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A STEREOTACTIC RADIOTHERAPY BEAM SHAPING SYSTEM USING INDEPENDENT JAWS

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INTRODUCTION

Fractionated stereotactic radiotherapy (FSRT) combines stereotactic localization techniqu es with fractionated dose delivery in order to achieve more effective the normal tissue sp aring.

In general, tumors treated with SRT are both larger and less spherical than those treate d with SRS(stereotactic radiosurgery). In these cases, the fixed circular apertures currently in use are clearly not ideal except mini multi-leaf collimator(miniMLC).

In this work we have implemented a simple beam shaping system consisting of indepe ndent jaws built in a linac and evaluated its clinical feasibility

MATERIALS and METHODS

Case

A brain metastatic tumor previously treated with SRT using conventional circular colli mator was selected for comparison. The planning target volume (PTV) of the tumor was 28 cc, and the geometrical aspect ratio between the maximum and the minimum length o f the tumor was 1.5.

Dose calculation model

Two plans were generated using a homemade SRT planning system. We implemented t he beam shaping method using independent jaws into the planning system. The conventio nal tissue-maximum ratio (TMR) dose calculation algorithm for circular collimator was ex panded to take account of beam shaping using rectangular jaws. The output factor and T MR were determined by equivalent square formalism. The penumbra is modeled by fitted penumbra functions.

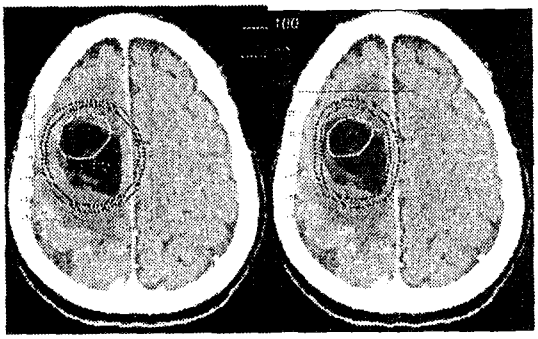
Plan evaluation

We planned this case-allowing beam shaping to optimize the position and direction of independent jaws. And then, the two plans were compared quantitative method.

Beam conformation was determined by the target volume ratio (TVR) introduced by Hacker et al.[1] The TVR is defined as the treated volume divided by the planning target volume(PTV), where both PTV and treated volume are as defined by the ICRU[2]. The normal tissue saving was compared using dose-volume histogram (DVH).

RESULTS

Figure 1 shows a transversal dose distribution of the two plans. The target volume rati o was 2.4 for the plan using circular collimator only and 1.9 for the plan using independ ent jaws as beam shaping method. Figure 2 shows DVHs for normal tissue. The volume of normal tissue exposed to more radiation than the minimum dose of PTV had been red uced to 66% when using independent jaws as beam shaping method.



(a) Cone only (b) Jaw blocking

Fig. 1. Dose distribtions of the two plan. Using (a) circular collimator only and
(b) independent jaws as beam shaping

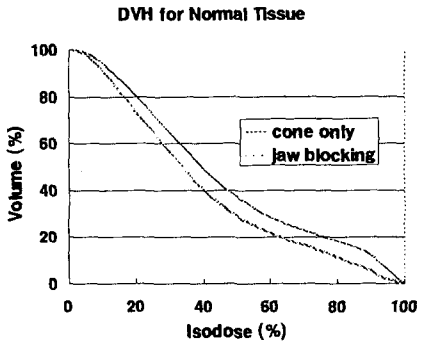


Fig. 2. Comparison DVHs of the two plans for normal tissue.

CONCLUSIONS

We have implemented a simple beam shaping method for SRT using independent jaws built in a linac. We found than this sort of simple method could improve tumor confor mation t

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