

Pancreatic tumors: Low-kilovoltage computed tomography (CT) for improved detection - a phantom study

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Background

- 13th most common cancer worldwide
- 4th leading cause of cancer death
- 80 % unresectable
- 5 % overall 5-year survival rate
- 20 % 5-year survival rate after surgery

Late detection - bad prognosis

Small tumors – difficult to detect

MDCT sensitivity for hypodense pancreatic lesions

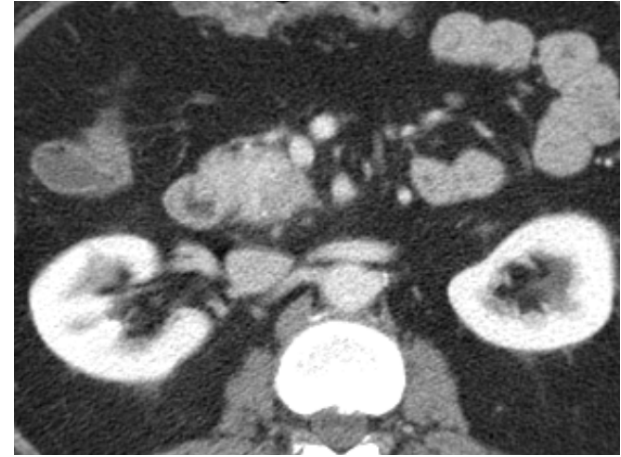
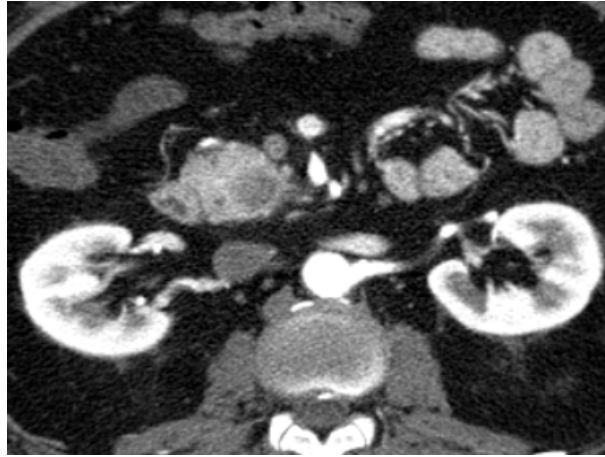
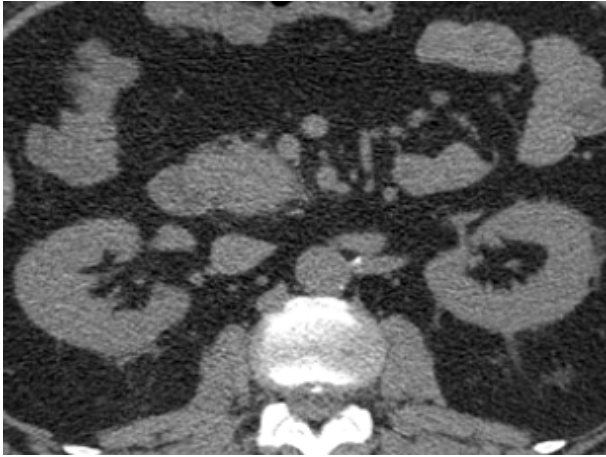
- > 2 cm 100 %
- < 2 cm 60-77 %

- *Pauls S et al., Rontgenpraxis 2003*
- *Bronstein YL et al., Am J Roentgenol 2004*

