- Occur in the stomach and duodenum
- Characterized by a break in the mucosal layer that penetrates the inner most muscle layer, resulting in bleeding

Gastroesophageal Varices

- Develop as a result of increased pressure in the portal venous system of the liver
- Obstructive disease of the liver impairs blood flow through it; blood is diverted to collateral channels found in the:
    - *distal esophagus (esophageal varices)
    - *proximal stomach (gastric varices)
    - *rectal vault (hemorrhoids)
- Acute upper GI bleed occurs when esophageal or gastric varices rupture as a result of increased portal vein pressure
- Portal Hypertension: Most commonly caused by liver disease, liver trauma, or thrombosis of the splenic or portal veins
- Associated with massive upper GI bleed

GI Bleed with Sudden Blood Loss

- Decrease in Venous Return to Heart
- Corresponding Decrease in Cardiac Output
- Triggers Cascade of *Hypovolemic Shock* (Refer to Handout- Hypovolemia algorithm)

Clinical Presentation

- History of: PUD, smoking, ETOH abuse, liver disease, severe physiologic stress, NSAID use, anticoagulant or antiplatelet therapy, other GI bleeding causes
- Hematemesis
- Melena/maroon stools
- Hematochezia
- Nausea
- Epigastric Pain
- Abdominal Distention
- Bowel Sounds-Increased or decreased
- Tachycardia, decreased pulses
- Increased and deep respirations
- Hypotension
- Fever

More Signs and Symptoms

- Cold, clammy skin
- Dry mucus membranes
- Weakness
- Decreased urinary output
- Mental status changes, anxiety, restlessness
- ECG changes (Consistent with ischemia): ST changes, arrhythmias

Diagnostic Tests

- Hematocrit/Hemoglobin (may be normal initially, decrease with fluid resuscitation and blood loss)
- WBC-elevated
- Platelet Count-decreased depending on amount of blood loss
- Sodium-increased initially, will ↓ with fluid replacement
- Potassium, usually decreased with vomiting
- BUN ↑ due to ↓ renal perfusion/hypovolemia
- Creatinine, usually stays about the same
- Serum Lactate will rise with anaerobic metabolism as bleeding continues and O2 carrying capacity of blood diminishes
- PT/PTT-usually decreased
- ABG-respiratory alkalosis early, then metabolic acidosis
- Gastric Aspirate-normal or acidic pH, guaiac positive

Management of Upper GI Bleed

Goals:
- Hemodynamic stabilization
- Identification of bleeding site
- Initiation of definitive medical or surgical interventions to stop or control bleeding
- Patient support and treatment of anxiety

Hemodynamic Stabilization

- Monitor VS including orthostatic changes, CVP, MAP and quality of pulses
- Insert at least 2 large bore IVs
- Obtain lab work: H/H, clotting studies, Type and cross-match
- Administer IV colloids, crystalloids, or blood products as ordered
- Monitor Coagulation studies (PT/PTT, PLTs)
- Monitor fluids and renal status (I/O, daily weight, BUN, Cr)
- Insert NG tube if large amount of bleeding
- Positon patient on side
- Monitor Temp-maintain normothermia
- Prepare patient for emergent endoscopy
- Administer O2, monitor respiratory function

Identification of Bleeding Site

- H and P
- Endoscopy to determine exact site:
  *Sedation
  *Position patient in left lateral
    decubitus position
  *Have suctioning equipment
    available
  *Monitor for cardiac ischemia
    during exam

Interventions to Stop or Control Bleeding

Refer to Handout, *Upper GI Bleeding Treatment Guide*

- Assess severity of blood loss
- Hemodynamic stabilization
- Emergency endoscopy

Lower GI Bleed

- Less common than UGIB
- Generally a disease of the elderly
- Usually associated with diverticulosis or cancer

Bowel Obstruction

- Small Bowel Obstruction (SBO)
- Large Bowel Obstruction (LBO)
- Ileus
- Acute Colonic Pseudo Obstruction

SBO, Etiology

- Adhesions resulting from previous surgery-most common cause
- Malignant tumors-2nd most common cause
- Other-hernias, Crohn disease

LBO, Etiology

- Colorectal cancer-most common cause of LBO in the US
- Other (Intrinsic): Fecal impaction, foreign bodies, inflammatory disease, ischemia, intussusception, anastomotic strictures
- Other (Extrinsic): Hernias, abscess, tumors in adjacent organs

Early Presentation

- Increased bowel motility and contractions
- Diarrhea
- Dehydration and hypovolemia
- Hypochloremia, hypokalemia, metabolic acidosis
- Abdominal distention

In SBO or LBO

- A segment of intestine can become trapped with a compromised blood supply
- Ischemia can occur and lead to bowel necrosis
- Cecum-most common site of colonic ischemia or perforation

Ileus

- Intestinal distention and the slowing or absence of the passage of intestinal contents
- Common causes: Drug induced (opiates, anticholinergics, psychotropics), metabolic derangements, neurogenic, infections
- Most common after abdominal operations
- Persists the longest after colon surgery

Acute Colonic Pseudo-obstruction

- AKA Ogilvie Syndrome
- Distention of the colon with signs and symptoms of obstruction, in the absence of a physical or mechanical cause
- Characterized by the absence of intestinal contractility
- Unknown cause
- Commonly seen in hospitalized or institutionalized patients, elderly, chronic renal failure, respiratory/ cerebral/cardiovascular disease
- Primarily affects the colon
- Diagnosed after LBO ruled out

Clinical Presentation of Bowel Obstruction

S &S will vary depending on cause and location

- Prior abdominal surgery
- Ischemia
- Hernia
- Abdominal cancer
- Abdominal radiation
- Inflammatory bowel disease
- Failure to pass stool or flatus
- Diarrhea
- Abdominal pain
- Abdominal distention
- Generalized tenderness

Clinical Presentation, cont'd

- Nausea, Vomiting
- Bowel sounds, may be hyperactive or absent
- Visible peristalsis
- Tympany
- Tachycardia
- Hypotension
- Fever
- Localized tenderness, rebound, guarding (suggest peritonitis)

Diagnosis of BO

- Abdominal films
- CT Scan
- Water soluble contrast enema may be necessary

Management of BO

- NGT (nasogastric tube)
- IVF
- Electrolyte monitoring and replacement
- Bowel Rest
- Antiemetics
- Antibiotics
- A Rectal Tube can be used to decompress the distal colon in patients with LBO
- Management of Ileus-supportive, eliminate cause
- Management of ACPO-Neostigmine (2.5mg IV over 3 min.).Patient must be on telemetry, atropine should be readily available. Colonoscopy for decompression if no response, surgery reserved for patients with S&S of ischemia, perforation or clinical deterioration

