Results: Key improvements included two of nine initial process steps being eliminated, decreased time between planning and treatment (average nine days down to six days), implementing visual management and accountability for wait times at each step/role/individual, remote plan approvals by ROs, daily and weekly huddles in dosimetry, and weekly posting of results. In the seventh month, the 90% RTT-to-RTx interval was 2.6 weeks. Managing change required and benefited from engagement of multiple stakeholders including patients, radiation therapists, treatment planners, booking clerks, radiation oncologists (ROs), medical physicists, management, and data analysts. The process improvement was sustained. Active reinforcement of ownership, measurement and continuous improvement are ongoing as are wait time improvement projects among the lung and GU patient groups.

Conclusions: Formal process improvement using LEAN and Six Sigma principles resulted in a significant and sustained improvement in RTT-to-RTx timeliness and a cultural change in accountability, the use of visual monitoring, and staff engagement to sustain the process improvement.

191 MARGIN DETERMINATION FOR HYPOFRACTIONATED PARTIAL BREAST IRRADIATION
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Purpose: To determine the Planning Target Volume (PTV) margin for Hypofractionated Partial Breast Irradiation (HPBI), a novel technique intended to provide local control in breast cancer patients not eligible for surgical resection using 40 Gy in 5 fractions prescribed to the gross disease.

Methods and Materials: The van Herk formalism, a widely accepted PTV margin recipe, is \( M = 2.5 \sigma_{\text{sys}} + 0.7 \sigma_{\text{rand}} \), with \( \sigma \) and a standard deviations (SDs) representing systematic and random uncertainties, respectively, which were quantified through retrospective analysis of cone-beam computed tomography (CBCT) data sets for ten patients. During simulation and treatment, patients were immobilized using a wing board and an evacuated bag. CBCT was acquired prior to treatment delivery (prefraction) for setup verification. The prefraction CBCT was rigidly registered to planning four-dimensional computed tomography (4DCT) using the chest wall and tumour and translational couch shifts were applied as needed. CBCT was also acquired following treatment delivery (post-fraction) for intrafractional verification. This clinical workflow was faithfully reproduced in Pinnacle (Phillips Medical Systems) to yield residual setup and intrafractional error through translational shifts and rigid registrations (ribs and sternum) of prefractio CBCT to 4DCT and post-fraction CBCT to pre-fraction CBCT, respectively. All ten patients included in this investigation were medically inoperable; the median age was 84 (range, 52-100) years; one patient was male and nine patients were female.

Results: The image quality of the CBCT was sufficient for required registrations. Systematic (and random) setup uncertainties corrected for the left-right, craniocaudal and anteroposterior directions were 2.1 (2.5) mm, 1.6 (3.6) mm and 1.7 (2.8) mm. Net systematic (and random) uncertainty was determined to be 2.2 (3.2) mm. Rotations > 2° in any axis occurred on 11/72 (15.3%) registrations.

Conclusions: Preliminary results suggest a non-uniform setup margin of 7.1 mm, 6.6 mm and 6.3 mm for the left-right, craniocaudal and anteroposterior directions is required. This investigation is ongoing, though published results from similar studies are consistent with the above findings. Determination of margins in breast radiotherapy is a paradigm shift, but a necessary step in moving towards hypofractionated regimens, which may ultimately redefine the standard of care for this select patient population.

192 EMPOWERING PATIENTS THROUGH EDUCATION - DEVELOPMENT AND EVALUATION OF A MULTIMEDIA PATIENT EDUCATION TOOL TO ENSURE PATIENT PREPAREDNESS FOR PLANNING CT SCAN FOR PROSTATE CANCER (RANDOMIZED STUDY)
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Purpose: A review of patient preparedness for prostate radiotherapy (RT) showed that thirteen out of 55 patients were prepared and 42/55 (76%) needed to be re-scanned due to inadequate bladder or rectum filling. To decrease additional scans, associated costs and patient satisfaction, a video outlining proper preparation for prostate RT was created. The purpose of this study was to determine the effectiveness of a video versus an educational handout to improve CT planning preparation for prostate RT.

Methods and Materials: A video outlining the importance of rectal and bladder preparation was created and revised based on clinical feedback from an interprofessional team consisting of patients, radiation oncologists, nurses and radiation therapists. Patients were accrued by the research assistant (RA) in new patient clinics or over the phone and were randomly assigned to either the control group (received handout) or the experimental group (watched video and received handout). At the CT planning appointment, planning therapists collected bladder and rectal volume based on departmental guidelines. The rectal volume was measured at the maximum point within the prostate volume. These measurements were used to determine if patients were prepared or needed to be rescanned. At the CT simulation appointment, the RA collected this data as well as patient satisfaction with the preparation materials (handout or video). A Likert scale was used to determine patient satisfaction outcomes.

