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### Overview

The esophagus is a muscular tube through which food descends from the mouth, through the diaphragm to the stomach. Muscles actively propel each mouthful of food (a process called peristalsis) so that humans can swallow, even upside down! Normal swallowing needs coordinated propulsion by the muscles of the esophagus followed by relaxation of the valve at the lower end, the lower esophageal sphincter or LES. The lower part of the esophagus is protected from stomach acid by muscles that tighten the entrance into the stomach, by other factors that create a valve effect.

### Hiatal Hernia

When the upper part of the stomach resides in the chest above the diaphragm this is called a hiatal hernia. The *hiatus* (where the esophagus passes through the diaphragm) is usually stretched. Many people have a hiatal hernia but no symptoms. Depending on the degree, if much of the stomach is twisted where it lies in the chest, a more dangerous *paraesophageal hernia* exists with the risk of strangulation of the stomach.

### GERD

Gastroesophageal reflux disease (GERD or *reflux*) occurs because of a failure of the normal mechanisms that protects the esophagus from the corrosive effects of acid and pepsin contained in stomach juices. Although heartburn is a common symptom of this disorder the complications of esophageal ulcers, bleeding and narrowing (stricture) of the lower esophagus can still occur with few or no symptoms. These are characteristics of *erosive esophagitis*, which is GERD in its most serious form. Surgery is the only permanent cure for this disorder and should be considered earlier rather than later, as the success of any treatment of the complications of long standing GERD is reduced as the disease progresses.

*Non-erosive reflux disease or NERD* occurs when symptoms of heartburn are experienced without the damaging effects of acid and pepsin being observed in the lining of the esophagus. The symptoms can be quite disturbing but the need for surgery is far less obvious.

Long-standing reflux or *hiatal hernia* can cause normal peristalsis to deteriorate. This is detected by a test called manometry and many patients considering surgery for reflux will need to undergo this examination.

### Achalasia

This is a rare disorder of unknown cause. Achalasia occurs when the nerves supplying the muscle of the last inch or so of the esophagus to disappear. This results in failure of the muscle to relax completely. Normal peristalsis in the esophagus is absent and patients complain of difficulty swallowing, regurgitation and chest pain. As time goes by the esophagus begins to dilate and twist till it resembles a large passive bag in which food and fluid accumulate because they cannot pass normally into the stomach. Eventually this results in weight loss and nutritional depletion. Because there is no known cure for achalasia, treatment is aimed at loosening the tight zone in the lower esophagus to allow food to pass through more easily. This can be performed endoscopically with a dilating balloon (*pneumatic dilatation*) or surgically (an operation called esophagomyotomy). In recent years the success of laparoscopic surgical myotomy has become so clear that many gastroenterologists no longer perform dilatation, fraught as it is with the risk of perforation of the esophagus of 5-10%, and prefer to refer their patients for surgery.

Once the esophagus deteriorates to a major degree, merely loosening the opening into the stomach may be insufficient to allow food to pass. It is usually worth trying esophagomyotomy as the first treatment although the more *sigmoid* the esophagus becomes (the term is used to liken it to the sigmoid colon, the “S” or sigmoid portion of the large bowel), the less likely the procedure is to work. Faced with a passive, tortuous baglike esophagus that will not allow swallowed foods to pass, if the patient cannot maintain weight due to regurgitation of most swallowed nutrients, the only solutions are removal of the esophagus using the stomach as a replacement (esophagectomy), or a tube feeding into the stomach, a decidedly less attractive option. Esophagectomy is discussed in more detail below.

### **Surgery for GERD, Hiatal Hernia and Achalasia**

Surgery is a treatment option for these disorders and has been revolutionized by the development of laparoscopic techniques identical to their conventional counterparts. Because there is no organ to remove, and only stitches to insert, this surgery can be performed through tiny incisions. Great precision is made possible by the magnification provided by the video system.

#### **Preparation**

For patients with symptoms of reflux, a 24-hour pH study measures how long and how often the esophagus is exposed to acid, and the correlation between acid exposure and symptoms such as heartburn. This allows the surgeon to identify patients unlikely to benefit from an operation. After surgery is performed, the same test measures the effect of the operation for comparison with pre-operative values. *Manometry* measures the pressure waves in the esophagus and is usually performed in patients with long-standing reflux, or when achalasia is suspected. All patients must have had an endoscopy in the 6-12 months before surgery to rule out the presence of a tumor of the esophagus or upper stomach, which can mimic some of the symptoms of these otherwise benign disorders.

For anti-reflux operations no specific preparation is required for this surgery. Routine laboratory tests, EKG and chest x-ray will be performed. Surgery is performed on the day of admission and can last from 1-3 hours, depending on the complexity of the case.

In severe achalasia is necessary to clear debris and retained food from the dilated esophagus before surgery can go ahead. Indeed during endoscopy in this situation it can be very difficult to see the lining of the esophagus clearly because it is covered with an adherent coating. Before endoscopy or surgery in these severe cases it is usually necessary to follow a liquid diet and then undergo a washout of the retained material.

