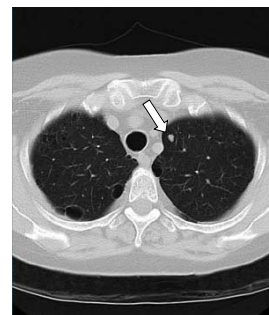


Accuracy of pulmonary nodule size measurement on chest tomosynthesis

Christina Söderman, Åse Johnsson, Jenny Viklund, Rauni Rossi Norrlund, David Molnar, Angelica Svalkvist and Magnus Båth

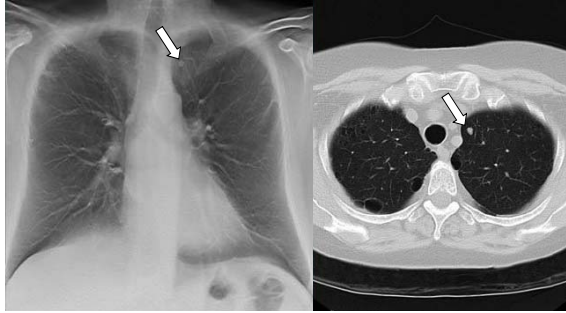
BACKGROUND

- Pulmonary nodule
 - Malignant or benign?
 - Follow up with CT – growth?



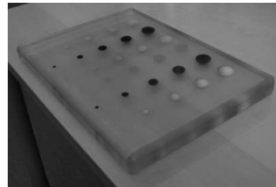
BACKGROUND

- Pulmonary nodule
 - Malignant or benign?
 - Follow up with CT – growth?
- Tomosynthesis instead?
 - Take pressure of CT resources
 - Lower patient doses



BACKGROUND

- Previous phantom study
- CT and tomosynthesis similar precision and accuracy



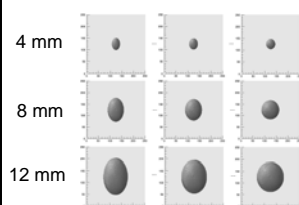
Measurement error (2 SD)	
CT	0,15 mm (0,90 mm)
Tomo	-0,10 mm (0,64 mm)

PURPOSE

- To further investigate observer nodule measurement error
 - Dependence on examination dose and nodule size
 - In anatomical background

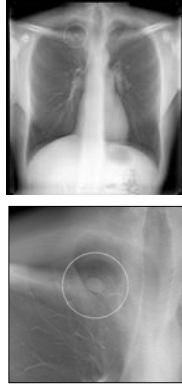
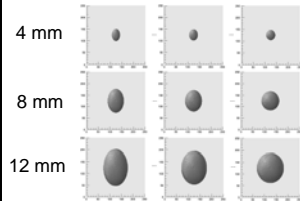
METHOD

- Ellipsoid shaped nodules



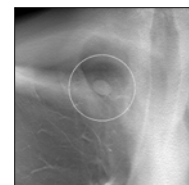
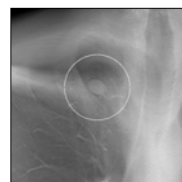
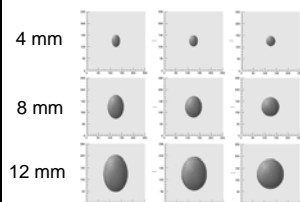
METHOD

- Ellipsoid shaped nodules
- Insert in clinical images

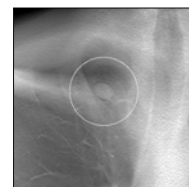


METHOD

- Ellipsoid shaped nodules
- Insert in clinical images
- Simulate lower dose



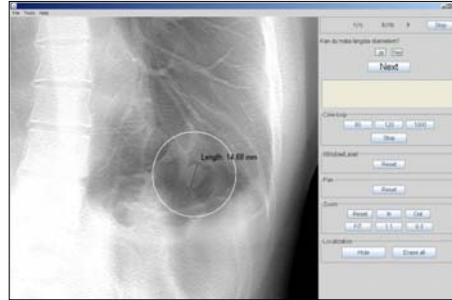
50 % dose



32 % dose

METHOD

- Observer task:
 - Determine the longest diameter
- Possible to state the nodule non-measurable
- Two observers completed



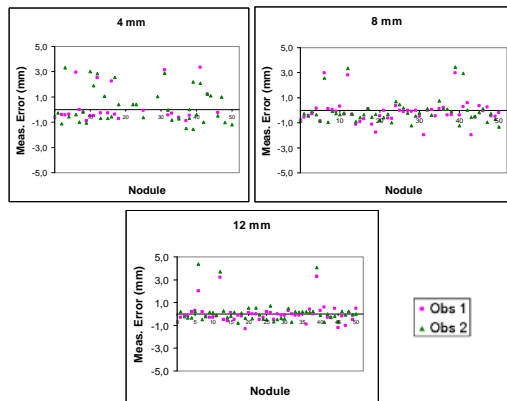
RESULTS

Measurement error (2 SD)	
CT	0,15 mm (0,90 mm)
Tomo	-0,10 mm (0,64 mm)

