

Purpose:

The purpose of this presentation is to show in selected case studies where differential dose planning is used in Cyberknife treatments, and which challenges are associated with each approach.

Method and Materials:

Three case studies were selected to demonstrate different situations where differential dose planning would be used in Cyberknife SRS.

Case 1: Multiple, anatomically close cranial lesions of varying sizes. As experience with GammaKnife SRS has shown, the risk of complications in treating brain metastasis is correlated with dose and lesion size. Lesions larger than 2 cm in diameter are typically treated with a lower dose. In the situation where multiple lesions of different size are located closely together in the brain, creating separate treatment plans on the Cyberknife would lead to longer treatment times, higher whole-body dose due to scatter and leakage, and difficulty to assess multiple plan dose overlays.

Case 2:

The second situation involved mostly head and neck cancers where the GTV and CTV are treated to different doses as a boost after conventional IMRT treatments. Typically, the GTV encompasses the PET positive areas. Around the GTV, a CTV enclosing the microscopic extension of the disease as determined by the physician based on the case history.

Case 3: Unusual cases.

A patient with pituitary adenoma was also diagnosed with Graves disease. Because of the proximity of the lesion and the orbital muscles affected by Graves disease, the tumor and orbital muscles were treated at the same time with different dose.

Results:

All three categories could be planned to the physicians' satisfaction. In case 1 patients, attention has to be paid to minimizing the dose to the healthy brain between the lesions. This can be achieved by using tuning structures or tuning shells around the tumors.

In Case 2, the limiting factor is the dose fall-off outside the GTV. A fraction of the CTV will be treated at a higher dose than planned.

In case 3, the combined planning of the Graves disease and the pituitary adenoma achieved good dose sparing of the optic apparatus.

Conclusion:

The Cyberknife software is very flexible and allows relatively easy planning for complex situations.