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ORIGINAL ARTICLE

Associations between surgeons' preoperative expectations of lumbar surgery and patient-reported 2-year outcomes

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Abstract

Purpose Surgeons' preoperative expectations of lumbar surgery may be associated with patient-reported postoperative outcomes.

Methods Preoperatively spine surgeons completed a validated Expectations Survey for each patient estimating amount of improvement expected (range 0–100). Preoperative variables were clinical characteristics, spine-specific disability (ODI), and general health (RAND-12). Two years postoperatively patients again completed these measures and global assessments of satisfaction. Surgeons' expectations were compared to preoperative variables and to clinically important pre- to postoperative changes (MCID) in ODI, RAND-12, and pain and to satisfaction using hierarchical models.

Results Mean expectations survey score for 402 patients was a 57 (IQR 44–68) reflecting moderate expectations. Lower scores were associated with preoperative older age, abnormal gait, sensation loss, vacuum phenomena, foraminal stenosis, prior surgery, and current surgery to more vertebrae (all $p \leq .05$). Lower scores were associated postoperatively with not attaining MCID for the ODI ($p = .02$), RAND-12 ($p = .01$), and leg pain ($p = .01$). There were no associations between surgeons' scores and satisfaction ($p = .06$–$.27$). 55 patients (14%) reported unfavorable global outcomes and were more likely to have had fracture/infection/repeat surgery (OR 3.2, CI 1.6–6.7, $p = .002$).

Conclusion Surgeons' preoperative expectations were associated with patient-reported postoperative improvement in symptoms and function, but not with satisfaction. These findings are consistent with clinical practice in that surgeons expect some but not complete improvement from surgery and do not anticipate that any particular patient will have markedly unfavorable satisfaction ratings. In addition to preoperative discussions about expectations, patients and surgeons should acknowledge different types of outcomes and address them jointly in postoperative discussions.

Keywords Surgeons' expectations · Lumbar surgery · Satisfaction · Delighted-terrible · Affective outcome

Introduction

Surgeons expect favorable technical results from lumbar surgery as well as improvement in patient-reported symptoms and function. Surgeons' expectations most likely derive from multiple sources, including diagnosis, prior treatments, physical examination and imaging abnormalities [1]. How these variables are ultimately weighed probably is influenced by surgeons' characteristics and prior experiences.

Most lumbar surgeries are elective and occur because patients desire symptom relief and improvement in function and quality of life. Surgeons proceed with surgery because they believe their interventions will achieve these goals–at least to some extent. Preoperative discussions with patients are essential to foster realistic expectations and to ensure patients and surgeons have aligned expectations and are pursuing the same goals.

A widely used patient-reported survey to measure function is the Oswestry Disability Index (ODI) which assesses disability in activities due to lumbar pain [2, 3]. The Veterans RAND-12 survey also is used for spine surgery to measure general health due to physical well-being [4]. A

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comparison of pre- and postoperative ODI and RAND-12 scores provides measures of change in disability and function. Threshold values for differences in scores have been proposed to reflect clinically important improvements [5, 6]. Other patient-reported outcomes are changes in pre- to postoperative back and leg pain measured with numeric rating scales; threshold values also have been proposed to reflect clinically important changes in pain [7].

Another common outcome is patients' global rating of satisfaction. Framed simply as 'how satisfied are you with the results of surgery', response options typically range from very satisfied to very dissatisfied [8, 9]. A more nuanced global assessment is an affective appraisal in which 'satisfied' is the middle option with 'delighted' and 'terrible' at the extremes [10]. Interestingly, while surgeons likely have a spectrum of anticipated improvement patients will probably achieve (i.e. ODI change) it is likely they anticipate all their patients will generally be satisfied with surgery, otherwise they would not operate.

