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# Two-year comprehensive medical management of degenerative lumbar spine disease (lumbar spondylolisthesis, stenosis, or disc herniation): a value analysis of cost, pain, disability, and quality of life

## Clinical article

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*Object*. Current health care reform calls for a reduction of procedures and treatments that are less effective, more costly, and of little value (high cost/low quality). The authors assessed the 2-year cost and effectiveness of comprehensive medical management for lumbar spondylolisthesis, stenosis, and herniation by utilizing a prospective single-center multidisciplinary spine center registry in a real-world practice setting.

*Methods*. Analysis was performed on a prospective longitudinal quality of life spine registry. Patients with lumbar spondylolisthesis (n = 50), stenosis (n = 50), and disc herniation (n = 50) who had symptoms persisting after 6 weeks of medical management and who were eligible for surgical treatment were entered into a prospective registry after deciding on nonsurgical treatment. In all cases, comprehensive medical management included spinal steroid injections, physical therapy, muscle relaxants, antiinflammatory medication, and narcotic oral agents. Two-year patient-reported outcomes, back-related medical resource utilization, and occupational work-day losses were prospectively collected and used to calculate Medicare fee–based direct and indirect costs from the payer and societal perspectives. The maximum health gain associated with medical management was defined as the improvement in pain, disability, and quality of life experienced after 2 years of medical treatment or at the time a patient decided to cross over to surgery.

*Results*. The maximum health gain in back pain, leg pain, disability, quality of life, depression, and general health state did not achieve statistical significance by 2 years of medical management, except for pain and disability in patients with disc herniation and back pain in patients with lumbar stenosis. Eighteen patients (36%) with spondylolisthesis, 11 (22%) with stenosis, and 17 (34%) with disc herniation eventually required surgical management due to lack of improvement. The 2-year improvement did not achieve a minimum clinically important difference in any outcome measure. The mean 2-year total cost (direct plus indirect) of medical management was $6606 for spondylolisthesis, $7747 for stenosis, and $7097 for herniation.

*Conclusions*. In an institution-wide, prospective, longitudinal quality of life registry that measures cost and effectiveness of all spine care provided, comprehensive medical management did not result in sustained improvement in pain, disability, or quality of life for patients with surgically eligible degenerative lumbar spondylolisthesis, stenosis, or disc herniation. From both the societal and payer perspective, continued medical management of patients with these lumbar pathologies in whom 6 weeks of conservative therapy failed was of minimal value given its lack of health utility and effectiveness and its health care costs. The findings from this real-world practice setting may more accurately reflect the true value and effectiveness of nonoperative care in surgically eligible patient populations. *(http://thejns.org/doi/abs/10.3171/2014.3.SPINE1320)*

**Key Words** • **medical management** • **lumbar spondylosis** • **lumbar stenosis** • **lumbar spondylolisthesis**

Low-back pain is one of the most common reasons for seeking medical attention; its lifetime prevalence ranges from 59% to 84%.[25] Lumbar spondylosis or degenerative spine disease is the most common etiology of low-back pain and can have profound effects on functionality and quality of life. It is a highly debilitating condition and the biggest contributor to missed work days with far-reaching consequences on our health care system. Direct medical costs due to back pain in the US

*Abbreviations used in this paper:* EQ-5D = EuroQol-5D; MCS = mental component summary; NRS-BP = numeric rating scale for low-back pain; NRS-LP = NRS for leg pain; ODI = Oswestry Disability Index; PCS = physical component summary; QALY = quality-adjusted life-year; RCT = randomized controlled trial; SF-12 = Short Form 12-item Health Survey.

