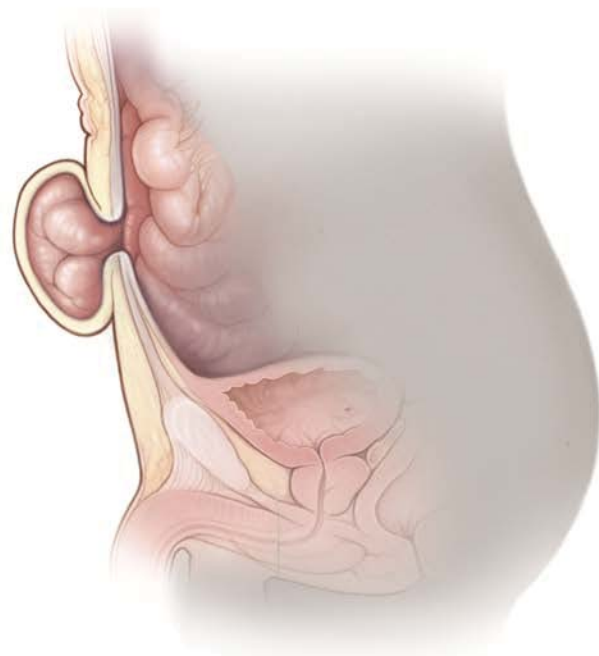
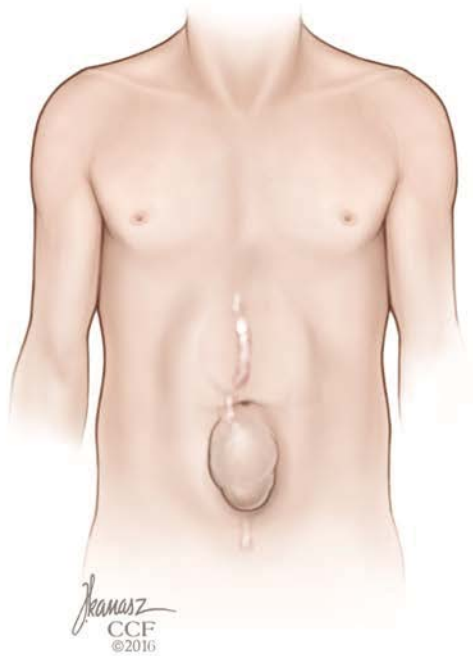


# Open Ventral Hernia Repair



# Table of Contents

|   |    |
|---|----|
| What is a Hernia?   | 1  |
| What is a Ventral Hernia?   | 1  |
| What are the Causes and Risk Factors for Developing a Ventral Hernia? | 2  |
| What are the Signs and Symptoms of a Ventral Hernia?                  | 2  |
| How is a Ventral Hernia Diagnosed?                                    | 3  |
| How is a Ventral Hernia Repaired?                                     | 3  |
| How Does the Surgeon Determine the Surgical Method for Me?            | 4  |
| <br>  |    |
| Open Ventral Hernia Repair  | 5  |
| Anatomy of the Abdominal Wall   | 5  |
| Mesh Choices  | 7  |
| Mesh Location   | 8  |
| Sublay Mesh Placement   | 9  |
| Component Separation  | 10 |
| Open Component Repair   | 10 |
| Complications of Open Ventral Hernia Repair                           | 12 |
| <br>  |    |
| Preparing for Your Surgery  | 13 |
| The Week Before Surgery   | 13 |
| The Day Before Surgery  | 13 |
| Day of Surgery  | 14 |
| Length of Surgery   | 14 |
| <br>  |    |
| Hospital Stay and Postoperative Care                                  | 14 |
| Postoperative Instructions  | 15 |
| When to Call the Doctor   | 17 |
| How to Care for Your Jackson Pratt Drain                              | 18 |
| Jackson Pratt Fluid Collection Record Sheet                           | 19 |
| <br>  |    |
| Glossary of Terms   | 20 |

# Open Ventral Hernia Repair

## What is a hernia?

A hernia occurs when there is a hole in the muscles of the abdominal wall, allowing a loop of intestine or abdominal tissue to push through the muscle layer.

Hernias can also occur outside the abdominal cavity and are named based on the location in which they occur. For example, an inguinal hernia occurs in the groin area.

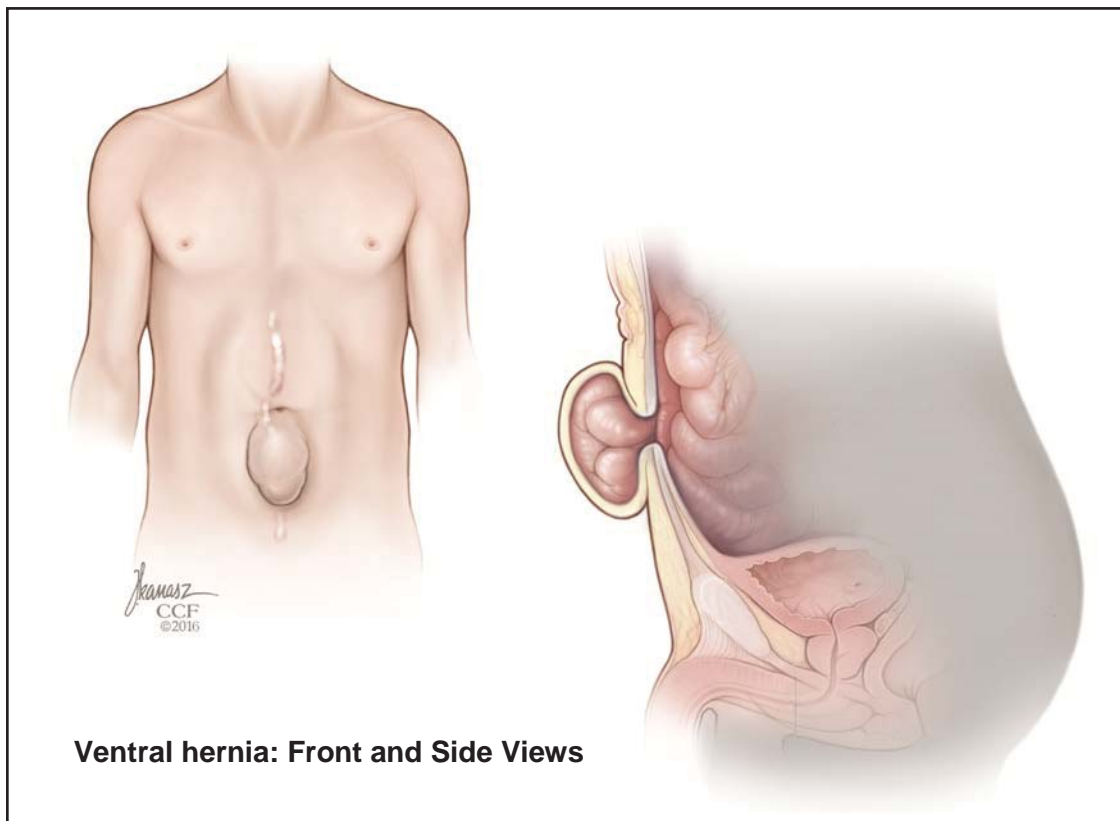
## What is a ventral hernia?

