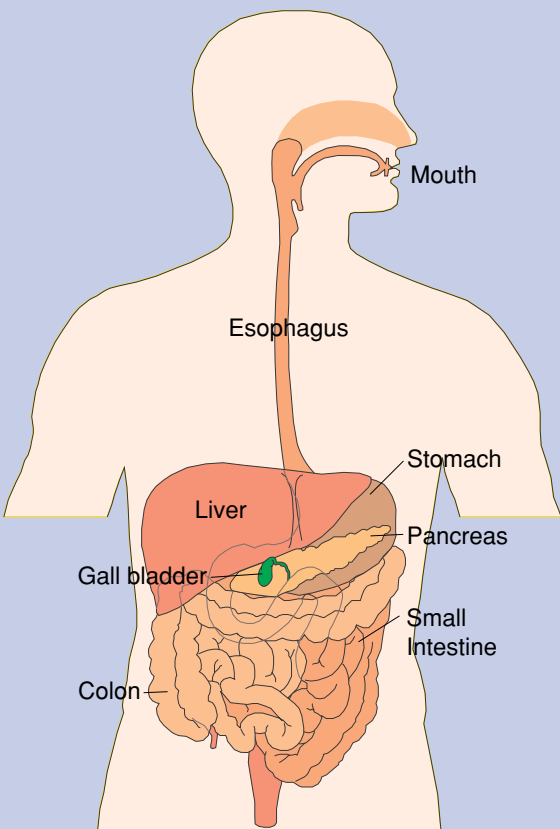


Controlling GI Side Effects after Transplant: What Every Patient Should Know



International Transplant Nurses Society



As you recover from transplant surgery, you learn many new things about your care. Your health concerns have probably changed because the complications you had from end stage organ disease are resolving or have gone away. Now you are more concerned and focused on returning to a more normal lifestyle, even though you may experience some complications such as rejection, infection, or side effects from your medications.

Side effects are complications or problems that occur because of the effects of some type of intervention or action. For example, a person might get dizzy or nauseated from riding a roller coaster or get a headache from eating ice cream. In healthcare, a medication or treatment may resolve a problem, but can cause another problem - a side effect. A blood pressure medication, for example, may lower the patient's blood pressure to a normal range, but that patient may also complain about feeling sleepy or dizzy after taking the medication.

Many transplant recipients experience gastrointestinal (GI) side effects after transplant. These side effects have to do with the organs involved in the process of digestion. This booklet will discuss the most common GI complications and the symptoms of each. It will also discuss how you and your transplant team can work together to prevent and treat GI complications.

What is the GI tract?

The gastrointestinal (GI) tract, or digestive system, includes the group of organs in your body that work together to digest, absorb and process the food you eat. The organs of the GI system include:

- Mouth and esophagus
- Stomach
- Liver
- Gall bladder
- Pancreas
- Small intestine
- Colon (large intestine)

How is food digested in the GI tract?

Digestion is the process by which food and liquids are changed into forms the body can use. These nutrients are then absorbed to provide energy and to build, nourish, and repair the cells of the body. Digestion begins in the mouth and is completed in the small intestine. The hollow organs of the digestive system – the mouth, stomach, and small intestine – have muscular walls that help mix and move food and liquid through the GI tract. This movement, often described as waves of muscular contractions, is called *peristalsis*.

Food is chewed in the mouth and mixed with saliva, then swallowed. It moves through the esophagus, the tube that connects the throat with the stomach, and passes to the stomach where it is mixed with digestive juices. The contents of the stomach are then slowly emptied into the small intestine. The digestion process is aided by juices produced by the liver and pancreas. The liver produces bile, which is stored in the gall bladder and sent into the small intestine, to help digest fats. The pancreas produces a juice with many *enzymes*, special types of proteins that trigger chemical reactions. These enzymes break down the nutrients – proteins, carbohydrates, and fats – in the food we eat so that they can be more easily absorbed by the body. The liquid food is then absorbed through the walls of the small intestine. After the digested nutrients are absorbed by the small intestine, the waste products are moved into the colon, where water absorption occurs. It can take up to 36 hours for this waste, or stool, to get through the colon in a healthy GI tract. The stool will stay in the colon until it is pushed out through a bowel movement.

What side effects can occur in the GI tract?

If a medication or treatment causes GI side effects, problems can occur in the digestive system. GI side effects include:

- Diarrhea: loose or watery stools
- Esophagitis: an irritation, inflammation, and swelling of the esophagus
- Ulcers: sores that develop in the soft tissue that lines the GI tract
- Gastritis: an irritation of the lining of the stomach
- Pancreatitis: an inflammation or irritation of the pancreas
- Hepatitis: an inflammation of the liver, not necessarily caused by a virus

The conditions listed above can cause a variety of GI side effects, depending on the organ or organs that are being affected. Common symptoms include:

- A change in bowel movements to a loose, watery stool
- Inability to control bowel movements
- Bloody or mucousy stools
- Pain or cramps in the abdominal area
- Swelling in the abdomen, feeling bloated
- Fever, chills
- Nausea, vomiting
- Decrease in appetite
- Difficulty swallowing
- Weight loss

Why do these problems occur after transplant?

GI side effects and symptoms are very common in the general population, and can be a problem for transplant recipients as well. However, the cause of GI side effects may be different and the consequences may be more serious in transplant recipients. Complications in the GI tract can occur as a side effect of immunosuppressive medications or a combination of these medications. Infections, or a change in the normal bacteria found in the intestine can also lead to GI side effects. Additionally, GI complications can lead to further problems for transplant recipients. For example, if a transplant recipient has a lot of diarrhea from a medication, the level of their immunosuppressant medication will be affected. If the level is decreased, rejection may occur. If the level is increased, patients may experience high blood pressure, high blood sugar, or tremors. An increased level may also lead to

infection. Diarrhea can cause dehydration and problems with fluid and electrolyte balance. GI side effects can lead to hospitalization in some transplant recipients.

How are GI side effects treated?

If you are experiencing GI side effects, it is important that your doctor and/or transplant team finds the exact cause of the problem. For example, if diarrhea is thought to be caused by a medication, but is really the side effect of an infection in your stool, the infection may get worse since the infection is not being treated. After the correct diagnosis is made through blood tests, stool cultures, and/or procedures, the appropriate treatment can be started. Treatment depends on the cause of the side effect, your current health status, and the organs that are affected. While these GI side effects are usually treated successfully with minimal intervention in most patients, prompt attention to symptoms and discussion with the medical team is important.



Common GI Problems after Transplant

Diarrhea

What is diarrhea?

Diarrhea, meaning a flowing through, describes stool that is very watery. The term diarrhea is also used to describe bowel movements that are less firm or “loose” and occur more frequently than normal. Your intestine usually absorbs liquids as they travel through the GI tract. If the fluids are not absorbed, or if your GI tract produces extra fluid, your stools will be watery. Almost everyone will have diarrhea at some time. The good news is that it is usually self-limiting, which means it will stop on its own. This is because most acute episodes are usually caused by a reaction to food or an infection by a virus. However, some people have diarrhea that lasts a few weeks (persistent diarrhea) or more than a month (chronic diarrhea).

What causes diarrhea?

