Economic impact of comorbidities in spine surgery

Clinical article

M. SAMI WALID, M.D., PH.D.,1 AND JOE SAM ROBINSON JR., M.D.2

1Medical Center of Central Georgia, and 2Georgia Neurosurgical Institute, Macon, Georgia

Object. Comorbidities in patients undergoing spine surgery may reasonably be factors that increase health care costs. To verify this hypothesis, the authors conducted the following study.

Methods. Major comorbidities and age-adjusted Charlson Comorbidity Index scores were retrospectively analyzed for 816 patients who underwent spine surgery at the authors’ institutions between 2005 and 2008, and treatment costs (hospital charges) were assessed with the help of statistical software. The sample was collected by a nonmedical staff (hired at the beginning of 2006). Patients underwent one of the three most common types of spine surgery: lumbar microdiscectomy (20.5%), anterior cervical decompression and fusion (ACDF; 60.3%), or lumbar decompression and fusion (LDF; 19.2%). Patients were nearly equally divided by sex (53% were female and 47% male), and 78% were Caucasian versus 21% who were African American; the rest were of mixed or unidentified race. The average age was 54 years, with an SD of ± 14 years.

Results. There were significant differences in the prevalence of major comorbidities between male and female and between severely obese and nonseverely obese patients. The impact of comorbidities on the cost of spine surgery was more prominent in older patients, and an additive effect from some comorbidities was recorded in various types of spine surgery. For instance, in the ACDF group, female patients with both severe obesity and diabetes mellitus (DM) had significantly higher hospital charges than those with only one or neither of these conditions ($34,943 for both severe obesity and DM vs $25,633 for severe obesity only; $25,826 for DM only; and $25,153 for those with neither condition [p < 0.05]). In the LDF group, female patients with both DM and a history of depression had significantly higher hospital charges than those with only one or neither of these conditions ($65,782 for both DM and depression vs $53,504 for DM only; $55,990 for depression only; and $52,249 for those with neither condition [p < 0.05]). A significant difference was also found in hospital cost ($16,472 [p < 0.01]; 32% increase over baseline) in the LDF group between patients with the lowest and highest scores on the Charlson Index.

Conclusions. Comorbidities additively increase hospital costs for patients who undergo spine surgery, and should be considered in payment arrangements. (DOI: 10.3171/2010.11.SPINE10139)

Key Words • comorbidity • cost analysis • length of stay • hospital charge • spine surgery

Health care costs in the US have been rising linearly in the past decades, surpassing $2.5 trillion in 2009.1 With increasing frequency of surgical spine procedures in an era of economic restraint,2 health care providers ever more struggle to keep up with health care costs. Previous research has suggested that comorbidities may increase the hospitalization cost of patients who undergo spine surgery.3-10 To study the prevalence of major comorbidities among patients undergoing expensive spine procedures and to examine their impact on hospital cost, we conducted the following study.

Abbreviations used in this paper: ACDF = anterior cervical decompression and fusion; BMI = body mass index; CABG = coronary artery bypass graft; DM = diabetes mellitus; DRG = Diagnosis-Related Group; LDF = lumbar decompression and fusion; LMD = lumbar microdiscectomy.
Economic impact of comorbidities in spine surgery

of spine surgery: LMD (20.5%), ACDF (60.3%), or LDF (19.2%). The patients who underwent LMD were treated between 2005 and 2007, and those who underwent ACDF and LDF were treated between 2006 and 2008 (Fig. 1). Patients were nearly equally divided by sex (53% were female and 47% male), and 78% were Caucasian versus 21% who were African American; the rest were of mixed or unidentified race. The average age was 54 years, with an SD of ± 14 years. Chi-square and Fisher tests were used for nominal variables, and the t-test and Wilcoxon-Mann-Whitney test were used for scale variables, as appropriate.

Results

Comorbidities and Patient Sex

Obesity (51% in female vs 41.2% in male patients; p < 0.05), severe obesity (28.1% vs 12%; p < 0.01), and morbid obesity (10.9% vs 3.5%; p < 0.01) were all more prevalent in female patients. Asthma (27.5% vs 12.9%; p < 0.01), thyroid problems (hypothyroidism in 41.1% vs 9.1% and hyperthyroidism in 2.4% vs 1%; p < 0.01), and history of depression (37.2% vs 21.3%; p < 0.01) were also more common in female patients. The comorbidities DM (69% in male vs 56% in female patients; p < 0.01), coronary artery disease (53.8% vs 36%; p < 0.01), history of CABG or stent surgery (51% vs 33.5%; p < 0.01), and history of myocardial infarction (14.3% vs 6.8%; p < 0.05) were, however, more common in male patients.

Impact of Obesity on Comorbidity Prevalence and Surgery Cost

Basically, 46.7% of patients were in the “obese” category (BMI ≥ 30 kg/m²), 20.9% were “severely obese” (BMI ≥ 35 kg/m²), and 7.6% were “morbidly obese” (BMI ≥ 40 kg/m²). Obesity-related medical comorbidities were statistically more frequent in patients with severe (including morbid) obesity, including hypertension (70.8% in severely obese vs 56.3% in obese patients; p < 0.01), high cholesterol (81.8% vs 63.7%; p < 0.01), DM (69.9% vs 56%; p < 0.01), history of CABG or stent surgery (50.8% vs 34.0%; p < 0.01), and asthma (33.9% vs 15.2%; p < 0.01). Orthopedic and psychiatric disorders with a possible connection to obesity were also significantly higher in severely obese patients; these disorders included hip problems (13.5% vs 4.6%; p < 0.05), knee arthritis (77.3% vs 58.5%; p < 0.01), and a history of depression (37.1% vs 27.5%; p < 0.05). Interestingly, a history of myocardial infarction, stroke, or thyroid problems was not statistically different between the two categories of patients.

