

Purpose:To evaluate setup errors of 192 patients undergone image-guided radiation therapy (IGRT) using kilovoltage (kV) cone beam CT (CBCT).

Methods:A retrospective study has been carried out for 192 patients treated with intensity-modulated radiation therapy (IMRT) for prostate cancer, cervical cancer, rectal cancer and pancreatic cancer or stereotactic body radiation therapy (SBRT) for lung cancer from March 2009 to December 2010. There were total 662 sets of setup errors gathered from the patients' CBCT images. All patients were immobilized with vacuum cushions and localized with directly marking isocenter technique in the Philips Brilliance CT scanner. The CT images were transferred to a Varian Eclipse workstation for treatment planning. Before radiation treatment, a kV-CBCT scan was performed and image registration was done on a Varian C_i-iX linear accelerator via OBI system. Each set of setup errors in right-left (RL), superior-inferior (SI), and anterior-posterior (AP) directions were recorded to the IGRT log in our in-house developed radiation therapy information management system (RTIMS). A statistical analysis was conducted with the 662 sets of data using SPSS 16.0.

Results:The statistical analysis showed that setup errors from the 662 datasets were depicted a Gaussian distribution. The system errors \pm random errors in RL, SI and AP were -0.5 ± 2.8 mm, 0.2 ± 3.0 mm and 0.6 ± 3.3 mm, respectively. Referring to the formula for planning target volume (PTV) margin calculation, $M=2.5\sigma+0.7\sigma$, the margins were calculated as 3.2 mm, 2.6 mm, and 3.8 mm, respectively. Considering the organ motion and inherent system errors of the IGRT system, the PTV margins would then be 5-8 mm for most IMRT and SBRT cases depending on different disease sites.

Conclusions:The margins derived from this retrospective study have confirmed the premise that the treatment plans were executed in patients with high reliability, thereby created a high sense of confidence for the clinicians.