

# Comparison of Patient and Surgeon Perceptions of Adverse Events After Adult Spinal Deformity Surgery

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**Study Design.** Survey based on complication scenarios.

**Objective.** To assess and compare perceived potential impacts of various perioperative adverse events by both surgeons and patients.

**Summary of Background Data.** Incidence of adverse events after adult spinal deformity surgery remains substantial. Patient-centered outcomes tools measuring the impact of these events have not been developed. An important first step is to assess the perceptions of surgeons and patients regarding the impact of these events on surgical outcome and quality of life.

**Methods.** Descriptions of 22 potential adverse events of surgery (heart attack, stroke, spinal cord injury, nerve root injury, cauda equina injury, blindness, dural tear, blood transfusion, deep vein thrombosis, pulmonary embolism, superficial infection, deep infection, lung failure, urinary tract infection, nonunion, adjacent segment disease, persistent deformity, implant failure, death, renal failure, gastrointestinal complications, and sexual dysfunction) were presented to 14 spinal surgeons and 16 adult patients with spinal deformity. Impact scores were assigned to each complication on the basis of perceptions of overall severity, satisfaction with surgery,

and effect on quality of life. Impact scores were compared between surgeons and patients with a Wilcoxon/Kruskal-Wallis test.

**Results.** Mean impact scores varied from 0.9 (blood transfusion) to 10.0 (death) among surgeons and 2.3 (urinary tract infection) to 9.2 (stroke) among patients. Patients' scores were consistently higher ( $P < 0.05$ ) than surgeons in all 3 categories for 6 potential adverse events: stroke, lung failure, heart attack, pulmonary embolism, dural tear, and blood transfusion. Three additional complications (renal failure, non-union, and deep vein thrombosis) were rated higher in 1 or 2 categories by patients.

**Conclusion.** There was substantial variation in how both surgeons and patients perceived impacts of various adverse events after spine surgery. Patients generally perceived the impact of adverse events to be greater than surgeons. Patient-centered descriptions of adverse events would provide a more complete description of surgical outcomes.

**Key words:** adverse events, outcomes, scoliosis, spinal fusion, spine surgery. **Spine 2013;38:732–736**

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The reported incidence of adverse events after adult spinal deformity surgery (ASD) remains substantial, ranging from 10% to as high as 77% in some series.<sup>1–15</sup> Despite these high reported rates, the actual incidence and impact of adverse events may, in fact, be even higher. For example, the incidence of adverse events after cervical spine surgery as recorded by surgeons' recollections and review of medical records has been shown to be lower than that reported by patient surveys.<sup>16</sup> Similar differences between surgeons' documentation and other data sources have been reported for other forms of spinal surgery.<sup>17–20</sup>

Clinical outcome studies currently utilize various health-related quality of life (QOL) measures as indications of the benefits of surgical and medical interventions. Validated tools such as the Oswestry Disability Index, Scoliosis Research Society 22 questionnaire, and 36-Item Short Form Health Surveys have been used extensively to investigate patient outcomes after ASD surgery.<sup>21–26</sup> Despite substantial advances in patient-centered outcomes research in spine surgery and other clinical arenas, objective measures of the impact of adverse

events on patient's QOL and satisfaction after spine surgery have yet to be developed and standardized.<sup>27-29</sup>

Known adverse events range from urinary tract infection and need for blood transfusions to stroke, blindness, paralysis, and death. The overall impact that these adverse events have on patients can vary from mild to devastating. As seems to be the case for reported incidence of adverse events, there may also be differences in perceived impacts of adverse events between patients and surgeons. Differences in perceived surgical benefit were in fact a primary impetus in development of the patient-centered health-related QOL tools listed earlier.<sup>30,31</sup>

Although there have been extensive studies identifying the incidence and factors related to the occurrence of adverse events in spinal deformity surgery, there has been less research investigating the perception that patients have of specific adverse events. Appropriate weighting of postoperative adverse events should incorporate patients' valuations of their importance because this may be distinct from those of their treating surgeons. This study assessed patients' and surgeons' perceptions of specific potential adverse events and their potential impact on clinical outcomes after ASD surgery.