Diarrhea develops when the GI tract has a problem absorbing water and/or when it is actively producing fluid. Diarrhea itself is not a disease, but the symptom of a condition occurring in the GI tract. There are many reasons why diarrhea might occur.

- **Infection:** Bacteria and viruses are common causes of diarrhea. The virus or bacteria is usually passed on through contaminated food or water. Parasites, tiny organisms that live inside larger organisms, can also cause diarrhea.
- **Some foods:** Foods that are contaminated with bacteria can cause “food poisoning.” Eating foods that upset the GI tract can also cause diarrhea.
- **Some medications:** Diarrhea is a side effect of many medications. Antibiotics, in particular, can change the amount and type of bacteria that is normally in your intestine. This change in bacteria can lead to diarrhea. Doctors call this “a change in the *normal flora*” of the GI tract. An overuse of laxatives can also cause diarrhea.
- **Food allergies:** Certain food allergies, with or without a rash, can cause diarrhea. When diarrhea is caused by an allergic reaction, bowel movements will usually become normal after removing that particular food from the diet.
- **Diseases that affect the GI tract:** Crohn’s disease, ulcerative colitis, irritable bowel syndrome, celiac disease and other chronic illnesses of the GI tract cause diarrhea.



What are some risk factors for getting diarrhea?

Anyone can get diarrhea, but there are some risk factors that increase a person’s chances of developing diarrhea and further complications.

- **Age:** The very young or very old are at higher risk for complications from diarrhea.
- **Medications:** Diarrhea is a side effect of many medications. Antibiotics, in particular, can change the amount of bacteria that is normally in your intestine. This change in the amount of bacteria can cause diarrhea. Doctors call this “a change in the *normal flora*” of the GI tract.
- **Recent surgeries or hospital stays:** These events can expose you to infection which can change your normal stomach flora.
- **Work place exposure:** Working in places such as day care, schools, and food service can increase your exposure to infections that cause diarrhea.
- **Pets:** Some pets can carry infection that may cause diarrhea in humans.
- **Gastrointestinal disease:** Although people with intestinal disease usually have chronic diarrhea, certain medications or infections can make their diarrhea worse.

Why do transplant recipients get diarrhea?

Diarrhea is a common complication following transplant, but it is usually managed well. Transplant recipients experience diarrhea for the same reasons as the general population, but there are some additional risks and concerns.

- Diarrhea and other GI side effects are associated with some anti-rejection medications. Mycophenolate mofetil (MMF or Cellcept®), cyclosporine (Neoral®, Gengraf®), tacrolimus (Prograf®), and sirolimus (Rapamune®) may cause GI side effects in some patients. In addition to diarrhea, GI side effects include constipation, abdominal discomfort or pain, cramping, nausea and vomiting.
- The risk of diarrhea depends on the dose and level of immunosuppressive medications, the types of drugs used, and if a combination of medications are used.
- Diarrhea can cause changes in your immunosuppression level. If you are having a lot of diarrhea, your GI tract may not be able to absorb your anti-rejection medication properly. This can cause changes in your level, even though you

are taking the medication correctly. If your level changes beyond your acceptable range, you are at increased risk for complications related to your transplant.

- *Normal flora* is a term used to describe bacteria that normally live in or on our bodies. Some of these “good” bacteria reside in our GI tract. Under normal circumstances, these bacteria protect us from infection rather than causing infection. Anti-rejection medications and other medications, particularly antibiotics, can change the amount of normal flora, causing diarrhea.
- Transplant recipients are at greater risk for infection because their immune system is suppressed. You may get a GI flu or infection in your stool more easily, particularly in the first few months after transplant or when your immunosuppression is increased. Infections in the GI tract usually cause diarrhea which can lead to other complications.
- Transplant recipients may be more likely to have more serious problems or complications from diarrhea, particularly if they are very young or an older adult. Diarrhea can lead to dehydration and other complications related to your general health and the health of the transplanted organ.



What other symptoms can occur with diarrhea?

Common symptoms that may occur with loose, watery stools include:

- Crampy abdominal pain
- An urgent need to have a bowel movement or being unable to control your bowels
- Frequent bowel movements that may become bloody
- Swelling or bloating in the abdomen
- Fever and chills
- Nausea
- Dehydration

What is dehydration?

Diarrhea can cause dehydration - when your body does not have enough fluid to function correctly. Dehydration occurs because too much fluid is leaving the body and not enough fluid is being taken into the body. When you lose a lot of fluids because of diarrhea, you also lose important chemicals called *electrolytes* (sodium, potassium, magnesium, chloride, calcium and carbon dioxide). These salts and minerals are needed by your body to perform its

many functions. Diarrhea can be dangerous if you become dehydrated and do not seek medical care. Losing fluids and electrolytes can be more serious for infants, young children, and older adults. Signs of dehydration include:

- Having a dry mouth and throat
- Being thirsty
- Feeling tired, dizzy, or lightheaded
- Urinating less often
- Having dark-colored urine
- Dry skin
- Headache
- Irritability
- Confusion
- Fainting
- Fast heart rate and a low blood pressure

Infants and young children who are dehydrated are usually very sleepy and/or irritable, have no tears when crying, have a dry mouth and tongue, sunken eyes, and have not had a wet diaper for 3 hours or more. Their skin becomes less elastic and does not flatten when it is squeezed and released.

Do I need to call my doctor if I have diarrhea?

Most people get better on their own when they have diarrhea, but if you have frequent watery stools for 3 days or more, you should contact your doctor. A doctor should be contacted for older people and young children if diarrhea continues for greater than 24 hours.

You should call your doctor if you have diarrhea, signs of dehydration, and any of the following associated symptoms:

- A temperature of 101°F/38.5°C or greater
- Severe stomach pain
- Stomach pain or cramps that come and go
- Bloody stool or black, tarry stool
- Mucous in your stool
- Nausea and vomiting

How is diarrhea diagnosed?

Your doctor will perform a physical examination to help diagnose the cause of your diarrhea. You will be asked questions about your medical history to determine if you have any risk factors for developing diarrhea. Your medical history may include questions about the food you have been eating, allergies, your

current medications, any recent hospital stays, or travel. You will be asked to describe your bowel movements in regard to color, consistency or texture, and frequency. You may be asked to bring a stool sample to your appointment.

Your doctor may also perform some tests on your blood, urine, and stool to find the cause of diarrhea and to see if you are dehydrated.

- Blood tests are obtained to look for bacteria or other signs of infection. Your electrolytes and kidney function tests will also be checked for signs of dehydration.
- Your urine will be checked to see if you are dehydrated.
- Stool samples are taken to check for infection (viruses, bacteria, or parasites), or blood that may be present in the stool.

People who have persistent or chronic diarrhea may require further testing to find the cause of their long-term diarrhea. A colonoscopy may be performed to examine the inside of the large intestine. While the patient is sedated, a thin, flexible lighted tube is inserted through the anus and into the colon so that the doctor can see the inside of the intestine and take samples of the tissue (biopsies). This examination and biopsy can help determine the cause of diarrhea.



How is diarrhea treated?

