

Complication Rates following Adult Spinal Deformity (ASD) Surgery: The Category of Complication Dictates Timing

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INTRODUCTION:

Adult spinal deformity (ASD) is a complex pathology associated with high complication rates. Although complication rates have been previously reported, the interplay between timing and type of complications has not been fully analyzed. The objective of the current study was to provide benchmarks for the rates of complications by type and timing.

METHODS:

In the context of a prospective multicenter ASD database, standardized forms were used to collect data on surgery-related complications. On-site research coordinators and central auditing helped ensure data capture completeness. Inclusion criteria were age >18 years, ASD, and minimum 2-year follow up. Date and type of complications were collected and classified into three severity groups (minor, major, major leading to a reoperation). Only complications occurring before the 2-year visit were retained for analysis. Outcome measures included rates of medical complications (cardiac, GI, infection, pulmonary, renal) and surgical complications (implant-related, operative, neurologic, radiographic) within two years post-surgery. For each complication type and severity, we used Kaplan-Meier survival curves analysis to illustrate the percentage of patients remaining "free of complications" over 2 years.

RESULTS:

A total of 997 out of 1,260 patients eligible for 2-year follow up (79.1%) were included in the analysis. The mean age at the time of surgery was 60.4yo±14.3, 76.3% were female, and 50.5% had a history of previous spine surgery. The vast majority of patients (98.9%) had treatment including a posterior procedure, 57.9% had decompression, 71.2% had at least one osteotomy, and 18.1% had a 3-column osteotomy. Interbody fusion (IBF) was used in 64.0%: 48.7% posterior (TLIF or PLIF), 38.3% anterior (ALIF), and 23.2% lateral (LLIF). The mean ASD surgical invasiveness index was 88.8±36.1; 66.3% of the patients were admitted postop to the ICU, with a median overall length of hospital stay of 7 days (IQR 5 to 9).

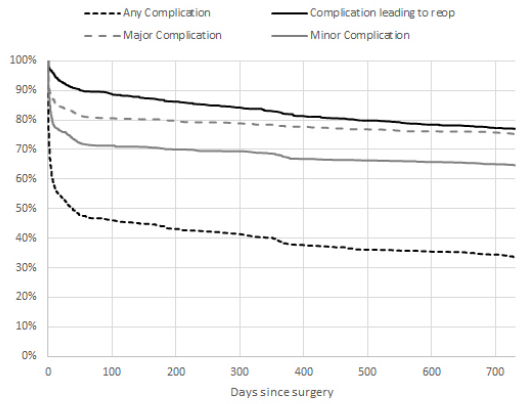
The overall complication rate was 67.4% (N=672). In total, 247 patients (24.8%) experienced at least one complication on the day of surgery (including intraoperative), 359 (36.0%) between POD1 and 6-weeks postoperative, 271 (27.2%) between 6 weeks and 1-year postoperative, and finally, 162 (16.3%) between 1-year and 2-years postoperative.

Using Kaplan-Meier survival analysis, the rate of remaining complication-free was estimated at 70.9% by POD1, 59.0% by POD7, 51.4% by 30 days, 47.4% by 3 months, and 33.6% by 2-years postoperative. Breakdown by severity of remaining complication-free revealed the following rates for minor | major | reop: by POD1= 87.3% | 90.1% | 97.4%, by POD7=78.4% | 86.8% | 95.8%, by 3 months= 71.6% | 81.0% | 86.7%, by 6 months = 70.3% | 80.1% | 86.7%, and by 2-years postop=64.5% | 75.1% | 77.0%.

Stratification by type of complication demonstrated that most medical complications occurred within the first 60 days. Surgical complications followed two types of behavior: operative, wound, and infection occurred early (within 60 days), while implant-related and radiographic complications happened at a constant rate over the 2-year period. Neurologic complications had a high occurrence with the first 60 days, followed by a continuous increase up to the 2-year visit.

DISCUSSION AND CONCLUSION:

Only one-third of ASD patients remain complication-free by 2 years, and 2 patients out of 10 will have had a complication requiring a reoperation/revision. Estimation of timing and type of complication associated with surgical treatment is crucial when counseling patients and planning treatment cost-effectiveness.



	1	7	30	60	180	365	730
Any	70.9%	59.0%	51.4%	47.4%	44.1%	38.7%	33.6%
Reop	97.4%	95.8%	91.7%	89.6%	86.7%	82.3%	77.0%
Major	90.1%	86.8%	83.2%	81.0%	80.1%	77.9%	75.1%
Minor	87.3%	78.4%	74.9%	71.6%	70.3%	67.7%	64.5%

	Days Since Surgery	1	7	30	60	180	365	730
Medical	Cardiac	98.8%	97.9%	97.7%	97.7%	97.7%	97.6%	97.5%
	Coagulopathy	99.6%	98.3%	96.9%	96.4%	96.1%	96.1%	96.1%
	GI	98.5%	94.2%	93.4%	93.2%	93.1%	93.0%	92.9%
	Infection	99.7%	98.2%	96.3%	95.4%	95.2%	95.1%	94.9%
	Neuro	98.8%	97.9%	97.6%	97.2%	97.2%	96.9%	96.9%
	Pulmonary	98.4%	95.4%	94.8%	94.3%	94.2%	94.2%	94.1%
	Renal	99.9%	99.5%	99.3%	99.3%	99.2%	99.2%	99.2%
	Implant Failure	99.5%	99.5%	99.3%	98.6%	97.8%	94.8%	89.2%
	Implant Malposition	99.7%	99.5%	99.3%	99.1%	98.8%	98.0%	96.8%
	Surgical	Infection	100.0%	99.6%	97.1%	96.2%	96.0%	95.9%
Operative		85.2%	83.8%	82.6%	82.5%	82.4%	82.1%	81.6%
Wound		99.5%	99.0%	97.9%	97.6%	97.2%	97.0%	96.9%
Radiographic		99.9%	99.7%	98.8%	95.4%	92.2%	87.2%	82.4%
Neuro		97.0%	95.5%	93.9%	91.4%	90.8%	88.3%	85.7%