Seed-Migration Detector for Embolized Seeds to the Lung in the context of permanent iodine-125 prostate brachytherapy

Janelle Morrier[*1], Mario Chrétien[1] and Luc Beaulieu[1]
[1]*Centre Hospitalier Universitaire de Québec, Hopital Hôtel-Dieu de Québec, Radiation Oncology Department, Québec, Canada.*

Abstract

Purpose: To evaluate the efficacy of a seed-migration detector for embolized seeds to the lung in the context of permanent iodine-125 prostate brachytherapy and to compare its performance to fluoroscopy and to the postoperative chest radiographs generally recommended.

Materials and Methods: A low energy gamma scintillation survey meter, Victoreen Model 425-110 was used together with a Victoreen count rate meter (model 190). It was converted to a seed-migration detector by adding a shield on the scintillation probe detection window, following the method proposed by Chen and Blair in 2003 **[*Med Phys* 2003;30:785−790]**. The detector response to three seeds activities of iodine 125 (0.42, 0.22 and 0.06 mCi) was measured for different source-to-detector distances in air and in water. The detector was used to perform a chest evaluation on 579 patients at their first postoperative visit, for a total of 31 826 seeds. When the detector showed activity around a patient's chest, it was confirmed by taking an antero-posterior chest radiograph and by looking at the region with fluoroscopy.

Results: 79 patients (13.6%) present at least one embolized seed in the chest area. This account for 94 of the 31 826 seeds, that is a 0.30% seed migration rate. Sixty-eight, seven and four patients had respectively a single, two and three seeds embolization. In three cases, a seed had migrated in the kidney, which was confirmed with a CT scan. Of the 94 seeds, 67 (71%) were visible under fluoroscopy and 55 (59%) appeared on the chest radiograph. Rapid movement of the seeds in the chest area, due to breathing or to a location close to the heart or the diaphragm, makes nine seeds to be visible with fluoroscopy but not on the radiograph. This also explains why twenty-seven seeds were not visible with fluoroscopy neither with radiograph. In comparison to the seed-migration detector, detection based on fluoroscopy would have led to twenty-seven false-negative detections while the radiograph would have resulted in thirty-nine. Finally, standard chest x-ray would have required a survey, and extra radiation dose to lung, to 100% of the patients rather than the 13.6% who needed it in this study.

Conclusions: Based on this study, the usual recommendation to perform chest radiographs at the first follow-up visit to scan the lungs for embolized seeds should be revised, because of the high false-negative rate and the superior efficacy of a scintillator-based seed-migration detector. Chest radiographs should remain for documentation purposes of positive cases only. Moreover, our clinical experience allowed us to conclude that the detector is convenient (1 minute procedure), cost-effective and non-invasive, meaning that it does not expose the patient to any additional radiation.

[*] Presenting author, E-mail: janelle.morrier@mail.chuq.qc.ca

KEYWORDS: Permanent prostate brachytherapy; Iodine-125; Seed migration.