

this is the rationale for the integration of biologic imaging in radiation treatment planning. However, no studies have so far quantified the tumor extension in MET-PET concerning the definition of targets in the stereotactic radiosurgery (SRS) of brain metastases. The purpose of this work is to investigate the recognition of a margin in the SRS of brain metastases by comparing these two imaging modalities using image fusion.

**Materials/Methods:** CT, gadolinium enhanced T1-weighted MRI and MET-PET were separately performed within 2 weeks in twenty patients (15 men and five women; age range 54–82 years; mean, 68 years) with a total of 97 brain metastases (41 lung, 32 breast, 10 bladder, 7 renal, 6 colorectal and 1 gastric carcinomas) for SRS treatment planning. The MET-PET and MRI studies were analyzed by two independent observers. These image sets (CT/MRI and CT/MET-PET) were then fused utilizing the Pinnacle System. The CT/MRI clinical target volume (CTV) (CTV-MRI) was defined as the contrast-enhanced area on CT/T1 gadolinium-MRI fusion images. CT/MET-PET CTV (CTV-MPET) was defined as the area of an accumulation of CT/MET-PET, which was apparently higher than that of normal tissue on CT/MET-PET fusion images. A threshold value for the tumor/normal tissue index of 1.7 was considered for the tumor in all lesions. In addition, CTV-MRI-1 mm, CTV-MRI-2 mm, CTV-MRI-3 mm and CTV-MRI-5 mm were defined as CTV-MRI plus 1 mm, 2 mm, 3 mm and 5 mm margins, respectively.

**Results:** CTV-MRI < 0.5 cc: The sensitivity of tumor detection of MET-PET was 43% (18/42). In 18 lesions, the mean CTV-MRI and CTV-MPET were 0.23 cc and 0.54 cc, respectively. In 18 (100%) of the lesions, the CTV-MPET was located within the CTV-MRI-1 mm. 0.5 cc < CTV-MRI < 2.5 cc: The sensitivity of tumor detection of MET-PET was 95% (18/19). The mean CTV-MRI and CTV-MPET were 1.01 cc and 1.80 cc, respectively. In 17 (95%) lesions, the volume of CTV-MPET extended beyond the CTV-MRI-1 mm was less than 1 cc. In 18 (100%) lesions, CTV-MPET was located within CTV-MRI-2 mm. 2.5 cc < CTV-MRI < 5.0 cc: The sensitivity of tumor detection of MET-PET was 100% (18/18). The mean CTV-MRI and CTV-MPET were 3.36 cc and 4.84 cc, respectively. In 17 (95%) lesions, the volume of CTV-MPET extended beyond the CTV-MRI-2 mm was less than 1 cc. 5 cc < CTV-MRI: The sensitivity of tumor detection of MET-PET was 100% (17/17). The mean CTV-MRI and CTV-MPET were 15.24 cc and 18.41 cc, respectively. In 14 (82%) lesions, the volume of CTV-MPET extended beyond the CTV-MRI-3 mm was less than 1 cc. In 100% of lesions, CTV-MPET was located within CTV-MRI-5 mm.

**Conclusions:** In brain metastases, the size of the residual 11C-methionine PET uptake differs considerably from the abnormalities found on MRI according to the lesion size. On defining the target volume definition in the SRS planning of brain metastases, this 11C-methionine PET study indicates that a margin of 0–1mm (CTV-MRI < 0.5 cc), 1 mm-2 mm (0.5 cc < CTV-MRI < 5.0 cc) and 3 mm-5 mm (5 cc < CTV-MRI) should therefore be added to MRI studies.

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## 184 Neurocognitive Impact of Whole Brain Radiation on Patients With Brain Metastases: Secondary Analysis of RTOG BR-0018

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**Purpose/Objective(s):** RTOG BR-0018 was a prospective feasibility study of neurocognitive evaluation in patients (pts) treated with whole brain radiation (WBRT) for brain metastases. The objective of this secondary analysis is to report the impact of WBRT on the neurocognitive and quality of life measures.

**Materials and Methods:** All pts received 37.5 Gy in 15 fractions for WBRT, and were required to undergo the following tests at baseline, end of WBRT, and 1 month (mo) follow-up (f-u): Mini-Mental State Exam (MMSE)—memory, attention, and cognition; Hopkins Verbal Learning Test (HVL)—memory; Verbal Fluency/Controlled Word Association Test (COWAT)—executive functioning, verbal learning, working memory, and vocabulary; Ruff 2 and 7—selective attention; and Trailmaking Test A and B (TMT-A, TMT-B)—focused attention and speed performance. Quality of life was measured with the Profile of Mood States Short Form (POMS) which assesses 6 distinct and transient moods.

**Results:** A total of 59 pts were accrued from November 2000 to August 2001; 55 analyzable pts comprise this report. Median f-u was 56 days. Only 7% of pts had intracranial progression by 1 mo. MMSE showed improvement or stability in 53% of pts by the end of WBRT and 63% by 1 mo f-u. While 3 out of 4 subtests of HVL declined at the end of WBRT, at 1 mo f-u 2 subtests returned to baseline levels while 2 subtests improved above the baseline. All 3 subtests of Ruff 2 and 7 declined by the end of WBRT; however, at 1 mo f-u 2 subtests improved above the baseline while 1 subtest continued to decline. Both TMT-A and TMT-B declined by end of WBRT; however, both tests showed significant improvements above the baseline by 1 mo f-u. COWAT declined by the end of WBRT; however, this returned to baseline by 1 mo f-u. The 6 moods in the POMS demonstrated an improvement or stability in 53–86% of pts by the end of WBRT, and 42–78% of pts by 1 mo f-u (table). In particular, tension was improved/remaining stable in 80% of pts by end of WBRT and 68% by 1 mo f-u, while confusion was improved/remaining stable in 84% and 78% of pts.

**Conclusions:** WBRT has often been cited as the principle cause of neurocognitive decline in pts with brain metastases. However, this study demonstrates that WBRT, even in a group with expected limited survival, results in improvements in neurocognitive and quality of life measures by 1 mo post-WBRT compared to pre-WBRT. These data corroborate recent studies that indicate that brain tumor progression, independent of systemic disease progression, may have the greatest impact in neurocognitive decline in cancer pts.

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## 185 Be Careful With Predamaged Brain: Differences in Memory Function Before and After Whole Brain Radiation Therapy in Patients With and Without Brain Metastases

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**Purpose/Objective(s):** To prospectively compare the impact of prophylactic and therapeutic whole brain radiation therapy (WBRT) on memory functioning in patients with and without brain metastases.