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Sexual Dysfunction and Urinary Incontinence in Female Patients Following Primary Anterior Lumbar Interbody Fusion: A Survey of 84 Patients

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ABSTRACT

Background: Anterior lumbar interbody fusion (ALIF) surgery can damage nerve fibers and has been linked to retrograde ejaculation in men. In women, sexual dysfunction following ALIF is rarely investigated. The aim of this study was to investigate the frequency of postoperative changes in sexual function and incontinence in women following ALIF.

Methods: For this study, 173 female patients aged 18 to 60 years who had undergone a primary ALIF surgery in 2015 to 2022 in a large spine center to retrospectively answer a questionnaire about sexual function and incontinence pre- and postoperatively; they were also asked to rate their satisfaction with the surgery. McNemar tests were used to compare the prevalence of specific problems pre- vs postoperatively.

Results: Of all respondents ($n = 84$), 23 (27%) reported a worsening of sexual function following ALIF surgery, and these changes were persistent in 83% of those patients. Among individual symptoms of sexual dysfunction, the highest increase was observed for the prevalence of vaginal dryness, which increased from 12% preoperatively to 32% postoperatively ($P < 0.001$), followed by dyspareunia, which increased from 8% to 21% ($P = 0.001$). Urinary incontinence increased from 25% to 41% ($P < 0.001$). Patient age, level of surgery, and fusion material were not associated with worsening of sexual function. However, worsening of sexual function was associated with a lower level of satisfaction with the surgery outcome and a lower proportion of patients who would have the surgery again.

Conclusions: Female patients undergoing ALIF should receive adequate preoperative information about potential changes in sexual function to enable them to make an informed decision.

Clinical Relevance: An improved understanding among patients will lead to more realistic patient expectations and higher patient satisfaction.

Level of Evidence: 4.

Lumbar Spine

Keywords: spine surgery, spinal fusion, ALIF, sexual dysfunction, sexual function

INTRODUCTION

Anterior lumbar interbody fusion (ALIF) is a widely used procedure to fuse vertebral bodies in patients with chronic back pain due to spondylolisthesis or neural compression. Compared with posterior or lateral approaches, the anterior approach has distinct advantages and disadvantages. On the one hand, the paravertebral muscles and the spinal canal are spared. On the other hand, there is a risk of injury to visceral organs, large vessels, and nerves of the hypogastric plexus.[1,2] In addition to these serious complications that are usually immediately recognizable, damage or irritation of small nerve fibers may occur during the anterior surgical access, which only becomes noticeable with a delay after surgery. For both anterior and posterior/lateral fusions, there are also common surgical complication risks such as an inflammatory reaction to the biologics used as filling material in the cage.[3] An inflammatory reaction due to biologics may cause retroperitoneal fibrosis, which can also adversely affect nerve function.[4]

The nerves of the hypogastric plexus are particularly at risk of impairment from ALIF due to their proximity to the surgical field. These nerves innervate the organs of the small pelvis—including the bladder, the urethra, the rectum, and the sexual organs—and are thus indispensable for sexual and urinary functions. Damage to these nerve fibers, either directly during surgery or later as a result of local inflammation, could lead to bladder and/or sexual dysfunction.[3,5]

In men, retrograde ejaculation due to nerve injury after ALIF is a relatively common postoperative complication.[6] In women, changes in sexual function or urinary incontinence after ALIF—both plausible due to the anatomical circumstances outlined above—are poorly studied.[5] Therefore, the aim of this study was to investigate the frequency of postoperative changes in sexual function and incontinence in women after ALIF.

METHODS

Study Design, Setting, and Participants

This was an observational study based on a customized questionnaire administered between February and April 2023 to patients who underwent an ALIF surgery between January 2015 and October 2022 in a high-volume spine center inBern, Switzerland. This institution is among the leading spine centers in Switzerland, with more than 1000 spine surgeries performed every year by 4 different surgeons.

