

# Long-Term Survival in Pediatric Meningioma Is Not Affected by Treatment or Tumor Size: A Surveillance, Epidemiology, and End Results (SEER) Database Analysis

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### Introduction

- Meningioma manifests rarely in children and epidemiological descriptions of pediatric meningioma are scarce.
- We used national database to examine potential prognostic factors of long-term survival in pediatric meningioma patients.

#### Methods

- The Surveillance Epidemiology and End Results (SEER) database was queried for patients with history of pediatric meningioma.
- Univariate and multivariate survival analyses were conducted using Cox regression model to determine the effects of clinical characteristics and treatments on overall survival.

## Results

A total of 443 patients diagnosed with pediatric meningioma between 1998 and 2014 were identified. Average age at diagnosis was 13.38 years old (SD ± 5.01) and 50.2% of the patients were males. (Table 1)

Demo	ographic Inf	ormation	1			
		Total	Gross Total Resection	Partial Resection	No Surgery	Р
Ν		443	163 (36.9%)	144 (32.4%)	136 (30.7%)	
Age at diagnosis		13.38 (±5.01)	12.8 (±5.38)	12.8 (±4.98)	14.71 (±4.36)	<0.001*
Year of Diagnosis		2009.7 (±3.71)	2009.2 (±3.83)	2010.0 (±3.81)	2010.2 (±3.41)	0.05
% Male		50.20%	58.30%	44.44%	47.10%	0.04**
Race	% Caucasian	76.10%	76.70%	77.10%	74.30%	0.83
	% Non- Caucasian	23.90%	23.30%	22.90%	25.70%	

Overall, and stratified by treatment outcome, demographic characteristics of SEER pediatric meningioma cases

- Gross total resection was achieved in 36.9% (n=163) of the patients. Partial resection was achieved in 32.4% (n=144) of the patients and 30.7% (n=136) did not receive any therapeutic surgical treatment.
- Out of those who underwent surgery, 16.9% (n=52) also received additional radiation therapy, including 11.0% (n=18) of gross total resection cases and 23.6% (n=34) of partial resection cases. (Table 2)

	(	Clinical C	Characteristi	cs		
Tumor size		All 40.3 (±36.4)	Gross Total Resection 45.5 (±43.1)	Partial Resection 49.2 (±29.7)	No Surgery 21.1.1 (±21.8)	P <.0001*
Diagnostic Confirmation	Positive Histology Positive Radiography	334 (75.4%) 99 (22.3%)	160 (98.4%) 0	143 (99.3%) 0	31 (22.8%) 98 (72.1%)	<.0001**
	Other	9 (2.0%)	3 (1.6%)	1 (0.7%)	7 (5.1%)	
Coded Behavior	Benign Borderline	336 (75.8%) 77	117 (71.8%) 33	88 (61.1%) 41	131 (96.3%) 3	<.0001
	Malignant Malignant	(17.4%) 30 (6.8%)	(20.2%) 13 (8.0%)	(28.5%) 15 (10.4%)	(2.2%) 2 (1.5%)	
Histologic Type	Meningioma NOS Benign Meningioma Atypical	282 (63.7%) 88 (19.9%) 73 (16.5%)	86 (52.8%) 40 (24.5%) 37 (22.7%)	71 (49.3%) 38 (26.4%) 35 (24.3%)	125 (91.9%) 10 (7.4%) 1 (0.7%)	<.0001 <u>A</u>
Adjunct Radiation	Yes (#/%)	(16.5%) 52 (16.9%) 255	(22.7%) 18 (11.0%) 145	(24.3%) 34 (23.6%) 110	(0.7%) N/A	<.01
	(#/%) Yes	(83.1%) 8	(89.0%)	(76.4%) 6	N/A 2	
Chemotherapy	(#/%) No (#/%)	(1.8%) 435 (98.2%)	0 163	(4.2%) 138 (95.8%)	(1.5%) 134 (98.5%)	0.02
† GT <u>∆</u> GT	* GTR v ** GTR v R vs. NS and I R vs. NS and I	rs. NS and rs. NS and PR vs. NS PR vs. NS ♥ GTR v	PR vs. NS b PR vs. NS b both P<0.01 both P<0.01 rs. PR P<0.05	ooth P<0.01 ooth P<0.01 (GTR vs. I (GTR vs. F 5	PR P=0.14 PR P=0.83	)
Overall,	and str	atifie	d by sı	urgica	l outc	ome,
	clinic	al ch	aracte	ristics		

# Survival

 Meningioma was the primary cause of death for 12 patients; 22 patients died due to other causes. Estimated 3-, 5- and 10-year survival was 97.5%, 94.7%, and 91.7% respectively.



The Kaplan-Meier estimated curve of survival for pediatric meningioma - overall and stratified by surgical outcome

#### **Cox Regression Analysis**

- Covariate analysis showed that the malignant behavior code is a significant factor (HR: 3.56, 95% CI: 2.34-4.76, p= 0.03) across the board.
- Tumor size, sex, race, age at diagnosis, year of diagnosis, histologic type, surgical modality and adjunct radiation/chemotherapy did NOT significantly alter the rate of survival.

	Ta	ble 3						
Univariate Cox Regression Analysis for All-Cause Mortality								
Variables	-	Coef	95%	5 CI	Р			
Age at diagnosis		-0.018	-0.098	0.063	0.67			
Race		0.124	-0.81	1.06	0.8			
Sex		-0.177	-1.02	0.66	0.68			
Year of Diagnosis		-0.096	-0.23	0.04	0.16			
Tumor Size		-0.002	-0.02	0.02	0.88			
Behavior Code								
	Benign	Ref	Ref		Ref			
	Borderline Malignant	0.43	-0.71	1.56	0.46			
	Malignant	1.68	0.70	2.67	< 0.001			
Histologic Type								
	Benign	Ref	Ref		Ref			
	Atypical	-0.64	-1.99	0.71	0.35			
	NOS	-0.61	-1.54	0.32	0.2			
Surgical Treatment Modality								
	No Surgery	Ref	Ref		Ref			
	PR	0.67	0.53	1.87	0.27			
	GTR	0.67	-0.49	1.83	0.26			
Radiation		1.02	0.08	1.95	0.03			
Chemotherapy		1.78	0.32	3.24	0.02			
Multivariate Cox Regression Analysis for All-Cause Mortality								
Variables		Coef	95%	5 CI	Р			
Behavior Code								
	Benign	Ref	Ref		Ref			
	Borderline Malignant	0.33	-0.81	1.47	0.57			
	Malignant	1.27	0.06	2.48	0.039			
Radiation		0.49	-0.61	1.59	0.37			
Chemotherapy		1.18	-0.38	2.74	0.13			
Coef: Cox coefficient, where > 0 signifies a negative prognostic factor								
Ref: reference group used to calculate the odds ratio								

Univariate and Multivariate Cox Analyses

## Conclusions

- Pediatric meningioma has a good prognosis for long-term survival.
- Surgical and treatment modalities do not seem to significantly alter survival, though samples are small. Malignant behavior was the only significant factor for shorter survival across the board.