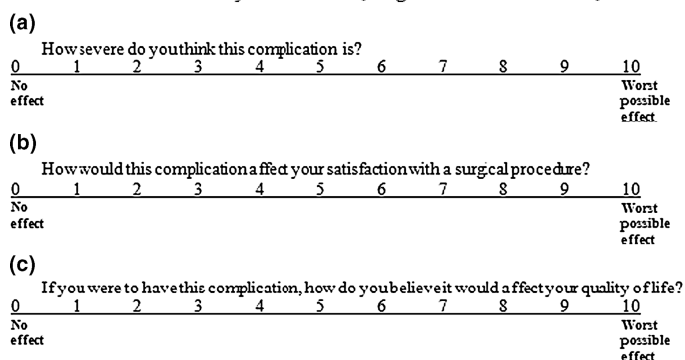
## MATERIALS AND METHODS

After obtaining institutional review board approval from all participating institutions, a questionnaire listing 22 specific surgical adverse events related to ASD was administered to 14 ASD surgeons and 16 ASD surgical patients postoperatively. Participants were asked to mark or circle an integer when answering the questionnaire. The patient cohort consisted of a sequential series of patients seen in follow-up in the corresponding author's clinic that had previously undergone a spinal arthrodesis for ASD surgery (scoliosis  $>25^\circ$  and/or sagittal imbalance). All surveyed surgeons are members of a study group with extensive experience in treating ASD. The surgeon cohort consisted of 12 orthopedic surgeons and 2 neurosurgeons, with an average age of 46 years (range, 32-68 yr) and an average of 11 years (range, 1-37 yr) in practice.

Adverse events surveyed were heart attack, stroke, spinal cord injury, nerve root injury, cauda equina injury, blindness, dural tear, blood transfusion, deep vein thrombosis, pulmonary embolism, superficial infection, deep infection, lung failure, urinary tract infection, nonunion, adjacent segment disease, persistent deformity, implant failure, death, renal failure, gastrointestinal complications, and sexual dysfunction. The list of adverse events was developed through review of the ASD surgical literature by 2 of the authors (R.A.H., S.R.B.), followed by a consensus-building session with all participating surgeons. The intent was to establish a comprehensive list of adverse events, including especially the most common and those of greatest impact. The questionnaire included a description of each adverse event in lay terminology and a list of possible effects that could result from the complication (Figure 1). All surgeons participated in generating the list of complications and confirmed personal experience or knowledge of patients experiencing such events.

Patients' and surgeons' perceptions of each adverse event were quantified using a numerical rating scale that ranged

**Heart attack:** Damage to the heart muscle due to lack of blood and oxygen. Possible effects include reduced ability to do activities, long term shortness of breath, and death.



**Figure 1.** Myocardial infarction (heart attack) as an example of the questionnaire format.

from 0 to 10 (0 = no effect at all, 10 = most severe effect) for each of the following 3 questions for each of the adverse events: (1) "How severe do you think the complication is?"; (2) "How would this complication affect your satisfaction with a surgical outcome?"; and (3) "If you were to have this complication, how do you believe it would affect your quality of life?"

A statistical consultant participated in the study design and analysis. Sample distribution showed a skewed distribution necessitating the use of the Wilcoxon/Kruskal-Wallis test to detect differences in sample means. Mean severity scores in each of these 3 categories were compared between the surgeon and patient groups;  $P \leq 0.05$  was chosen as the level of statistical significance. Assuming a detectable difference of 2.5 and a power to detect of 0.8, a total sample size of 26 participants was deemed to provide sufficient statistical power. Institutional review board approval was granted for this study.

## RESULTS

The patient cohort consisted of 9 females and 7 males, with a mean age of 51.6 years (range, 17-76 yr). The average number of levels fused was 6.2 (range, 4-10). The duration of intensive care unit stay was 2.0 days (range, 0-7 d), the duration of initial hospitalization was 9.1 days (range, 4-16 d), and the average time between surgery and completion of the questionnaire was 16.1 months (range, 2-98 mo). Estimated blood loss for the procedures was 1663 mL (range, 150-3300 mL). One patient underwent an isolated anterior approach, 8 patients underwent isolated posterior approaches, and 7 patients underwent combined anterior and posterior arthrodesis. Nine patients were undergoing revisions of prior spinal deformity surgery. Five patients (5/16; 32%) experienced complications related to their surgery (excessive blood loss, pneumothorax, and aspiration pneumonia), and 2 patients experienced proximal junctional failure.

Mean adverse event scores varied from 0.9 (SD = 1.3) (blood transfusion) to 10.0 (SD = 0.0) (death) among the surgeon group and from 2.3 (SD = 2.1) (urinary tract

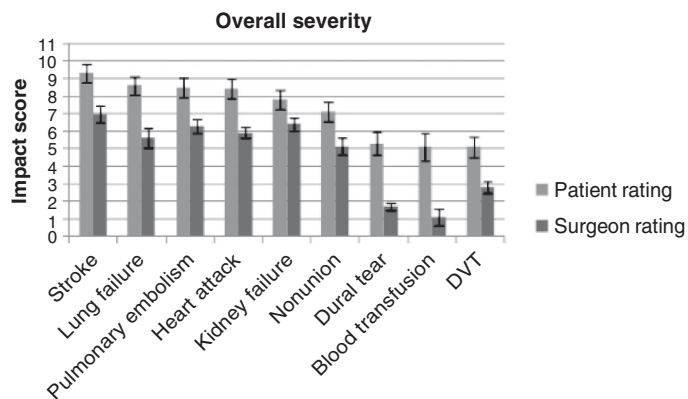
**TABLE 1. Comparison of Severity Scores Between Patients and Surgeons**

