

The use of 3D conformal radiotherapy (3DCRT) and IMRT in head and neck squamous cell carcinoma (HNSCC) which permits exquisite dose distribution to volumes of almost any shape, has critically raised the issue of accurate delineation of the macroscopic tumor volume (GTV) and its microscopic extension (CTV). For various physical and logistics reasons, CT scan has been (and is still) typically the main modality used for treatment planning purpose. Image guided therapy with MR and FDG-PET is however under evaluation.

The combination of these imaging modalities has in turn raised the issue of their specificity and sensitivity with regards to the delineation of the GTV. In this framework, our group performed a comprehensive comparison of the tumor extension assessed by CT, MR and FDG-PET to the surgical specimen in a series of locally advanced laryngeal squamous cell carcinomas scheduled for total laryngectomy. A unique methodology was developed to allow 3D-registration of CT, MR and PET images performed before surgery to the macroscopic specimen. GTVs could then be delineated on the various images and on the pathologic specimens, and compared quantitatively and qualitatively. It was shown that all imaging modalities significantly overestimated the tumor volume compared to the macroscopic specimen, illustrating their lack of specificity for assessing tumor extension. The GTV delineated from the FDG-PET images was however the closer to the macroscopic specimen. Another interesting finding was that all imaging modalities underestimated a small fraction (around 10%) of the tumor volume corresponding to superficial extension, illustrating their limitation in spatial resolution.

This study has clearly demonstrated the limitation of the imaging modalities used for 3DCRT and IMRT of HNSCC, and emphasized on the usefulness of the CTV not only to take into account the microscopic tumor extension, but also to take into account the lack of sensitivity of the imaging modalities used for treatment planning.