

## **ASSESSMENT OF THREE-DIMENSIONAL SET-UP ERRORS IN PELVIC RADIATION THERAPY**

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Set-up errors are inevitable features of radiation treatment. Coverage of target volume is a direct function of set-up margins, which should be optimized to prevent inadvertent irradiation of adjacent normal tissues. The aim of this study was to evaluate three dimensional set-up errors and propose optimum margins for target volume coverage in pelvic radiation therapy since involuntary internal movements are significant in this region.

Fifty pelvic cancer patients with *HipFix* thermoplastics were studied. Two Portal images were obtained for the first two fractions per patient at orthogonal gantry angles 0° and 90° using a typical exposure time one monitor unit at a dose rate of 300 monitor unit/min and 6 MV energy. Displacements between Digitally Reconstructed Radiographs (DRR) and Electronic Portal Images (EPI) were estimated and analysed along the three axes by matching rigid bony structures. Mean displacements, population systematic and random errors and three dimensional vectors of displacements were calculated. Set-up margins were calculated using published margin recipes recommended by the International Commission on Radiation Units and measurements [ICRU (Stroom and van Herk)].

The random errors were 0.2339, 0.1603, and 0.1628 cm, respectively along antero-posterior (AP), supero-inferior (SI) and medio-lateral (ML) axes. The systematic errors were 0.2698, 0.3284, and 0.2568 cm along AP, SI and ML axes, respectively. The mean displacement in the vertical, longitudinal and lateral axes were 0.103 cm (range - 0.7 to 0.8 cm), -0.177 cm (range - 0.8 to 0.7 cm), and 0.075 cm (range - 0.6 to 0.8 cm), respectively, and the standard deviation in the vertical, longitudinal and lateral axes were 0.2698, 0.3284, 0.2568, respectively for pelvic cancer. Based on the ICRU report 62, the clinical target volume to planning target volume margins were 0.357, 0.365 and 0.304 cm along AP, SI and ML axes, respectively. The corresponding values were 0.703, 0.769 and 0.627 cm with Stroom's formula and 0.838, 0.933 and 0.756 cm with van Herk's formula.

The results of our study suggest that there is a significant difference within the three major axes. Approximately 22% of displacements had exceeded the tolerance limit (>5mm) in pelvic cancer patients with *HipFix* thermoplastics. Calculated set-up margins compared well with published margin recipes. It is recommended to increase the number of portal images acquired to regulate the random and systematic errors effectively.