AMERICAN COLLEGE OF SURGEONS
DIVISION OF EDUCATION

Patient Education

Partners in Your Surgical Care

# Appendectomy

Surgical Removal of the Appendix

## Patient Education

This educational information is to help you be better informed about your operation and empower you with the skills and knowledge needed to actively participate in your care.

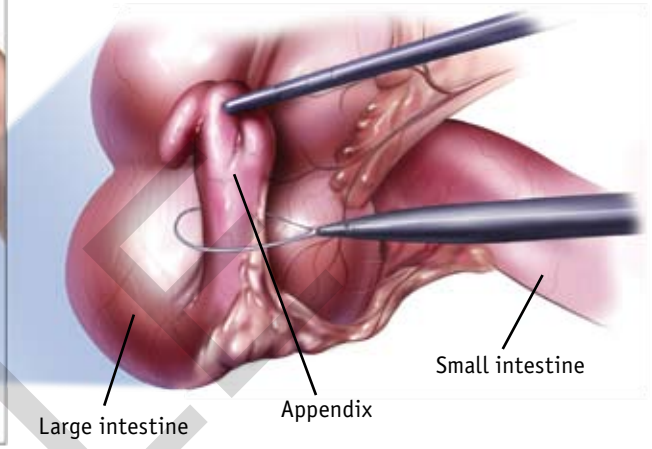
## Keeping You Informed

Information that will help you further understand your operation and your role in healing.

### Education is provided on:



**Removal of the Appendix**




## The Condition

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.

### What are the common symptoms?

- Abdominal pain that starts around the navel
- 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 only option for an acute (sudden) infection of the appendix.

## 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.

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 in 1 or 2 days 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.



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

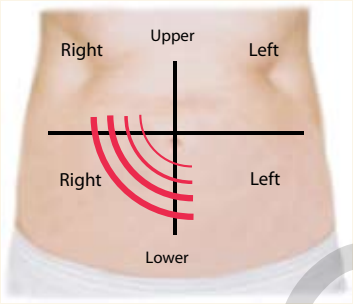
# The Condition, Signs and Symptoms, and Diagnostic Tests

## 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.[1,2]

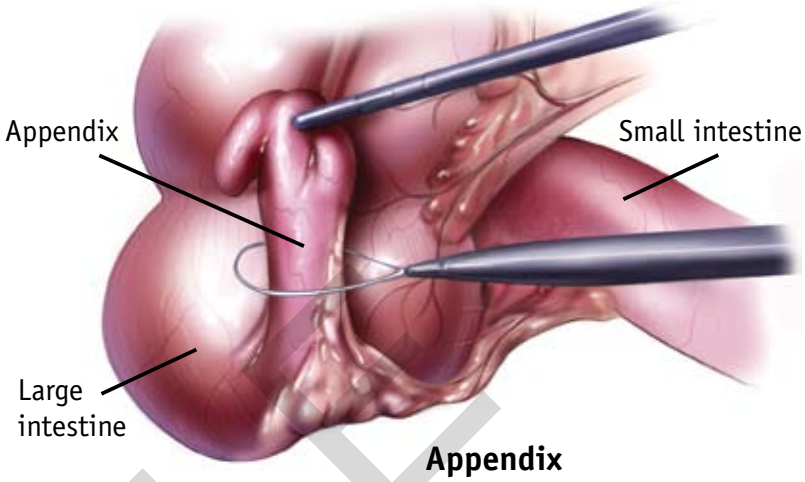



Other medical disorders have symptoms similar to appendicitis, such as inflammatory bowel disease, pelvic inflammatory disease, gastroenteritis, urinary tract infection, right lower lobe pneumonia, Meckel's diverticulum, intussusception, and constipation.

## 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 cause of infection can be from an illness, thick mucus or hard stool trapped in the opening of the appendix, or parasites.




### 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 affects 1 in 1,000 people, most often 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.

Appendectomy is the surgical removal of the appendix.

## Symptoms

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

## Common Diagnostic Tests

### History and Physical

The focus will be on your abdominal pain.

