$P = 0.29$). No significant difference in either initial ($P = 0.30$) or durable pain scores of < 3 ($P = 0.31$) or < 4 ($P = 0.56$) was found between SF-SRS vs. MF-SRS.

**Conclusion:** Patients with spinal metastases treated with SRS had encouraging palliative responses. Greater than 80% of patients had an initial pain response and close to 50% an initial CR with durable pain response achieved for roughly 60% of patients. Performance status, age, and primary histology (lung and or/breast) are prognostic factors to consider when determining suitability for SRS in the absence of pain.

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## 2996

### Adrenal Stereotactic Body Radiation Therapy: The Effects of a Full and Empty Stomach on Radiation Dose to Organs at Risk

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**Purpose/Objective(s):** Evidence of the effectiveness of Stereotactic Body Radiation Therapy (SBRT) has recently been published [1-11]. It has also been reported that curative treatment for oligometastasis. There is also a form of adrenal recurrence after radical resection of the primary lesion. However, the adrenal glands are surrounded by radiation-sensitive organs, such as the pancreas, kidneys, small intestine, biliary system, and stomach. Treatment planning therefore requires many regulations due to the dose limit to the organ at risk. Radiotherapy can be adjusted for gastric capacity. We therefore performed an OAR analysis for SBRT to the left adrenal gland based on gastric state (empty or full stomach) at the time of irradiation. We examined whether it was possible to reduce the dose to OAR.

**Materials/Methods:** A sample of 20 randomly selected stomachs were arranged in descending order from the largest to the smallest size and divided into two groups of 10. The "empty group" is defined as the smaller stomach group (n = 10), while the "full group" is the larger stomach group (n = 10). Clinical target volume (CTV) adds a 3 mm margin to the GTV. Planning target volume (PTV) is in the same range as CTV. The prescribed PTV dose was 54 Gy / 6 fx and D 95 coverage of PTV(CTV) (the dose to 95% of the PTV volume). The capacity of the stomach was measured for its effects on OAR. We compare the difference between two groups as stomach volume.

**Results:** The gastric OAR dose in the empty group was significantly lower than in the full group (D5 and D10). However, the OAR dose to the left kidney in the empty group was statistically significantly higher than in the full group (V12, V15, and V21).

**Conclusion:** When SBRT was performed on the left adrenal gland, it was found that the smaller the stomach size, the lower the dose to the stomach. The stomach is an abdominal organ that can be artificially resized. Therefore, it is better to perform SBRT on patients with an empty stomach.

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## 2997

### Clinical Outcomes of Stereotactic Body Radiation Therapy for Bone and Non-Spine Bone Metastases: A Large Single Institution Experience

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**Purpose/Objective(s):** Improved oncologic therapies have expanded the role of stereotactic body radiation therapy (SBRT) for bone metastases; however, the impact of SBRT on local control (LC), progression-free survival (PFS), overall survival (OS) and long-term risks remains poorly understood. We characterized predictive factors associated with clinical outcomes through a large single institution experience.

**Materials/Methods:** We retrospectively reviewed all patients with bone metastases treated with SBRT at our institution and characterized patient, tumor, and treatment factors and subsequent outcomes. Common treatment indications included synchronous (S) or metachronous (M) oligometastatic cancer, re-irradiation, or radioresistant histology. Common fractionations included 30-35Gy/5F, 9-10Gy/3F, 16-20Gy/1F. Outcomes were assessed on a per patient and per lesion basis using Cox regression to evaluate predictive factors for LC, PFS, and OS. Toxicities were graded by CTCAEv5.