Fluids and diet: In most people, diarrhea can be treated by replacing fluids and electrolyte losses to restore your body's normal fluid and electrolyte balance. You can help replace your fluids by drinking broths (without fat), clear soups, tea, and fruit juices without pulp. The recommendation for adults is at least six 8-ounce glasses of fluid a day (about 1500 ml). Drink small amounts frequently throughout the day. As you start feeling better, you can advance your diet to foods that are soft and bland such as:

- Rice
- Bread
- Saltine crackers
- Lean meats such as baked chicken (without the skin)
- Soft fruits
- Boiled or soft vegetables

Doctors often recommend the BRAT diet, consisting of bananas, rice, applesauce, and toast as patients recover from diarrhea.

There are some additional recommendations for children who are experiencing diarrhea. If dehydrated from diarrhea, children should drink rehydration solutions that have the nutrients they need. Your pediatrician will advise you on the appropriate fluid for your child. Prescriptions are not needed for these products and they are available in grocery stores and drug stores. Pedialyte®, Ceralyte®, and Ricelyte® are examples of rehydration solutions. There are also some recipes for making rehydration solutions at home from common household ingredients. Talk to your pediatrician about making a home solution. The BRAT diet is also appropriate for children, but they need to drink as well. Pediatricians often advise “feeding through” diarrhea unless the child is dehydrated. This means to continue giving them a regular diet or breastfeeding even though they have diarrhea.

If you have diarrhea, doctors usually recommend that you avoid these foods:

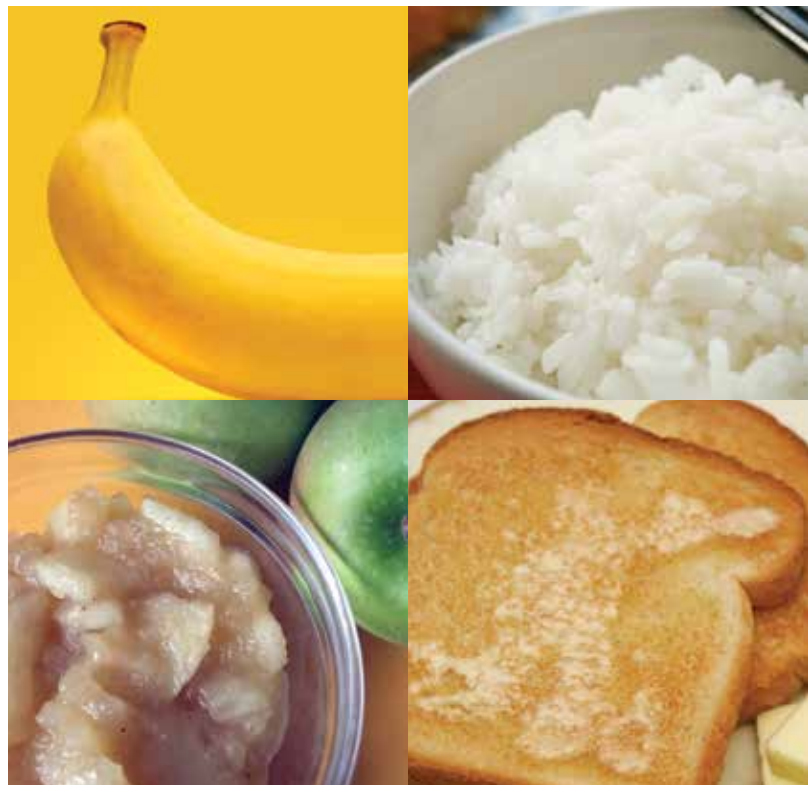
- Milk and milk products
- High fat foods
- Fried foods
- High fiber foods
- Foods high in sugar (cakes, cookies)
- Juices that are high in sugar

Medications: Because most episodes of diarrhea resolve on their own within about two to three days, medications are usually not needed. In some

instances, mild cases of diarrhea are treated with over-the-counter (OTC) medications such as Pepto-Bismol®, Imodium A-D®, and Kaopectate®. These medications should only be used if your doctor has determined that your diarrhea is not caused by an infection. If diarrhea continues for more than 3 days, it is important to diagnose the source of diarrhea so it can be treated correctly. There are some other important points to keep in mind:

- Talk to your doctor before taking any OTC medications for diarrhea.
- If you are taking an OTC medication, stop taking this medication and call your doctor if your symptoms get worse or if your diarrhea lasts for more than two to three days.
- Do not stop taking any of your current medications or change the dose unless told to do so by your doctor.
- You will not usually need an antibiotic unless you have a bacterial infection in your stool.

People who have chronic diarrhea because of diseases of the GI tract or other chronic illnesses usually require more treatment than the general population. These patients may need medications to slow down the motility of their intestine, antibiotics, and/or diet changes. Chronic diarrhea leads to dehydration, malnutrition, and weight loss because the intestine can not absorb nutrients. This is a serious condition that requires treatment and careful medical management.



What additional treatments are there for transplant recipients?

As in the general population, it is important to find out why you are having diarrhea so that it can be treated appropriately. If you are having diarrhea for greater than 24 hours, it is important to contact your transplant coordinator or doctor. Your doctor will consider all the usual reasons why you might have diarrhea as well as your specific risks because of the transplant. Your care may include:

- **Medication changes.** Sometimes the types or doses of your transplant medications may be changed to help control diarrhea. Your doctor will carefully consider the risk of complications from diarrhea and the risk of rejection in making any changes in your immunosuppression. Do not change your medications or stop taking any medications unless told to do so by your doctor.

- **Blood tests.** During the time it takes for your diarrhea to resolve, your blood tests may be checked more frequently. Immunosuppression levels, electrolytes, and kidney function will be monitored closely. You will also be watched for any signs of rejection or infection.
- **Stool samples.** A sample of your stool will be collected to test for signs of infection.
- **Organ-specific tests.** Your doctor may also want to do some specific tests depending on your transplanted organ. For example, diarrhea is the most common symptom of rejection in intestine transplant recipients, so an endoscopy with biopsy would be performed in those patients to check for rejection. Although significant dehydration usually affects kidney function in all patients, kidney transplant recipients would be watched closely for symptoms of dehydration which could affect the transplanted kidney.



Are there any ways to prevent diarrhea?

Hand washing: Diarrhea caused by an infection is best prevented through good hand washing. To wash your hands well, you should wet your hands with warm running water, then lather with soap. Scrub for 15-30 seconds being careful not to rinse away the soapy lather. Be sure to wash the front and back of your hands, between the fingers, and under your nails. Rinse well with warm running water. Turn the water off with a paper towel, then dry your hands thoroughly with a clean towel. Alcohol based antibacterial soaps are useful if you do not have access to running water. It is important to wash your hands:

- before and after using the bathroom
- before and after food preparation
- after touching or petting animals
- after blowing your nose or sneezing
- after changing a diaper
- after taking out the garbage
- after working in soil or gardening
- when your hands are visibly dirty

Remember that during the time you have infectious diarrhea, you can spread the infection. It is important to protect others as well.

