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中国肿瘤临床 2012, Vol. 39 Issue (16): 1211-1215 DOI: doi:10.3969/j.issn.1000-8179.2012.16.020

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食管癌多原发肿瘤调强放疗与三维适型放疗的剂量学对比研究

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Three-dimensional Conformal, Intensity-modulated, and Volumetric-modulated Arc Radiation Therapy for Multiple Primary Cancers of the Esophagus: A Planning Comparison Study

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摘要

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摘要 在食管多原发癌中比较三维适型、静态调强、容积调强放疗计划的剂量分布。方法: 中山大学肿瘤防治中心放疗科收治的7例食管多原发癌患者, 利用CT模拟定位勾画靶区, 临床靶区包括全食管及全纵隔淋巴引流区, 计划靶区为临床靶区外扩5 mm, 同时设计3DCRT、7野IMRT和单弧VMAT计划, 比较各个放疗计划靶区及危及器官受照射剂量体积。结果: 靶区内最低剂量IMRT与VMAT明显高于3DCRT [D99: (49.4±0.8) Gy, (49.2±0.7) Gy, (43.9±2.8) Gy, P<0.001]; IMRT、VMAT与3DCRT计划比较, 双肺V30稍低、V5明显升高 (V30: 11.8%±2.5%, 10.5%±2.1%, 13.2%±2.1%, P=0.096; V5: 92.5%±3.2%, 93.6%±5.6%, 68.5%±2.1%, P<0.001); 心脏V30明显减少, 脊髓最高剂量明显降低。VMAT与IMRT计划在靶区均匀性、危及器官照射剂量体积无明显差异, VMAT较IMRT治疗时间明显缩短 [(3.0±0.6) min, (6.2±0.2) min, P<0.001]。结论: 调强设计明显改善处方剂量95%以上剂量覆盖的靶区体积, 降低心脏的V30及脊髓最高剂量, 但同时明显增加全肺V5体积。由于V5体积高于目前的推荐限制剂量, 调强设计全食管/全纵隔放射治疗需要谨慎。另外单弧VMAT与IMRT计划剂量分布无明显区别, 可使治疗时间缩短52%。

关键词: 食管癌 放射疗法 调强适型放疗 剂量学

Abstract: To compare the doses distribution among 3DCRT, IMRT, and VMAT for multiple primary cancers of the esophagus. **Methods:** Seven patients with multiple primary cancers of the esophagus were selected. The patients underwent a CT simulator scan, and the targets were contoured. The clinical target volume (CTV) included the entire esophagus and lymph node areas in the mediastinum. The planning target volume included the CTV plus a 5 mm margin. Three radiotherapy plans were designed for each patient, namely, 3DCRT, seven-field IMRT, and one-arch VMAT. The dose distribution in the target volumes and critical organs were compared among the three plans. **Results:** D99 of the target volume of the IMRT or VMAT plan was significantly higher than that of the 3DCRT plan (49.4 ± 0.8, 49.2 ± 0.7, and 43.9 ± 2.8 Gy, respectively; P < 0.001). Compared with the 3DCRT plans, we found that V30 was lower but V5 of the lungs was significantly increased in IMRT or VMAT (IMRT vs. VMAT vs. 3DCRT, V30: 11.8% ± 2.5%, 10.5% ± 2.1%, and 13.2% ± 2.1%, P = 0.096; V5: 92.5% ± 3.2%, 93.6% ± 5.6%, and 68.5% ± 2.1%, P < 0.001). V30 in the heart and D1 in the spinal cord were also significantly lower in IMRT and VMAT. The VMAT plan had no significant difference in the dose homogeneity of the target volume and DVH of critical organs, but had less treatment time (VMAT vs. IMRT, 3.0 ± 0.6 min, 6.2 ± 0.2 min, P < 0.001) compared with the IMRT plan. **Conclusion:** IMRT or VMAT radiotherapy plan improves the target volume by over 95% of the isocenter dose line. These radiotherapy plans decrease V30 in the heart and D1 in the spinal cord, but significantly increase V5 in the lungs. Given that V5 in the lungs is much higher than the current recommended lung dose limitation, the use of IMRT or VMAT in treating the entire esophagus or mediastinum should be performed carefully. The dose distribution of the single-arc VMAT plan has no significant difference with that of the IMRT plan, but the treatment time is shortened by 52%.

Key words: Esophageal cancer Radiotherapy IMRT Dose distribution

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Three-dimensional Conformal, Intensity-modulated, and Volumetric-modulated Arc Radiation Therapy for Multiple Primary Cancers of the Esophagus: A Planning Comparison Study[J]. Chinese Journal of Clinical Oncology, 2012, 39(16): 1211-1215.

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