QUALITY ASSURANCE OF THE TREATMENT PLANNING SYSTEM LEKSELL GAMMA PLAN

Ikbal, Sofia1,2, Rosa, M. J.1,2, Fernandes, Â.1,2, Silva, A.1,2, Carvoeiras, P.1,2, Mota, M.1,2

1Mercurius Health, Portugal; 2Centro Gamma Knife - Hospital CUF Infante Santo, Portugal

E-mail: Sofia Ikbal - sofia.ikbal@gmail.com

Introduction

The Gamma Knife Center in the Hospital CUF Infante Santo in Lisbon is the only hospital in Portugal that has the Leksell Gamma Knife Perfexion from Elekta. The system comes complete with Leksell Gamma Plan, the dedicated treatment planning system (TPS). Since 2007 more than 800 patients received the Gamma Knife treatment at the hospital. The most common pathologies treated include metastasis, Arteriovenous Malformation (AVM), acoustic schwannomas, meningiomas and adenomas.

Aim

The aim of this work is to implement, at the Gamma Knife Center, dosimetric tests for the Quality Assurance of the Treatment Planning System Leksell Gamma Plan.

Keyword: Radiosurgery, Gamma Knife, Gamma Plan, Quality Assurance, dose profile.

Methods

Leksell Gamma Plan 8.3.1. is a computer-based treatment planning system specifically designed for the simulation and planning of stereotactic Leksell Gamma Knife radiosurgery based on tomographic and projectional images.

For this work we have acquired dose profiles for all collimator sizes (16, 8 and 4mm) and for all directions (x, y and z) with a diode and radiochromic film and compared them with dose profiles from the TPS. Therefore we have made a Gamma Analysis using Microsoft Excel 2011 and Omni Pro IMRT 6.1. We have also measured absolute dose with an ion chamber and compared the output factor for the 16 mm collimator with the value from the TPS.

Results

Fig. 3 - Dose profiles for all collimator sizes (16, 8 and 4mm) and for all directions (x, y and z). Diode --> Dose profiles from the TPS Radiochromic film -->

Conclusion

We have encountered some limitations during the realization of this work such as the algorithm we have available is water-based. This implies that the dose calculation algorithm ignores the scatter photon contribution and assumes homogeneous patient geometry. Although brain tissues are relatively homogeneous, beams that pass through low density air cavities or high density skull bones are expected to be perturbed. Variations in attenuation and absence of electronic equilibrium adjacent to air-tissue inhomogeneity could cause errors in dose calculation. In the future, we recommend the upgrade for another algorithm such as the Convolution and therefore compare the dose profiles. Also, would be important to acquire appropriate ion chambers recommended for stereotactic radiosurgery and to take into account the lake of reproducibility of the radiochromic film. Dosimetric tests requires time and effort but it’s recommend to be made monthly or when there’s a change of setup of the hardware or software.