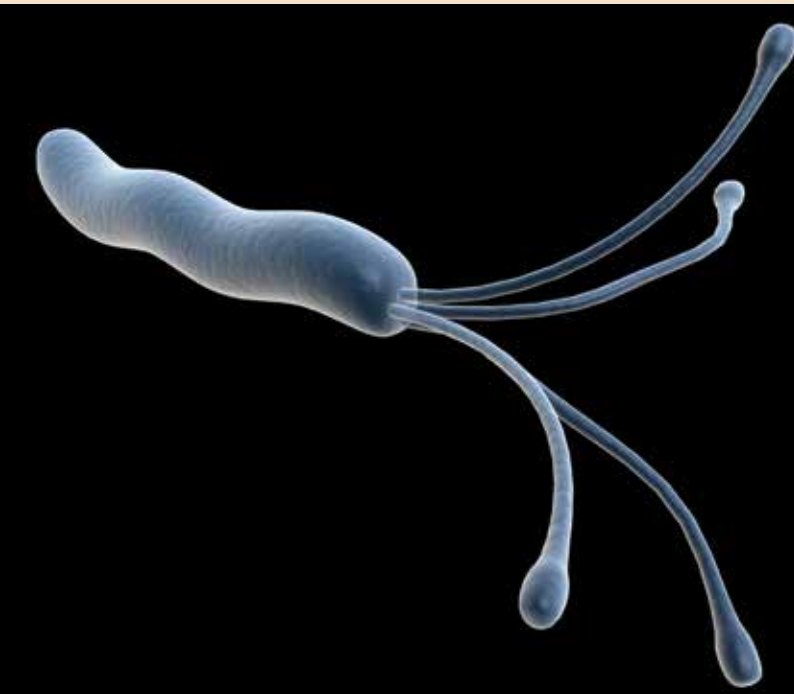
Infection control: Along with good hand washing, avoid others who are ill. Some transplant centers recommend that patients avoid crowds during the early months after transplant, whenever their immunosuppression level is high, and during cold and flu season. Wearing masks is encouraged by some transplant centers if you can not avoid crowds during cold and flu season. Always check with your transplant coordinator for your center's recommendations.

Food safety: Food safety is an important issue for everyone to decrease the risk of diarrhea through infection or contaminated food. Transplant recipients are encouraged to observe food safety guidelines because their suppressed immune system can increase their risk of developing an infection. Check with your transplant team for your center's specific guidelines. Common food safety guidelines for transplant recipients, as well as the general public, include:

- Always cook food thoroughly and serve it hot.
- Do not serve or eat raw or undercooked meats or fish.
- Do not eat meat or fish that is not hot when served to you.
- Avoid unpasteurized milk and juices. Dairy products made from unpasteurized milk should also be avoided.
- Check labels on meat, fish, and dairy products for “sell by” dates.
- Place foods in the refrigerator or freezer as soon as possible if they need to be in cold storage.
- Scrub all raw fruits and vegetables before cooking or eating them.
- Avoid salad bars and buffets due to possible contamination or low food temperature.
- Do not eat food served by street vendors.
- Check your water source. Although bottled water is always safe to drink, you can also drink tap water

that has been purified through an approved water safety process in your community. If your water source is well water, it should be tested every 6 months for bacteria.

Diarrhea is a common complication after transplant. It can be a reaction to food through an allergy, a contaminated food source, a sensitivity to food or a sensitivity to a medication. Diarrhea can be the result of a community-acquired illness or a side effect of immunosuppression. It can also be a sign of organ rejection in some patients. It is important to contact your transplant center and/or local doctor as instructed if you are experiencing diarrhea. Diarrhea is usually well-managed after transplant, but serious complications can develop if ignored and left untreated.



Ulcers

What is an ulcer?

Ulcers are sores that can develop in the soft tissue that lines the esophagus, stomach, and intestine. Ulcers are very common in the general population. Ulcers are named by their location in the GI tract. For example, esophageal ulcers are located in the esophagus while gastric or peptic ulcers are found in the stomach. Ulcers can develop in any of the three sections of the small intestine (duodenum, ileum, jejunum) as well as the large intestine.

What causes stomach or peptic ulcers?

Ulcers are caused by an imbalance in the digestive fluids in the GI tract and the disruption or breakdown of the protective coating of the GI tract. There are several reasons why this can occur:

- **Bacterial infection:** Most ulcers are caused by an infection from a type of bacteria called *Helicobacter pylori* or *H. pylori*. This bacterium weakens the protective mucous coating of the stomach and duodenum (the first part of the small intestine). Once through this barrier, stomach acid can irritate the lining of the stomach or intestine and cause an ulcer. Developing ulcers from this type of bacteria can happen in transplant patients just as it does in the general population.
- **Medications:** Ulcers can develop as a side effect of some medications, particularly a group called nonsteroidal anti-inflammatory drugs (NSAIDs). Aspirin, ibuprofen products (Motrin®, Advil®) and some arthritis medications can cause ulcers.
- **Lifestyle:** Your lifestyle can contribute to your risk of developing an ulcer. People who smoke have a greater chance of developing an ulcer. The ulcer may not heal, or may take longer to heal, if the smoking habit continues. Drinking alcohol can also increase your risk. Stress is another factor associated with problems due to ulcers. Stress does not cause ulcers, but can make an ulcer worse.

Other risk factors associated with peptic (stomach) ulcer disease include a family history of ulcers and an age of 50 years or greater.

Transplant patients have additional risk factors for developing ulcers in their stomach or intestines.

- **Infection:** Transplant recipients carry a greater risk of getting infected by certain viruses because their immune system is suppressed. Cytomegalovirus (CMV) is a common virus that can cause problems after transplant and often involves the GI tract. Patients with CMV in their GI tract can develop ulcers in the lining of their intestine. Epstein Barr Virus (EBV) can present with GI complications and ulcers. EBV is also associated with a process called Post-Transplant Lymphoproliferative Disease (PTLD) that can lead to further complications.

- **Medications:** Prednisone is commonly used after transplant to suppress the immune system. Although it is helpful in preventing rejection, this medication has several side effects. Patients taking higher doses of prednisone, especially in conjunction with NSAIDs, are at increased risk for developing ulcers in the stomach and intestine.
- **Stress:** Clinical evidence does not show that stress causes ulcers. However, when stress is combined with other risk factors, you may be more likely to develop an ulcer. Transplant recipients commonly experience stress during the transplant process, particularly in the early post-operative period.



- Frequent burping or hiccupping
- Nausea and vomiting after meals
- A decreased appetite
- An unexpected weight loss

Sometimes the symptoms are related to the location of the pain. If you have trouble swallowing or if you have pain when you swallow, the ulcer is probably in your esophagus (esophageal ulcer). The ulcer is most likely in your stomach (gastric ulcer) if you feel worse when you eat. If you have an ulcer in your intestine (duodenal ulcer) you may feel better after eating, but have a return of the pain in about one to two hours.

In some cases ulcers may cause a more serious condition. If you develop any of the following symptoms you should call your doctor immediately and/or go to the emergency room.

- Sharp severe pain in your abdomen that does not change or go away
- Stools that are bright red or black due to bleeding in your GI tract
- Bloody vomit or vomit that looks like “coffee grounds”
- Feeling dizzy or lightheaded, particularly when moving from lying down to a standing or sitting position

These symptoms could be signs of serious problems. Bleeding occurs in the stomach or intestine if the ulcer breaks or opens a blood vessel. A more severe problem called a *perforation* occurs when the ulcer erodes through the stomach or intestine wall, making a hole (perforating) through the tissue. Surgery is required if the wall of the intestine or stomach perforates.

