



# Results of Spinal Fusion in Patients with Spinal Nerve Sheath Tumors

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## Introduction

Intradural extramedullary spine tumors represent two-thirds of all primary spinal neoplasms. Approximately half are peripheral nerve sheath tumors, predominately schwannomas and neurofibromas. Given the rarity of this disease and the restricted indications for adding fusion to laminectomy for resection of tumor, analyses of spinal fusion outcomes are limited. Analysis of patients who concomitantly undergo fusions after tumor resection has been limited given the rarity of this disease.

## Methods

Age, gender, clinical presentation, presence of neurofibromatosis, tumor type, location, extent of resection characterized as gross total resection (GTR) or subtotal resection (STR), use of spinal fusion, fusion-related complications, surgical complications, neurologic outcomes, and clinical follow-up were recorded retrospectively by analysis of hospital and clinic records.

## Learning Objectives

By the conclusion of this session, participants should be able to 1) recognize utility of fusion for spinal peripheral nerve sheath tumors, 2) recognize association between tumor pathology/location and need for fusion, 3) recognize most common complications of fusion.

## Results

221 tumors in 199 patients were identified with a mean age of 45 years. 53 were neurofibromas, 163 schwannomas, and 5 malignant peripheral nerve sheath tumors. 79 patients underwent fusion procedures, with 70 instrumented and 9 non-instrumented procedures. Fusions were performed for 39 cervical tumors (49%), 19 thoracic tumors (24%), and 21 lumbosacral tumors (27%). The rate of fusion was higher for extradural lesions compared to intradural lesions (60% vs. 30%,  $p=0.001$ ) and for tumors involving the cervicothoracic junction (88% vs. 31%,  $p<0.001$ ). The mean number of levels fused was 4, with a range of 2-10. There was a no difference in fusion rates based on tumor pathology. Rates of new or worsening neurologic deficits including sensory (19% in fusion vs. 13% in non-fused,  $p=0.268$ ) and motor symptoms (8% in fused vs. 4% in non-fused,  $p=0.289$ ) were not significantly different. Rates of wound infection (3% in fusion vs. 6% in non-fused) and CSF leak or pseudomeningocele (6% in fusion vs. 4% in non-fused) were not statistically different. There were 10 fusion-related complications: 6 adjacent segment disease, 3 implant failures, and 1 pseudoarthrosis. The mean time from surgery to last follow-up was 32 months.

## Conclusions

In this cohort, spinal nerve sheath tumors in the cervical spine, spanning the cervicothoracic junction, and those with extradural involvement were associated with higher rates of spinal fusion. Fusion was not associated with increased rates of new or worsening motor or sensory deficits, CSF leak, pseudomeningocele, wound infection, or spinal deformity. Fusion-related radiographic complications were observed in 13% of cases. Only one patient developed a symptomatic complication that required reoperation. Overall, spinal fusions were well tolerated in this cohort and did not increase the risk of postoperative neurologic or surgical complications.

Table 1. Fusion characteristics

Characteristic	n=79
Levels fused	
Mean	4
Range	2-10
Tumor level	
Cervical	39
Thoracic	19
Lumbosacral	21
Junction involvement	
Cervicothoracic	15
Thoracolumbar	7
Fusion type	
Instrumented	70
Non-instrumented	9
Surgical approach	
Posterior	74
Anterior	1
Anterior and Posterior	4
Fusion complications	
Total	10
Adjacent segment disease	6
Implant failure	3
Pseudoarthrosis	1
Last fusion imaging (months)	
Mean	23
Median	15
Range	2-86

Characteristic	Fusion (n=79)	No fusion (n=142)	Significance (p value)
Table 2. Surgical outcomes after fusion			
Surgical complications	30 (38%)	40 (28%)	0.133
Complication type			
New/worse sensory deficit	15 (19%)	19 (13%)	0.268
New/worse motor deficit	6 (8%)	6 (4%)	0.289
CSF leak/pseudomeningocele	5 (6%)	6 (4%)	0.491
Wound infection	2 (3%)	9 (6%)	0.335*
Spinal deformity	3 (4%)	3 (2%)	0.669*
Other	2 (3%)	4 (3%)	1.000*
Tumor recurrence	8 (10%)	12 (8%)	0.677
Time to recurrence/progression			
Mean	35	59	0.162
Median	21	46	
Range	4-86	5-119	
*Fisher's Exact Test			
Table 3. Patient demographics by fusion status			
Characteristic	Fusion (n=79)	No fusion (n=142)	Significance (p value)
Age (years)			
Mean	46	44	0.276
Median	48	45	
Range	5-76	1-88	
Gender			0.784
Male	43 (54%)	80 (56%)	
Female	36 (46%)	62 (44%)	
Neurofibromatosis			
Type 1	15 (19%)	27 (19%)	0.996
Type 2	4 (5%)	7 (5%)	0.599*
None	60 (76%)	108 (76%)	0.986
Symptom duration (months)			
Mean	20	13	0.109
Median	6	6	
Range	0-120	0-120	
Clinical presentation			
Pain	61 (77%)	107 (75%)	0.518
Weakness	31 (39%)	48 (34%)	0.342
Numbness/paresthesias	33 (42%)	43 (30%)	0.062
Gait disturbance	4 (5%)	8 (6%)	1.000*
Bowel/bladder incontinence	1 (1%)	11 (8%)	0.060*
Incidental	1 (1%)	3 (3%)	1.000*
Tumor Location			
Cervical	39 (49%)	46 (33%)	0.013
Thoracic	19 (24%)	43 (30%)	0.323
Lumbosacral	21 (27%)	53 (37%)	0.105
Tumor spanning junction			
Cervicothoracic	15 (19%)	2 (1%)	<0.001*
Thoracolumbar	7 (9%)	13 (9%)	0.092
Vertebral levels spanned by tumor			
Mean	1.3	1.2	0.756
Median	1	1	
Range	1-6	1-3	
Dural Location			
Intradural	48 (61%)	112 (79%)	0.004
Extradural	28 (35%)	19 (13%)	<0.001
Paraspinal	3 (4%)	11 (8%)	0.388
Tumor pathology			
Neurofibroma	23 (29%)	30 (21%)	0.183
Schwannoma	54 (68%)	109 (77%)	0.173
MPNST	2 (3%)	3 (2%)	1.000*
Extent of resection			
GTR	58 (73%)	108 (76%)	0.664
STR	21 (27%)	33 (23%)	0.579
Biopsy	0 (0%)	1 (1%)	1.000*
Time to last follow-up (months)			
Mean	31	32	0.939
Median	16	15	
Range	0-159	0-162	
*Fisher's Exact Test			