Incidence, Survival, and the Impact of Radiotherapy in Pediatric Primary Spinal Cord Tumors

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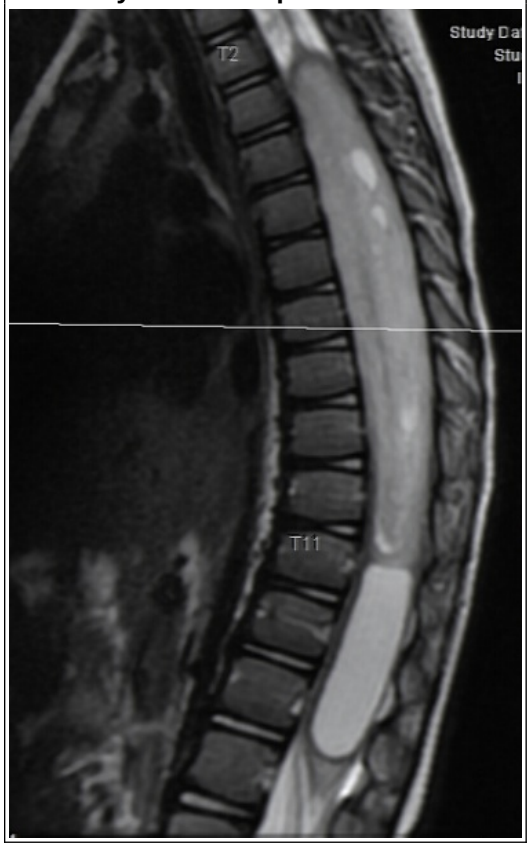
Introduction

Pediatric primary spinal cord tumors are rare, with little available data regarding incidence and outcomes. Specifically, the efficacy of external beam radiation (EBR) in these patients is difficult to determine due to the relative paucity of cases. The Surveillance Epidemiology and End Results database (SEER) allows for evaluation of the demographics and overall survival of patients with primary spinal cord tumors, particularly in regard to radiotherapy.

Primary Pediatric Spinal Cord Tumor



Methods

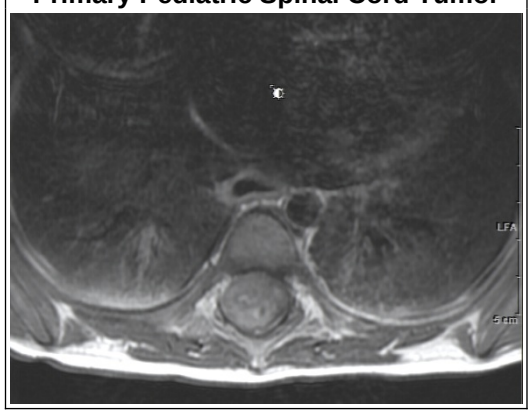
The SEER database was queried over 1975 to 2007 for patients less than age nineteen diagnosed with a primary spinal cord tumor. Histological diagnoses were grouped into pilocytic astrocytoma, other low-grade astrocytoma (fibrillary astrocytoma, NOS), ependymoma, and high-grade glioma. Patient demographics, were collected with tumor pathology, treatment with EBR, and overall survival.

Diagnostic Grouping of Primary Pediatric Spinal Cord Tumors

	GRADE				
HISTOLOGY	**I**	**II**	**III**	**IV**	**MISSING**
Pilocytic Astrocytoma	PA	PA	HGG	HGG	PA
Ependymoma NOS	EP	EP	EP	EP	EP
Anaplastic Ependymoma	EP	EP	EP	EP	EP
Myxopapillary Ependymoma	EP	EP	EP	EP	EP
Astrocytoma NOS	PA	LGA	HGG	HGG	LGA
Anaplastic Astrocytoma	-	-	HGG	HGG	HGG
Fibrillary Astrocytoma	PA	LGA	HGG	HGG	LGA
GBM NOS	-	-	HGG	HGG	HGG
Mixed Glioma	PA	LGA	HGG	HGG	LGA
Malignant Glioma	PA	LGA	HGG	HGG	HGG
Oligodendroglioma NOPS	PA	LGA	HGG	HGG	LGA
Protoplasmic Astrocytoma	PA	LGA	-	-	LGA

PA: pilocytic astrocytoma
EP: epenydmoma
LGA: low-grade astrocytoma, non-ependymoma
HGG: high-grade glioma, non-ependymoma
-: no cases