Complication	Patient			Complication	Surgeon			
	Average	Overall Severity	Satisfaction With Surgery		Quality of Life	Average	Overall Severity	Satisfaction With Surgery
Stroke	9.2*	9.3*	8.8*	9.5*	10.0	10.0	10.0	10.0
Death	8.7*	8.4	8.6	8.9	8.9	8.8	8.9	9.0
Blindness	8.3	8.3	8.2	8.4	8.1	7.9	8.0	8.4
Lung failure	8.1*	8.6*	7.8*	8.1*	7.3	7.1	7.3	7.5
Heart attack	8.1*	8.4*	7.7*	8.2*	7.3	7.0	7.4	7.5
Pulmonary embolism	8.2*	8.5*	7.9*	8.2*	6.8	7.0	6.5	6.9
Spinal cord injury	8.0	8.2	7.6	8.3	6.2	6.4	6.0	6.2
Renal failure	7.6*	7.8*	7.0	7.9*	5.5	5.9	5.1	5.6
Cauda equina	7.3	7.3	7.0	7.5	5.5	5.1	6.1	5.3
Non-union	6.6*	7.1*	6.1	6.4	5.3	5.1	5.9	4.9
Sexual dysfunction	6.2	6.5	5.9	6.3	5.2	5.6	5.6	4.4
Deep infection	5.8	6.4	5.3	5.7	5.1	5.1	5.5	4.7
Adjacent segment disease	5.7	5.9	5.1	6.2	5.0	6.3	4.6	4.2
Implant failure	5.1*	5.5	4.7	5.1	4.8	5.0	5.0	4.4
Nerve root injury	5.4	5.3	5.3	5.4	4.6	5.6	4.1	4.1
Dural tear	5.4*	5.3*	5.4*	5.5*	4.1	4.4	4.4	3.5
Persistent deformity	5.6	5.8	5.4	5.5	2.5	2.9	2.7	1.8
Blood transfusion	5.0*	5.1*	4.7*	5.2*	2.4	2.8	2.3	2.2
DVT	4.7*	5.1*	4.3	4.6*	2.0	2.4	2.1	1.4
GI problems	3.0	3.3	2.4	3.3	1.5	1.7	1.5	1.3
Superficial infection	2.6	2.9	2.6	2.4	1.2	1.6	1.1	1.0
UTI	2.3*	2.5	2.1	2.2	0.9	1.1	0.7	0.8

\*Significant difference between scores at  $P \leq 0.05$ .

Highlighted adverse events were rated as significantly greater impact in at least one scale by patients as compared to surgeons.

DVT indicates deep vein thrombosis; GI, gastrointestinal; UTI, urinary tract infection.

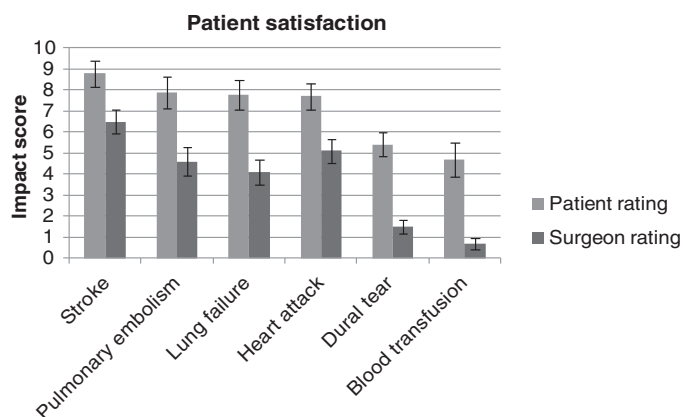


**Figure 2.** Overall severity scores (mean ± SEM) for all adverse events that surgeons and patients scored significantly differently ( $P \leq 0.05$ ). DVT indicates deep vein thrombosis; SEM, standard error of mean.