How do I know if I have an ulcer?

Although some people have no symptoms, most people have mild to moderate symptoms when they have an ulcer. For people who experience symptoms, the most common complaints include:

- A burning or dull pain in the middle or upper stomach between meals or at night after laying down
- Heartburn, a burning sensation in the chest that occurs after eating
- Chest pain, particularly after eating or lying down
- Feeling bloated



How does my doctor diagnose an ulcer?

Your doctor will make a diagnosis based on your physical examination, medical history, symptoms and complaints, prescribed medications, and the results of specific GI (gastrointestinal) tests as listed below. Your doctor may also refer you to a *gastroenterologist*, a doctor who specializes in the treatment of diseases of the GI tract. There are several tests that are used to diagnose ulcers. These include:

- **Blood tests:** A sample of your blood will be taken to check for *H. pylori*. This blood test detects antibodies to *H. pylori* bacteria and is used to see if you have had any exposure to the bacteria. A complete blood count (CBC) or full blood cell count (FBC) may be done to check for anemia, a low red blood cell count. Anemia can occur because the body is losing blood from an ulcer that is bleeding.
- **Fecal occult blood test (FOBT):** A small sample of your stool will be checked to see if it contains blood. This test alone does not diagnose an ulcer, but may detect if an ulcer is bleeding. Stool samples can also be tested for *H. pylori*.
- **Breath test:** This is a very effective test used to detect *H. pylori*. The patient is asked to drink a liquid that contains a special carbon atom. If *H. pylori* are present, carbon is released and carried to the lungs by the blood. The carbon is then exhaled from the lungs by the patient. This test measures the level of carbon that is exhaled.
- **Upper GI Series:** This procedure is an examination of the esophagus, stomach and duodenum through a series of X-ray pictures of the GI tract. Patients drink a chalky liquid called barium which coats the

GI tract, making these organs and any ulcers show up more clearly. The doctor will examine the X-rays to see if the barium coating on the GI tract shows any unusual findings such as an ulcer or narrowing.

- **Upper Endoscopy:** This study is performed by a gastroenterologist and takes about 30 minutes. Patients are given a medication through the vein (IV) to make them sleepy (sedation). The doctor inserts a long flexible device called an endoscope into the mouth, then passes it through the stomach and into the small intestine. There is a small camera and light on the end of the tube so the doctor can see the area and take pictures. The doctor looks for signs of irritation, swelling, bleeding, ulcers, or any unusual tissue. The tube is designed so that samples of stomach liquid can be removed and samples of the tissue (biopsies) can be taken. This is helpful in looking at infections which may cause ulcers.
- **Colonoscopy:** This test is similar to the upper endoscopy and examines the large intestine. An instrument called a colonoscope, which is similar to the upper endoscope but slightly larger, is inserted into the rectum and passed through to the colon while the patient is sedated. The doctor examines the area and takes samples of fluid and tissue for analysis.

How are ulcers treated?

Treatment of an ulcer is based on the cause, location, and severity of the ulcer. Therapy usually includes both medications and avoiding things that will irritate or worsen the ulcer, such as cigarette smoking and drinking alcohol.

Medication therapy may consist of a single agent or a combination of medications (double or triple therapy), depending on the cause of the ulcer. Some commonly prescribed medications to treat ulcers include:

- **H-2 Blockers (Histamine-2 Receptor Blockers):** These medications prevent or block the production of acid made by the stomach. They do this by blocking histamine, a substance that helps stimulate acid production. H-2 blockers include: cimetidine (Tagamet®), ranitidine (Zantac®), famotidine (Pepcid®), and nizatidine (Axid®).

- **Proton Pump Inhibitors (PPIs):** PPIs block the stomach's ability to make acid by stopping the mechanism that pumps the acid into the stomach. Omeprazole, lansoprazole, rabeprazole, esomeprazole, and pantoprazole are proton pump inhibitors.
- **Antacids:** These medications neutralize stomach acid and coat the ulcer. This action protects the tissue from additional acid damage and allows it to heal without further irritation. Bismuth subsalicylate (Pepto-Bismol®) is a commonly used antacid.
- **Antibiotics:** If the ulcer is caused by *H. pylori*, oral antibiotics will be prescribed. Currently, the most proven effective treatment is a 2-week course of triple therapy. This treatment includes two antibiotics to kill the bacteria plus either an acid suppressor (PPI or H-2 blocker) or an antacid for protection.

- **Antivirals:** If cytomegalovirus (CMV) is diagnosed through a biopsy of the ulcer or by blood work, the doctor will order IV and/or an oral medication to treat this viral infection. If the ulcer is due to Epstein Barr Virus (EBV), then a change in medication or dosing may be necessary. Treatments for these viruses vary by center and the organ transplanted.

As always, check with your transplant center before starting any new medications. It is important to check for interactions with your current medications. For example, some antacid medications should be taken at least 2 hours from cyclosporine or tacrolimus. Be sure to talk with your doctor or transplant coordinator about how to take these medications. Be aware of the side effects of your ulcer treatment medications. Some people may experience side effects from the medications used to treat ulcers. The most common complaints include itching, rash, nausea, vomiting, and/or diarrhea. Notify your physician immediately if you develop any new symptoms after starting these medications.



Can ulcers be prevented?

An H-2 blocker, a PPI, and/or an antacid are prescribed frequently for most transplant recipients at the time of transplant to protect them from getting ulcers after transplant. This prevention plan and prescribed medications vary by center. Ask your transplant team what medications you are taking to prevent ulcers and how long you should expect to take them.

No one knows exactly how the *H. pylori* infection is spread, so it is difficult to prevent. It is thought to be

passed from person to person by close contact and exposure to stomach secretions or vomit. Good hand washing is the best prevention, particularly after using the bathroom and before eating.

Other suggestions to decrease your risk of developing ulcers include:

- Avoid excessive use of over-the-counter NSAIDs.
- If you are taking medications that increase the risk of ulcers, discuss the most effective way of taking those medications with your doctor. In some cases, the amount or frequency of your dose can be decreased. Remember that you should never change a dose or stop taking any medication unless told to do so by your doctor.
- Stop drinking alcohol or reduce the amount that you drink. Those who drink alcohol are more likely to develop ulcers in the esophagus. Most transplant centers recommend that transplant recipients avoid alcohol.
- Stop smoking. Smoking causes many serious health problems. Smokers are also more likely to develop ulcers in the duodenum (small intestine) than non-smokers.
- Avoid foods that upset your stomach or cause symptoms of heartburn. Although certain foods may not increase your risk of developing an ulcer, you should avoid them if they bother you.

Esophagitis

What is esophagitis?

Esophagitis is an *inflammation* of the esophagus, the muscular tube that carries food from your mouth to your stomach. Inflammation is your body's response to something that is irritating. If inflammation occurs in any part of your GI tract, the tissue usually looks swollen and red, and is more easily injured. You can also have pain or a "burning" sensation. If the inflammation is severe, ulcers or sores can develop.

If you have esophagitis, the tissue lining your esophagus becomes swollen and red. It can be uncomfortable or painful to swallow. If esophagitis is severe, the lining of the esophagus can be worn away (eroded) and ulcers may develop.

