Stereotactic Radiosurgery for Atypical Meningiomas

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Introduction

Atypical meningiomas (WHO Grade II) are associated with high recurrence rate despite surgical resection. The optimal management of these tumors has not been well delineated. This study aims to evaluate the role of stereotactic radiosurgery (SRS) in controlling progression of these lesions.

Methods

The followed cohort consisted of 29 women and 24 men underwent SRS at a median age of 60 years (range, 28-84 years). Of the 63 patients treated for a histologically confirmed WHO grade II meningioma, follow-up data was available for 44 patients. Of the 10 patients treated for a histologically confirmed diagnosis of WHO grade III meningioma, follow-up data was available for 9 patients. All patients had undergone surgical resection prior to CK SRS. Surgical resection of WHO grade II and III diagnosed patients occurred immediately before CK SRS for 19 and 3 patients, respectively. Prior radiotherapy had been performed in 20 patients, of which 14 and 6 patients had WHO Grade II and II, respectively. Patient characteristics are listed in Table 1.

Among WHO Grade II lesions, the median tumor volume or resection cavity was 3.33 cc (range, 0.33-26.0 cc), the median dose was 20.0 Gy (range, 15.0-35.0 Gy), and the median maximum dose was 25.0 Gy (range, 18.5-43.1 Gy). Among WHO Grade III lesions, the mean tumor volume or resection cavity was 3.36 cc (range, 0.13-35.3 cc), the median dose was 20.0 Gy (range, 12.0-40.0 Gy), and the median maximum dose was 26.3 Gy (range, 15.1-50.0 Gy). Lesions were treated in fractions ranging from 1 to 5 sessions, with a median of 1 and 3 sessions, respectively.

Results

Among 44 Grade II patients with follow-up, recurrence was seen in 26 (59%) patients (Table 2). Local failure occurred in 17 (39%) patients after a median period of 18 months, and regional failure in 14 (32%) patients after a median period of 14 months. Among the 9 Grade III patients with follow-up, recurrence was seen in 8 (89%) patients (Table 2). Local failure occurred in 8 (%) patients after a median time of 8.5 months, and regional failure in 4 (44%) patients after 20 months follow-up. Overall, patients were observed for a median follow-up of 28 months (range, 3-70 months), and the 12-, 24-, and 36-month actuarial local control rates were 86%, 78%, and 78%, respectively. The regional control rates were 96%, 83%, and 76%, respectively. The overall locoregional control rates were 84%, 64%, and 57%, respectively.

Overall, 5 of 44 Grade II patients and 6 of 9 Grade III patients have died at the time of analysis. Calculate from the time of initial CyberKnife SRS at the author's institution, with a median follow-up time of 23.5 months, the overall 5-year survival rate is 86%.

Table 1. Patient Characteristics

	All Patients (N = 53)	Grade II (N = 44)	Grade III (N = 9)
Age at Diagnosis			
Mean	53.6	52.7	59.1
Median	56	55	64
Age at time of treatment, y			
Mean	58.5	58.5	68
Median	60	58.5	68
Male	24 (45%)	21 (48%)	3 (33%)
Female	29 (55%)	23 (52%)	6 (66%)
Patient Receiving Early SRS	22 (42%)	19 (43%)	3 (33%)
Number of Prior Treatment			
Median	2 (1-10)	1 (1-10)	4 (1-8)
Number of Prior Surgeries			
Median	1	1	2
1	31	27	4
2	9	9	9
3	5	4	1
4	6	2	4
≥5	1	1	0
Number of Prior Radiation Treatments			
Median	1	1	2
1	13	11	0
2	3	1	2
3	2	1	1
4	3	2	1