Patients aged 18 to 60 years at the time of the surgery who underwent a primary ALIF surgery at 1 or 2 levels between L4 and S1 from January 2015 to October 2022 and did not undergo revision surgery were eligible for the study. Eligible patients were identified based on data from the hospitals' clinic information system. All eligible patients were contacted in writing (in German) and provided with information about the study, a consent form, and the (encrypted) questionnaire. Nonresponders were contacted again after 4 to 6 weeks.

The study was approved by the ethics committee of the canton of Bern (BASEC-No. 2022–01832). Results were reported in line with the Consensus-Based Checklist for Reporting of Survey Studies.[7]

Data Collection

From the hospitals' information system, we extracted data encompassing name, address, age, type and date of surgery, level/height of surgery, biologics (bone morphogenic protein [BMP, InductOs, Medtronic], pelvic crest, or ReadiGraft Cancellous Chips [LifeNet Health]), as well as having an infiltration (using local anesthetics and/or steroids), a revision surgery on the spine, or a gynecological surgery. With the questionnaire, we captured baseline variables including civil status, primary disease, medications, previous surgeries, deliveries, hormonal status, and hormonal contraceptives or other hormonal treatments. Participants were queried about specific aspects of sexual and urinary function, such as the occurrence of problems with vaginal dryness, dyspareunia, vaginal penetration, libido, menstrual changes, and urinary or fecal incontinence before the spine surgery. In the next section of the questionnaire, participants were asked about postoperative sexual activity, changes in sexual function, menopausal status, contraceptives or hormonal treatment, and the same aspects related to sexual and urinary function as above. Satisfaction with the outcome of the surgery, rated on a scale of 0 to 10 (with 10 being the highest possible satisfaction), and whether they would have the surgery again were also assessed. All questionnaires were completed by participants independently of the hospital, and all responses were based on the (subjective) judgment of the participants.

All patient data for this study were then entered into a secure REDCap Cloud database.

Definitions

The primary outcome of the study was the change in sexual function after surgery compared with before surgery. The answer options for this question were "worse function," "better function," "no change," and "unsure." Because of the low number of participants with improved sexual function and those who were unsure, they were combined with participants who reported no change into 1 group ("no worsening") and then compared with participants who reported a worsening in sexual function ("worsening").

The secondary outcomes were urinary incontinence, fecal incontinence, and patient satisfaction with the outcome of surgery. We calculated rates of new-onset urinary incontinence, defined as reported postoperative incontinence without preoperative incontinence. The satisfaction score was categorized into "not satisfied" (score 0–2), "somewhat satisfied" (3–7), and "satisfied to very satisfied" (8–10).

Statistical Analysis

In the descriptive analyses, continuous variables were expressed as medians and interquartile ranges (IQRs), and proportions were reported as raw numbers and percentages. We compared characteristics of participants with worsening vs no worsening of sexual function using χ^2 test or Fisher exact test for categorical values and Wilcoxon rank-sum test for continuous variables as appropriate. We used the exact McNemar test to compare paired data (ie, pre-post comparisons). In pre-post comparisons, the answer "unsure" was combined with "no problems," while missing values were ignored.

A P value less than 0.05 was considered significant. Analyses were conducted using R for Windows version 4.2.1.[8]

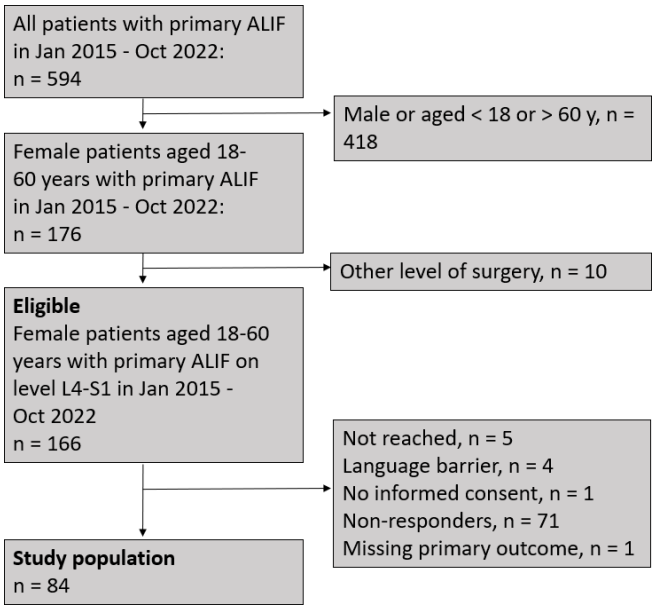

Figure 1. Study flowchart. Jan, January; Oct, October.

