



Predictors of Hematologic Toxicity and Implications for Bone-marrow Sparing Pelvic IMRT for Cervical Cancer

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Purpose

Concurrent chemoradiation (CCRT) is the established standard of care for Stage II-IV cervical cancer. CCRT is associated with increased Hematologic Toxicity (HT) and treatment breaks. Factors that predict for HT, particularly bone marrow volume irradiated, were studied.

Methods

Medical records of 64 women receiving radiation for cervical cancer at LUMC between 2001 and 2006 were reviewed. Of these, forty patients with complete records who received weekly Cisplatin and whole pelvic 3-D conformal RT were eligible. HT was defined using Common Toxicity Criteria (v2.0). Treatment planning CT scans for these women were recontoured to estimate bone marrow dose. Bony contours of the following were used as surrogate for bone marrow volume irradiated: (1) lumbosacral (L5 and sacrum), (2) ilium (iliac crests to superior border of the femoral heads), (3) lower pelvis (pubis, ischium, acetabulum, proximal femurs), pelvis (4) included 2 and 3 and whole pelvis (5) included 1 and 4. Dose Volume Histograms (DVH) were created showing the designated volumes of bone marrow (%) at different doses (20, 30, 45Gy). Other variables predicting for HT including age, BMI, and transfusions were included in the data analysis.