#### **The Operations Performed**

General anesthesia is required. The upper abdomen is inflated with gas and five small incisions are made for instruments to perform surgery.

If the problem is reflux, the lower esophagus is dissected and the upper part of the stomach is partially or completely wrapped around it to create a valve. For an increasing number of patients with non-erosive reflux disease (NERD) who do not have a hiatal hernia, a minimal procedure known as Dor or *anterior fundoplication* can give just the right amount of anti-reflux effect without subjecting the patient to the added risk of post operative hiatal herniation or displacement of the wrap, both mechanical complications which spoil the results of laparoscopic anti-reflux surgery.

For paraesophageal hernia, the lining of the hernia is removed, the stomach is returned to the abdomen and the diaphragm is repaired. A valve may be created to prevent reflux. The stomach is attached to the inside of the abdomen (called gastropexy) to lessen the tendency for the stomach to be pushed up into the chest.

In achalasia, the muscle on the front of the esophagus is split surgically to remove the high-pressure non-relaxing zone. Endoscopy of the inside of the esophagus is performed simultaneously to check that the muscle split (or esophagomyotomy) is adequate. An anti-reflux procedure normally completes the procedure to prevent regurgitation from the stomach into the esophagus.

As with any laparoscopic operation, if it cannot be completed safely, it may be necessary to convert to a conventional procedure. The chance of this is less than 1%.

The following day, a limited barium swallow examination is performed to record the position of the stomach and the esophagus as it passes through the hiatus. If all is well, food is commenced immediately and you will be discharged later in the day. Painkillers by mouth should be sufficient at this stage and for the next day or two. Lengthy use of Percocet or Tylenol 3 will cause constipation and should be avoided after the first two or three doses.

It is common to experience some minor swallowing discomfort or difficulty for up to a month after the surgery. This is due to swelling of the operated tissues and almost always goes away without treatment.

In general, any medication that you take for reflux such as Prilosec, Pepci etc. can be discontinued once the surgery is over.

### **Esophagectomy**

Complete removal of the esophagus for achalasia, pre-cancerous conditions, or certain cancer of the esophagus or upper stomach is now possible by minimally invasive techniques.

Esophagectomy is a very big operation but can be performed as a combined laparoscopic and thorascopic procedure. This reduces to an major degree the amount of surgical trauma to the abdominal and chest walls that traditional laparotomy and thoracotomy create and allow the body's defenses to recover more rapidly. The entire esophagus can be removed if necessary. By freeing the attachments within the abdomen but preserving its blood supply, the stomach can be pulled up through the chest into the neck as far as needed to replace the esophagus, allowing the patient to eat again. Another version of this "pull-up" operation through the abdomen and neck as described by Dr. Orringer is similarly possible, although with far greater precision and much less trauma laparoscopically than by the original technique through large incisions.

### **Diet after GERD, Hiatal Hernia procedures and Esophagomyotomy**

It should be possible to eat a normal diet, but foods that tend to remain in large lumps when swallowed such as quickly chewed steak, tough breads or bagels, may stick and should be avoided. In patients who have had a procedure for achalasia, a puree diet will be necessary for 10 days after the operation to lower the chance of damaging the lining of the esophagus weakened by the myotomy.

Because there is a loose, one-way valve at the LES, many patients experience a change in the way they belch. They may pass more gas from below and generally feel more "gassy". To minimize these effects they should eat slowly, chew each mouthful well and avoid carbonated beverages. If patients remain comfortable after drinking gassy liquids there is no reason to abstain.

### **Complications**

In the days following discharge, abdominal pain, vomiting, fever or absence of gas and normal bowel movements should be reported. Progressive difficulty or complete inability to swallow may indicate a problem with the wrap and evaluation by the surgeon is necessary. Recurrence of

reflux may mean the wrap has come loose. In our experience, injury to adjacent organs such as, the spleen or the stomach is very uncommon. Surgery for reflux is very effective in 90-95% of cases. This means that a small number of patients will have a less satisfactory result and further evaluation with barium x-ray, manometry and 24-hour pH testing may be necessary. Whether performed by conventional or laparoscopic surgery, paraesophageal hernia has been reported to recur in 10-15% of cases. Although the recurrence rate in our experience has been much less than this, we have had to re-operate on a small number of patients to correct this problem.

The results of surgery for achalasia depend to a large degree on how much damage has occurred to the wall of the esophagus prior to operation and how deformed the esophagus has become. In early achalasia results are excellent, with normal swallowing being restored in 90% or more of patients. Results are not as good with very severe achalasia.

### **Research**

We are constantly refining techniques to make laparoscopic surgery more safe and effective and to collect data concerning the longer-term results. At intervals after your procedure one of our research assistants may call to check on your progress.