Appendectomy

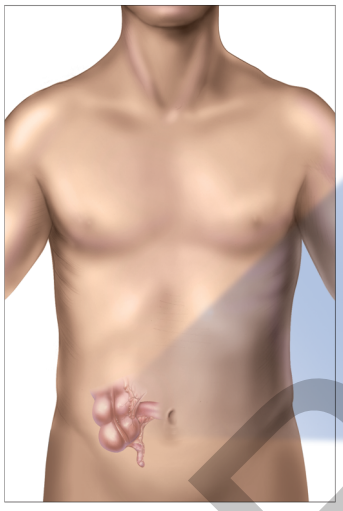
Surgical Removal of the Appendix

ACS AMERICAN COLLEGE OF SURGEONS

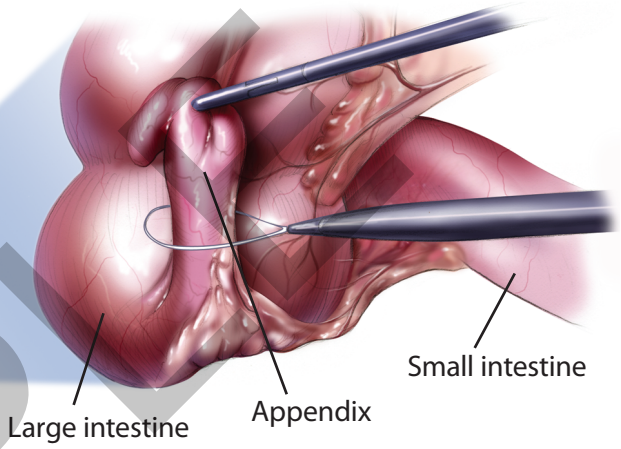
The Condition

Appendicitis is one of the most common causes of abdominal pain with a lifetime risk of 8.6% in men and 6.7% in females.[1]

Appendectomy is the surgical removal of the appendix. The operation is done to remove an infected appendix. An infected appendix, called appendicitis, can burst and release bacteria and stool into the abdomen.



Removal of the Appendix



Symptoms

What are the common symptoms?

- Abdominal pain that starts around the navel and may move to lower right abdomen
- Not wanting to eat
- Low fever
- Nausea and sometimes vomiting
- Diarrhea or constipation

Treatment Options

Surgery

Laparoscopic appendectomy—The appendix is removed with instruments placed into small abdominal incisions.

Open appendectomy—The appendix is removed through an incision in the lower right abdomen.

Nonsurgical

Surgery is the standard treatment for an acute (sudden) infection of the appendix. Antibiotic treatment might be used as an alternative for specific patients and children.[2]

Benefits and Risks

An appendectomy will remove the infected organ and relieve pain. Once the appendix is removed, appendicitis will not happen again. The risk of not having surgery is the appendix can burst, resulting in an abdominal infection called peritonitis.

Possible complications include abscess, infection of the wound or abdomen, intestinal blockage, hernia at the incision, pneumonia, risk of premature delivery (if you are pregnant), and death.

Expectations

Before your operation—Evaluation usually includes blood work, urinalysis, and an abdominal CT scan, or abdominal ultrasound. Your surgeon and anesthesia provider will review your health history, medications, and options for pain control.[3]

The day of your operation—You will not be allowed to eat or drink while you are being evaluated for an emergency appendectomy.

Your recovery—If you have no complications, you usually can go home 1 day after a laparoscopic or open procedure.

Call your surgeon if you are in severe pain, have stomach cramping, a high fever, odor or increased drainage from your incision, or no bowel movements for 3 days.

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This first page is an overview. For more detailed information, review the entire document.

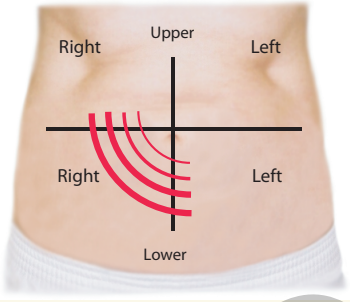
The Condition, Signs and Symptoms, and Diagnostic Tests

Keeping You Informed

Appendicitis Pain

Pain can be different for each person because the appendix can touch different organs. This can be confusing and make it difficult to diagnose appendicitis.