Figure 1. Proportion of HT2+ at 20Gy

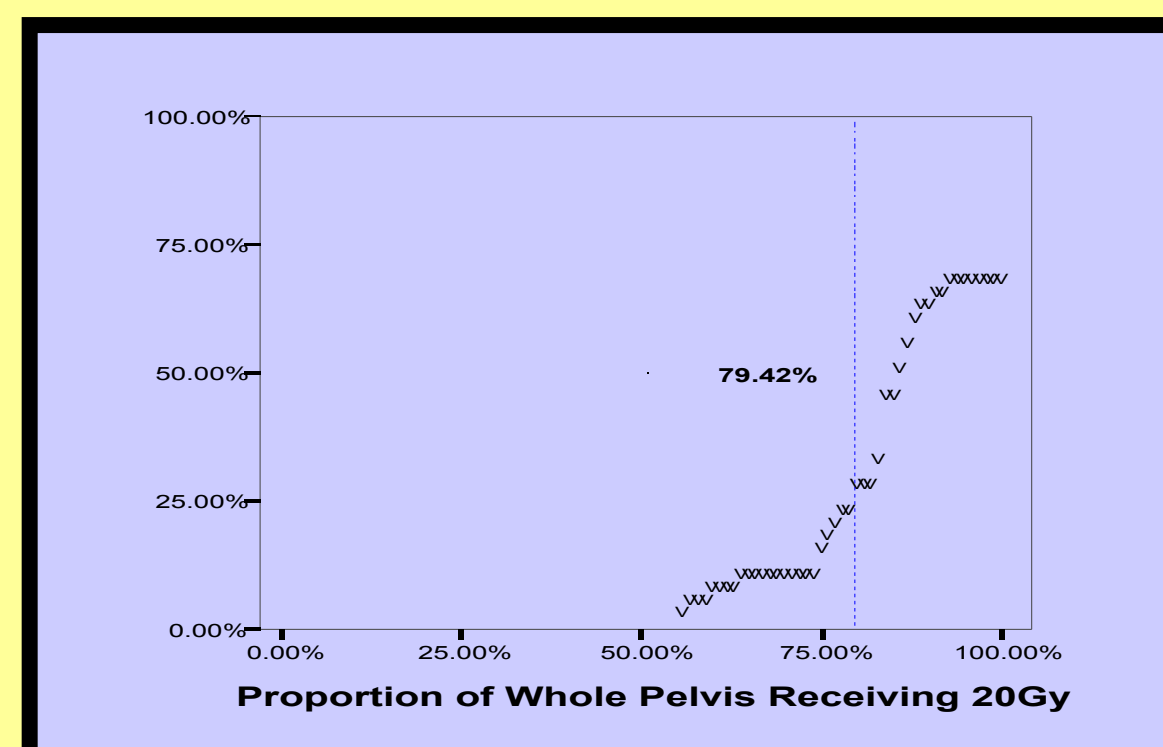


Figure 2. Xio Dose/Volume Histogram of Whole Pelvis at 20Gy

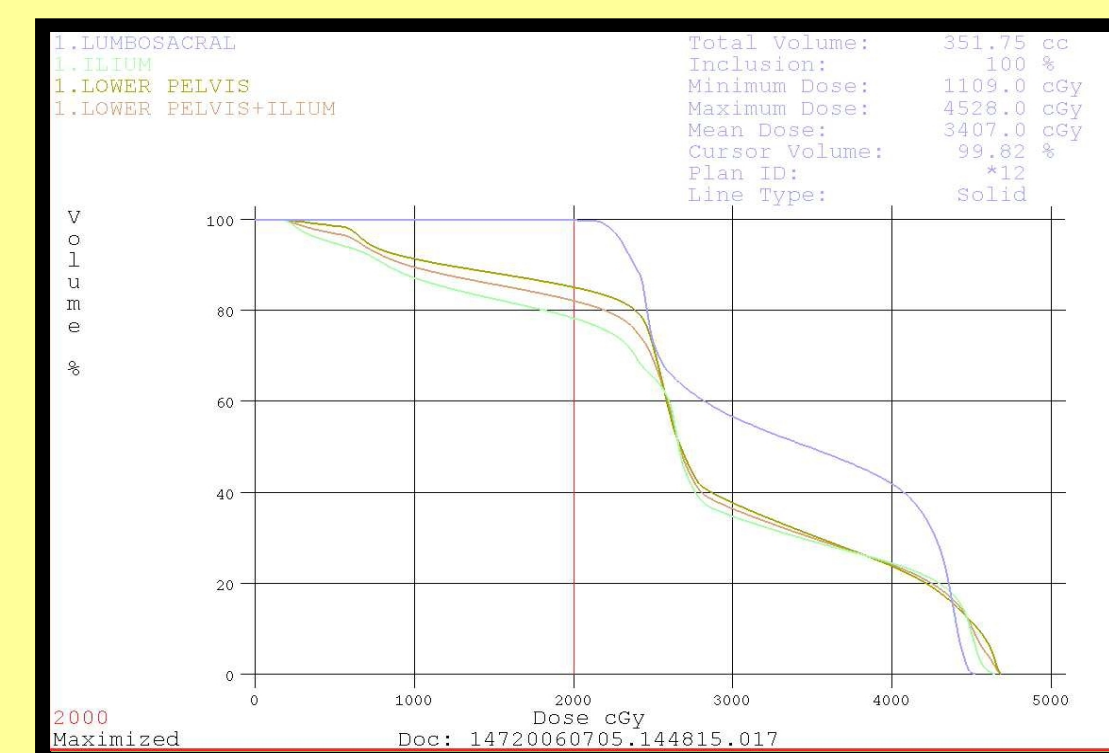
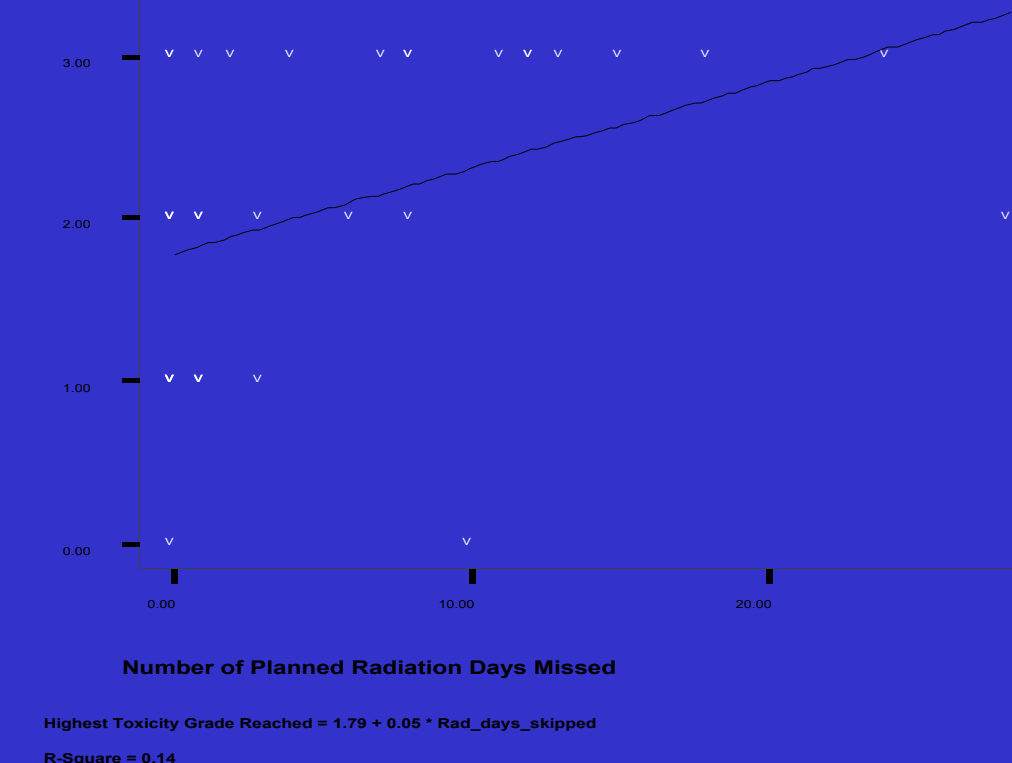


Figure 3. Hematologic Toxicity Grouping

	Frequency	Percent	Cumulative Percent
Grades 0-1	13	32.5	32.5
Grades 2-4	27	67.5	67.5

Fig 4. N days missed of RT relative to highest HT grade



Results

Thirteen patients (32.5%) had Grades 0-1 HT and 27 (67.5%) had Grades 2-4 HT (HT2+). Ten patients had at least 1 chemotherapy cycle held; 4 due to HT. Twenty-seven patients had at least 1 dose of RT held; 7 due to HT. Median duration of RT (including brachytherapy) was 56 days. Multiple logistic regression analysis of potential predictors showed that only V20 Gy of whole pelvis(5) (volume of bone marrow receiving 20 Gy dose) was tending toward significance for predicting HT. A partitioning analysis (Figure1) showed a cutoff value of 79.42% for HT2+ with whole pelvis at 20Gy (p=.033, 95%, CI=1.084, 18.689). Identical analyses for 30Gy showed a cutoff of 41.78% (p=.043, 95%, CI=.970, 25.771). Using logistic regression analysis, when the V20 of whole pelvis exceeds 80%, the risk of developing HT2+ increases by a factor of 4.5 (p=.038). In our study, there was a correlation found between the number of days of RT missed and HT (p=.018).

Conclusions

Prolongation of RT has been shown to reduce local control. We have shown a correlation between bone marrow volume irradiated and development of HT. This has implications for use of bone marrow sparing pelvic IMRT, which can potentially decrease volume of bone marrow exposed to 20Gy dose, indirectly decrease HT, and increase the percentage of women who complete RT on time.