Our experience

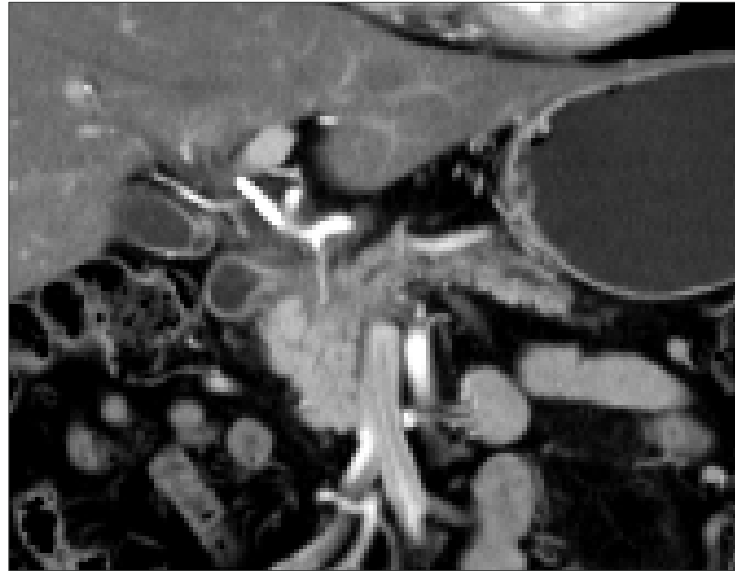
- > 1 cm ~100 %
- < 1 cm challenging problem

Contrast tumor-parenchyma



Parenchymal phase best

Contrast tumor-parenchyma

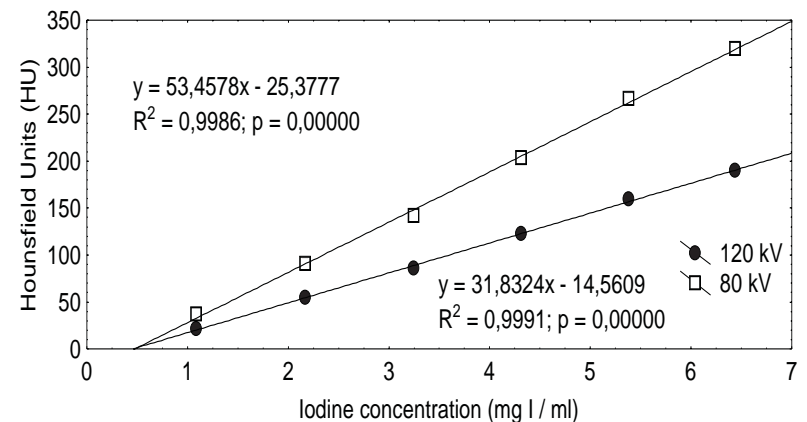


Sometimes hard to detect and stage

- CT 120 kV
 - ✓Parenchyma 130 HU
 - ✓Lesions 110 HU

} 20 HU
- CT 80 kV
 - ✓Parenchyma 219 HU
 - ✓Lesions 185 HU

} 34 HU



Aim

Does the decrease of tube voltage, from 120 kV to 80 kV, improve the detection of small hypovascularized pancreatic tumors?

