Optimizing the CTPA Protocol – Reduced Dose with Preserved Image Quality Using Phantom Model Validation

VSH Chan, M Law, WC Wong, CF Cheung, F Ng, PM Wong, TPW Lam

Background and Aims

Pulmonary embolism (PE) is a frequent and potentially fatal disease; CTPA is currently the gold standard for diagnosis for PE, and is one of the most commonly performed thoracic CT scans in the "on-call" setting.

CTPA has excellent sensitivity and specificity.

There have been rapid improvements made in scanning and post-processing techniques, and hence, an increased awareness for methods to reduce radiation exposure and dose.

The authors herein sought to optimize the department's existing CTPA protocol in order to reduce dose with an attempt to maintain image quality.

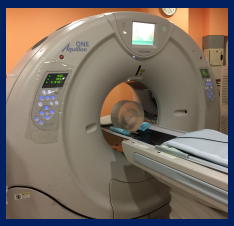
Materials and Methods

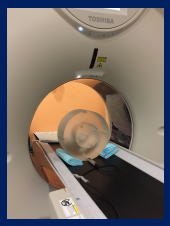
CT scanner: Toshiba Aquillion One; Protocol: For CT pulmonary angiography

Validation on Catphan model with radiation doses measured, with 3 different protocols applied

Original department protocol with 100 kV, automatic mA setting, and Standard Deviation (SD) of 9; Clinical Radiology (Nania, et al, Clinical Radiology 73, 2018, 320.e1-320.e8), with recommended protocol of 120 kV, minimum mA lowered to 40 mA, SD of 19; our new tested protocol, with 100 kV (current department setting), automatic mA (current setting), and SD increased to 15 (solitary change)

Images acquired and post-processing with standardized window levels





Results

Original Protocol:
- 100 kV
- Automatic mA
- SD 9

Adapted Protocol from *Clinical Radiology*:
- 120 kV
- 40 mA
- SD 19

Proposed Local Protocol:
- 100 kV
- Automatic mA
- SD 15

Detector Position	Original Protocol (mGy)	From *Clinical Radiology* (mGy)	Proposed Protocol (mGy)
Central	79.8	71.8	66.5
Right	162.6	114.1	120.6
Bottom	152.2	141.7	133.3
Left	161.8	116.7	130.0
Top	166.0	152.2	145.1
Average	144.5	119.3	119.1

	Original Protocol	From *Clinical Radiology*	Proposed Protocol
DLP (mGy.cm)	242.2	233.8	215.7
Difference from UK National DRL for DLP (= 440 mGy.cm)	-197.8	-206.2	-224.3
$CTDI_{vol}$ (mGy)	11.5	11.1	10.2
Difference from UK National DRL for $CTDI_{vol}$ = 13 (mGy)	-1.5	-1.9	-2.8

Conclusions

Spatial resolution is similar across 3 different protocols, with subjective image quality analysis performed by radiology specialists of varying clinical experience.

Although current department protocol fulfills UK national DRL and $CTDI_{vol}$, new protocol can further reduce dose with preserved image quality.

With only minor adjustments in SD, optimization of the CTPA scan can be performed.

放射科 Radiology

RADIOLOGY HONG KONG 2019