### Tests (see glossary)

Abdominal ultrasound—checks for an enlarged appendix

Computed tomography (CT) scan—checks for an enlarged appendix and infection

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

Rectal exam—checks for tenderness on the right side and for any rectal problems that could be causing the abdominal pain

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

# Surgical and Nonsurgical Treatment

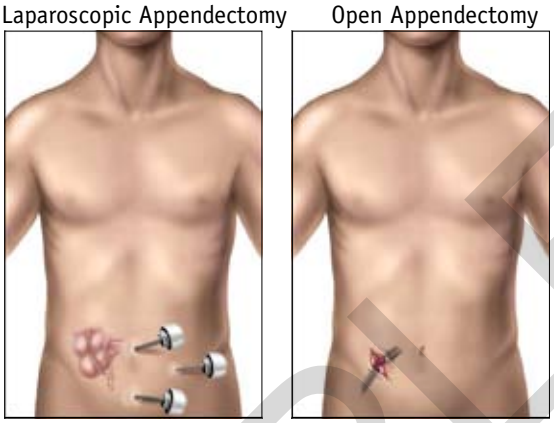
## Surgical Treatment

An operation is the only option for acute infection of the appendix.

### Laparoscopic Appendectomy

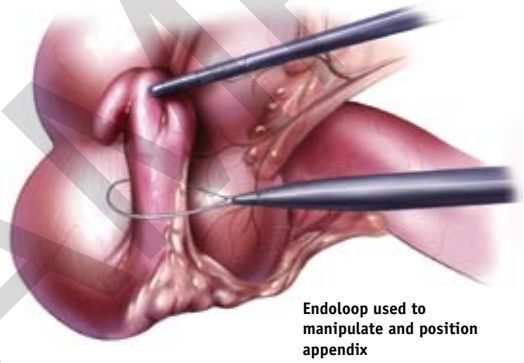
This technique is the most common for simple appendicitis. The surgeon will make 1 to 3 small incisions in the abdomen. A port (nozzle) is inserted into one of the slits, and carbon dioxide gas inflates the abdomen. This process allows the surgeon to see the appendix more easily. A laparoscope is inserted 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 sites are closed with sutures or staples or covered with glue-like bandage and steri-strips. Your surgeon may start with a laparoscopic technique and need to change to an open technique. This change is done for your safety.

**Laparoscopic versus Open Appendectomy**

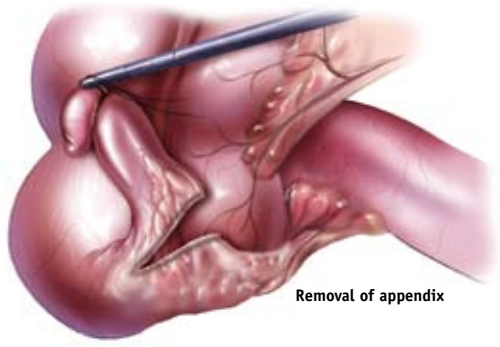



### Open Appendectomy

The surgeon makes an incision about 2 to 4 inches long in the lower right side of the abdomen and cuts through fat and muscle layers to the appendix. 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 site is closed with sutures or staples or covered with glue-like bandage and steri-strips.



Endoloop used to manipulate and position appendix



Removal of appendix

## Nonsurgical Treatment

If you only have some of the signs of appendicitis, your surgeon may monitor you to see if the symptoms get any worse. If you have an abscess (a collection of pus), your surgeon may treat you with antibiotics first and may have you come back for elective surgery in 4 to 6 weeks.

## Keeping You Informed

### Conversion Rates

Conversion rates from a laparoscopic to an open procedure average 110 per 1,000 patients.[2] Conversion to an open technique is most commonly due to adhesions (bands of scar-like tissue sticking on organs), followed by perforation (bursting) and peritonitis.[3,4]

### Pediatric Considerations

There is no reported difference in the length of hospital stay for laparoscopic versus open procedures for nonruptured (2.3 versus 2.0 days) and ruptured (5.5 versus 6.2 days) appendices.[5]

### Ruptured Appendix

Unfortunately, many people do not know they have appendicitis until the appendix bursts. If this happens, it causes more serious problems. The incidence of ruptured appendix is 270 per 1,000 patients. 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.[1,7]

