Understanding Outcomes of Minimally Invasive vs. Open 1-3 Level Lumbar Fusion Spine Surgery in an Multimorbid Disadvantaged Population: A retrospective analysis of an inner city, disadvantaged population

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INTRODUCTION: Minimally Invasive Spine Surgery (MIS) is associated with improved surgical characteristics and similar outcomes compared to Open Spine Surgery (OS) in the general population. It is currently unclear whether MIS offers similar outcomes compared to OS in the obese population. The purpose of this study was to compare outcomes between MIS and OS lumbar fusion in a cohort of multimorbid patients in a large intercity hospital center and identify risk factors associated with poor surgical outcomes.

METHODS: A retrospective analysis of 459 patients ≥18 years old who underwent an elective 1-3 level lumbar fusions between 2022-2024 was performed. The primary outcome was construct revision. Secondary outcomes included chronic opioid use, 90-day complications, and ongoing postoperative pain management. Demographics, surgical characteristics including approach, and outcomes were abstracted and analyzed using Student's T-test and Fisher's exact test as indicated. Multivariate logistic regressions were performed for primary and secondary outcomes. P-values < 0.05 were considered significant.

RESULTS: Of 459 patients, 202 utilized MIS techniques and 257 utilized OS techniques. 92% were non-white, 88% were on government insurance, and 29% did not speak English. The mean age-adjusted Charlston comorbidity index was 3.8. MIS patients had a significantly higher BMI (32.0 vs. 30.9, p=0.04) and Class II/III Obesity patient population (30.2% vs. 21.4%, p=0.04), whereas more OS patients had Medicare (61.5% vs. 48.5%, p=0.006). OS patients also had more levels fused (1.6 vs. 1.4, p=0.003) and estimated blood loss (EBL) (254.5 vs. 144.7 mL, p <0.001). The OS cohort had significantly longer Length of Stay (LOS) (5.0 vs. 4.3 days, p=0.02), 90-day readmissions (13.6% vs. 5.9%, p=0.008), and 90-day return to OR (7.0% vs. 0.50%, p <0.001), but 90-day ER presentations were similar. Revisions, radicular symptoms/pain management, and chronic opioid use were similar between cohorts. Subgroup analysis showed Class II/III Obesity MIS patients had significantly lower EBL (144.0 vs. 245.9 mL, p=0.004), 90-day return to OR (0% vs. 14.3%, p=0.002), and revision/extension rates (3.3% vs 16.1%, p=0.03). Multivariate logistic regression revealed that smoking status and psychiatric history independently predicted higher revision rates (OR 4.5, 95% CI [1.8, 11.2]; OR 3.7, 95% CI [1.6, 8.9]). Female sex was protective of 90-day return to OR (OR 0.4, 95% CI [0.1,0.96]). Open Surgery independently predicted 90-day readmission and return to OR (OR 2.6, 95% CI [1.3,5.1]; OR 19.6, 95% CI [2.5,154.1]). Class II/III Obesity status independently predicted 90-day return to OR and chronic opioid use (OR 4.0, 95% CI [1.4,11.3]; OR 4.9, 95% CI [2.7,9.0]).

DISCUSSION AND CONCLUSION: While open 1–3 level lumbar fusion was associated with multiple perioperative complications in our inner-city, disadvantaged cohort, surgical approach was not independently associated with long-term revision, chronic opioid use, or pain management utilization. Revision was independently associated with psychiatric history and smoking, suggesting that optimizing host factors may be more important to construct survival than surgical technique.