In addition to expecting relief of pain and disability, patients have multiple other expectations of surgery and fulfillment of these expectations is another important outcome [11]. We previously showed that compared to patients' preoperative expectations, surgeons' preoperative expectations more accurately predicted what patients ultimately reported as their actual postoperative improvement 2 years postoperatively [12]. Specifically, the proportion of fulfilled expectations more closely matched what surgeons anticipated (OR 2.98) than what patients anticipated (OR 0.34). Thus, surgeons' expectations were highly associated with patient-reported fulfillment of expectations.

The purpose of the current analysis was to identify associations between surgeons' preoperative expectations and preoperative clinical characteristics and to ascertain if these expectations were associated with other patient-reported outcomes of lumbar surgery, particularly change in ODI and RAND-12 scores and satisfaction. We hypothesized that among patients undergoing lumbar surgery for diverse diagnoses, surgeons' expectations, paired to each patient, would be associated with patient-reported change in ODI and RAND-12 scores, but not with patient-reported satisfaction.

Methods

This analysis was conducted with data from a prospective study comparing patients' and surgeons' expectations of lumbar surgery and patients' fulfillment of expectations 2 years postoperatively. This study was approved by the Institutional Review Board at our institution; all patients provided written informed consent.

At enrollment Patients were eligible if they were scheduled for elective lumbar surgery by one of 5 participating surgeons, were ≥ 18 years old, and spoke English. Before surgery patients were interviewed and completed the validated Lumbar Spine Surgery Expectations Survey composed of 20 items addressing symptoms, function, and psychological well-being [11]. Based on factor analysis the items can be grouped into four domains: personal daily activities (e.g. sleeping), function (e.g. walking), psychological issues (e.g. reducing emotional stress), and skeletal improvement (e.g. improving balance).

For each patient his/her surgeon independently completed an identical version of the survey asking surgeons 'how much improvement do you expect' for your patient for each item with response options ranging from complete improvement to a little improvement; the option of this expectation does not apply also was offered [12]. Points were assigned for each response and then summed to generate a score ranging from 0–100; higher scores indicate greater expectations. Patients also completed the 10-item ODI (possible score range 0–100, higher is more disability), and the 12-item Veterans RAND-12 general health survey (possible score range for the physical function component 0–100, higher is better function) [2–4]. Patients rated back and leg pain on a 0–10 numeric rating scale and provided demographic and clinical data [7]. Charts were reviewed for systematically recorded physical examination and radiographic/imaging data.

At follow-up Two years postoperatively patients were contacted by telephone and asked to complete the ODI, RAND-12 and pain assessments from their current state and whether they had any untoward events since surgery, such as fracture, infection or repeat surgery. They were asked a general satisfaction question: 'how satisfied are you with the result of surgery' with response options of very satisfied, satisfied, neither, dissatisfied, and very dissatisfied. They also completed the validated Delighted-Terrible scale, a global single-item question used in diverse disciplines for an affective appraisal of recent experiences with a situation. Patients were asked, 'How would you feel if you were to spend the rest of your life with your spine symptoms just the way they have been in the past 24 h with 7-point response options of delighted, pleased, mostly satisfied, mixed, mostly dissatisfied, unhappy, terrible.

Data analysis preoperative assessments To account for more advanced disease potentially influencing surgeons' expectations, several clinical and imaging variables were included, such as abnormal lower extremity sensation, previous lumbar surgery, current multiple level surgery, and presence of disc vacuum phenomenon. These preoperative data were independent variables in bivariate analyses with surgeons' expectations scores as the dependent variable.

Postoperative assessment Change in pre-to postoperative patient-reported status for the ODI, RAND-12 and back and leg pain were calculated as continuous variables and compared to surgeons' expectations scores. Changes were then

dichotomized according to standard minimum clinically important differences, or threshold values, of 15 points for the ODI (MCID15), 5 points for the RAND-12 (MCID5), and 3 points for back and leg pain [5–7]. Frequencies of responses to the general satisfaction and affective questions were calculated. These postoperative measurements were dependent variables in bivariate analyses with surgeons' expectations as the independent variable.