Management cont'd

- Approximately 90% of all SBO will resolve spontaneously with supportive therapy; Occasionally surgery will be required
- Refer to handout: (Intervention) SBO for Inpatients, Process
- LBO is treated with surgery:

  Lysis of adhesions

  Reduction of hernias

  Bypass of obstructions

  Resection of affected intestine

  Temporary or permanent ileostomy or colostomy

Management cont'd

- IVF-monitor patient response (VS, Wt., I & O)
- Antimicrobial therapy
- Elevate HOB to promote lung expansion, relieve pressure from abdominal distention
- Deep breathing exercises
- Pain management-(analgesics and sedatives) avoid opiates
- NGT-suction to drain and decompress the upper GI tract
- Monitor and report S&S of ongoing infection or peritoneal signs or clinical deterioration
- Provide nutrition as prescribed

Whipple Procedure

- Pancreatoduodenectomy-procedure performed for tumors of the head of pancreas
- 6-7 hour OR case
- Diagnosis made by ERCP
- Removal of pancreatic head, duodenum, part of the jejunum, common bile duct, and gallbladder
- Only 10-15% of patients with pancreatic cancer benefit from surgical resection

Other procedures

- **Tumors in the pancreatic duct**-further down (tail of the pancreas) removed laparoscopically
- **Tumors in the middle of the pancreas**-removed either laparoscopically or invasively depending on the size (middle pancreatectomy)
- Most of the Islet cells are in the tail of the pancreas

Islets cells of the pancreas secrete insulin-the patient may be discharged on insulin if part or all of the tail of the pancreas is removed.

Nursing Care

- Pulmonary toilet-long OR, general anesthesia
- NG tube for decompression
- Monitor VS, note changes/trends
- Pain assessment-PCEA for 3-5 days
- A-line for BP continuous monitoring
- Drains-usually 2 JPs; monitor amount and color
- Leakage-check color of JP drainage
- Monitor for Bleeding
- Glucose control (goal <150; 150-170 is tolerated)
- Wound infection control-monitor for signs of infection
- Diet-clear liquids, advanced as tolerated, very individual
- Meds to decrease pancreatic enzymes
- Early ambulation (post-op day #1)
- Listen to the patient!

Complications

- Leaking of pancreatic juices-most common post-op complication

    *most common with tumors in the middle of the pancreas
- Bleed-retroperitoneal, monitor for lower back pain
- Diabetes-If tail of pancreas removed
- Weight loss
- Post-op complications

Leaks

Watch for:

- Changes in VS
- Signs and symptoms of infection-potential for sepsis
- Change in drainage color (cloudy/whitish or muddy water)
- Abdominal distention, firmness, tenderness
- C/O abdominal pain, no longer relieved by pain med

Rx:

- NPO
- Possible to OR

Abdominal Compartment Syndrome

- Potentially lethal condition, results from intra-abdominal hypertension
- Intra-abdominal pressure normally 5-7 mm Hg
- Abdominal compartment syndrome defined as a sustained IAP > 20 mm Hg
- Etiology:
  Aggressive fluid resuscitation
  Burns
  Ascites, peritonitis, abdominal surgery, intraperitoneal bleed
  Gaseous bowel distention
  Ruptured abdominal aneurism
  Trauma
  Sepsis
- Distended abdomen compresses the organs in the abdominal and chest cavities

Abdominal Compartment Syndrome

- Effects on other systems

  Cardiovascular: ↓ Cardiac Output, ↓venous return

  Respiratory: Compromised lung expansion

  Neurologic: ↓Cerebral Blood Flow

- Treatment

  Monitor IAP, as well as other hemodynamics

  Reduce Intra-abdominal volume

  Ventilatory support

  Hemodynamic support

  Surgical decompression

Decompression

- NGT-used to decompress the distended stomach from fluid or air
- Large bore, single or double lumen
- Levine tube-single lumen (14-18 Fr)
- Must be connected to low (30-40mm), intermittent suction to prevent gastric erosion and tearing of the stomach lining
- Should be replaced with a feeding tube for feedings and med administration

Always note tube marking at the nare to identify migration!

Patient Assessment

- VS (HR, BP, RR, T, U/O, CVP, Wt.)
- ECG
- Patient clinical presentation
- Pain
- Abdomen
- Drainage from tubes/drains
- Observe for trends and response to interventions/therapies
- Identify new potential problems, deviations from baseline assessment

Pain Assessment

- Pain/discomfort- clues to the patient and nurse that something is wrong
- Needs prompt attention
- Differentiate acute from chronic pain
- Determine related physiologic symptoms
- Qualities and characteristics of pain
- Investigate patient's perceptions and emotional reactions to the pain
- Avoid applying personal values when assessing pain
    - *Use patient's own words and descriptions
    - *Use pain scale
- **Listen to the patient!**

Documentation

Consistent and thorough

- All VS: Observe for trends!
- Patient assessment
- Observations
- Wounds, dressings
- Drainage tubes
- Patient response to interventions/therapies
- Any newly identified problems

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The Postoperative Assessment

A systematic approach helps to ensure a thorough assessment:

- ❖ Overall appearance
- ❖ Level of consciousness, skin color, mucous membranes
- ❖ Respiratory status-breathing pattern, rate, depth, auscultate breath sounds; monitor O2 saturation and obtain an order to administer oxygen if needed
- ❖ Pulse-rate and quality-should be within 20% of the pre-op heart rate
- ❖ Blood Pressure-should be within 20% of pre-op BP
- ❖ Temperature-anesthesia lowers body temperature; use blankets as needed
- ❖ Pain-intensity, characteristics, location, frequency, duration; provide medication as needed/ordered
- ❖ Other symptoms or sources of discomfort-nausea, vomiting, positioning, anxiety; provide medication as needed/ordered
- ❖ Infusion sites-assess for redness, swelling, infiltrates, pain, drainage
- ❖ Surgical wound dressings-assess drainage, amount, characteristics, odors
- ❖ Presence and condition of drains and tubes-color, type, odor, amount of drainage and urinary output. **Make sure all tubes and drains are properly connected and free of kinks and obstructions.**
- ❖ Post vascular or orthopedic surgery-assess extremity(s) for color, temperature, sensation, movement, presence and quality of pulses
- ❖ Antiembolic stockings/PAS stockings-apply to **non-surgical** leg(s)
- ❖ Monitor intake and output closely
- ❖ Assess for the presence of bowel sounds and passage of flatus before offering food to patients following abdominal surgery-check physician orders
- ❖ Encourage coughing and deep breathing exercises
- ❖ Patient controlled anesthesia-instruct patient on how to use (if being used)
- ❖ Instruct the patient on the use of the call bell
- ❖ Assess lab work-Lab values often change within the first 2 days following surgery as a result of blood and fluid loss and the body's reaction to surgery

Special considerations

- ❖ Fear, pain, anxiety, hypothermia, confusion, and immobility can upset the patient and jeopardize his safety and postoperative status. Offer emotional support to the patient and his family. Keep in mind that the patient who has lost a body part or who has been diagnosed with an incurable disease will need ongoing emotional support. Refer him and his family for counseling as needed.