Most often pain starts around the navel and then moves to the right lower abdomen. The pain is often worse with walking or talking. During pregnancy, the appendix sits higher in the abdomen, so the pain may seem to come from the upper abdomen. In the elderly, symptoms are often not as noticeable because there is less swelling.[4]

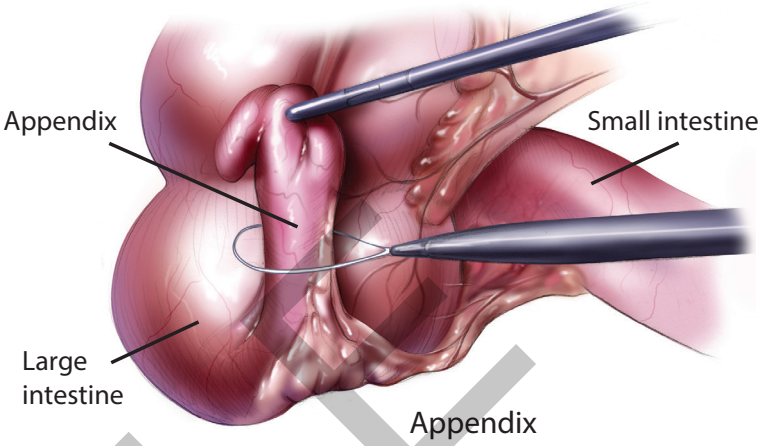


Other medical disorders have symptoms similar to appendicitis, such as inflammatory bowel disease, pelvic inflammatory disease, gastroenteritis, urinary tract infection, right lower lobe pneumonia, Meckel's diverticulum, intussusception, and constipation.

The Condition

The Appendix

The appendix is a small pouch that hangs from the large intestine where the small and large intestine join. If the appendix becomes blocked and swollen, bacteria can grow in the pouch. The blocked opening can be from an illness, thick mucus, hard stool, or a tumor.



Appendicitis

Appendicitis is an infection of the appendix. The infection and swelling can decrease the blood supply to the wall of the appendix. This leads to tissue death, and the appendix can rupture or burst, causing bacteria and stool to release into the abdomen. This is called a ruptured appendix. A ruptured appendix can lead to peritonitis, which is an infection of your entire abdomen. Appendicitis most often affects people between the ages of 10 and 30 years old. It is a common reason for an operation in children, and it is the most common surgical emergency in pregnancy.[5]

Appendectomy is the surgical removal of the appendix.

Symptoms

- Stomach pain that usually starts around the navel and then moves to the lower right side of the abdomen
- Loss of appetite
- Low fever, usually below 100.3°F or 37.9 C
- Nausea and sometimes vomiting
- Diarrhea or constipation

Common Diagnostic Tests

History and Physical

The focus will be on your abdominal pain. There is no single test to confirm appendicitis.

Tests (see glossary)

Abdominal ultrasound or abdominal CT scan—Abdominal CT scan is used in adults to diagnose appendicitis. Abdominal ultrasound may be used more frequently in children and pregnant women to decrease Xray exposure.[6]

Complete blood count (CBC)—A blood test to check for infection

Pelvic exam—May be done in young women to check for pain from gynecological problems like pelvic inflammation or infection

Urinalysis—Checks for an infection in your urine, which can cause abdominal pain

Electrocardiogram (ECG)—Sometimes done in the older adult to make sure heart problems are not the cause of pain

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Surgical and Nonsurgical Treatment

Surgical Treatment

Acute appendicitis is an urgent problem requiring surgical consultation.

Laparoscopic Appendectomy

This technique is the most common for simple appendicitis. The surgeon will make 1 to 3 small incisions in the abdomen. A port (nozzle) is inserted into one of the slits, and carbon dioxide gas inflates the abdomen. This process allows the surgeon to see the appendix more easily. A laparoscope is inserted through another port. It looks like a telescope with a light and camera on the end so the surgeon can see inside the abdomen. Surgical instruments are placed in the other small openings and used to remove the appendix. The area is washed with sterile fluid to decrease the risk of further infection. The carbon dioxide comes out through the slits, and then the slits are closed with sutures or staples or covered with glue-like bandage or Steri-Strips. Your surgeon may start with a laparoscopic technique and need to change to an open technique. This occurs more often in males and people who are over 40 years, diabetic, obese or have a ruptured appendix.[7]

