Enhancing Fraction predicts Recurrence-free Survival in Patients with Carcinoma of the Cervix treated with Radiotherapy

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Purpose/Introduction

Patient survival in cervical cancer varies considerably. There is a need to predict, before or early in treatment, those patients unlikely to respond to conventional therapy so that additional treatments can be given. DCE-MRI parameters have shown varying degrees of success in predicting cervix cancer patient outcome [1, 2, 3]. Enhancing fraction (E_F = enhancing voxels / total tumour voxels) has been shown to predict clinical outcome following chemotherapy in patients with ovarian cancer [4]. The aim of this work is to analyse the prognostic value of E_F in cervix tumours prior to external-beam radiotherapy (EBRT) and to monitor changes in E_F following EBRT.

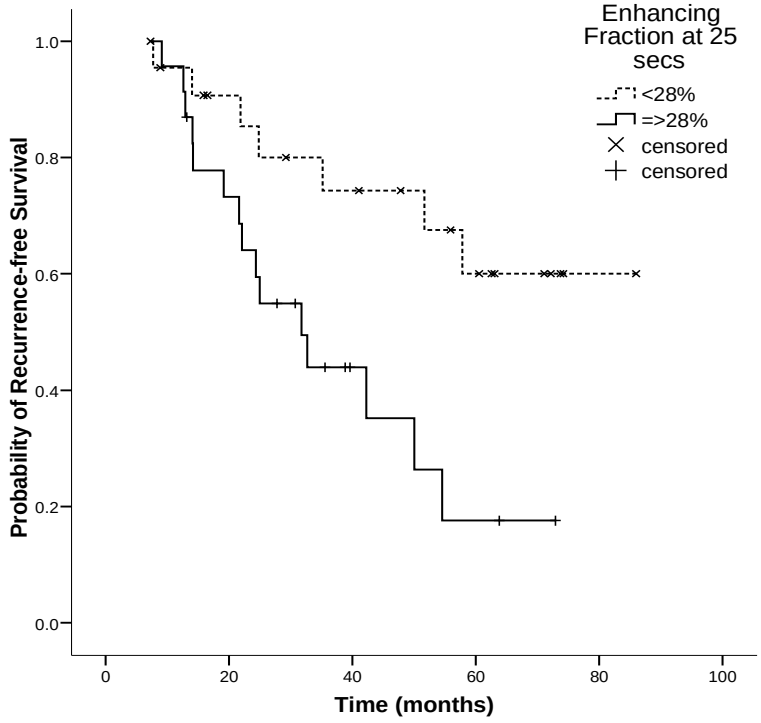
Subjects and Methods

46 patients (stages II to IVA) underwent DCE-MRI scans prior to receiving EBRT. 10 of these patients also underwent DCE-MRI scans following 40-45 Gy EBRT. All MR scans were performed on a 1.0 T Siemens Magnetom Impact using a phased-array pelvic coil. The dynamic sequences consisted of 8 gradient echo T1-w sagittal scans through the tumour (TR / TE = 130 / 6.5 ms, $\alpha = 70^o$, FOV = 290 x 290 x 5 mm, matrix = 9 x 256 x 256). The time between successive dynamic scans was 25 seconds. Patients received an injection of 0.1 mmol/kg Gd-DTPA. 1 pre-contrast and 7 post-contrast scans were acquired. Whole tumour ROIs were outlined and E_F was calculated at 25, 50, 75 and 100 s post-contrast. Enhancing voxels were those which showed signal increases ≥ 3 times the standard deviation of the pre-contrast signal in the tumour. Patients were stratified by the median E_F obtained prior to treatment. E_F values obtained in 10 patients pre- and post-EBRT were compared using a paired t-test. A significance level of 0.05 was used throughout.

Results

Significant relationships were seen between E_F and recurrence-free survival (RFS) at all time points (the data from the 25 s time point is shown in the figure). Patients whose tumours had high E_F had a significantly poorer RFS than tumours with low E_F (p=0.011 at 25 s).

Average E_F measured in 10 patients pre- and post-EBRT increased at all time points although the increase only reached statistical significance at 100s post-contrast (79 to 97%, p = 0.05).



Discussion/Conclusion

The poor outcome of patients with high E_F may be indicative of more agressive / angiogenic tumours, agreeing with previous reports in cervical [3] and ovarian [4] cancers. E_F is simple to calculate, even when the DCE-MRI data acquisition is sub-optimal. The increase in E_F following EBRT is consistent with an increase in blood flow and microvascular permeability. E_F reflects tumour heterogeneity which is known to be important in the success of treatment outcome [5]. E_F provides a simple radiological biomarker of prognosis in patients with cervix tumours.

References

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