

- Cardiac
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Deep learning–based image restoration algorithm for coronary CT angiography

- Fuminari Tatsugami 
- Toru Higaki,
- Yuko Nakamura,
- Zhou Yu,
- Jian Zhou,
- Yujie Lu,
- Chikako Fujioka,
- Toshiro Kitagawa,
- Yasuki Kihara,
- Makoto Iida &
- Kazuo Awai

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Abstract

Objectives

The purpose of this study was to compare the image quality of coronary computed tomography angiography (CTA) subjected to deep learning–based image restoration (DLR) method with images subjected to hybrid iterative reconstruction (IR).

Methods

We enrolled 30 patients (22 men, 8 women) who underwent coronary CTA on a 320-slice CT scanner. The images were reconstructed with hybrid IR and with DLR. The image noise in the ascending aorta, left atrium, and septal wall of the ventricle was measured on all images and the contrast-to-noise ratio (CNR) in the proximal coronary arteries was calculated. We also generated CT attenuation profiles across the proximal coronary arteries and measured the width of the edge rise distance (ERD) and the edge rise slope (ERS). Two observers visually evaluated the overall image quality using a 4-point scale (1 = poor, 4 = excellent).

Results

On DLR images, the mean image noise was lower than that on hybrid IR images (18.5 ± 2.8 HU vs. 23.0 ± 4.6 HU, $p < 0.01$) and the CNR was significantly higher ($p < 0.01$). The mean ERD was significantly shorter on DLR than on hybrid IR images, whereas the mean ERS was steeper on DLR than on hybrid IR images. The mean image quality score for hybrid IR and DLR images was 2.96 and 3.58, respectively ($p < 0.01$).

Conclusions

DLR reduces the image noise and improves the image quality at coronary CTA.

Key Points

• *Deep learning–based image restoration is a new technique that employs the deep convolutional neural network for image quality improvement.*

- *Deep learning–based restoration reduces the image noise and improves image quality at coronary CT angiography.*
- *This method may allow for a reduction in radiation exposure.*

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Abbreviations

CNR:
Contrast-to-noise ratio

CTA:
Computed tomography angiography

DCNN:
Deep convolutional neural network

DLR:
Deep learning–based image restoration

ERD:
Edge rise distance

ERS:
Edge rise slope

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Author information

Affiliations

Department of Diagnostic Radiology, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima, 734-8551, Japan

Fuminari Tatsugami, Toru Higaki, Yuko Nakamura, Makoto Iida & Kazuo Awai

Canon Medical Research USA, Inc., 706 N Deerpath Drive, Vernon Hills, IL, 60061, USA

Zhou Yu, Jian Zhou & Yujie Lu

Department of Radiology, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima, 734-8551, Japan

Chikako Fujioka

Department of Cardiovascular Medicine, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima, 734-8551, Japan

Toshiro Kitagawa & Yasuki Kihara

Corresponding author

Correspondence to Fuminari Tatsugami.

Ethics declarations

Guarantor

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Methodology

- retrospective
- diagnostic or prognostic study
- performed at one institution

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