Method and materials



Catphan® 600 phantom
64 channel MDCT GE LightSpeed VCT

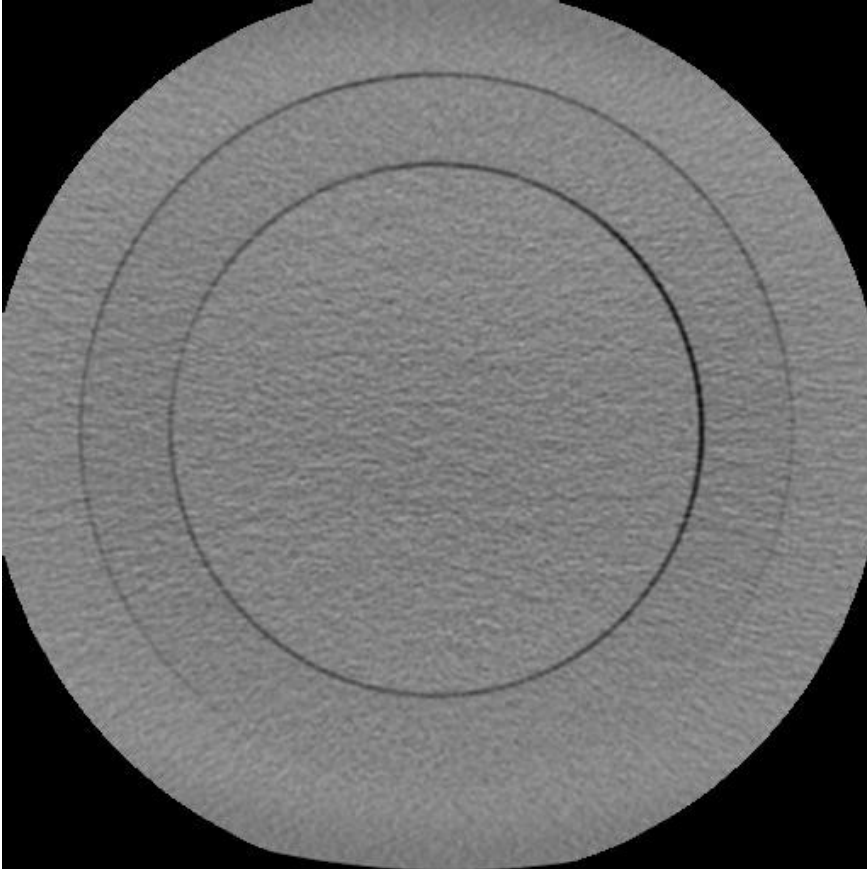
Standard protocol A

- Tube voltage: 120kV
- Tube current: 160mA
- Radiation dose: 15mGy
- Noise: 15 HU
- Rotation time: 0,6 s
- Slice collimation: 0,625mm
- Slice thickness: 3 mm
- Increment: 1,5 mm

