The Role of PET/CT for Radiotherapy Treatment Planning in Head & Neck Carcinoma

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The interest in integrating biological information in the Radiotherapy planning process has improved from the last decade as a result of the technologic development of both Imagers and tracers. Among others [18F]FDG-PET became the reference for primary carcinoma of Head & Neck which according to recent studies showed an overall sensitivity of 93-100%, a specificity of 90-100% and an accuracy of 94-98% [1]. Accurate delineation of target volumes based on PET assume particular interest when intensity modulated radiation therapy (IMRT) is the treatment approach, both for increase tumor control probability (TCP) and reduce normal tissues complication probability (NTCP).

PET provides information where every voxel is associated with a number that reflects biological characteristics throughout the tumor which can be used as guidance for non-uniform voxel intensity based IMRT approaches. The heterogeneous dose optimization pattern based on intrinsic tumour biological factors has been designated "dose painting" [2]. The theoretical concept brought a completely new perspective for more realistic dose optimization and personalized targeted treatments.

Dose painting have been described by several authors by using different optimization strategies, which essentially investigated, both dose painting by contours and dose painting by numbers. Prior knowledge of potential high clonogen density and/or hypoxic radioresistant regions may result on better sparing of normal surrounding tissues and therefore less morbidity, which is crucial for head and neck radiosensitive structures such as parotid or lacrimal glands, optic or auditory pathways, swallowing structures, etc [3].

Reducing the dose to organs at risk and maintain the integrity of tumour prescription dose, will allow IMRT techniques to improve TCP through dose escalation, mainly to the gross tumour volume (GTV).

Since [18F]FDG-PET/CT exhibits a higher accuracy for GTV definition than other imaging modalities it became the preference for boosting subvolumes inside a planning target volume.

References

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