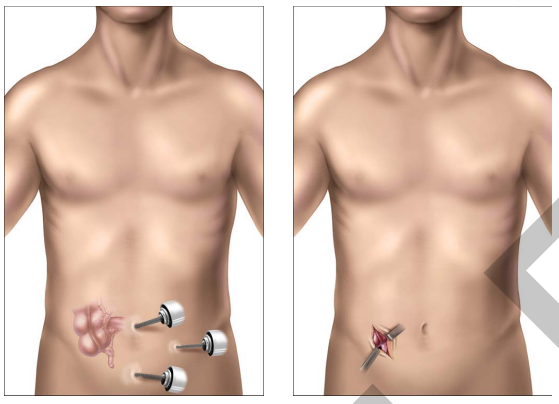
Open Appendectomy

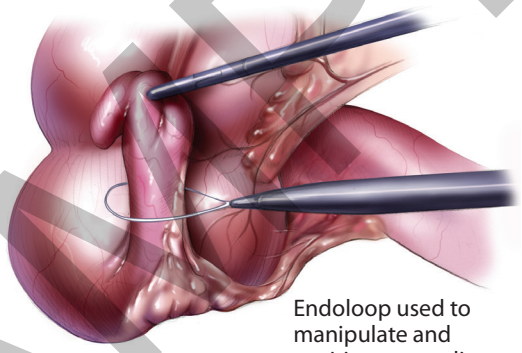
The surgeon makes an incision about 2 to 4 inches long in the lower right side of the abdomen. The appendix is removed from the intestine. The area is washed with sterile fluid to decrease the risk of further infection. A small drainage tube may be placed going from the inside to the outside of the abdomen. The drain is usually removed in the hospital. The wound is closed with absorbable sutures and covered with glue-like bandage or Steri-Strips.

Nonsurgical Treatment

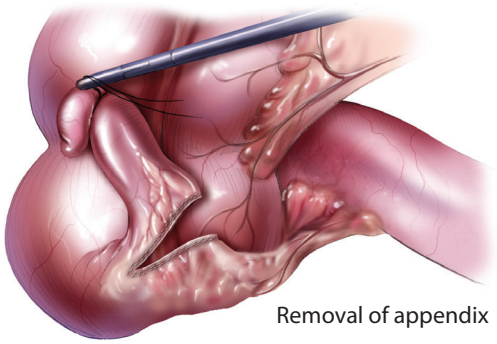
If you only have some of the signs of appendicitis, your surgeon may treat you with antibiotics and watch for improvement. In an uncomplicated appendicitis, antibiotics may be effective, but there is a higher chance of reoccurrence.[8]

Laparoscopic versus Open Appendectomy





Endoloop used to manipulate and position appendix



Removal of appendix

Keeping You Informed

Laparoscopic versus Open

For both adults and children, laparoscopic appendectomy has the advantage of lower infection rates, shorter hospital and recovery times, and lower pain scores.[5]

Ruptured Appendix

Unfortunately, many people do not know they have appendicitis until the appendix bursts. If this happens, it causes more serious problems. A ruptured appendix may occur in up to 32% of patients who have acute appendicitis.[1] This is higher in the very young and very old and also higher during pregnancy because the symptoms (nausea, vomiting, right-sided pain) may be similar to other pregnancy conditions.[1,6]

Antibiotic Therapy

Antibiotic treatment can be used to treat appendicitis if there is no rupture. This may result in fewer complications, less sick leave and less pain medication than surgery. Of those treated with antibiotics, 40% had a second event within a year and needed an appendectomy.[8]

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Risks Based on the ACS Risk Calculator

Your surgeon will do everything possible to minimize risks, but an appendectomy, like all operations, has risks.