A ventral hernia is a hernia that occurs at any location along the midline (vertical center) of the abdomen wall. There are three types of ventral hernia:

**Epigastric (stomach area) hernia.** This hernia occurs anywhere from just below the breastbone to the navel (belly button). This type of hernia is seen in both men and women.

**Umbilical (belly button) hernia.** This hernia occurs in the area of the belly button.

**Incisional hernia.** This hernia develops at the site of a previous surgery. Up to one-third of patients who have had an abdominal surgery will develop an incisional hernia at the site of their scar. This type of hernia can occur anytime from months to years after an abdominal surgery.



## **What are the causes and risk factors for developing a ventral hernia?**

There are many causes including:

- Weakness at the incision site of a previous abdominal surgery (which could result from an infection at the surgery site or failed surgical repair/mesh placement).
- Weakness in an area of the abdominal wall that was present at birth.
- Weakness in the abdominal wall caused by conditions that put strain on the wall. These include:
  - Being overweight
  - Frequent coughing episodes
  - Severe vomiting
  - Pregnancy
  - History of lifting or pushing heavy objects
  - Straining while having a bowel movement/urinating
  - Injuries to the bowel area
  - Lung diseases (chronic obstructive pulmonary disease and emphysema; struggling to breathe puts strain on the abdominal wall)
  - Prostatism (enlargement of the prostate gland, which causes straining while urinating in older men)
  - Older age (general loss of elasticity to abdominal wall)

## **What are the signs and symptoms of a ventral hernia?**

Some patients don't feel any discomfort in the early stages of ventral hernia formation. Often, the first sign is a visible bulge under the skin in the abdomen or an area that is tender to the touch. The bulge may flatten when lying down or pushing against it.

A ventral hernia causes an increasing level of pain when a person:

- Lifts heavy objects
- Strains to have a bowel movement/urinate
- Sits or stands for long periods of time

Severe abdominal pain can occur if part of the intestine bulges through the abdominal wall and becomes trapped in the opening. If this happens, the trapped portion of the intestine becomes strangled, loses its blood supply, and starts to die. This is a medical emergency that requires immediate care.

## How is a ventral hernia diagnosed?

First, your doctor will review your medical and surgical history. He or she will also perform a physical exam of the abdominal area where a ventral hernia may have occurred. Your doctor may then order imaging tests of the abdomen to look for signs of a ventral hernia. These tests may include an ultrasound, computed tomography (CT) scan, or a magnetic resonance imaging (MRI) study.

## How is a ventral hernia repaired?

Ventral hernias require surgery to repair. Unfortunately, ventral hernias do not go away or get better on their own. In fact, without treatment, ventral hernias can get larger and worsen with time. Untreated hernias can become difficult to repair and can lead to serious complications, such as strangulation of a portion of the intestine.

The goal of ventral hernia surgery is to repair the hole/defect in the abdominal wall so that the intestine and other abdominal tissue cannot bulge through the wall again. The surgery often restores the tone and shape of the abdominal wall by repairing the hole and bringing the muscles back to their normal position.

There are two main types of surgical approaches, laparoscopic hernia repair and open hernia repair.

**Laparoscopic surgery.** With this approach, several small incisions are made away from where the hernia has occurred. A laparoscope (a thin lighted tube with a camera on the tip) is inserted through one of the openings to help guide the surgery. A surgical mesh material may be inserted to strengthen the weakened area in the abdominal wall.

Advantages of this approach, compared with open hernia repair, include a lower risk of infection (smaller-sized incisions are used).

**Open hernia repair.** With this approach, an open incision is made in the abdomen where the hernia has occurred and the intestine or abdominal tissue is pushed back in place. Depending on the size of your hernia, your surgeon might need to perform a component separation procedure. This typically involves cutting through some of your abdominal wall muscles along the side of your body. A mesh material is placed to reinforce this repair and reduce hernia recurrences. The skin is typically closed with dissolvable stitches and glue.

## **How does the surgeon determine what surgical method is the best for me?**

Your surgeon will consider several factors to help determine the best surgical hernia repair method for you. Such factors include your age, existing health problems and medical history, size of the hernia, size and contour of the abdominal wall, amount of skin that can be used for the repair, and presence of infection. Importantly, your hernia repair is tailored to your specific situation based on the goals of the procedure and expected outcomes.

**Within each surgical repair option -- laparoscopic surgery and open surgery -- several different techniques can be used. The remainder of this article will focus on open ventral hernia repair.**

# Open ventral hernia repair

## Anatomy of the abdominal wall

It is important to know some basic anatomy of the abdominal wall before describing the techniques used in open ventral hernia repair (see figure 1).

The abdominal wall is made up of two vertical muscles that run the length of the abdominal wall. These muscles are called the **rectus abdominis**. The three upper segments of this muscle are commonly known as your “six pack.”

On each side of the rectus abdominis lie three flat muscles that are layered on one other. The **external oblique** is the outermost muscle layer (the layer closest to the skin). The **internal oblique** is the middle muscle layer. The **transversus abdominis** is the innermost muscle layer. The muscle fibers of these three muscle layers run in different directions (see figure 2), which creates a strong abdominal wall to protect the internal organs.

Another key tissue involved in ventral hernia repair is called the **anterior rectus sheath**. This strong tissue lies on top of the rectus abdominis muscles. The strong tissue lying beneath the rectus abdominis is called the **posterior rectus sheath** (see figure 3).

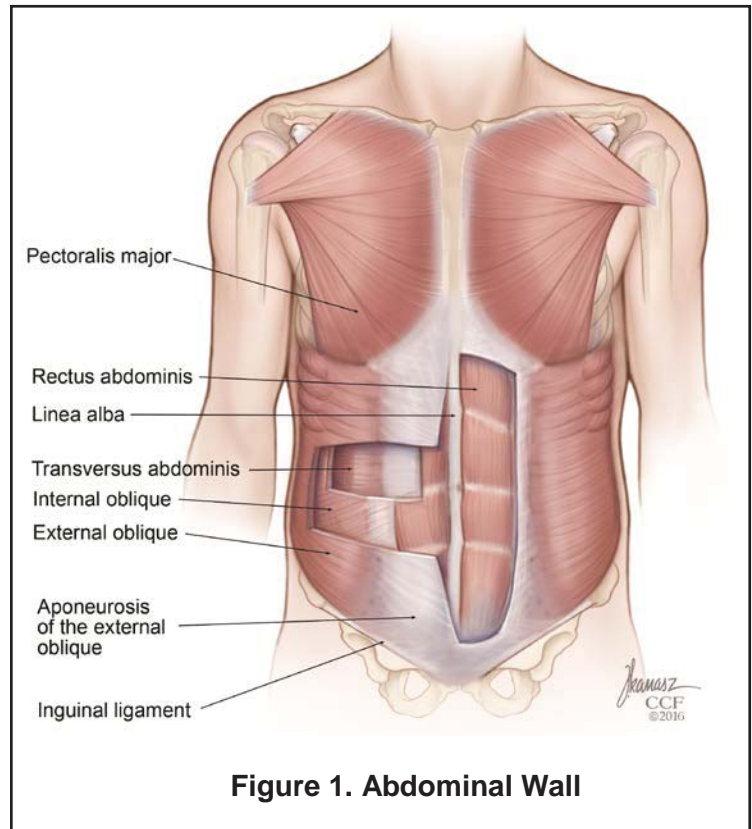


Figure 1. Abdominal Wall

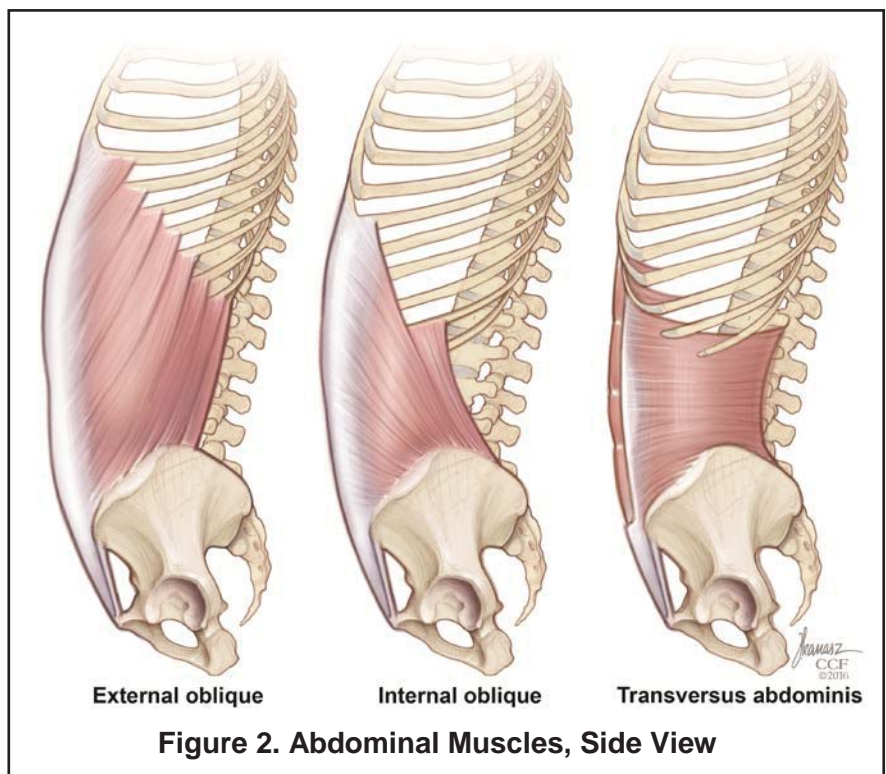
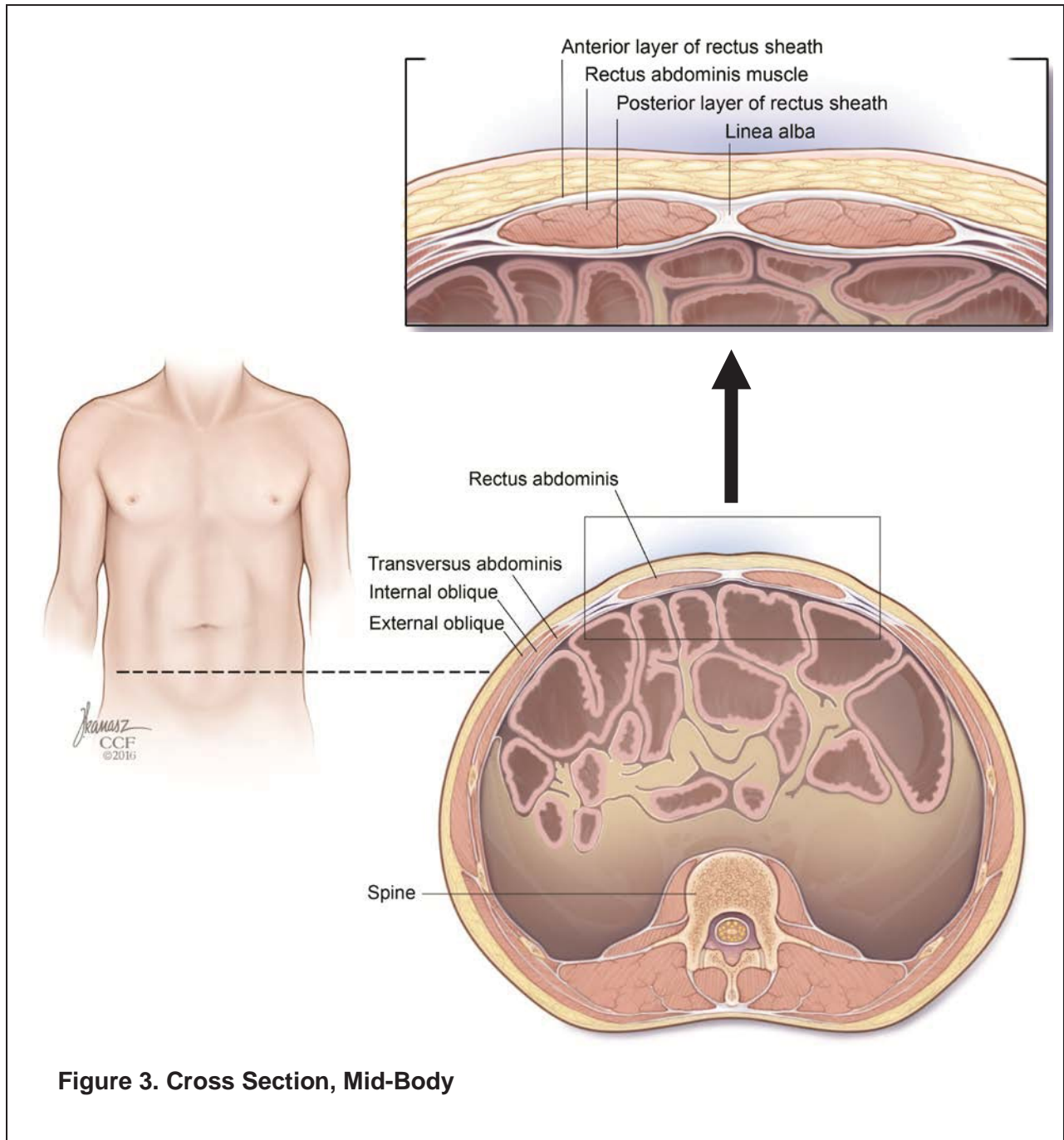


Figure 2. Abdominal Muscles, Side View



The **linea alba** is another structure that plays an important role in open ventral hernia repair. The linea alba is the white tendon-like tissue that runs down the center of abdominal wall between the rectus abdominis muscles (see figures 1 and 3). Each posterior rectus sheath combines with the anterior sheath to form the linea alba at the midline of the abdomen. During hernia repair, this structure is incised (cut through) so that a large piece of mesh can be placed across the center vertical rows of rectus abdominis muscles. With the linea alba now “released,” the overlying rectus abdominis muscle can slide to the midline to help close the hole.



**Figure 3. Cross Section, Mid-Body**



## Mesh choices

For small umbilical and epigastric hernias, mesh might not always be necessary. However, mesh is needed to repair most incisional hernias. The mesh reinforces the abdominal wall and reduces the chance of developing another hernia at or near that location.

One of the potential benefits of using mesh is that it reduces the risk of the hernia recurring by providing a “tension-free” repair. When only stitches are used to sew the muscle edges back together, the muscle layer at the site of the defect no longer lays flat. Stitching alone creates an area of tension and becomes a location where a hernia could recur. With “tension-free” mesh repair, the mesh acts as a reinforcement that supports the repair and the area surrounding the defect. New tissue grows into the mesh, reinforcing the abdominal wall. Over time, the mesh becomes embedded in the muscle layer, creating a strong permanent repair.

There are three types of surgical meshes: synthetic mesh, biologic mesh, and bio-absorbable synthetic mesh. Each has advantages and disadvantages.

**Synthetic mesh:** These meshes are made of different man-made materials and combinations of materials. This type of mesh is used most often when no infection is present in the abdominal area before beginning surgery. In certain circumstances, your surgeon might use a synthetic mesh if there is some infection present during your procedure as well. This type of mesh is made of permanent material and results in the most durable repair.

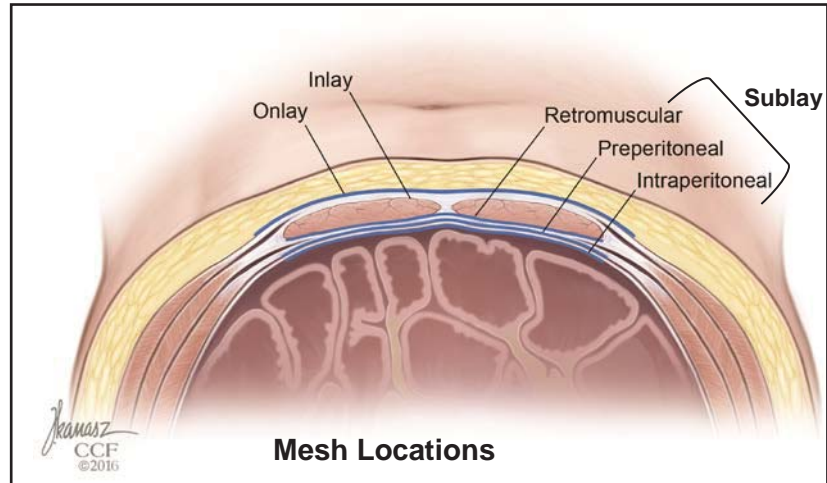
**Biological mesh:** These meshes are categorized mainly by source of material (human, pig, or cow), how the material is processed, and how it is sterilized. Biological mesh is usually used in patients at a higher risk of a surgical site infection. These patients include those who already have an infection present in the area needing repair, have other existing health issues (including diabetes, obesity, steroid use, immune problems, or history of methylene-resistant *Staphylococcus aureus* [MRSA] infection), or other risk factors for infection. This mesh type is the most expensive and is less durable than synthetic mesh.

**Bioabsorbable synthetic mesh:** This mesh type is often used when an infection is already present in the area needing repair. This mesh is less expensive than biologic mesh and is designed to provide short-term support and eventually be replaced with scar tissue.

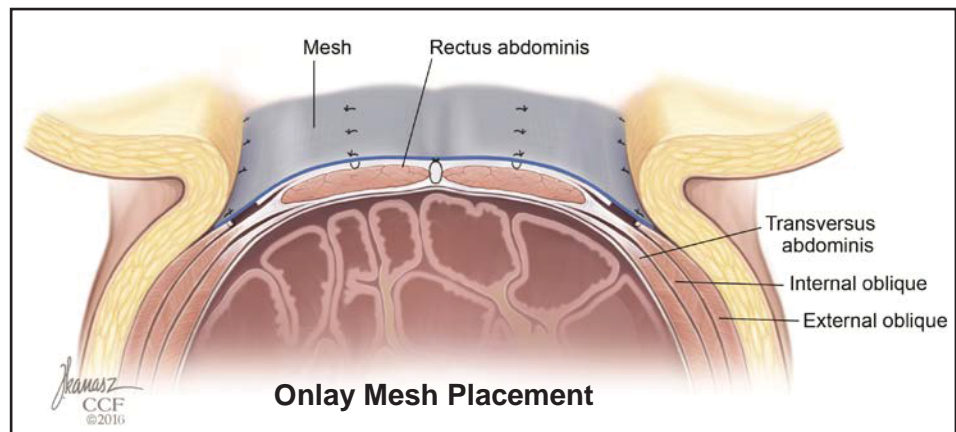
The risks of using mesh in abdominal hernia repair include risk of infection and development of bowel adhesions, bowel obstruction, fistulas, and seromas. See glossary at end of booklet for definitions of these terms. Your surgeon will talk with you about the most appropriate mesh to use for your hernia repair.

## Mesh location

Mesh materials can be placed in several locations under the skin. They can be positioned on top of the abdominal muscles (onlay), sewn directly to the edges of the hernia defect (inlay), or underneath the layers of abdominal muscles (sublay). The location of the mesh plays a critical role in the success of the hernia repair. There are certain advantages to placing the mesh in the different locations.



The advantage of onlay repairs is that this position may reduce the complications seen with sublay mesh positioning, such as adhesive bowel obstruction or fistula formation. Disadvantages of onlay mesh placement include poor healing of the overlying tissue, wound problems such as the development of a fluid collection (seroma) or wound infection, and high hernia recurrence rate compared with other types of repairs.



The inlay repair is usually a temporary repair only used for emergency situations, such as for patients who are too ill to undergo more involved abdominal wall repair. The advantage of this operation is the ability to quickly close the abdomen. However, the disadvantage is that this approach has a very high hernia recurrence rate.

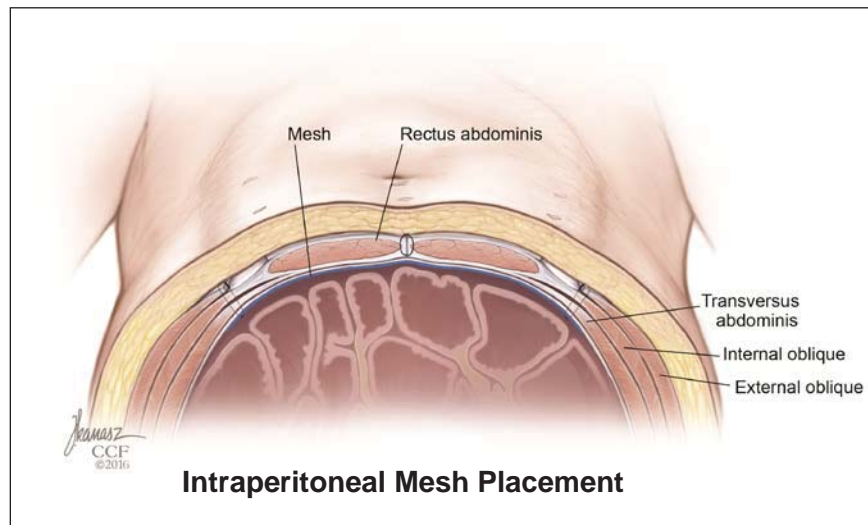
Most surgeons who perform hernia repair favor sublay mesh placement. Using this method, the mesh is protected in between layers of muscle and tissue. Another advantage of this placement is that the pressure exerted against the abdominal wall following the repair is spread across the mesh under layers of muscles and tissue. Mesh can be positioned in one of three sublay tissue planes — intraperitoneal, retrorectus, and preperitoneal. To read more details about these three mesh placements, read the sidebar, “Sublay Mesh Placement.”

## Sublay Mesh Placement

### **Intraperitoneal mesh**

**placement:** In this location, mesh is positioned against the peritoneum and faces the viscera (the abdominal organs; also known as your “gut”). The peritoneum is the membrane that lines the abdominal cavity. The advantage of intraperitoneal mesh placement is that it avoids injury to the rectus sheath as well as injury to the rectus muscle itself. Another

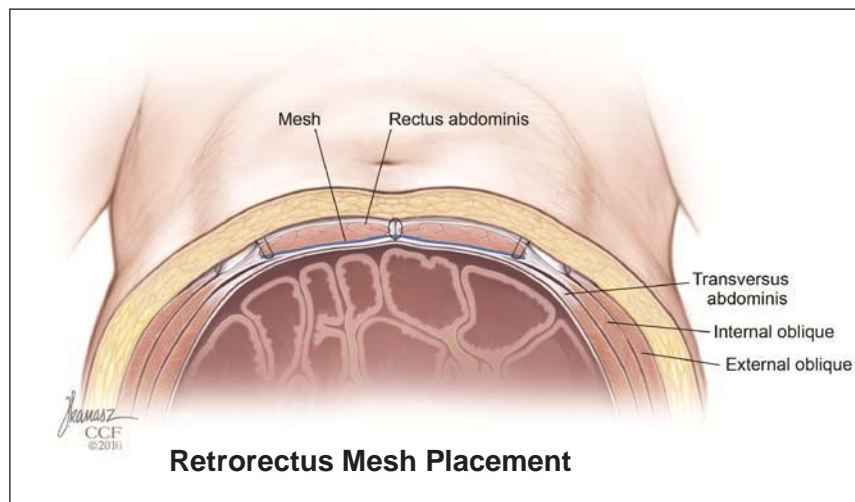
advantage of this mesh placement location is that it allows other procedures to be performed at the same time as the hernia repair. The disadvantage of this technique is that adhesions and fistulas may form. This is the location that mesh is placed for all laparoscopic hernia repairs.



### **Retrorectus mesh**

**placement:** In this location, mesh is positioned between the rectus abdominis muscles and the posterior rectus sheath. The advantage of retrorectus mesh placement is that it is relatively easy to perform and insulates the mesh from the gut, where adhesions may form. Another possible advantage of this mesh position directly against

rectus muscle is that the muscle tissue can grow into the mesh more quickly due to the good blood supply to the muscle.



**Preperitoneal mesh placement:** In this location, mesh is positioned between the posterior rectus sheath and the preperitoneal fat layer underneath. This location puts the mesh in direct contact with the underside of the rectus muscle sheath. This location is a good option for patients who have a thick fat pad.

## Component separation

Component separation is a surgical hernia repair technique in which the abdominal muscles are “released” (cut free) from their attachment site at the sides of the abdomen. The muscle and fascia layers can then be moved to cover hernias that occur along the body’s midline (ventral hernias). Component separation can be used in certain cases for patients who have large and complex abdominal wall defects. Such defects may result from:

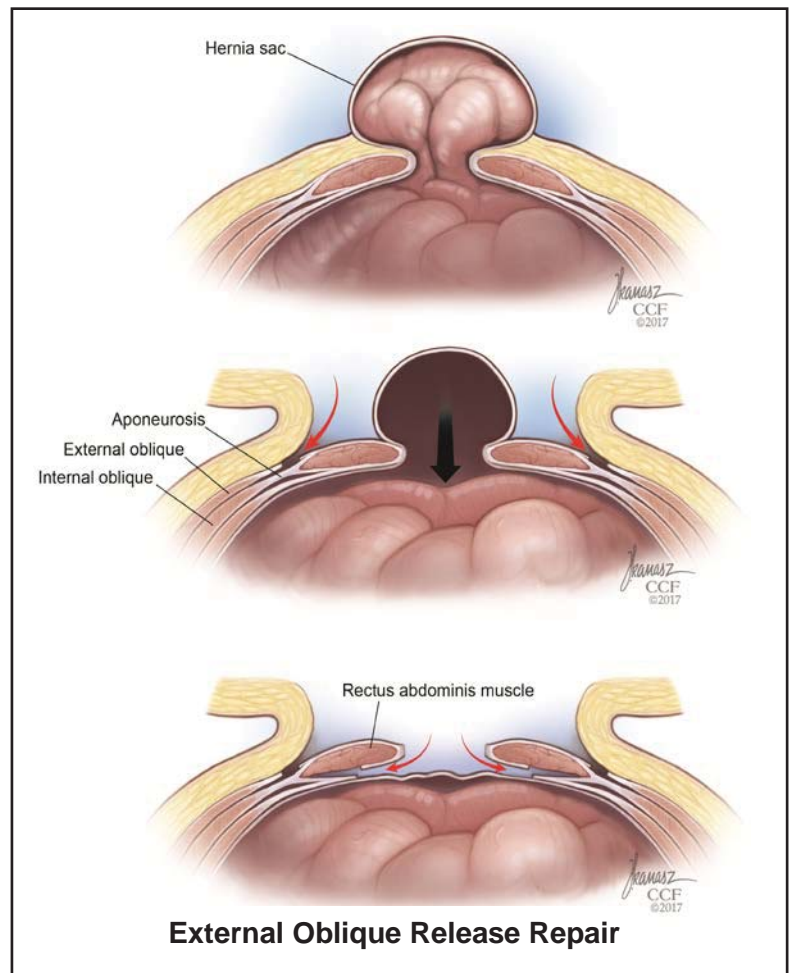
- An incisional hernia that developed as a result of multiple abdominal operations. (This is the most common cause of abdominal wall defects.)
- Surgical removal of part of the abdominal wall due to infection, cancer, or trauma (sudden, severe injury; for example, from a car accident).
- Severe infections -- such as gangrene -- that involve and destroy abdominal wall muscle, skin, and the tissues below the skin.
- Purposely leaving an abdominal incision open at the completion of intra-abdominal surgery because of the need to repeat or re-explore the repair of a severe, life-threatening abdominal injury.

## Open component repair

There are several types of open component repair techniques. This article will focus on two approaches – an anterior repair called an **external oblique release** and a posterior repair called a **transversus abdominis release**.

### External oblique release repair:

To perform this type of abdominal wall repair, an incision is made through the skin and underlying layer of fat tissue. This incision creates a large skin flap. The flaps are raised off the anterior rectus sheath, exposing the aponeurosis of the external oblique muscle. Next, an incision is made in the





aponeurosis of the external oblique muscle, which exposes the internal oblique muscle. (See glossary of terms to learn more about the aponeurosis of the external oblique, internal oblique, and transversus abdominis muscle groups.)

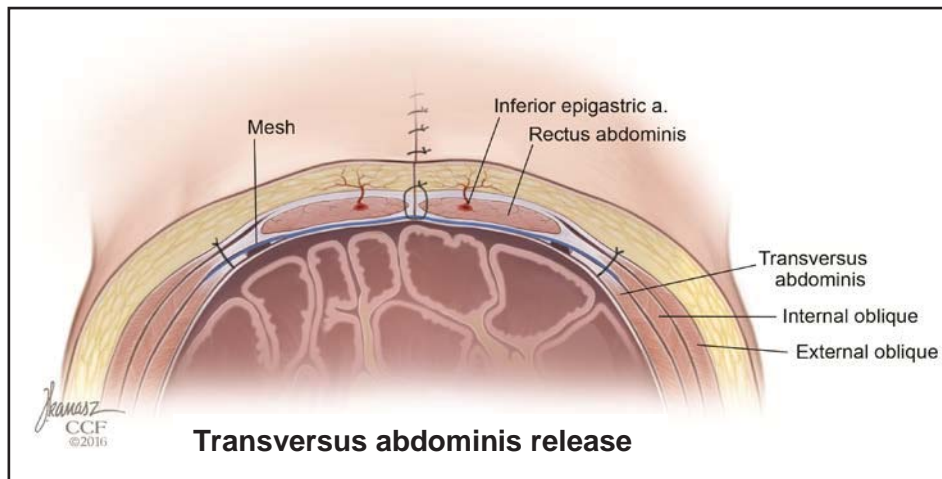
Next, the external oblique muscle is lifted and separated from the internal oblique muscle. Care is taken not to disturb the nerves, arteries, and veins that are located between the internal oblique and transversus abdominis muscles. If additional space is needed to make the repair, the inner edge of the posterior rectus sheath is incised to separate it off the rectus muscle to allow it to move back to the midline. The mesh is then inserted into the space and the skin flaps are repositioned and stitched closed at the midline of the abdomen.

External oblique release repair restores the function and structural strength of the abdominal wall. In addition, it provides a tension-free repair. The technique preserves the blood supply to the rectus muscle and the nerves that control muscle function. When using a mesh to reinforce this repair, the hernia recurrence rate is between 10 and 30 percent. The disadvantage of this technique is that it requires the creation of a large space underneath the skin, which can lead to wound issues after the operation.

**The transversus abdominis release (TAR):** The transverse abdominis release is another component repair technique. With this method, the incision is made beneath the transversus abdominis muscle. The release of the muscle itself allows complete reconstruction of the abdominal wall layers both underneath and on top of the mesh. This places the mesh in an area well supplied by

blood vessels, deep under the skin surface. The large amount of space created with the TAR method allows wide overlap of mesh, which is needed to reinforce the abdominal wall when repairing larger and

difficult defects. Another advantage is that it preserves the abdominal wall blood supply by avoiding the large skin flaps that are needed in the external oblique release repair and therefore has less issues with wound healing.



The hernia recurrence rate using the transverse abdominis release repair techniques is about 3 to 5 percent. At the Cleveland Clinic, TAR is the preferred method for managing patients who require open ventral hernia repair, and in fact, was originally described by members of the Cleveland Clinic Hernia Team.

## Complications of open ventral hernia repair

Complications of open ventral hernia repair include wound infection, wound rupture along incision site, nausea/vomiting, constipation, incision site redness, fever, drainage, and urinary tract infections. Wound infections are the most common complication of the component separation technique. Infection rates range from 27 to 41 percent depending on many factors. Higher rates of infection are seen in patients who are obese or smoke.

Synthetic mesh infection after open ventral hernia repair occurs in up to 2 percent of patients. Surgery may be needed to help resolve the infection.

Seromas occur when fluid builds up in the area where the hernia used to be. This is normal and will typically resolve over weeks to months. If the seroma is too bothersome, it can be drained.

Hematomas (severe bruises in the tissues that can contain some blood clots) occur in about 2 percent of patients. These complications usually resolve and do not require draining.

Another complication can occur when removing scar tissue that has formed from prior surgeries. The surgical procedure (called an enterotomy) in which an incision is made into the intestine, can result in an injury to part of the bowel wall or the full thickness of the wall. If this occurs, your return to your normal diet after surgery will need to be made in small steps. If the repair was to leak, you can get very sick very quickly.

Other complications include blood clots in the legs or in the lungs (deep venous thrombosis or pulmonary embolism) and respiratory failure.



## Preparing for your surgery

Before hernia repair surgery, your doctor will perform a medical evaluation. This typically includes the following:

- Review your medical and surgical history.
- Perform a physical exam.
- Discuss medications, diet, and herbal supplements you are taking.
- Order lab tests, if needed, such as blood work.
- Order X-rays, CT scans, and/or MRI studies of your abdomen.
- Order additional testing, if needed, such as pulmonary or cardiac tests.

Before surgery can be considered, you must:

- Quit smoking.
- Have your diabetes under control.
- Lose weight and undergo weight loss counseling if obese.

### The week before surgery

- You may be asked to stop taking aspirin, products that contain aspirin, or certain blood thinner medications. Some diet and herbal supplements must be stopped two weeks prior to surgery.
- Check with your doctor about which medications can be taken the morning of surgery.
- Arrange for someone to take you to the hospital the day of surgery and home afterwards.
- You may want to arrange for someone to stay with you for a few days following surgery, especially if you are having open surgery.

### The day before surgery

- Your doctor may tell you not to eat after a certain time and to drink only clear liquids until midnight before the surgery.
- Apply antibiotic-containing nasal ointment to reduce infection.
- Shower with the antibacterial soap provided by your doctor.
- Leave valuables, such as rings and watches, at home.
- Pack loose clothing to go home.

## Day of surgery

You may not eat or drink anything after midnight the day before your surgery. Your anesthesiologist will give you instructions about your daily medications. Some medications may be discontinued because they will complicate surgery and other medications may be needed.

## Surgery

The surgery will last approximately 2 to 8 hours.

## Hospital stay and postoperative care

Plan to stay in the hospital for 3 to 5 days after your surgery (for open repair operations). Depending on the complexity of your hernia, you may spend the first 1 to 2 nights in the ICU. You will be asked to get out of bed the day after your surgery. You will also start using an incentive spirometer. This device helps you take long, deep breaths to keep your lungs clear and active during your recovery period.

**Pain management:** For the first three to four days after surgery, your pain will be managed either by an intravenous, patient-controlled analgesia device or through an epidural catheter. Patient-controlled analgesia (PCA) is a computerized pump that safely permits you to push a button to deliver a small programmed amount of pain medicine into your intravenous (IV) line, usually in your arm. Epidural pain management uses a PCA pump to deliver pain control medicine into an epidural catheter (a very thin plastic tube) that is placed into your back. Pain medicine is switched to an oral narcotic when you are able to eat solid food.

**Diet:** You will begin with a clear liquid diet until your bowel function returns; then you will slowly return to your regular diet.

**Drains:** Drains are used to remove fluid buildup around the operative site. The length of time they need to remain in place varies based on where the drains need to be positioned, the type and location of mesh used, and the amount of fluid exiting into the drain. Some drains can be removed before hospital discharge; others may need to remain in place for about 2 weeks.

**Abdominal binder:** You will wear an abdominal binder, which is a snug bandage or “girdle,” immediately after surgery. You may wear the binder as desired after discharged home for up to 6 weeks.

**Blood clot and infection prevention:** Medication to prevent blood clots was started in the operating room and must continue to be taken until discharge. Antibiotics to prevent an infection were started before surgery and will be stopped within 24 hours. If you had a soft tissue or mesh infection before surgery, antibiotics will continue until the infection has resolved.

## Postoperative instructions

The following instructions will help you know what to expect in the days and weeks following your surgery. The expected recovery period is 6 to 8 weeks after major abdominal wall reconstruction hernia surgery. Do not hesitate to call if you have any questions or concerns.

### Activity

- Do not lift anything heavier than 10 to 15 pounds until your first follow-up appointment. If your job requires heavy lifting or straining, be careful if you return to work before a full 6 weeks after your operation. You should always keep your back straight when you lift and allow your legs to do most of the lifting.
- Climbing stairs is permitted, but take the stairs slowly and one at a time.
- You may shower 2 days after surgery. Remove your dressing before showering.
- You may resume sex as long as it does not cause significant pain.
- Do not drive, work with heavy equipment, or sign legal documents for 24 hours.
- Rest at home for 24 hours following general anesthesia.
- Do not drink alcoholic beverages or take sleeping pills for the next 18 hours.
- Take frequent short walks as soon as you can to improve circulation and minimize the risk of blood clots in your legs.
- Ask your doctor about returning to work.

### Pain control

- You will be given a narcotic prescription for pain. You can either choose to take the narcotic pain medication or may choose to take acetaminophen (Tylenol®) or ibuprofen (Advil®, Motrin®) as an alternative. (Caution: your doctor may write a prescription for a pain medication that contains both a narcotic and acetaminophen.) Do not take additional acetaminophen if you choose to take this combination medication. Follow the instructions on the prescription label.) Narcotics cause constipation. We advise taking Milk of Magnesia®, two tablespoons twice a day until you are off narcotic pain medicine and your bowels are moving regularly.
- Avoid medications containing aspirin for 10 days. Aspirin can increase bleeding (if bleeding occurs).
- Do not drive a motor vehicle or operate power tools or machinery while taking narcotic pain reliever.

- If the pain increases 1 to 2 days after discharge, call your physician.
- Rest is an important part of the healing process, too much activity will cause your discomfort to increase.
- Use an ice pack for comfort and to help keep the swelling down.
- You may have a sore throat for a few days. Throat lozenges/ice chips may provide comfort from these symptoms.
- Small areas of numbness or an unpleasant skin sensation may temporarily result from the operation. Also, you may find that your incision is swollen and tender for a few days; this should resolve with time.

## **Wound care**

- You may go home with a drain. (See care instructions that follow on the next page.)
- Keep the operative site clean and dry for 2 days. Change the dressing after 2 days.
- You may shower 48 hours after surgery. Avoid getting soap in the incision area for a few days to help prevent infection.
- If the incision is draining, continue to change the dressing until the drainage has stopped.
- Keep an ice bag on the incision site as needed. This will reduce the pain, provide some local comfort, and reduce swelling in the incision.

## **Bowel movements**

- There may be bloating and constipation for a few days. If you have not had a bowel movement in 24 hours, take a mild laxative such as Milk of Magnesia<sup>®</sup> (two tablespoons twice a day) or prune juice.

## **Follow-up appointment**

- See your doctor for a follow-up appointment 2 to 3 weeks after surgery. You will need to call your doctor's office to schedule an appointment.

## When to call the doctor

It's important to call your doctor if you experience any of the following symptoms during your recovery:

- Fever of 101°F/38°C or higher or if you experience fever and chills
- Nausea or vomiting
- Difficulty urinating
- Increased redness, foul-smelling odor, or drainage from your incisions or any increased redness or warmth around the incision
- Increased pain and swelling not relieved by rest, medication, and ice
- Bleeding
- Increased weakness or fainting

If you experience difficulty breathing, chest pain, or shortness of breath, seek immediate medical attention.

## **How to Care for Your Jackson Pratt Drain**

After surgery, there is continued oozing and shedding of cells and bodily fluids at the surgical site. Removal of this fluid speeds healing.

### **How does the drain work?**

Your drain will automatically suction fluid out when the bulb is compressed (flattened shape). The bulb has to be compressed very well and the drain tab has to be closed in order for the suction to work. If the bulb maintains its compressed shape, the suction is working correctly.

### **How do you empty the drain?**

Make sure your hands are thoroughly washed with soap and water before you empty the drain. The drain can be emptied by opening the tab. You will probably be given a measuring cup or plastic bottle (measured in cc); empty the fluid into this. Record the amount of cc and discard the fluid in the toilet. Please record the time and amount of fluid. After you empty, compress the bulb (as flat as you can) and replace the tab to re-establish the suction. The color of the drainage changes from red to a yellow over time. There may be red stringy material in the drainage. These are not blood clots -- DO NOT WORRY! This material does, however, tend to block the tubing. You may need to “milk” the tubing. To do this, either use alcohol wipes (wrap the wipe around the tubing) or put lotion on your fingertips (to create a smoother gliding surface on the tubing). Then pinch the tubing behind the material and pull gently on the tubing (flattening the tube). This will move the stingy material down the tube and prevent clots from forming.

### **How often should the drain be emptied?**

The drain should be emptied as often as possible so that the bulb can be compressed fully to maintain suction. In general, this is usually done every 8 hours the first few days until the amount decreases. The drain should remain in place until your doctor tells you it is okay to be removed. Sometimes, after the drain is removed, the fluid may re-accumulate and swell at the surgical site. This fluid is called a seroma. If it should occur, this is not an emergency; however, call the office and we will drain it. It is a painless procedure and only takes a few minutes.

### **Helpful tips**

There is a tab on the bulb part of the tubing that can be pinned to your bra, under your shirt, or slipped over a belt or piece of elastic. Some patients prefer to conceal the bulb and tubing in a “fanny pack” or passport pouch.

### **Cleaning the drain site**

Gently cleanse the drain site (where the drain exits the skin) with a Betadine® swab twice a day. Discard the swab after each use.



## Jackson Pratt Drain Fluid Collection Record Sheet

| Date | Time | Amount |  | Date | Time | Amount |
|------|------|--------|--|------|------|--------|
|      |      |        |  |      |      |        |
|      |      |        |  |      |      |        |
|      |      |        |  |      |      |        |
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## Glossary of terms

**Abdominal cavity:** The large space in the body that contains most of the major organs, including the stomach, small and large intestines, rectum, liver, gallbladder, pancreas, spleen, kidneys, and bladder.

**Abdominal wall:** A structure that consists of layers of tissue, fat, and muscle that protect the abdomen.

**Adhesions:** Scar-like tissue that sticks tissues together. In the case of hernia repair, adhesions occur when loops of the intestines stick to each other or to the mesh.

**Aponeurosis:** A pearly white thin layer of connective tissue that extends from the ends of the external oblique, internal oblique, and transversus abdominis muscles. The external oblique muscle aponeurosis and one of the two layers of the internal oblique muscle aponeurosis form the layer of tissue that is on top (anterior) of the rectus abdominis muscle. This tissue is called the anterior rectus sheath. The other layer of the aponeurosis of the internal oblique muscle and the aponeurosis of the transversus abdominis muscle form the layer of tissue that is on the bottom (posterior) of the rectus abdominis muscle. This tissue is called the posterior rectus sheath. This sheath surrounds the rectus muscles at the midline of the body.

**Bowel obstruction:** A blockage that keeps food or liquid from passing through the small intestine or large intestine. One cause of bowel obstruction is adhesions in the abdomen that form after surgery.

**Fascia:** A flat band of tissue below the skin that covers underlying tissues and separates different layers of tissue. Fascia also surrounds muscles.

**Fistulas:** An enterocutaneous fistula (ECF) is a late complication of mesh repair of an incisional hernia. It is usually caused by erosion of the intestines by mesh that has been placed in direct contact with the intestines.

**Hematoma:** Severe bruises in the tissues that can contain some blood clots. Hematomas usually occur at or near the site of hernia surgery.

**Inlay mesh placement:** This mesh position is between the central edges of the rectus abdominis (an inlay repair).

**Intraperitoneal mesh placement:** In this location, mesh is positioned against the peritoneum and faces the viscera (the abdominal organs; also known as your “gut”).

**Linea alba:** A white tendon-like tissue that runs down the center of abdominal wall between the rectus abdominis muscle. Each posterior rectus sheath combines with the anterior sheath to form the linea alba at the midline of the abdomen.

**Linea semilunaris:** The two curved tendon-like tissues found on either side of the linea alba. They are the lateral (side) borders of the rectus abdominis muscles.

**Onlay mesh placement:** This mesh position is above the muscles in the abdominal wall.

**Peritoneum:** The membrane that lines the abdominal cavity. It is the deepest layer of the abdominal wall just above the intestines. It holds the organs, such as the intestines, in place.

**Preperitoneal mesh placement:** This mesh position is between the posterior rectus sheath and the preperitoneal fat layer underneath.

**Rectus sheath:** The thin layer of tissue that is directly above (anterior) and underneath (posterior) the rectus muscle.

**Retrorectus mesh placement:** This mesh position is within the posterior rectus sheath deep to the rectus abdominis muscle.

**Seroma:** A collection of fluids that build up under the surface of the skin usually at the site of the incision.

**Skin flap:** A full-thickness mass or flap of tissue that may contain skin and fat, or skin, fat, and muscle. Often, a skin flap is still attached to its original site at one end and remains connected to a blood vessel.

**Sublay mesh placement:** This mesh position is below the muscle layers in the abdominal wall.

**Wound dehiscence:** A surgical complication in which the wound ruptures along the surgical incision.

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