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Use of Electromagnetic Transmitter to Monitor Intrafraction Motion in Prostate Cancer Radiotherapy: Application, Stability, Treatment Time

Tulay Ercan [1] , Sefik M. İgdem [2] , Metin M. Barlan [3]

1. Radiation Oncology Nedical Physicist, Gayrettepe Florence Nightingale Hospital, Istanbul, TUR 2. Radiation Oncology, Demiroglu Bilim Universitesi, Istanbul, TUR 3. Radiology, Gayrettepe Florence Nightingale Hospital, Istanbul, TUR

Corresponding author: Tulay Ercan, tulayercan@florence.com.tr

Categories: Radiation Oncology, Quality Improvement, Medical Physics
Keywords: electromagnetic transmitter, hypofractionated, prostate, sbrt, radiotherapy, srs

How to cite this abstract
Ercan T, İgdem S M, Barlan M M (October 24, 2019) Use of Electromagnetic Transmitter to Monitor Intrafraction Motion in Prostate Cancer Radiotherapy: Application, Stability, Treatment Time. Cureus 11(10): a446

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Objective(s): Real-time follow-up of intrafractional organ movement in prostate cancer radiotherapy is especially important in hypofractionated schemes. In this study, patient tolerance, positional stability of the system, effect on treatment time and organ movement information in RayPilot electromagnetic positioning system were examined.

Methods: Between 09 / 17-11 / 18, three gold markers and electromagnetic transmitters with transrectal US guided transperineal route were placed in 6 cases under general anesthesia. Application-related toxicity was assessed by a questionnaire. Ultrahypofractionation was performed in five patients and mild hypofractionation was applied in one patient. Orthogonal kV imaging was performed before each fraction and the position of the markers and transmitter was evaluated. During treatment, prostate movements were recorded in three planes. For long-term movements exceeding 0.3 cm, the treatment was stopped and the movement was expected to pass.

Results: The transmitter was successfully implanted in all cases. Transmitter position was evaluated as optimal in 4 cases and suboptimal in two cases (within the gland but close to the apex). In general, all patients reported mild to moderate disturbance due to the transmitter. In particular, two cases reported tolerable pain during sitting in the perineum. One patient developed perineal infection at the exit site of the transmitter. In 40 (75%) of 53 fractions, the transmitter was in the planning position. The median 0.52 cm (0.36-1.31 cm) shifted from the original position of the transmitter in the remaining 13 fractions. Particularly in one case, each fraction was shifted from the original position of the transmitter and after removal of the transmitter, it was sent to the manufacturer for examination. Median 0.01 cm (-1.79-2.37 cm) lateral, -0.06 cm (-4.19-1.85) longitudinal, and -0.05 cm (-5.9-1.68 cm) vertical movement were recorded during the real-time measurements. 2.65% and 1.5% of the measurements in the lateral direction, 6% and 3% in the longitudinal direction, 6.7% and 5% in the vertical direction were above 3 and 5 mm. Fractions were completed in median 12 minutes (4.14-46.42 minutes).

Conclusion(s): Transmitter placement was well tolerated by the patients. No major problems occurred during insertion and removal of the transmitter. Orthogonal radiographs taken before treatment showed that the transmitter position was not stable. Therefore, it is recommended to

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Published 10/24/2019

use with marker or CBCT for localization. Although it may cause prolonged treatment periods from time to time, treatment can usually be completed within 15 minutes of appointment.