This article contains some figures that are displayed in color online but in black-and-white in the print edition.

have doubled from $52 to $102 billion in only 7 years, with a 65% increase in national expenditure on back-related issues from 1997 to 2005.[15]

With increasing health care cost threatening the stability of the US economy, policymakers and health care providers have shifted focus on pay-for-performance and value-based purchasing. Current health care reforms are scrutinizing all interventions and call for a reduction in the number of procedures and treatments that are less effective, more costly, and of little "value." Because the health care value equation (cost/effectiveness) is being used to drive policies and health care reforms, accurate measurement of real-world effectiveness is of utmost importance. Prospective registries have emerged as a feasible way to capture and measure real-world effectiveness via patient-reported outcomes incorporating multiple domains of patients' general health status, disease-specific health, and societal productivity. As compared with a randomized controlled trial (RCT), prospective longitudinal registries are more feasible and may more closely reflect daily clinical situations, as they measure real-world care and are not artificially constrained by research settings, strict inclusion/exclusion criteria, and loss of patients not consenting to participate in clinical trial.[20]

Patients with lumbar spondylosis are typically given a 6- to 8-week trial of nonoperative treatment including narcotic and nonnarcotic medications, muscle relaxants, steroid injections, and physical therapy. While the majority of patients will improve with nonoperative management, those who do not are offered the option of undergoing spinal surgery. The a priori understanding of who will benefit from continued medical treatment versus surgery is unclear and often debated. The SPORT (Spine Patient Outcomes Research Trial) and a recent systematic review by Kovacs et al. have shown that surgery is more effective than continued medical treatment.[14,28–30] Over the last few decades, there has been a rapid increase in the number of surgical spine procedures and overall Medicare expenditure for this disease. Rates of lumbar fusion for degenerative lumbar disease have quadrupled in the past 2 decades, leading to significantly increased health care costs.[5,6] Given the high cost of spine surgery and the increasing scrutiny by policymakers and health care providers, health care reform may reward cheaper care (cost-based purchasing) rather than more valuable care (value-based purchasing) without true evidence of effectiveness of medical management of lumbar spondylosis. In the light of this, we set out to determine the 2-year cost and effectiveness (value) of continued comprehensive medical management for patients with lumbar spondylolisthesis, stenosis, and disc herniation who did not improve after an initial 6-week trial of medical therapy and who were thought to be appropriate surgical candidates.

## Methods

### *Patient Selection*

One hundred fifty patients with degenerative lumbar spine disease (spondylolisthesis, n = 50; stenosis, n = 50; and disc herniation, n = 50) managed nonoperatively at a single comprehensive spine center over a 12-month period were included in our prospective registry. The institutional review board approved this study. To be included, a patient had to have the following: 1) MRI evidence of structural spine pathology (lumbar spondylolisthesis, stenosis, or disc herniation) eligible for spine surgery but for which the patient opted for medical management; 2) mechanical low-back pain and radicular symptoms; and 3) an age of 18–70 years. Patients were excluded if they had one of the following: 1) a history of a previous back operation; 2) an extraspinal cause of back pain or sciatica; 3) an active medical or workman's compensation lawsuit; 4) any preexisting spinal pathology; or 5) were unwilling or unable to participate with follow-up procedures. Patients with notable associated abnormalities such as inflammatory arthritis or metabolic bone disease were also excluded.

For representative sampling, a 6-day rolling cycle for enrollment was followed and 6 patients were enrolled during each enrollment cycle. Patients were enrolled into the registry only if they were felt to be surgical candidates and therefore represented an "apples to apples" patient population for comparisons to surgical cohorts. More specifically, only patients with radiographically proven lumbar spondylolisthesis, stenosis, or disc herniation who had undergone 6 weeks of multimodality medical management without improvement were enrolled. Because only patients demonstrating little to no response to their initial trial of conservative therapy are candidates for surgery, patients reporting symptomatic improvement in their 6-week trial of medical management were excluded as they did not represent a surgically relevant patient population.