Higher Impact of Comorbidities on Cost in Older Patients

Some comorbidities had a significantly higher impact on spine surgery cost in the older age groups (Fig. 2). For example, a history of CABG or stent surgery was associated with significantly higher hospital charges in female patients > 60 years of age in the LDF group ($73,823 vs $52,861; p < 0.01). There were no patients ≤ 40 years of age who had a history of CABG or stent surgery. Interestingly, although a history of CABG or stent surgery was more common in male patients, the impact on spine surgery cost was more significant in the female cohort.

Additive Effect of Comorbidities on Cost

An additive effect from some comorbidities has been noted in various types of spine surgery. In the ACDF group, female patients with both severe obesity and DM had significantly higher hospital charges than those with only one or neither of these conditions ($34,943 for both severe obesity and DM vs $25,633 for severe obesity only; $25,826 for DM only; and $25,153 for those with neither condition [p < 0.05, Fig. 3]). In the LDF group, female patients with both DM and a history of depression had significantly higher hospital charges than those with only one or neither of these conditions ($65,782 for both DM and depression vs $53,504 for DM only; $55,990 for depression only; and $52,249 for those with neither condition [p < 0.05, Fig. 4]).
Charlson Comorbidity Index

Approximately half (50.1%) of our patients in whom spine surgery was performed had a score of 0 on the Charlson Index; 17% were in the 1–2 range; 21.6% were in the 3–4 range, and 11.3% had a score of 5 or higher. No statistically significant differences were observed between the 3 spine surgery categories regarding Charlson Index distribution. However, a significant difference was found in hospital charges ($16,472 [p < 0.01]; 32% increase over baseline) in the LDF group between patients with the lowest and highest scores on the Charlson Index. Correspondingly, length of stay jumped from 4 to 8 days in patients with the highest scores on the Charlson Index (Fig. 5).

Discussion

Current demographic trends denote a larger cohort of the aged, obese, and medically fragile population than in previous decades. This, coupled with an aggressive approach to spine problems, has led to a dramatic increase in the number of costly interventions on the spine of elderly patients afflicted with concomitant chronic diseases. Reflecting such circumstances in our patient population (both as directly demarcated and as assessed by the Charlson Comorbidity Index), hospital cost and length of stay have increased in synchrony with comorbidities. Thus, screening patients preoperatively for significant comorbidities may be beneficial, because comorbidities are predictors of increased postoperative complications and mortality rates.3,4 Furthermore, such attention may and should produce significant savings in expenditure of hospital resources.

We have analyzed comorbidity rates according to the sex and obesity categories, and found significant differences. The single and additive impact of comorbidities on hospital charges was more evident in the female cohort. These cost disparities may partly explain the findings of prior studies of Medicare consumption trends in the US, which have shown consistently higher health care spending for women than men after adjusting for longevity.5,6 Postoperative complications, which are closely related to the general health of the patient and his or her comorbidities, were probably not reflected in this study because we used hospital charges for the postsurgery hospitalization period only. All patients were treated at a single hospital, and the method by which charges were computed (charges-to-cost ratio) was the same.

Importantly, even discounting the well-known inadequacy of the reimbursement by federal compensation providers, the additive, subtle effect of comorbidities on cost and reimbursement calculations has not been rigorously considered. For instance, despite an improved 2008 DRG system, which better recognizes differences in illness severity and resource consumption, the latest Medicare numbers for spine surgery miss the complexity of the problem. Major and minor comorbidities are insufficiently stratified, and are arbitrarily joined with post-therapeutic complications. For example, Medicare 2008 compensation numbers for lumbar decompression and...
Economic impact of comorbidities in spine surgery

fusion were as follows: $23,915.70 for DRG 459 (Spinal Fusion Except Cervical With Major Complication or Co-morbidity) versus $17,131.42 for DRG 460 (Spinal Fusion Except Cervical Without Major Complication or Co-morbidity), a 28% addition over baseline.

Conclusions

The interaction of comorbidities and their impact on cost needs to be discussed in the current national health care debate. Moreover, the complex influence of comorbidities makes nationally mandated treatment guidelines and, possibly, compensation parameters, as suggested in some health reform schemes, a rather difficult goal, to say the least.

Disclosure

The authors have no affiliations that may pose a conflict of interest, and have not received any funding for preparing this manuscript.

Author contributions to the study and manuscript preparation include the following. Conception and design: Walid. Acquisition of data: Walid. Analysis and interpretation of data: Walid. Drafting the article: Walid. Critically revising the article: Robinson. Reviewed final version of the manuscript and approved it for submission: both authors. Statistical analysis: Walid. Study supervision: Robinson.

References


Accepted November 2, 2010.
Parts of this study were presented at the 2010 American Association of Neurological Surgeons’ Annual Meeting, held on May 1–5 in Philadelphia, Pennsylvania.
Please include this information when citing this paper: published online January 14, 2011; DOI: 10.3171/2010.11.SPINE10139.
Address correspondence to: M. Sami Walid, M.D., Ph.D., Medical Center of Central Georgia, Macon, Georgia 31201. email: mswalid@yahoo.com.