RESULTS

Study Population

Of the 166 patients contacted, 5 could not be reached (outdated address and/or phone number) and 4 were not able to complete the questionnaire due to language barriers. Of the 157 remaining patients, 84 completed the questionnaire (61 after the first and 23 after the second dispatch), which corresponds to a response rate of 54% (Figure 1). Participants and nonresponders were similar in terms of age ($P = 0.169$), date of/time since surgery ($P = 0.542$), and level of surgery ($P = 0.656$).

The characteristics of the 84 participants are presented in the Table (additional information is provided in Supplemental Table 1). The median age was 48 years (IQR 41–54) at the time of surgery and 51 (IQR 44–60) at the time of survey, with a median time between surgery and survey of 4 years and 4 weeks (IQR 1 year 50 weeks to 6 years, minimum 34 weeks, maximum 7 years 48 weeks). Almost half of the participants were married at the time of the survey ($n = 40$, 48%), and the majority ($n = 53$, 63%) had given birth at least once. Thirty-four (60%) participants had comorbidities, with osteoarthritis ($n = 17$, 19%) occurring most frequently.

Both musculoskeletal ($n = 35$, 42%) and urogenital surgery ($n = 23$, 27%) prior to ALIF were prevalent, but for one-third of the participants (n = 28, 33%), ALIF was the first surgery. Most participants had an ALIF on the level L5/S1 ($n = 66$, 79%), followed by an ALIF on both levels L4/L5 and L5/S1 ($n = 13$, 16%), and an ALIF on the level L4/L5 ($n = 5$, 6%). The most common fusion material was BMP ($n = 69$, 82%).

Overall, 71 participants (84%) had been sexually active since surgery. A change in hormonal phase (eg,

Table. Patient characteristics stratified by worsening in sexual function.

Characteristic	Total ($n = 84$)	Worsening ($n = 23$)	No Worsening ($n = 61$)	*P*
At time of surgery				
Age, y, median (IQR)	48 (41, 54)	48 (43, 54)	46 (38, 54)	0.267
Prior operations, *n* (%)				
None	28 (33.3)	5 (21.7)	23 (37.7)	0.202
Musculoskeletal	35 (41.7)	11 (47.8)	24 (39.3)	0.649
Urogenital	23 (27.4)	6 (26.1)	17 (27.9)	>0.99
Visceral	10 (11.9)	4 (17.4)	6 (9.8)	0.450
Other	16 (19.0)	5 (21.7)	11 (18.0)	0.941
Surgery level, *n* (%)				0.261
L5/S1	66 (78.6)	18 (78.3)	48 (78.7)	
L4/L5 + L5/S1	13 (15.5)	5 (21.7)	8 (13.1)	
L4/L5	5 (6.0)	0 (0.0)	5 (8.2)	
Fusion material, *n* (%)				0.850
Inductos	69 (82.1)	18 (78.3)	51 (83.6)	
Pelvic crest	12 (14.3)	4 (17.4)	8 (13.1)	
Readygraft/crunchychips	3 (3.6)	1 (4.3)	2 (3.3)	
Between surgery and survey, *n* (%)				
Having an infiltration	23 (27.4)	6 (26.1)	17 (27.9)	0.870
Having a revision surgery on the spine	11 (13.1)	4 (17.4)	7 (11.5)	0.474
Having a gynecological surgery[a]	3 (3.6)	2 (8.7)	1 (1.6)	0.362
At survey				
Time since surgery, wk, median (IQR)	212 (102, 312)	237 (100, 311)	210 (114, 312)	0.758
Having been sexually active since surgery, *n* (%)	71 (84.5)	19 (82.6)	52 (85.2)	>0.99
Change in hormonal phase since surgery, *n* (%)[b]	24/76 (31.6)	7/18 (38.9)	17/58 (29.3)	0.563
Change in hormonal treatment/contraception since surgery, *n* (%)[b]	15/81 (18.5)	5/21 (23.8)	10/60 (16.7)	0.520