### *Clinical Outcome Measures*

Patient demographics, disease characteristics, and treatment variables were assessed prospectively for each case. Baseline and 2-year pain, disability, quality of life, and satisfaction were assessed in a phone interview conducted by an independent investigator not involved with clinical care. Patient-reported outcomes instruments included the numeric rating scale for low-back pain (NRS-BP), NRS leg pain (NRS-LP),[9,12] Oswestry Disability Index (ODI),[8] EuroQol-5D (EQ-5D),[7] Short Form 12-item Health Survey (SF-12; physical component summary [PCS] and SF-12 mental component summary [MCS]),[26] Zung Self-Rating Depression Scale,[16,21] and North American Spine Society satisfaction questionnaire.[22] The maximum health gain with medical management was defined as the improvement in preoperative pain, disability, and quality of life experienced after 2 years of medical treatment or at the time a patient decided to cross over to surgery.

### *Utility*

Quality-adjusted life-years (QALYs), which account for both quality and length of life, are recommended for assessing the value of interventions in health and medicine.[11] The EQ-5D instrument was used for utility measurement as it has been validated and found to be responsive to low-back treatment.[23] It is a 5-question preference-based general health state instrument that provides a single index value for health status.

*Two-Year Resource Utilization and Direct Cost*

To estimate direct health care costs, patient-reported resource utilization data during the 2-year period were collected prospectively via telephone interviews and included outpatient visits (surgeons, chiropractors, other physicians, physical therapists, acupuncturists, or other health care providers); spine-related diagnostic tests (radiography, CT, MRI, and electromyography); injections; devices (braces, canes, walkers, shoe inserts, and so on); emergency room visits; and rehabilitation or nursing home days. Participants were asked in detail about their use of all medications, including but not limited to nonsteroidal antiinflammatory drugs and COX-2 inhibitors, oral steroids, narcotics, muscle relaxants, and antidepressants.

To estimate direct medical cost at each time point, self-reported instances of medical resource use were multiplied by unit costs for each cost component. Unit costs for office visits, hospitalizations, diagnostic tests, and procedures were based on current 2012 Medicare national allowable payment amounts. Medication prices were based on average wholesale price of the individual drugs obtained from First Data Bank's National Drug Data File Plus (http://www.fdbhealth.com/fdb-medknowledge-drug-pricing/).

*Indirect Cost*

At each follow-up, productivity losses due to a spine-related problem (that is, missed work days for those employed outside of the home) were recorded. Costs were estimated using the standard human capital approach by multiplying the change in hours worked by the gross-of-tax wage rate based on self-reported wages.[13]

*Statistical Analysis*

Parametric data are given as mean ± SD and were compared via the Student t-test. Nonparametric data are presented as the median with the interquartile range and compared via Mann-Whitney U-test. Nominal data were compared via the chi-square test. A p value $< 0.05$ was considered statistically significant.

## Results

*Patient Population*

A total of 150 patients (50 with spondylolisthesis, 50 with stenosis, and 50 with disc herniation) were enrolled in the study. There were 65 males (43.3%) and 85 females (56.7%). The mean age of patients was 58.2 ± 11.9 years. All patients presented with back/leg pain as well as radiographic evidence of degenerative spinal disease. For all patients at presentation, the mean scores were as follows: 7.4 ± 2.5 for NRS-BP, 7.1 ± 2.9 for NRS-LP, and 57.1% ± 18.6% for ODI. The mean baseline SF-12 PCS, SF-12 MCS, and Zung depression scores were 31.4 ± 8.0, 49.8 ± 11.8, and 33.9 ± 10.5, respectively. The mean baseline EQ-5D perceived health-state was 0.50 ± 0.20 QALYs.

Baseline characteristics and patient-reported outcomes of the 3 cohorts are presented in Table 1. Patient characteristics and comorbidities were similar for each of the cohorts. There were no significant differences in baseline pain, disability, quality of life, or depression scores among the 3 diagnostic categories. In all patients, an initial trial of at least 6 weeks of medical management had failed to improve symptoms, but the patients preferred not to undergo surgical management at time of enrollment in the registry.