Method and materials

Protocol	Tube voltage [kV]	Tube Current [mA]	CTDIvol [mGy]	Noise [HU]
A Standard	120	160	15	15
B Same dose	80	500	15	17
C Same noise	80	675	20	15

Method and materials



- **100 cases:**

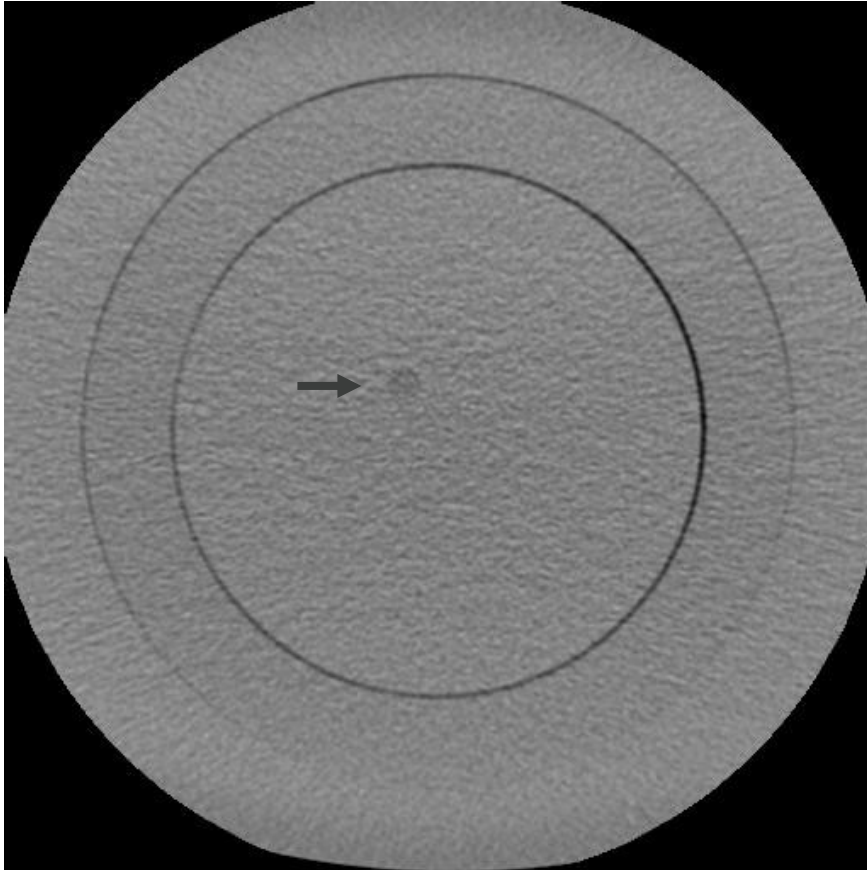
- ✓ 57 cases 1-3 spherical lesions
- ✓ 2-10 mm diameter

