The Economic Impact of Revision Surgery for Proximal Junctional Failure After Adult Spinal Deformity (ASD) Surgery: A Cost Analysis of 70 Proximal Junctional Failures in 464 ASD Surgeries

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Introduction

Proximal junctional failure (PJF) after fusions for ASD is a major cause of post-op disability. While clinical sequelae are described, PJF-revision operation costs are incompletely defined. We therefore evaluated the economic impact of revision surgery for PJF.

Methods

We performed a retrospective analysis of consecutive adults who underwent thoracolumbar fusions for ASD from 8/2003 to 1/2013 at our institution. Inclusion criteria included instrumentation extending from pelvis to L2 or above, and minimum 2 years follow-up. Direct costs were calculated for the index ASD operation and subsequent operations for PJF. Direct costs included surgical supplies/implants, room/care, and medications, but did not include indirect costs, surgeon fees, or revision operations for indications other than PJF (i.e., infection, pseudarthrosis). Student t-tests were used to compare patients based on the construct's upper instrumented vertebra (UIV): upper thoracic (UT: T1-6) vs. thoracolumbar junction (TLjxn: T9-L2).

Results

Of 578 ASD patients, 410 had complete data and were analyzed. Fifty-one patients [UT:14; TLjxn: 40 at index; average follow-up 39.4 months (7-76 months)] had revisions for PJF, which summed to a total direct cost of $3.2 million. Average direct cost of index operations for the cohort ($68,194) was significantly greater than PJF-revisions ($55,547). Compared to TLjxn, UT had a significantly higher avg cost for index operations ($80,095vs$65,701). However, PJF-revision cases were similar in avg cost between groups (UT:$60,103; TLjxn:$53,920). The cost of PJF amounted to an additional 11.3% of the cost of the total index surgical cost in 410 patients.

Revision Operations

	All	TLjxn-UIV	UT-UIV	*p*-value
Patients	51 (12.4%)	40 (11.8%)	14[@] (19.7%)	0.08
Cases	57*	42^	19[#]	n/a
Direct cost ($)	55,547 ± 15,538 (22,263 – 97,883)	53,920 ± 14,665 (34,586 – 97,883)	$60,103 ± 17,484 (22,263 – 88,888)	0.09
Age	64 ± 9 (38 – 78)	64 ± 7 (49 - 78)	64 ± 11 (38 - 77)	0.47
Gender				
Male	11 (21.6%)	9 (22.5%)	2 (14.3%)	0.71
Female	40 (78.4%)	31 (77.5%)	12 (85.7%)	
BMI	29.7± 6.7 (18.0 – 49.0)	30.3 ± 7.2 (18.0 – 49.0)	28.1 ± 4.6 (20.0 – 36.6)	0.15
# Posterior Levels Fused	6.3 ± 2.3 (2.0 – 10.0)	6.7 ± 2.1 (2.0 – 10.0)	5.1 ± 2.6 (2.0 – 9.0)	0.01
3CO	21 (36.8%)	14 (33.3%)	7 (36.8%)	0.36
PSO	11 (52.4%)	10 (71.4%)	1 (14.3%)	0.02
VCR	10 (47.6%)	4 (28.6%)	6 (85.7%)	
Extension to Cervical Spine	12 (21.1%)	0 (0.0%)	12 (63.2%)	<0.01
Op time (mins)	319 ± 135 (142 - 823)	314 ± 135 (142 - 823)	333 ± 140 (177 - 425)	0.35
EBL (mL)	1,207 – 991 (150 – 5,500)	1,328 ± 1,084 (150 – 5,500)	893 ± 619 (200 – 2,500)	0.08
LOS (days)	7.2 ± 3.0 (2.0 – 15.0)	6.6 ± 2.7 (2.0 – 15.0)	9.1 ± 3.1 (3.0 – 15.0)	<0.01

Direct Comparative Costs

UIV	Index (n=410)	Revision (n=57)	*p*-value
All			
Total Direct Cost	$27,959,453 (n=410)	$3,166,199 (n=57)	n/a
Average ± SD (range)	$68,194 ± $21,192 ($14,186 – $151,900)	$55,547 ± $15,538 ($22,263 – $97,883)	<0.01
TLjxn Index			
Total Direct Cost	$22,272,688 (n=339)	$2,264,652 (n=42)	n/a
Average ± SD (range)	$65,701 ± $19,891 ($21,133 – $141,997)	$53,920 ± $14,665 ($34,586 – $97,883)	<0.01
UT Index			
Total Direct Cost	$5,686,765 (n=71)	$901,547 (n=15)	n/a
Average ± SD (range)	$80,095 ± $23,233 ($14,186 – $151,900)	$60,103 ± $17,484 ($22,263 – $88,255)	<0.01

Conclusions

Revisions for PJF after ASD surgery represent a major economic burden with an average cost of nearly $55,000 per case. Revision costs for PJF are similar based on the index procedure UIV level. PJF comes at very significant economic cost amounting to nearly 3.2 million dollars at a major tertiary center over a 10-year period.