What causes esophagitis?

Esophagitis is caused by something that irritates the soft tissue of the esophagus. The most common cause of esophagitis is **gastro-esophageal reflux disease (GERD)**. This condition occurs when the stomach contents flow back, or *reflux*, into the esophagus. The fluid is able to reflux into the esophagus because the valve between the esophagus and stomach does not close well. This acidic fluid irritates the soft tissue that lines the esophagus. The most common symptom of GERD is heartburn, an uncomfortable burning feeling behind the breastbone, which usually occurs around eating.

Infections can also cause esophagitis. Infections in the esophagus are rare in people who have a normal immune system, but more commonly occur in people with a suppressed immune response, especially transplant recipients. The most common infections that can cause esophagitis are:

- *Candidiasis*, also called thrush or a yeast infection, is an infection caused by a fungus that normally lives in the mouth. This fungus can cause an infection in people who have a suppressed immune system. Transplant recipients are at greater risk of developing candidiasis when receiving higher levels of immunosuppression to treat rejection.

This infection appears as white patchy areas on the lining of the mouth (*oral mucosa*), tongue, and throat. It can spread through the esophagus and even further into the GI tract if not treated. The tissue is usually reddened and may be sore. Thrush is treated with a medicine that can be taken as a lozenge, pill or oral rinse. Your doctor will prescribe

this medication for you to take after transplant to prevent thrush, particularly if you are on high levels of anti-rejection medications, including prednisone (*corticosteroids*).

- *Cytomegalovirus (CMV)* is a common virus belonging to the herpes family. It is rare to have complications from this virus unless you have a suppressed immune system. CMV can cause ulcers in the mouth and esophagus which makes chewing and swallowing very painful and difficult. CMV esophagitis is treated with an antiviral medication that can be given orally or intravenously (IV).
- *Herpes simplex* is a viral infection that can cause inflammation and ulcers in the esophagus. Herpes esophagitis is rare in people with a normal immune system, even if they carry this virus, but can be more severe in people who are immunosuppressed. People who have herpes esophagitis have severe pain with swallowing, just like that caused by CMV. They can also have fever, chills, and joint pain. Herpes esophagitis is treated with an antiviral medication as well as pain medication. It can usually be treated very effectively with these medications.

Additional risk factors for esophagitis include:

- Frequent vomiting: Excessive vomiting can be caused by an illness or an eating disorder such as bulimia. The acid nature of vomit irritates the esophagus and can cause inflammation and injury.
- Hiatal hernias: A hiatal hernia is when a part of the upper portion of the stomach protrudes through an opening in the diaphragm. In this case, the stomach lies above the diaphragm rather than below. A small hiatal hernia usually doesn't cause a problem, but a larger hernia can cause heartburn and GERD by allowing acid to reflux into the esophagus. People who have hiatal hernias may also have problems swallowing.
- Surgery
- Swallowing a corrosive or caustic liquid
- Chemotherapy or radiation therapy: These treatments for cancer, especially when targeted at organs of the chest and neck, can sometimes injure the lining of the esophagus.
- Medications. Some medications can irritate the esophagus, especially when they get lodged in the esophagus and stay in contact with the lining for an extended period of time. Medications that are associated with esophagitis include potassium, aspirin, NSAIDs, osteoporosis medicines such as alendronate (Fosamax®), iron supplements, and quinidine.



Are transplant recipients at risk for developing esophagitis?

As discussed above, transplant recipients have additional risks for developing esophagitis. Because transplant recipients have a weakened immune system, they are at greater risk of developing infections in the esophagus. Candidiasis, CMV esophagitis, and herpes esophagitis can occur in transplant recipients. Although treatable, these infections can cause irritation, ulcers, and pain in the esophagus.

What are the symptoms of esophagitis?

The most common symptoms of esophagitis include:

- Difficulty swallowing or feeling like something is stuck in your throat
- Pain when swallowing
- Burning sensation in the esophagus
- Heartburn
- Sores in the mouth
- Nausea and vomiting

How is esophagitis diagnosed?

Esophagitis is most commonly diagnosed through an upper endoscopy. This procedure is usually done by a gastroenterologist (GI doctor). After the patient is lightly sedated, the doctor uses a flexible lighted tube called an endoscope to examine the inside walls of the esophagus. The doctor carefully examines the lining of the esophagus for inflammation, ulcers, or bleeding. Samples (biopsies) of tissue are taken for further testing. It is important to examine the biopsy tissue to accurately diagnose the cause and severity of inflammation.

How is esophagitis treated?

It is important to find the cause of esophagitis so that it can be treated correctly. If reflux or GERD is the cause of esophagitis, medications to decrease stomach acid are prescribed. Patients are also advised about making lifestyle changes including:

- Eat smaller, more frequent meals.
- Avoid eating for at least 2 hours before going to bed.
- Maintain a healthy weight.
- Eliminate or reduce your intake of fatty foods, alcohol, coffee, chocolate, peppermint, and nicotine.
- Raise the head of the bed eight to ten inches (20-25 cm) so that gravity will help keep stomach acids from refluxing into the esophagus while sleeping.
- Avoid excessive bending, lifting or abdominal exercises which could increase the pressure in your abdomen and cause reflux.

If esophagitis is caused by an infection, the source of that infection must be identified so that the appropriate medication can be used. An antifungal medication will be used to treat candidiasis or thrush. Antiviral medications will be used to treat CMV or herpes esophagitis. If your transplanted organ is healthy, sometimes a change may be made in your immunosuppression medications to help your immune system fight the infection as well.

If esophagitis is not treated, it can lead to more serious complications. Swallowing can become more difficult and more painful. Weight loss can occur because of the inability or refusal to swallow and eat. As the esophagus continues to be damaged by acid reflux, scars or strictures may develop. The scar tissue can block the esophagus, increasing the difficulty in eating and swallowing.

Gastritis

What is gastritis?

Gastritis is an inflammation and irritation of the lining of the stomach. When gastritis occurs suddenly, it is called acute gastritis. When it develops slowly and lasts for a long time, it is called chronic gastritis.

What causes gastritis?

Infection is the most common cause of gastritis. *Helicobacter pylori* (*H. pylori*) is the most common bacteria that cause gastritis. This is the same bacteria that cause stomach (peptic) ulcers as discussed previously. This infection weakens the protective mucous coating of the stomach, eventually irritating the lining of the stomach. Developing gastritis from *H. pylori* can happen in transplant patients just as it does in the general population. Bacterial infections with *Salmonella* or *E. coli* (*Escherichia coli*) have been associated with developing gastritis.

Other causes of gastritis include:

- Viral infections
- Medications: Long term use of NSAIDs and aspirin can irritate the lining of the stomach. Steroid use has been linked to gastritis, especially when taken with NSAIDs.
- Back-flow of bile into the stomach from the duodenum (called bile reflux)
- Radiation and chemotherapy
- Autoimmune disorders: These conditions occur when the body's tissues are attacked by its own immune system. Rheumatoid arthritis and lupus are examples of autoimmune disorders.
- Stress: Stress gastritis, caused by excessive stomach acid secretion, is most commonly seen in patients who are in intensive care units, have had major surgery, or have been severely injured by burns.