- ❖ If the patient has **epidural analgesia infusion** for postoperative pain control, monitor his respiratory status closely. *Respiratory arrest may result from the respiratory depressant effects of the opioid.* Also monitor the patient's blood

pressure, heart rate, and arterial oxygen saturation. He may also suffer nausea, vomiting, or itching. Epidural analgesia may also include administering a local anesthetic with the opioid. Assess the patient's lower-extremity motor strength every 2 to 4 hours. If sensorimotor loss occurs (numbness or weakness of the legs), notify the anesthesiologist because the dosage may need to be decreased.

❖ If the patient is older, be aware of age-related changes that will alter your assessment. Cardiovascular status should be monitored carefully *because blood loss, pain, bed rest, and fluid and electrolyte imbalances can alter it.* Respiratory status also should be monitored carefully *because ventilation and oxygenation can be altered by age-related changes or years of smoking or chronic diseases.* Monitor level of consciousness and pain carefully *because mental status changes can affect these and make pain control more difficult. Drug metabolism slows with age* so monitor the older adult's risk for drug reactions, toxicity, and interactions. Monitor intake and output carefully and watch for urinary tract infections because of decreased renal functioning and decreased bladder capacity. Be careful when positioning the older patient and prevent postoperative falls *because the patient may have osteoporosis and may be prone to fractures.* Also monitor for signs and symptoms of infection *because risk for infection increases with age.*

❖ **All post-operative patients are considered a fall risk for the first 24 hours** following surgery. Assist patients with ADLs and mobility during this time. Assessment of fall risk is ongoing!

Complications

Postoperative complications may include arrhythmias, bleeding, hypotension, hypovolemia, septicemia, septic shock, atelectasis, pneumonia, thrombophlebitis, pulmonary embolism, urine retention, wound infection, wound dehiscence, evisceration, abdominal distention, paralytic ileus, constipation, altered body image, and postoperative psychosis.

Documentation

Document assessments and vital signs on the appropriate flowsheet. Record the condition of dressings, and drains, and characteristics of drainage. Document all interventions taken to alleviate pain and anxiety and the patient's responses to them. Document any complications and interventions taken, as well as patient response.

2008 Lippincott Williams & Wilkins- Postoperative Care; Updated 1/2015, LM

The Whipple procedure

Better outcomes for pancreatic cancer surgery.

Pancreatic cancer has been in the public eye lately because it has afflicted several prominent people, including Supreme Court Justice Ruth Bader Ginsburg, Apple CEO Steve Jobs, actor Patrick Swayze, and Randy Pausch, a computer science professor at Carnegie Mellon University whose inspirational last lecture became a YouTube sensation and, as a book, a national best seller.

It's odd that the disease would strike so many famous people at about the same time, because pancreatic cancer is fairly uncommon. Nearly 38,000 Americans were diagnosed with the disease last year, a fraction of the 215,000 who will be diagnosed with lung cancer. The media attention isn't hard to fathom, though. It's morbid interest: no other common cancer has such a poor prognosis. Only about 5% of those diagnosed with pancreatic cancer are alive five years later, in contrast to about 66% of colon cancer patients and 90% of female breast cancer patients. For a variety of reasons—screening, earlier diagnosis, better treatment—cancer isn't the proverbial death sentence it once was. For many, it is a survivable (if harrowing) condition that can be lived with for many years in relative good health. Pancreatic cancer stands out as a throwback.

But one bright spot in pancreatic cancer treatment is improved results for the Whipple procedure, the operation most often used to treat the disease. In the 1970s, over 15% of the patients who had the procedure died during the operation or shortly afterward. Improvements in surgical technique, anesthesia, and postoperative care have driven that rate into the low single digits at some hospitals, and the five-year survival rate after the operation may be as high as 20%. Studies have consistently shown that results are better at hospitals where many Whipples are done, and the operation is held up as an example of why steering patients to high-volume centers for complex surgeries and treatments might be one way to improve the quality of health care and treatment outcomes.

One head, two hats

A healthy pancreas is spongy, yellowish-tan, and about seven inches long. It has a creaturely shape, with a large head that nestles into a loop of the first part of the small intestine (the duodenum), a longish body that squeezes behind the stomach, and a narrower tail that reaches the spleen (see the illustration on the next page). Physiologically, the pancreas wears two hats. It contains exocrine tissue that produces digestive enzymes, which are transported via ducts to the small intestine, and endocrine tissue that produces hormones, including insulin and glucagon. Over 90% of pancreatic cancers come from the exocrine part, and most of them are ductal adenocarcinomas—cancers that form in the lining of the organ's elaborate ductwork.

Some pancreatic cancers are caught early, discovered incidentally on computed tomography (CT) scans and other imaging studies ordered for unrelated reasons. That's apparently what happened in Ginsburg's case.

But for the most part, pancreatic cancer is diagnosed after someone has symptoms, which typically include abdominal pain, weight loss (common with cancer but especially so with pancreatic cancer), and jaundice, a yellowing of the skin and the whites of the eyes from a buildup of bilirubin in the blood, which can occur when a pancreatic tumor impinges on the common bile duct. A major reason pancreatic cancer is so lethal is that the cancer grows and spreads long before it causes any symptoms.

Surgical candidates

At the time of diagnosis, about 40% of pancreatic cancer patients have cancer that has already spread (metastasized) extensively outside the organ. Surgery isn't an option once that has happened. Another 40% of patients have "locally advanced disease": the cancer hasn't metastasized, but it may have adhered to or invaded adjacent structures. The pancreas wraps around two large blood vessels, the superior mesenteric vein and artery. If the cancer gets intertwined with those blood vessels, that may preclude surgery.

Locally advanced pancreatic cancer can be treated with radiation and chemotherapy, but the median survival time is eight to 12 months. It's even shorter for people whose cancers have metastasized.

That leaves about 20% of pancreatic cancer patients with tumors that are, in the words of cancer specialists, "resectable"—that is, they can be treated surgically. Most of these tumors are confined to the head of the pancreas or its extension, the uncinate process, and the Whipple procedure is the preferred operation. By the time the cancer is in the body or tail of the pancreas, it's usually too late to operate, although that's not always the case.

The Whipple procedure

Pancreaticoduodenectomy, the formal name for the Whipple procedure, is a mouthful, so even doctors prefer the eponym. The procedure is named for Dr. Allen O. Whipple, the first American surgeon to perform the operation in 1935.