# Risks of This Procedure

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

| The Risk | What Happens | Keeping You Informed |
|---|---|---|
| **Infection** | For simple acute appendicitis, wound infection is reported as 0 to 34 per 1,000 patients for laparoscopic and 1 to 70 per 1,000 for open procedures. The risk increases for a perforated appendix and abdominal infection.[2,3,8-11] | Antibiotics are typically given right before the operation. Your health care team should wash their hands before examining you. |
| **Abscess** | An abscess is reported as 0 to 24 per 1,000 patients for laparoscopic and 0 to 10 per 1,000 for open procedures.[2,3,8] | Call your surgeon if your wound is red or draining pus. Antibiotics are used to treat an abscess. |
| **Intestinal obstruction** | Swelling of the tissue around the intestine can stop stool and fluid from passing through your intestine. Short-term intestinal obstruction is reported as 38 per 1,000 patients.[8] | Your abdomen will be checked for bowel sounds, and you will be asked if you are passing gas. If you have a temporary block, a nasogastric tube may be placed through your nose into your stomach for 1 to 2 days to remove fluid from your stomach. |
| **Pneumonia** | Pneumonia is reported as 25 per 1,000 patients.[3,8] | Deep-breathing exercises and movement can help expand your lungs and decrease this risk.[12] |
| **Heart problems** | Heart problems are rare. Heart attacks are reported as 4 per 1,000 patients and stroke as 2 per 1,000.[8] | Call your surgeon if you have chest pain. Your anesthesia provider is always prepared in advanced cardiac life support. Special leg compression stockings and blood thinning medication may be given. |
| **Kidney problems** | Urinary tract infections are reported as 11 per 1,000 patients and decreased renal flow as 4 per 1,000.[8] | Let your nurse know when you urinate. Call your surgeon if you have signs of a urinary infection (pain with urination, fever, cloudy urine). Blood work may be done to check for renal flow. |
| **Deep vein thrombosis (blood clots)** | No movement during the operation can lead to blood clots forming in the legs. In rare cases the clot can travel to the lungs. | Your surgeon or nurse will place support or compression (squeezing) stockings on your legs and may give you blood thinning medication. Your job is to get up and moving after the operation. |
| **Bleeding** | Bleeding is extremely rare.[2,3] | A blood transfusion is usually not required. |
| **Pregnancy risks** | Premature labor is reported as 83 per 1,000 patients and fetal loss as 26 per 1,000.[7] | The risk of fetal loss increases to 109 per 1,000 patients with peritonitis (infection of the abdominal cavity).[7] |
| **Pediatric risks** | Complications are rare and range from 0 to 5 per 1,000 patients for simple appendectomy. There are no deaths reported in current studies for simple appendectomy.[5,9-11] | Children with gangrenous or perforated appendices have increased wound infection rates (26 per 1,000) and abdominal infections (44 per 1,000). There is an increased rate of abscess (90 per 1,000) with laparoscopic surgery.[5] |
| **Elderly risks** | The complication rate is higher in the elderly, with 143 to 208 per 1,000 patients. Death is reported as 3 to 20 per 1,000 elderly patients.[6] | Complications, lengths of stay, and deaths are lower with laparoscopic versus open procedure in the elderly, while the cost is higher.[6] |
| **Death** | Death is extremely rare in healthy people for appendectomy without peritonitis, with mortality reported as 0 to 18 per 1,000 patients.[2,8] | The risk of death increases with having another severe disease, total dependence on others to function, a contaminated wound, and chronic pulmonary disease.[8] |

# Expectations: Preparation for Your Operation

## Preparing for Your Operation

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

Be sure to tell your surgeon if you are taking blood thinners (Plavix, coumadin, aspirin).

### Home Preparation

You can often go home in 1 or 2 days. Your hospital stay may be longer for a ruptured appendix.

### 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.

### Don't Eat or Drink

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

### What to Bring

- Insurance card and identification
- Advance directive (see terms)
- List of medicines
- Personal items such as eyeglasses and dentures
- Loose-fitting comfortable clothes
- Leave jewelry and valuables at home

## What You Can Expect

A bracelet with your name and identification number will be placed on your wrist. Your wristband should be checked by all health care team members before providing any procedures or giving you medication. If you have any allergies, an allergy bracelet should also be placed on your wrist.