Abbreviation: IQR, interquartile range.
[a]Calculated using 2-sided Fisher exact test.
[b]Denominator shown because missing values exceeded 5% in some groups.

from [ir]regular periods to menopause) had occurred in 24 (out of 76 participants without missing values; 31.6%), and 15 (out of 81 participants without missing values; 18.5%) had experienced a change in hormonal treatment (eg, from using contraceptives to not using contraceptives).

Sexual Function

Of all 84 participants, 23 (27%) reported a worsening of sexual function after ALIF surgery, 2 (2%) reported a better sexual function, and the remaining reported no change ($n = 55$, 65%) or were unsure ($n = 4$, 5%).

Patient age, surgery level, fusion material, time since the surgery, sexually active status since the surgery, changes in hormonal phase and hormonal treatment/contraception, as well as having an infiltration, a revision surgery on the spine, or a gynecological surgery, did not vary significantly between participants with worsening of sexual function vs those without (Table).

Among participants who reported a worsening of sexual function, 9 (39%) reported that changes first occurred within 3 months after surgery, and 10 (43%) reported that they became apparent later than 3 months after surgery (with 3 participants being unsure and 1 response missing). In most participants, the worsening of sexual function was ongoing at the time of the survey ($n = 19$, 83%), and none of the participants reported a worsening that lasted less than 1 month.

Figure 2 depicts participants' problems across different areas of sexual function preoperatively vs postoperatively, separately for all participants, participants who reported a worsening of sexual function, and participants who did not (see Supplemental Table 2 for detailed information). The most common problem among all participants before surgery concerned their libido ($n = 17$, 20%). After surgery, the most common problem was vaginal dryness ($n = 27$, 32%), followed by problems with libido ($n = 20$, 24%), and dyspareunia ($n = 18$, 21%).

The highest proportional increase was observed for vaginal dryness. It increased by a factor of 2.7 in all participants ($P < 0.001$) and by a factor of 6.3 in participants who reported worsening of sexual function ($P < 0.001$). There was no increase of vaginal dryness in participants who did not report worsening of sexual function. Similarly, dyspareunia increased by a factor of 2.6