Because resectable pancreatic cancer is limited to the head of the pancreas in most cases, you might think that the operation to remove it would involve taking out just that part of the pancreas. But the head of the pancreas is structurally tied in to other organs and ducts, and it shares a common blood supply with them, so to remove it requires a much more extensive operation, namely the Whipple. A Whipple involves removing the head of the pancreas, the duodenum, the common bile duct, the

gallbladder, and often part of the stomach (see illustration). Surgeons then seal off the end of the small intestine and reattach what's left of the bile duct, pancreas (body and tail), and stomach.

Patients typically spend a week in the hospital. The recovery at home can be slow and fairly painful, so painkillers of some kind are usually needed. Initially, Whipple patients can eat only very small amounts of food that are very easy to digest, and they may need to take pancreatic enzymes to help with digestion, particularly of fatty foods. Diarrhea can be a problem that makes getting out of the house difficult. But, remarkably, the rearranged and plumbed digestive tract manages to recover in two to three months. "Last night I had steak and steak fries, and I'm doing pretty well," a 37-year-old patient told us in early February. He had his Whipple operation in October 2008.

One variation on the Whipple keeps the stomach intact. Pylorus-preserving Whipples (the pylorus is the muscular opening of the stomach that attaches to the duodenum) reduce surgical time and, theoretically, improve digestion and nutrition. Surgeons at Johns Hopkins Hospital favor the pylorus-preserving procedure, but Dr. Carlos Fernández-del Castillo, a surgeon at Harvard-affiliated Massachusetts General Hospital, said surgeons there don't do them for two reasons. First, studies haven't shown any long-term benefit. Second, patients are more likely to need intravenous feeding and stay in the hospital longer.

The most common complication immediately after surgery is leakage of pancreatic juices from the remnant of the pancreas. This may be more of a problem for patients with healthier, more productive pancreases. Leaks can be treated with slender drains that channel the juices out of the body so they don't collect inside the abdomen. Dr. Fernández-del Castillo says a CT scan can help doctors decide if a leak is serious and needs treatment.

The Whipple procedure for pancreatic cancer

❶

To the liver

Gallbladder

Stomach

Resection

Common bile duct

Body and tail of pancreas

Tumor inside head of pancreas

Resection

Duodenum (first part of the small intestine)

Jejunum

❷

Shortened pancreas (head removed)

Hepatic duct attached (gallbladder and common bile duct removed)

Smaller stomach (bottom portion removed)

End of jejunum sealed off (duodenum removed)

More is better

Many studies have shown that the outcomes for an operation tend to be better at hospitals where those operations are performed often. This commonsensical relationship seems to be especially true of the Whipple procedure, probably because of its complexity. In one frequently cited study published in *The New England Journal of Medicine* several years ago, the death rate at low-volume hospitals (those where less than one Whipple a year was performed, on average) was four times higher (16.3% vs. 3.8%) than at high-volume hospitals (more than 16 procedures a year).

The same high-volume–better-outcome math seems to apply to surgeons. According to one study, operative mortality rates varied by a factor of nearly four depending on the number of Whipples performed by the surgeon, even at a high-volume hospital.
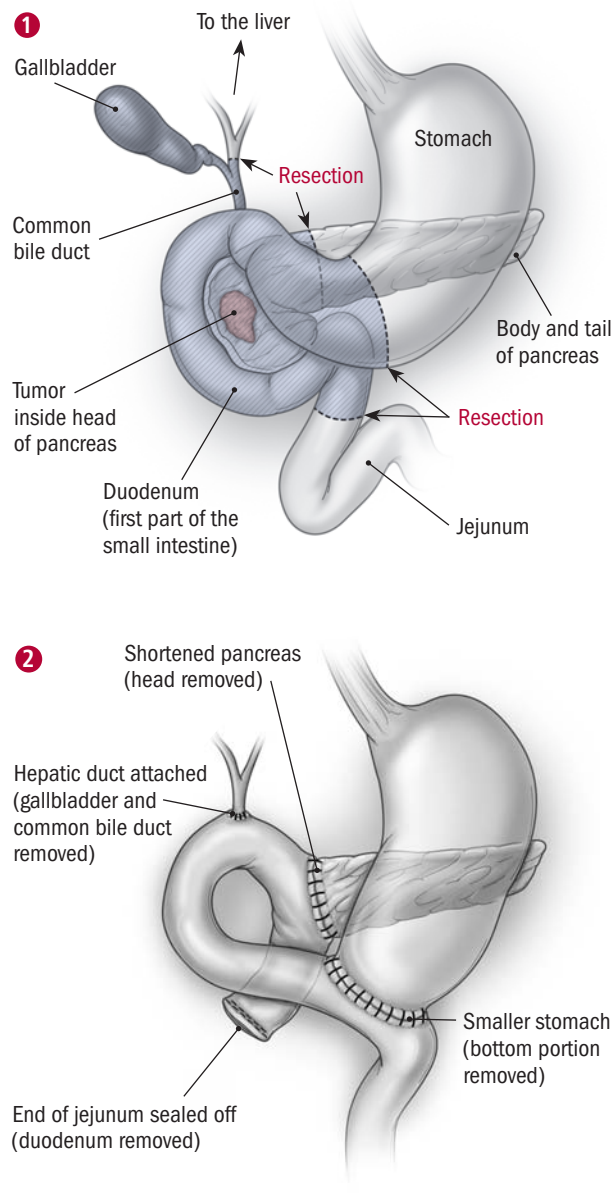
Still an uphill battle

The post-Whipple prognosis is brightest for patients whose cancers have not spread to nearby lymph nodes. For these "node negative" patients, the five-year survival rate is 25% to 30%. For node-positive patients, it's only about 10%. Regardless of their lymph node status, most Whipple patients will get radiation therapy, chemotherapy, or both, to improve these odds, but cancer specialists haven't settled on the right combination nor precisely which drugs should be used (there have been encouraging results for a drug called gemcitabine).

