for patients determined to have calcification present were reviewed by an experienced cardiologist and then compared to treatment dose.

Results: A group of 8 patients who received treatment from 2003-2015 were reconstructed from initial planning information. Treatment areas included breast, lung, stomach, liver, and esophagus. The mean and maximum heart doses from reconstructed DVHs were within a ±10% margin of error of initial DVHs in all available cases (n = 3), all with a mean dose of <100 cGy for all patients. Heart volumes contoured on CT sim and CAC CTs were found to have a CI of >0.90, except for 1 patient whose heart was initially autocontoured (CI = 0.84). Left atrium, left ventricle, right atrium, and right ventricle mean CIs were 0.60, 0.78, 0.82, and 0.78, respectively. Among patients with a >5-year period between treatment and CAC CT scans, 66% had coronary calcium present, all within the high dose receiving region of the heart (all left anterior descending (LAD) artery).

Conclusion: Our deformable fusion method for evaluating coronary calcification could be performed accurately in patients with a small-to-moderate margin of error, except in a single patient for whom autocontouring was used. This method was successful in a range of dose patterns and thoracic and abdominal treatment sites. Cardiac CT deformable fusion may be employed in a larger patient population in the future to establish a quantitative correlation of coronary calcium and radiation dose for appropriate patient populations who receive significant radiation to the heart.

Author Disclosure: None.

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Image-Based Mathematical Modeling to Differentiate Radiation-Induced Necrosis From Tumor Recurrence Following Stereotactic Radiosurgery for Intracranial Metastasis

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Purpose/Objective(s): A group of 8 patients who received treatment from 2003-2015 were reconstructed from initial planning information. Treatment areas included breast, lung, stomach, liver, and esophagus. The mean and maximum heart doses from reconstructed DVHs were within a ±10% margin of error of initial DVHs in all available cases (n = 3), all with a mean dose of <100 cGy for all patients. Heart volumes contoured on CT sim and CAC CTs were found to have a CI of >0.90, except for 1 patient whose heart was initially autocontoured (CI = 0.84). Left atrium, left ventricle, right atrium, and right ventricle mean CIs were 0.60, 0.78, 0.82, and 0.78, respectively. Among patients with a >5-year period between treatment and CAC CT scans, 66% had coronary calcium present, all within the high dose receiving region of the heart (all left anterior descending (LAD) artery).

Conclusion: Our deformable fusion method for evaluating coronary calcification could be performed accurately in patients with a small-to-moderate margin of error, except in a single patient for whom autocontouring was used. This method was successful in a range of dose patterns and thoracic and abdominal treatment sites. Cardiac CT deformable fusion may be employed in a larger patient population in the future to establish a quantitative correlation of coronary calcium and radiation dose for appropriate patient populations who receive significant radiation to the heart.

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Melanoma Induces Endothelial Folate Hydrolase-1 (FOLH1) Expression and Facilitated Internalization of Immunotheragnostic Agent

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Purpose/Objective(s): Patients with metastatic (m) melanoma (MM) have a 12%-28%, 5-year survival. Additional targeted therapies are needed. Radioimmunotherapy (RIT) selectively delivers radiation to the tumor(s), sparing normal tissue; but, lack of a targetable biomarker limits implementation. Folate hydrolase-1 (FOLH1; prostate-specific membrane antigen), is a type II transmembrane receptor expressed by solid tumor neovessels, but not by normal endothelium. FOLH1 is validated in phase 1/2 trials as a theranostic cancer target using anti-human FOLH1, 1591. An ongoing trial is investigating the effects of a cumulative dose of 70 mCi of 111In-J591 (NCT00967577) on tumor perfusion and cellularity. In vivo tumor localization has been demonstrated with 111In-J591 SPECT of 6 patients with mMM. We aim to provide initial validation of FOLH1 expression on MM neovessels.