- **3 readers:**

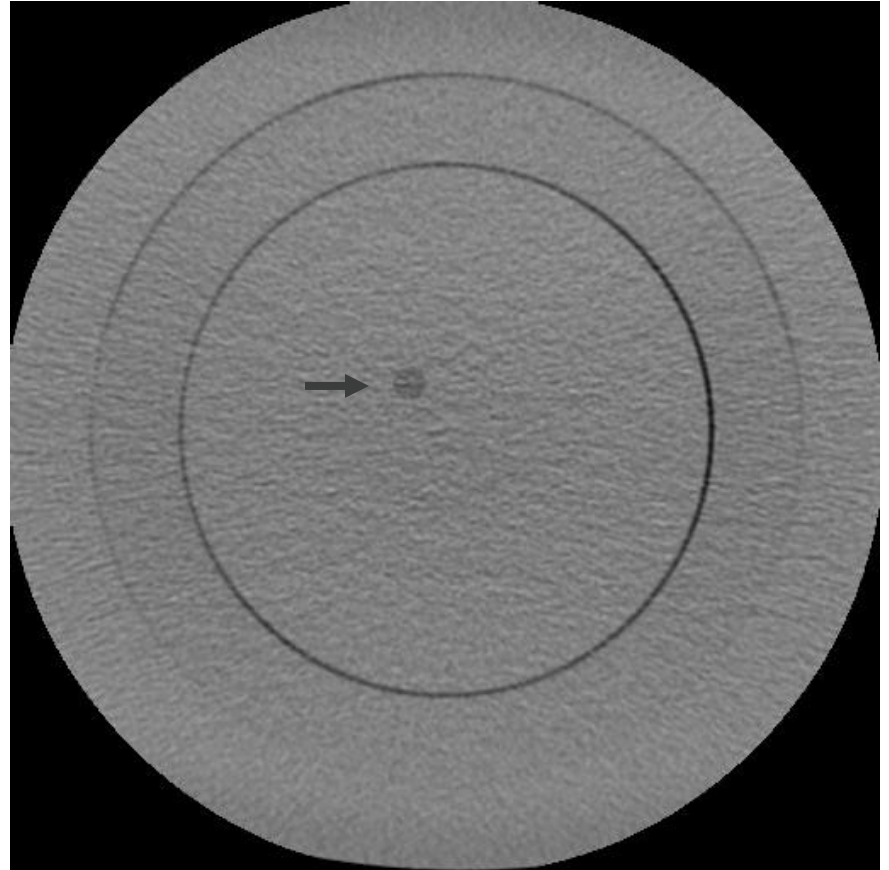
- ✓ fixed & free window settings

Method and materials

10 mm lesion



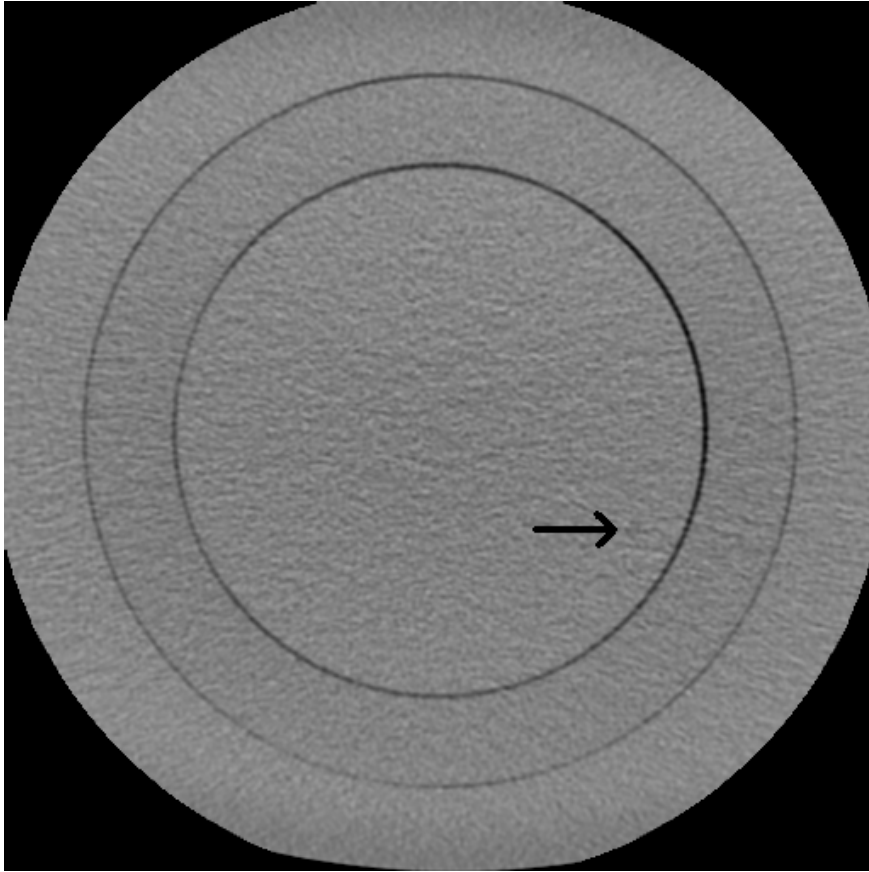
120kV



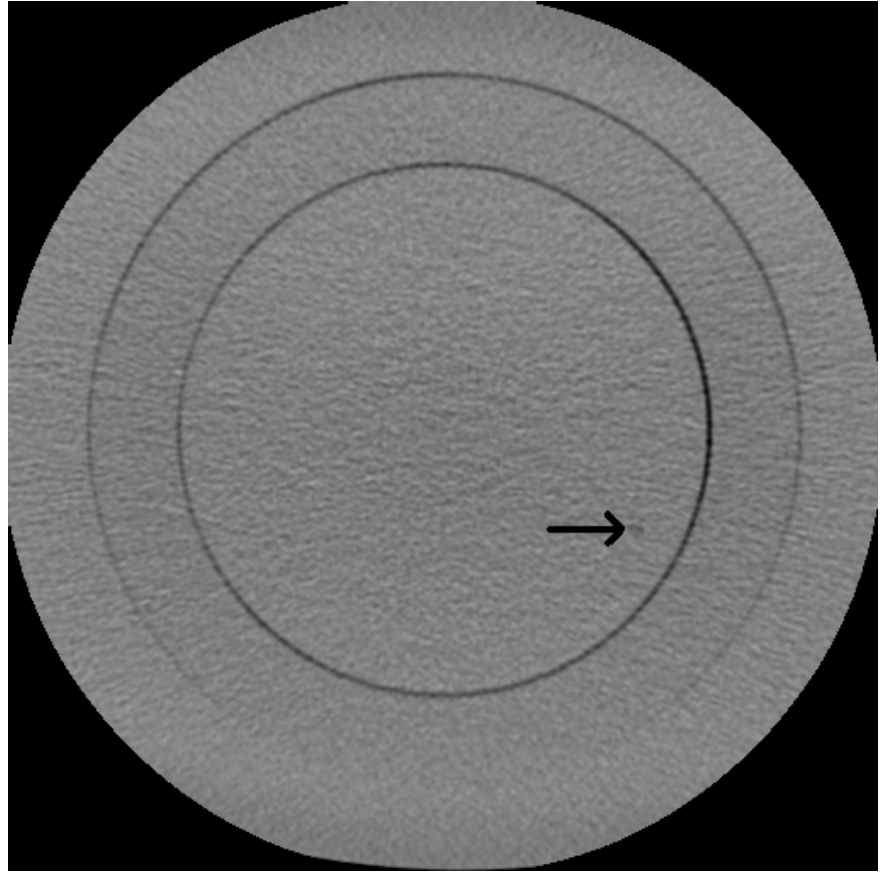
80kV

Method and materials

5 mm lesion

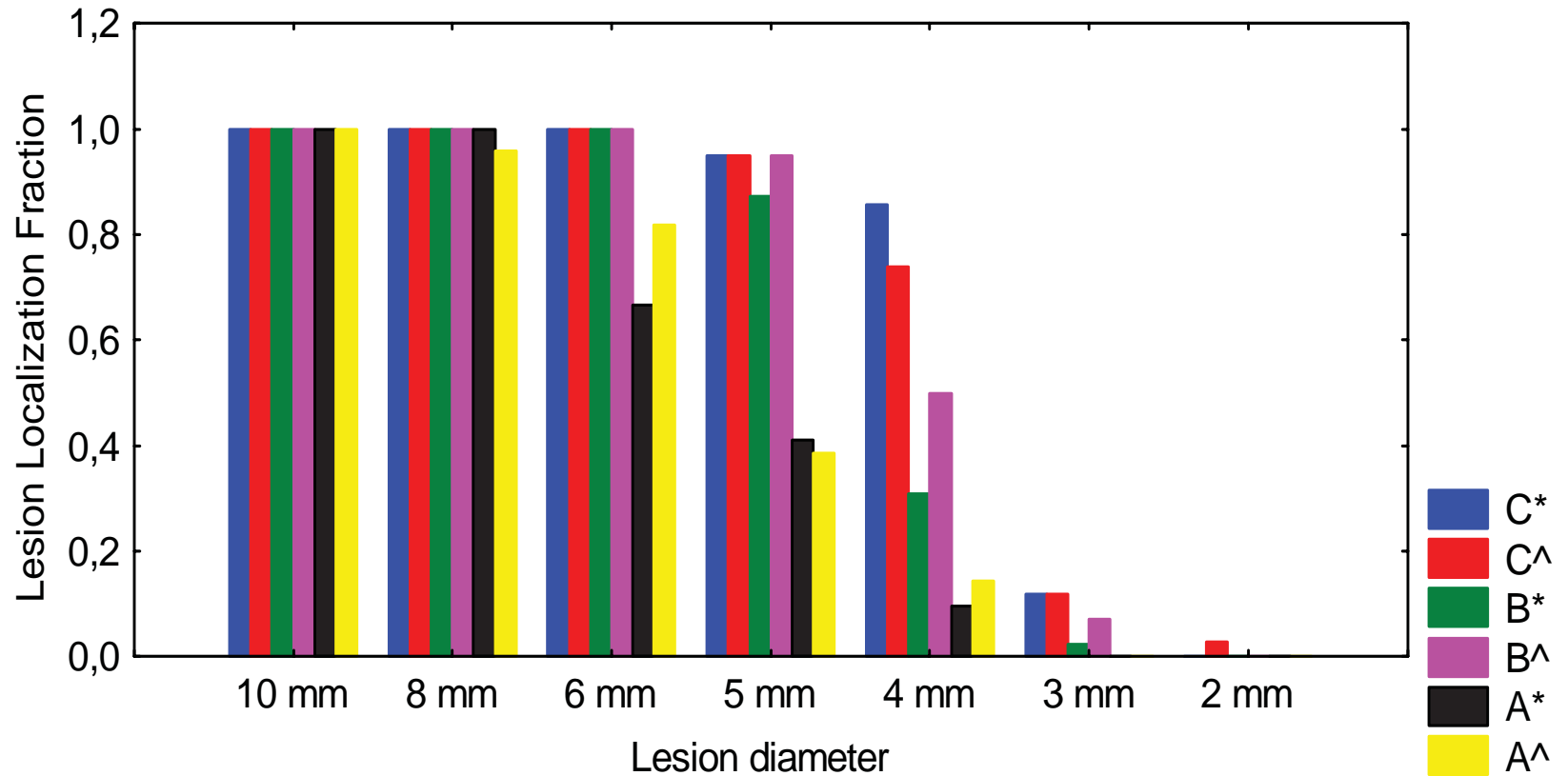


120kV