*Maximum Health Gain With Medical Management*

For patients with lumbar spondylolisthesis, medical therapy failed to significantly improve any outcome assessed. Back pain, leg pain, physical disability (ODI), mental (MCS) and physical (PCS) quality of life, and depression (Zung Scale) scores were not significantly improved with sustained medical therapy.

For patients with lumbar stenosis, medical therapy did not significantly improve leg pain, physical disability (ODI), mental (MCS) and physical (PCS) quality of life, or depression (Zung Scale) (Table 2 and Fig. 1). Only back pain (NRS-BP 7.6 vs 6.2, $p = 0.012$) demonstrated a statistically significant improvement with medical management.

For patients with lumbar disc herniation, prolonged medical treatment was associated with statistically significant improvement in back pain (NRS-BP; $p = 0.006$), leg pain (NRS-LP; $p = 0.03$), and physical disability (ODI; $p = 0.03$). There was no improvement seen for mental (MCS) and physical (PCS) quality of life or depression (Zung Scale) scores (Table 2 and Fig. 1).

*Cross-Over From Medical Management to Surgery*

Eighteen patients (36%) with spondylolisthesis, 11 (22%) with stenosis, and 17 (34%) with disc herniation eventually required surgical management due to lack of improvement (Fig. 2). The mean time (months) to surgery was 7.3 ± 4.0 for spondylolisthesis, 11.3 ± 5.0 for stenosis, and 6.8 ± 5.6 for disc herniation. Patients in the comprehensive medical management cohort who eventually underwent surgery compared with those who did not had similar baseline characteristics and comorbidities. There was no difference in baseline pain, disability, or quality of life in the 2 groups as assessed by analyzing patient-reported outcomes.

*Two-Year Costs*

Medical management was associated with significant 2-year direct costs related to medical resource utilization in the 3 cohorts: health care visits (range $1996–$2088), diagnostic imaging (range $989–$1070), and medications/injections ($3233–$4330) (Table 3). The mean 2-year direct health care cost was $6326 for spondylolisthesis, $7488 for stenosis, and $6842 for disc herniation. The mean 2-year indirect cost was $280 for spondylolisthesis, $260 for stenosis, and $255 for disc herniation. The total mean 2-year cost of medical management was $6606 for spondylolisthesis, $7747 for stenosis, and $7097 for disc herniation (Table 3).

## Discussion

Surgical treatments of structural low-back diseases

**TABLE 1: Baseline characteristics and self-reported outcomes of patients undergoing comprehensive medical management for degenerative lumbar disease***

| Baseline Characteristics | Lumbar Pathology (%) | | | p Value |
|---|---|---|---|---|
| | Spondylolisthesis | Stenosis | Disc Herniation | |
| no. of patients | 50 | 50 | 50 | |
| patient demographics | | | | |
| mean age | 57.4 ± 11.3 | 59.4 ± 12.3 | 57.9 ± 12.2 | 0.70 |
| male | 18 (36) | 22 (44) | 25 (50) | 0.37 |
| diabetes mellitus | 7 (14.0) | 8 (16.0) | 5 (10.0) | 0.67 |
| smoker | 20 (40.0) | 20 (40.0) | 19 (38.0) | 0.98 |
| COPD | 5 (10.0) | 1 (2.0) | 2 (4.0) | 0.19 |
| CAD | 7 (14.0) | 5 (10.0) | 5 (10.0) | 0.79 |
| hypertension | 29 (58.0) | 26 (52.0) | 23 (46.0) | 0.55 |
| atrial fibrillation | 3 (6.0) | 3 (6.0) | 4 (8.0) | 0.89 |
| depression | 14 (28.0) | 12 (24.0) | 13 (26.0) | 0.93 |
| mean BMI | 28.4 ± 5.9 | 28.7 ± 5.7 | 27.8 ± 7.2 | 0.85 |
| mean patient-reported outcome scores† | | | | |
| NRS-BP | 7.2 ± 2.8 | 7.6 ± 2.2 | 7.6 ± 2.4 | 0.65 |
| NRS-LP | 7.5 ± 2.5 | 6.5 ± 3.3 | 7.4 ± 2.6 | 0.14 |
| ODI (%) | 58.6 ± 18.0 | 54.6 ± 19.6 | 58.1 ± 18.1 | 0.48 |
| SF-12 PCS | 30.2 ± 7.5 | 32.6 ± 8.6 | 31.5 ± 7.7 | 0.31 |
| SF-12 MCS | 49.0 ± 12.9 | 49.4 ± 11.3 | 51.1 ± 11.3 | 0.67 |
| Zung Depression Scale | 34.9 ± 11.8 | 33.3 ± 9.8 | 33.5 ± 9.9 | 0.69 |
| EQ-5D | 0.49 ± 0.22 | 0.52 ± 0.18 | 0.50 ± 0.19 | 0.77 |