Materials/Methods: RNA was isolated from formalin-fixed, paraffin-embedded benign nevi (BN) (n = 20), primary (P) MM (n = 20), mMM (n = 20), and normal skin (NS) (n = 10) after deparaffinization. cDNA was synthesized by reverse-transcription; RTqPCR was performed with primers for FOLH1 and RPL27 (control gene). NS provided an internal control for normalization. Relative mRNA expression levels were indicated as 2-DDCt. Deparaffinized sections were rehydrated and stained with 3E6 (DAKO), mouse IgG1 monoclonal anti-human FOLH1. Mouse IgG1 (10 ug/ml in 1% BSA) and CD31 (IgG1) was used as an isotype matched negative and positive control, respectively. Human umbilical vein endothelial cells (HUVEC) were grown in the cultured media of 6 MM cell lines. FOLH1 expression and internalization was evaluated with 3591-based immunofluorescence.

Results: Analysis of BN (n = 20), pMM (n = 20), mMM (n = 20), and NS (n = 10) revealed a significant P = 0.0041. 10.64-fold mean increase of FOLH1 expression in pMM (2-DDCt range: 1.14 to 48.34) when compared to NS (2-DDCt range 0.0006 to 2.86), and a 4.90-fold mean increase of the FOLH1 in pMM when compared to BN (2-DDCt range: 0.002 to 13.72) (P = 0.0081). Similarly, a significant P = 0.042 18.21-fold mean increase was observed in mMM (2-DDCt range: 1.19 to 108.67) when compared to NS, and in mMM compared to BN (8.39-fold mean increase, P = 0.0284). None of 5 BN tested demonstrated FOLH1-staining of the vasculature. In
4/11 (36%) pMM cases, moderate to strong FOLH1 expression was identified within the lesions. FOLH1 expression correlated with dysplasia and depth of pMM invasion. 9/14 (64%) mMM cases stained positive for FOLH1. The conditioned medium from 4/6 MM cell lines induced in vitro FOLH1 expression in HUVEC, independently of BRAF mutation status; endothelial FOLH1 effectively internalized J591.

**Conclusion:** FOLH1 is significantly increased in pMM and mMM. By immunohistochemistry, FOLH1 is more abundantly expressed in mMM neovessels as compared to pMM. MM induces endothelial FOLH1 expression and facilitated J591 internalization. Our findings support testing the efficacy of J591-derived targeted therapy for MM.


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**Impact of Radiation Therapy Modalities as Part of Multimodal Treatment in Abdominal Desmoplastic Small Round Cell Tumor: A Retrospective Analysis of 107 Patients**

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**Purpose/Objective(s):** Multicentric retrospective study to identify the prognostic impact of adjuvant abdominal radiation therapy.

**Materials/Methods:** All patients treated for primary abdominal DSRCT in 8 French centers from 1993 to 2014 were included. Patients were retrospectively staged into 3 groups; group A treated with adjuvant radiation therapy (RT) after cytoreductive surgery, group B without RT after cyto-reductive surgery, and group C by exclusive chemotherapy. Peritoneal progression-free survival (PPFS), progression-free survival (PFS), and overall survival (OS) were evaluated. We also performed a direct comparison between groups A and B to evaluate RT after cytoreductive surgery. RT was also evaluated according to completeness of surgery: complete cytoreductive surgery (CCS) or incomplete cytoreductive surgery (ICS). We also compared results according to RT modalities: whole abdominopelvic RT (WAP-RT) or focalized RT (F-RT), WAP-RT dose or boost modalities.

