Calibration of Gamma Knife Perfexion using the new IAEA-AAPM code of practice for the dosimetery of small static photon field

Marouf Adili, Ali Zaila

Prince Sultan Medical Military City, Riyadh, Saudi Arabia

Objectives

A new code of practice, TRS 483, for reference and relative dose determination of small static fields in external beam radiotherapy has been released by the IAEA and AAPM. The aim of this work is to apply the new code on Gamma Knife Perfextion and highlight any differences between the new code and the current procedure

Methods

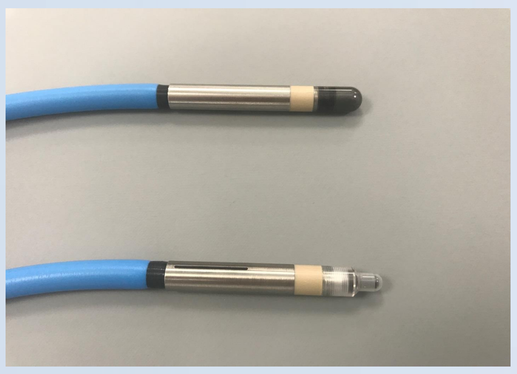
Two tasks have been performed:

- determination of the reference absorbed dose to water in machine –specific reference (msr) field (16mm collimator)
- determination of field output factor for the other two collimators available (8mm and 4mm).

Two PTW chambers were used Semiflex T31010 and PinPoint 3D T31016 with Elekta solid water phantom of 16cm diameter. Both chambers have a calibration coefficient in terms of absorbed dose to water for Co-60 at 10x10 field size, 100 SCD and chamber at 5cm depth.

The two chambers were operated at calibration voltage of +300V. Polarity and recombination correction factors were calculated according to the new code of practice

Semiflex chamber (top)
PinPoint 3D chamber (bottom)



Elekta solid water phantom

Results

The difference in reference dose calculation between the new code and the current procedure was 1.3% and 1.8% for the Semiflex and PinPoint chambers respectively, these differences are a result of introducing the new $K_{Q_{msr},Q_0}^{f_{msr},f_{ref}}$ factor which convert the absorbed dose in solid phantom to absorbed dose in water (1.0037, 1.004), Polarity correction (1.0084, 1.0125) and recombination correction (1.0009, 1.0012) for both chambers respectively. The current procedure has been introduced during the installation of the machine by Gamma Knife installation team, and it does not include the polarity and recombination correction factors as they were considered negligible.

PinPoint chamber was used to measure the output factor for the 8mm collimator only. Applying the field output correction factor $K_{Q_{clin},Q_{msr}}^{f_{clin},f_{msr}}$ (1.032) provided by the new code resulted in an agreements within 0.4% of the value used in the Leksell Gamma Plan.

Conclusion

Even though the difference in reference dose calculation can be considered clinically insignificant, procedure has to be changed as measurements show that the correction factor cannot be considered negligible. Caution must be taken when using the T31016 chamber for reference dose calculation because of the large polarity correction factor

Poster ID.: P130. European Congress of Medical Physics, 23 – 25 August 2018, Copenhagen. Denmark. email: madili@psmmc.med.sa