Table 1: Demographics and Outcomes of MIS vs. Open Fusions from 2022 to 2024

	COHORT (N = 459)	OPEN (N = 257)	MIS (N = 202)	OPEN VS. MIS (P-VALUE)
AGE AT OR (YEARS)	62.7 ± 12.4	63.1 ± 11.5	62.3 ± 13.5	0.5
BMI	31.3 ± 5.6	**30.9 ± 5.4**	**32.0 ± 5.7**	**0.04**
CLASS II/III OBESITY (BMI >35)	116 (25.3%)	**55 (21.4%)**	**61 (30.2%)**	**0.04**
SEX (% FEMALE)	317 (69.1%)	173 (67.3%)	144 (71.3%)	0.4
NON-ENGLISH SPEAKING	134 (29.2%)	72 (28.0%)	62 (30.7%)	0.5
MEDICAID	153 (33.3%)	81 (31.5%)	72 (35.6%)	0.4
MEDICARE	256 (55.8%)	**158 (61.5%)**	**98 (48.5%)**	**0.006**
NON-WHITE	423 (92.2%)	238 (92.6%)	185 (91.6%)	0.7
SMOKER	73 (15.9%)	40 (15.6%)	33 (16.3%)	0.9
PSYCH HX	109 (23.7%)	60 (23.3%)	49 (24.3%)	0.8
CHARLSON COMORBIDITY INDEX	1.1 + 1.5	1.6 + 0.1	1.4 + 0.1	0.5
PRIOR LAMINECTOMY	78 (17.0%)	46 (17.9%)	32 (15.8%)	0.6
# LEVELS FUSED	1.5 + 0.7	**1.6 + 0.7**	**1.4 + 0.67**	**0.003**
INTRAOPERATIVE COMPLICATION	31 (6.8%)	16 (6.2%)	15 (7.4%)	0.7
INTRAOP TRANSFUSION	9 (2.0%)	3 (1.2%)	6 (3.0%)	0.2
ESTIMATED BLOOD LOSS (CC)	206.2 + 208.0	**254.5** + 191.4	**144.7** + 212.5	**< 0.001**
LENGTH OF OR (MIN)	286.3 + 115.3	289.2 + 113.5	282.6 + 117.7	0.5
HOSPITAL LENGTH OF STAY (DAYS)	4.7 + 3.2	**5.0 + 3.2**	**4.3 + 3.2**	**0.02**
NON-HOME DISCHARGE	99 (21.6%)	56 (21.8%)	43 (21.3%)	0.9
90-DAY READMISSION	47 (10.2%)	35 (13.6%)	12 (5.9%)	0.008
90-DAY RETURN TO OR	19 (4.1%)	**18 (7.0%)**	**1 (0.50%)**	**< 0.001**
90-DAY ER PRESENTATION	88 (19.2%)	55 (21.4%)	33 (16.3%)	0.2
HARDWARE REVISION/EXTENSION AT MAX F/U	25 (5.4%)	18 (7.0%)	7 (3.5%)	0.1
PERSISTENT RADICULOPATHY / PAIN MANAGEMENT	119 (25.9%)	64 (24.9%)	55 (27.2%)	0.6
CHRONIC OPIOIDS	55 (12.0%)	35 (13.6%)	20 (9.9%)	0.2

Table 2: Demographics and Outcomes of MIS vs. Open Fusions in Class II/III Obesity (BMI >35) patients from 2022 to 2024

	COHORT (N = 117)	OPEN (N = 56)	MIS (N = 61)	OPEN VS. MIS (P-VALUE)
AGE AT OR (YEARS)	58.8 + 11.7	57.3 + 12.1	60.2 + 11.3	0.2
BMI	38.7 + 3.4	38.8 + 3.3	38.6 + 3.5	0.8
SEX (% FEMALE)	91 (77.8%)	40 (71.4%)	51 (83.6%)	0.1
NON-ENGLISH SPEAKING	20 (17.1%)	9 (16.1%)	11 (18.0%)	0.8
MEDICAID	37 (31.6%)	18 (32.1%)	19 (31.1%)	1.0
MEDICARE	61 (52.1%)	32 (57.1%)	24 (39.3%)	0.4
NON-WHITE	95 (81.2%)	44 (78.6%)	51 (83.6%)	0.6
SMOKER	14 (12.0%)	4 (7.1%)	10 (16.4%)	0.2
PSYCH HX	34 (29.1%)	21 (37.5%)	13 (21.3%)	0.07
CHARLSON COMORBIDITY INDEX	1.1 + 1.3	1.0 + 1.3	1.1 + 1.2	0.4
PRIOR LAMINECTOMY	18 (15.4%)	9 (16.1%)	9 (14.8%)	1.0
# LEVELS FUSED	1.5 + 0.7	1.6 + 0.7	1.5 + 0.6	0.5
INTRAOPERATIVE COMPLICATION	7 (6.0%)	2 (3.6%)	5 (8.2%)	0.4
INTRAOP TRANSFUSION	2 (1.7%)	0 (0%)	2 (3.3%)	0.5
ESTIMATED BLOOD LOSS (CC)	192.7 + 193.4	**245.9 + 116.4**	**144.0 + 234.2**	**0.004**
LENGTH OF OR (MIN)	309.6 + 110.8	292.1 + 103.3	325.6 + 115.8	0.1
HOSPITAL LENGTH OF STAY (DAYS)	4.9 + 3.2	5.1 + 3.6	4.6 + 2.8	0.4
NON-HOME DISCHARGE	25 (21.4%)	11 (19.6%)	14 (23.0%)	0.8
90-DAY READMISSION	15 (12.8%)	11 (19.6%)	4 (6.6%)	0.05
90-DAY RETURN TO OR	8 (6.8%)	**8 (14.3%)**	**0 (0%)**	**0.002**
90-DAY ER PRESENTATION	24 (20.5%)	14 (25.0%)	10 (16.4%)	0.3
HARDWARE REVISION/EXTENSION AT MAX F/U	11 (9.4%)	**9 (16.1%)**	**2 (3.3%)**	**0.03**
PERSISTENT RADICULOPATHY / PAIN MANAGEMENT	29 (24.8%)	12 (21.4%)	17 (27.9%)	0.5
CHRONIC OPIOIDS	30 (25.6%)	19 (33.9%)	11 (18.0%)	0.06