**Results:** From 2009 to 2020, 434 patients (median age 64, range 19-93, 65% male, 88% Caucasian, ECOG PS 0-1 88%) were treated with SBRT primarily for oligometastatic cancer (82% M, 5% S; 96% with 1-3 lesions) of various origin (39% prostate, 21% breast/lung). 651 lesions (66% spine, 31% non-spine bone, 3% spine/paraspinal) were treated. 96% of lesions had ≥95% PTV covered by 90% of prescription dose (V90) (median 100, range 42-100). Median PTV volume was 41.3cc, and 87% of lesions were < 150cc. 46% lesions were prescribed a biologically equivalent dose (BED) ≥50 ($\alpha/\beta = 10$). LC was significantly worse if PTV V90 < 95% (HR 2.06, CI 1.18-3.62, $P < 0.05$) and improved if prescribed BED≥50 (HR 0.59, CI 0.42-0.83, $P < 0.01$) on multivariate analysis (MVA). Larger lesions ≥150cc predicted worse LC on univariate analysis (UVA) only (HR 1.80, CI 1.22-2.64, $P < 0.005$). Improved PFS and OS were associated with better performance status ($P < 0.0001$) and prostate histology ($P < 0.01$) on MVA. Metachronous presentation with met-free interval ≥1 year had improved PFS and OS on UVA only ($P < 0.001$). Common acute toxicities were pain flare (9% vs 12%) and grade 1-2 fatigue (14% vs 19%), among oligometastatic vs re-irradiation lesions, respectively. Late toxicities included treatment-related fracture (1.2%) for oligometastatic lesions and radiation-related myelopathy (2.3%) and nerve pain (1.2%) for re-irradiation/other lesions.

**Conclusion:** SBRT may be an effective means of improving LC among patients with oligometastatic bone disease if adequate target coverage and a BED≥50 can be achieved, independent of fraction number, and with minimal risk of acute or late toxicity. Prostate histology and performance status were patient factors predictive of PFS and OS. Our experience highlights important factors that can help guide appropriate patient selection and use of SBRT in this unique population.

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## 2998

### Dosimetric and Clinical Evaluation of Stereotactic MR-Guided Online Adaptive Radiation Therapy (SMART) for Treatment of Adrenal Metastases

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**Purpose/Objective(s):** Stereotactic MR-guided Adaptive Radiotherapy (SMART) is an appealing treatment option for irradiation of intra-abdominal tumors. Daily adaptation with SMART has the advantage of dose escalation while protecting organs at risk (OARs). We aimed to document dosimetric parameters during SMART and analyze local control for adrenal metastases.

**Materials/Methods:** Fifteen patients treated between September 2018 and October 2020 for adrenal metastases were included in the study. The institutional constraints were used to evaluate the doses to OARs and target volumes. For each fraction, an adaptive plan was generated following registration and delineation of the daily disposition. A comparison was done between predicted plans (original plan on the daily anatomy) and adapted plans (new plan after re-optimization accounting the new contours) in terms of target volumes coverage and OARs doses. Patients were treated every other day.

**Results:** The median age was 63 years (range 36-74 years) and 73.3% of patients were male. The median delivered total dose was 50 Gy (range 35-50 Gy); with a median fraction number of 5 (range 3-5 fractions) and the median fraction dose was 10 Gy (range 7-15 Gy), corresponding to a median BED10 of 100 Gy (range 60-113 Gy). Nine patients presented with a left-sided lesion, five with right-sided and one patient with both left and right-sided lesions. All of the initial plans met target and OARs constraints. Among 70 fractions 56 fractions (80%) were re-optimized. The dosimetric findings for PTV and OARs on predicted and re-optimized fractions were compared. PTV V100 (90.9% vs 94.3%) and PTV D98 (40.8 Gy vs 44.5 Gy) were better with re-optimization and the differences were statistically significant ($P < 0.05$). The OARs doses for 0.5 cc, 1 cc, 5 cc and 10 cc were compared. The right and left sided lesions were analyzed separately. For the left sided metastases there was OARs dose violation for stomach in one patient and for bowel in one patient. For the right sided metastases there was OARs dose violation for duodenum in two patients and for bowel in two patients. After re-optimization all dosimetric parameters met the institutional constraints. Local control rate was 93.8% with a median follow up time of 11.7 months (range 4.5-26.4 months). One patient with progressive disease underwent adrenalectomy. All treatments were well tolerated. The most common radiation induced acute toxicities were grade 1-2 fatigue and nausea. There were no grade 3 or higher acute or late toxicities experienced during the treatment and follow-up course.

**Conclusion:** The use of re-optimization with SMART improved the PTV coverage and OARs doses for treatment of adrenal metastases. SMART has some advantages when compared to other radiotherapy techniques due to its better visualization of soft tissue, real-time tumor tracking without fiducial markers and potentially reduced toxicity to OARs. These results need to be confirmed with more patients and longer follow-up.