Risks of This Procedure Based on the ACS Risk Calculator in Feb 2022*	Percentage	Keeping You Informed
Wound Infection: Infection at the area of the incision	Open: 5.3% Laparoscopic: 1.5%	Antibiotics are typically given before the operation. Smoking can increase the risk of infection.
Return to the operating room	Open: 2.3% Laparoscopic: 0.8%	Significant pain and bleeding may cause a return to surgery.
Pneumonia: Infection in the lungs	Open: 0.8% Laparoscopic: 0.2%	Stopping smoking, walking, and deep breathing after your operation can help prevent lung infections.
Urinary tract infection: Infection of the bladder or kidneys	Open: 0.4% Laparoscopic: 0.3%	A urinary catheter (small thin tube) that drains urine from the bladder is sometimes inserted. Signs of a urinary tract infection include pain with urination, fever, and cloudy urine.
Blood clot: A clot in the legs that can travel to the lung	Open: 0.5% Laparoscopic: 0.2%	Longer surgery and bed rest increase the risk. Getting up, walking 5 to 6 times per day, and wearing support stockings reduce the risk.
Heart complication: Includes heart attack or sudden stopping of the heart	Open: 0.3% Laparoscopic: 0.1%	Problems with your heart or lungs can be sometimes be worsened by general anesthesia. Your anesthesia provider will take your history and suggest the best option for you.
Death	0%	Death is extremely rare in healthy people.
Any complication, including: Surgical infections, breathing difficulties, blood clots, renal (kidney) complications, cardiac complications, and return to the operating room	Open: 10.3% Laparoscopic: 3.7%	Complications are higher in smokers, obese patients, and those with other diseases such as diabetes, heart failure, renal failure and lung disease. Wound healing may also be decreased in smokers.
Predicted length of stay		Laparoscopic ½ day; open 1.5 days.
Risks of This Procedure from Outcomes Reported in the Last 10 Years of Literature	**Percentage**	**Keeping You Informed**
Intestinal obstruction: Short-term blockage of stool or fluids	3%[9]	Swelling of the tissue around the intestine can stop stool and fluid from passing. You will be asked if you are passing gas, and bowel sounds will be checked. If you have a temporary block, a tube may be placed through your nose into your stomach for 1 or 2 days to remove fluid from your stomach.
Pregnancy risks	Premature labor: 8 to 10% Fetal loss: 2%	The risk of fetal loss increases to 10% when the appendix ruptures and there is peritonitis (infection of the abdominal cavity).[10]

The ACS Surgical Risk Calculator estimates the risk of an unfavorable outcome. Data is from a large number of patients who had a surgical procedure similar to this one. If you are healthy with no health problems, your risks may be below average. If you smoke, are obese, or have other health conditions, then your risk may be higher. This information is not intended to replace the advice of a doctor or health care provider. To check your risks, go to the ACS Risk Calculator at *http://riskcalculator.facs.org.

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Expectations: Preparing for Your Operation

Preparing for Your Operation

Home Medication

Appendectomy is usually an emergency procedure. You can help prepare for your operation by telling your surgeon about other medical problems and medications that you are taking.

Be sure to tell your surgeon if you are taking blood thinners (Plavix, Coumadin, aspirin or NSAIDs) or using marijuana or CBD products.

Anesthesia

You will meet with your anesthesia provider before the operation. Let him or her know if you have allergies, neurologic disease (epilepsy or stroke), heart disease, stomach problems, lung disease (asthma, emphysema), endocrine disease (diabetes, thyroid conditions), loose teeth, or if you smoke, drink alcohol, use drugs, or take any herbs or vitamins. Let your surgical team know if you smoke and plan to quit. Quitting decreases your complication rate. Resources to help you quit can be found at *facs.org/quitsmoking*.

Length of Stay

You can often go home in 1 day. Your hospital stay may be longer for a ruptured appendix, if you have severe vomiting, or are unable to pass urine.

Don't Eat or Drink

You will not be allowed to eat or drink while you are being evaluated for appendectomy. Not eating or drinking reduces your risk of complications from anesthesia.

What to Bring

- Insurance card and identification
- Advance directive (see glossary)
- List of medicines
- Loose-fitting, comfortable clothes
- Slip-on shoes that don't require you to bend over
- Leave jewelry and valuables at home

What You Can Expect

Safety Checks

An identification (ID) bracelet and allergy bracelet with your name and hospital/clinic number will be placed on your wrist. These should be checked by all health team members before they perform any procedures or give you medication. Your surgeon will mark and initial the operation site.

Fluids and Anesthesia

An intravenous line (IV) will be started to give you fluids and medication. For general anesthesia, you will be asleep and pain free during the operation. A tube may be placed down your throat to help you breathe during the operation.

After Your Operation

You will be moved to a recovery room where your heart rate, breathing rate, oxygen saturation, blood pressure, and urine output will be closely watched. Be sure that all visitors wash their hands.

Preventing Pneumonia and Blood Clots

Movement and deep breathing after your operation can help prevent postoperative complications such as blood clots, fluid in your lungs, and pneumonia. Every hour, take 5 to 10 deep breaths and hold each breath for 3 to 5 seconds.

When you have an operation, you are at risk of getting blood clots because of not moving during anesthesia. The longer and more complicated your surgery, the greater the risk. This risk is decreased by getting up and walking 5 to 6 times per day, wearing special support stockings or compression boots on your legs, and for high-risk patients, taking a medication that thins your blood.

