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Interbody Cages for Spine Fusion

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In September of 1996, the FDA approved anterior interbody cages for use in the disc space, providing a new technique that allows the spine to be fused with less morbidity (e.g. less post-operative discomfort) than in the past.


Fig 1: ALIF
(larger view)

Anterior interbody cages are titanium cylinders that are placed in the disc space. The cages are porous and allow the bone graft to grow from the vertebral body through the cage and into the next vertebral body. The cages offer excellent fixation, so most patients do not need additional instrumentation (e.g. pedicle screws) or post-operative back braces for support.

Most of the cages are placed in the front of the spine (anterior lumbar interbody fusion or ALIF) . The cages can be inserted through a small incision (minilaparotomy) or with an endoscope (a scope that allows the surgery to be done through several one-inch incisions (see Figure 1).


Fig 2: PLIF
(larger view)

By far the most popular approach for inserting titanium cages is through a minilaparotomy as the endoscopic approach is difficult and does not provide as good exposure. Also, it does not seem as though the endoscopic approach reduces the morbidity of an ALIF surgery as was first believed it would.

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While most cages are placed through an ALIF, they can also be placed in the back of the spine (posterior lumbar interbody fusion or PLIF) through a midline incision in the back (see Figure 2).

Originally, anterior interbody fusions were all done with a patient's own bone from their iliac crest. Besides the bone graft site pain and problems, there was a high nonunion rate with procedures. Initially, the threaded cylindrical titanium cages that became popular in the late 1990's helped the success rate of the procedure by providing more firm fixation of the disc space. Also, the amount of bone that needed to be harvested from the iliac crest was greatly reduced because only the soft inner cancellous bone was needed for the fusion. A structural cortical graft was not needed and the outer table of the pelvis was not violated. Currently, there are now several bone graft substitutes that may even eliminate the need for bone graft harvests.

After an initial surge in popularity, it was recognized that the threaded cages did not fixate the spine well enough in certain situations. Where they seemed to work the best was in one-level severe degenerative disc disease with disc space collapse. They are particularly effective at L5-S1 where there is not naturally a lot of motion.

More Spinal Fusion Info:
Cervical Spinal Fusion
Lumbar Spinal Fusion

At L4-L5 and above, especially in patients with either a tall disc space or an associated isthmic spondylolisthesis, cages do not provide as good a fixation. They are not also all that effective in multilevel lumbar fusions without supplemental posterior fixation.

Another problem has been that the cages obscure postoperative assessment with x-rays because of all the metal in the disc space. There are various radiolucent cages now (carbon fiber or PEEK) which allow postoperative visualization of the bone graft healing, but do not provide as good fixation. Generally, posterior pedicle screw supplementation is also necessary.

Another design that is now available is a metallic cage that can firmly grip the disc space, but more closely matches the anatomy of the disc space. Because it is not a cylinder, it can be used in disc spaces that are still tall. A cylinder needs to be quite large in a tall disc space so a lot of the strong subchondral bone at the end of the vertebral body is reamed away. This can weaken the disc space and lead to postoperative subsidence of the cages into the vertebral bodies. If this happens the fixation is lost.

Theoretically, a rectangular geometry should allow for more surface area between the cage and the vertebral endplate, which in turn should decrease the force per unit area on the vertebral endplate. Because anterior interbody fusions fail as a result of the endplate not being able to support the stress of the cage, decreasing the force per unit area should lead to less endplate failures and cage subsidence. However, there is not yet enough experience with this type of implant to know if it will work as a stand-alone device. If more support can be gained with design, it will also be a more effective way of distracting the disc space to relieve nerve root compression in the foramen (indirect nerve root decompression).

At this time there is not one best anterior device, and some surgeons may use multiple different devices in different situations.

Cages Risks and Potential Complications

The risks and possible complications of inserting an anterior lumbar cage would include all the