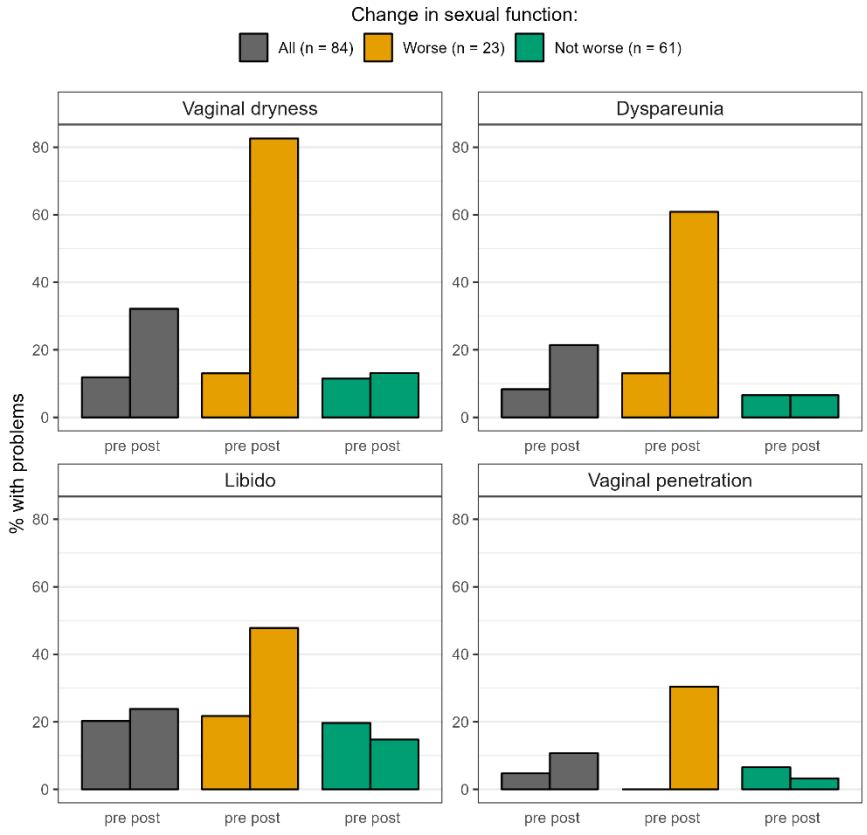

Figure 2. Individual aspects of sexual dysfunction pre- and postoperatively, stratified by subjective worsening of sexual function.

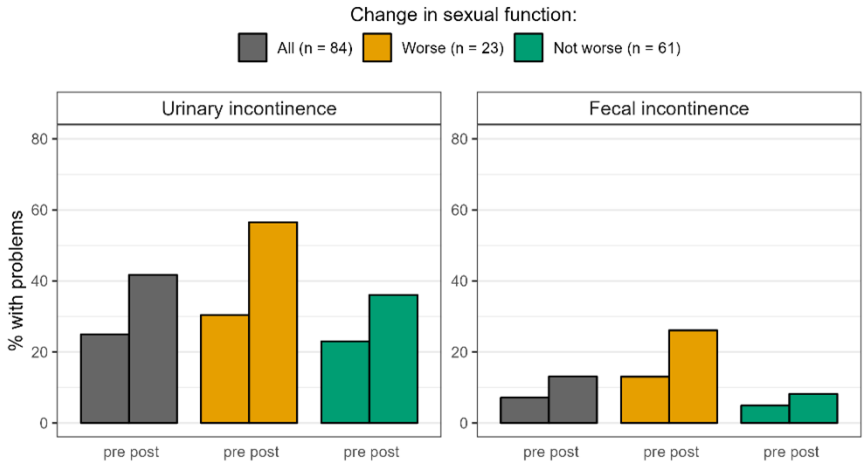

Figure 3. Urinary and fecal incontinence pre- and postoperatively, stratified by subjective worsening of sexual function.

overall ($P = 0.001$) and by a factor of 4.6 in participants who reported worsening of sexual function ($P = 0.003$). There was no increase in dyspareunia in participants without worsening of sexual function.

Urinary and Fecal Incontinence

The occurrence of urinary incontinence increased pre- to postoperatively, both in participants who reported worsening of sexual function ($P = 0.023$) and in those who did not ($P = 0.016$; see Figure 3 and Supplemental Table 3). Overall, it increased from 21 (25%) to 35 (41%; $P < 0.001$) participants, whereby 19 (23%) participants had new-onset urinary incontinence. The most common form of urinary incontinence postoperatively was stress incontinence ($n = 28$, 80% of participants with incontinence). Urge incontinence and unnoticed incontinence were observed by 11 (31% among those with incontinence) and 8 participants (23% among those with incontinence), respectively.

The number of participants reporting fecal incontinence did not increase significantly (see Figure 3 and Supplemental Table 3).

Satisfaction

Figure 4 displays satisfaction ratings on a scale from 0 to 10. Among all participants, 66 (79%) were satisfied to very satisfied with the surgery. Satisfaction was lower among participants who reported worsening of sexual function after ALIF ($n = 15$ or 65%) vs in those who did not ($n = 51$ or 84%; $P = 0.023$). The majority of participants would have the surgery again ($n = 71$ or 85%). This proportion was also lower among participants who reported worsening of sexual function ($n =$

