Less exposure surgery for multilevel anterior cervical fusion using 2 transverse incisions

Technical note

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Multilevel anterior cervical fusion often necessitates a large extensile incision for exposure and substantial retraction of the esophagus for placing long plates, potentially predisposing patients to complications such as dysphagia, dysphonia, and neurovascular injury. To the authors’ knowledge, the use of 2 incisions as an option has not been published, and so it is not intuitive to young surgeons or widely practiced. In this report, the authors discuss the advantages and raise awareness of using 2 incisions for multilevel anterior cervical fusion, and they document a safe skin bridge length. They also describe the advantages of using 2 incisions for performing multilevel anterior cervical fusion either at contiguous or noncontiguous levels as in adjacent-segment disease. By using the 2-incision technique, the authors made the surgery technically easier and diminished the amount of esophageal retraction otherwise needed through 1 long transverse or longitudinal incision. A skin bridge of 3 cm was safe.

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Key Words • cervical spine • incision • fusion • dysphagia • minimally invasive surgery • less exposure surgery • plate

Anterior cervical fusion has been shown to be a successful and often preferred treatment option in the surgical management of cervical radiculopathy and cervical spondylotic myelopathy.1,2,6,9,11,12 However, treatment for multilevel disease often necessitates an extensile incision, and depending on the situation, may require substantial esophageal retraction and exposure through previous scar tissue. This is most evident in the case of noncontiguous diseased levels as in adjacent-segment disease above and below a previous fusion. Patients with this condition can be predisposed to approach-related complications such as dysphagia and dysphonia (Chin KR, Yu W, Riew KD, presentation to the Cervical Spine Research Society 34th Annual Meeting, 2006).9

A 2-incision technique has been developed in total hip arthroplasty as a minimally invasive surgical treatment option to limit soft-tissue exposure and injury.1–5,10 A similar approach may be an effective technique for multilevel cervical spine fusion to limit simultaneous soft-tissue retraction and exposure and the possible associated complications.

This technique may already be in use by some surgeons, but it is not intuitive to all surgeons, and it is also not widely practiced. Therefore, this report would serve to be the first documentation in the literature of the use of 2 contiguous incisions for multilevel anterior cervical decompression and fusion with the goals of learning the benefits, increasing awareness, describing potential indications, and describing 2 illustrative cases. We will also document a safe skin bridge distance between the 2 incisions in the neck.

Case Reports

Case 1

History and Examination. This 52-year-old man, a nonsmoker, was referred to our hospital for consultation for axial neck pain and radiculitis. The patient had a history of ACDF at the C4–5 level 10 years earlier and at the C5–6 level 7 years earlier. The patient noted a fall approximately 14–15 months prior to presentation, with the onset of neck and arm pain at that time that had recently worsened. The neck pain was moderate to severe

Abbreviation used in this paper: ACDF = anterior cervical discectomy and fusion.
Two cervical incision technique

in intensity, with radiating symptoms into both his arms and hands, including numbness and tingling in the hands.

On physical examination, a well-healed transverse incision from the patient’s prior surgeries was noted on the anterior neck. Notable findings consisted of stiffness and pain in his neck through all ranges of motion, including flexion-extension, lateral bending, and rotation. Motor strength testing in both upper extremities demonstrated 5/5 strength in the trapezius and deltoid muscles bilaterally, 4+/5 strength in the biceps and triceps bilaterally, and 5/5 strength in the remaining muscles distally.

Plain radiographs, MRI studies, and CT myelograms of the cervical spine were available for review at the time of the patient’s visit. Radiographs revealed a well-healed in situ fusion mass at the level of C4–6 with degenerative disc disease at the C3–4 and C6–7 levels (Fig. 1). Magnetic resonance imaging confirmed evidence of degenerative disc disease at the C3–4 level, with a small central disc protrusion at this level, and showed more severe degenerative disc disease at the C6–7 level, with Type I Modic changes and a central disc protrusion at this level. Computed tomography myelography demonstrated similar findings.

