

Less Radiations, Better Images: A Systematic review and Meta-analysis of Artificial Intelligence-based Computed Tomography Reconstruction

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BACKGROUND

- Computed tomography (CT) is an essential diagnostic imaging modality but contributes substantially to medical radiation exposure.
- Reduction of CT radiation dose traditionally results in increased image noise and degradation of diagnostic image quality.
- Artificial intelligence-based deep learning reconstruction (DLR) has emerged as a promising approach to overcome this trade-off by suppressing image noise while preserving spatial resolution and diagnostic information.

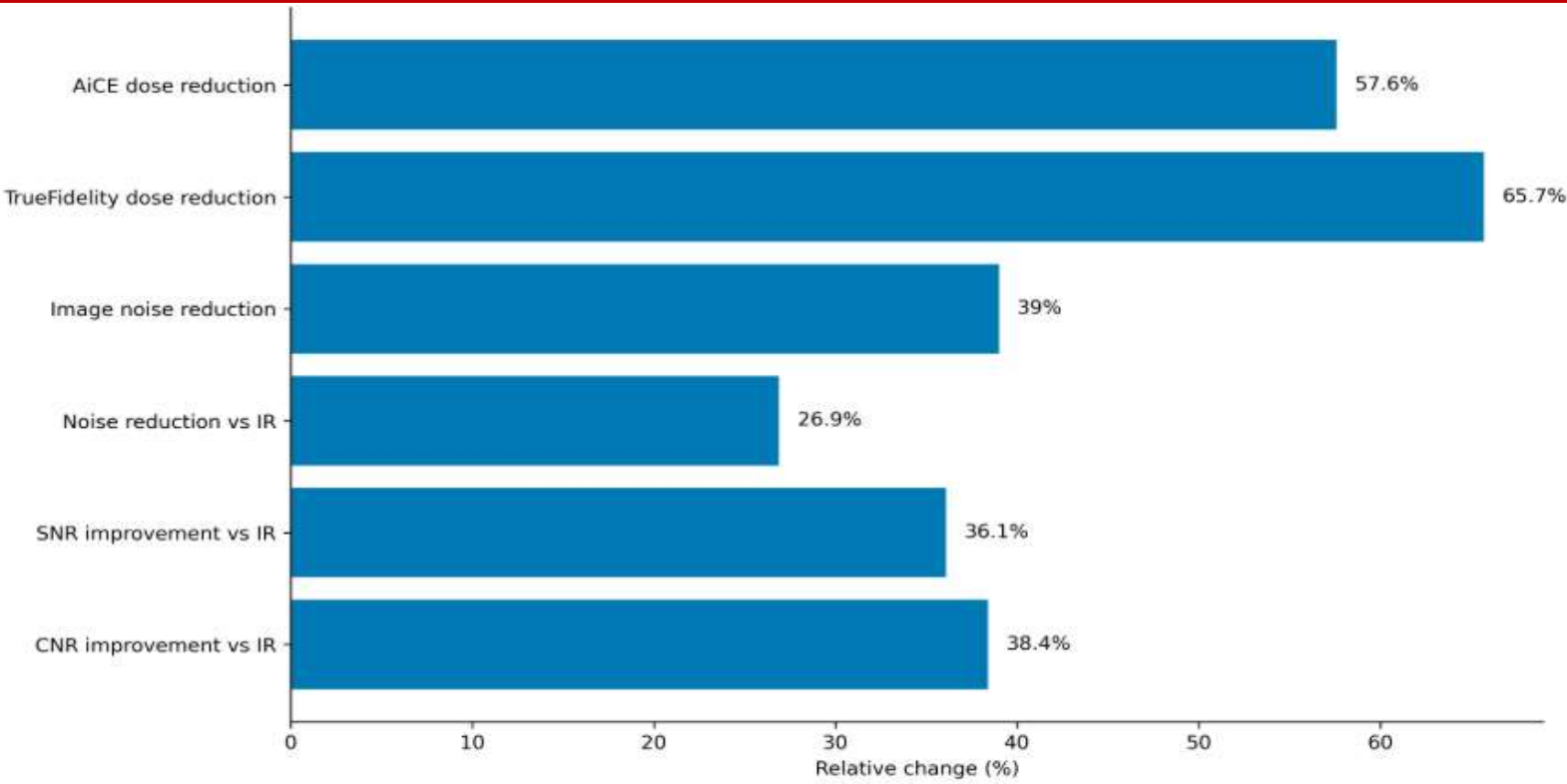
OBJECTIVE

- To evaluate whether AI-based CT reconstruction can simultaneously reduce radiation dose and preserve or improve diagnostic image quality across anatomical regions and CT applications as compared to conventional techniques.

METHODOLOGY

- PubMed/MEDLINE, Embase, Scopus, Web of Science and Cochrane Library for studies evaluating AI/deep learning-based CT reconstruction compared with Filtered back projection (FBP) and/or iterative reconstruction.
- **Parameters extracted:**
 - CT Dose Index Volume (CTDIvol), Dose–Length Product (DLP), effective dose, image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), subjective image quality and diagnostic confidence.
- Risk of bias and between-study heterogeneity were assessed using established systematic-review methodology.

IMPACT OF AI-BASED CT RECONSTRUCTION



CONVENTIONAL vs. AI-BASED CT RECONSTRUCTION

Parameter	FBP	Conventional IR	AI/DLR
CTDIvol	Higher	↓	Further ↓
DLP	Higher	↓	Further ↓
Effective dose	Higher	↓	Further ↓
Image noise	Higher	↓	Further ↓
SNR	Lower	↑	Further ↑
CNR	Lower	↑	Further ↑
Subjective image quality	Reference	Improved	Maintained / improved
Diagnostic confidence	Reference	Improved	Maintained / improved

RESULTS & ANALYSIS

- AI-based DLR consistently **reduced radiation exposure** compared with conventional reconstruction, with reported dose reductions of **34–89%**, including **35.1–78.5%** in abdominal CT.
- **Mean dose reductions** were **57.6%** with **AiCE** and **65.7%** with **TrueFidelity**.
- **Image noise** was reduced by **22–57.3%**
- **Coronary CT** demonstrated **26.9%** lower noise, **36.1%** higher SNR, and **38.4%** higher CNR versus IR.
- **Compared with FBP**, DLR reduced noise by 59.6% and increased SNR by 182%.
- Subjective image quality and diagnostic confidence were generally maintained or improved despite dose reduction, with higher diagnostic confidence consistently reported in abdominal CT studies.

KEY TAKEAWAYS

- ✓ AI-based deep learning reconstruction substantially reduces CT radiation exposure compared with conventional FBP/IR.
- ✓ The findings support DLR as a promising strategy for dose-efficient CT without compromising diagnostic performance.
- ✓ Standardized protocols and prospective clinical validation are needed to define optimal dose-reduction thresholds across anatomical regions and clinical applications.

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