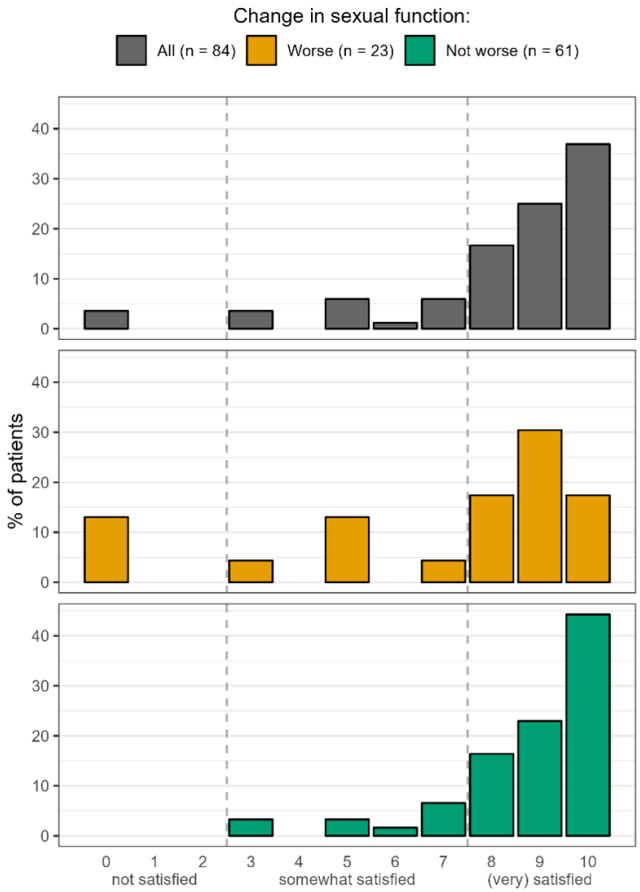

Figure 4. Patient satisfaction with their anterior lumbar interbody fusion surgery on a scale from 0 to 10, stratified by subjective worsening of sexual function.

14 or 61%) vs those who did not (n = 57 or 93%; P = 0.001).

DISCUSSION

In this study of 84 female patients, 23 (27%) reported a worsening of sexual function after ALIF surgery, and only 2 reported an improvement. The highest proportional increase in individual symptoms was observed in the prevalence of vaginal dryness and dyspareunia. Patient age, level of surgery, and fusion material were not associated with worsening of sexual function, but worsening of sexual function was associated with a lower level of satisfaction with the surgery outcome.

Evidence regarding sexual dysfunction in women following ALIF surgery is scarce. Wuertz-Kozak et al prospectively surveyed 15 patients who underwent ALIF and found no change in the total "Female Sexual Function Index" and the subscores desire, arousal, lubrication, orgasm, satisfaction, and pain but an increase in sexual desire, which they attributed to postsurgical pain relief.[5] This finding is in contrast to our findings of not only the consideraable prevalence of worsening of sexual function but also an increased prevalence of vaginal dryness and dyspareunia but unchanged libido (ie, desire). Interestingly, we observed a relatively high prevalence of specific aspects of sexual dysfunction already preoperatively, which is in line with the literature. For instance, 12% of participants in our study reported vaginal dryness preoperatively, whereas the prevalence of "arousal and lubrication disorders" in the general population was previously estimated at 8% to 15%.[9] Similarly, preoperative problems with libido were reported by 20% of our participants, which is within the broad range of 17% to 55% reported in the literature[9] and is very consistent with a Moroccan study, which reported a loss of sexual desire in 20% of female patients with low back pain.[10]

Given the lack of further studies on sexual dysfunction following ALIF in women, it is worth taking a look at the evidence in men. In a recent systematic review, Body et al synthesized evidence from 18 studies on retrograde ejaculation, a specific form of sexual dysfunction, following ALIF in men.[6] This allows for a comparison of our results and reveals 3 interesting differences. First, a quarter of our female respondents experienced a worsening of sexual function. This far exceeds the frequency found in men, which has been estimated at 2.3%.[6] However, this number was specific to retrograde ejaculation, which is more narrowly defined than sexual dysfunction. Second, while retrograde ejaculation was resolved by the final follow-up (ranging from 6–62 months) in 46% of patients,[6] sexual dysfunction in our female participants persisted in 83% after a mean observation time of about 4 years. Third, while the use of BMP-2 was associated with retrograde ejaculation in earlier studies,[6] we found no association between worsening of sexual function and fusion materials (with InductOs/BMP-2 being the most commonly used). However, Body et al also found no differences between BMP-2 and controls when restricting the analysis to patients operated on after 2008.[6]

