Changing Patterns in Surgical Management of OPLL in the U.S.: Comorbidities, Complications, and Cost

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INTRODUCTION:

Ossification of the posterior longitudinal ligament (OPLL) is a rare spinal condition that can lead to significant neurological deficits. While prior research has focused predominantly on Asian populations, contemporary data on OPLL surgical management in the United States remains limited.

METHODS:

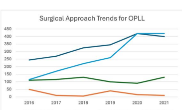
Using the National Inpatient Sample (NIS) from 2016 to 2021, we identified patients undergoing surgery for OPLL. Patients were stratified by surgical approach: anterior fusion (AF), posterior fusion (PF), decompression only, and combined anterior-posterior fusion. Demographics, hospital characteristics, postoperative complications, length of stay, and hospital charges were compared using weighted analyses. Multivariable models adjusted for age, sex, comorbidity burden, and hospital factors.

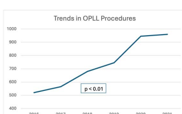
RESULTS:

Among 4,415 patients, AF (45%) and PF (36%) were the most common procedures. Combined approaches were least frequent (2.9%) but were associated with the longest hospital stay (8.85 days, $p<0.001$) and highest total charges ($249,221, $p<0.001$). PF had the highest neurological complication rate (17.6%, $p<0.001$), especially in patients with diabetes (24.7%) and hypertension (22.3%). Dysphagia occurred more frequently after combined (15.4%) and AF (8.5%) procedures ($p<0.001$). PF was associated with increased rates of DVT (3.1%) and PE (0.6%) ($p<0.001$). Surgical site infections and hardware removal were most common in the combined group (7.7% each, $p<0.001$). Diabetes, chronic kidney disease (CKD), and congestive heart failure (CHF) were the most common comorbidities associated with complications across all surgical approaches.

DISCUSSION AND CONCLUSION:

Surgical interventions for OPLL have increased in the U.S., with a shift toward PF over time. While PF may be associated with lower functional complications, it carries higher neurologic and thromboembolic risks in medically complex patients. Comorbidity-informed surgical planning is critical. These findings highlight the importance of individualized approaches that consider both anatomical and systemic risk factors in the management of OPLL.





Variable	AF (n=2005)	Combined (n=130)	Decompression (n=675)	PF (n=1605)	*P*-value
Mean age	58	60	59	61	**0.008**
Gender, n (%)	1,110 (55.4)	95 (73.1)	374 (55.6)	995 (62.0)	0.108
Female	895 (44.6)	35 (27.0)	300 (44.4)	610 (38.0)	
Male	1,110 (55.4)	95 (73.1)	374 (55.6)	995 (62.0)	
Race, n (%)					**<.001**
White	1,365 (69.0)	100 (77.0)	350 (54.7)	815 (52.0)	
African American	335 (17.0)	15 (11.5)	110 (17.2)	380 (24.2)	
Hispanic	115 (5.8)	10 (7.7)	45 (7.0)	110 (7.0)	
Asian or Pacific Islander	95 (4.8)	0	90 (14.1)	215 (13.7)	
Native American	5 (0.3)	0	15 (2.3)	5 (0.3)	
Other	65 (3.3)	5 (3.9)	30 (4.7)	45 (2.9)	
Elixhauser Comorbidities Index					**0.03**
0	455 (22.7)	15 (11.5)	105 (15.6)	190 (11.8)	
1	505 (25.2)	40 (30.8)	150 (22.2)	385 (24.0)	
2	470 (23.4)	35 (27.0)	170 (25.2)	380 (23.7)	
3	265 (13.2)	25 (19.2)	105 (15.6)	280 (17.4)	
4+	310 (15.5)	25 (19.2)	145 (21.5)	375 (23.4)	
Primary payer, n (%)					**<.001**
Medicare	590 (29.5)	50 (38.5)	260 (38.5)	660 (41.1)	
Medicaid	185 (9.3)	14 (11.5)	105 (15.6)	190 (11.8)	
Private	970 (48.5)	50 (38.5)	270 (40.0)	620 (38.6)	
Self-pay	60 (3.0)	5 (3.9)	5 (0.7)	50 (3.1)	
No charge	5 (0.3)	0	5 (0.7)	5 (0.3)	
Other	190 (9.5)	10 (7.7)	30 (4.4)	80 (5.0)	
Location/Teaching status, n (%)					**<.001**
Rural	180 (9.0)	0	20 (3.0)	50 (3.1)	
Urban/non-teaching	340 (17.0)	20 (15.4)	50 (7.4)	185 (11.5)	
Urban/teaching	1,485 (74.1)	110 (84.6)	605 (89.7)	1,370 (85.4)	
Hospital Region, n (%)					**0.013**
Northeast	365 (18.2)	15 (11.5)	105 (15.6)	335 (20.9)	
Midwest	385 (19.2)	30 (23.1)	65 (9.6)	290 (18.1)	
South	865 (43.1)	35 (27.0)	285 (42.2)	585 (36.5)	
West	390 (19.5)	50 (38.5)	220 (32.6)	395 (24.6)	
Admission day, n (%)					**<.001**
Weekday	1,925 (96.0)	130 (100.0)	645 (95.6)	1,450 (90.3)	
Weekend	80 (4.0)	0	30 (4.4)	155 (9.7)	
Disposition, n (%)					**<.001**
Discharge home	1,455 (72.6)	55 (42.3)	560 (53.3)	655 (40.9)	
Transfer to Short-Term Hospital	10 (0.5)	5 (3.9)	15 (2.2)	20 (1.3)	
Transfer to SNF or ICF	265 (13.2)	40 (30.8)	175 (26.0)	600 (37.4)	
Home Health Care	265 (13.2)	30 (23.1)	120 (17.8))	310 (19.3)	
Left Against Medical Advice	10 (0.5)	0	0	5 (0.3)	
Died	0	0	5 (0.7)	15 (0.9)	

