Better Results with Spinal Fusion: How and Why?

For a very long time, spinal fusion was the answer to chronic low back pain. But with time, surgeons were also able to see that once the spine was fused, load transferred to the next segment caused degeneration there as well. They call this phenomenon: adjacent segment degeneration (ASD). Many solutions to the problem of ASD have been proposed.

The use of artificial disc replacement has been one way to approach the problem. The hope is to preserve spinal motion while protecting the adjacent vertebral levels. But when comparing the results between spinal fusion and disc replacement, there hasn't been an overwhelming benefit shown for disc replacement over spinal fusion.

For that reason, some surgeons continue to look for ways to improve results of spinal fusion. They have tried different fusion techniques. They have analyzed patient factors looking for ways to identify patients who would benefit the most from spinal fusion.

In this study from Denmark, surgeons looked at the rate and extent of adjacent segment degeneration after lumbar spinal fusion for two different groups. Group one had a lumbar fusion at one level using the posterolateral approach.

Posterolateral means the surgeon fused the two segments together by coming into the area from the back and slightly off to the side. The results of posterolateral fusion (PLF) were compared to the second group who had a PLF combined with an anterior lumbar interbody fusion (ALIF).

In the ALIF procedure, the surgeon works on the spine from the front (anterior) and removes a spinal disc in the lumbar spine. The surgeon inserts a bone graft into the space between the two vertebrae where the disc was removed (the interbody space).

Previous studies have already shown that PLF + ALIF yields better results compared with PLF alone. In this study, they took a closer look at the results trying to find out why anterior column support provided by the ALIF makes a difference.

They used MRIs to examine the discs looking for any signs of degeneration, herniation, stenosis (narrowing of the spinal canal), and endplate changes. Stenosis occurs when a herniated disc pushes into the spinal canal reducing the space available for the spinal cord. The endplate is a circular-shaped piece of cartilage located between the disc and the vertebral bone.

With disc degeneration, the endplate can get damaged as well. Sometimes with the loss of cushioning (normally provided by an intact disc), the increased pressure between the two vertebral bones exerts enough force to push the endplate up into the bone. Imaging studies detect these kinds of changes.

Patient characteristics were also collected as data and analyzed for possible factors affecting degeneration of the segments adjacent. Maybe developing adjacent segment degeneration (ASD) after lumbar fusion is really a matter of how old you are when you have the surgery. Or perhaps lifestyle choices are the key (smoking, exercising, obesity) to unlocking why ASD develops in the first place.

Everyone in the study was treated at the same spinal center. They were all between the ages of 20 and 65 years old. They were randomly selected to be in either group one or group two. There were an equal number of patients (73) in each group.

In addition to X-rays and MRIs as outcome measures, the patients filled out a number of different questionnaires designed to provide information on mental and physical health as well as before and after measures of symptoms, function, patient satisfaction, and quality of life.

They found that almost everyone in both groups had some evidence of adjacent segment degeneration (ASD). And two-thirds of those patients had signs of ASD at more than one level. Disc degeneration and disc herniation were the most common signs of ASD.

Endplate changes were seen in one-fourth of the total group (group one and group two). Endplate changes were most likely to occur at the first adjacent level and were always linked with disc degeneration. That makes sense since endplate changes seem to be a late event in the degeneration process. They are rarely seen without associated disc disease. And endplate changes at the first adjacent level were always more severe than changes seen two or three levels away from the fusion site.

For patients who did not have any changes in disc height over time, it became apparent that age was a factor. It was always the younger patients whose disc spaces remained intact and older adults who had obvious signs of disc narrowing.

What was the take-home message from this study? First, adjacent segment disease (ASD) is common after spinal fusion. But this phenomenon is not yet directly linked to the fusion procedure. It's possible that these same patients would have experienced just as much ASD if they had not had the surgery.

Second, anterior fusion does increase support to the spinal column and results in better overall outcomes. The exact factors that contribute to these improved results remain unknown. And third, (older) age is a definite risk factor for ASD.

In summary, surgeons are trying to find ways to improve patient outcomes following spinal fusion. Taking into account patient risk factors and surgical techniques, this study was still unable to explain the superior results in patients who have lumbar spinal fusion using a combined PLF + ALIF approach.

For the moment, it does not look like ASD is accelerated by spinal fusion -- it would have happened anyway. Surgeons will continue to study this problem looking for clear explanations and solutions to the problem of ASD.

Reference: Tina S. Videbaek, MD, et al. Adjacent Segment Degeneration After Lumbar Spinal Fusion: The Impact of Anterior Column Support. In Spine. October 15, 2010. Vol. 35A. No. 22. Pp. 1955-1964.