* BMI = body mass index; CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease.
† Mean values are presented ± SD.

are facing increasing scrutiny of whether their cost is justified by the benefit to patients from a population health perspective. In a health care reform era embracing value-based purchasing and patient-centeredness, the Institute of Medicine, the Agency for Health Research and Quality, and the Patient Protection and Affordable Care Act have called for evidence from everyday practice to guide policy and purchasing decisions via registries. At the heart of this evidence-driven reform process are safety and effectiveness (quality) and the cost of care, driving the value equation (quality/cost). Critical to assessing the value of lumbar surgery is a meaningful and accurate comparison with a gold-standard treatment option. Comprehensive medical management of lumbar spondylosis includes spinal steroid injections, physical therapy, bracing, muscle relaxants, and various narcotic and nonnarcotic oral agents. To date, medical management of surgically relevant pathologies such as lumbar disc herniation, stenosis, and spondylolisthesis has been assumed to be the gold standard against which higher-cost therapies should be compared. However, evidence unequivocally supporting multimodality medical therapy as an effective and valuable treatment option for these structural and surgically relevant spine pathologies continues to be

**TABLE 2: Improvement in patient-reported outcomes after 2 years of comprehensive medical management***

| Outcome Measurement Instrument | Lumbar Pathology | | |
|---|---|---|---|
| | Spondylolisthesis | Stenosis | Disc Herniation |
| NRS-BP | 1.1 ± 2.8 (p = 0.082) | 1.4 ± 3.0 **(p = 0.012)** | 1.6 ± 3.1 **(p = 0.006)** |
| NRS-LP | 0.96 ± 2.7 (p = 0.103) | 1.2 ± 3.6 (p = 0.092) | 1.6 ± 2.9 **(p = 0.03)** |
| ODI (%) | 6.6 ± 18.0 (p = 0.089) | 6.7 ± 21.4 (p = 0.135) | 9.6 ± 22.0 **(p = 0.03)** |
| SF-12 PCS | 0.51 ± 6.4 (p = 0.758) | 1.3 ± 8.2 (p = 0.512) | 2.4 ± 9.3 (p = 0.22) |
| SF-12 MCS | 1.2 ± 3.9 (p = 0.652) | 0.59 ± 6.4 (p = 0.805) | 0.4 ± 5.1 (p = 0.87) |
| Zung depression | 1.4 ± 7.2 (p = 0.552) | 1.5 ± 7.8 (p = 0.466) | 2.3 ± 6.6 (p = 0.25) |
| EQ-5D | 0.07 ± 0.18 (p = 0.120) | 0.07 ± 0.25 (p = 0.112) | 0.09 ± 0.23 (p = 0.06) |

* Each subset contained 50 patients. Mean values are presented ± SD. Boldface indicates statistical significance.

