Patterns of Outpatient Multimodal Analgesic Use Among Patients Who Develop C5 Palsy Following Cervical Spine Fusion: A 3:1 Propensity Matched Cohort

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INTRODUCTION: C5 palsy is classically associated with sensory and motor weakness in the C5 distribution. Patients may also report persistent pain, though no studies have explored its effects on postoperative analgesic use. The purpose of this study was to analyze postoperative utilization of opioids, gabapentinoids muscle relaxants, antidepressants, and benzodiazepines by patients with C5 palsy as compared to a matched cohort without C5 palsy. Additionally, we compared analgesic use amongst C5 palsy patients whose symptoms recovered by 6 months to those whose symptoms persisted beyond 6 months.

METHODS: Adult patients who underwent anterior cervical discectomy and fusion and posterior decompression and fusion from 2017-2022 and subsequently developed C5 palsy were identified. A 3:1 propensity match incorporating age, sex, surgery performed, and levels fused was performed. We also divided C5 palsy patients by time to symptomatic resolution (>6 months vs <6 months) for further analysis. One year preoperative and postoperative opioid use, and utilization of gabapentinoids, muscle relaxants, and benzodiazepines were all obtained from the Pennsylvania Prescription Drug Monitoring Program (PDMP). In-hospital morphine milligram equivalents (MME) and antidepressant use was obtained from patient chart review.

RESULTS: We identified 43 patients who underwent cervical fusion and subsequently developed postoperative C5 palsy; 76% underwent a PCDF, 17.1% underwent an ACDF, and 6.98% underwent a combined ACDF/PCDF. These patients were compared to a matched cohort of 129 patients who did not develop C5 palsy.

No statistically significant differences existed between C5 palsy patients and non-C5 palsy patients with regards to preoperative, in-hospital, or postoperative opioid consumption, including total prescriptions, total MME, and MME at any of the smaller time intervals. Additionally, there were no differences between C5 palsy patients and non-C5 palsy patients with regards to utilization of gabapentinoids, muscle relaxants, benzodiazepines, duloxetine, or tricyclic antidepressants either preoperatively or postoperatively.

In our sub-analysis of C5 palsy patients, we identified 16 whose symptoms recovered by 6 months, and 25 whose symptoms were not recovered by 6 months (an additional two patients did not have any outpatient follow ups at 6 months postoperatively, and were thus not included in this sub-analysis). Among C5 palsy patients, we similarly did not observe any statistically significant differences with regards to preoperative, in-hospital, and acute postoperative opioid consumption, nor any differences in, gabapentinoid, muscle relaxant, duloxetine, tricyclic antidepressant, or benzodiazepine consumption.

DISCUSSION AND CONCLUSION:

As the opioid epidemic persists, it is imperative that surgeons are able to provide patients with a thorough understanding of the risks of surgery and any factors which may influence opioid consumption in the postoperative setting. Our study suggests that individuals who sustain a C5 palsy in the post-surgical setting, are not at increased risk of persistent opioid, gabapentinoid, muscle relaxant, duloxetine, tricyclic antidepressant, or benzodiazepine consumption up to 1 year after surgery when compared to a propensity-matched cohort of patients who did not develop C5 palsy. Additionally, we found that patients with C5 palsy whose symptoms persist beyond 6 months do not consume higher quantities of opioids or other analgesic medications when compared to patients who recover within 6 months.

Table 1: Demographic and Surgical Characteristics

	No C5 Palsy (N=129)	C5 Palsy (N=43)	P Value
Age*	63.3 (10.2)	64.4 (10.9)	0.514
Race			0.695
White	103 (79.8%)	34 (79.1%)	
Black	23 (17.8%)	7 (16.3%)	
Asian	2 (1.55%)	1 (2.33%)	
Other	1 (0.78%)	1 (2.33%)	
*Sex**			0.919
Male	96 (74.4%)	33 (76.7%)	
Female	33 (25.6%)	10 (23.3%)	
Body Mass Index	29.2 (5.72)	29.1 (4.85)	0.910
CCI	3.26 (1.87)	3.44 (2.00)	0.785
Smoking Status			0.451
Never	47 (36.4%)	17 (39.5%)	
Former	55 (42.6%)	14 (32.6%)	
Current	27 (20.9%)	12 (27.9%)	
*Surgery Performed**			0.851
PCDF	98 (76.0%)	32 (74.4%)	
ACDF	22 (17.1%)	8 (18.6%)	
ACDF/PCDF	9 (6.98%)	3 (6.98%)	
Levels Fused*	4.22 (1.21)	4.21 (1.21)	0.993
Revision Procedure	3 (3.88%)	2 (4.65%)	1.000

Data listed as either: mean (SD) or n (%)

**C5 Palsy patients matched to controls based on age, sex, surgery performed, and levels fused*
CCI=Charlson Comorbidity Index, ACDF=Anterior Cervical Decompression and Fusion, PCDF=Posterior Cervical Decompression and Fusion

Table 2: Pre and Post-Operative Opioid Consumption: C5 Palsy vs Non-C5 Palsy Patients

