



ASSESSMENT OF PTV MARGIN IN HEAD AND NECK CANCER: AN INSTITUTIONAL STUDY.

Dr Sumit Goyal	Assistant Professor, Department of Radiotherapy, GCRI, Ahmedabad.
Dr Shikha Dhal*	Assistant Professor, Department of Radiotherapy, GCRI, Ahmedabad. *Corresponding Author
Dr U Suryanarayana	Professor and HOD, Department of Radiotherapy, GCRI, Ahmedabad.
Dr Pooja Nandwani Patel	Associate Professor, Department of Radiotherapy, GCRI, Ahmedabad.
Dr R.K Vyas	Professor and Director, Department of Radiotherapy, GCRI, Ahmedabad.

(ABSTRACT) **Introduction:** Head and neck cancer radiotherapy usually delivered using IMRT (Intensity Modulated Radiotherapy) technique. EPID (Electronic Portal Imaging Device) and CBCT (Cone Beam Computed Tomography) scan helps in determining systemic and the random positioning deviations for a setup, which may be the base for establishing the specific correction protocol in order to improve setup techniques.

Aims and Objectives: Aim of this retrospective analysis was to assess PTV margin of our institute in head and neck cancer treated using IMRT.

Material and Methods: We have retrospectively assessed seventy head and neck cancer patient who has received IMRT and image verification done using CBCT from June 2016 to December 2016 for the assessment of PTV margin of our institute. Shifts along X-axis, Y axis and Z-axis obtained by matching with reference image was noted.

RESULTS: Out of seventy patients eleven (11/70) were female and rest all (59/70) were male patients. Total 367 CBCT were taken among seventy patients.

Systemic Errors (SE) were 0.18, 0.15 and 0.15 cm along X-axis, Y-axis and Z-axis respectively. Random Errors (RE) were 0.13, 0.12 and 0.12 cm along X-axis, Y-axis and Z-axis respectively.

PTV margin calculated using Van Herk's margin recipe ($2.5SE + 0.7RE$) were 0.541, 0.466 and 0.459 cm along X-axis, Y-axis and Z-axis respectively. The empirical PTV margin given was 5mm and from our study also it was within 5mm.

CONCLUSION: PTV margin obtained were comparative to different studies done all over world and now further trying to reduce it to 3mm by doing daily onboard imaging.

KEYWORDS :

Introduction:

Head and neck cancer mainstay of treatment is chemo-radiotherapy, radiotherapy in head and neck usually delivered using IMRT (Intensity Modulated Radiotherapy) technique for sparing of parotid and delivering high dose to tumor.

According to the RTOG contouring guidelines we have to delineate GTV (Gross tumor Volume), CTV (clinical target volume) and PTV (planning target volume).

By imaging and measuring the error specific patient group regularly with the devices like EPID (Electronic Portal Imaging Device) and CBCT (Cone Beam Computed Tomography) scan, the typical size of the systemic and the random positioning deviations for a setup can be determined, which may be the base for establishing the specific correction protocol in order to improve setup techniques.

It is recommended that every institute should generate data on its set up accuracy without blindly adopting the published margin recipes because the cause for systemic error is specific to particular setups.⁽¹⁾

Aims and Objectives:

Aim of this retrospective analysis was to assess PTV margin of our institute in head and neck cancer treated using IMRT.

Material and Methods:

We have retrospectively assessed seventy head and neck cancer patient who has received IMRT and image verification done using CBCT from June 2016 to December 2016 for the assessment of PTV margin of our institute. Shifts along X-axis, Y axis and Z-axis obtained by matching with reference image was noted.

The mean and standard deviations were then calculated for all the patients in all the 3 axes (x,y,z) and recorded for individual patient.

After this mean systemic and random error were calculated.

On the basis of calculated error appropriate CTV-PTV margins was calculated using required formula as given by Van Herk's margin recipe.

RESULTS:

Out of seventy patients eleven (11/70) were female and rest all (59/70) were male patients. 45 patients were of Oropharyngeal Cancer, 7 patients were of Hypopharyngeal Cancer and 18 patients were of oral cavity cancers. Total 367 CBCT were taken among seventy patients.

Systemic Errors (SE) were 0.18, 0.15 and 0.15 cm along X-axis, Y-axis and Z-axis respectively.

Random Errors (RE) were 0.13, 0.12 and 0.12 cm along X-axis, Y-axis and Z-axis respectively.

Rotational errors was not calculated as our machine does not have this facility of correction.

PTV margin calculated using Van Herk's margin recipe ($2.5SE + 0.7RE$) were 0.541, 0.466 and 0.459 cm along X-axis, Y-axis and Z-axis respectively. The empirical PTV margin given was 5mm and from our study also it was within 5mm.

DISCUSSION:

PTV margin is given around CTV to compensate for various uncertainties of setup and treatment delivery.

Systematic errors can be of various types target delineation error, target position and shape error, transfer error and patient position, shape, size, weight loss, shift of target relative to skin setup marks.

Random error can be of the following type's patient setup error, target position and shape.

Errors may again be interfraction or intrafraction motion errors. Interfraction errors arise from many factors like daily patient setup, weight gain or loss during treatment, or the patient's cognitive state and technician's expertise.⁽²⁾

In addition the tumor experiences intrafraction motion i.e. changes in position during a treatment session. This motion is defined by motion of the organ containing the tumor (viz. lung cancer), motion of surrounding organs in immediate vicinity of the tumor (viz. bladder and rectal fullness in Carcinoma prostate) and involuntary movements (viz. swallowing in Head and Neck cancers).⁽²⁾

Rotational deviations yield anisotropic margins, that is the size of the margin will vary depending on the position with respect to the axis of rotation. The introduction of a rotation adversely affects the measurement because the axis of rotation and the measurement axis (the centre of the imager) are not coincident. Rotation errors are important in the sense that they decrease the probability of delivering a high Equivalent Uniform Dose (EUD) and thereby also decrease the Tumor Control probability (TCP).⁽³⁾

Gibeau et al⁽⁴⁾ reported systemic error of 1-2.2 mm range and random error of 0.7-2.3 which was comparable to our study also.

Suzuki et al⁽⁵⁾ reported PTV margin of 5mm which was also comparable to our study and they also reported systemic error of 0.7-1.3mm which was comparable to our study range and they also reported random error of 0.7-1.6 which was also comparable to our study results.

CONCLUSION:

PTV margin obtained were comparative to different studies done all over world and now further trying to reduce it to 3mm by doing daily onboard imaging.

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