Questions to Ask

About My Operation:

- What are the side effects and risks of anesthesia?
- What technique will be used to remove my appendix? Laparoscopic or open?
- What are the risks of this procedure for me?
- Will you be performing the entire operation yourself?
- What level of pain should I expect, and how will it be managed?
- How long will it be before I can return to my normal activities (work, driving, lifting)?

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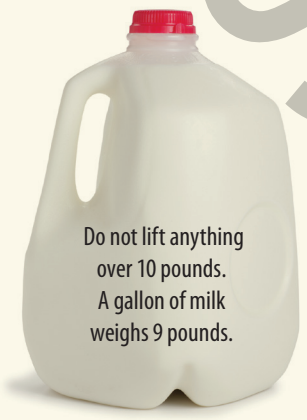
Your Recovery and Discharge

Keeping You Informed

High-Fiber Foods

Foods high in fiber include beans, bran cereals and whole-grain breads, peas, dried fruit (figs, apricots, and dates), raspberries, blackberries, strawberries, sweet corn, broccoli, baked potatoes with skin, plums, pears, apples, greens, and nuts.



Your Recovery and Discharge

Thinking Clearly

The anesthesia may cause you to feel different for 1 or 2 days. Do not drive, drink alcohol, or make any big decisions for at least 2 days.

Nutrition

- When you wake up, you will be able to drink small amounts of liquid. If you do not feel sick, you can begin eating regular foods.
- Continue to drink lots of fluids, usually about 8 to 10 glasses per day.
- Eat a high-fiber diet so you don't strain during bowel movements.

Activity

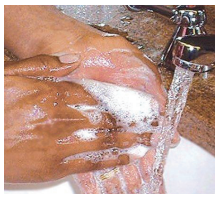
- Slowly increase your activity. Be sure to get up and walk every hour or so to prevent blood clots.
- Do not lift or participate in strenuous activity for 3 to 5 days for laparoscopic and 10 to 14 days for open procedure.
- It is normal to feel tired. You may need more sleep than usual.

Work and Return to School

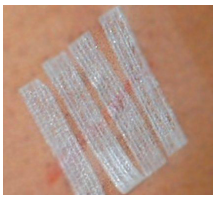
- You can go back to work when you feel well enough. Discuss the timing with your surgeon.
- Children can usually go to school 1 week or less after an operation for an unruptured appendix and up to 2 weeks after a ruptured appendix.
- Most children will not return to gym class, sports, and climbing games for 2 to 4 weeks after the operation.

Wound Care

- Always wash your hands before and after touching near your incision site.
- Do not soak in a bathtub until your stitches or Steri-Strips® are removed. You may take a shower after the second postoperative day unless you are told not to.
- A small amount of drainage from the incision is normal. If the drainage is thick and yellow or the site is red, you may have an infection, so call your surgeon.
- If you have a drain in one of your incisions, it will be taken out when the drainage stops.



Handwashing



Steri-Strips®

- Steri-Strips will fall off in 7 to 10 days or they will be removed during your first office visit.
- If you have a glue-like covering over the incision, allow the glue to flake off on its own.
- Avoid wearing tight or rough clothing. It may rub your incisions and make it harder for them to heal.
- Protect the new skin, especially from the sun. The sun can burn and cause darker scarring.
- Your scar will heal in about 4 to 6 weeks and will become softer and continue to fade over the next year.
- The ACS Surgical Home Skills kit.

Bowel Movements

- After intestinal surgery, you may have loose watery stools for several days. If watery diarrhea lasts longer than 3 days, contact your surgeon.
- Pain medication (narcotics) can cause constipation. Increase the fiber in your diet with high-fiber foods if you are constipated. Your surgeon may also give you a prescription for a stool softener.

