Optimized Camera-based Patient Positioning in CT: Impact on Radiation Exposure.

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Study Protocol and Statistical Analysis Plan

Title: Optimized Camera-based Patient Positioning in CT: Impact on Radiation Exposure.

Description of the study:

To investigate different options for patient positioning. Target parameters are the achievable differences in radiation exposure and the deviation from isocenter.

Design:

Retrospective

Status: The patients are positioned laser guided on the CT table by the trained technicians for the CT examinations.

A 128-slice single-source CT scanner was used. This CT scanner system with an integrated 3D camera system offers a recommendation for the patient's table positioning.

Statistical analysis

For radiation exposure analysis:

Power analysis was performed with a sample size of 1806 patients for each group to detect an effective size of 0.12 for radiation exposure analysis based on test measurements on an anthropomorphic phantom.

Isocenter accuracy:

According to previous results, a power analysis for the isocenter accuracy was performed with a group size of 10 patients in each group.

A chi-squared test was used to analyze patients' characteristics.

Levine's test was used for calculating the equality of variances followed by student's t-test for independent samples. A p value < 0.05 was considered indicating statistically significant differences. For the study, the patients are not additionally exposed to radiation or contrast media. Tests that require a higher radiation exposure (perfusion) are excluded.

The evaluation of the data is carried out anonymously via a dose management system.

The duration of the study will be approximately 12 months.

Results:

	Cameramode	H	Mean value	Standard- deviation	P value
isocenter	off	1557	-10.9	16.6	0.000
	on	1561	-3.8	10.1	
Reconstruction diameter	off	1557	400.8	40.8	0.251
	on	1561	399.2	40.1	
pitch	off	1557	0.8	0.2	0.894
	on	1561	0.8	0.2	
mAS max	off	1557	219.8	114.2	0.042
	on	1561	211.2	112.2	
kVp	off	1557	94.8	18.6	0.796
	on	1561	95.0	18.8	
Table height	off	1557	170.0	20.4	0.000
	on	1561	165.6	16.2	
age	off	1557	64.1	15.8	0.423
	on	1561	63.7	16.1	
BMI	off	1557	26.1	5.4	0.957
	on	1561	26.1	5.5	
weight	off	1557	76.2	18.4	0.885
	on	1561	76.3	18.0	
height	off	1557	1704.6	97.8	0.506
	on	1561	1707.0	96.4	

Legend:
mAs = milliampere-seconds; kVp = kilovoltage peak; BMI= Body Mass Index

	Cameramode	H	Mean value	Standard-deviation	P value
ED	off	1557	3.5	2.9	0.053
	on	1561	3.3	2.7	
DLP	off	1557	342.0	280.7	0.033
	on	1561	321.1	266.7	
$CTDI_{vol}$	off	1557	6.8	4.6	0.011
	on	1561	6.4	4.3	
Organ dose of eye lens	off	1557	0.1	0.1	0.21
	on	1561	0.1	0.3	
Organ dose of heart	off	1557	3.9	3.1	0.443
	on	1561	3.8	3.0	
Organ dose of colon	off	1557	3.5	3.9	0.015
	on	1561	3.1	3.6	
Organ dose of ovaries	off	1557	3.1	3.6	0.902
	on	1561	3.1	3.5	
Organ dose of red bone marrow	off	1557	2.4	2.1	0.049
	on	1561	2.3	1.9	
Organ dose of thyroid gland	off	1557	0.3	0.4	0.205
	on	1561	0.3	0.8	
Organ dose of upper colon	off	1557	3.7	3.9	0.012
	on	1561	3.3	3.6	
Organ dose of salivary glands	off	1557	0.0	0.0	0.226
	on	1561	0.0	0.2	
Organ dose of esophagus	off	1557	2.3	1.7	0.355
	on	1561	2.2	1.7	

Legends: Dose Length Product (DLP) in mGy*cm, Effective Dose (ED) in mSv, CT Dose Index ($CTDI_{vol}$) in $mGy_{,}$ and Organ Dose in mSv.