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Title: Iterative reconstruction algorithm in image quality and radiation dose in coronary computed tomography angiography

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摘要: 目的 探讨新双源CT迭代重建算法(sinogram affirmed iterative reconstruction,SAFIRE)与滤波反投影(filtered back projection,FBP)算法冠状动脉CT血管造影(coronary computed tomography angiography,CCTA)图像质量的差异,评价不同管电压行CCTA的辐射剂量。方法 对置入模拟左右冠状动脉的仿真体模,采用100、120 kV管电压行CCTA检查,分别进行FBP及SAFIRE算法的图像重建,测量CT值并计算SNR、CNR、CT值SD。通过体模内放置热释光剂量计(TLD),测量在不同管电压相同管电流成像的器官吸收剂量,并计算有效剂量。比较不同CCTA成像条件的图像质量。结果 (1)不同管电压下,SAFIRE算法重建的图像质量均优于FBP算法。(2)管电压及重建算法固定,随着管电流的增加(200~360 mA),图像质量呈逐渐改善趋势,340 mA以上图像质量指标趋于稳定。(3)SAFIRE重建算法时,120 kV图像质量优于100 kV,CNR、SNR、CT值SD的差异均有统计学意义( $P<0.05$ )。两种重建算法图像的平均CT值比较,组间100 kV高于120 kV,但组内差异无统计学意义( $P>0.05$ )。(4)80~120 kV的CCTA成像,患者器官吸收剂量和有效剂量均逐渐增加。结论 采用SAFIRE算法在相同扫描条件下可明显提高图像质量。在CCTA成像适宜管电压范围内,患者的器官吸收剂量和有效剂量随着管电压升高而增加。

Abstract: Objective To investigate the difference of image quality between sinogram affirmed iterative reconstruction (SAFIRE) and filtered back projection (FBP) in

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the radiation dose in dual-source computed tomography (CCTA), and to evaluate the radiation dose in dual-source computed tomography (DSCT) using different tube voltages. **Materials** A Chinese anthropomorphic chest phantom with simulated coronary arteries and thermoluminescent dosimeters (TLD) was given CCTA using different tube voltages (100 and 120 kV). The CCTA data sets of the two groups were reconstructed with SAFIRE and FBP. The CT value was measured, and the carrier noise ratio (CNR), signal noise ratio (SNR) and standard deviation (SD) of CT value were calculated. The organic radiation doses were recorded and were converted into effective doses. The image quality of each group was compared by Dunnett *t*-test. The paired *t*-test was conducted to analyze the image quality at 120 kV/340 mA and 100 kV/340 mA. **Results** (1) The image quality of SAFIRE reconstruction was better than that of FBP reconstruction in different tube voltages. (2) The image quality tended to be improved along with the increase of tube current from 200 to 360 mA, and became stable when the tube current came to 340 mA or more. (3) In SAFIRE reconstruction, the SNR, CNR, and SD of CT value were statistically significant between the two groups (100 and 120 kV) ( $P < 0.05$ ). (4) Both the effective doses and organic radiation doses increased along with the increase of scan parameters of CCTA from 80 to 120 kV. **Conclusion** The new reconstruction algorithm of SAFIRE can significantly improve the image quality under the same scan parameters. The effective doses and organic radiation doses increase along with the increase of CCTA tube voltage in an appropriate range.

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