An intravenous line (IV) will be started to give you fluids and medication. The medication will make you feel sleepy.

A tube will be placed down your throat to help you breathe during the operation.

Your surgeon will perform your operation and then close your incisions. A drain may be placed from the inside of your incision out your abdomen.

After your operation, you will be moved to a recovery room.

### Preventing Pneumonia

Movement and deep breathing after your operation can help prevent fluid in your lungs and pneumonia.[10]

### Preventing Blood Clots

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 operation, the greater the risk. Your doctor will know your risk for blood clots, and steps will be taken to prevent them. This may include blood thinning medication and support or compression (squeezing) stockings.

### Preventing Infection

- The risk of infection can be lowered if antibiotics are given right before the operation and hair is removed at the surgical site with clippers versus shaving.
- All health care providers should wash their hands before examining you.

### Questions to Ask

- Ask about the risks, problems, and side effects of general anesthesia.

## Keeping You Informed

### Anesthesia

The most frequent option for general anesthesia is called balanced anesthesia, where a combination of different drugs is used. Common drugs are:

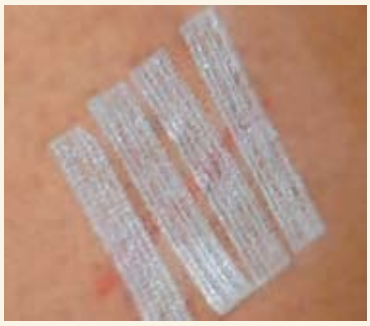
- Inhaled gases—nitrous oxide
- Barbiturates—thiopental
- Benzodiazepines—midazolam
- Opioids—fentanyl, morphine
- Other agent—propofol

### Deep Breathing

Take 5 to 10 deep breaths every hour while you are awake. Breathe deeply and hold for 3 to 5 seconds. Young children can do deep breathing by blowing bubbles.

# Your Recovery and Discharge

Avoid driving



Steri-strips will fall off or they will be removed during your first office visit

Wash your hands before and after touching near your incision site

## 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 are not nauseous, you can begin eating regular foods.
- Continue to drink lots of fluids, usually about 8 to 10 glasses per day.

### Activity

- You will be helped getting out of bed and walking.
- Slowly increase your activity.
- Do not lift or participate in strenuous activity for 3 to 5 days for laparoscopic and 10 to 14 days for open procedure.
- Avoid driving until your pain is under control without narcotics.
- You can have sex when you feel ready, usually after your sutures or staples are removed.
- 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, steri-strips, or staples are removed. You may take a shower after the second postoperative day unless you are told not to.
- Follow your surgeon's instructions on when to change your bandages.
- 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.
- Surgical staples will be removed during your first office visit.
- Steri-strips will fall off in 7 to 10 days or they will be removed during your first office visit.
- 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. Keep the wound site out of the sun or use sunscreen.
- Sensation around your incision will return in a few weeks or months.

### 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.
- 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.

### Pain

The amount of pain is different for each person. Some people need only 1 to 3 doses of pain control medication, while others use narcotics for a full week.

### Home Medications

The medicine you need after your operation is usually related to pain control.

## 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)
- 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

**Other Instructions:**

**Follow-up Appointments**

| Who | Date | Phone |
|---|---|---|
| | | |
| | | |

## Pain Control

Everyone reacts to pain in a different way. A scale from 0 to 10 is often used to measure pain. At a "0," you do not feel any pain. A "10" is the worst pain you have ever felt.

### Common Medicines to Control Pain

Narcotics or opioids are used for severe pain. Some side effects of narcotics are sleepiness; lowered blood pressure, heart rate, and breathing rate; skin rash and itching; constipation; nausea; and difficulty urinating. Some examples of narcotics include morphine, oxycodone, and hydromorphone. Medications are available to control many of the side effects of narcotics.

### Non-narcotic Pain Medication

Most nonopioid pain medications are nonsteroidal anti-inflammatory drugs (NSAIDs). They are used to treat mild pain or combined with a narcotic to treat severe pain. They also can reduce inflammation. Some side effects of NSAIDs are stomach upset, bleeding in the stomach or intestines, and fluid retention. These side effects usually are not seen with short-term use. Examples of NSAIDs include ibuprofen and naproxen.