To acknowledge potential differences in rating expectations among the 5 surgeons, all pre- and postoperative analyses were carried out accounting for surgeon and for multiple observations per surgeon using hierarchical models with generalized estimating equations in SAS 9.3. Convergence criteria were met for all models.

Results

In total 415 patients had surgeons' Expectations Survey scores, and of these 402 (96%) had a 2-year follow-up (mean 2.1 years, range 1.8–2.9) and were included in this analysis. Of the 13 patients who did not have follow-up, 3 refused because they had a bad outcome, 6 were lost to follow-up, and 3 were not eligible (deceased, cognitive deficit). Patients who refused because of a bad outcome or who were lost to follow-up did not differ from those who participated in terms of age, sex, diagnosis, and ODI and RAND-12 scores, but they had more multiple level surgery (44% vs. 26%) and lower surgeon expectations scores (46 vs. 57).

Patients' preoperative variables At enrollment the mean age of patients was 55 ± 14 years, 55% were men, 51% were employed, 32% had major comorbidity, 34% were taking opioids, 24% had previous lumbar surgery, 21% had a herniated disc, and 79% had diverse degenerative diagnoses (Table 1).

Surgeons' variables and Expectations Survey scores The 5 participating surgeons were men, fellowship trained in spine surgery, and in practice for 2–25 years. The number of patients per surgeon ranged from 34 to 115. Surgeons' mean Expectations Survey score was 57 ± 16 (interquartile range 44–68).

Surgeons' Expectations Survey scores and patients' preoperative variables Associations between surgeons' expectations scores (dependent variable) and patients' preoperative characteristics (independent variables) were compared. Lower expectations were found for demographic characteristics (e.g. older age, not working), clinical characteristics (e.g. abnormal gait, diminished lower extremity sensation) and imaging characteristics (e.g. disc vacuum phenomena, severe foraminal stenosis) (Table 2). Prior lumbar surgery and currently having surgery to more vertebral levels also were associated with lower expectations, particularly if previous surgery involved fusion and instrumentation.

Table 1 Preoperative patient demographic and clinical variables and survey scores (N = 402)

Variable	Value
Age, years (mean ± SD)	55 ± 14
Men	55%
Employed	51%
Back pain	
0–4	21%
5–7	33%
8–10	46%
Leg pain	
0–4	27%
5–7	33%
8–10	40%
Physical examination	
Abnormal toe walk	11%
Abnormal gait	23%
Abnormal sensation	29%
Prior lumbar surgery	24%
Prior fusion	9%
Prior instrumentation	6%
Current diagnosis	
Herniated disc	21%
Degenerative condition	79%
Number of levels for current surgery	
1	45%
2	29%
≥ 3	26%
Imaging	
Facet arthrosis	88%
Vacuum phenomena	34%
Severe foraminal stenosis	10%
Surveys	
Patients' Owestry Disability Index score (mean ± SD)[a]	53 ± 14
Patients' RAND-12 physical function score (mean ± SD)[b]	36 ± 6
Surgeons' Lumbar Spine Surgery Expectations Survey score (mean ± SD)[c]	57 ± 16

[a]Possible range 0–100, higher is more disability

[b]Possible range 0–100, higher is better function, 50 = general population

[c]Possible range 0–100, higher is greater expectations

Patients' postoperative outcome variables At follow-up, the mean within-patient pre- to postoperative difference in ODI scores was 34 ± 23 ($p < 0.0001$) and 80% met MCID15 (Table 3). The mean within-patient difference in RAND-12 scores was 12 ± 10 ($p < 0.0001$) and 77% met MCID5. Improvement of > 3 points occurred in 52% for back pain and 47% for leg pain. For the general satisfaction outcome, 71% reported they were very satisfied/satisfied, 21% neither, and 8% dissatisfied/very dissatisfied. For the affective outcome, 46% reported they were delighted/pleased, 44% mostly