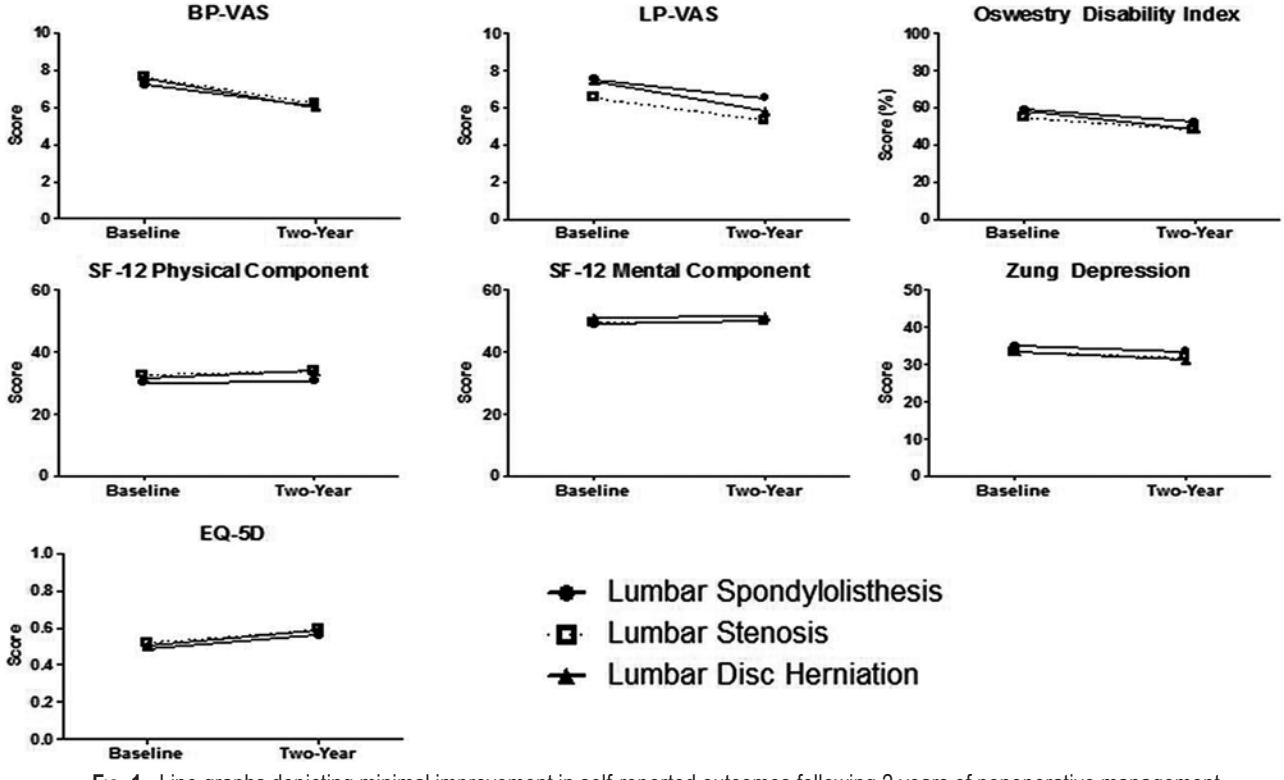


**Fig. 1.** Line graphs depicting minimal improvement in self-reported outcomes following 2 years of nonoperative management for patients with degenerative lumbar spondylolisthesis, stenosis, and disc herniation. BP-VAS = visual analog scale score for back pain; LP-VAS = visual analog scale score for leg pain.

debated. We challenge the notion that long-term medical therapies for 3 common surgical low-back pathologies are effective and valuable treatment options at the time point when surgery in considered; that is, when a lack of medical response has already been demonstrated.

