

Retrospective cost analysis of cervical laminectomy and fusion versus cervical laminoplasty in the treatment of cervical spondylotic myelopathy

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Abstract

Background: Cervical laminoplasty (CLP) and posterior cervical laminectomy and fusion (CLF) are well-established surgical procedures used in the treatment of cervical spondylotic myelopathy (CSM). In situations of clinical equipoise, an influential factor in procedural decision making could be the economic effect of the chosen procedure. The object of this study is to compare and analyze the total hospital costs and charges pertaining to patients undergoing CLP or CLF for the treatment of CSM.

Methods: We performed a retrospective review of 81 consecutive patients from a single institution; 55 patients were treated with CLP and 26 with CLF. CLP was performed via the double-door allograft technique that does not require implants, whereas laminectomy fusion procedures included metallic instrumentation. We analyzed 10,682 individual costs (HC) and charges (HCh) for all patients, as obtained from hospital accounting data. The Current Procedural Terminology codes were used to estimate the physicians' fees as such fees are not accounted for via hospital billing records. Total cost (TC) therefore equaled the sum of the hospital cost and the estimated physicians' fees.

Results: The mean length of stay was 3.7 days for CLP and 5.9 days for CLF ($P < .01$). There were no significant differences between the groups with respect to age, gender, previous surgical history, and medical insurance. The TC mean was \$17,734 for CLP and \$37,413 for CLF ($P < .01$). Mean HCh for CLP was 42% of that for CLF, and therefore the mean charge for CLF was 238% of that for CLP ($P < .01$). Mean HC was \$15,426 for CLP and \$32,125 for CLF ($P < .01$); the main contributor was implant cost (mean \$2582).

Conclusions: Our study demonstrates that, in clinically similar populations, CLP results in reduced length of stay, TC, and hospital charges. In CSM cases requiring posterior decompression, we demonstrate CLP to be a less costly procedure. However, in the presence of neck pain, kyphotic deformity, or gross instability, this procedure may not be sufficient and posterior CLF may be required.

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Keywords: Cervical laminoplasty; Cervical laminectomy and fusion; Cost comparison; Hospital cost

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Introduction

Cervical spondylosis is a common disorder that results from degeneration of intervertebral discs and hypertrophic ossification of discoligamentous structures within the cervical spine. Resultant cervical spinal stenosis may cause cervical spondylotic radiculopathy (CSR) and cervical spondylotic myelopathy (CSM). Additional pathologies, such as a herniated nucleus pulposus and ossification of the posterior longitudinal ligament (OPLL), may contribute to the development of axial neck pain, CSR, and CSM. Recently, guidelines have been published regarding the natural history, predictive prognostic features, surgical indications for cervical radiculomyelopathy, and means for

assessing functional outcomes.^{1–5} Significant controversy remains concerning the most appropriate means of operative management.

Posterior cervical procedures, such as cervical laminectomy (CL), cervical laminectomy and fusion (CLF), and cervical laminoplasty (CLP), have been advocated for patients with multisegmental disease (>2 segments).^{4,6,7} CLP has the additional caveat of requiring preserved lordotic cervical alignment.^{8–10} There have been no large, multicentered, prospective, randomized, controlled trials comparing CLF with CLP and the existing literature is limited to retrospective case series and cohort analyses.^{11–13} There have been several studies that demonstrate the relative merits of these 2 procedures and their superiority over simple CL.^{6,7,14–18} There are well-described situations in which one procedure may be preferred over the other based on clinicoradiographic features; however, in situations of clinical equipoise, the question of relative cost may be significant. There is essentially no existing literature on the relative cost of CLF in comparison with CLP.

There is a growing concern over the escalating cost of health care, and the relative cost of procedures may ultimately become a component of a surgical decision-making algorithm. This is certainly the case in clinical scenarios where both laminoplasty and laminectomy and fusion are deemed to be appropriate treatments. In such scenarios, the advantages and disadvantages of each procedure must be compared to determine the best course of action, and cost may become a relevant issue to both patients and providers. Direct care cost has been defined in the literature as the cost directly associated with intervention (ie, cost of perioperative inpatient management).¹⁹ This excludes both the utilization of outpatient healthcare resources and consideration of lost or gained economic productivity (or return to work potential). Our hypothesis is that CLP has an obvious cost advantage over CLF due to the lack of surgical implants, even if open-door spacer implants are utilized. However, a detailed account of the contributing factors has never been demonstrated. The aim of this study is to analyze the relative direct and indirect (housekeeping etc. are “indirect costs,” which are different from outpatient and long-term resource consumption) care costs associated with 2 surgical techniques for subjects with symptomatic cervical disease, CLP and CLF.

Methods

Patient population

The institutional review board approved this study before collection of any data. A retrospective chart review was performed at a single institution between 2006 and 2009 for subjects treated for CSM, OPLL, and multilevel CSR. Subjects were treated according to the surgeon's preference, via either variable length CLF (C2-T1 inclusive) or CLP

(C2-T1 inclusive). CLF was performed using typical lateral mass screw and rod constructs with C7 and T1 pedicle screw fixation in individual cases; CLP was performed using the “double-door” or “French-door” technique, utilizing cadaveric allograft bone struts with suture fixation.^{8,10,17} There was no direct involvement with industry in this study, and therefore no consideration was given to companies providing supportive grants. The double-door technique utilizes cadaveric allograft and suture only, whereas the laminectomy and fusion procedures were completed with metallic implants from a single vendor with no known discount other than the negotiated rate for the institution. No laminoplasty spacers were employed preferentially.

Subject demographic and surgical data were obtained for each individual subject. This included subject's age, gender, length of stay (LOS), surgical technique, revision cases, number of levels decompressed/fused, and method of payment as non-Medicare versus Medicare. A matched sub-analysis, focused on patients undergoing C3-7 level decompression, including demographics and the overall cost analysis, was also performed.

Financial data

Individual subject costs, charges, and payment values were obtained from the hospital financial records with regard to all itemized costs for direct care. These costs included, but were not limited to, operating room materials and supplies (ORMS), transfusions, time in the operating room, laboratory results, physical therapy, and inpatient housekeeping. To these costs were added the costs of the physicians' labor (physician cost); physician costs were based on Medicare reimbursement schedules and were comprised of the procedure-specific Medicare reimbursement rates for surgeon, neuromonitoring, and anesthesiologist fees. The Current Procedural Terminology (CPT) codes used for calculating physician fees were taken from the *Current Procedural Terminology 2009 Professional Edition*, and the Manhattan health referral region adjustment factor was applied to all the fees.²⁰ This information is kept confidential by institutional policy, as billing rates are shared between insurance and medical device companies, and publication of such information could represent a breach of such a contract with providers.

Physician cost was calculated using the formula described and illustrated later in the article, which accounts for relative value units (RVUs) for both the surgeon and neuromonitoring, as well as the anesthesia rate per procedure (PR). The RVUs are location-specific factors and represent the labor and supply elements required to provide a service. The physician-specific RVU we used were based on CPT codes and comprised of work, practice expense, and malpractice expense values. Each of these individual values is dependent upon geographic location; for our study, these values were adjusted for Manhattan rates. Physician-specific RVUs were multiplied by standard

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