Posterior Lumbar Interbody Fusion

Posterior lumbar interbody fusion (PLIF) is a procedure used to treat problems such as disc degeneration, disc herniation, and spine instability. In this procedure, the surgeon works on the spine from the back and removes a spinal disc in the lower (lumbar) spine. The surgeon inserts bone graft material into the space between the two vertebrae where the disc was removed (the interbody space). The graft may be held in place with a special fusion cage. The goal of the procedure is to stimulate the vertebrae to grow together into one solid bone (known as a fusion). A fusion creates a rigid and immovable column of bone in the problem section of the spine. Such fusion prevents abnormal vertebral movement and instability alleviating pain.

This procedure is often used to stop symptoms from lumbar disc disease. Discs degenerate (wear out), as a natural aging process and chronic stress and strain on the back. Over time, the disc begins to collapse, and the space between the vertebrae decreases. As this happens, the openings around the spinal nerves (the neural foramina) narrow and may put pressure on the nerves. The long ligaments in the spine slacken due to the collapse in vertebral height. These ligaments may even buckle and put further pressure on the spinal nerves.

This surgery is done through an incision in the low back. The incision reaches to the spinous processes, which are the bony projections of the back of the vertebrae. A large block of bone, called the vertebral body makes up the front section of each vertebra. A soft cushion known as intervertebral disc separates the vertebral bodies.
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On the back of the vertebral body, the lamina and pedicle bones form a protective ring around the spinal canal. The spinal nerves are enclosed in the spinal canal and exit through small openings on the sides of each vertebral pair, one on the left and one on the right. These passageways are called the neural foramina. (The term neural foramen describes a single passageway).

Pain from disc degeneration can also come from a tear in the outer portion of the disc; pain ensues due to chemical inflammation inside the disc, or from a herniated disc that pushes on a nearby spinal nerve root. Mechanical pain can also occur from excess movement within the problem part of the spine, a condition known as spinal instability.

Taking out the painful disc is intended to relieve symptoms. It also provides room for placing a graft that will allow the two vertebrae to fuse together.

Once the disc is removed, the surgeon spreads the bones of the spine apart slightly to make room to implant bone graft material. Bone graft is commonly taken from the rim of the pelvis and packed in a special case, called a fusion cage. Bone taken from your own body is called autograft. Bone substitutes are also being used and avoid the need for taking bone from your pelvis.

Another option is to use a wedge of hard, cortical bone taken from preserved human bone. This source of bone graft is called allograft. During the PLIF procedure, the cage or bone wedge is implanted into the interbody space. The PLIF method provides a large surface area for fusion to occur.

The graft creates a solid spacer to separate and hold the vertebrae apart. Enlarging the space between the vertebrae widens the opening of the neural foramina, taking pressure off the spinal nerves that pass through these openings. Also, the long ligaments that run up and down inside the spinal canal are pulled taut so they don't buckle into the spinal canal.

The surgeon also fixes the bones in place using pedicle screws. This instrumentation (or hardware, as it is sometimes called) holds the vertebrae together and prevents them from moving. The less motion there is between two bones trying to heal, the higher the chance they will successfully fuse. The use of instrumentation has increased the success rate of spinal fusions considerably.

During the PLIF procedure, surgeons also commonly add bone graft material along the back sides of the spine. This step is called posterolateral bone grafting. When combined with instrumentation, this approach helps fuse a large surface area on the back (posterior column) of the spine.

In a successful fusion, the vertebrae that are fused together no longer move against one another. The fusion creates one solid bone. No movement happens within the bones that are fused. Instead, they move as one unit. This helps stop the mechanical pain that was coming from the moving parts of the back. Fusion also prevents additional wear and tear on the spinal segment that was fused. By fusing the bones together, surgeons hope to reduce future problems at the spinal segment.

Surgical Procedure

Patients are given a general anesthesia to put them to sleep during most spine surgeries. As you sleep, your breathing may be assisted with a ventilator. A ventilator is a device that controls and monitors the flow of air to the lungs.

