

**TREATMENT**

# Bone Grafts in Spine Surgery

Spinal fusion is one of the most common surgeries performed in the neck or back. The basic idea is to fuse together painful or unstable bones in the spine so that they heal into a single, solid bone. For bones to fuse or heal together, additional bone is needed. This additional bone is called a bone graft.

To make bone, there must typically be:

- Stability so bone can form. Therefore, screws, rods, and/or plates are used to aid in fusion.
- Cells that can make bone, proteins to stimulate bone, and a scaffold to which bone can attach. If a bone graft material has all of these properties, it can successfully make bone. If it lacks one or more of these properties, the bone graft material must be combined with other graft materials.

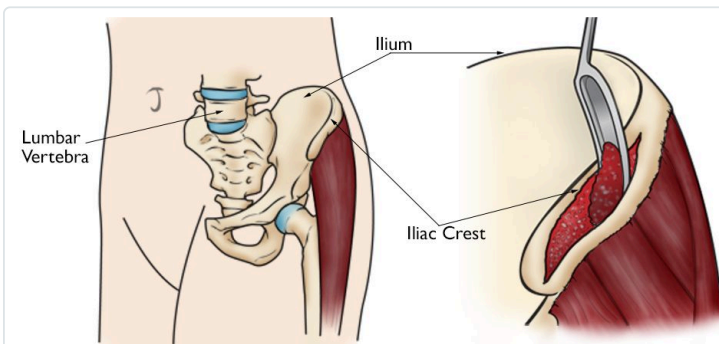
There are many bone graft options available today. The graft or combination of grafts that will work best for you depends on which section of your spine needs to be fused, your age, and your general health. Your surgeon will discuss your options with you.

## Types of Bone Grafts

### ***Autograft***

The standard technique used in fusion is to take extra bone from one part of the patient's body (harvest) and move (graft) it to another part of the body, such as the spine. This type of bone graft is called an autograft.

The surgeon usually takes the bone from an area of the body where its removal will not cause a problem. In spine surgery, the bone is typically harvested from the iliac crest, which is the rim of the pelvic bone. The surgeon uses sharp tools to scoop the bone out of the iliac crest.



Most autografts are harvested from the iliac crest of the hip.

Bone taken from the iliac crest has been used with good results; however, there are some disadvantages:

- In some cases, it hurts to remove the bone; this pain may last for some time after the surgery.
- There is a limited amount of bone in the iliac crest, especially as we get older and our bone thins and weakens.
- The iliac crest may fracture or break.
- An infection or bleeding may occur.

As newer technologies have emerged, this technique has been used less frequently. Surgeons will use this technique typically in high-risk patients whose fusion has not healed in the past, who smoke, or who have other risk factors that inhibit healing.

The advantage of an iliac crest autograft is that it contains cells, proteins, and scaffolding to promote bone healing. In addition, minimally invasive techniques may be used to minimize the trauma of harvesting this bone graft, which can decrease pain at the site.

## ***Local Bone Autograft***

In some spinal fusion procedures, parts of the spinal bones are removed to relieve pressure on the nerve roots. This removed bone is often saved during the surgery and used as the graft. The bone is essentially recycled; it is moved from an area where it is no longer needed to the area that the surgeon wants to fuse.

The advantages to using local bone are:

- It is the patient's own bone and, therefore, cannot be rejected.
- It requires no additional incision.
- It does not cause pain in the hip.
- Like the iliac crest autograft, this graft has all the properties needed to form bone.

The disadvantage is that because the spinal bones are small, there is a limited amount of bone available to harvest.

## ***Cadaver or Allograft Bone***

Many surgeons use bone that is harvested from a donor or cadaver. This type of graft – called an allograft – is typically acquired through a bone bank. Like other organs, bone can be donated upon death.

Allografts have been used for a long time in spinal fusion surgery. Unlike autografts taken from a patient, allografts do not form new bone. Instead, the allograft works as a scaffold that allows the natural bone to grow through its surface. Over time, the natural bone replaces the donor bone.

These are the advantages of using allografts:

- Allograft bone comes in different shapes and sizes to fit into the area of the spine where it is needed.
- In most cases, allografts do a good job of getting bone to heal.
- Because the donor bone is dead and is used only as a scaffold for bone growth, the tissue is rarely rejected. Therefore, this graft does not need to have cells or proteins to stimulate growth.
- The transmission of diseases from the donor bone is also very rare.

## ***Allograft Stem Cells***

Allograft stem cells can come from either a donor or from a cadaver. Stem cells are living cells that have the ability to form bone cells and aid in the fusion. They are unlikely to cause tissue rejection because they are basic cells that have not differentiated into specific cell types.

Current data is promising in showing very good fusion rates, but long-term studies comparing allograft stem cells to other graft types are not yet available. Although these graft materials have all three properties needed to make bone, there probably are not enough living cells to make the bone on their own, and a combined graft approach may be necessary.

## ***Demineralized Bone Matrix (DBM)***

DBM is bone processed in such a way that the calcium in the bone is removed.

The benefit of this process is that it makes important proteins available to stimulate bone healing.

The disadvantage of this graft is that there are no cells that can form bone. Like allografts, DBM serves as a scaffold for bone to grow. Because of the lack of bone cells, DBM must be combined with other graft materials.

## ***Synthetic Bone***

Synthetic bone grafts are made from calcium materials and are often called ceramics. They are similar in shape and consistency to autograft bone. Ceramics have the advantage of being made without cadaver bone and are available in large amounts.

Like DBM, these grafts do not have any cells that can become bone. They also do not have any proteins to stimulate growth. As a result, synthetic grafts must be combined with other bone products to be successful.

## ***Bone Marrow Aspirate***

Bone marrow is located in the centers of long bones, such as the bones in your arms, thighs, and legs. The marrow is the area of the bone that contains stem cells. Stem cells are special cells in your body that can differentiate, or turn into other types of cells. They also have some ability to make new bone.

Stem cells can be aspirated or drawn out of the bone marrow with a needle, similar to how blood is drawn from your arm for tests. The cells are then combined with another type of graft — such as local bone autograft, allograft, or synthetic bone — to speed the healing process.

Currently, research is underway to find new ways of harvesting stem cells. The disadvantage of this process is that as we age, the amount of stem cells found in our bones decreases. So in older adults, bone marrow aspiration yields a limited amount of the key cells that are needed to make bone.

## ***Biologics or Proteins***

We all have proteins in our bodies that naturally stimulate bone growth. A very common type is called bone morphogenic protein (BMP). BMP has been used to promote solid spine fusions for some time and is a common graft option.

BMP has very powerful bone-forming capabilities so care must be taken with its use. While some studies of BMP in the spine show that too much bone may be formed or that BMP may increase the patient's risk for cancer, other studies have shown that the use of BMP is very safe. Your surgeon will talk with you about the risks and benefits of using this powerful protein in your case.

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