



The Dosimetric Evaluation of Cesium 131 Brachytherapy Permanent Implants for Resected Brain Tumors

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INTRODUCTION

To reduce local recurrence after surgical resection of brain metastatic lesion, post-operative cavity radiotherapy has been commonly recommended. Although stereotactic radiosurgery to the surgical cavity is a popular approach, intracavitary brachytherapy has remained a valuable option with advantage of delivering conformal dose coverage and convenience for patient complete all treatment during surgery. We present our institutional experience with post implant using Cesium¹³¹ permanent brachytherapy for brain metastases, especially for recurrence after previous radiotherapy and large metastatic lesion with indication of surgical resection.

AIM

The Cesium-131 seeds are implanted intra-operatively into the tumor bed after surgical resection of brain tumors to reduce the recurrences. Post implant plans for cavity volumes and dosimetric parameters were evaluated.

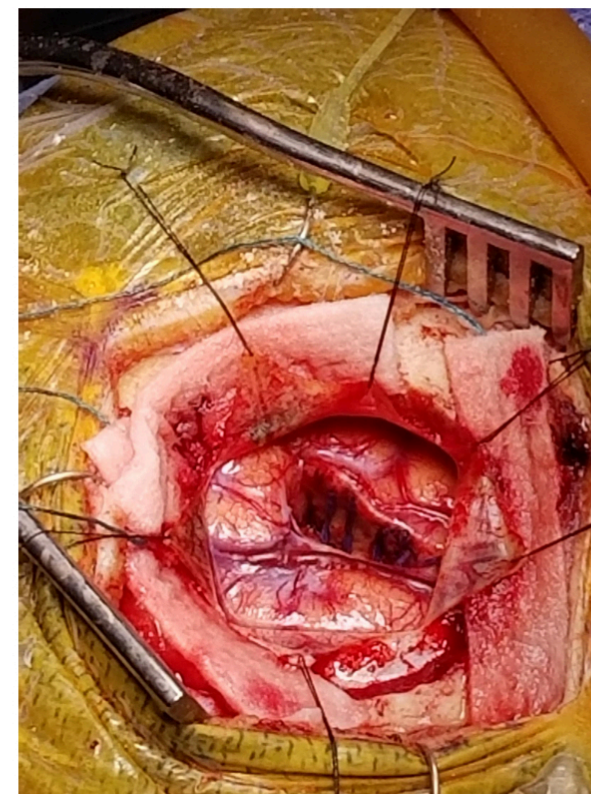
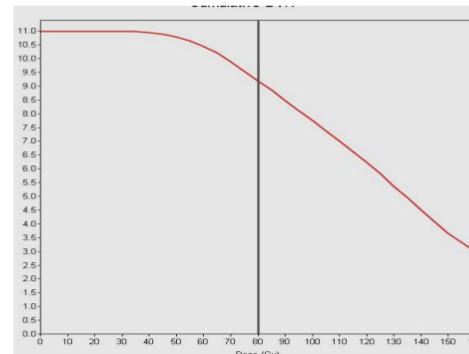
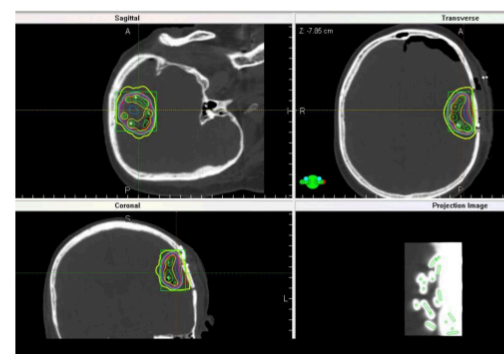
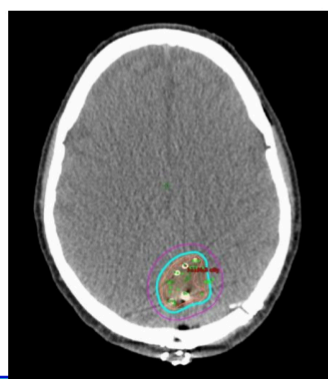
METHOD

Sixteen patients were treated with Cs-131 permanent implants, 8 patients previously had SRS treatment and 7 of them received no previous radiation. Total number of seeds were estimated based on Revard's nomogram for prescription dose of 80Gy by contouring the tumor volume on pre-op MRI in Eclipse. Cs-131 Seeds with air kerma strength of 2.4U/seed were implanted at the tumor-bed with desired seed interspacing of 7-10mm. CT and MRI were performed on the second or third day from the day of implant. CT and MRI data sets were imported in the Eclipse planning system and tumor cavities were contoured. CT along with the contours were transferred to the VariSeed for post implant planning. Pre-Op tumor volume(POTV), Post implant Cavity volume(PICV), and other dose coverage parameters were analyzed and compared.