**Results:** Thirty-seven (35.9%), 36 (34.9%), and 30 (28.0%) patients were included in groups A, B and C, respectively. Three-year OS was 62.1% (41.0-76.0), 37.6% (22.0-53.1), and 17.3% (6.3-32.8) for groups A, B and C, respectively. OS, PPFS, and PFS differed significantly between the 3 groups (P<0.001, P<0.001; and P<0.001, respectively). OS and PPFS were higher in group A (RT group) compared to group B (no RT group) (P=0.045 and P=0.006, respectively). Three-year PPFS was 23.8% (10.3-40.4) for group A and 12.51% (4.0-26.2) for group B. After CCS, RT improved PPFS (P=0.024) but differences in OS and PFS were not significant (P=0.40 and P=0.30, respectively). Median PFS for patients undergoing WAP-RT was 22.4 (14.4-42.3) months and 8.6 (8.6-29.1) months for patients undergoing F-RT (P=0.0376) after CCS (P=0.031). On the 26 patients treated by WAP-RT, PPFS differed significantly for patients treated by a dose ≥30 Gy (P=0.031). A trend of OS increase was observed (47.0 vs 28.0 months) but was not statistically significant (P=0.116). Boost radiation was not associated with better survival. After ICS, RT improved OS (P=0.044). A trend of PPFS and PFS increase was observed but the difference was not statistically significant (P=0.073 and P=0.076). Analysis according to RT modalities for patients with ICS was not performed because of the very limited number of patients.

**Conclusion:** In this large series for DSRCT, adjuvant RT as part of multimodal treatment seems to confer oncological benefits for patients treated for abdominal DSRCT after cytoreductive surgery and perioperative chemotherapy.


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**Outcomes in Patients With Recurrent Desmoid Tumor Managed With Surgery Alone, Combined Surgery and Radiation Therapy, or Radiation Therapy Alone**

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**Purpose/Objective(s):** Desmoid tumor is a benign tumor that can be locally aggressive and is managed with a variety of treatments including surgery, radiation therapy (RT), and systemic agents in the recurrent setting. The purpose of this study was to determine the disease-free survival (DFS) in patients with recurrent desmoid tumor treated with one of these modalities.

**Materials/Methods:** The medical records of 43 patients with recurrent desmoid tumor treated at our institution from 1980 through 2012 were reviewed to collect patient, tumor, and treatment-related characteristics. Kaplan-Meier method was used to analyze survival outcomes.

**Results:** The median age of the patient at first recurrence was 36.4 years (range, 9-79). There were 17 (39.5%) male patients. Breakdown of tumor location was 25 (58.1%) in the extremity, 5 (11.6%) in the spine/sacrum/ bony pelvis, 4 (9.3%) in the trunk, and 2 (4.7%) in the head and neck, with 1 (2.3%) in the thorax and 1 (2.3%) in the retroperitoneum. The median size of tumor at time of initial surgery was 8 cm (range, 3.1 – 21) and 12 (28%) of patients had close or positive margins. Margin status was not available for 17 (39.5%) patients. Median time to recurrence was 14 months (range, 1.9-96.1). Median follow-up was 9 years (range, 1.3-35). At the time of first recurrence, 17 (39.5%) patients were treated with surgery alone, 18 (41.9%) patients were treated with surgery and RT, and 5 (11.6%) patients were treated with RT alone. Other patients were treated with observation, systemic therapy alone, or a combination of surgery and/or RT with systemic therapy. One patient in the RT alone group was also treated with systemic therapy. Three (7%) of patients were treated with systemic therapy. Of those patients treated with RT, the median dose was 55.5 Gy (range, 48.4-64.6). Eleven (25.6%) were treated with conventional RT, 5 (11.6%) patients were treated with protons, 2 (4.7%) were treated with IMRT, and 1 (2.3%) was treated with IORT. RT modality was not specified for 3 (7.0%) patients. Five-year DFS was 34.3% (95% CI: 13.5-55.5) and 63.5% (95% CI: 35.3-82) for patients treated with surgery alone or a combination of surgery and RT, respectively. In addition, there were no recurrences in the 5 patients treated with RT alone (P=0.009).

**Conclusion:** DFS is best in patients treated with RT alone or a combination of surgery and RT at the time of first recurrence. Inclusion of RT as treatment modality may be considered for patients with recurrent desmoid tumor when technically feasible and the risk of morbidity is small.