But another sobering way to view those survival percentages is to consider the larger percentage of Whipple patients who don't make it to the five-year mark. Randy Pausch is an example. He was diagnosed in the summer of 2006, had a Whipple and follow-up radiation and chemotherapy. Pausch was 47 when he died in July 2008. The improvements in the Whipple operation are a welcome development, but it's a relatively small step in the long, uphill battle against pancreatic cancer. ♥

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Post–Pancreatic Resection
General Overview and Unique Complications

Maureen Morrison, MSN, ACNP, DNPc

Pancreatic cancer is one of the most silently lethal forms of malignancy. With a lack of evidence-based research regarding pancreatic cancer, the evidence-based treatment options are limited. Currently, the best chance for a curative treatment is a pancreatic resection that typically is combined with chemotherapy and/or radiation therapy. The long-term treatment course and overall survival of the patient depend largely on the pathology report generated from the expurgated tissue analysis. After pancreatic resection, patients may experience both general and unique complications that, if not treated appropriately and assessed correctly, can be lethal. Provided here is a general overview of pancreatic resections and their unique postoperative complications for critical-care nurses. As the first-line provider, critical-care nurses assess and manage acute complications, in addition to educating patients to the long-term complications and how to manage them.
Keywords: Pancreatic cancer, Pancreatic resection, Postpancreatic resection

◼ PANCREATIC CANCER

Pancreatic cancer is characterized by its very aggressive biological behavior. It can quickly become a rapidly disseminating and deadly tumor. Additionally, with pancreatic cancer's silent behavior, the diagnosis is often made after it is too late to pursue a curative treatment. The National Cancer Institute's Surveillance Epidemiological and End Results cancer statistics analysis reports that, in 2009 alone, there will be more than 40 470 people diagnosed with pancreatic cancer, whereas 35 240 people will succumb to the disease.[1] Of those diagnosed, only 7% of cases are diagnosed while the cancer is still locally confined at the primary site; 26% are diagnosed after the cancer has spread to regional lymph nodes or directly beyond the primary site; 53% are diagnosed after the cancer had already metastasized, and the remaining 14% of patients had unknown staging information.[1,2]

The overall outcome of pancreatic cancer has not improved much over the last decade, with mortality continuing to soar above 95%.[1] Between 1998 and 2002, the median age at diagnosis for pancreatic cancer was 72 years, whereas the median age at death was 73 years.[1] The overall 5-year relative survival rate for a person diagnosed with pancreatic cancer between 1999 and 2005 was 5.5%. The corresponding 5-year relative survival rates were 22.2% for localized, 8.7% for regional, 1.8% for distant, and 4.9% for unstaged survivors.[1] Furthermore, upon surgery, approximately 1 in 10 patients considered preoperatively to have resectable tumors was found to have nonresectable disease intraoperatively. Pancreatic cancer is a very aggressive tumor, and although most diagnosed are treated by nonsurgical methods, the best chance for long-term survival is to pursue a potentially curative pancreatic resection. Because of the nature

of the high degree of technical expertise required to perform a pancreatic resection, consultation at a specialized, high-volume pancreatic center will help to minimize operative mortality. Not only do post–pancreatic-resection patients require technically skilled surgeons, but they also depend greatly on the specially trained and educated critical-care nurses who treat them postoperatively.[1-3]

> *The overall 5-year relative survival rate for a person diagnosed with pancreatic cancer between 1999 and 2005 was 5.5%.*

If the patient who is about to undergo a pancreatic resection is correctly counseled prior to having an oper-

ation, he/she would have been told about the possibility of having to experience several postoperative complications (Table 1).[3-13] However, it is important to keep in mind that, even with the most in-depth and detailed preoperative counseling, the patient is mostly likely extremely overwhelmed and will be in need of counseling more than once to allow the perioperative education time to be processed and absorbed. The patient is going to turn to the care providers whom he/she has first contact with after the operation, when the postoperative complications begin, for guidance in what to expect during the normal postoperative course. Therefore, critical-care nurses have become the first provider that the patients turn to for education, reassurance, and support.

◼ THE PANCREAS

The pancreas is a comet-shaped organ, with a round head, a body, and a tapered tail. It sits between the spine

TABLE 1	Pancreatic Resection Postoperative Complications			
Complications	**Pathology**	**S/Sx**	**Treatment**	**Time of Onset and Duration**
Gastric ileus	Gastrointestinal paralysis secondary to the trauma of an operation combined with delayed motility secondary to perioperative medications	Early satiety, postprandial nausea and vomiting, decreased bowel sounds, constipation, anorexia	Liquid diet, use of medications to stimulate gastric emptying, gastric decompression via gastrostomy tube release or possible nasogastric tube placement	POD 0-7; typically short term during initial healing of gastrointestinal trauma, but can continue with constipating pain medications
Endocrine insufficiency	If not enough healthy pancreatic tissue remains after resection, islet/acinar cell trauma, death, or removal	Hyperglycemia and associated symptoms	Exogenous insulin is typically required; it should be noted some oral antidiabetes medications can adversely affect the pancreas and should be avoided	POD 0-30; can be lifelong
Fistula	An abnormal connection between the pancreatic/bile ducts that cause the seepage of pancreatic and bilious fluids that can cause digestions of surrounding tissues in the peritoneal and abdominal cavity	Abdominal pain/distension, dullness to percussion, fever, chest pain, copious amounts of pancreatic enzyme/bilious fluid containing drainage	In acute situations, there is a possibility that the patient may need operative intervention, or possible insertion of, or reinsertion of, a percutaneous intra-abdominal drainage tube such as a Jackson-Pratt, combined with supportive therapies such as antipyretics	POD 0-7
Biliary reflux	The flow of bile upward from the small intestines to the stomach or esophagus due to biliary dyskinesia or biliary stricture	Chronic acid reflux, chronic nausea with bilious emesis, dyspepsia, halitosis, tooth enamel decay	Acid-suppressing medications and antiemetics	POD 0-45
Exocrine insufficiency	If not enough healthy pancreatic tissue remains after resection, islet/acinar cell trauma, death, or removal	Postprandial hyperperistalsis and diarrhea, malnutrition secondary to lack of fat absorption, weight loss	Exogenous pancreatic enzymes, antidiarrhea medications, nutritional counseling and support	POD 0-30; can be lifelong

Abbreviations: POD, postoperative day; S/Sx, signs and symptoms.

and the stomach, with the head nestled in the curve of the duodenum, whereas the tail of the pancreas is tucked into the spleen. The pancreas is one of the major digestive and endocrine organs; it provides both endocrine and exocrine functions. The pancreas secretes digestive enzymes, such as amylase and lipase, into the small intestines from the main pancreatic duct where they help to digest carbohydrates, proteins, and fats to be later absorbed. The pancreas produces hormones such as insulin, glucagon, and somatostatin, which help regulate the endocrine system.[14,15]

PANCREATIC RESECTIONS

There are several different types of pancreatic resections, and the type used is greatly dependent on the location of the mass that needs to be removed. Pancreatic resections vary widely; there is a total pancreatectomy, in addition to several other distinct subtotal pancreatectomies (Table 2).[3-13,16-21] Total pancreatectomies are less common than subtotal resections as the postoperative complication of type 1 diabetes can seriously and permanently impact the quality of the patient's life. This is particularly true as, according to the American Cancer Society, the average age of a person diagnosed with pancreatic cancer is 72 years, and the effect of diabetes in this population can be devastating on his/her overall health.[2,6] The most common subtotal pancreatic resections include the pancreaticoduodenectomy and central or distal pancreatec-

tomies. Although each resection is unique in the technical aspects of the operation, several of the postoperative complications are similar (Tables 1 and 2). There are a few complications that are very unique to pancreatic resection, and those 3 are addressed in this article. The remaining complications are listed in Tables 1 and 2.

