

Patterns of Care and Prognosis of Patients with Anaplastic Astrocytoma

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Introduction

The prognosis of patients with grade III gliomas is relatively favorable in comparison to other high grade gliomas such as glioblastoma multiforme. However, variability in patient cohorts according to age, extent of surgical resection, sensitivity to chemotherapy, and treatment approaches have yielded a wide range of survival estimates in pre-existing studies.

Methods

A nationwide cohort of anaplastic astrocytoma (AA) and anaplastic oligodendroglioma (AO) patients diagnosed between 1973 and 2008 was studied using the Surveillance, Epidemiology, and End Results (SEER) cancer registry database. Univariate and multivariate Cox proportional hazards models were used to evaluate the role of patient- and clinical- characteristics in overall survival. Critical covariates such as age, gender, marital status, number of tumor primaries, tumor size, radiotherapy, gross total resection (GTR), and decade of treatment were evaluated.

Results

A total of 3,211 patients were identified. Of these, 2,595 patients were classified as AA and 616 as AO. The median overall survival was 16 months in the AA cohort and 42 months in the AO cohort. More aggressively treated patients (GTR plus radiation) had a significantly longer overall median survival (48 median) than a generalized cohort of patients undergoing surgery with radiation (21 months) or surgery without radiation (7 months). Multivariate analysis showed that older patients (≥ 65) had almost 6 times (HR 5.89, $p < .001$) and 5 times (HR 5.21, $p < .0001$) the hazards of mortality than younger patients (≤ 39) in the AA and AO cohorts, respectively. Radiation (HR 0.64, $p < .0001$) and GTR (HR 0.55, $p < .0001$) significantly minimized the hazards of mortality particularly in AA patients, whereas radiation did not have a significant effect upon survival in AO patients (HR 0.96, $p = .70$). While no improvement in survival prognosis was observed in the AO cohort over the prior three decades, AA patients treated in the 2000's compared to the 1970's had a significantly lower hazards of mortality (HR 0.78, $p = .02$).

Conclusions

This study estimated survival for a large cohort of AA and AO patients while adjusting for critical confounding factors. Age and GTR status were factors consistently associated with improved survival among anaplastic gliomas, whereas radiotherapy was only a strong predictor of survival within the AA cohort.

Learning Objectives

By the conclusion of the session, participants should be able to

1. Describe the trends in survival for patients with Anaplastic Astrocytoma.
2. Discuss patterns of care for patients with AA.
3. Identify prognostic factors and the importance of age at diagnosis for AA patients.

Variables	A. Astrocytoma (N=2,595)	A. Oligodendroglioma (N=616)	p value
Age at diagnosis			
mean(SD)	48.8 (23.4)	48.2 (16.1)	.74
median	49.0	47.5	
Gender			.69
male	1456 (56.1)	351 (57.0)	
female	1139 (43.9)	265 (43.0)	
Race, N (%)			.59
White	2304 (88.8)	544 (88.3)	
Black	133 (5.1)	30 (4.9)	
Other	158 (6.1)	42 (6.8)	
Marital status, N (%)			.0006
single	616 (23.7)	130 (21.1)	
married	1566 (60.4)	389 (63.2)	
separated	24 (0.9)	2 (0.3)	
divorced	142 (5.5)	56 (9.1)	
widowed	171 (6.6)	23 (3.7)	
unknown	76 (2.9)	16 (2.6)	
Tumor primaries			.88
single	2326 (89.6)	550 (89.4)	
multiple	269 (10.4)	65 (10.6)	
Tumor size, N (%)			<.0001
≥ 4 cm	1633 (76.1)	405 (95.1)	
< 4 cm	514 (23.9)	21 (4.9)	
Tumor location, N (%)			.006
brain nerves	2498 (96.3)	610 (99.0)	
cerebellum	57 (2.2)	3 (0.5)	
ventricle	38 (1.5)	3 (0.5)	
pineal gland	2 (0.1)	0 (0)	
Vital Status, N (%)			<.0001
alive	540 (20.8)	247 (40.1)	
deceased	2055 (79.2)	369 (59.9)	
Radiotherapy, N (%)			<.0001
radiation	1983 (76.4)	404 (65.6)	
no radiation	612 (23.6)	212 (34.4)	
Surgery, N (%)			<.0001
biopsy	929 (35.8)	196 (31.8)	
partial resection	491 (18.9)	171 (27.8)	
gross total resection	353 (13.6)	213 (34.6)	
surgery, NOS	822 (31.7)	36 (5.8)	

