Comparison of a pre planned dose distribution with a real time dose distribution in ultrasound guided 3D conformal brachytherapy of prostate cancer

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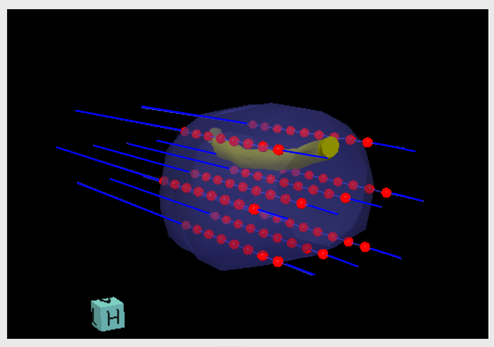
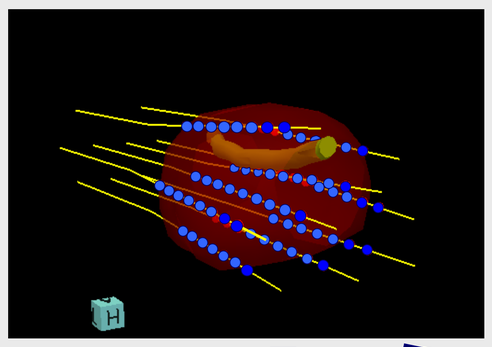
Introduction: Since 1998 the University Hospital in Örebro has been treating prostate cancer with HDR brachytherapy in combination with external radiotherapy. Since mars 2004 a real time dose planning system ”SWIFT” (Nucletron B.V.) is used for ultrasound guided 3D conformal brachytherapy.
During the needle insertion the needles can diverge from the planned positions and this will cause some deviation in the final geometry and of course also in the dose distribution, if no corrections are made.
The aim of this study was to evaluate the influence of the needle displacement on the dose distribution.

Materials and Methods:
We used SWIFT to simulate the effect of the needle displacement for 37 patient treatments. We compared two dose distributions, one of them was corrected for needle displacement and variations in target and risk organs due to the inserted needles and one was not.We also measured the transversal displacement of the first dwell position for the 570 needles in these treatments.

A planned dose distribution based on parallell needles.



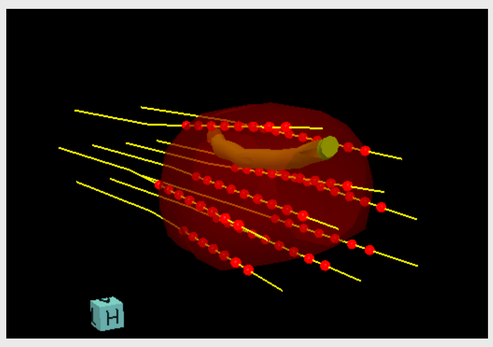
The needles are then inserted according to the plan.



Final geometry based on a UL-scan with the actual needle positions.

Dwell times

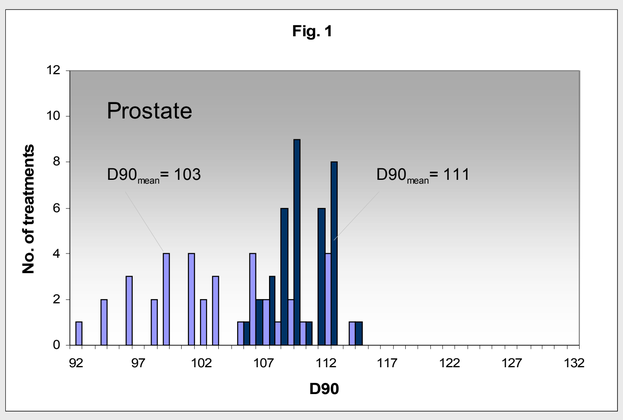
Geometry

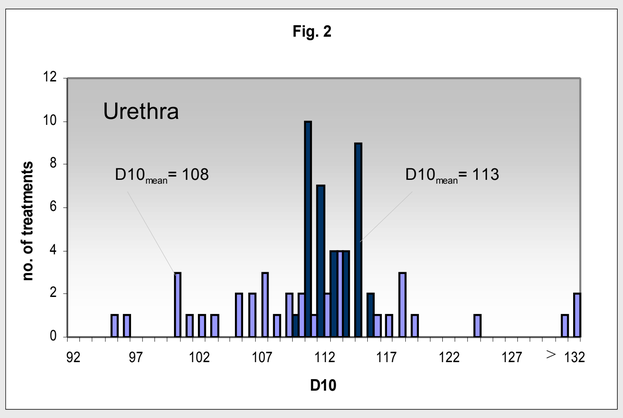


Not corrected dose distribution

Corrected dose distribution

Results:





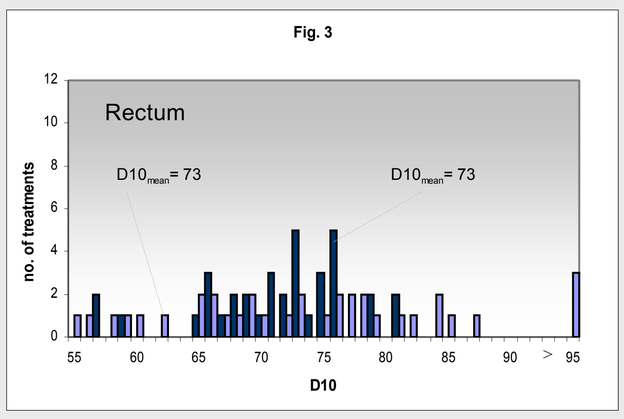


Fig. 1-3 Distribution of Dose Volume Histogram data D90 (prostate) and D10 (urethra and rectum) for the evaluated treatments.

Discussions: For the “not corrected” dose distribution we found, in general, that it was the inner part of the prostate that received a somewhat lower dose. We also saw a rather wide spread in the D10-values for urethra and rectum, some of them quite high. The mean value of the transversal displacement of the first dwell position, for 570 needles, was found to be 2,4 mm.

Conclusion: We consider it to be important to use this kind of real time dose planning tool to be able to make individual dose plans as accurate as possible.