Generating accurate and meaningful evidence from medically managed cohorts that allows for an "apples to apples" comparison with surgery-treated patients has historically been a challenge. To make a meaningful comparison for value analysis, one must minimize confounding that is inherent in the shared decision to undergo surgery (selection bias), limiting the use of nonrandomized prospective cohort studies. However, ethical constraints of RCTs mandating the allowance of treatment group crossover also results in confounded medical treatment cohorts. In nonrandomized studies, medically managed patients tend to represent those indivisuals most satisfied with or responsive to medical treatment, whereas surgical cohorts represent those patients not responsive and least satisfied with their initial trial at medical therapy. In RCTs such as SPORT, an intent-to-treat analysis generates a medical

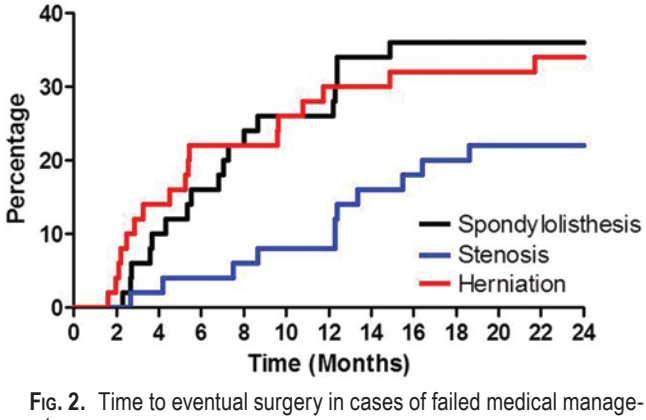


**Fig. 2.** Time to eventual surgery in cases of failed medical management.

**TABLE 3: Mean costs by treatment received and type of cost component***

| Treatment & Cost Component | Lumbar Pathology | | |
|---|---|---|---|
| | Spondylolisthesis | Stenosis | Disc Herniation |
| treatment | | | |
| health care visits | $2042 | $2088 | $1996 |
| diagnostic imaging | $1051 | $1070 | $989 |
| medications/injections | $3233 | $4330 | $3857 |
| total direct costs | **$6326** | **$7488** | **$6842** |
| cost component | | | |
| patient's/caregiver's missed work | $280 | $260 | $255 |
| total indirect costs | **$280** | **$260** | **$255** |
| total 2-year cost | **$6606** | **$7747** | **$7097** |

* Each subset contained 50 patients. Total values are shown in boldface.

cohort confounded by inclusion of surgically treated patients, and the "as treated" analysis by definition generates a medical cohort of patients who remain only after nonresponders to medical treatment have crossed over to surgery, artificially elevating the group mean measure of effectiveness.[23,24] Neither study design can answer the question, "Is prolonged medical treatment effective?" Hence, comparison studies to date provide a cloudy assessment of the effectiveness and value of medical therapy.

The authors feel that prospective longitudinal registries offer unique advantages to assessing single-treatment cohorts in everyday care. In accordance with the Institute of Medicine, the Agency for Health Research and Quality, and the Patient Protection and Affordable Care Act, careful case definitions within a prospective registry can allow for a measured and homogeneous patient population that is most similar to those patients to whom surgery is offered, without artificially affecting measurement due to research study constraints. In the current registry analysis, only patients who are typically offered low-back surgery were studied—that is, those with documented structural pathology; failure to demonstrate any improvement with 6–8 weeks of physical therapy, epidural injection, antiinflammatory, and muscle relaxant therapies; and clearly evident symptoms of mechanical back pain and neural compression. It is this population in which surgery is relevant, to which surgical effectiveness should be compared, and in which medical treatment effectiveness was studied here.

The goal of our study was to determine the 2-year cost and effectiveness of comprehensive medical management for lumbar spondylolisthesis, stenosis, and herniation by utilizing a prospective, single-center, multidisciplinary spine center registry in a real-world practice setting. In our cohort of 150 patients, the maximum health gain in back pain, leg pain, disability, quality of life, depression, and general health state did not achieve statistical significance by 2 years of medical management, with the exception of pain and disability in the disc herniation cohort and back pain in the lumbar stenosis cohort. Specifically, comprehensive medical management was associated with minimal gain in QALYs (0.07–0.09) and a significant 2-year cost ($6606–$7747). Around one-third of the patients in this series eventually required surgical management because medical treatment failed to improve their symptoms.

