Longitudinal Comparison of Existing Frailty Indices to Predict Complications following Adult Spinal Deformity Surgery

Tyler Kade Williamson, Pooja R Dave, Bassel Diebo[1], Bailey Thomas Imbo, Rachel Joujon-Roche, Oscar Krol[2], Jamshaid Mir, Stephane Owusu-Sarpong[2], Peter Gust Passias[3], Andrew J Schoenfeld, Justin S Smith[4], Peter Sergeyevich Tretiakov[2], Shaleen Vira[5], Jordan Lebovic[6]

[1]Brown University, [2]NYU Langone Orthopedic Hospital, [3]NY Spine Institute / NYU Medical Center-Hjd, [4]University of Virginia, [5]University of Texas Southwestern Medical Center, [6]NYU Orthopedics

INTRODUCTION:

The comparison of various frailty indices and their ability to predict complications after adult spinal deformity (ASD) surgery has not been investigated. The purpose of this study was to identify if certain frailty indices have predictability of complication rates following ASD surgery.

METHODS:

Operative ASD patients with baseline (BL) and 2-year (2Y) data were included. Four frailty indices were used for comparison: *Passias* et al. modified ASD frailty index (mFI), *Miller* et al. ASD frailty index (FI-ASD), the ACS-NSQIP 5-Factor frailty index (ACS-FI5), and the FRAIL Scale (PMID: 29792992). Patients were stratified into not frail (NF), frail (F), and severely frail (SF). Associations of the indices with EBL, operative time, complications, hospital-acquired conditions (HAC: UTI, DVT/PE, SSI), reoperations, SICU stay, and LOS were compared using one-way ANOVA, logistic and linear regression analyses.

RESULTS:

A total of 421 ASD patients were included (Age: 60.4, BMI: 28.0, CCI: 1.9). Total cohort complication rates: 71% any comp, 27% major (68% were surgical, 32% medical), 35% minor, 25% intraoperative, 18% mechanical, 22% underwent reoperation. Upon presentation, severely frail patients were much more likely to present with a severe ODI (OR: 16, [7.2-29.8]). All four indices significantly correlated with intraop details and complications. During hospital stay, all four indices correlated to SICU time and total LOS. Only FRAIL Scale correlated with SICU admission rate (OR: 1.2, [1.03-8.8]), while no index was predictive of complications prior to discharge (all p>.05). ASD-FI had the strongest correlation with perioperative complications, including Hospital-acquired complications (OR: 1.2, [1.1-6.3]), any (OR: 1.2, [1.02-7.3]), and major complications (OR: 1.5, [1.1-4.7]). When assessing 2Y comps, logistic regression analysis demonstrated correlation between ASD-FI, mFI, and FRAIL Scale indices and any comps, major comps, and reoperation. However, mFI was the only correlate for all 2Y complications (any, major, minor, mechanical, reoperation), along with highest OR for predicting mechanical complications (OR: 1.6, [1.3-1.9]). Clinically, ASD-FI SF group had the greatest improvement (ODI,SRS-Total), while mFI SF had lowest rates of improvement. Given their higher complication rates, this translated to higher cost-per-QALY by two years for SF patients when stratified by mFI (p<.001).

DISCUSSION AND CONCLUSION:

Frailty imposes a significant burden on adult spinal deformity patients from the moment of presentation through cost-utility at two years. Assessing frailty by different measures demonstrated meaningful differences in complications and outcomes. These findings highlight the impact of frailty stratification during surgical planning to effectively assess the risk of patients undergoing corrective surgery.

Table 8. Cost-Effectiveness Evaluation by Frailty Index

		Utility Gained	p	QALYs Gained	p	Overall Cost	p	Cost per QALY	P
ASD-FI	NF	0.080	.020	0.16	.020	$89,794.20	<.001	$578,276.72	.595
	F	0.096		0.19		$102,893.70		$552,198.17	
	SF	0.101		0.20		$113,149.38		$577,175.91	
		Utility Gained	p	QALYs Gained	p	Overall Cost	p	Cost per QALY	P
ASD-mFI	NF	0.082	.058	0.16	.058	$90,896.75	<.001	$571,099.62	<.001
	F	0.098		0.19		$99,345.44		$522,275.04	
	SF	0.084		0.16		$116,000.91		$711,474.96	
		Utility Gained	p	QALYs Gained	p	Overall Cost	p	Cost per QALY	P
mFI-5 Cat	NF	0.082	.176	0.16	.176	$94,136.82	.053	$591,456.87	.203
	F	0.095		0.18		$101,339.19		$549,580.39	
	SF	0.095		0.18		$105,427.88		$571,754.09	
		Utility Gained	p	QALYs Gained	p	Overall Cost	p	Cost per QALY	P
Frail Scale	NF	0.074	.004	0.14	.004	$91,330.34	.005	$635,858.92	<.001
	F	0.094		0.18		$101,325.88		$555,354.02	
	SF	0.107		0.21		$107,905.70		$519,562.74	