Ruptured (Perforated) Appendicitis

Patient and family information, brought to you by the Education Committee of APSA

Overview - "What is it?"

The appendix is a small extension of the intestine that is connected to the large intestine (colon). The appendix is usually located in the right lower side of the belly, and it is tubular in shape. Its length differs based on the age. The appendix has no known important function.

Appendicitis is inflammation and infection of the appendix and often results from blockage of the appendix by stool (feces). Sometimes, the feces forms a small stone called a fecalith. Other causes of appendicitis include swelling of lymph tissues within the appendix wall because of recent infection; sometimes worms can also block the appendix.

Once blockage of the appendix occurs, several things happen:

- The appendix cannot empty the mucus and fluid that it makes.
- The pressure in the appendix increases and it swells.
- Bacteria multiples inside the appendix.
- The swelling cuts off the blood supply to the appendix. If the infection continues, part of the appendix wall dies resulting in a hole. This is how ruptured or perforated appendix happens.

Ruptured Appendicitis: The time interval between onset of symptoms and rupture of the appendix is about 36 to 72 hours. Rupture occurs in about one of three patients admitted to children's hospitals. The severity of ruptured appendicitis is different for every patient. Some children have a small rupture, while others may have a big spillage of stool and pus into the abdomen. Still others can have problems with intestinal blockage from the inflammation and infection. Some children who have appendicitis going on for days before the diagnosis may be so sick that the infection spreads into the blood stream. This is a serious condition and can be life-threatening. These patients will need to be stabilized before undergoing surgery. Therefore, the treatment including timing of surgery depends on how sick the patient is.

There are 70,000 appendicitis cases in kids per year in the United States. Overall, 7% of people in the United States have their appendix removed during their lifetime.

Signs and Symptoms - "What symptoms will my child have?"

Early signs and symptoms: When inflammation in the appendix begins, there is pain around the middle of the belly by the belly button. The child may have decreased appetite and feels like vomiting. The pain never completely goes away and becomes sharper with time.

Most children with appendicitis have a fever of 38°C to 39° C (100.5°F to 102°F).

Later signs and symptoms: More than 24 hours after the pain starts, it moves to the right lower side of the belly. Sometimes, a child complains of right lower abdominal pain while walking or refuses to stand up or walk due to pain. Younger children (less than five years old) have a higher chance of having ruptured appendicitis because they may not be able to talk clearly about their symptoms. If the appendix ruptures, a high fever may be seen. There may be episodes of diarrhea

Diagnosis - "What tests are done to find out what my child has?"

History: The doctor will obtain a history and perform a physical exam. This is important for diagnosis of appendicitis. The surgeon will be interested in the type and location of pain: right lower side that hurts with jumping, walking or other jarring movements. The doctor will ask whether the child may have nausea, vomiting, refusal to eat, fever or diarrhea.

Physical Exam: A careful abdominal examination is performed by the surgeon. Other medical problems that cause belly pain will be investigated.

Labs and Tests: Bloodwork may be sent to look indications of an infection. Urine may be tested for a bladder infection or a kidney stone. Female teenagers should have a urine pregnancy test.

Diagnostic Imaging: In some cases, the child's story and the examination by the doctor may be very convincing that appendicitis is present. If the diagnosis is not clear, other tests may be ordered.

- *Chest X-ray:* If there is a concern for pneumonia
- *Abdominal X-ray*: A belly X-ray looks for clues regarding what may be causing the pain in general.
- *Ultrasound:* Ultrasound is very helpful to diagnose appendicitis. A probe is placed over the belly and sound waves are used to look at the appendix. Ultrasound may be useful for girls to look at the ovaries.
- *Computed tomographic (CT) scan:* CT is most useful when the diagnosis is not clear or if ruptured appendicitis suspected. Unlike ultrasound, CT scan uses radiation to obtain images. The child may be asked to drink a liquid that outlines the stomach and intestines. Sometimes, the contrast is given through the rectum. In some cases, an IV

medicine is needed to help the CT get better pictures leading to a more accurate diagnosis.

Conditions that mimic appendicitis: Gastroenteritis ("stomach flu"), constipation, ovarian cyst, twisting of ovary (torsion), groin (inguinal) hernia, pneumonia, Meckel's diverticulum, inflammatory bowel disease, kidney diseases, urinary tract infection, intestinal obstruction, pregnancy.

Children with history and physical exam findings that are convincing with appendicitis may not need any further tests. It is important to note that in children with unclear cause of belly pain, there are several possibilities.

If the diagnosis of appendicitis is not clear, the doctor may recommend observation in the emergency room or hospital for a period of time. A doctor will examine the child every few hours to see if the pain gets better or worse. Ultrasound or CT may be done depending on the situation.

Treatment - "What will be done to make my child better?"

Medicines: Since appendicitis is an infection, antibiotics are an important part of the treatment. Antibiotics are medicines that fight bacteria. It is given through the vein.

Patients with ruptured appendicitis have a high risk of getting infection of their wound or developing an abscess or pus collection inside their belly. They need several days of antibiotics depending on how bad the rupture is.

Fluids are needed for patients with appendicitis. Since appendicitis causes loss of appetite, the patient may be dehydrated. Fluids are usually given through the vein.

Medicine is also given to the patient to manage belly pain.

Surgery: The standard way to treat appendicitis is by removing it (appendectomy). This can be done the traditional way ("open" or larger incision) or laparoscopic.

Preparation for surgery: Your child will be given fluids, antibiotics, pain medicine prior to surgery.

