Purpose:: Stereotactic radiosurgery (SRS) procedures are known to deliver a very high dose per fraction and thus, the increased risk of secondary types of cancer due to increased peripheral dose could be a limiting factor for the long term survival of the patients. The aim of this study is to evaluate the peripheral dose (PD) received at preselected anatomical sites in an anthropomorphic phantom for treatments of intracranial lesions with the CyberKnife.

Methods: Eight patients treated using the CyberKnife were selected for this study. Organs at risk and target were delineated on volumetric CT data and treatment planning (Multiplan v.4.5.0) was optimized accordingly, in order to achieve the required prescribed target dose and critical structures sparing for each patient. The final treatment plan was delivered with a CyberKnife VIS (Accuray, Inc., Sunnyvale, CA) operating with a dose rate of 1000 MU/min at a flattening filter free mode and upgraded shielding. We performed our measurements using a male anthropomorphic RANDO phantom (Alderson Research Laboratories, Inc., Stamford, CT). Groups of three TLD 100 were placed anteriorly inside RANDO at a depth of 5 cm at locations corresponding to the thyroid, breast or lung, uterus and inferior abdomen for each treatment plan.

Results: The average percentage dose normalized to the prescribed dose for the thyroid gland was 0.92±0.23 % with a max of 1.95%. The maximum reduction of the PD (expressed as percentage of the prescribed dose) was 80% between the thyroid gland and the lower pelvic area. Similarly the PD normalized to the number of MU showed an average of 0.84x10^-3 (cGy/MU), with a max of 0.0025 (cGy/MU) for the thyroid gland region.

Conclusions: It is evident that the PD is proportional to the number of MU as well as to the prescribed dose. These correlations can be utilized to estimate the PD during intracranial treatments.