80kV

Results



^fixed window setting
*free window setting

Results

Figure of merit (FOM) for each reader and scanning protocol

Reader	Fixed window			Free window		
	A [^] Standard	B [^] Same dose	C [^] Same noise	A [*] Standard	B [*] Same dose	C [*] Same noise
1	0,72	0,78	0,84	0,71	0,77	0,83
2	0,74	0,79	0,84	0,70	0,81	0,84
3	0,68	0,83	0,83	0,72	0,84	0,88
Average	0,71	0,80	0,84	0,71	0,81	0,85

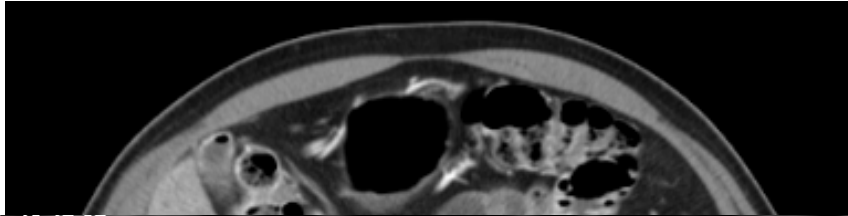
- a significant better lesion detection at 80 than at 120 kV
- similar lesion detection using 500 and 675 mA tube current at 80 kV
- similar lesion detection using fixed and free window setting

