Cervical arthroplasty complicated by delayed spontaneous fusion

Case report

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The authors describe the case of a 55-year-old woman who presented with a left C-6 radiculopathy and neck pain and in whom there was evidence of disc/osteophyte compression of the left C-6 nerve root. The patient underwent a C5–6 anterior cervical decompression and placement of a Bryan disc prosthesis. More than 7000 cervical discs have been inserted worldwide. Postoperatively, dynamic imaging demonstrated loss of motion at the instrumented level. The patient suffered persistent neck and arm pain that was slow to resolve. Seventeen months after the initial surgery osseous fusion was observed across the interspace and posterior surface of the prosthesis. This is the first documented case of fusion occurring at the level at which cervical arthroplasty had been performed. The precise reason for this phenomenon is unclear, but potential contributing factors include patient-related issues, poor motion due to neck pain, or possibly implant-related issues. To date, this is an exceedingly rare complication and warrants careful and prolonged follow up of all arthroplasty-treated cases.

KEY WORDS • arthroplasty • Bryan disc • cervical myelopathy • fusion • stenosis

NTerior cervical decompression is a recognized treatment for myelopathy or radiculopathy due to cervical disc herniation. The procedure is usually followed by interbody fusion with or without placement of instrumentation. Cervical anterior interbody fusion is widely accepted as a means of reducing normal cervical spine motion and increasing the stress at adjacent levels. Hilibrand, et al., confirmed a 2.9% annual rate of adjacent-segment disease in patients who have undergone anterior interbody fusion. As a result of this, attempts have been made to reconstruct the intervertebral disc space by using a prosthesis that preserves motion while allowing adequate neural decompression. A number of such prostheses have been devised in an effort to achieve this aim. The Bryan Cervical Disc Prosthesis (Medtronic Sofamor-Danek, Memphis, TN) is one such cervical intervertebral disc, designed to permit motion similar to that of the normal cervical spinal unit. Until now there have been no reported cases of fusion occurring despite implantation of the Bryan disc. We present the first such case and discuss its possible causes.

Case Report

Presentation and Examination. This 55-year-old woman presented with a 3-month history of neck pain after undergoing chiropractic manipulation. This was accompanied by paresthesia in the left arm, affecting the thumb, lateral two fingers, and the lateral aspect of the forearm, which initially responded to conservative therapy but recurred with C-6 weakness. Her general health was otherwise excellent. On examination the left biceps and supinator jerk reflexes were absent; however, tone, power, and pin-prick sensation were normal. Magnetic resonance imaging demonstrated C5–6 osteophytic bar and disc protrusion and consequent compression of the left C-6 nerve root (Fig. 1). Dynamic radiography revealed preservation of normal motion at this level (Fig. 1 center and right). Because of her persistent weakness, an anterior decompression was offered as was the potential for implantation of an artificial disc. It was explained that this procedure was relatively new, experimental, and that its long-term outcome has yet to be determined. She requested surgical intervention.

Operation. The patient was brought to the operating room and general anesthesia was induced. A transverse skin incision was made on the left side of the neck after fluoroscopic localization. A standard extensive exposure of the C-5 and C-6 VBs was conducted. A routine C5–6 discectomy was performed, with removal under microscopic magnification of the posterior longitudinal ligament and a thorough decompression of both foramina at this level. Using the Bryan Cervical Disc System, a 14-mm Bryan disc was inserted. Blood loss was minimal, and the entire procedure was performed in 95 minutes. There

Abbreviation used in this paper: CT = computerized tomography.
were no immediate postoperative complications. Static radiography and CT scanning demonstrated adequate placement of the prosthesis. On initial dynamic imaging, however, no movement was noted at the C5–6 level (Fig. 2). She was discharged on antiinflammatory medication after 72 hours; although some residual neck and arm pain remained, this was an improvement over her presenting symptom.

Postoperative Course. The patient continued to complain of neck pain after the procedure, with variable improvement in her arm symptoms. She was neurologically intact. She continued to take antiinflammatory medication. Her response to physical therapy did not involve dramatic reductions in postoperative symptoms. She underwent serial radiological and clinical follow-up examinations. Movement was not demonstrated radiologically at the C5–6 level. She continued to complain of neck and arm symptoms that were better than her preoperative symptoms but not completely resolved. Seventeen months after surgery, plain radiography and CT scanning demonstrated bone bridging at the C5–6 interspace posteriorly adjacent to the arthroplasty site. Spondylotic lipping at the C4–5 and C6–7 levels also appeared to have progressed (Fig. 3). This was explained to the patient, who was happy with her degree of pain relief and motion, and further interventions were declined.