POSTOPERATIVE COMPLICATIONS

Pancreatic Fistula

Patients who have undergone pancreatic resection experience general postoperative complications such as hemorrhage and infection; however, several postoperative complications specific to pancreatic resection occur. Particularly, there is a tremendous amount of gastrointestinal and endocrine dysfunction including gastric ileus, pancreatic fistula, biliary reflux, pancreatic exocrine insufficiency, and pancreatic endocrine insufficiency (Table 2).

> *Several postoperative complications specific to pancreatic resection occur.*

Pancreatic fistulas are one of the highest reported postoperative complications that occur after resection.[18]

TABLE 2   Pancreatic Resection Types and Associated Complications

Type of Resection	Common Postoperative Complications[a]
Total pancreatectomy: the radical resection of the pancreas	Lifelong pancreatic endocrine insufficiency and pancreatic exocrine insufficiency, biliary reflux
Pancreaticoduodenectomy: the diseased portion of the head of the pancreas is removed along with a segment of the duodenum, and a new connection between the two is made. Typically, this operation is part of what is known as the Whipple procedure	Short-term pancreatic endocrine/exocrine insufficiency, gastric ileus, biliary reflux, pancreatic fistula
Whipple procedure: removal of the diseased portion via a pancreaticoduodenectomy, antrectomy, cholecystectomy, choledochectomy with reconstruction of the anatomy via pancreaticojejunostomy, choledochojejunostomy, and a gastrojejunostomy	Lifelong pancreatic endocrine insufficiency and pancreatic exocrine insufficiency or short-term pancreatic endocrine/exocrine insufficiency, gastric ileus, biliary reflux, pancreatic fistula, postcholecystectomy syndrome
Central pancreatectomy: a middle or central portion of the pancreas is removed, preserving as much of the remaining tissue as possible	Short-term pancreatic endocrine/exocrine insufficiency, pancreatic fistula
Distal pancreatectomy: the distal portion of the pancreas is resected; typically, the spleen is also removed at this time, given probable involvement of the splenic artery	Short-term pancreatic endocrine/exocrine insufficiency, pancreatic fistula, asplenia
Pancreaticojejunostomy: a loop of the jejunum is mobilized and attached to the pancreatic duct to allow for better drainage of the pancreas	Short-term pancreatic endocrine/exocrine insufficiency, gastric ileus, biliary reflux, pancreatic fistula
Frey procedure: there is local resection at the head of the pancreas with a longitudinal pancreaticojejunostomy	Short-term pancreatic endocrine/exocrine insufficiency, gastric ileus, biliary reflux, pancreatic fistula, necrotic bowel syndrome
Beger procedure: in this pancreatic head resection, the duodenum is preserved	Short-term pancreatic endocrine/exocrine insufficiency, pancreatic fistula

[a]Excludes general postoperative complications such as infection, DVT/PE, hemorrhage, etc.

Defined as the formation of an abnormal communication between the pancreas and other internal structures or organs that is developed secondary to surgical resection. A pancreatic fistula can be a difficult complication to manage and can occur both in the early and late stages of the postoperative healing course. If a fistula forms, it can allow the passage of digestive enzymes to flow into the peritoneal or pleural cavities, can cause pancreatic ascites, and eventually may track through the retroperitoneum into the mediastinum by way of the aortic or esophageal hiatus. If the secretions break through the mediastinal pleura, then a fistula into 1 or both pleural cavities can result. An internal pancreatic fistula should be suspected in any patient who presents with ascites or with a massive unilateral or bilateral pleural effusion. The diagnosis is confirmed by cross-sectional imaging, and then a therapeutic paracentesis or thoracentesis is performed. The fluid drained should be sent for analysis, the results of which will help to confirm diagnosis.[8,18]

It is vital that these fistulas are diagnosed and treated early, given the ease with which these types of complications can progress. Critical-care nurses should be aware of the signs and symptoms of postoperative fistulas. Therefore, routine assessment for abdominal ascites or pulmonary dysfunction consistent with pleural effusions should be performed. Abdominal ascites is typically uncommon in a patient without a history of liver dysfunction, and its development should be followed up on immediately. Postoperative pleural effusions are considered more commonplace and may be associated with many different etiologies. Consideration of cross-sectional imaging to rule out a pancreatic fistula is appropriate in the setting of a persistent malingering or worsening effusion. Particular care should be used when evaluating for or treating pancreatic fistulas, given the limited and poor treatments available. Nurses administering care to patients after pancreatic resection should keep this complication, and the associated signs and symptoms, in mind during physical assessment.

Pancreatic Endocrine/Exocrine Insufficiency

When discussing pancreatic resection, it is important to remember the functions of the pancreas. The pancreas has two main functions: exocrine function and endocrine function. The pancreas has one main duct and several smaller tributary ducts that excrete digestive enzymes such as amylase and lipase into the duodenum of the small intestines The enzymes mix with food to digest carbohydrates, proteins, and fats along the intestinal tract, so that the body is able to absorb that calories and nutrients it needs to maintain energy. This secretion of enzymes to digest food is the exocrine function of the pancreas. When the pancreas is damaged, or there is less

healthy tissue remaining to provide exocrine function, the patient experiences digestive dysfunction most commonly diagnosed by postprandial abdominal pain, diarrhea, and steatorrhea. Exocrine insufficiency can be treated by the intake of exogenous digestive enzymes a few minutes prior to eating, but if untreated both long- and short-term complications arise. In the short term, lack of nutritional absorption can cause poor wound healing, diarrhea-induced dehydration, electrolyte imbalance, and lethargy. Long-term exocrine insufficiency can lead to malnutrition and weight loss, and it is considered a poor prognostic indicator. A patient may develop pancreatic insufficiency as a result of intraoperative trauma to the pancreas, and as the pancreas heals, this complication may diminish; however, if there is not enough healthy pancreatic exocrine tissue remaining, this complication may be lifelong.[9,11-13,21]

In addition to exocrine function, the pancreas is an endocrine gland. The pancreas produces hormones such as insulin and glucagon, in addition to other hormones, which have unique functions throughout the body. Particularly, the pancreas is known for its control of blood glucose levels, which is why, when the pancreas does not have enough healthy or functioning pancreatic endocrine cells remaining, the patient will develop post–pancreatic-resection insulin-dependent diabetes. It should be noted that almost all patients who undergo pancreatic resection will be maintained on exogenous insulin postoperatively for the first week as a result of pancreatic trauma. During the initial postoperative course, blood glucose levels are expected to be quite labile, as the pancreas may first function in short spurts during initial healing. Typically, by the fourth week postoperatively, the patient will know whether he/she will have permanent endocrine insufficiency. During the postoperative course, the patient will be responsible for learning how to check his/her blood glucose levels, so upon discharge home, he/she will be able to monitor and record his/her blood glucose levels. These levels are crucial for the first postoperative outpatient follow-up appointment, and patients typically require checking their blood glucose daily upon discharge home.[11-13,22]