Table 2 Surgeons' preoperative Expectation Survey scores versus patients' preoperative characteristics

Variable	Surgeons' Expectations Survey score		
	Has attribute	Does not have attribute	*p* value*
Age > 55 years[a]	54 ± 14	60 ± 17	< .0001
Employed	58 ± 16	55 ± 15	.02
Back pain			
0–4	55 ± 17	–	.12
5–7	56 ± 17	–	
8–10	57 ± 15	–	
Leg pain			
0–4	54 ± 17	–	.02
5–7	57 ± 16	–	
8–10	58 ± 15	–	
Abnormal toe walk	62 ± 14	56 ± 16	.05
Abnormal gait	60 ± 15	55 ± 16	.04
Abnormal sensation	60 ± 15	55 ± 15	.02
Prior lumbar surgery	53 ± 15	58 ± 16	.008
Prior fusion	48 ± 14	57 ± 16	.0002
Prior instrumentation	47 ± 13	57 ± 16	.001
Number of levels for current surgery			
1	59 ± 16	–	< .0001
2	55 ± 17	–	
≥ 3	54 ± 14	–	
Herniated disc	62 ± 17	55 ± 15	< .0001
Facet arthrosis	56 ± 15	62 ± 18	.07
Vacuum phenomena	54 ± 14	58 ± 16	.02
Severe foraminal stenosis	53 ± 14	59 ± 16	.0007

[a]Mean value for entire sample

*Based on hierarchical models, controlling for surgeon

Table 3 Patient-reported postoperative outcomes

Variable	Value
Owestry Disability Index	
Score (mean ± SD)	19 ± 21
Difference (mean ± SD)[a]	34 ± 23
met MCID15	80%
RAND-12 Physical Function	
Score (mean ± SD)	48 ± 10
Difference (mean ± SD)[a]	12 ± 10
met MCID5	77%
Met pain improvement > 3 points	
Back	52%
Leg	47%
General satisfaction	
Very satisfied	49%
Satisfied	22%
Neither satisfied or dissatisfied	21%
Dissatisfied	5%
Very dissatisfied	3%
Affective appraisal	
Delighted	26%
Pleased	20%
Mostly satisfied	17%
Mixed	24%
Mostly dissatisfied	3%
Unhappy	7%
Terrible	3%

[a]Within-patient change from preoperative score ($p < .0001$)

satisfied/mixed/mostly dissatisfied, and 10% unhappy/terrible. Patients also reported any untoward events during the follow-up period, such as infection (5 patients), fracture (5 patients), and another lumbar surgery (38 patients), for a composite of 43 patients (11%) having any untoward spinal event.

Surgeons' Expectations Survey scores and patients' postoperative outcomes Associations between surgeons' preoperative expectations and patients' postoperative ratings were first assessed as continuous variables. Controlling for surgeon, expectations were associated with ODI ($p < 0.0001$), RAND-12 ($p = 0.002$), and leg pain ($p = 0.004$), but were not associated with back pain ($p = 0.10$). Surgeons' expectations were then assessed according to MCID thresholds. Surgeons' expectations were lower for patients who did not meet the ODI MCID15 threshold ($p = 0.02$), for patients who did not meet the RAND-12 MCID5 threshold ($p = 0.01$), and for patients who did not meet the leg pain threshold ($p = 0.01$) (Fig. 1). These associations were strongest for surgeons' expectations in the function domain of the survey ($p < 0.05$ for all comparisons). Lower expectations were associated with less change in back pain ($p = 0.03$) but did not meet the threshold of > 3.

There were no associations between surgeons' expectations and either patients' global satisfaction or their affective assessment (Fig. 2).