Discussion

Intervertebral disc replacement in the cervical spine is a relatively new procedure that has really only been available since the 1980s. Recently Wigfield, et al.,17 reported 2-year follow-up data obtained in patients in whom Prestige discs (Medtronic Sofamor-Danek) were placed. This device is composed of a stainless steel ball-and-socket mechanism to maintain motion. At 2 years postoperatively the mean angulation of the motion segment decreased from the preoperative level of 7.5 to 6.5° in 15 patients. The range decreased from 1 to 15° with up to 2 mm translation noted. Motion was observed at all treated levels and no spontaneous fusions occurred. Goffin and colleagues7 reported on a much larger group of patients who underwent implantation of the Bryan disc. This implant consists of a polyurethane nucleus designed to fit between two titanium-alloy shells. The majority of the 97 patients with radiculopathy (93%) underwent one-level anterior cervical decompression and placement of the Bryan disc. At 12 months the clinical success rate ranged between 85 and 90%. No subsidence of the devices was noted, but in two patients there was the possibility of device migration. Range of motion was between 1 and 21° (mean 9°). Using their motion-related criteria (> 2° of dynamic angulation indicating motion), at 6 months 94% and at 12 months 88% of patients exhibited motion at the instrumented level. No spondylotic bridging occurred at the implanted disc space and no spontaneous fusions were documented. Finally Sekhon15 more recently described seven patients presenting with cord compression and/or clinical myelopathy, in whom cervical arthroplasty was successful. During a follow-up period of up to 17 months all patients maintained motion (based on the criteria established by...
Cervical arthroplasty

Goffin and colleagues) and no spontaneous fusions occurred.

Cervical spine motion occurs at both the interbody region and the facet joints. The goal of fusion is typically to stop motion at either one or both of these regions. Loss of motion either anteriorly or posteriorly can lead to subsequent ankylosis at the other motion center. The assessment of motion can be difficult. In their original arthroplasty study, Goffin and colleagues’ defined the presence of flexion–extension motion as more than a 2° difference in angulation of the intervertebral disc space. Cannada, et al., 1 recently described an alternative method to diagnose pseudarthrosis after spinal fusion. They suggested that if the interspinous distance increases by more than 2 mm during flexion–extension, motion is present. This method seems to be more reliable because it takes into account the greater distance from the interbody region of the spinous process tips, which magnifies any subtle movement. Using this method, clear preoperative fanning of the spinous processes in our case was present but was absent immediately postoperatively. The reasons for this are uncertain but could be the result of patient- or prosthesis-related causes. The latter cause would encompass potential overdistraction of the facet joints that would take motion away. The Bryan disc is uniform in height, which may cause problems in small-boned individuals. This loss of motion may have led to eventual ossification of residual hematoma or alternatively, in this patient’s case, abnormal ossification may have predisposed her to bridging bone developing in a scenario in which progression to ossification would not have occurred in most individuals. It is also conceivable that the prosthesis used for this patient failed and therefore ceased to allow motion, functioning rather as an unconstrained interbody spacer.

McAfee and associates13 reported that heterotopic ossification occurs in 2 to 53% of hip arthroplasties. They commented that heterotopic ossification after hip arthroplasty occurs most readily in the hypertrophic type of osteoarthritis and that the true incidence after lumbar arthroplasty is unknown. Using their four-tiered classification system, our case would be classified as Class 4—complete ankylosis and bridging bone. Recently, Heller, et al., 2 examined heterotopic ossification after cervical arthroplasty. They noted that in most cases ossification occurred in the first 100 days of surgery. Typically, it was observed lateral to the vertebral bodies and could potentially be reduced through the judicious use of antiinflammatory medica-

tions postoperatively. Interestingly, in our case, ossification did not develop laterally and occurred despite a course of antiinflammatory medication 17 months after surgery.

In the lumbar spine spontaneous fusion after arthroplasty has been demonstrated. In a series of 96 patients undergoing implantation of the Link SB Charité III lumbar disc David2 reported on five patients in whom complete ossification developed around the implant.

Conclusions

Bryan disc–assisted cervical arthroplasty is a promising treatment for cervical disc disease. With preservation of motion at the diseased level, the incidence of adjacent-segment disease and its associated problems may be reduced. It is important that careful long-term follow-up study be completed to ensure that complications such as spontaneous fusion, albeit rare, are detected.

Disclosure

Dr. Sekhon is a consultant for Medtronic Sofamor-Danek and Stryker Spine.

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