Anterior Cervical Discectomy—Outcomes and the Future

a report by
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Anterior cervical discectomy and fusion (ACDF) with or without decompression is a well-established surgical treatment for spine patients with the appropriate indications. It has enjoyed a long history of success, and it certainly has withstood the test of time. The indications for ACDF are for patients with acute disc herniation, chronic (or hard disc) herniations, stenosis (either foraminal with nerve root compression, or central with spinal cord compression, or both), or even axial neck pain. The vast majority of these patients will undergo extensive non-operative treatment prior to an ACDF, typically with pharmacological, physical therapy and/or chiropractic, passive and active modalities and spinal steroid injections, or even alternative treatments. Physical examination and advanced imaging studies (magnetic resonance imaging or computed tomography/myelography) can help isolate specifically affected nerve roots and disc levels and differentiate symptoms due to facet syndrome, myofascial conditions or shoulder conditions.

Additional diagnostic procedures such as spinal steroid injections and electromyogram when combined with imaging studies are often helpful in confirming that neck symptoms are indeed related to a surgical condition of the cervical spine. The timing of treatment after initial presentation to the spinal surgeon often depends on the severity of symptoms and/or neurological deficit, or potential of neurological deficit. For example, a patient with acute disc herniation with pain predominately, but minimal neurological deficit, can often undergo additional non-operative treatment; whereas the patient who is myelopathic, but with minimal pain symptoms will be recommended to have early surgical treatment.

Traditional ACDF is performed using an anterior approach to the cervical spine and may be either right or left-sided. Surgeons have their own preference for which side they approach. Removal of the disc, as well as osteophyte-producing stenosis, are typically done under magnification. A fusion is then performed using traditional iliac crest bone graft, or bone graft alternatives. Owing to poor clinical outcomes related to pseudarthrosis (lack of fusion healing), instrumentation (see Figure 1) is now commonly used particularly when multiple levels are being treated.

Outcomes performed at the author’s institute with a 6–10 year follow-up have demonstrated a high degree of success in ACDF patients.9 Outcomes were measured using a neck and arm pain visual analog scale (0–100) with 100 being the most severe pain), pain drawings, Oswestry or neck disability scale (0–100 with 100 indicating severe disability), as well as use of pain medication and patient’s self-assessment of treatment success. For our study of 146 patients with 6–10 year follow-up, there was significant improvement at all follow-up periods for all scales relative to pre-operative scores (see Figure 2). The use of narcotic pain medication decreased substantially, but many patients still used non-steroidal anti-inflammatory medications long-term. Success ranged from 89–92%. Over the long-term, approximately 17% of the patients required additional surgery. The pseudoarthrosis rate was 13% and was highly correlated with patients who were smokers; this has been previously reported. Another common reason for additional procedures was for adjacent segment degeneration either above or below the patient’s index ACDF. The rate for surgical treatment of adjacent conditions was 8%.

Variations of traditional ACDF using iliac crest bone autograft have included a number of alternatives of which allograft bone is most common. This avoids pain at the iliac bone graft donor site. Bone graft donor site pain varies considerably amongst reports (10–50%). The author has found that reconstruction of the bone graft site has led to elimination of bone graft site donor pain in the vast majority of the patients. Allograft bone, however, is slow to heal and has a higher pseudoarthrosis rate, particularly when multiple levels are treated. The author has found the most common reason for cervical spine revision surgery is treating a pseudoarthrosis in which an allograft was used for ACDF performed elsewhere.

The use of instrumentation seems to improve the rate
of allograft healing, but it is still inferior to that used for autograft. Autograft healing is not only superior, but also occurs over a short period of time, and thus, post-operative bracing can be reduced in patients treated with an autograft. Another alternative is to use bone morphogenic protein. A number of studies have now demonstrated that bone morphogenic protein reliably leads to a solid fusion. Bone morphogenic protein is used in an off-label fashion and has a high risk of neck swelling and dysphagia. This is typically temporary and may be improved with the use of steroids, but occurs in between one-half and two-thirds of patients. The author has used bone morphogenic protein in a selected group of ACDF patients with a high rate of success in terms of fusion and outcomes over a two-three year follow-up period. Other authors have experienced severe complications with the use of bone morphogenic protein, and thus, it is not recommended for routine cases and should be used only with careful monitoring and specific consent from the patient regarding its off-label use.

Another variation on traditional ACDF is the use of bioresorbable plates in lieu of metallic plate instrumentation. Biomechanical testing of the plates for one-level ACDF has shown that the stability of the construct is inferior to that of the metallic plates, but still sufficient for patients with healthy bone and who are compliant with a post-operative bracing program. Early clinical results have been promising, and all patients treated by the author have experienced substantial improvement in symptoms similar to those treated with metallic plates.

As noted above, one reason for a re-operation on ACDF patients is for adjacent segment syndrome, which is, in part, due to stress on the adjacent segments after an ACDF as well as inherent aging and degeneration of these levels. Cervical spine arthroplasty (disc replacement) is now on the horizon and may have the potential to decrease adjacent segment degeneration. However, the stability of these devices is also by no means perfect and some have migrated. Others have the potential for heterotopic bone formation. Some have also resulted in malalignment. The optimal device has yet to be developed.

The author’s opinion is that cervical disc replacement will not replace ACDF for all cases. The author expects that the most common scenario in the future will be to do disc replacement at the adjacent level to an old ACDF for the treatment of adjacent segment degenerative disc disease, or use disc replacement in a ‘hybrid’ procedure in which one of multiple levels is treated with a disc replacement, and the other levels are treated with traditional ACDF.

In summary, ACDF continues to enjoy a high degree of success when used for the appropriate indications. However, there is still room for improvement and this remains an active area of research and development.

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