- All nodule sizes
- Original (100 %) dose level

Mean measurement error (2 SD)			
	4 mm	8 mm	12 mm
Obs 1	0,3 (2,8)	-0,1 (2,0)	0,0 (1,6)
Obs 2	0,3 (2,8)	-0,1 (2,2)	0,1 (2,2)

Non measurable			
	4 mm	8 mm	12 mm
Obs 1	49%	3%	0%
Obs 2	32%	4%	0%



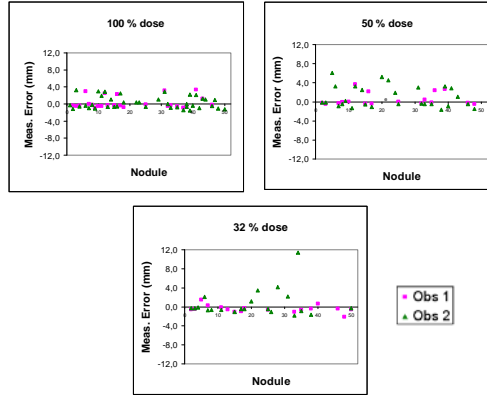
RESULTS

Measurement error (2 SD)	
CT	0,15 mm (0,90 mm)
Tomo	-0,10 mm (0,64 mm)

- 4 mm
- All dose levels

Mean measurement error (2 SD)			
	32 % dose	50 % dose	100 % dose
Obs 1	-0,4 (1,6)	0,5 (2,6)	0,3 (2,8)
Obs 2	0,6 (5,8)	1,0 (4,4)	0,3 (2,8)

Non measurable			
	32 % dose	50 % dose	100 % dose
Obs 1	63 %	65 %	49 %
Obs 2	54 %	50 %	32 %



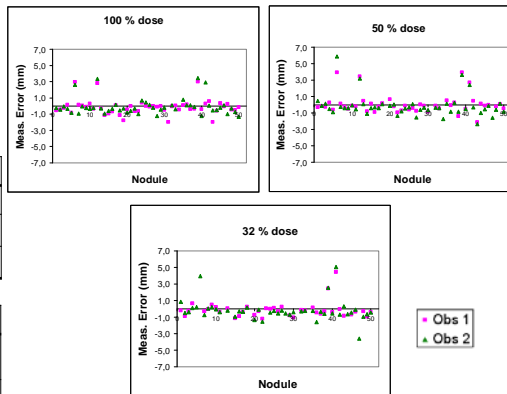
RESULTS

Measurement error (2 SD)	
CT	0,15 mm (0,90 mm)
Tomo	-0,10 mm (0,64 mm)

- 8 mm
- All dose levels

Mean measurement error (2 SD)			
	32% dose	50% dose	100% dose
Obs 1	-0,1 (2,0)	0,1 (2,4)	-0,1 (2,0)
Obs 2	-0,2 (2,6)	-0,2 (2,8)	-0,1 (2,2)

Non measurable			
	32 % dose	50 % dose	100 % dose
Obs 1	18%	8%	3%
Obs 2	9%	3%	4%



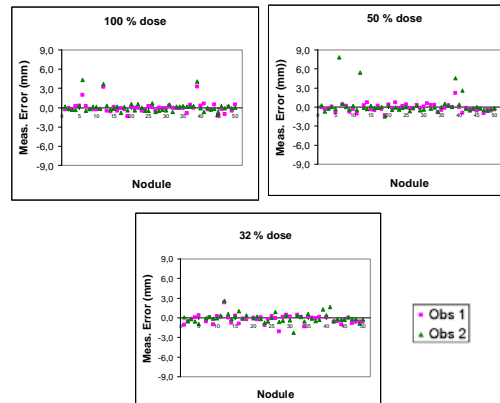
RESULTS

Measurement error (2 SD)	
CT	0,15 mm (0,90 mm)
Tomo	-0,10 mm (0,64 mm)

- 12 mm
- All dose levels

Mean measurement error (2 SD)			
	32% dose	50% dose	100% dose
Obs 1	-0,2 (1,4)	-0,1 (1,2)	0,0 (1,6)
Obs 2	0,0 (1,4)	0,3 (3,2)	0,1 (2,2)

Non measurable			
	32% dose	50% dose	100% dose
Obs 1	11%	2%	0%
Obs 2	4%	1%	0%



DISCUSSION

- Measurement error larger than on CT and tomosynthesis with phantom
 - Complex background
 - Overestimation of small nodules
 - Standard deviation larger (lower precision) - Outliers
- Relatively large number of small nodules non-measurable
 - Contradicting previous results - CT reference
- Dose dependence
 - Number of non-measurable nodules
 - Larger measurement error
- Study of detection of size change needed to establish clinical usefulness

CONCLUSION

- Measurement error worse than previously seen on simple phantom
- Dependency of dose seen on both number of non-measurable and measurement error