Critical-care nurses should be aware of the possible postoperative complications that can arise due to pancreatic endocrine or exocrine insufficiency. Nurses should be prepared to answer questions about the way pancreatic resection can affect the endocrine system. It should be noted that, given the average age of those diagnosed with pancreatic cancer is 72 years, the development of diabetes can be a difficult postoperative complication to learn how to manage. Diabetes education and training can seem daunting and be overwhelming for a patient to experience. The new diagnosis of diabetes can have a heavy emotional

impact, and although this complication can be transient postoperatively, all patients are at risk for developing permanent diabetes after pancreatic resection. It is in the patient's best interest to be aware of what diabetes is, and how it can affect his/her quality of life. The patient will need support when it comes to diabetes education and training, and the more the patient is exposed to diabetes training and education, the more reinforced the information becomes. Reinforcing this information provides the patient with the ability to take control and responsibility for keeping his/her blood glucose in check and at a safe level. Critical-care nurses should be prepared to facilitate the patient's diabetes training and education. Additionally, critical-care nurses should be evaluating the patient for diarrhea and postprandial pain that is associated with pancreatic exocrine insufficiency. Symptoms of either pancreatic exocrine or endocrine dysfunction should be evaluated during physical assessment.

> *Nurses should be prepared to answer questions about the way pancreatic resection can affect the endocrine system.*

CONCLUSION

Pancreatic cancer is a very lethal malignancy that is not easily treated. The patient's limited treatment options include a major abdominal operation preceded and/or followed by oncologic therapies. These treatments are fraught with serious complications that can, if not managed appropriately, leave the patient with a very poor quality of life. To help the patient become his/her own best advocate, it is up to the providers to educate the patient about the complications and how to manage them effectively. As critical-care nurses are the frontline of providers caring for these patients, it is up to them to help the patient focus on what they should expect to experience and how to ensure they maintain a safe, positive treatment course.

Although pancreatic resections are not commonplace, particularly at smaller medical institutions, as technology improves and as more research on pancreatic cancer is conducted, there will continue to be an increasing number of patients requiring pancreatic resection. It is imperative that critical-care nurses are prepared to care for patients with pancreatic cancer who are status post pancreatic resection.[12,13,22,23]

Critical-care nurses spend more time with the patient than any other multidisciplinary team member does during postoperative hospitalization. It is up to us to be knowledgeable about pancreatic cancer and the way

pancreatic resections affect our patients. By understanding the technical differences between resections, and the pathophysiology of how pancreatic resection affects the endocrine and gastrointestinal systems, assessment for unique complications is more effective. With effective assessment, early diagnosis and treatment of lethal complications can ensue, ultimately preventing mortality and securing improved overall survival, not to mention patient quality of life. We need to evaluate for those postoperative complications that are unique to pancreatic resection, and we need to help educate and inform our patients about what type of complications can arise, and how to be prepared to handle them. A nurse who is able to counsel a patient about what to expect after a pancreatic resection, that the complications are unique, but expected, and how the patient can prevent or handle these complications reduces the enormous amounts of fear and helplessness that the patient experiences.

Acknowledgment

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Small Bowel Obstruction for Inpatients: Process

A CT of abdomen/pelvis with IV contrast is done to diagnose a small bowel obstruction. If diagnosed, the following process may be followed:

- Do not proceed with process if:
  - Infectious abdominal process
  - Cancer
  - Incarcerated hernia
  - Pregnant
  - Abdominal surgery within 6 weeks
  - History of pelvic radiation
  - Previous Roux-en-Y bypass
  - Concern for inguinal hernia
- ***Patients should be continuously assessed and re-evaluated for peritonitis throughout this process*** (increasing abdominal pain/tenderness/distention, fever, nausea/vomiting, loss of appetite, diarrhea, decreased urinary output, thirst, inability to pass stool or gas, fatigue)
  - Report to covering MD right away.
- Insert NGT
- Correct electrolytes and resuscitate with fluids (per MD orders)
  - Consult surgery if not already done
- Ensure NGT is patent, intra-gastric on x-ray, has been on suction for at least 2 hours
- Place head of bed > 30 degrees
- Administer **90 ml** of Gastrograffin or Isovue 300 via NGT and **clamp for 1 hour then place back on suction** (Isovue 300 is the name of the contrast; 90 ml of either contrast is the correct dose to administer)
- Check portable KUB in 8 hours from contrast administration
  - If contrast ***not in cecum***, repeat KUB in 24 hours (if contrast still not in cecum, surgery should be considered)
  - If contrast ***is in cecum***, remove NGT and starts sips of liquid with advancement to full liquids within 24 hours

Contrast for CT Scan of Abdomen (Not for Small Bowel Obstruction)

- Contrast bottle comes from CT scan
- Directions are on the bottle (doses, timing of administration and when to send the patient to CT scan)
- Clamp NGT after administration of each dose, leave clamped through patient transport to radiology
- Contact radiology with any questions, ext. 44624
- Contrast is given in this case for diagnostic purposes, not therapeutic

🛏️ AT THE BEDSIDE

Upper GI Bleeding

A 45-year-old white man is admitted with reports of an 8-hour history of nausea and vomiting of large amounts of "coffee-ground secretions" and frequent "maroon-colored" stools. He reports a previous history of peptic ulcer disease diagnosed at age 35. He has been hospitalized twice in the past for active GI bleeding. A duodenal ulcer near the pylorus on the posterior wall of the stomach was diagnosed by endoscopy. Significant findings on his admission profile were

Vital Signs

Blood pressure:	96/60 mm Hg lying; 90/58 mm Hg sitting
Heart rate:	120 beats/min; sinus tachycardia
Respiratory rate:	32 breaths/min, deep
Temperature:	99.2°F (oral)

Respiratory

Breath sounds clear in all lung fields

Cardiovascular

S_1/S_2 no murmurs
Extremities cool, diaphoretic; pulses present but weak

Abdomen

Distended with hyperactive bowel sounds in all four quadrants

Tender right upper quadrant, no rebound tenderness

Neurologic

Alert, oriented
Anxious

Genitourinary

50 mL of amber, cloudy urine following Foley catheter insertion
Stools liquid maroon, guaiac positive

