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Dosimetric Evaluation of Forwarding-Optimizing-Fluence-Script and Hybrid IMRT Planning Techniques for Whole Left Breast Treatment

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INTRODUCTION

Hybrid IMRT[1-2] (H-IMRT) is one of the commonly used IMRT techniques for whole left breast treatment. The Forwarding-Optimizing-Fluence-Script (FOFS) is a forward-planning script for a treatment planning system and is deployed to generate optimal fluence for tangential breast plans. It is known that creating a plan with the FOFS is more efficient than with the H-IMRT technique[3]. However, no publication on dosimetric evaluation and delivery efficiency of the plans with the two techniques was found.

AIM

A retrospective study including 29 whole left breast cases was performed to evaluate the dosimetric quality of the plans with the two techniques.

METHOD

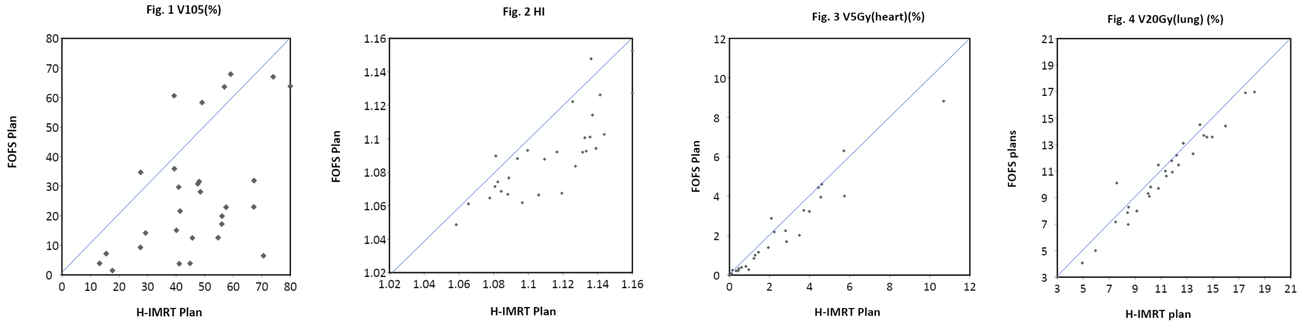
The H-IMRT was created by first making a 3D plan with two tangent fields (lung and heart blocked) and the maximum dose is prescribed to a half of the PD (prescription dose), making a copy of the two fields and deleting the block, and optimized the four fields based on the first 3D plan. More often the fluence map of the H-IMRT plan has to be modified after IMRT optimization to reduce the maximum dose in breast or reduce the dose to heart.

The 29 H-IMRT plans were clinically delivered in 2019 and a new FOFS plan for each case was created with identical geometry and breast coverage. The FOFS is called EZFluence (Radformation, NY), a script program imbedded in Eclipse planning system. It is used to generate optimal fluence for tangent breast plans. It starts with a two-tangent-blocked-field plan. After identifying points in the center of the target or near the surface of an organ at risk (OAR, e.g. lung), the fluence maps are iteratively modulated so that the hot spots are balanced on both sides of the breast while the maximum dose is reduced to a specific goal. It can also create the flash automatically. The EZFluence can produce multiple fluence-based plan options with varied maximum dose limit goals.

The following indexes were evaluated: HI (homogeneity Index), D_{mean} (mean dose to PTV), V_{105} (percentage of PTV with 105% prescription dose(PD) or higher), $D_{max(heart)}$ (maximum dose to heart), $D_{mean(heart)}$ (mean dose to heart), $V_{5(heart)}$ (percentage of heart with 5Gy or higher), $V_{20(lung)}$ (volume in percentage of left lung with 20Gy or higher), $D_{mean(lung)}$ (mean dose to lung) and delivery efficiency.

RESULTS

The average HI was decreased by (2.1±0.6)% with FOFS technique while the V_{105} and D_{mean} was decreased by (229±123)% and (0.8 ±0.3)%, respectively. The $D_{max(heart)}$, $D_{mean(heart)}$ and $V_{5(heart)}$ were reduced by (23.3±11.3)%, (4.6±1.8)% and (37.2±19)%. The $V_{20(lung)}$ and $D_{mean(lung)}$ were also decreased by (7.6±4.6)% and (4.2 ±1.8)%. The typical delivery time for FOFS plan was 50% of that for H-IMRT.



Comparison of dosimatic indexies of the plans created with H-IMRT and FOFS(EZFluence). Note that if the data point is under the diagonal it means that the value of the dosimatic index in the H-IMRT plan is larger. Each data point represents the values of the index in both H-IMRT and FOFS plans.

CONCLUSIONS

Dose in the FOFS plan was more uniform while dose to heart and lung were significantly reduced compared to that in the H-IMRT plan. The faster delivery for FOFS plan greatly facilitated patient comfort of DIBH (deep inspiration breath hold)/gated treatment.

REFERENCES

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