Limiting fusion levels by combining anterior cervical decompression and fusion with posterior laminectomy: Technical note

Kingsley R. Chin^{a,b,d,e,*}, Fabio J.R. Pencle^{c,d}, Juan M. Valdivia^{c,f}, Jason A. Seale^{c,d},
Josue P. Gabriel^{c,g}

^a Herbert Wertheim College of Medicine at Florida International University

^b Charles E. Schmidt College of Medicine at Florida Atlantic University

^c Less Exposure Surgery (LES) Society, 350 Main St., Malden, MA 02148

^d Less Exposure Surgical Specialists Institute (LESS Institute), 3816 Hollywood Blvd. Ste #102, Hollywood, FL 33021

^e University of Technology, Jamaica, WI

^f BayCare Medical Group, 2727 West Dr. Martin Luther King Jr. Blvd. Suite 460, Tampa, FL 33607

^g Spine Institute of Ohio, 3535 Fishinger Blvd, Suite 280, Hilliard, OH 43026

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ABSTRACT

Background: Authors aim to report on the outcomes of combining selective anterior cervical decompression and fusion (ACDF) with laminectomy in patients with cervical spondylotic radiculomyelopathy (CSR).

Methods: 10 patients with ACDF and posterior laminectomy reviewed.

Results: 60% female population, mean age 61 ± 3 years, mean BMI 24.7 ± 3.4 kg/m². VAS and NDI showed significant improvement, $p < 0.001$, $p = 0.02$ respectively. Mean PCS 31.9 ± 2.7 , MCS 38.9 ± 3.4 improved to mean PCS 42.2 ± 5.1 , MCS 51.0 ± 4.7 , $p = 0.09$ and 0.06 respectively. At final follow up fusion rate was 90% and all patients had Nurick Grade 0.

Conclusion: In this pilot study, procedure shown to be safe with improved symptoms.

1. Introduction

Surgical decision-making can be challenging for patients with multilevel cervical spondylotic radiculomyelopathy (CSR).¹ Through anterior, posterior or a combination of both approaches, surgery can maintain mechanical stability and achieve adequate decompression.^{2–6} Anterior approaches include anterior cervical decompression and fusion (ACDF), corpectomies, or both, while posterior approaches include laminectomies with lateral mass fusion or laminoplasty.^{7,8} When there is substantial axial neck pain and/or kyphosis, anterior fusion or posterior laminectomies, or a combination thereof are recommended and laminoplasty is contraindicated.⁹

We examined the feasibility and outcomes of combining ACDF with limited posterior laminectomy to treat patients with axial neck pain, diminished lordosis and canal stenosis. To our knowledge this is the first paper to detail this approach.

2. Materials and methods

We reviewed the medical records of 10 consecutive patients, with clinical and radiographic evidence of CSR due to multilevel spinal and

foraminal stenosis (Fig. 1), in which ACDF with multilevel laminectomy was performed. Outcome measures included Visual Analogue Scale (VAS) scores for neck and arm pain, Nurick grade, Neck Disability Index (NDI) and Physical and Mental Composite Scores (PCS and MCS) of the Short Form 12 (SF-12) health survey. Patients failed at least six months of conservative therapy and preoperative narcotics were discontinued.¹⁰ IRB approval was obtained for the study as part of a cohort population. This was a multicenter, multisurgeon study that had experience in performing each procedure separately and combined. The follow up period for this study was two years.

2.1. Less exposure surgery method

2.1.1. Anterior cervical discectomy and fusion

2.1.1.1. Positioning. Patient is placed supine on operative table. A bolster was placed beneath the shoulders and the neck was allowed to assume a natural lordotic position. The head was supported to prevent over extension. The patient's arms were then pulled on the side and tucked.

2.1.1.2. Incision. A transverse midline skin incision approximately

* Corresponding author at: Less Exposure Surgery Specialists Institute, 3816, Hollywood Blvd. Ste #102, Hollywood, FL, 33021, United States. Tel.: 844 537 7362; fax: 877 647 7874.
E-mail address: kingsleychin@thelessinstitute.com (K.R. Chin).

Fig. 1. MRI demonstrating cervical spondylotic radiculomyelopathy A: Sagittal, B Axial.

Fig. 2. X-ray showing postoperative ACDF and laminectomy A: AP, B lateral.

1–1.5 inches long is made.

2.1.1.3. Exposure. Dissection was carried in a cephalad and caudal direction to allow sufficient mobility to the skin. The platysma was preserved and dissected around the lateral edge. Exposure performed through an avascular space to prevertebral fascia. Once the spine was palpable, a bent 18-gauge spinal needle used to identify correct disc

space. Lateral fluoroscopic views were used to confirm location.

2.1.1.4. Discectomy. Discectomy is performed using various instruments. High speed burr and Kerrison ronguers are used to perform total discectomy and bilateral foraminotomies. Bone wax is placed to all bony defects for hemostasis. The endplates are prepared and an adequately sized PEEK interbody device (Arena-C, SpineFrontier

Fig. 3. MRI demonstrating improvement of CSR A: Sagittal, B Axial.

