



Cervical spine surgery for tandem spinal stenosis: The impact on low back pain[☆]

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ABSTRACT

Study Design: Retrospective Cohort.

Objective: Tandem spinal stenosis (TSS) can present similarly to cervical myelopathy, but often has a worse prognosis. Few studies have investigated outcomes and compared treatment approaches for patients with TSS. We sought to determine the impact of cervical spine surgery on cervical and lumbar spine symptoms in patients with symptomatic tandem spinal stenosis.

Patients Methods: 84 patients with TSS were identified over 5 years. 48 underwent cervical spine surgery alone, 20 underwent both cervical and lumbar spine surgery, and 16 received conservative treatment alone (conservative cohort). Quality of life (QOL) measures included the Visual Analogue Scale (VAS) for arm, neck, and back pain, and EuroQOL-5 Dimensions (EQ-5D). QOL data were acquired at baseline (pre-operative) and 1 year postoperatively via an institutional prospectively collected database.

Results: Both surgical cohorts showed significant ($p < 0.01$) pre- to postoperative improvement for VAS neck and arm scores at 1-year post-op and significantly ($p < 0.01$) greater improvements than the conservative cohort. In addition, the cohort undergoing cervical spine surgery alone experienced significant improvement in the EQ-5D score whereas those undergoing both cervical and lumbar spine surgery did not.

Conclusions: Cervical spine surgery with or without follow-up lumbar spine surgery significantly improves neck pain in patients with TSS. In contrast, cervical spine surgery in these patients does not improve lumbar symptoms. Lumbar surgery also did not improve low back pain or quality of life. Future prospective studies are necessary to examine the impact of lumbar decompression alone on cervical spine symptoms in patients with TSS.

1. Introduction

Symptomatic tandem spinal stenosis (TSS) is a clinical entity in which both the cervical and lumbar portion of the spinal canal is narrowed. TSS occurs in 5–28% of all people [1,2]. Patients usually present with a triad of neurologic signs of both upper and lower motor neuron dysfunction, neurogenic claudication, and progressive gait disturbances. Commonly, either cervical (myelopathy) or lumbar (claudication) symptoms initially predominate. When these initial symptoms are treated surgically, complaints related to the secondary site of stenosis arise. Patients undergoing treatment for TSS may undergo staged (cervical prior to lumbar or vice versa) or simultaneous surgery.

Previous studies have shown similar positive outcomes for staged and simultaneous surgical approaches for treatment of patients with TSS [3–5]. When using a staged approach, the initial decompression is usually the more symptomatic site. Alternatively, if both sites are equally symptomatic, the cervical spine may be decompressed first, as there are reports of post-operative reduction of the lumbar symptoms in addition to the cervical symptoms following cervical spine surgery [6]. The question remains, however, if a staged or simultaneous surgery (i.e., both cervical and lumbar) is necessary to treat these patients effectively.

Studies have shown that cervical decompression with or without fusion can improve symptoms of myelopathy or radiculopathy in

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patients with either cervical stenosis alone or TSS [3–5]. However, the effects of cervical decompression on lumbar symptoms in patients with TSS have not been formally investigated. Within all studies published on this topic, only brief mention of the positive effects of cervical surgery on lumbar symptoms occurs [10,11]. Moreover, there have been no controlled studies investigating these proposed effects. Accordingly, in the present study, we hypothesized that cervical decompression surgery can lead to improvement of both cervical and lumbar symptoms as well as overall quality of life.

2. Material and methods

Electronic medical records were retrospectively reviewed to identify patients with TSS using both current procedural terminology (CPT) and international classification of diseases (ICD-9) codes for patients with myelopathy undergoing cervical spine decompression with or without fusion. Once identified, demographic and clinical information on each patient was collected. The diagnosis of tandem spinal stenosis was made both clinically and radiographically via magnetic resonance imaging (MRI) prior to initial surgery. Patients needed to have both clinical and imaging evidence to be included.

Patients were divided into three cohorts: those that underwent cervical spine surgery, those that underwent cervical spine surgery and subsequent lumbar spine surgery, and those that did not undergo surgery (conservative cohort). Patients were excluded if they were younger than 18 years or older than 80 years, had previous spine surgery, non-spondylotic causes of radicular pain (e.g., tumor, infection), neuromuscular disease (e.g., multiple sclerosis), or a workers' compensation claim.

This study is derived from prospective data that was reviewed retrospectively. Quality of life (QOL) scores including the Visual Analogue Scale (VAS) for arm, neck, and back, Pain Disability Questionnaire (PDQ), Patient Health Questionnaire-9 (PHQ-9), and EuroQOL-5 Dimensions (EQ-5D) were acquired via the institutional Knowledge Program (KP). The KP is a patient derived outcome assessment tool that is embedded in our electronic medical record. For all measures, except the EQ-5D, a decrease in score represents improvement. These data have been systematically collected since 2009, in a prospective fashion, at the time of the patient visits. The minimum clinically important difference (MCID) used for each questionnaire in a 1-year time frame was as follows: VAS (2.6), PDQ (26), PHQ-9 (5), and EQ-5D (0.1) [7–9]. Demographic variables (categorical data) between cohorts were compared using Fisher's exact tests. Quality of life outcomes (continuous data) between cohorts were compared using the Student's *t*-test and one-way ANOVA analyses with post hoc paired *t*-tests and Tukey simulations. All *p*-values ≤ 0.01 were considered statistically significant to adjust for multiple comparisons.