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## 2999

### Comparison of SBRT for Oligometastatic Colorectal Cancer by Site: Lung vs. Liver

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**Purpose/Objective(s):** We seek to report patient outcomes following Stereotactic Body Radiotherapy (SBRT) to the lung and liver for oligometastatic colorectal cancer (oCRC), and identify differences by tumor site and KRAS status.

**Materials/Methods:** An IRB-approved prospective registry of 2138 lung SBRT patients and 294 liver SBRT patients was surveyed for patients with oCRC (defined as $\leq 5$ lesions) involving the lung or liver treated with SBRT from 2005 to 2020. Patient, tumor, and treatment factors were analyzed. Actuarial rates for local control (LC), first local, regional or distant failure (TTFF), and overall survival (OS) were evaluated. Univariate analysis of outcome by KRAS status was conducted.

**Results:** 86 patients met study criteria, with 61 having lung, 24 patients having liver, and 1 patient having lung and liver SBRT. Median follow up was 24.8 months. Median age was 65.9 years (range 36.4 − 89.7), 63.9 for lung and 72.5 for liver ($P = 0.022$). 56.3% of patients were male, 48.4% for lung and 76% for liver ($P = 0.018$). Median KPS was 90 (range 70 − 100). 21.0% of lung patients had prior metastasis-directed therapy (MDT) (wedge resection, lobectomy). 60.0% of liver patients had prior MDT (surgery, bland embolization, RFA, Y-90). Mean liver lesion size (2.92 cm) was larger than mean lung lesion size (1.69 cm) ($P < 0.0001$). SBRT dose was 30 − 60 Gy in 1 − 8 Fx, with median dose of 50 Gy in 5 Fx for both lung and liver. 36% of patients were treated to 2+ synchronous lesions. 14% of patients had further SBRT to metachronous lesions. KRAS status was known for 71.3% of patients, 67.8% for lung, 80% for liver. Of those, KRAS mutation was present in 48.4% of patients, 47.6% for lung and 50% for liver. LC at 1 and 2 years was 87.9% (95% CI: 80.4 − 95.3) and 78.0% (95% CI: 68.1 − 88.0), respectively. OS at 1 and 2 years was 88.3% (95% CI: 81.5 − 95.1) and 74.1% (95% CI: 64.6 − 83.7), respectively. Median OS for all patients was 51.5 months, 59.0 months for lung and 19.5 months for liver ($P < 0.0001$). There was a statistically significant difference on log rank test between the lung and liver cohorts in both local control ($P = 0.008$) and overall survival ($P < 0.0001$), see table. Median TTFF was 12.4 months for all patients, 14.3 months for lung and 5.1 months for liver patients ($P = .690$). There were no differences in LC or OS by KRAS status across all patients ($P = .124$ and $P = .923$ respectively), or for lung SBRT ($P = .811$ and $P = .455$ respectively), or liver SBRT ($P = .167$ and $P = .247$, respectively).

**Conclusion:** Local control and overall survival with SBRT for oCRC were inferior in the liver compared to lung, likely due to larger lesion size, more extensive prior therapy, and more advanced age in the liver cohort. There were no differences in outcomes by KRAS status.

**Abstract 2999 − Table 1**

| | All Patients (N = 87) | Lung SBRT (N = 63) | Liver SBRT (N = 26) |
|---|---|---|---|
| 1-yr LC | 87.9% | 94.3% | 70.2% |
| 2-yr LC | 78.0% | 85.5% | 57.4% |
| 1-yr OS | 88.3% | 93.5% | 74.8% |
| 2-yr OS | 74.1% | 86.5% | 40.6% |

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## 3000

### Stereotactic Body Radiation Therapy for the First-Line Comprehensive Treatment of Oligometastatic Nasopharyngeal Carcinoma: A Prospective, Single-Arm, Phase II Trial

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**Purpose/Objective(s):** The current treatment strategy for patients with metastatic nasopharyngeal carcinoma (NPC) is mainly based on palliative chemotherapy, with low complete remission rate and poor progression-free survival (PFS). Radiation therapy has proven efficacy in the treatment of patients with nonmetastatic NPC, with emerging indication in the setting of limited metastatic disease. We proposed a single-arm phase II study