Despite more than 6 months of nonoperative treatment, such as physical therapy and nonsteroidal antiinflammatory medications, the patient’s symptoms continued to worsen, and the decision was made to proceed with operative intervention to address his adjacent-level disease at the C3–4 and C6–7 levels, which was thought to be the source of his axial pain and radiculopathy. The patient had previously seen a surgeon who recommended an ACDF at the C6–7 level but that C3–4 should be fused posteriorly, to avoid a long extensile incision to address both levels anteriorly through the previous scar, with a significant risk of dysphagia and dysphonia. We thought that both levels could be addressed anteriorly without extensive dissection or an increased risk of complications by using a 2-incision technique, sequentially treating 1 level at a time. An ACDF was therefore planned at the C3–4 and C6–7 levels using 2 transverse incisions with tricortical iliac crest autograft by the primary author (K.R.C.). The patient was informed and consented to have information concerning his treatment submitted for publication.

Operation. The patient was positioned supine on the operating table, with his neck placed in hyperextension and a bump placed under his left hip for the iliac crest donor site. Both the anterior neck and left hip were prepared and draped in sterile fashion. The 2 transverse incisions were marked at the appropriate levels with a skin bridge of 3 cm between them (Fig. 2). A standard anterolateral cervical approach was performed through each incision. The upper incision was made at the C3–4 level, measuring 3.5 cm transversely from the midline to the left side of the neck. An ACDF was completed at this level before making a second incision at the level of C6–7, measuring 3.7 cm transversely. Significant scar tissue was encountered during the exposure, but we avoided even more of the scar by using 2 incisions.

After completion of both ACDFs, each incision was closed in the usual fashion, and the skin bridge between the 2 neck incisions was again measured to be 3 cm. Sterile dressings were placed over the incisions, and the patient was placed in a hard cervical collar. The Penrose drain was removed on the 1st postoperative day.

Postoperative Course. At the 2-week follow-up visit, the patient noted minimal neck pain with only infrequent symptoms in his arms and hands. He denied symptoms of dysphagia, dysphonia, or graft donor site pain. Motor strength was 5/5 throughout both upper extremities with intact sensation. At the 6-week follow-up, the patient continued to do well with minimal neck pain, occasional numbness in his hands, and a stable physical examination. The neck incisions were well healed. The upper incision contracted to 2.5 cm and the lower incision to 2.8 cm. The skin bridge between them measured 3.6 cm. Radiographs showed healed fusions at the C3–4 and C6–7 levels, with a complete fusion mass from C3 to C7 (Fig. 3). The hard cervical collar was discontinued, and the patient was given a soft collar for comfort. At the 6-, 12-, 24-, and 30-month follow-up visits, the patient continued to do well, with radiographs again showing healed fusions and good alignment of the cervical spine.

Case 2

History and Examination. This technique was also used in a 72-year-old man on renal dialysis who underwent prior C3–6 laminectomies and developed postlaminectomy kyphosis. Severe breakdown at C6–7 resulted in a chin-on-chest deformity (Fig. 4), anterior spinal cord compression, and cervical radiculomyelopathy manifested as clawing of the fingers, unsteady gait, clumsiness and numbness in all fingers of both hands, and markedly positive Hoffman reflexes bilaterally. The patient noted worsening myelopathy and progressive visual field loss due to
his chin-on-chest deformity. Therefore, a staged anterior-posterior decompression and fusion was planned.

Operation. Given the patient’s metabolic disease and predisposition to pseudarthrosis or failure of posterior-only instrumentation, the primary author (K.R.C.) chose to perform anterior fusion at the top of the posterior construct at C3–4 and also at the apex of the patient’s deformity at the C6–7 level where there was anterior wedging. Tricortical iliac crest autograft bone and cervical plates (Synthes) and 2 incisions were used sequentially as described above.