Urinary incontinence was reported by 25% of our participants (median age of 48 years) preoperatively, which is not surprising, given that it is a well-known problem in women that is highly dependent on age. Two population-based studies of Swedish women reported a prevalence of around 12% to 15% for women aged 40 to 60 years.[11] In our study, urinary incontinence increased to 42% following ALIF, with stress incontinence being the most common type. This is in contrast to the study of Wuertz-Kozak et al, who found no difference in urinary incontinence after surgery.[5] Contrary to urinary incontinence, we found no significant increase in fecal incontinence after ALIF. However, the lack of evidence of an increase is not evidence that there is no increase, particularly given the limited sample size and the (increasing) trend that we observed. Therefore, this null result should not be overinterpreted.

Importantly, patient satisfaction with the outcome of the surgery was generally very high, with 79% of participants who were satisfied to very satisfied and 85% of participants who would have the surgery again. However, participants with sexual dysfunction after the surgery were less satisfied with the outcome of the surgery and were less willing to have the surgery again. Due to the lack of causality, we do not know whether the dissatisfaction in these participants was a result of sexual dysfunction or of a poor surgery outcome (eg, with persistent pain), which also led to worsening of sexual function.

Strengths and Limitations

To the best of our knowledge, the present study is the first of its size to study sexual dysfunction after ALIF in women. Nevertheless, there are several limitations. First, our results may be biased by the moderate response rate of 54% (participation bias). Differences between responders and nonresponders on the basis of age, time since surgery, and level of surgery could be excluded, but nonobserved differences may exist. Second, there was a long period (mean of 4 years) between the surgery and the survey (recall bias for

both perception of pre- and postoperative sexual function). Third, the patient information about the study could have had a suggestive effect. Fourth, the median patient age at the time of the survey in this study was 51 years, which corresponds to the average age of menopause in Swiss women.[12] Patient age and the proportion of patients with a change in hormonal phase and in hormonal treatment/contraception did not differ substantially in participants who observed a worsening of sexual function vs those who did not. Still, the advanced patient age may have biased our results. Generally, we assume that these 3 limitations could have inflated the rate of sexual dysfunction we observed in this study, and the overestimation may have been reinforced by the limitation that all outcomes were self-reported.[13] Furthermore, other causes that might influence sexual function, such as the burden of physical and mental illness or overall relationship satisfaction,[14] were not specifically investigated. Similarly, only participants without subsequent spinal surgery were included in the study, which may have led to a more conservative result than would be expected if a proportion of these participants had to undergo subsequent spinal surgery. Moreover, our questionnaire was not validated, which limits the comparability of our results to other studies. Finally, the external validity of our study was restricted by the fact that we only observed patients from 1 spine center with 4 surgeons.

Implications

We found frequent and persistent signs of sexual dysfunction and incontinence in a survey after ALIF in women. Given our study design, we cannot draw any direct conclusions as to how the worsening of sexual function is related to the ALIF surgery. In this context, it is interesting that almost half of participants who reported a worsening of sexual function stated that it did not start until more than 3 months after the surgery. In light of the high rates of sexual dysfunction, the effect of the surgery should be assessed more conclusively, that is, in a prospective, controlled survey study.

Nevertheless, we propose that care professionals performing ALIF should be aware of the potential impact of the surgery on sexual function and continence in women. Moreover, they should provide patients with adequate and transparent patient information about the risk of these conditions prior to surgery. Postoperatively, patients should be asked explicitly about changes in sexual function and urinary incontinence and, if indicated, offered specific symptom-related treatments such as pelvic floor physiotherapy, lubricants, or local estrogen therapy.

CONCLUSION

Our study showed a substantial proportion of patients with worsened sexual function and urinary incontinence on average 4 years after ALIF surgery. Participation and recall bias as well as high patient age may have influenced the study results. Further research with a prospective, controlled study setting is needed to verify the observed results, investigate the temporal dimension, and re-assess potential risk factors for postoperative impairment.

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