Conclusion

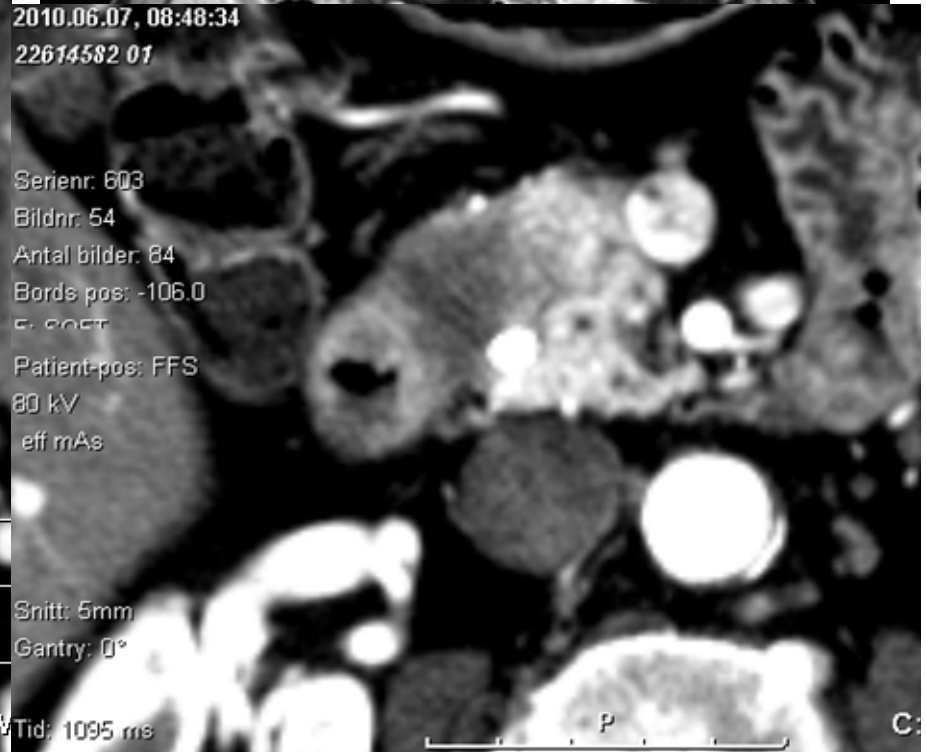
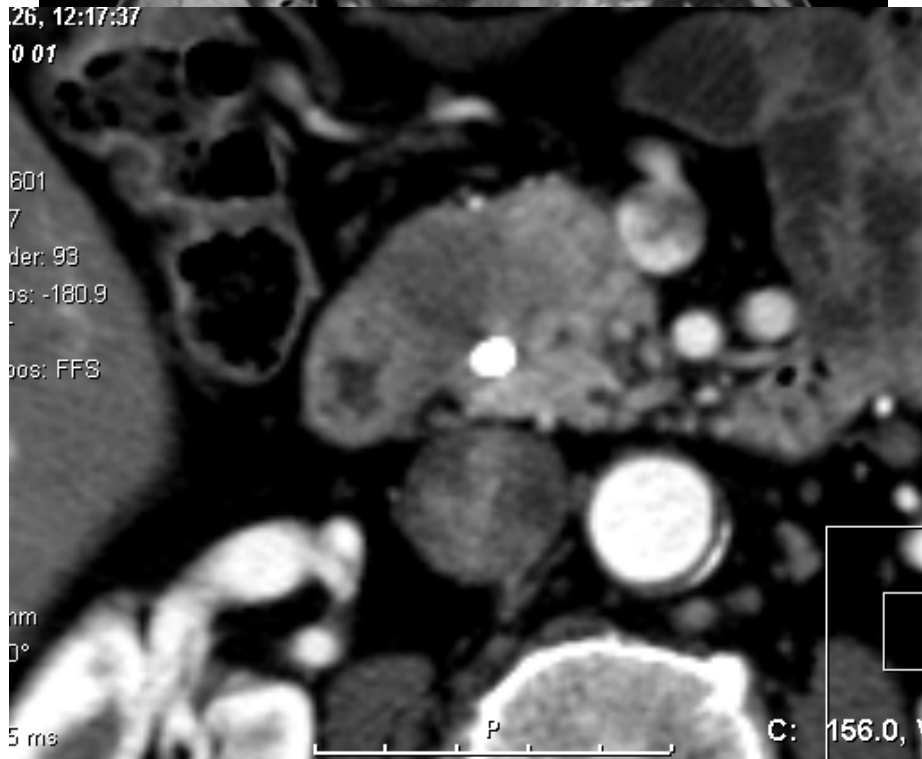
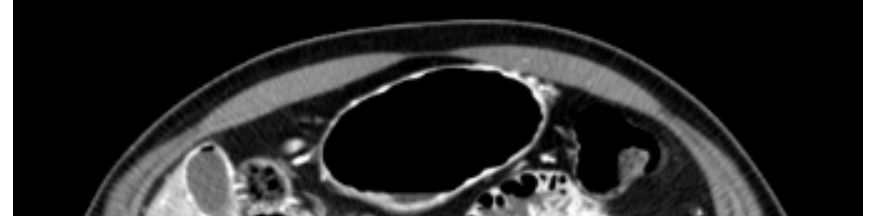
**By decreasing the tube voltage
from 120 kV to 80 kV
more and smaller digital hypodense tumors
can be detected**

The next step ...

120kV



80kV



120kV



80kV



Thank you!

