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A new mathematical modeling method designed for individual template in interstitial brachytherapy

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INTRODUCTION

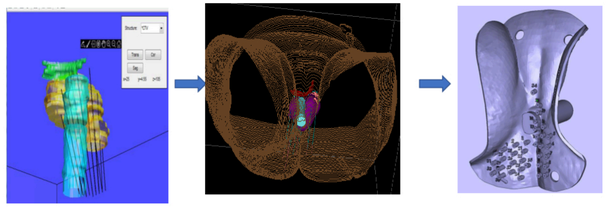
For some pelvic tumors which need branchytherapy treatment, due to the complex shape of the target and the surrounding nerves, blood vessels and other OARs , it is difficult to obtain a better dose distribution by manual implantation .

AIM

this study proposes a mathematical modeling method which can individually improve the accuracy of implantation and the dose distribution in brachytherapy treatment planning.

METHOD

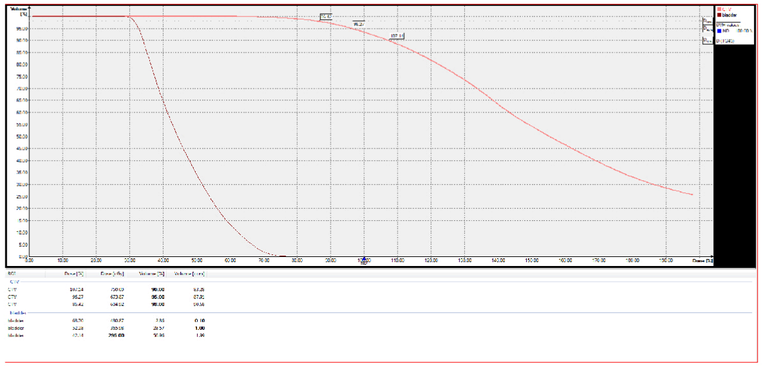
- Step1: Structures were imported to MATLAB to establish mathematical model and needle arrangements were initially auto-calculated.
- Step2: Novel needles were minorly adjusted in TPS to make a better dose distribution(pre-plan).
- Step3: Template with precise channels were printed by 3D printer.



Initial needles | Adjusted needles | Printed template

The patient's lesions were located in posterior vagina wall and left posterior wall of the cervix.Under the condition that template fitted skin well, CT images showed needles reached expected positions. Surgery went safely and quickly. In the treatment plan, D_{90} of the CTV were 750cGy, D_{2cc} of the bladder were 295cGy, HI were 3.18, CI were 0.75. Dosimetry parameters and dwell points weight were similar as pre-plan.

One section of treatment Images



Dose-Volume Histogram

CONCLUSIONS

Compared with the conventional methods, the template guided surgery can not only reduce damage risk and improve the accuracy of implantation, but also potentially improve treatment quality. Moreover, further mathematical and dosimetry algorithms need to be discussed to optimize better needle channels.

REFERENCES

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