Primary Pediatric Spinal Cord Tumor



5-Year Relative Survival for Pediatric Primary Spinal Cord Tumors

	Cases	(%)	5-Year Relative Survival	[95% CI]
Overall	330	(100)	76.0%	[70.7, 80.4]
Sex				
Male	190	(57.6)	74.8%	[67.6, 80.6]
Female	140	(42.4)	77.5%	[69.1, 83.9]
Age at Diagnosis				
0 – 4 years	79	(23.9)	86.5%	[76.0, 92.6]
5 – 9	68	(20.6)	85.6%	[74.0, 92.3]
10 – 14	105	(31.8)	67.6%	[57.2, 76.0]
15 – 19	78	(23.6)	67.9%	[55.3, 77.7]
Race				
White	274	(83.0)	77.2%	[71.5, 82.0]
Black	34	(10.3)	69.9%	[50.9, 82.6]
Others including Unknown	22	(6.7)	72.2%	[48.1, 86.5]
External Beam Radiation				
Yes	121	(36.7)	53.7%	[44.0, 62.5]
No	199	(60.3)	89.0%	[83.3, 92.9]
Unknown	10	(3.0)	89.0%	[42.9, 98.4]
Grade				
I	41	(12.4)	91.9%	[76.5, 97.4]
II	72	(21.8)	93.9%	[84.0, 97.8]
III	19	(5.8)	41.5%	[19.6, 62.2]
IV	45	(13.6)	28.6%	[15.6, 43.0]
Unknown	153	(46.4)	81.7%	[74.1, 87.2]
Tumor Type				
Pilocytic Astrocytoma	100	(30.3)	93.1%	[85.0, 96.9]
Ependymoma	70	(21.2)	85.6%	[73.7, 92.4]
Low-grade Astrocytoma	90	(27.3)	88.5%	[79.5, 93.7]
High-grade Glioma	70	(21.2)	26.5%	[16.4, 37.7]
Year of Diagnosis				
1975 – 1989	73	(22.1)	65.6%	[53.4, 75.4]
1990 – 2007	257	(77.9)	79.2%	[73.3, 83.9]

Trends in use of EBR and Diagnosis Considering Year of Diagnosis

	Epoch				
	1975 – 1989	(%)	1990 – 2007	(%)	P-Value[a]
Age at Diagnosis					0.3367
0 – 4 years	12	(16.4)	67	(26.1)	
5 – 9	18	(24.7)	50	(19.5)	
10 – 14	26	(35.6)	79	(30.7)	
15 – 19	17	(23.3)	61	(23.7)	
		(100)		(100)	
External Beam Radiation[b]					< 0.0001 *
Yes	43	(60.6)	78	(31.3)	
No	28	(39.4)	171	(67.7)	
		(100)		(100)	
Tumor Type					0.0003 *
Pilocytic Astrocytoma	10	(13.7)	90	(35.0)	
Ependymoma	12	(16.4)	58	(22.6)	
Low-grade Astrocytoma	31	(42.5)	59	(23.0)	
High-grade Glioma	20	(27.4)	50	(19.5)	
		(100)		(100)	

[a]Chi-Square test
[b]Excludes 10 cases with missing data

Results

330 cases of histologically confirmed primary pediatric spinal cord tumors were identified. Despite the advent of MRI, the age-adjusted incidence did not change over the thirty-year study window (0.09 cases/100,000). Incidence was slightly higher in males (57%). Overall 5-year relative survival was 76%. Pilocytic astrocytoma had the best survival (93%) compared to high-grade glioma (27%). 60% of children did not receive EBR, for whom the survival was 89% compared to only 54% for those that did require EBR. The difference in survival for children treated with EBR or not was, respectively, 75% vs 95% in pilocytic astrocytoma, and 75% vs 25% in high-grade glioma. In ependymoma and low-grade astrocytoma (excluding pilocytic), the 5-year relative survival was not significantly different in children receiving EBR from those that did not (approximately 82% vs 91%).

Conclusions

The survival for pediatric spinal pilocytic astrocytoma, low-grade astrocytoma, and ependymoma is quite high, while the outcome for spinal high-grade gliomas is similar to that for pediatric supratentorial high-grade tumors. This data may be particularly useful for clinicians considering the use of EBR in this patient population.

Learning Objectives

To describe the incidence and survival for pediatric spinal cord tumors, considering the use of radiotherapy.