

## 论著

### 图像引导下放射治疗中心型非小细胞肺癌的配准范围、配准方式及靶区外放的研究

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**摘要:** 目的:研究图像引导下放射治疗(imaging-guided radiation therapy, IGRT)中心型非小细胞肺癌(non-smallcell lung cancer, NSCLC)中不同配准范围、配准方式对千伏锥形束CT(kilo-voltage cone beam CT, kVCBCT)图像与计划CT图像配准的影响,并探讨临床靶区(clinical target volume, CTV)的外放范围,为更好实施精确放射治疗提供依据。方法:选取26例中心型NSCLC患者每人在IGRT的摆位误差纠正前获得的kVCBCT图像4幅,共104幅图像进入分析。首先采用灰度配准加手动与治疗计划的CT图像进行配准,比较肿瘤、肿瘤+椎体两种配准范围的差异;其次以肿瘤+椎体为配准范围与治疗计划的CT图像进行配准,比较骨性配准加手动与灰度配准加手动两种配准方式的差异及所需时间。最后将所有患者200幅摆位误差纠正前kVCBCT图像以肿瘤+椎体为配准范围,采用骨性加手动配准方式与计划CT图像进行配准,记录其摆位误差并计算CTV的外放范围。结果:采用灰度配准加手动配准,肿瘤与肿瘤+椎体两种配准范围在X, Y, Z轴的平移及旋转误差差异均无统计学意义( $P>0.05$ )。以肿瘤+椎体作为配准范围,骨性配准加手动、灰度配准加手动两种配准方式在X, Y, Z轴平移及旋转摆位误差差异均无统计学意义( $P>0.05$ );而骨性配准加手动配准时间 $[(1.9\pm 0.3) \text{ min}]$ 小于灰度配准加手动 $[(3.1\pm 0.2) \text{ min}]$ 。以肿瘤+椎体为配准范围,采用骨性配准加手动配准, X, Y, Z轴方向CTV外放范围分别为5.3, 4.9, 5.7 mm。结论:IGRT中心型NSCLC可选择肿瘤+椎体作为配准范围,并建议采用骨性配准加手动方式进行图像配准;为减少摆位误差影响,提高治疗精确度,CTV外放计划靶区(planning target volume, PTV)时建议各方向外放6 mm。

**关键词:** 癌,非小细胞肺 图像引导放射治疗 图像配准范围 图像配准方法

### Scope and method of image registration and clinical target volume margin for central-type non-small cell lung cancer in image-guided radiotherapy

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**Abstract:** Objective: To determine the influence of different registration scopes and methods on kilo-voltage cone beam CT (kVCBCT) image and CT image and to estimate the appropriate clinical target volume (CTV)-to-planned target volume (PTV) margin for central-type non-small cell lung cancer in image-guided radiation therapy (IGRT).

**Methods:** Twenty-six patients with central-type non-small cell lung cancer (NSCLC) who received IGRT were enrolled in this study and totally 104 flames of kVCBCT scanning acquired before radiotherapy were analyzed. First, registrations were performed by gray plus manual match and were compared among different registration scopes of tumor and tumor plus vertebra. Then, the results of registration as well as time cost using tumor plus vertebra as registration scope were compared among different registration methods of gray plus manual match and bone plus manual match. At last, 200 registrations using tumor plus vertebra as the registration scope performed by bone plus manual match were recorded and the CTV-to-PTV margin was calculated.

**Results:** There was no significant difference in X, Y and Z translational and rotational movements between the registration scopes of tumor and tumor plus vertebra when gray plus manual match was used as the registration method ( $P>0.05$ ). The registration results of gray plus manual match and bone plus manual match were equal when tumor plus vertebra was used as the registration scope ( $P>0.05$ ), but the time cost of bone plus manual match  $[(1.9\pm 0.3) \text{ min}]$  was shorter than that of gray plus manual match  $[(3.1\pm 0.2) \text{ min}]$ . The CTV-to-PTV margins were 5.3, 4.9 and 5.7 mm in X, Y, and Z directions respectively.

**Conclusion:** For central-type NSCLC, tumor and vertebra can be used as registration scope and the bone plus manual match is suggested in IGRT. To avoid errors, we suggest a CTV-

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