analysis. Patients were categorized into three groups based on their cavity visibility on CT: C1 (indistinct or no visible cavity); C2 (moderately visible cavity with indistinct borders); and C3 (highly visible cavity). Three observers manually registered the CBCTs for each patient utilizing two methods and materials: matching the ipsilateral breast/chest wall and lung interface as the target surrogate, and direct registration to the cavity. Krippendorff’s alpha was used to assess agreement between the two methods. Root mean square (RMS) was calculated to assess the difference between observers.

Results: Thirty breast boost patients, 10 in each cavity visualization category, were included for analysis. A total of 150 CBCT images were analyzed by each observer. Registration to the ipsilateral breast/chest wall reported a median RMS error of 0.1989 between observers. The Krippendorff’s alpha for direct cavity registration in C1, C2 and C3 patients in the left-right (LR), cranio-caudal (CC), and anterior-posterior (AP) directions were: 0.72, 0.86, 0.78; 0.67, 0.86, 0.55; and 0.81, 0.72, 0.55; and 0.78, 0.6, 0.52, respectively. The Krippendorff’s alpha for direct cavity registration in C1, C2 and C3 patients in the LR, CC, and AP directions were: 0.72, 0.64, 0.78; 0.62, 0.86, 0.72; and 0.78, 0.72, 0.75, respectively. The ranksum difference between registration methods was p = 0.1538, with variation reported between cavity visualization categories (C1, p = 0.8903, C2, p = 0.0257, C3, p = 0.9450).

Conclusions: Image registration to the ipsilateral breast/chest wall and lung interface for breast boost RT was more consistent than direct registration to the cavity, resulting in lower inter-observer variability for breast boost CBRT. Varying visibility of the post-operative tumour bed on CBCT images limits direct registration to the breast cavity.

188 VOLUMETRIC WHOLE BRAIN IRRADIATION EVALUATION
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Purpose: Whole brain radiotherapy (WBRT) has been effectively used for palliative treatment of brain metastases, and for prophylactic treatment in cancers shown to commonly metastasize to the brain. A retrospective investigation was completed to compare the traditional whole brain osseous-based field placement technique to a volumetric based technique with respect to clinical target volume (CTV) coverage, planning target volume (PTV) coverage, and the optical lens Dmax.

Methods and Materials: This study included 47 patients treated with field-based WBRT in an aqua plastic mask at the Simcoe Muskoka Regional Cancer Program between July 2012 and July 2013. On the 3D CT image, the CTV (brain) was contoured with a 5 mm penumbra margin and 5 mm shielding around the optic lens. The plan was then normalized using V95% ≥ 99% to PTV with a Dmax point dose ≤ 115%. This contour-based plan was then compared to the original field-based plan. Descriptive statistics was used for analysis.

Results: The mean values for the field based plans and the contour based plans are as follows. CTV V95%: 95.35%, SD = 0.47% compared to 99.96%, SD = 0.08%; PTV V95%: 98.62%, SD = 0.82% compared to 99.73%, SD = 0.21%, optic lens Dmax: 3.66 Gy, SD = 3.09Gy compared to 3.68 Gy, SD = 0.78 Gy.

Conclusions: This study demonstrates an increase in CTV V95% of 0.41% and PTV V95% of 1.11% with the volumetric based WBRT planning technique compared to the traditional osseous field-based technique. A contour-based WBRT approach ensures standardization in generating a plan and eliminates the inter-operator variability amongst the radiation oncologists, while maintaining comparable optic lens Dmax dose.

189 VAGINAL SPARING WITH VOLUMETRIC MODULATED ARC THERAPY (VMAT) FOR RECTAL CANCER
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Purpose: Compare dosimetric differences between VMAT plans with and without an objective to spare the vagina, to determine whether the volume of the vagina that receives 20 (V20 Gy), 30, 40, 45, or 50 Gy could be reduced. Secondary objectives included whether the maximum dose (Dmax) delivered, and the mean dose (Dmean) delivered are significantly different between the two treatment plans.

Methods and Materials: Ten patients with rectal cancer previously treated with 3D conformal radiotherapy were selected for this study. All patients received 50.4 Gy in 28 fractions of radical neoadjuvant RT for T3, N1-2, low rectal cancers. Two VMAT plans were created for each patient; one with an objective to spare the vagina and one without. Target coverage and sparing of other organs at risk were not compromised between the two VMAT plans. Differences in vaginal dose was determined using Wilcoxon signed-rank tests. The selected threshold for significance was p-value ≤ 0.05/7 using a Bonferroni correction for multiple comparisons.

Results: Significant differences were observed for the median Dmax and Dmean doses delivered, and the median V50Gy volumes; 52.6 versus 49.6 Gy (p = 0.0051), 49.9 versus 47.8 Gy (p = 0.0051), and 47.6 versus 0% (p = 0.0051) respectively. V45 Gy volumes also appeared different between the two treatment plans and would be considered significant at the p-value ≤ 0.05 threshold, but because the threshold p-value was adjusted using the Bonferroni correction, it was no longer significant. The dosimetric differences between V20 Gy, V30 Gy, and V40 Gy were not significant.

Conclusions: VMAT planning using an objective to spare the vagina can significantly reduce the volume of vagina receiving 50 Gy, as well as the Dmax and Dmean, without compromising target coverage or adjacent organs at risk dose constraints.

190 REDUCING RADIATION THERAPY READY-TO-TREAT TO TREATMENT START TIMES
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Purpose: To determine the impact of a process improvement project on the Ready-to-Treat to Treatment (RTT-to-Tx) target which had been reduced from 90% within four weeks to 90% within 2.6 weeks in a nine-linac cancer centre with a pre-project RTT-to-Tx interval of 90% within 3.8 weeks.

Methods and Materials: Using a process improvement methodology based on LEAN and Six Sigma principles, the defined opportunity goal, was to reduce the RTT-RTx for patients receiving RT for breast cancer (25% of the centre’s RT courses) by 30% from 3.8 weeks to 2.6 weeks (27 days reduced to 18 days) within six months, with the objective of minimizing waiting times without negatively impacting other tumour groups. The RTT-to-Tx data was reported as three monthly rolling averages. The improvement process was structured along six components: Define Opportunity, Build Understanding, Manage Change, Act to Improve, Sustain Results, and Share Learning. To define the opportunity, a six-hour, current state process mapping occurred. This demonstrated that the existing process had many steps/hand-offs/interruptions/waits without much continuous flow. The value stream map showed that there was inconsistent use of the RTT date, an average lead time from Booking to Treatment of 12-13 working days (18 calendar days), and only five to eight hours of value added time. Building understanding included presentations to radiation oncology, therapist and clerical groups.