Our findings demonstrate a lack of improvement in almost every validated, patient-centered outcomes instrument employed. In those subsets in which a statistical change was observed, the magnitude of change did not surpass the minimum clinically important difference,[4,18] suggesting that in the few instances when statistical significance was observed, clinical significance was not. Even if powered appropriately so that the observed, nonsignificant, small health gains did reach statistical significance, none of them would have reached clinical significance (that is, a minimum clinically important difference). The cost of medical therapy observed in our practice was almost entirely direct medical cost, as occupational losses of patients and caregivers (indirect cost) were minimal. While the observed costs here were only one-third of the costs previously reported for surgical cohorts in like-patient groups,[1,19,23,24] our results suggest that there was no sustained benefit to justify these costs, putting into question the value of continued medical treatment in patients in whom improvement did not manifest in the first 6–8 weeks of therapy. There are a few reasons why our findings challenge those of previous reports. Medical management outcome studies will inevitably demonstrate greater effectiveness of medical treatment in those measured populations that 1) include patients without well-defined surgically relevant structural pathology, 2) include patients who have not fully engaged in an initial trial of the medical therapy to be studied, 3) include patients who demonstrate even modest improvements with their initial trial of medical management, or 4) exclude patients who subsequently choose to undergo surgery due to their poor outcomes with medical treatment. However, based on current evidence-based guidelines, those populations are not those that surgery should be offered to.[27]

In contrast, surgical treatments for structural low-back diseases have been shown to be cost-effective and provide sustained improvement over time. A recent study by Glassman et al. demonstrated that lumbar fusion is an effective, durable, and cost-effective treatment in a long-term 5-year follow-up.[10] Similar results have been demonstrated by Parker and colleagues and Adogwa et al., with the value of lumbar spine surgery ranging from $53,914–$62,995 per QALY gained depending on the procedure performed,[1–3,10,17,19] compared with $78,856–$110,671 per QALY gained for medical management as demonstrated in our study.

It is important to highlight the fact that comprehensive medical management is very effective in managing the sea of patients with low-back and leg pain. The vast majority of lumbar pathologies and symptoms will respond to medical therapies. It is only in the small subset of patients with documented structural spine pathology, with symptoms corresponding to those structural pathologies, and with pathologies and symptoms that demonstrate no improvement after patients fully engage in multimodality medical treatment that continued medical treatment may be of least value. It is this patient subset in which surgery, despite its cost, is likely the most valuable treatment option, from both a value-based and patient-centered perspective. Losing sight and grasp of an appropriate "apples to apples" medical comparison group most relevant to surgical patient populations will create an artificial headwind against the true value of surgical treatment options.

## Conclusions

In this prospective registry, comprehensive medical management was shown to provide no durable improvement for patients with degenerative lumbar spondylolisthesis, stenosis, or disc herniation. From both the societal and payer perspective, medical management of lumbar spondylolisthesis, stenosis, and disc herniation was associated with low effectiveness and high cost, resulting in low value. The findings from this real-world practice setting may more accurately reflect the true value and effectiveness of nonoperative care in this patient population.

### Disclosure

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Author contributions to the study and manuscript preparation include the following. Conception and design: McGirt, Parker, Godil. Acquisition of data: Parker, Godil, Mendenhall, Zuckerman, Shau. Analysis and interpretation of data: Parker, Godil, Mendenhall, Zuckerman, Shau. Drafting the article: Parker, Godil, Mendenhall, Zuckerman, Shau. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: McGirt. Statistical analysis: Godil. Study supervision: McGirt.

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