Sub-analyses were performed for the 29 patients (8%) who reported they were dissatisfied or very dissatisfied, and for the 53 (13%) who reported they felt mostly dissatisfied, unhappy, and terrible. These two groups overlapped with a composite of 55 patients (14%) having these unfavorable outcome ratings. Compared to patients with more favorable ratings, these patients did not differ by age, sex, diagnosis, number of vertebrae undergoing surgery, and surgeons' expectations scores (57 vs. 54, $p = 0.24$). However, patients with unfavorable ratings were more likely to have had previous lumbar surgery (22% vs.40%; OR 2.4, 95% CI 1.3–4.3, $p = 0.005$) and to have had an untoward event from the current surgery (i.e. fracture, infection, repeat surgery) (9% vs. 24%; OR 3.2, 95% CI 1.6–6.7, $p = 0.002$).

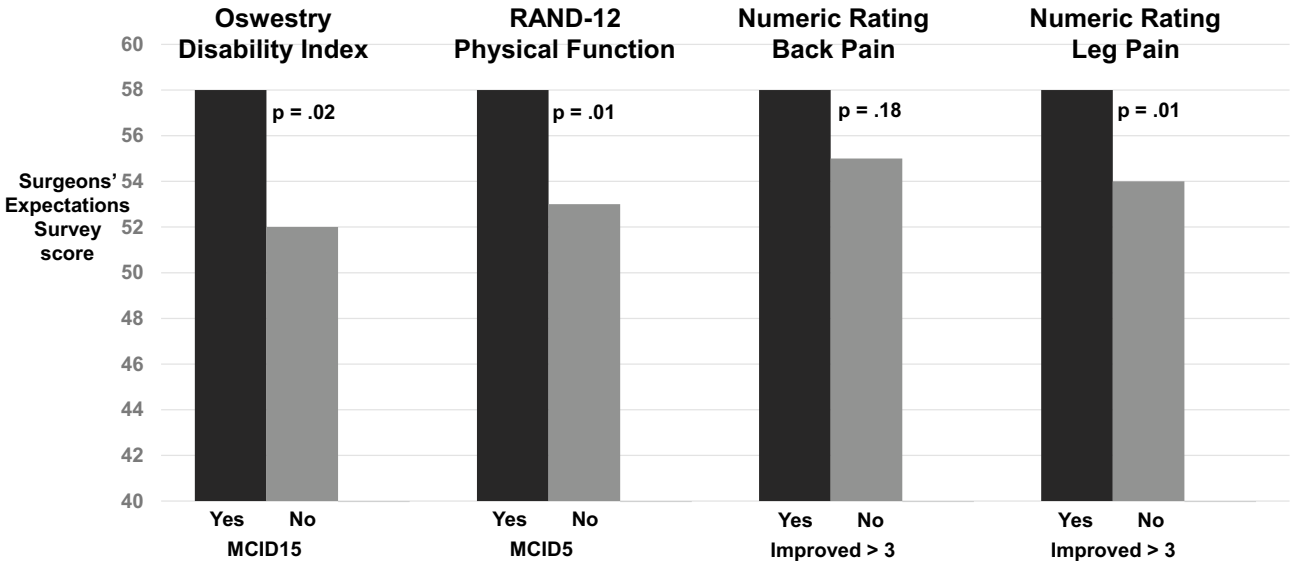

Fig. 1 The figure shows surgeons' preoperative Expectations Survey scores and pre- to postoperative patient-reported change in function and pain. Surgeons' expectations scores were lower for patients who did not meet ODI, RAND-12, and leg pain thresholds