When to Contact Your Surgeon

If you have:

- Pain that will not go away
- Pain that gets worse
- A fever of more than 101°F (38.3°C)
- Repeated vomiting
- Swelling, redness, bleeding, or bad-smelling drainage from your wound site
- Strong abdominal pain
- No bowel movement or unable to pass gas for 3 days
- Watery diarrhea lasting longer than 3 days

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Pain Control

Pain Control

Your pain can be controlled using acetaminophen (Tylenol®) and ibuprofen (Motrin®,Advil®). Nonmedication therapies, such as ice may also be effective. For severe pain that is keeping you from moving and sleeping, an opioid may be needed. By day 4, most people report no severe pain after an operation. Pain from the surgical incision is usually gone in 7 to 10 days. See the **Safe and Effective Pain Control Guide** below or on the ACS website for more information. *https://www.facs.org/education/patient-education/safe-pain-control*

Pain	How Intense is my pain	What Can I Take to Feel Better	Most Common Therapies
Mild	• I hardly notice my pain, and it does not interfere with my activities. • I notice my pain and it distracts me, but I can still do activities (sitting up, walking, standing).	**Non-medication therapies** + **Non-opioid, oral medications** • Take as needed when you feel pain. • These help to decrease pain and swelling (inflammation)	**Non-medication Therapies** • Ice, elevation, rest, meditation, massage, distraction (music, TV, play) walking and mild exercise • Splinting the abdomen with pillows **Non-Opioid Medication** • Acetaminophen (Tylenol®) • Non-steroidal anti-inflammatory drugs (NSAIDS) Aspirin, Ibuprofen (Motrin®, Advil®) Naproxen (Aleve®)
Moderate	• My pain is hard to ignore and is more noticeable even when I rest. • My pain interferes with myusual activities.	**Non-Medication Therapy** + **Non-opioid, oral medication** Take these on a regular schedule	**Take Non-opioid medication** on a regular schedule instead of as needed. (Ex: Tylenol® every 6 hours at 9am, 3pm, 9pm, 3am and Motrin® every 6 hours and 12am,6am,12pm, 6pm
Severe	• I am focused on my pain, and I am not doing my daily activities. • I am groaning in pain, and I cannot sleep. I am unable to do anything. • My pain is as bad as it could be, and nothing else matters.	**Non-Medication Therapy** + **Non-opioid, oral medication** • Take these on a regular schedule **Short-acting Opioids** • Take for a few days and decrease/ stop as soon as possible	Opioids block pain and give a feeling of euphoria (feel high). Addiction, a serious side effect of opioids, is rare with short term use. Examples of short-acting opioids include: Tramadol (Ultram®), Hydrocodone (Norco®, Vicodin®), Hydromorphone (Dilaudid®

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Keeping You Informed

Following a laparoscopic procedure, pain may be felt in the shoulder. This is due to the gas inserted into the abdomen during the procedure. Moving and walking helps to decrease the gas and the shoulder pain.

Glossary of Terms and More Information

For more information, please go to the American College of Surgeons Patient Education website at surgicalpatienteducation.org.
For a complete review of appendectomy, consult Selected Readings in General Surgery, *"Pediatric Surgery" 2018, Vol 44, No. 3 and "Colon, Rectum & Anus, Part I" 2019, Vol 45, No. 2 at* facs.org/srgs.

GLOSSARY

Abdominal ultrasound: Sound waves are used to determine the location of deep structures in the body. A hand roller is placed on top of clear gel and rolled across the abdomen.

Abscess: Localized collection of pus.

Advance directives: Documents signed by a competent person giving direction to health care providers about treatment choices. They give you the chance to tell your feelings about health care decisions.

Adhesion: A fibrous band or scar tissue that causes internal organs to adhere or stick together.

Complete blood count (CBC): A blood test that measures red blood cells (RBCs) and white blood cells (WBCs). WBCs increase with inflammation. The normal range for WBCs is 8,000 to 12,000.

Computed tomography (CT) scan: A specialized X ray and computer that show a detailed, 3-D picture of your abdomen. A CT scan normally takes about 1½ to 2 hours.

Electrocardiogram (ECG): Measures the rate and regularity of heartbeats, the size of the heart chambers, and any damage to the heart.

Nasogastric tube: A soft plastic tube inserted in the nose and down to the stomach.

Urinalysis: A visual and chemical examination of urine, most often used to screen for urinary tract infections and kidney disease.

DISCLAIMER

Important Note on the Use of This Document

The American College of Surgeons (ACS) is a scientific and educational association of surgeons that was founded in 1913 to improve the quality of care for the surgical patient by setting high standards for surgical education and practice. The ACS endeavors to provide procedure education for prospective patients and those who educate them. It is not intended to take the place of a discussion with a qualified surgeon who is familiar with your situation. The ACS makes every effort to provide information that is accurate and timely, but makes no guarantee in this regard.

REFERENCES

The information provided is chosen from clinical research. The research below does not represent all of the information available about your operation.

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