Informed consent: A consent form is a legal document that states the tests, treatments or procedures that your child may need and the doctor or practitioner that will perform them. Before surgery, your doctor should tell you what the operation is, the goal of the surgery and other possible treatment options that are available. Your doctor should explain the risks and benefits of the surgery. You give your permission when you sign the consent form. You can have someone sign this form for you if you are not able to sign it. You have the right to

understand your child's medical care in words you know. Before you sign the consent form, make sure all of your questions are answered. It is important to know that during surgery, there are things that can happen that your doctor may have not predicted before going in. He or she will explain these to you after the surgery.

Open appendectomy: The appendix is removed through a transverse open incision in the right lower part of the belly.

Laparoscopic appendectomy: In laparoscopic appendectomy, several small cuts (incisions) are made. Through one of the cuts, a video camera is placed. The surgery itself is done using small instruments placed through the other incisions. The usual number of incisions (cuts) for laparoscopic surgery vary from one (single port umbilical) to three. Sometimes an extra cut is needed if the appendix is really ruptured and stuck. The placement of the incisions depends on the location of the appendix.

Open and laparoscopic appendectomy take the same amount of time to perform. Appendectomies for ruptured appendicitis take longer than those for non-ruptured appendicitis. One benefit of laparoscopy is that other abdominal structures can be examined using the video camera during surgery. Laparoscopy also has lower risks of wound infection.

Special circumstances with ruptured appendicitis and their treatment

Ruptured appendicitis with abscess: Patients with ruptured appendicitis spill stool from the appendix into the belly. This causes an infection resulting in a collection of pus or an abscess. The abscess may be seen on ultrasound or CT. If the abscess is big, the surgeon may decide that the infected fluid should be drained first to calm down the infection before doing surgery. With an operation done when there is a large abscess, there is a higher complication rate than an operation done when the abscess is resolved.

> Drainage of the abscess is usually done by a specialist that will use either an ultrasound or CT to look for a safe window to drain the pus. Sometimes the window is through the front of the belly, the side of the belly or even through the opening of the anus. Placement of the drain depends on where the abscess is located and the internal organs around it. Usually, the radiologist leaves a small drainage tube to allow all the infected fluid to come out. The drain is removed when all the pus has been drained.
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> Drainage of the abscess and antibiotics settle the infection. The patient feels better and is able to be sent home. The appendix is removed weeks later.

Ruptured appendicitis and intestinal obstruction: Sometimes the inflammation from ruptured appendicitis is so bad that it causes kinking of the intestines. This leads to blockage of the flow of food through the intestinal tract. Intestinal blockage or obstruction is suspected if the patient has lots of vomiting and the vomit is green or bright yellow in color. X-rays or CT may show intestinal obstruction.

When obstruction is present, it usually means the appendicitis is severe. Although a laparoscopic approach may be possible, an open operation may be needed. This may require a large vertical incision in the middle of the belly.

Postoperative care:

Activity: Your child's caregiver will tell you when it is okay for your child to get out of bed. Usually, the child is encouraged to walk around as soon as possible.

Diet: In patients with ruptured appendicitis, it may take a few days for the intestines to work normally. Your doctor will make the decision when your child should ready to eat. This depends on many things such as how badly ruptured the appendix was, whether there was intestinal blockage, if your child is still vomiting, and whether he or she is passing gas.

Foley catheter: Sometimes there is a tube or catheter that may be put into your child's bladder to drain urine.

Nasogastric tube: Sometimes a nasogastric (NG) tube is inserted through your child's nose or mouth and down into his stomach. This tube keeps the stomach empty to decrease vomiting after surgery.

Medicines: Your child may need any of the following:

> **Antibiotics:** This medicine is given to help prevent or treat an infection caused by bacteria.
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> **Anti-nausea medicine:** This medicine may be given to control vomiting (throwing up).
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> **Pain medicine:** Pain medicine can include acetaminophen (Tylenol®), ibuprofen (Motrin®), or narcotics. These medicines can be given by vein if the intestines are not fully working yet.

Home Care ("What do I need to do once my child goes home?")

Diet: Your child may eat a normal diet after surgery.

Activity: Your child should avoid strenuous activity and heavy lifting for the first 1-2 weeks after laparoscopic surgery, 4-6 weeks after open surgery.

Wound care: Surgical incisions should be kept clean and dry for a few days after surgery. Most of the time, the stitches used in children are absorbable and do not require removal. Your surgeon will give you specific guidance regarding wound care, including when your child can shower or bathe.

Medicines: Medicines for pain such as acetaminophen (Tylenol®) or ibuprofen (Motrin® or Advil®) or something stronger like a narcotic may be needed to help with pain for a few days after surgery. Stool softeners and laxatives are needed to help regular stooling after surgery, especially if narcotics are still needed for pain.

What to call the doctor for: Call your doctor for worsening belly pain, fever 38.5°C (101°F), vomiting, jaundice, f the wounds are red or draining fluid, diarrhea or problems with urinating.

Follow-up care: Your child should follow up with his or her surgeon 2-3 weeks after surgery to ensure proper post-operative healing.

Long-Term Outcomes ("Are there future conditions to worry about?")

In majority of cases, patients do well after removal of appendix. However, in rare cases, the following complications my arise:

Wound infection: Happens around 3% of the time. Infections may need only antibiotics or may require opening up of the wound depending on how bad the infection is.

Abscesses (pus pockets): Happens about 10-20% of the time with ruptured appendicitis. If the abscess is small, antibiotics may treat it. If it is big, it may need to be drained. The technique is the same as described in the section Ruptured Appendicitis with Abscess

Small bowel obstruction: 3-5% risk after appendicitis and appendectomy.

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