



Cyberknife Partial Breast Irradiation For Early Stage Breast Cancer: A Pilot Study

Author(s):

Shaan Kataria, MD¹
Lloyd Campbell, BS²
Sean Collins, MD³
Sonali Rudra, MD⁴
Brian Collins, MD⁵

Background:

In carefully selected women with early-stage breast cancer, the preliminary outcomes following accelerated partial breast irradiation (APBI) are comparable to whole breast irradiation. Stereotactic body radiation therapy with fiducial tracking is an attractive APBI treatment option. Here, we report our institutional experience.

Methods:

Women with DCIS and early-stage breast cancer treated from 2008 to 2015 with a minimum follow up of 2 years were evaluated. Treatments were delivered utilizing the CyberKnife (CK) radiosurgical system. Four to six gold fiducials, tracked in real-time using the CK Synchrony tracking system, were implanted around the lumpectomy cavity prior to the start of treatment. A dose of 30 Gy in 5 fractions was delivered. Clinical examination and mammography were completed at 6-12 month follow up intervals. Fat necrosis was diagnosed on mammography.

Results:

Twenty women were treated with CK over a median 7 days. Three women had radiopaque BioZorb markers implanted at the time of surgery to aide in tumor bed delineation and tracking. The median treated volume was 63 cm³. At a median follow up of 40 months, locoregional control was 100%. Acute toxicity was rarely observed. A focal Grade 1 telangiectasia was identified in one woman at 52 months. Fat necrosis was diagnosed on mammography in 2 asymptomatic women at 28 and 59 months, respectively.

	#, n=20	Median (Range)
Age (years)		65 (47-85)
< 50 vs. ≥ 50	1 vs. 19	
Postmenopausal		
Yes	18	
No	2	
ECOG Performance Status		1 (0-2)
0	17	
1	1	
2	2	
Race		
Caucasian	11	
African American	7	
Asian	2	
Smoking History		
Never	11	
Current	3	
Former	6	
Histology		
DCIS	14	
ILC	1	
IDC	5	
Hormone Receptor Status		
Positive	16	
Negative	3	
N/A	1	
Max Tumor Diameter (cm)		1 (0.3-6)
T-Stage		
T0	14	
T1a	0	
T1b	4	
T1c	2	
Tumor Volume (cc)		13 (4-38)
Tumor Laterality		
Right	7	
Left	13	
Tumor Location		
UOQ	10	
UIQ	5	
LOQ	3	
LIQ	1	
Central	1	

	Median	Range
Days from Surgery to RT	74	41-166
# Fiducials Placed	4	4-6
PTV (cc)	62.5	15-142
PTV/Breast Ratio (%)	8.3	4.1-26
Max Dose (Gy)	36.3	34.6-40
Prescribed Isodose Line (%)	83	75-87
# Non-zero Beams	136	77-196
RT Days Elapsed	7	5-13
PTV 30Gy (%)	100	95-100
Ipsilateral Breast V30Gy (%)	11	3-26
Ipsilateral Breast V15Gy (%)	27	8-58
Contralateral Breast Dmax (Gy)	0.75	0.12-11
Ipsilateral Lung V9Gy (%)	1.8	0-17
Contralateral Lung V15Gy (%)	2.6	0-24
Mean Heart Dose (Gy)	1.2	0.17-2.8
Heart V1.5 (%) – Left	27	0-51
Heart V1.5 (%) – Right	7.4	0-71
Skin Dmax (Gy)	32	24-39
Chest Wall Dmax (Gy)	28	16-36

Conclusions:

CyberKnife is a suitable APBI technique for the treatment of select early-stage breast cancer patients. Implantable radiopaque Biozorb markers will be utilized in future patients. Longer follow up is required to assess oncologic outcomes and late toxicity.