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Clinical Study

Effect of obesity on cost per quality-adjusted life years gained following anterior cervical discectomy and fusion in elective degenerative pathology

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Abstract

BACKGROUND: Obese patients have greater comorbidities along with higher risk of complications and greater costs after spine surgery, which may result in increased cost and lower quality of life compared with their non-obese counterparts.

PURPOSE: The aim of the present study was to determine cost-utility following anterior cervical discectomy and fusion (ACDF) in obese patients.

STUDY DESIGN: This study analyzed prospectively collected data.

PATIENT SAMPLE: Patients undergoing elective ACDF for degenerative cervical pathology at a single academic institution were included in the study.

OUTCOME MEASURES: Cost and quality-adjusted life years (QALYs) were the outcome measures.

METHODS: One- and two-year medical resource utilization, missed work, and health state values (QALYs) were assessed. Two-year resource use was multiplied by unit costs based on Medicare national payment amounts (direct cost). Patient and caregiver workday losses were multiplied by the self-reported gross-of-tax wage rate (indirect cost). Total cost (direct+indirect) was used to compute cost per QALY gained. Patients were defined as obese for body mass index (BMI) ≥35 based on the WHO definition of class II obesity. A subgroup analysis was conducted in morbidly obese patients (BMI≥40).

RESULTS: There were significant improvements in pain (neck pain or arm pain), disability (Neck Disability Index), and quality of life (EuroQol-5D and Short Form-12) at 2 years after surgery (p<.001). There was no significant difference in post-discharge health-care resource utilization, direct cost, indirect cost, and total cost between obese and non-obese patients at postoperative 1-year and 2-year follow-up. Mean 2-year direct cost for obese patients was $19,225±$8,065 and $17,635±$6,413 for non-obese patients (p=.14). There was no significant difference in the mean total 2-year cost between obese ($23,144±$9,216) and non-obese ($22,183±$10,564) patients (p=.48). Obese patients had a lower mean cumulative gain in QALYs versus non-obese patients at 2-years (0.34 vs. 0.42, p=.32). Two-year cost-utility in obese ($68,070/QALY) versus non-obese patients ($52,816/QALY) was not significantly different (p=.11). Morbidly obese patients had lower QALYs gained (0.17) and higher cost per QALYs gained ($138,094/QALY) at 2 years.

FDA device/drug status: Not applicable.

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The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

The authors report no conflict of interest.

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CONCLUSIONS: Anterior cervical discectomy and fusion provided a significant gain in health state utility in obese patients, with a mean 2-year cost-utility of $68,070 per QALYs gained, which can be considered moderately cost-effective. Morbidly obese patients had lower cost-effectiveness; however, surgery does provide a significant improvement in outcomes. Obesity, and specifically morbid obesity, should to be taken into consideration as physician and hospital reimbursements move toward a bundled model.

Keywords: Cervical; Cost; Cost-effectiveness; Decompression; Fusion; QALY; Spine

Introduction

There is an upward trend in the number of cervical spine procedures performed each year [1–5]. Costs related to surgery in the cervical spine have risen substantially in recent years [6], with one study reporting an increase in spending from $1.6 billion in 2000 to $5.6 billion in 2009 [7]. In this era of increasingly scarce health-care resources, many efforts are being made to evaluate higher cost interventions, maximize patients' quality of life, and determine the real-world clinical benefit and cost-effectiveness.

Cost-utility analysis has emerged as an important tool to determine the value of care by merging patient-centered outcomes with utilization of healthcare resources [8–12]. This allows policymakers and providers to compare treatment strategies among different disciplines and identify the relative priorities for optimal resource allocation among various interventions. Cost-utility can also be used to compare differences in cost per quality-adjusted life year (QALY) gained among patient-specific factors [13–16]. Numerous studies have analyzed the cost-effectiveness of various spine procedures [17–19]. Carreon et al. reported the cost per QALY after anterior cervical discectomy and fusion (ACDF) to be $23,460 at 5 years, which is well within the commonly accepted cost-effectiveness threshold of $50,000–$100,000 per QALY [17,20–22]. Angevine et al. similarly reported the cost per QALY in ACDF to be roughly $32,000 at 4 years [1]. However, the impact of common comorbidities on cost-effectiveness following ACDF is yet to be analyzed.

Obesity is a common comorbidity with a prevalence of 35% in the adult population. Obesity has been shown to negatively impact surgical outcomes and accounts for an estimated $150 billion dollars in annual medical costs [23–25]. A number of studies have reported the impact of obesity on complications and outcomes following spine surgery [26–30]. The impact of obesity on the cost-effectiveness of ACDF surgery has yet to be investigated. In this analysis, we set forth to determine the cost-effectiveness of ACDF surgery in obese patients at 1 year and 2 years following surgery.

Methods

Patients undergoing elective primary ACDF for degenerative cervical spine pathology at a single academic institution between 2010 and 2014 were enrolled into a prospective, web-based longitudinal registry. The inclusion criteria for this study were (1) patients aged >18 years; (2) presenting with neck pain or arm pain (NP or AP); (3) correlative imaging findings for the diagnosis of degenerative pathology: stenosis, disc herniation, and spondylolisthesis; and a (4) failed 3 months of multimodal conservative care or progressive neurologic deficit. The exclusion criteria were (1) any pathologic spine disease (including infection, tumor, or trauma); (2) an active medical or workman's compensation lawsuit; (3) any extraspinal cause of NP or AP; (4) patients with prior cervical spine surgery; (5) number of levels operated on >4 and number of segments fused >3; and (4) patients who were unwilling or were unable to participate in the follow-up questionnaires. All surgeons participating in this study practiced similar postoperative treatment paradigms. In all cases, the surgeon encouraged discharge from the hospital beginning 24 hours after surgery, weaning of opioids beginning 2–3 weeks after surgery, and return to work as soon as the patient felt capable. Patients were defined as "obese" for body mass index (BMI) greater than or equal to 35 based on WHO criteria for class II obesity. The BMI greater than or equal to 40 was defined as morbid obesity.

Outcome measures

Patient-reported outcomes (PROs) for disability, pain, quality of life, and satisfaction were recorded at baseline, 3 months, 1 year, and 2 years after surgery. The outcomes were assessed via phone interview conducted by an independent investigator not involved with clinical care. The PRO instruments included Neck Disability Index (NDI) [31], EuroQol-5D (EQ-5D) [32], and numeric rating scale pain scores (NRS) for NP and AP [33] and Short Form-12 item health surgery (SF-12), physical component score (PCS), and mental component score (MCS) [34].

Cost data

All costs were recorded based on resource utilization, derived from both patient-reported use and institutional records. Hospital discharge and billing records for all study patients were collected in a prospective longitudinal registry. Costs were calculated from the payer's perspective (direct costs) and the societal perspective (direct+indirect costs). All cost data were adjusted based on the Medicare national payment amounts. Total direct costs were included hospital cost, physician cost, and resource utilization cost. The post-discharge resource utilization costs for visits to health-care providers, diagnostic imaging costs, and medication-associated costs were