	No C5 Palsy (N=129)	C5 Palsy (N=43)	P Value
Number of Patients Using Opioids 1 Year Pre-Op	72 (55.8%)	23 (53.5%)	0.829
Number of Patients Using Opioids 30-60 Days Pre-Op	31 (24.0%)	11 (25.6%)	1.000
Number of Patients Using Opioids 0-30 Days Pre-Op	42 (32.6%)	15 (34.9%)	0.925
Total Prescriptions Pre-Op	3.74 (6.79)	2.49 (3.91)	0.684
Total MME 1 Year Pre-Op	227 (634)	104 (203)	0.458
MME 30-60 Days Pre-Op	21.3 (65.8)	11.9 (24.8)	0.985
MME 0-30 Days Pre-Op	24.8 (68.9)	19.6 (39.6)	0.987
Total In-Hospital MME	193 (141)	213 (148)	0.489
Hospital Length of Stay	5.11 (2.61)	2.95 (1.91)	0.096
Average Daily In-Hospital MME	70.8 (48.5)	88.1 (30.9)	0.591
Number of Patients Using Opioids 0-30 Days Post-Op	113 (87.6%)	41 (95.3%)	0.268
Number of Patients Using Opioids 30-90 Days Post-Op	49 (38.0%)	17 (39.5%)	1.000
Number of Patients Using Opioids 90-365 Days Post-Op	53 (41.1%)	21 (48.8%)	0.477
Total Prescriptions Post-Op	5.97 (8.17)	6.30 (7.39)	0.569
Total MME 0-90 Days Post-Op	177 (207)	192 (212)	0.422
MME 0-30 Days Post-Op	122 (119)	150 (153)	0.174
MME 30-90 Days Post-Op	55.1 (121)	42.3 (78.6)	0.925
Total MME 0-1 Year Post-Op	354 (595)	339 (458)	0.612
MME 90-365 Years Post-Op	177 (420)	147 (271)	0.463

Data listed as either: mean (SD) or n (%)

MME=Morphine Milligram Equivalent

Table 3: Pre and Postoperative Utilization of Additional Pain Medications: C5 Palsy vs Non-C5 Palsy Patients

	No C5 Palsy (N=129)	C5 Palsy (N=43)	P Value
Used Benzodiazepines Before Surgery	28 (21.7%)	8 (18.6%)	0.829
Used Muscle Relaxant Before Surgery	25 (19.4%)	5 (11.6%)	0.333
Used Gabapentin/Pregabalin Before Surgery	28 (20.2%)	5 (11.6%)	0.303
Used Benzodiazepines After Surgery	37 (28.7%)	16 (37.2%)	0.391
Used Muscle Relaxant After Surgery	43 (33.3%)	21 (48.8%)	0.101
Used Gabapentin/Pregabalin After Surgery	44 (34.1%)	15 (34.9%)	1.000
Number of Patients Taking Antidepressants			
SNRI (Duloxetine)	6 (4.65%)	4 (9.30%)	0.497
Tricyclic Antidepressants	2 (1.55%)	0 (0.00%)	1.000

Data listed as: n (%)

SNRI=Serotonin-norepinephrine reuptake inhibitor

Table 4: Pre and Post-Operative Opioid Consumption For C5 Palsy Patients Based on Recovery Time

	Recovered by 6 Months (N=16)	Not Recovered by 6 Months (N=25)	P Value
Number of Patients Using Opioids 1 Year Pre-Op	10 (62.5%)	13 (52.0%)	0.735
Number of Patients Using Opioids 30-60 Days Pre-Op	4 (25.0%)	7 (28.0%)	1.000
Number of Patients Using Opioids 0-30 Days Pre-Op	6 (37.5%)	9 (36.0%)	1.000
Total Prescriptions Pre-Op	2.82 (3.58)	2.40 (4.28)	0.705
Total MME 1 Year Pre-Op	98 (133)	137 (245)	0.825
MME 30-60 Days Pre-Op	8.72 (13.3)	16.1 (30.3)	0.686
MME 0-30 Days Pre-Op	14.6 (29.9)	24.1 (45.9)	0.780
Total In-Hospital MME	238 (166)	201 (144)	0.584
Average Daily In-Hospital MME	74.9 (35.7)	63.2 (27.9)	0.306
Number of Patients Using Opioids 0-30 Days Post-Op	15 (93.8%)	24 (96.0%)	1.000
Number of Patients Using Opioids 30-90 Days Post-Op	6 (37.5%)	11 (44.0%)	0.931
Number of Patients Using Opioids 90-365 Days Post-Op	8 (50.0%)	13 (52.0%)	1.000
Total Prescriptions Post-Op	5.44 (5.46)	7.04 (8.64)	0.861
Total MME 0-90 Days Post-Op	192 (232)	194 (209)	0.810
MME 0-30 Days Post-Op	160 (196)	139 (130)	0.422
MME 30-90 Days Post-Op	24.6 (45.8)	57.0 (94.4)	0.411
Total MME 0-1 Year Post-Op	274 (351)	396 (529)	0.820
MME 90-365 Years Post-Op	81.3 (138)	208 (330)	0.551

Data listed as either: mean (SD) or n (%)

MME=Morphine Milligram Equivalent

Table 5: Pre and Postoperative Utilization of Additional Pain Medications For C5 Palsy Patients Based on Recovery Time

	Recovered by 6 Months (N=16)	Not Recovered by 6 Months (N=25)	P Value
Used Benzodiazepines Before Surgery	2 (12.5%)	6 (24.0%)	0.448
Used Muscle Relaxant Before Surgery	4 (25.0%)	1 (4.00%)	0.067
Used Gabapentin/Pregabalin Before Surgery	3 (18.8%)	2 (8.00%)	0.362
Used Benzodiazepines After Surgery	5 (31.2%)	11 (44.0%)	0.625
Used Muscle Relaxant After Surgery	9 (56.2%)	11 (44.0%)	0.658
Used Gabapentin/Pregabalin After Surgery	5 (31.2%)	10 (40.0%)	0.814
Number of Patients Taking Antidepressants			
SNRI (Duloxetine)	3 (12.5%)	2 (8.00%)	0.657
Tricyclic Antidepressants	0 (0.00%)	0 (0.00%)	1.000

Data listed as: n (%)

SNRI=Serotonin-norepinephrine reuptake inhibitor