Additional risk factors include:

- Excessive alcohol intake
- Smoking (nicotine)
- Spicy foods
- Older age

Are transplant recipients at risk for gastritis?

Transplant recipients have some additional risks for getting gastritis.

- Infection: Transplant recipients have a greater risk of developing infection because their immune system is suppressed. Some infections can cause inflammation of the stomach lining.
- Medications: Prednisone is often used after transplant to suppress the immune system. Although it is helpful in preventing rejection, this medication can cause stomach irritation.
- Irritation: Transplant recipients commonly have tubes placed in the GI tract for drainage or feeding following transplant surgery. These tubes, such as a nasogastric (NG) or a orogastric (OG) tube, may be in place for several days to weeks and can cause stomach irritation in some patients.

What are the symptoms of gastritis?

Although gastritis can be present without any symptoms, most cases have symptoms similar to those seen with ulcers. The most common, but not specific, symptoms of gastritis are:

- A gnawing or burning ache or pain (indigestion) in your upper abdomen that may become either worse or better when you eat
- Nausea
- Vomiting
- Loss of appetite
- Belching or bloating
- A bad taste in the mouth
- Indigestion
- Loose stools or diarrhea
- Hiccups
- A feeling of fullness in the upper abdomen after eating
- Weight loss
- Vomiting blood or material that looks like coffee grounds
- Black, tarry stools

How is gastritis diagnosed?

Contact your doctor if you have any symptoms of gastritis. After talking to you about your symptoms and performing an examination, your doctor will order tests to confirm this diagnosis. These tests may include:

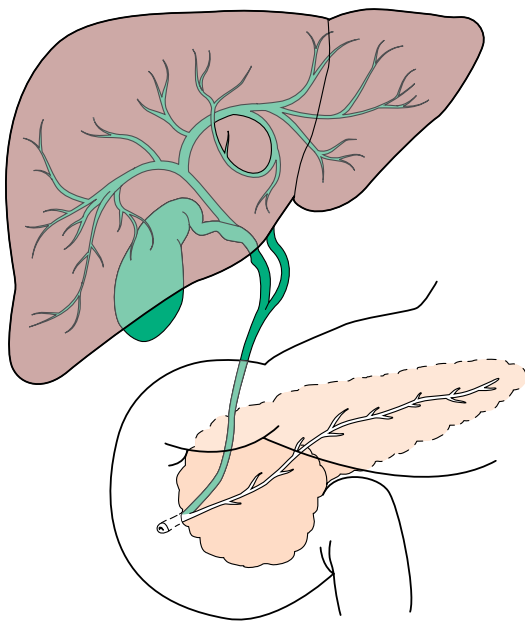
- **Blood tests:** A complete or full blood count (CBC/FBC) will be obtained to check for anemia, a low blood count. This could be a sign of bleeding or lead to another diagnosis. Exposure to *H. pylori* can also be assessed through a blood test.
- **Stool tests:** Stool tests will be completed to check for blood in the stool, a sign of bleeding in the stomach or other parts of the GI tract. The stool can also be checked for the presence of any abnormal bacteria that could be irritating the GI tract.
- **Endoscopy or gastroscopy:** During this procedure, the doctor inserts an endoscope or gastroscope, a thin flexible tube with a camera, through the mouth and into the stomach. The lining of the stomach is examined for inflammation, ulcers or breaks in the tissue, and bleeding. Samples of the lining (biopsies) are taken for further testing. Depending upon the symptoms and severity, the doctor may perform this test right away. For other patients, medications may be used for seven to ten days. If symptoms do not resolve within that time, an endoscopy is performed.

How is gastritis treated?

Treatment of gastritis usually includes a combination of medication and lifestyle changes.

- **Medications:** Antacids and acid-blocking medications are prescribed to reduce stomach acid. Decreasing the acidity of the stomach will decrease further irritation of the lining of the stomach. Reducing the acid in the stomach gives your stomach tissue time to heal. Antibiotics are prescribed for gastritis caused by *H. pylori* or other types of bacteria.
- **Lifestyle changes:** Patients who smoke should stop smoking. Alcohol use should be avoided or limited. Nutritional changes, such as eating a diet that is rich in fiber, can be helpful. Avoiding certain foods while the stomach is healing can decrease the risk of getting gastritis again. Foods that should be avoided or limited include:
 - foods high in acid such as citrus fruits and juices
 - foods that make your stomach produce more acid such as chocolate, coffee, and other caffeine containing products
 - spicy foods
 - foods high in fat
 - carbonated beverages

Gastritis usually resolves when treated effectively. However, if left untreated, severe blood loss can occur and sometimes surgery is necessary. In rare cases, gastritis can increase the risk of developing stomach cancer.



Pancreatitis

What is pancreatitis?

Pancreatitis is an inflammation of the pancreas. The pancreas is an organ located behind the stomach, close to the upper part of the small intestine (duodenum). It secretes substances called *enzymes* that travel through the pancreatic duct into the small intestine. Insulin is one of the hormones secreted by the pancreas into the blood stream. Insulin is involved in controlling blood sugar levels. The pancreas also secretes enzymes which are involved in the digestion of food. These digestive enzymes are amylase, lipase, and trypsin.

What causes pancreatitis?

The digestive enzymes that are secreted by the pancreas become active when they reach the small intestine and begin digesting food. In pancreatitis, these enzymes become active while still in the pancreas and actually “digest” the pancreas itself, causing it to become inflamed. In severe cases, this inflammation causes the tissue in parts of the pancreas to die, a process called necrosis.

Pancreatitis can occur suddenly and last a few days (acute) or it can continue for an extended amount of time (chronic). In acute pancreatitis, the pancreas becomes swollen and inflamed. It is usually caused by gallstones or drinking an excessive amount of alcohol. Acute pancreatitis can also be caused by medications, trauma or surgery to the abdomen, abnormalities of the pancreas or intestine, and infections. Acute pancreatitis is a mild disease in most people and resolves within a few days with treatment. Severe acute pancreatitis, which occurs in about 20% of cases, can have serious complications and can be life-threatening.

Chronic pancreatitis causes chronic inflammation of the pancreas which scars the pancreas tissue. This scarring can affect how food is digested and can cause diabetes and malabsorption of food. The most common cause of chronic pancreatitis in adults is long term alcohol abuse. The most common cause in children is cystic fibrosis. Sometimes a specific cause is not identified. When a cause can not be determined, it is called *idiopathic* pancreatitis.

What are the symptoms of acute pancreatitis?

The most common symptoms of acute pancreatitis are:

- mild to severe pain in the upper abdomen that can spread to the back and continues for several days
- nausea
- vomiting
- fever
- increased heart rate

As acute pancreatitis progresses, the symptoms can become more serious. These symptoms include: dehydration, kidney failure, respiratory symptoms, shock, internal bleeding, low blood calcium, and low blood glucose.

What are the symptoms of chronic pancreatitis?

In chronic pancreatitis, the pancreas does not secrete enough enzymes to help digest food. The symptoms of chronic pancreatitis are related to poor digestion and absorption of nutrients.

The most common symptoms include:

- Abdominal pain that is constant or intermittent
- Greasy or oily stools
- Weight loss
- Diabetes

What are the risks for developing pancreatitis?