Inc, Malden MA) is measured, packed and placed into the disc space.

2.1.1.5. Fusions. Fusion is aided with demineralized bone matrix and an anterior cervical plate (Inset Plate, SpineFrontier Inc, Malden MA) with screws. Adequate hemostasis achieved and a Penrose drain placed. Closure performed in layers.

2.1.2. Posterior laminectomy

2.1.2.1. Positioning. Patient is placed prone on operative table in the reverse trendelenburg position. The use of fluoroscopy was used to prevent wrong level spine surgery with the aid of a 20 gauge needle to locate the correct level.^{11–13}

2.1.2.2. Incision. A midline vertical incision through the skin is made.

2.1.2.3. Exposure. Dissection was carried in a cephalad and caudal direction through the subcutaneous layer down to the posterior fascia layer. The rectus spinal muscles are elevated laterally to expose to the spinous process of the appropriate levels.

2.1.2.4. Laminectomy. Laminectomy is performed using Kerrison ronguers to expose dura at most affected levels limiting to three levels. Compressive ligamentum flavum is removed if indicated. Bone wax is placed to all bleeding edges for hemostasis. Wound is irrigated and a hemovac drain is placed and closure performed in layers. Postoperative X-Ray were performed at 6 week follow up (Fig. 2).

2.1.2.5. Statistical analysis. Statistical analysis was performed using SPSS v22 (IBM corporation, New York, USA). A student T-test was used for continuous expressed as means with standard error. Tests were considered significant if $p < 0.05$.

3. Results

Females represented 60% of the patients in study. Mean age was 61 ± 3 years and mean body mass index 24.7 ± 3.4 . The mean estimated blood loss was 209 ± 59 mls combined and the mean operating time was 173 ± 35 mins

There was reduction in VAS score by 4 points in all patients at final follow up of two years. Mean preoperative VAS scores of 8.1 ± 1.0 reduced to 1.9 ± 0.8 postoperatively, $p < 0.001$. Mean preoperative NDI scores of 60.1 ± 7.6 reduced to 30.4 ± 7.7 postoperatively, $p = 0.02$. 80% of patients presented with Nurick grade I and the other 20% Nurick II and at final follow up all patients had Nurick Grade 0.

QoL assessment using SF12 demonstrated overall improvement in PCS and MCS.

Preoperative mean PCS 31.9 ± 2.7 and MCS 38.9 ± 3.4 showed clinical significant improvement postoperative mean PCS 42.2 ± 5.1 and MCS 51.0 ± 4.7 , $p = 0.09$ and 0.06 respectively. Radiographic MRI demonstrating improvement in stenosis (Fig. 3). Overall fusion rate¹⁴ for primary surgery was 90%. One male patient developed adjacent segment disease, diagnosed clinically after history of persistent pain and CT radiograph confirmation. Patient subsequently underwent revision surgery after 6 months of failed improvement.

4. Discussion

This study aimed to demonstrate the feasibility of a combined anteroposterior approach for circumferential decompression in patients with multilevel cervical spondylotic radiculomyelopathy. There was statistically significant improvement in VAS and NDI scores with clinical improvement in patient overall health and mental status.

Cervical spondylotic radiculomyelopathy has a variety of treatment options for single as well as multilevel disease.^{1,4,7,15,16} The benefits of laminoplasty for multilevel CSR have been well established.^{9,17} Contraindications to stand-alone laminoplasty are moderate to severe

preoperative neck pain and kyphotic deformity.^{2,9} The ultimate goal of this technique is to achieve maximal circumferential decompression, improved outcomes, stability and alignment with the least extensive procedure to the patient. As a result, our patients were not exposed to the potential risks associated with a multilevel anterior construct including pseudarthrosis, hardware failure or adjacent segment disease.^{3,18} The 5-laminae (C3-7) procedure of laminoplasty is the most popular technique used.^{19–21} However, in a prospective study conducted by Hosona et al.²² demonstrated a statistically significant decrease in the incidence of axial neck pain. This was achieved by reducing the number of segments treated from C3-7 to C3-6.²² Studies have demonstrated the complication of laminectomy is development of kyphosis.^{23,24}

As the literature expands on techniques of treating CSR. The authors report no biases but acknowledge the limitation of small sample size and retrospective nature of study. There was also lack of a control group due to the complexity of surgery.

However, despite these limitations, we note this can be an alternative technique in the treatment for cervical spondylotic radiculomyelopathy.

5. Conclusion

The use of less invasive technique to focus on the affected segment to achieve adequate decompression and maintain stability has been demonstrated by this study.

We note this can be a safe and effective alternative with good outcomes in a select group of patients.

Conflict of interest

None.

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Contributions

All authors contributed to drafting, revising and final submission. KRC: supervision, FJRP: analysis, JAS, JMV, JPG: data and proofing.

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