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Movement of the hyoid during head and neck radiotherapy: Implications for off-line verification

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Abstract

Abstract Title:

Movement of the hyoid during head and neck radiotherapy: Implications for off-line verification

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Purpose or Objective

Improved conformality of radiotherapy methods and increasingly adaptive radiotherapy requires optimal on-set verification. Standard verification for radically treated oropharyngeal cancer often involves off-line cone beam CT (CBCT). Many oropharyngeal tumours are influenced by the movement of the hyoid due to direct fixation or infiltration of swallowing muscles. The position of the hyoid can change significantly as tumours respond to treatment; it may move inferiorly over the course of radiotherapy as base of tongue tumours respond to radiotherapy and release extrinsic muscles of the tongue. If the hyoid bone is used as a surrogate for primary gross tumour volume (GTV_P) position, we may well inaccurately verify treatment during the latter fractions of radiotherapy as the hyoid moves more independently of the GTV_P. Alternatively, if we don't consider the hyoid bone in verification and match to other bony landmarks in patients where the primary moves with the hyoid, we could risk geographical miss, or unplanned increase in dose to organs at risk (OARs). As far as we are aware, there is a paucity of literature addressing this issue and no standard protocols to reduce its prevalence or impact upon verification. In our centre, radically treated head and neck patients who have persistent on set changes to the hyoid position on CBCT at verification, are referred for review and discussion of potential geographical miss. Standardly a 5-6mm and 3-5mm margin is added to the GTV_P inferiorly and superiorly to account for microscopic spread and internal movement/set up error respectively. This is a total of 8-11mm. We studied the magnitude of hyoid displacement in head and neck patients at our centre to identify those whose hyoid moved superiorly or inferiorly by 8mm or more and so were at risk of geographical miss.

Material and Methods

The 2018 records of patients who were referred for set up review were screened. Patients having radical head and neck radiotherapy referred on account of hyoid movement were identified. The date of referral was the date of the on-set CBCT demonstrating the hyoid displacement. The referral CBCT was fused with the baseline planning CT on Prosoma. Using the CT slice numbers, the position of the GTVp and hyoid on baseline CT, and hyoid on CBCT was recorded.

Results

32 radical head and neck patients were referred for hyoid bone displacement during 2018. 29 oropharyngeal primary tumours, 75% staged as T4 primaries. We had complete imaging histories

on 27 patients. In 20 patients the GTV_P overlapped with the hyoid bone at baseline. 17 patients had superior or inferior hyoid displacement of 8mm or more.

Conclusion

On set verification based upon position of the hyoid in some oropharyngeal tumours maybe suboptimal in view of the high proportion of patients who have inferior/superior hyoid displacement during a course of treatment. On set imaging with improved soft tissue definition or margins adapted to risk of hyoid displacement may improve accuracy of verification.