Results: Fifty-eight out of 65 patients completed the study, with 29 patients in each arm. The mean age in the control group was 71 and 68 in the experimental group. In the control group, 23/29 were prepared for planning CT scan and 6/29 needed to be rescanned due to full rectum (5/28), empty bladder (0/28) or both (2/28), with one person needing to be rescanned twice. In the experimental group, 22/29 were prepared and 7/29 needed to be rescanned due to full rectum (4/28) or empty bladder (5/28), with two people needing to be rescanned twice. There was no statistical difference between groups in re-scanning rate. Most patients were planned within 11 days after consenting to the study. Patients in the experimental group watched the video 1.4 times on average and expressed feeling more prepared for their appointment than the control group. Patients indicated that they liked the length of the video and would recommend the video to other patients with prostate cancer.

Conclusions: The CT re-simulation rate was 55% lower in the control group and 52% lower in the experimental group compared to the initial review. Despite no statistical difference in re-simulation rates between the groups, patient satisfaction in the experimental group was higher.

193 PRE-OPERATIVE VERSUS POST-OPERATIVE RADIOSURGERY FOR BRAIN METASTASIS: VOLUMETRIC AND DOSIMETRIC COMPARISON
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Purpose: Cavity radiosurgery has largely supplanted whole-brain radiotherapy for patients, with solitary brain metastasis, who require surgical excision. However, coverage of the operative tract, in addition to tumour bed, may lead to large treatment volumes and inter-observer variability. We hypothesized that pre-operative radiosurgery may reduce target volume size and...
inter-observer variability compared to post-operative radiosurgery. **Methods and Materials:*** We identified 10 consecutive patients, with solitary brain metastasis, treated with post-operative cavity radiosurgery. Pre- and post-operative axial T1 contrast MRI were co-registered with the planning CT scans. Three radiation oncologists independently contoured the target volumes on the pre- and post-operative imaging and CyberKnife treatment plans were generated. The following parameters were evaluated in the two plans: Mean target volume (cc), 50% isodose volume(%)c, Inter-observer variability (Jaccard Index JI) and Conformity Index (CI). Results were analyzed with STATA version 14. **Results:** Radiosurgery doses ranged from 18 Gy in 1 to 30 Gy in 5 fractions depending on the location and volume (Median 24 Gy in 3 fractions). There was no significant difference in the mean target volume, nor 50% isodose volume, between pre- and post-operative strategies. (17.6 ± 12.3 versus 19.4±15 cc, p = 0.80; 61.7 ± 37.7 versus 77.7 ± 69.0 cc, p = 0.65). There was significantly less inter-observer variability and improved conformity in the pre-operative group (Mean JI 0.84±0.04 versus 0.70±0.13, p = 0.005; Mean CI 1.32 ± 0.09 versus 1.45 ± 0.14, p = 0.01). Planned subgroup analysis did not reveal any significant difference (between pre- versus post-op) in the mean volume of cystic versus non-cystic metastasis. Deep lesions (> 2.5 cm from dura) had a larger post-operative target volume (25.8±17.3 versus 12.3±9.3 cc, p = 0.06) compared to superficial lesions. **Conclusions:** Pre-operative radiosurgery has less inter-observer variability and improved plan conformity. However, there was no difference in mean target volume between the pre- versus post-operative radiation. Counting guidelines, and peer review, may help to reduce inter-observer variability for cavity radiosurgery.

194 POPULATION-BASED ANALYSIS OF STEREOTACTIC BODY RADIOTHERAPY (SBRT) FOR OLGOMETASTATIC LYMPH NODE METASTASES
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**Purpose:** In the setting of limited metastatic burden of disease, stereotactic body radiotherapy (SBRT) has been shown to achieve high local control rates. It has been hypothesized that SBRT may translate to better quality of life by delaying the need for systemic chemotherapy and possibly increased survival. There is limited published literature on the clinical outcomes of SBRT in limited nodal metastases. The primary objective is to report the clinical outcome of SBRT in a series of patients with either solitary or oligometastases from various tumours to lymph nodes.

**Methods and Materials:** A retrospective study of patients treated on a provincial protocol with SBRT to metastatic lymph nodes (March 2010 and June 2015) was conducted. Primary endpoint was local control (LC) and chemotherapy free survival following SBRT. Secondary endpoints included toxicities, progression-free survival (PFS), and overall survival (OS).