### Non-medicine Pain Control

Distraction helps you focus on other activities instead of your pain. Music, games, and other engaging activities are especially helpful with children in mild pain.

Splinting your stomach by placing a pillow over your abdomen with firm pressure before coughing or movement can help reduce the pain.

Guided imagery helps you direct and control your emotions. Close your eyes and gently inhale and exhale. Picture yourself in the center of somewhere beautiful. Feel the beauty surrounding you and your emotions coming back to your control. You should feel calmer.

## Keeping You Informed

Extreme pain puts extra stress on your body at a time when your body needs to focus on healing. Do not wait until your pain has reached a level "10" or is unbearable before telling your doctor or nurse. It is much easier to control pain before it becomes severe.

### Laparoscopic Pain

Following a laparoscopic procedure, pain is sometimes felt in the shoulder. This is due to the gas inserted into your abdomen during the procedure. Moving and walking helps to decrease the gas and the right shoulder pain.[2,3]

Splinting your stomach

Guided imagery

# Glossary of Terms and More Information

## Glossary of Terms

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-dimensional 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.

Radiographic barium contrast enema A special X ray of the large intestines. Pictures are taken of the abdomen after barium dye is inserted into the rectum.

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



## For More Information

For more information, please go to the American College of Surgeons Patient Education Web site at *www.facs.org/patienteducation/*.

### References

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

1. Anderson B, Nielsen TF. Appendicitis in pregnancy: diagnosis, management and complications. *ACTA Obstetricia Gynecologica Scandinavica*. 1999;78(9):758-762.
2. Ho H. Appendectomy. In: *ACS Surgery: Principles and Practice 2004*. New York, NY: WebMD, 2004.
3. Sauerland S, Lefering R, Neugebauer EAM. Laparoscopic versus open surgery for suspected appendicitis (Review). *The Cochrane Database of Systemic Reviews* 2004, Issue 4 Art No: CD001546. pgb2.DOI: 10.1002/14651858.CD001546.pub2.
4. Liu SI, Siewart B, Raptopoulos V, Hodin RA. Factors associated with conversion to laparotomy in patients undergoing laparoscopic appendectomy. *Journal of the American College of Surgeons*. 2002;194(3):298-305.
5. Paik PS, Towson JA, Anthone GF, et al. Intra-abdominal abscesses following laparoscopic and open appendectomies. *Journal of Gastrointestinal Surgery*. 1997;1(2):188-193.
6. Harrell AG, Lincourt AE, Novitsky YW, et al. Advantages of laparoscopic appendectomy in the elderly. *American Surgeon*. 2006;72(6):474-480.
7. Cohen-Kerem R, Railton C, Oren D, Lishner M, Koren G. Pregnancy outcome following non-obstetric surgical intervention. *American Journal of Surgery*. 2005;190(3):467-473.
8. Margenthaler JA, Longo WE, Virgo KS, Johnson FE, Oprian CA, Henderson WG, Daley J, Khuri SF. Risk factors for adverse outcomes after the surgical treatment of appendicitis in adults. *Annals of Surgery*. 2003;238(1):59-66.
9. Emil S, Laberge JM, Mikhail P, Baican L, Flageole H, Nguyen L, Shaw K. Appendicitis in children: a ten-year update of therapeutic recommendations. *Journal of Pediatric Surgery*. 2003;38(2):236-242.
10. Newman K, Ponsky T, Kittle K, et al. Appendicitis 2000: variability in practice, outcomes and resources utilization at thirty pediatric hospitals. *Journal of Pediatric Surgery*. 2003;38(3):372-379.
11. Chen C, Botelho C, Cooper A, et al. Current practice patterns in the treatment of perforated appendicitis in children. *Journal of the American College of Surgeons*. 2003;196(2):212-221.
12. Overend TJ, Anderson CM, Lucy SD, et al. The effect of incentive spirometry on post-operative complications. *Chest*. 2001;120:971-978.

Reviewed by: Thomas Whalen, MD, MMM, FACS
Marshall Schwartz, MD, FACS

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Doctor's Name:

Phone Number:

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Instructions: