



## Transjugular Intrahepatic Portosystemic Shunt (TIPS)

Transjugular Intrahepatic Portosystemic Shunt or TIPS is a procedure that uses imaging guidance to connect the portal vein to the hepatic vein in the liver. A small metal device called a stent is placed to keep the connection open and allow it to bring blood draining from the bowel back to the heart while avoiding the liver. TIPS may successfully reduce internal bleeding in the stomach and esophagus in patients with cirrhosis.



Tell your doctor if there's a possibility you are pregnant and discuss any recent illnesses, medical conditions, allergies and medications you're taking. You may be advised to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners several days prior to your procedure and instructed to not eat or drink anything after midnight the night before. Your doctor will tell you which medication to take in the morning. Leave jewelry at home and wear loose, comfortable clothing. You will be asked to wear a gown. Plan to stay overnight at the hospital for one or more days.

### What is a Transjugular Intrahepatic Portosystemic Shunt (TIPS)?

A transjugular intrahepatic portosystemic shunt (TIPS) is a tract created within the liver using x-ray guidance to connect two veins within the liver. The shunt is kept open by the placement of a small, tubular metal device commonly called a stent.

During a TIPS procedure, interventional radiologists use image guidance to make a tunnel through the liver to connect the portal vein (the vein that carries blood from the digestive organs to the liver) to one of the hepatic veins (three veins that carry blood away from the liver back to the heart). A stent is then placed in this tunnel to keep the pathway open.

Patients who typically need a TIPS have portal hypertension, meaning they have increased pressure in the portal vein system. This pressure buildup can cause blood to flow backward from the liver into the veins of the spleen, stomach, lower esophagus, and intestines, causing enlarged vessels, bleeding and the accumulation of fluid in the chest or abdomen. This condition is most commonly seen in adults, often as a result of chronic liver problems leading to cirrhosis (scarring of the liver). Portal hypertension can also

occur in children, although children are much less likely to require a TIPS.

## What are some common uses of the procedure?

A TIPS is used to treat the complications of portal hypertension, including:

- variceal bleeding, bleeding from any of the veins that normally drain the stomach, esophagus, or intestines into the liver.
- portal gastropathy, an engorgement of the veins in the wall of the stomach, which can cause severe bleeding.
- severe ascites (the accumulation of fluid in the abdomen) and/or hydrothorax (in the chest).
- Budd-Chiari syndrome, a blockage in one or more veins that carry blood from the liver back to the heart.

## How should I prepare?

You should report to your doctor all medications that you are taking, including herbal supplements, and if you have any allergies, especially to local anesthetic medications, general anesthesia or to contrast materials containing iodine (sometimes referred to as "dye" or "x-ray dye"). Your physician may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners for a specified period of time before your procedure.

Women should always inform their physician and x-ray technologist if there is any possibility that they are pregnant. Many imaging tests are not performed during pregnancy so as not to expose the fetus to radiation. If an x-ray is necessary, precautions will be taken to minimize radiation exposure to the baby. See the Safety page for more information about pregnancy and x-rays.

You will likely be instructed not to eat or drink anything after midnight before your procedure. Your doctor will tell you which medications you may take in the morning.

You should plan to stay overnight at the hospital for one or more days.

You will be given a gown to wear during the procedure.

## What does the equipment look like?

In this procedure, x-ray or ultrasound equipment, a stent, and a balloon-tipped catheter are used.

The equipment typically used for this examination consists of a radiographic table, one or two x-ray tubes and a television-like monitor that is located in the examining room. Fluoroscopy, which converts x-rays into video images, is used to watch and guide progress of the procedure. The video is produced by the x-ray machine and a detector that is suspended over a table on which the patient lies.

Ultrasound scanners consist of a console containing a computer and electronics, a video display screen

and a transducer that is used to do the scanning. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. Some exams may use different transducers (with different capabilities) during a single exam. The transducer sends out high-frequency sound waves (that the human ear cannot hear) into the body and then listens for the returning echoes from the tissues in the body. The principles are similar to sonar used by boats and submarines.

The ultrasound image is immediately visible on a video display screen that looks like a computer or television monitor. The image is created based on the amplitude (loudness), frequency (pitch) and time it takes for the ultrasound signal to return from the area within the patient that is being examined to the transducer (the device placed on the patient's skin to send and receive the returning sound waves), as well as the type of body structure and composition of body tissue through which the sound travels. A small amount of gel is put on the skin to allow the sound waves to travel from the transducer to the examined area within the body and then back again. Ultrasound is an excellent modality for some areas of the body while other areas, especially air-filled lungs, are poorly suited for ultrasound.

A catheter is a long, thin plastic tube that is considerably smaller than a "pencil lead", or approximately 1/8 inch in diameter.

The stent used in this procedure is a small wire mesh tube, often covered with a fabric made of GORE-TEX®.

Other equipment that may be used during the procedure includes an intravenous line (IV), ultrasound machine and devices that monitor your heart beat and blood pressure.

## How does the procedure work?

A TIPS reroutes blood flow in the liver and reduces abnormally high blood pressure in the veins of the stomach, esophagus, bowel and liver, reducing the risk of bleeding from enlarged veins across the esophagus and stomach.

A TIPS procedure involves creating a pathway through the liver that connects the portal vein (the vein that carries blood from the digestive organs to the liver) to a hepatic vein (one of three veins that carry blood from the liver to the heart).

A stent placed inside this pathway keeps it open and allows some of the blood that would ordinarily pass through the liver to bypass the liver entirely, reducing high blood pressure in the portal vein and the associated risk of bleeding from enlarged veins.

## How is the procedure performed?

Image-guided, minimally invasive procedures such as a TIPS are most often performed by a specially trained interventional radiologist in an interventional radiology suite or occasionally in the operating room. Some interventional radiologists prefer performing this procedure while the patient is under general anesthesia, while some prefer conscious sedation for their patient. The advantage of general anesthesia is that the patient will not feel anything.

You will be positioned on your back.

You may be connected to monitors that track your heart rate, blood pressure and pulse during the procedure.

A nurse or technologist will insert an intravenous (IV) line into a vein in your hand or arm so that sedative medication can be given intravenously. Moderate sedation may be used. As an alternative, you may receive general anesthesia.

The area of your body where the catheter is to be inserted will be sterilized and covered with a surgical drape.

Your physician will numb an area just above your right collarbone with a local anesthetic.

A very small skin incision is made at the site.

Using ultrasound, the doctor will identify your internal jugular vein, which is situated above your collarbone, and guide a catheter, a long, thin, hollow plastic tube into the vessel.

Using real time x-ray guidance, your doctor will then guide the catheter toward the liver and into one of the hepatic veins. Pressures are measured in the hepatic vein and right heart to confirm the diagnosis of portal hypertension, and also to determine the severity of the condition. To help plan for the placement of the TIPS stent, a contrast material will be injected in the hepatic vein to identify the portal venous system. Access is then gained from the hepatic vein into the portal system using a TIPS needle (a special long needle extending from the neck into the liver). A stent is then placed under fluoroscopy extending from the portal vein into the hepatic vein. Once the stent is in the correct position, the balloon is inflated, expanding the stent into place.

The balloon is then deflated and removed along with the catheter. Subsequently, pressures are measured to confirm reduction in portal hypertension. Additional portal venograms are also performed to confirm satisfactory blood flow through the TIPS.

Pressure will be applied to prevent any bleeding and the opening in the skin is covered with a bandage. No sutures are needed.

You will be admitted to the hospital following your procedure, where you will be closely observed.

This procedure is usually completed in an hour or two but may take up to several hours depending on the complexity of the condition and vascular anatomy.

## **What will I experience during and after the procedure?**

Devices to monitor your heart rate and blood pressure will be attached to your body.

You will feel a slight pin prick when the needle is inserted into your vein for the intravenous line (IV) and when the local anesthetic is injected. Most of the sensation is at the skin incision site, which is numbed using local anesthetic. You may feel pressure when the catheter is inserted into the vein or artery.

If you receive a general anesthetic, you will be unconscious for the entire procedure, and you will be monitored by an anesthesiologist.

If the procedure is done with sedation, the intravenous (IV) sedative will make you feel relaxed, sleepy and comfortable for the procedure. You may or may not remain awake, depending on how deeply you are sedated.

When the needle is advanced through the liver and the pathway is expanded by the balloon, you may experience discomfort. If you feel pain, you should inform your physician; you may be given extra intravenous medications.

As the contrast material passes through your body, you may experience a warm feeling which quickly subsides.

After the procedure, you will be monitored closely and your head will be kept elevated for a few hours after you return to your room. Often, symptoms are mild or controlled enough that the procedure can be done electively and patients may go home the next day. However, the amount of bleeding that can occur can sometimes be life threatening and those patients are monitored in intensive care beforehand and during recovery.

You should be able to resume your normal activities in seven to 10 days.

Follow-up ultrasounds will be performed frequently after the TIPS procedure to make sure that it remains open and functions properly.

## Who interprets the results and how do I get them?

Prior to leaving the hospital, you may have an ultrasound exam to determine the effectiveness of the procedure and placement of the stent.

The interventional radiologist can advise you as to whether the procedure was a technical success when it is completed.

## What are the benefits vs. risks?

### Benefits

- A TIPS is designed to produce the same physiological results as a surgical shunt or bypass, without the risks that accompany open surgery.
- TIPS is a minimally invasive procedure that typically has a shorter recovery time than surgery.
- Your TIPS should have less of an effect than open surgical bypass on future liver transplantation surgery because the abdomen has not been entered, thus there is no scar tissue formed in the abdomen.
- The stent that keeps the shunt open (TIPS) is contained entirely inside the diseased liver, and is removed with it during a transplant operation.

- Studies have shown that this procedure is successful in reducing variceal bleeding in more than 90 percent of patients.
- No surgical incision is needed—only a small nick in the skin that does not have to be stitched.

## Risks

- Any procedure where the skin is penetrated carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- There is a very slight risk of an allergic reaction to the contrast material used for venograms. Also, kidney failure (temporary or permanent) due to contrast material use is a concern, particularly in patients with poor kidney function.
- Any procedure that involves placement of a catheter inside a blood vessel carries certain risks. These risks include damage to the blood vessel, bruising or bleeding at the puncture site, and infection. However precaution is taken to mitigate these risks.

Other possible complications of the procedure include:

- fever
- muscle stiffness in the neck
- bruising on the neck at the point of catheter insertion
- delayed stenosis, or narrowing within the stent, which is less common with the current generation of GORE-TEX-lined stents

Serious complications, reported in fewer than five percent of cases, may include:

- occlusion, or complete blockage, of the stent and rapid recurrence of symptoms
- infection of the stent or fabric lining
- abdominal bleeding that might require a transfusion
- laceration of the hepatic artery, which may result in severe liver injury or bleeding that could require a transfusion or urgent intervention
- heart arrhythmias or congestive heart failure
- radiation injury to the skin is a rare complication (it may happen in complex and lengthy procedures requiring extended fluoroscopy use)
- death (rare)

## What are the limitations of TIPS?

Patients with more advanced liver disease are at greater risk for worsening liver failure after TIPS. If your liver failure is severe, a TIPS may not be the best use and a different procedure may be needed to control your symptoms. They are also at risk for encephalopathy, which is an alteration of normal brain function that can lead to confusion. This is because toxic substances in the bloodstream are ordinarily filtered out by the liver. The TIPS may cause too much of these substances to bypass the liver, so a patient who already has encephalopathy because of their liver disease may not be a good candidate for the procedure. Encephalopathy can be treated with certain medications, a special diet or, by revising the stent, but sometimes the stent must be blocked off intentionally to solve the problem.

Although extremely rare, children may also require a TIPS procedure. TIPS in children are more likely to be performed before liver transplant in those with ascites or variceal bleeding resistant to traditional medical treatments. The greatest difference in performing TIPS in children is their tremendous variability in size, physiology, and medical diseases. This can result in significant challenges in creating the TIPS.

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