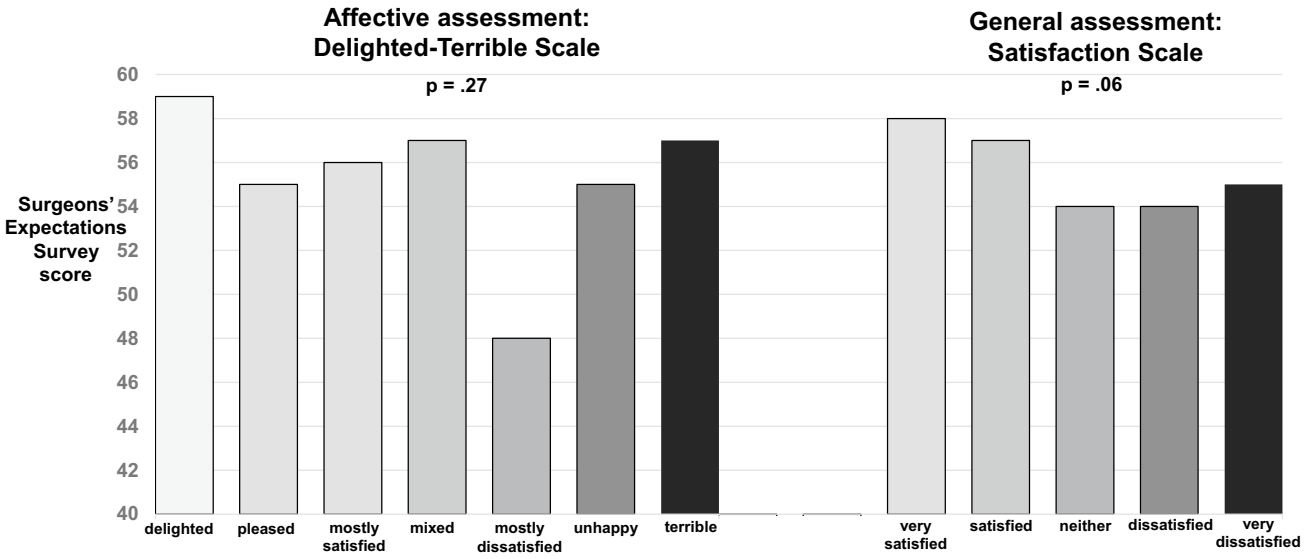

Fig. 2 The figure shows surgeons' preoperative Expectations Survey scores and postoperative patient-reported satisfaction. There were no associations between surgeons' expectations and either patients' global satisfaction or their affective assessment

As a preliminary estimate for a threshold expectations score that would be associated with patient-reported favorable outcomes, we found a median score of 57.5 corresponded to MCID values for the ODI, RAND-12 and leg pain, and a score of 56.3 corresponded to global satisfaction (i.e. responses of very satisfied/satisfied and delighted/pleased/mostly satisfied).

Discussion

Using a validated lumbar surgery Expectations Survey, we found that surgeons' preoperative expectations for improvement in symptoms and function were associated with preoperative patient demographic and clinical

characteristics, such as lower expectations for older age and imaging abnormalities. We found that surgeons' lower expectations were associated with patients' longitudinal reports of less improvement in disability and general well-being at 2 years. In contrast, we did not find associations with surgeons' expectations and patients' satisfaction with surgery based on global general and affective outcomes. Thus surgeons were able to predict postoperative functional outcomes but not satisfaction.

What is the reason for these divergent findings? When considered carefully, these results have face validity and are consistent with clinical practice. Specifically, surgeons expect patients will benefit from surgery and have some improvement in symptoms and function; hence the associate with post-operative ODI and RAND-12. However, surgeons expect some, but not complete improvement, as evidenced by their modest mean score on the Expectations Survey (57) versus the maximum possible score (100), which reflects complete improvement or back to normal. Thus it is fitting that the postoperative improvement reported by patients is a graduated amount consistent with surgeons' anticipated degree of improvement.

The story for satisfaction, however, is somewhat different. While surgeons acknowledge there probably will be a range of satisfaction, it is likely they do not anticipate any particular patient will be at the extreme and be dissatisfied, or worse, feel unhappy or terrible. In our study surgeons rated expectations for each patient individually. It is likely that if they expected real benefits they would operate even if they believed patients might not be fully satisfied. In addition, many patients with unfavorable ratings underwent a subsequent surgery during the follow-up period—it is unlikely that surgeons could have predicted which patients would require a repeat procedure during this short interval. Thus our findings are consistent with clinical practice and the selection of patients for surgery.