**Results:** Eighteen patients underwent SBRT to a metastatic lymph node with a mean age of 61.8 years (range: 20-84 years) and a median follow up of 22 months. There were four (22%) liver, seven (39%) colorectal, four (22%) pancreatic, one (6%) esophageal, one (6%) gallbladder and one (6%) lung primary. Eleven (61%) patients had lymph node metastases as part of their initial presentation of metastatic disease. Seven patients (39%) had systemic therapy prior to SBRT, with the majority of patients (71%) receiving two lines of chemotherapy. Eight patients had solitary metastatic disease at the time of SBRT, with all patients having four or fewer total sites of metastases. Average size of the lymph node metastases was 2.3 cm (range: 0.8-6.2 cm). RT doses were 31 to 60 Gy in four to ten fractions, with 44% of patients receiving 35 Gy in 5 fractions. At one year, LC was 93% and chemotherapy-free survival from the time of SBRT was 58%. PFS at one and two years were 42% and 18% respectively. One and two year OS were 92% and 84%. There were no Grade 3 or higher toxicities reported. On univariate analysis, absence of prior chemotherapy and non-colorectal primary approached significance for improved local control (both p = 0.052) while solitary metastases was associated with improved PFS (p = 0.029) and tended to improved chemotherapy-free survival (p = 0.066).

**Conclusions:** In this single institution study, SBRT to oligometastatic lymph nodes provides high local control and a moderate chemotherapy-free interval with acceptable toxicities. Progression of disease remains prominent in these patients. Larger cohort studies are required to better identify a subset of patients with oligometastatic nodal disease who benefit the most from SBRT.

195 CARO ELEKTA
LONG-TERM QUALITY OF LIFE OF RETROPERITONEAL SARCOMA PATIENTS TREATED WITH PRE-OPERATIVE RADIOTHERAPY AND SURGERY
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**Purpose:** The management of retroperitoneal sarcomas (RPS) may include pre-operative radiotherapy (RT) and surgery. As RPS often require multi-visceral resection, combined treatment with pre-op RT is possible. However, treatment with pre-op RT can be associated with substantial toxicity as radiation sensitive organs may be affected by pre-op RT. We aimed to examine how these treatments related toxicities affect patient quality of life (QOL).

**Methods and Materials:** In a cross-sectional study, 25 primary RPS patients treated with pre-operative IMRT from 2004-2012 were recruited and assessed for QOL (EORTC QLQ-C30) and to determine RT and surgery related toxicities (CTCAE V.4). Baseline and prospective QOL was available for 11 patients. In the other 14 patients cross-sectional data alone were obtained at different time points during their follow up (four weeks, six months, one year, three years, five years and 10 years post-IMRT). Unless stated otherwise, all scores refer to the global domain.

**Results:** Ten female and 15 male patients with a median age of 56 (38-80) were treated with IMRT to a median dose of 50.4 Gy (41.4-50.4). The median maximum dimension was 13.4 cm (5.7-28) and the majority (17/25) were liposarcomas. The median time from completion of RT to RPS surgery was 9.4 weeks (5-17.4). Of the 11 patients who completed baseline QOL assessments, their compliance at four weeks, six months, one year and three years post-RT were 80%, 100%, 90%, and 100%. Mean pre-RT QOL was 48.5 (standard deviation (SD) 19.3). At four weeks post-RT, mean QOL was 57.5 (SD: 23.7) however, the mean diarrhea symptom scale increased from baseline (85 versus 18.1, p < 0.001). Correspondingly, 54% of patients had gastrointestinal toxicities (32% G1, 56% G2 and 8% G3) by the end of RT. Regression slope analysis suggested that QOL significantly (p = 0.002) improved over the first three years. The number of toxicities was significantly (p = 0.002) associated with QOL over time. Clinically important improvement (> 10 points) from baseline was observed at one year (68.6, SD: 18.4). At three years post-RT, 88% of patients had chronic RT and/or surgery related toxicities of which 30% were Grade 3 toxicities. RPS patients who survived at least three years had significantly better QOL (mean: 67.2, p = 0.007 Mann-Whitney Test) relative to the full group at diagnosis. QOL changed little (mean: 0.31 point/month; SD: 0.36) after three years (n = 10). RT dose, tumour size, patient age and gender were not associated with three year QOL scores.

**Conclusions:** Treatment toxicities seem to contribute to QOL recovery during the first three years. The number of toxicities a patient had was significantly associated with QOL. Despite patients having on average 2.5 treatment-related chronic toxicities, QOL at three years was better than at diagnosis.