

Recurrence landscapes of uterine cervix carcinoma – A 3-D analysis of topography and spatial frequency distribution

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Introduction

We introduce a method to accomplish a representative three-dimensional mapping of recurrence locations after primarily treated cervical carcinoma. Such collective-based mapping is of utmost importance for our present research on local tumour spread within the female pelvis [1]. In particular, we are interested in the analysis of differences depending on the primary treatment (surgical vs. radio-(chemo-)therapy).

Material and Methods

51 patients with loco-regional recurrences of cervical carcinoma have been delineated based on T2-weighted NMRI. Following, the recurrence outlines were projected onto a reference pelvis data set using a landmark-based linear transform. Underlying data for this reference pelvis was taken from the cryosection data set of the “visible woman” part of “The Visible Human Project”, National Library of Medicine [2]. Depending on the primary treatment, two separate maps (“recurrence landscapes”) were built up just by superimposition of the respective projected recurrence locations. Such recurrence maps can be analysed concerning extent, shape, frequency distribution and topographical assignment.

Results

For the primary therapy, 34 cases have undergone a hysterectomy (3: simple; 31: radical), while 17 cases received a radio-(chemo-)therapy. Recurrence landscapes obtained from patients with primary radio-(chemo-)therapy (i) exhibit smaller overall volumes (see Figure 1) compared to those obtained from patients with primary radiation therapy (whereas the individual recurrence volume distributions do not differ), (ii) show a arched instead of a rather (semi-)circular contour (in the transversal plane), and (iii) possess a rather centrally localised map maximum instead of two or more lateral maxima.

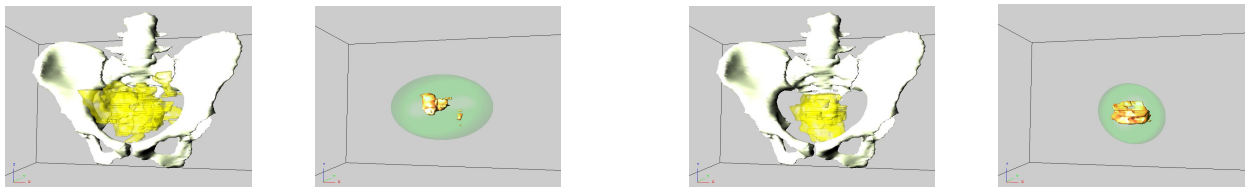


Figure 1: Overall entries (yellow) and 50%-level surface (orange) of the maps for surgically treated (left pair) vs. the radiated branch (right pair). Green ellipses illustrate 3σ surfaces assuming multivariate normal map distributions.

Discussion

The localisation of loco-regional recurrences of cervical carcinoma, besides tumour-biological factors, is decisively determined by (i) the preceding therapy and (ii) the topographical relations of the pelvic intestines. In accordance with the concept of a compartment-related tumour spread within the pelvis, the obtained shapes in the recurrence maps support the hypothesis of an incomplete resection within the embryologically defined uterovaginal (Müllerian) compartment during conventional radical hysterectomies. Further on, the results also rectify a modification of the prescribed dose distribution within a modern intensity-modulated radiation therapy during the primary cervical carcinoma treatment.

References

- [1] Höckel, M.; Horn, L.-C.; Manthey, N.; Braumann, U.-D.; Wolf, U.; Teichmann, G.; Frauenschläger, K.; Dornhöfer, N.; Einkenkel, J.: Resection of the embryologically defined uterovaginal (Müllerian) compartment and pelvic control in patients with cervical cancer: A prospective analysis. *The Lancet Oncology*. Vol. 10, No. 7, July 2009, pp. 683 - 692
- [2] http://www.nlm.nih.gov/research/visible/visible_human.html