عنوان مقاله:

Monte Carlo Dosimetric Study of Percutaneous Vertebroplasty and Brachytherapy for the Treatment of Spinal Metastases

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خلاصه مقاله:

Background: Percutaneous vertebroplasty employs bone cement for injecting into the fractured vertebral body (VB) caused by spinal metastases. Radioactive bone cement and also brachytherapy seeds have been utilized to suppress the tumor growth in the VB.Objective: This study aims to investigate the dose distributions of low-energy brachytherapy seeds, and to compare them to those of radioactive bone cement, by Monte Carlo simulation.Material and Methods: In this simulation study, nine CT scan images were imported in Geant۴. For the simulation of brachytherapy, I-۱۲۵, Cs-۱۳۱, or Pd-۱۰۳ seeds were positioned in the VB, and for the simulation of vertebroplasty, the VB was filled by a radioactive cement loaded by P-۳۲, Ho-۱۶۶, Y-۹۰, or Sm-۱۵۳ radioisotopes. The dose-volume histograms of the VB, and the spinal cord (SC) were obtained after segmentation, considering that the reference dose is the minimum dose covered ۹۵% of the VB.Results: The SC sparing was improved by using beta-emitting cement because of their steep gradient dose distribution. I-۱۲۵ seeds and Y-۹۰ radioisotope showed better VB coverage for brachytherapy and vertebroplasty techniques, respectively. Pd-۱۰۳ seeds and P-۳۲ radioisotope showed better SC sparing for brachytherapy and vertebroplasty, respectively. The minimum mean doses that covered ۱۰۰% of the VB were ۶۲.۰%, ۵۶.۵%, and ۴۵.۰% for I-۱۲۵, Cs-۱۳۱, and Pd-۱۰۳ seeds, and ۲۸.۳%, ۲۸.۶%, ۳۲.۹%, and ۱۷.۷%, for P-۳۲, Ho-۱۶۶, Y-۹۰, and Sm-۱۵۳ sources, respectively. Conclusion: I-۱۲۵ and Cs-۱۳۱ seeds may be useful for large tumors filling the entire VB, and also for the extended tumors invading multiple vertebrae. Beta-emitting bone cement is recommended for tumors located near the SC.

کلمات کلیدی:

Percutaneous Vertebroplasty, Brachytherapy, Bone Cement, Spinal Metastasis, Vertebral Body, Spinal cord, Dosimetry, Monte Carlo