Risk factors for developing pancreatitis include:

- Excessive, long term alcohol abuse
- Gallstones
- Certain genetic (inherited) diseases such as cystic fibrosis
- Increased blood levels of fats (triglycerides)
- Increased blood levels of calcium (hypercalcemia)
- Certain medications:
 - corticosteroids (prednisone)
 - NSAIDs (ibuprofen)
 - some blood pressure medications (thiazides)
 - some antibiotics (tetracycline and sulfonamides)
- Surgery of the abdomen
- Abnormalities in the structure of the pancreas or the common bile duct of the liver
- Trauma to the abdomen that pushes the pancreas against the spine
- Some viral infections: mumps, hepatitis and Epstein-Barr virus
- Bacterial infections



Are transplant recipients at risk for pancreatitis?

Transplant recipients carry the same risks for pancreatitis as the general population, but there are some additional concerns.

- **Infection:** Transplant recipients have a greater risk of developing infection because their immune system is suppressed. Some infections can cause pancreatitis.
- **Medications:** Prednisone and cyclosporine are commonly used after transplant to suppress the immune system. These medications have been associated with pancreatitis.
- **Abdominal surgery:** Having surgery to transplant an abdominal organ can increase the risk of developing pancreatitis because the pancreas may be irritated during the surgery from pressure or movement.
- **Specific risks:** Some risks are related to the organ that is transplanted. Liver transplant recipients may be at risk because of bile duct problems. Patients who receive liver transplants for alcoholic cirrhosis may have a history of pancreatitis. Pancreatitis is a complication of pancreas transplant.

How is pancreatitis diagnosed?

If you have severe abdominal pain, call your doctor or go to the nearest emergency room. Your doctor will examine you and ask you questions about your pain and current health. Abdominal pain can be a symptom of many medical conditions, but if your history and risk factors make your doctor think you have pancreatitis, certain tests will be done.

- **Blood tests:** Your pancreatic enzyme levels (amylase and lipase) will be checked through blood tests. These enzymes will be high if the pancreas is inflamed. Since these enzymes can also be elevated in other conditions, additional testing is needed to confirm the diagnosis of pancreatitis. Because fluid balance and absorption are affected, there may also be changes in the blood levels of calcium, magnesium, sodium, potassium, and bicarbonate. Blood sugar levels and lipids (fats) may also be high.
- **Imaging tests:** If the pancreatic enzymes are high, your doctor may request an ultrasound, a computerized tomography (CT) scan, or a magnetic resonance imaging (MRI) of your abdomen to further examine your pancreas and confirm the diagnosis. Another test that may be performed is called an Endoscopic Retrograde Cholangiopancreatography or ERCP. A thin, flexible

lighted tube (endoscope) is passed through the mouth and esophagus into the duodenum, the upper part of the small intestine after the patient is sedated. Then a smaller tube is placed through the endoscope and threaded into the bile duct and pancreatic duct. A dye is injected through the tube into the ducts and X-rays are taken to examine the pancreas. Imaging tests check for the presence of gallstones, problems in the pancreatic duct, or damage to the pancreas. In some cases, a small tube (stent) is placed in the duct to help drain the fluid and enzymes that build up as a result of the inflammation.

What is the treatment for pancreatitis?

The treatment for pancreatitis depends on whether it is acute or chronic, the reason for developing pancreatitis, and complications of the disease. Patients who have severe acute pancreatitis are usually hospitalized and require intensive care. Most treatments of pancreatitis focus on resting the pancreas, giving intravenous (IV) fluids and nutrition, managing pain, and providing supportive treatment for complications.

- **Food restrictions:** Since the pancreas begins working when you eat, patients are restricted in what they are allowed to eat by mouth so that the pancreas can “rest.” If the patient is not allowed to eat for several days, nutrition will be given intravenously.
- **IV fluids:** IV fluids are given to maintain a balance of fluids in the body.
- **Pain:** Medications are given to provide comfort from pain caused by the inflamed pancreas. Pain is particularly difficult to control in patients with chronic pancreatitis. The pain care team or pain specialists in the hospital may be consulted to help.
- **Medications:** Sometimes patients need enzyme supplements to help digest their food when the pancreas is not working well. These medications (Pancrease®, Viokase®) can help improve absorption of nutrients in the small intestine. Insulin may be needed in patients who have high blood sugar levels that are not controlled by diet or oral medications. Antibiotics are needed if there is an infection in the pancreas.
- **Surgery:** If pancreatitis is caused by gallstones, surgery may be needed to unblock the bile duct or to remove the gall bladder. If there is severe injury to the pancreas causing tissue death (necrosis), surgery may be done to remove the dead tissue.

What can I do to minimize GI side effects?

GI complications commonly occur following organ transplantation. There are additional concerns for transplant recipients because of the side effects of some anti-rejection medications, having an immune system that is suppressed, and the stress and trauma associated with transplant surgery. To minimize and control GI side effects, transplant recipients are advised to:

- Contact your doctor or transplant team if you develop abdominal pain, diarrhea, or fever. Know your center's guidelines for reporting symptoms.
- Discuss side effects of your medications with your doctor or transplant coordinator. Be aware of any medications that are associated with GI side effects.
- Follow your center's guidelines for taking your medications.
- Do not change or adjust any medications unless told to do so by your doctor.
- Maintain a healthy weight.
- Eat a well-balanced diet.
- Exercise regularly.
- Learn how to manage the stress in your daily life.

For most transplant recipients, GI complications, although common, will resolve or can be controlled with medical treatment, life style changes, and preventative care.



Related Links For More Information

ITNS is not responsible or liable for any information received from these websites. These sites are provided as a network resource. Information from the Internet in regard to your transplant should always be discussed with your transplant team. Additional information on GI side effects and complications can be found on these websites:

<http://www.acg.gi.org> **American College of Gastroenterology.** Provides patient education on many GI diseases and procedures.

<http://www.cdc.gov> **Department of Health and Human Services, Centers for Disease Control and Prevention.** Contains information about health conditions and services.

<http://www.digestive.niddk.nih.gov> **National Digestive Disease Information Clearinghouse (NDDIC).** A service of the National Institutes of Diabetes and Digestive and Kidney Diseases. Contains information about digestive diseases.

<http://www.mayoclinic.com> **Mayo Clinic website.** Provides education for patients on a variety of medical conditions.

<http://www.nlm.nih.gov/medlineplus> A service of the **US National Library of Medicine and the National Institutes of Health.** This site contains extensive information about medications, an illustrated medical encyclopedia, interactive patient tutorials, and health news.

<http://www.pancreatitis.org.uk> **The Pancreatitis Supporters' Network.** Provides medical information and support for people who have pancreatitis.

<http://www.transweb.org> **Transweb.** A website about transplantation and donation. Contains links to other transplant websites.



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The International Transplant Nurses Society was founded in 1992 as the first professional nursing organization to focus on the professional growth and development of the transplant clinician. ITNS is committed to the promotion of excellence in transplant clinical nursing through the provision of educational and professional growth opportunities, interdisciplinary networking and collaborative activities, and transplant nursing research. This educational brochure is designed to enhance patient education as provided by individual transplant centers. Patients should always follow their transplant team's specific guidelines for controlling gastrointestinal (GI) side effects.

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