3. Results

3.1. Demographics

Eighty-four patients with clinical and MRI evidence of TSS were identified. Included patients exhibited signs and symptoms of both cervical (myelopathy) and lumbar (claudication) stenosis. Sixty-eight underwent surgery while 16 did not (Table 1). The average follow-up for the three cohorts (cervical, cervical/lumbar, conservative) was 10.9, 11.6, and 15.1 months, respectively. The average age of patients for the three cohorts was 61.2, 63.9, and 53.8, respectively ($p = 0.01$), with a significantly greater percentage of males in the surgical cohorts (64.6% and 65% vs. 25%; $p = 0.01$). The average duration of symptoms (myelopathy and claudication) prior to the date of hospital presentation was 17 months and ranged from 1 month to 120 months for all three cohorts, with no significant difference in duration of symptoms among cohorts. In the surgical cohorts combined, 90% of patients underwent cervical fusion and 88% received multi-level operations (average 2.6

levels). The number of levels operated did not impact outcomes. No patient received simultaneous cervical and lumbar operations. Six neurosurgeons and five orthopaedic surgeons, all fellowship trained in spine surgery, performed all operations (with equal distributions of the surgical approaches and levels). After undergoing cervical fusion (90%) or cervical decompression only (10%), 20 patients (29%) subsequently underwent lumbar surgery. None of the subsequent lumbar surgeries were simultaneous procedures. On average, patients underwent subsequent lumbar surgery 4–5 months after cervical spine surgery.

3.2. Health-related outcomes

The average pre- to postoperative change in scores for each questionnaire (cervical, cervical/lumbar, conservative cohorts, respectively) were (Table 2): VAS Arm (−3.3, −4.4, 0.50), VAS Neck (−3.1, −4.4, 0.19), VAS Low Back (0.02, −1.2, −0.27), PDQ (−8.8, −5.7, −0.85), PHQ-9 (−1.2, 1.1, 1.9), and EQ-5D (0.13, 0.03, 0.02). At 1-year post-op, both surgical cohorts had statistically significant ($p < 0.01$) and clinically significant (Change score $>$ MCID) improvement in VAS arm and neck scores while the conservative cohort had no improvement. In addition, the cohort undergoing cervical surgery alone had statistically and clinically significant improvement in the EQ-5D. Low back pain VAS scores did not improve after cervical surgery alone, but did improve non-significantly after lumbar surgery. On the contrary, cervical spine surgery was associated with worsening low back pain VAS scores. Lumbar spine surgery performed after cervical spine surgery did not lead to greater improvement in quality of life in any outcome measure other than the low back pain VAS score as compared with cervical spine surgery alone. For the low back pain VAS score, the improvement after both cervical and lumbar surgery only brought the cohort to its baseline low back pain VAS score prior to surgery.

4. Discussion

Although only sparsely studied in the literature, TSS is an entity that requires a proper understanding by both the clinician and patient to ensure the most effective treatment is undertaken. The combination of both myelopathy and claudication should trigger the possibility of TSS in the mind of the clinician and subsequent ordering of full-body imaging if clinical suspicion is high. Confirmation of the diagnosis of TSS allows for a better informed decision making process related to treatment of the patient. Currently, patients receive either a staged or simultaneous procedure (cervical and lumbar decompression) upon establishment of the diagnosis. However, performing both surgeries may not necessarily ensure a higher QOL than performing only one. In the present study, we sought to evaluate the impact of cervical decompression on lumbar symptoms and whether subsequent lumbar decompression improved QOL. We found that cervical decompression minimally affects lumbar symptoms. In addition, subsequent lumbar decompression had minimal impact on overall quality of life. Given what has been previously published, staged or simultaneous surgery may not be necessary or sufficient in improving lumbar symptoms in patients with TSS.

Epstein et al. [10] reported outcomes of 20 patients with TSS who underwent cervical decompression, and found that 12 patients (60%) experienced improvement of lower extremity symptoms, as well as relief of spasticity and myelopathy. No QOL outcomes or statistical analysis was performed. The authors suggested that the improvement in the lower extremity symptoms might have been due to relief of the posterior column and corticospinal tracts in the cervical spine. At two-year follow-up, none of the patients required lumbar decompression. However, the other eight patients, who experienced initial improvement for 6–9 months postoperatively, developed significant lumbar complaints impairing ambulation and required subsequent lumbar laminectomy. The patients that required a second surgery were an average of 10 years older than the rest of the cohort. In the present study, patients requiring

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