AF; anterior fusion, PF; posterior fusion, SNF; skill nursing facility, ICF; intermediate care facility.

Values in bold are statistically significant.

Complication, n (%)	AF (n=2005)	Combined (n=130)	Decompression (n=675)	PF (n=1605)	*P*-value
Dysphagia	170 (8.5)	20 (15.4)	10 (1.5)	50 (3.1)	**<.001**
Neurological	125 (6.2)	15 (11.5)	80 (11.9)	280 (17.6)	**<.001**
Durotomy	55 (2.7)	5 (3.9)	10 (1.5)	35 (2.2)	0.798
DVT	5 (0.3)	0	10 (1.5)	50 (3.1)	**<.001**
PE	10 (0.5)	0	0	10 (0.6)	**<.001**
SSI	0	10 (7.7)	5 (0.7)	5 (0.3)	**<.001**
Reoperation					**< .001**
Hardware removal	35 (1.0)	10 (7.7)	0	10 (0.6)	
Exploration	0	0	0	5 (0.3)	

AF; anterior fusion, PF; posterior fusion, DVT; deep vein thrombosis, PE; pulmonary embolism, SSI; surgical site infection.

Values in bold are statistically significant.

Dysphagia				
Comorbidity	AF	AF	AF	PF
1	DM: 14.7%	HTN: 15%	DM: 9.1%	DM: 16%
2	CKD: 5.3%	Obesity: 10%	Obesity: 9.1%	COPD: 12%
3	CHF: 3.5%	COPD: 10%	N/A	HTN: 10%
Neurological				
Comorbidity	AF	Combined	Decompression	PF
1	DM: 18.4%	DM: 13.3%	DM: 20%	DM: 24.7%
2	HTN: 12.8%	Obesity: 13.3%	HTN: 15%	HTN: 22.3%
3	CKD: 6.4%	COPD: 13.3%	PVD: 8.8%	CKD: 15.2%
Durotomy				
Comorbidity	AF	Combined	Decompression	PF
1	DM: 21.8%	DM: 40%	DM: 27.3%	DM: 22.9%
2	HTN: 14.5%	N/A	HTN: 9.1%	HTN: 9.1%
3	CKD: 10.9%	N/A	CKD: 9.1%	CKD: 9.1%
DVT				
Comorbidity	AF	Combined	Decompression	PF
1	CHF: 33.3%	N/A	CHF: 27.3%	CHF: 24%
2	CKD: 33.3%	N/A	CKD: 9.1%	CKD: 18%
3	N/A	N/A	PVD: 9.1%	PVD: 18%
PE				
Comorbidity	AF	Combined	Decompression	PF
1	Obesity: 40%	N/A	N/A	Obesity: 33.3%
2	CKD: 20%	N/A	N/A	CKD: 22.2%
3	CHF: 20%	N/A	N/A	CHF: 22.2%
SSI				
Comorbidity	AF	Combined	Decompression	PF
1	N/A	CKD: 30%	CKD: 30%	CKD: 40%
2	N/A	DM: 20%	DM: 20%	DM: 40%
3	N/A	CHF: 20%	CHF: 20%	CHF: 40%
Hardware Removal				
Comorbidity	AF	Combined	Decompression	PF
1	Obesity: 30%	Obesity: 30%	N/A	Obesity: 33.3%
2	CKD: 20%	CKD: 20%	N/A	CKD: 22.2%
3	DM: 20%	DM: 20%	N/A	DM: 22.2%
Exploration				
Comorbidity	AF	Combined	Decompression	PF
1	N/A	N/A	N/A	HTN: 40%
2	N/A	N/A	N/A	CHF: 40%
3	N/A	N/A	N/A	N/A

	Length of Stay	Total Charges ($)
Anterior Fusion	3.95	125,926.29
Combined	8.85	249220.63
Decompression	5.19	109462.41
Posterior Fusion	7.02	187,786.70
P-value	**.001**	**<.001**

Data are presented as mean values.

Values in bold are statistically significant.