Arterial Blood Gases

pH	7.49
PaCO$_2$	28 mm Hg
HCO$_3$	19 mEq/L
PaO$_2$	61 mm Hg on room air
SaO$_2$	89%
Hematocrit	25%
Hemoglobin	7.0 g/dL
White blood cell count	17,000/mm^3
Prothrombin time	11 seconds
Activated partial thromboplastin time	30 seconds
Platelet count	110,000/mm^3
Serum potassium	3.5 mEq/L (decreased)
Serum sodium	150 mEq/L
Serum glucose	210 mg/dL
Serum blood urea nitrogen	40
Serum creatinine	0.9
Liver function	Within normal limits

Blood loss
↓ venous return to heart
↓ cardiac output ⟹ Clinical signs
• ↓ BP
• Tachycardia
• Orthostatic hypotension
• Narrow pulse pressure

Epinephrine and norepinephrine released

Vasoconstriction

Tissue Ischemia
Anaerobic metabolism
Production of lactic acid
Clinical signs
• Hyperventilation (respiratory alkalosis)
• Weakness
• Changes in mental status

↓ Renal blood flow
Clinical signs
• ↓ urine output

↓ Arterial blood flow
Clinical signs
• Skin cold, clammy
• Pallor
• ↓ pulses
• Dry mucous membranes

↓ Splanchnic blood flow
Bowel Ischemia
Clinical signs
• Abdominal distention
• Third spacing
• ↓ bowel sounds
• Abdominal pain
• Fever

↑ Blood flow to cerebral and cardiovascular system initially, then a decrease
Clinical signs
• ECG change
• Mental confusion to coma

Figure 14-3. Hypovolemic shock.

Assess severity of blood loss

Hemodynamic stabilization

Emergency endoscopy

Peptic ulcer or gastritis

Endoscopic hemostatic therapies

Surgical therapies
- Resection
- Billroth I
- Billroth II

Pharmacologic therapies

Ablative methods
- Laser photocoagulation
- Heater probe
- Argon plasma coagulation

Injection therapy
- Epinephrine
- Sclerosing agents
- Saline

Mechanical methods
- Metallic clips
- Endoloops
- Rubberband ligation

Combined methods
- Electrocautery and epinephrine
- Metallic clips and epinephrine

Acid suppresion
- Antacids
- Histamine blockers
- Mucosal enhancers
- Proton pump inhibitors
- Octreotide

***H. pylori* eradication**
- Amoxicillin
- Clarithromycin
- Lansoprazole

Variceal bleed

Balloon tamponade
- Sengstaken-Blakemore tube

Endoscopic injection therapy
- Sclerosing agents
- Variceal banding
- Variceal ligation

Pharmacologic therapies
- Somatostatin
- Octreotide

Surgical therapies
- Emergency shunt

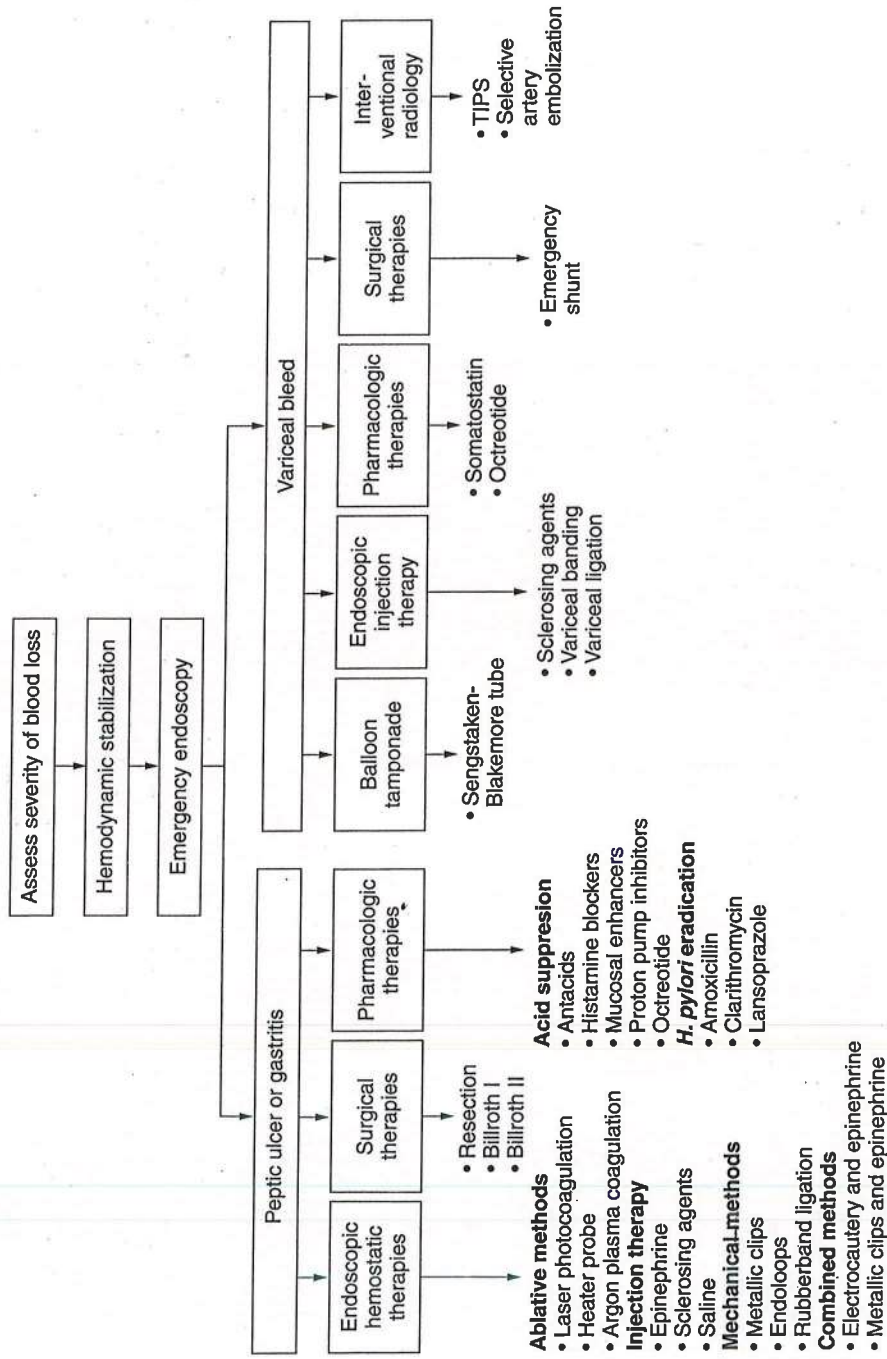Interventional radiology
- TIPS
- Selective artery embolization

Figure 14-4. Upper GI bleeding treatment guide.