Postoperative Course. The patient had no incision-healing or approach-related complications or dysphagia postoperatively. He was happy with his straightened cervical spine, self-image, and diminished myelopathic symptoms. He showed radiographic fusion at 8 weeks (Fig. 5). His wife informed us he died within 3 months postoperatively of a pulmonary embolus from his right arm that contained the port for his renal dialysis treatments.

Discussion

Performing less exposure surgery as described in these 2 cases has the potential advantages espoused by minimally invasive techniques for the surgical management of cervical spondylosis and radiculopathy. The use of 2 incisions to address multilevel anterior cervical fusion at either contiguous or noncontiguous levels allowed us to minimize the incision length, exposure, and the amount of simultaneous esophageal retraction, potentially decreasing the risk of dysphagia, dysphonia, and neurovascular injury.

In Case 1, the technique addressed noncontiguous levels (C3–4 and C6–7) with symptomatic adjacent-segment disease by anterior fusion alone, while avoiding a large extensile incision anteriorly or the need to potentially perform one or both fusions posteriorly. The patient had no incision-healing or approach-related complications, dysphagia, dysphonia, or neurovascular injury postoperatively. We therefore recommend this technique in cases of symptomatic degenerative disease at noncontiguous levels.

While the benefits of the 2-incision technique are clearer for multilevel anterior cervical fusions at noncontiguous levels, the technique may also be a valuable technique when attempting multilevel anterior cervical fusion over 3 or more contiguous levels. When performing ACDF with long anterior plating through a single incision, extensile esophageal retraction is needed over an extended period, and difficulty may arise in adequately visualizing the superior and inferior extent of the plate within a single wound, potentially compromising plate placement and necessitating a larger incision and more exposure.
prolonged and vigorous retraction. With the 2-incision technique, the superior and inferior extent of the planned fusion is well exposed, allowing both ends of the plate to be visualized simultaneously to ensure correct screw placement (Fig. 6). As in the second case described in this report, the 2-incision technique may be used to stabilize the superior segment and the cervicothoracic segment anteriorly to support the posterior construct during long posterior fusions such as for an osteotomy. With cervical disc replacements, the 2-incision technique may also become useful for noncontiguous disc replacements for which precision is required for adequate placement.

One of the limitations of this report is that since much of the dissection in anterior cervical approaches is anatomical, soft-tissue morbidity is relatively minimal in most cases. In addition, the total incision length in Case 1 was 7.2 cm, which might be very similar to the length one would have used if a single transverse or longitudinal type of incision were performed. The surgeon and the assistant could close both incisions simultaneously to save time. Finally, we have not demonstrated that using this technique will ensure all patients will benefit from the proposed advantages.

Conclusions

This newly described 2-incision technique can be added to the armamentarium of surgical techniques for performing multilevel anterior cervical fusions. Although the 2-incision technique is simply a repeat of the standard Smith-Robinson anterior cervical approach, it was not intuitive to use 2 incisions in instances similar to those described above prior to this report, and therefore we believe it is valuable information that should be disseminated to other surgeons. The potential advantages include less extensile esophageal and soft-tissue retraction, improved cosmesis over an oblique extensile incision, and improved visualization of the ends of plates for placement. We documented a 3-cm skin bridge as safe between the 2 incisions, and it seems our patients had no difficulties with dysphagia, mastication, or phonation.

Given the limitations discussed, prospective studies may better define the risks and benefits of this procedure in comparison with more traditional techniques and determine whether a skin bridge smaller than 3 cm is safe.

Disclosure

Dr. Riew has direct stock ownership in Osprey, Expanding Orthopedics, Spineology, Spinal Kinetics, Amedica, Nexgen Spine, Vertiflex, Benvenue Medical, Inc., Paradigm Spine, and PSD. He also holds patents with Medtronic Sofamor Danek and Osprey.

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