During surgery the patient usually kneels face down on a special operating table. The special table supports the patient so the abdomen is relaxed and free of pressure. This position reduces blood loss during surgery. It also gives the surgeon more room to work.

Two measurements are made before surgery begins. The first measurement ensures that the surgeon chooses a fusion cage or bone wedge that will fit inside the disc space. To correctly size the fusion cage or bone wedge, the surgeon uses an X-ray image to measure the disc space in a healthy disc, above or below the problem segment.

Second, to size the length of the pedicle screws, a CT scan is used to measure the length of the pedicle bone on the back of the vertebrae to be fused. The CT scan is a special type of X-ray that lets doctors see slices of bone tissue. The machine uses a computer and X-rays to create these slices.

To begin the procedure, an incision is made down the middle of the low back. The tissues just under the skin are separated. Then the small muscles along the sides of the low back are moved aside, exposing the back of the spinal column. Next, the surgeon takes an X-ray to make sure that the procedure is being performed on the correct vertebrae.
The bone graft is prepared. When autograft (bone taken from your body) is used, the same incision made at the beginning of the surgery can be used.

Then the surgeon prepares to implant bone graft into the space between the vertebral bodies. The surgeon removes the lamina bones that cover the back of the spinal canal. Next, the surgeon cuts a small opening in the ligamentum flavum, an elastic ligament separating the lamina bones and the spinal nerves. Removing the ligamentum flavum allows the surgeon to see inside the spinal canal.

Surgeon can directly assess crused nerves within the spinal canal and neuroforamen.

The nerves are checked for tension where they exit the spinal canal. If a nerve root is under tension, the surgeon enlarges the neural foramen, the opening where the nerve travels out of the spinal canal. The surgeon locates the spot where the pedicle screws are to be placed.

A fluoroscope is used to visualize the pedicle bones. A fluoroscope is a special type of X-ray that allows the surgeon to see an X-ray picture continuously on a TV screen. The surgeon uses the fluoroscope to guide one screw through the back of each pedicle, one on the left and one on the right.

The nerve roots inside the spinal canal are then pulled aside with a retractor so the problem disc can be examined. With the nerves held to the side, the surgeon is able to see the disc where it sits just in front of the spinal canal.
A hole is cut into the rim of the back of the disc. Forceps are placed inside the hole in order to clean out disc material within the disc. Reamers and scrapers are used to open up and remove additional disc material.

The surgeon prepares the disc space where the fusion cages or bone wedges are to be inserted. Special spreaders hold the two vertebral bodies apart. A layer of bone is shaved off the flat surfaces of the two vertebrae, causing the surfaces to bleed. Bleeding stimulates the bone graft to heal the bones together.

Adequate room is needed to get the bone graft implants through the spinal column and into the disc space. The nerve roots must be pulled as far to the side as possible to open up enough space.

With the disc space held apart by the spreaders, the surgeon has enough room to place the bone graft between the two vertebral bodies. For the fusion cage method, the surgeon packs two cages with bone taken from the pelvis bone or with a suitable bone substitute. Two cages are inserted, one on the left and one on the right. When allograft bone wedges are used, the surgeon inserts the wedges and aligns them within the disc space.

A wide opening of the canal spinal allow good nerve decompression (neuroforamen “unroofing”) and enough room to slide in the appropriate interbody devices (fusion cages).

The surgeon uses a fluoroscope to check the position and fit of the graft. The spreaders used to hold the disc space apart are released. Then the doctor tests the graft by bending and turning the spine to make sure the graft is in the right spot and is locked in place. Some surgeons add strips of bone graft along the back of the vertebrae to be fused. This is called posterolateral fusion. The bones that project out from each side of the back of the spine are called transverse processes. The back surfaces of the transverse processes are shaved, causing the surfaces to bleed. Small strips of bone, usually taken from the pelvis bone at the beginning of the surgery, are placed over the transverse processes. The combination of this graft material with the pedicle screws helps hold the spine steady as the interbody fusion heals.

A drainage tube may be placed in the wound. The muscles and soft tissues are then put back in place. The skin is stitched together. The surgeon may place you in a rigid brace that straps
across the chest, pelvis, and low back to support the spine while it heals.