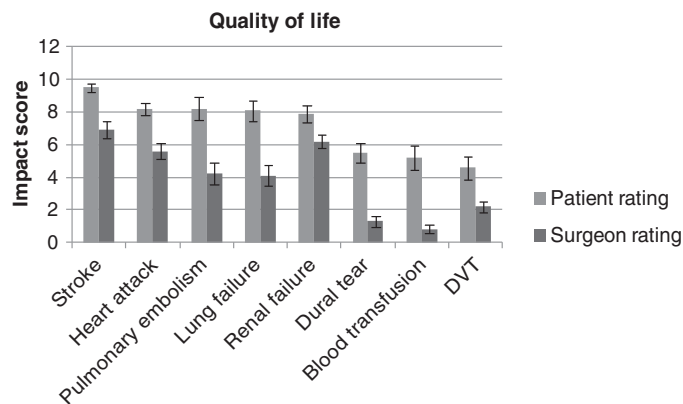
infection) to 9.2 (SD = 2.0) (stroke) among patients (Table 1). Perceived impacts for stroke, lung failure, heart attack, pulmonary embolism, dural tear, and blood transfusion were statistically different between surgeons and patients in all 3 outcome categories, with patients indicating higher perceived severity scores than surgeons (Figures 2–4). In addition, renal failure and deep vein thrombosis were greater for perception of overall severity ( $P = 0.012$  and  $P = 0.006$ , respectively) and QOL ( $P = 0.005$  and  $P = 0.022$ , respectively), whereas nonunion was greater for perceived impact on overall severity ( $P = 0.020$ ). Severity impacts in each category for all remaining adverse events did not differ statistically between the surgeon group and the patient group.

## DISCUSSION

This survey demonstrates substantial variation in how surgeons and patients assess the potential impact of adverse events after spine surgery. In general, patients' perception of the impact and severity of several adverse events was greater than the surgeons' perceptions. For all adverse events for which patients' and surgeons' assessments differed, patients' impact scores were higher than those of surgeons.



**Figure 3.** Patient satisfaction scores (mean ± SEM) for all adverse events that surgeons and patients scored significantly differently ( $P \leq 0.05$ ). SEM indicates standard error of mean.



**Figure 4.** Quality of life scores (mean ± SEM) for all adverse events that surgeons and patients scored significantly differently ( $P \leq 0.05$ ). DVT indicates deep vein thrombosis; SEM, standard error of mean.

This study complements a recent article by Ratliff *et al*,<sup>20</sup> which focused on a smaller list of adverse events from a broader range of spine surgical procedures including cervical spinal procedures. In contrast, we both sought opinions of patients with ASD postoperatively and also sought assessments regarding impacts of complications on QOL and satisfaction. As for Ratliff *et al*,<sup>20</sup> we found that when surgeons' and patients' opinions differed, patients tended to perceive a higher level of severity.

It is perhaps not surprising that the perceived impact of adverse events from a layperson's point of view differs from that of a trained physician. Presumably, surgeons have the benefit of knowledge and experience in managing adverse events and might be argued to have a more informed opinion than their patients. However, the finding that assessment of severity is consistently higher among patients than among surgeons is important. The consistency of the direction of severity assessment (patients' ratings are consistently higher than surgeons') may in part reflect the position of patients as the individuals for whom the complication would occur as opposed to the surgeons' role as the individuals managing it.

Knowledge of the perceived impact of adverse events among patients may be useful in developing an appropriately structured outcomes tool aimed at measuring the impact of adverse events after spinal deformity surgery. Current clinical reporting of adverse outcomes is variable.<sup>26–28</sup> Simple lists of specific adverse events do not allow consistent comparison of adverse outcomes from competing interventions. Development of an outcomes tool focused on adverse events would allow a more consistent and complete assessment of clinical outcome in addition to the current health-related QOL tools that are frequently used. Appropriate weighting of the impact of adverse outcomes clearly requires information derived from patients regarding those impacts.

There may also be important implications of patients' perceptions of adverse events for shared decision making. Preoperative planning requires provision of the best available data to patients regarding treatment options, including potential adverse events.<sup>32,33</sup> Effective sharing of information will potentially benefit from attempts to evaluate where gaps



in understanding between surgeons and patients currently exist. Our results demonstrate that information that surgeons may feel to be open and obvious can be perceived by patients in a very different light.

This survey showed that patients perceive potential adverse events from ASD surgery to be generally of greater impact than spine surgeons. These preliminary results may be useful in developing a patient-centered outcomes tool to measure adverse events after surgery. In addition, continued research in this area may help improve shared decision making for patients undergoing spinal deformity surgery. Further efforts to define the impact of adverse events on patient-reported QOL may also help in developing appropriate weighting of specific adverse events.

### ➤ Key Points

- ❑ Patients' and surgeons' perception of the severity of 10 (of 22 assessed) potential adverse events after ASD surgery differed significantly.
- ❑ Patients generally perceived the impact of adverse events to be greater than surgeons in terms of severity of the complication, the satisfaction with the surgical procedure, and the effect of the complication on QOL.
- ❑ These preliminary results may be useful in developing a patient-centered outcomes tool to measure adverse events after surgery.

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