	A. Astrocytoma (N=2,595)	A. Oligodendroglioma (N=616)
Median Survival in months*	16 (15, 17)	42 (37, 51)
Overall survival rate, % (95% CI)		
1 year	57.8 (55.9, 59.7)	77.1 (73.5, 80.2)
2 year	40.4 (38.5, 42.3)	62.4 (58.4, 66.2)
3 year	33.8 (32.0, 35.7)	55.1 (50.9, 59.1)
4 year	28.9 (27.1, 30.7)	47.8 (43.5, 51.9)
5 year	25.8 (24.0, 27.6)	43.4 (39.1, 47.6)

*log-rank $p < .0001$

	AA		AO	
	HR (95% CI)	p value	Hazard Ratio	p value
Age in years (ref: ≤ 39)				
40-64	3.30 (2.05-2.58)	<.0001	1.43 (1.10-1.86)	.007
≥ 65	5.89 (5.18-6.69)	<.0001	5.21 (3.82-7.09)	<.0001
Gender (ref: male)				
female	0.86 (0.79-0.94)	.0008	0.91 (0.73-1.12)	.36
Marital Status (ref: unmarried*)				
married	0.94 (0.85-1.03)	.19	0.82 (0.66-1.03)	.09
Tumor primaries (ref: multiple)				
single	1.00 (0.87-1.15)	.97	0.90 (0.65-1.24)	.51
Radiotherapy (ref: no radiation)				
radiation	0.64 (0.58-0.71)	<.0001	0.96 (0.77-1.20)	.70
Extent of Surgery (other**)				
GTR	0.55 (0.47-0.63)	<.0001	0.75 (0.59-0.94)	.01
Decade of treatment (ref: 1970s)				
1980s	0.74 (0.61-0.91)	.0004	3.27 (0.73-24.6)	.25
1990s	0.83 (0.69-1.010)	.07	3.74 (0.51-24.7)	.20
2000s	0.78 (0.64-0.96)	.02	3.26 (0.44-24.3)	.25

* Unmarried corresponds to single/separated/divorced/widowed/unknown patients.
 ** low resection corresponds to either biopsy/partial resection/surgery NOS.

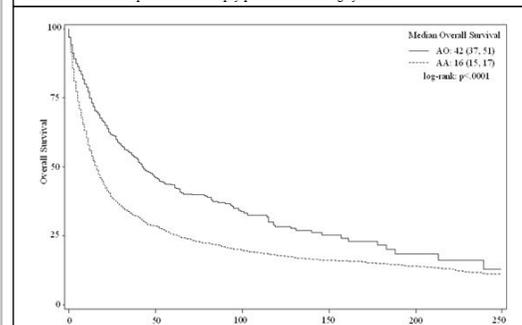


Figure 1. Overall survival for 616 AO and 2,595 AA patients. Kaplan-Meier estimates for overall survival in months is significantly different in AO (solid-line) and AA (dashed-line) patients ($p < .0001$).

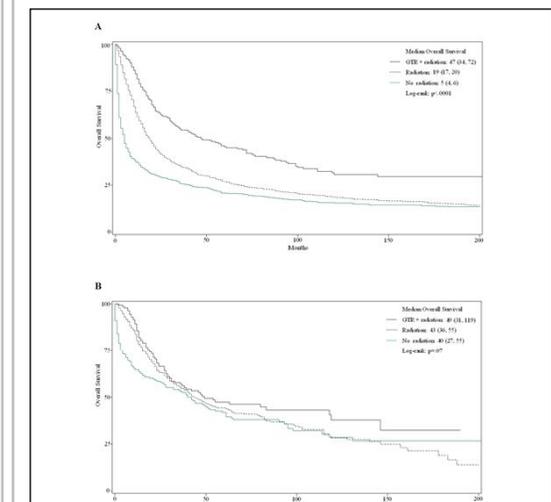


Figure 2. Overall survival for 3,211 anaplastic tumor patients by treatment for AA (A) and AO (B) patients. Kaplan-Meier estimates for overall survival in months is significantly different in GTR+radiation (solid-black-line), radiation (dashed-line), and no radiation (solid-green-line) ($p < .0001$).