Table 2. Treatment Characteristics

	All Patients (N = 53)	Grade II (N = 44)	Grade III (N = 9)
Time from Diagnosis to Reported CK SRS, y			
Mean	6.6	6.1	9
Median	3.5	2.8	7.8
Total lesions treated	76	60	16
Lesions Treated Per Patient			
Median (range)	1 (1-5)	1 (1-4)	1 (1-5)
1	40	34	6
2	6	5	1
3	5	4	1
4	1	1	0
5	1	0	1
Lesions Treated Per SRS Session			
Median (range)	1 (1-3)	1 (1-3)	1 (1-3)
1	53	44	8
2	11	9	2
3	4	2	2
Treatment Planning			
Median Target Volume (cm3)	3.58 (0.13-35.3)	3.33 (0.33-26.0)	3.36 (0.13 -35.3)
Median Prescription Dose (Gy)	20 (12-40)	20 (15-35)	20 (12-40)
Median Maximum Dose (Gy)	25.1 (15.1-50)	25 (18.5-43.1)	26.9 (15.1 - 50)
Prescription Isodose Line (%)	80 (66-89)	80 (66-89)	80 (75-82)
Fractions			
Median (range)	1 (1-5)	1 (1-5)	3 (1-5)
1	43	41	2
2	12	9	3
3	20	13	7
4	1	1	0
5	7	5	4
Follow-up			
Local Failure	25 (47%)	17 (39%)	8 (89%)
Median Duration, m	16	20	14
Regional Failure	18 (34%)	14 (32%)	4 (44%)
Median Duration, m	20	19	20
Local Regional Failure	34 (64%)	26 (59%)	8 (88%)
Median Duration, m	17.5	18	14

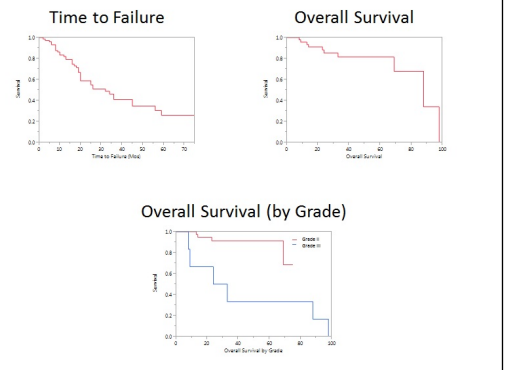

Table 4. Treatment Characteristics (All Lesions)

	Grade II (N = 60)	Grade III (N = 16)	P-value
Age at Diagnosis	53.4	57.3	0.3109
Age at Treatment	59.7	67.7	0.0164
Time to CK SRS	85.5	143.9	0.0322
Locoregional Failure	0.46	0.72	0.045
Time to Locoregional Failure	21.7	16.9	0.2901
Local Failure	0.25	0.444	0.1087
Time to Local Failure	23.8	18	0.5115
Regional Failure	0.265	0.222	0.7173
Time to Regional Failure	18.83	29	0.1143
Fractions	1.853	2.944	0.0013
Rx Dose	20.62	21.06	0.7134
Dmax	26.04	26.79	0.6167
Tumor Vol	5.01	5.92	0.6056
Tumor in RT Dose	5.06	3.45	0.321
NT in Tx Dose	2.71	1.7	0.3242
NT in Cov Iso	4.95	4.42	0.796
Rx Iso	78.59	79.41	0.4192

Conclusions

Stereotactic radiosurgery is a safe and effective treatment modality for local control of delayed progression following surgical resection of atypical meningiomas.

Learning Objectives

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

1) Describe the significance and treatment of atypical meningiomas
2) Describe the stereotactic radiosurgery (SRS) strategy for targeting atypical meningiomas
3) Understand the evidence behind SRS treatment of atypical meningiomas for optimal tumor control and progression free survival

References

1. Modha A, Gutin PH. Diagnosis and treatment of atypical and anaplastic meningiomas: a review. Neurosurgery. 2005;57(3):538-50; discussion -50.
2. Sun SQ, Hawasli AH, Huang J, Chicoine MR, Kim AH. An evidence-based treatment algorithm for the management of WHO Grade II and III meningiomas. Neurosurgical focus. 2015;38(3):E3.
3. Choi CY, Soltys SG, Gibbs IC, Harsh GR, Jackson PS, Lieberson RE, et al. Cyberknife stereotactic radiosurgery for treatment of atypical (WHO grade II) cranial meningiomas. Neurosurgery. 2010;67(5):1180-8.