AbstractID: 5660 Title: Cell proliferation and tumor hypoxia during radiation therapy

Purpose: Tumor hypoxia is an important resistant component that significantly affects response to treatment. Our aim was to concurrently monitor cell proliferation and tumor hypoxia distribution during radiation therapy.

Materials and Methods: Several canine subjects with soft tissue sarcomas were repeatedly imaged with PET/CT before, during and after radiation treatment. The tumors were treated with ^{60}Co in four 8 Gy weekly fractions. 3'-Deoxy-3'-fluorothymidine ([F-18]-FLT) and Cu-diacetyl-bis(N4-methylthiosemicarbazone) ([Cu-61]-ATSM) as surrogates of cell proliferation and tissue hypoxia, respectively, were used to follow the response. Approximately 200 MBq of FLT or Cu-ATSM activity was administered per scan. The CT data between the imaging sessions was co-registered and the corresponding PET data compared and analyzed.

Results: Tumor response to therapy varied significantly between the subjects and even for different tumors in the same patient in case of multicentric disease. High heterogeneity of both cell proliferation and hypoxia (up to 50% in SUV) of the tumor was observed in several cases. Early proliferative response seems to be indicative of the overall tumor response. Both cell proliferation and hypoxia distributions changed during treatment, but their differential response remained rather constant. The distributions of cell proliferation and tissue hypoxia were often found to be complementary, but not exclusively.

Conclusions: Concurrent monitoring of cell proliferation and tissue hypoxia represents a new dimension in tumor monitoring and provides basis for more efficient, biologically based treatment optimization. High heterogeneity of tumor kinetics and microenvironment together with spatially variable response calls for individualized approach to cancer management.