Surgeons' preoperative perspectives are based on weighing multiple patient variables and integrating their own prior experiences with similar clinical scenarios. How all these variables are combined to ultimately formulate an overall assessment is a complex process. Our current analysis showed that surgeons assembled a composite picture and then estimated patients' likely situation 2 years after surgery. In a previous analysis we showed these estimates corresponded to fulfillment of patients' expectations for physical and psychological well-being [12].

It was notable to find in the current analysis that expectations were not lower based on severity of certain preoperative features, such as more back pain, but were lower for other indicators of severity, such as presence of vacuum phenomena and previous lumbar surgery. One possible explanation for this is that, as above, surgeons' overall perspectives are a composite of multiple variables and considering variables in isolation does not depict the actual assessment process. Another possible explanation is that certain features that indicate worse status do not necessarily portend worse outcome if the surgeon believes these features are amenable to repair and the planned intervention will be effective.

In our previous report from this study we compared patients' and surgeons' expectations and found 84% of patients had higher expectations with a mean Expectation Survey score of 73 compared to their surgeons' mean score of 57 with a paired intraclass correlation coefficient of 0.31, reflecting fair agreement [12]. Thus a cornerstone of preoperative discussions with patients should be aligning expectations to ensure patients and surgeons are working toward the same goals.

Other studies also assessed concordance between patients' and surgeons' expectations [13–16] for spine surgery using surveys similar to the one in our study, and also reported patients had greater expectation than surgeons [12]. With respect to associations with preoperative variables, older age was consistently associated with lower surgeons' expectation [15–17]. Only one study considered associations with outcomes and reported surgeons' expectations were associated with patient-reported postoperative improvement in function for hip arthroplasty, but not for knee arthroplasty [17]. Another study compared expectations among foot/ankle surgeons and found certain surgeons tended to have higher expectations than others. The authors attributed these differences to years of experience, variety of procedures possible for certain diagnoses, and sub-specialization of practice [15].

Our study has particular strengths. We had a large sample of patients undergoing surgery for diverse diagnoses by different surgeons, and potential variations among surgeons' and their patient samples were accounted for with hierarchical models. Our surgeons completed a survey for each of their patients, thus expectations were tailored to patients' unique scenarios. To acknowledge the multifactorial nature of expectations, we considered diverse influences on expectations such as symptoms, prior treatments, physical examination and imaging variables, and we reported bivariate analyses in order not to unduly underestimate the importance of variables that might be eliminated in final multivariable models. We also considered diverse outcomes that were important to patients, such as symptom relief and function, as well as global assessment including an affective measure that reflects an emotional appraisal of how surgery ultimately impacted quality of life.

Our study has several limitations. First, this study was conducted in a tertiary care center and our patients and surgeons may differ from others in different settings. Second, our selection of variables representing diverse clinical features may not have captured the most salient issues affecting surgeons' expectations. Third, we did not ask surgeons

why they chose the expectations they did. In future studies it would be interesting to ask surgeons for their rationale in choosing expectations, particularly if they differ for patients with similar clinical features. Fourth, we were not able to develop and test a clinical prediction model with this study design. Such a model can be formulated in a future study to include the covariates we found as well as surgeons' rationale for choosing their expectations; the model then can be prospectively tested in another sample.

In summary, surgeons' preoperative expectations were associated with diverse preoperative clinical variables and with patient-reported postoperative improvement in symptoms and function, but not with global measures of satisfaction. In addition to addressing expectations before surgery as an essential part of preoperative discussions, addressing fulfillment of expectations should be part of comprehensive postoperative discussions and the mutual patient-surgeon assessment of diverse outcomes.

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Declarations

Conflict of Interest None of the authors has financial or non-financial interests that are directly or indirectly related to the submitted work.

Ethical approval The work was approved by the Institutional Review Board at Hospital for Special Surgery.

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