RESULTS

The mean values of POTV, pre-op seed numbers and total air kerma strength(AKS) were 14.4cc (SD 9.5;range 1.6-33), 30.9 (SD 10.3;range 14-50) and 74.3U (SD 24.6;range 33.6-120) respectively. Mean values of PICV, number of seeds implanted and total air kerma strength were 12.1cc (SD7.4;range 1.9-30.4), 22.7 (SD 8.3, range 9-37) and 54.5U (SD 20; range 21.6-88.8) respectively. Nomogram estimated 33% more seeds than implanted. PICV volume were 15% smaller than POTV likely due to collapse of the surgical cavity. PICV mean of D90%, Dmax, Dmin, Dmean and V100% were 99.3Gy(SD 27.8;range 60-142), 904.7Gy (SD 170.4;range 647- 1257), 51.9Gy (SD 17.2; range 27-84), 206.2 (SD 42.6; range 141-277) and 92.9% (SD 7.8; range 77-100) respectively.

Metastasis Number	Pre-Op Target Volume (POTV) cc	Post-Implant Cavity Volume (PICV) cc	No. of Cs-131 Seeds Implanted	Total AKS (U) Implanted	D90 (Gy)	Dmax (Gy)	Dmin (Gy)	Dmean (Gy)	V100 (%)
1	3.5	7.1	14	33.6	73	882	35	171	86
2	1.6	5.1	14	33.6	75	1059	41	182	88
3	2	4.9	15	36	118	839	62	225	99
4	16	12.6	24	57.6	106	806	57	202	98
5	9	7.6	15	36	84	1257	42	201	92
6	12	11	18	43.2	70	647	33	145	83
7	17	19.8	37	88.8	117	1203	45	218	98
8	10	9.2	26	62.4	142	971	73	277	100
9	3	1.9	9	21.6	138	779	73	266	100
10	22	8.7	20	48	100	968	47	248	96
11	21	8.8	22	52.8	109	972	48	225	97
12	30	30.4	34	81.6	60	964	27	163	80
13	11	10.5	29	69.6	140	919	84	259	100
14	33	20.2	23	55.2	61	733	35	141	77
15	18	15.7	29	69.6	112	749	75	209	100
16	18	19.6	34	81.6	84	727	53	167	92
Mean	14.4	12.2	22.7	54.5	99.3	904.7	51.9	206.2	92.9



Dose (Gy)	%	Dose (Gy)	%	Dose (Gy)	%
0.00	0.00	10.00	100.00	0.00	0.00
0.00	0.25	10.00	100.00	0.00	0.00
10.00	12.50	10.00	100.00	0.00	0.00
10.00	10.75	10.00	100.00	0.00	0.00
20.00	25.00	10.00	100.00	0.00	0.00
25.00	31.25	10.00	100.00	0.00	0.00
30.00	37.50	10.00	100.00	0.00	0.00
35.00	43.75	10.00	100.00	0.00	0.00
40.00	50.00	10.00	100.00	0.00	0.00
45.00	56.25	10.00	100.00	0.00	0.00
50.00	62.50	10.00	100.00	0.00	0.00
55.00	68.75	10.00	100.00	0.00	0.00
60.00	75.00	10.00	100.00	0.00	0.00
65.00	81.25	10.00	100.00	0.00	0.00
70.00	87.50	10.00	100.00	0.00	0.00
75.00	93.75	10.00	100.00	0.00	0.00
80.00	100.00	10.00	100.00	0.00	0.00
85.00	106.25	10.00	100.00	0.00	0.00
90.00	112.50	10.00	100.00	0.00	0.00
95.00	118.75	10.00	100.00	0.00	0.00
100.00	125.00	10.00	100.00	0.00	0.00
105.00	131.25	10.00	100.00	0.00	0.00
110.00	137.50	10.00	100.00	0.00	0.00
115.00	143.75	10.00	100.00	0.00	0.00
120.00	150.00	10.00	100.00	0.00	0.00
125.00	156.25	10.00	100.00	0.00	0.00
130.00	162.50	10.00	100.00	0.00	0.00
135.00	168.75	10.00	100.00	0.00	0.00
140.00	175.00	10.00	100.00	0.00	0.00
145.00	181.25	10.00	100.00	0.00	0.00

CONCLUSIONS

Treating tumor bed with Cs-131 seeds is an effective and safe treatment for recurrent as well as new brain metastatic lesions with good clinical outcome. Our implant procedure found to be satisfactory based on our post implant dosimetric analysis.

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