St.-Petersburg University
Medical Faculty
Mariinsky Hospital

The role of spiral computer tomography in anatomic structures value and possibilities in diagnostic of throat cancer

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" What would become today with phtysiopulmonology and urology, gynecology and otolaryngology, neurology and oncology, surgery and orthopedy, ophthalmology and traumatology if to deprive it what has given rentgenology in the field of diagnostics and treatment? "

N.N. Priorov , 1946

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Computer tomography (CT) - the level-by-level radiological research based on the computer reconstruction of the image during circular scanning of object by a narrow beam of X-ray radiation

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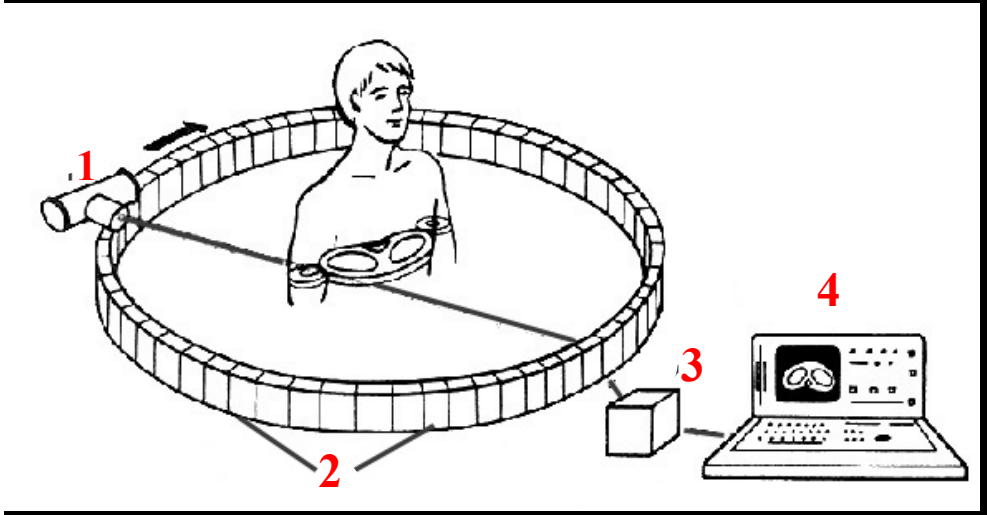
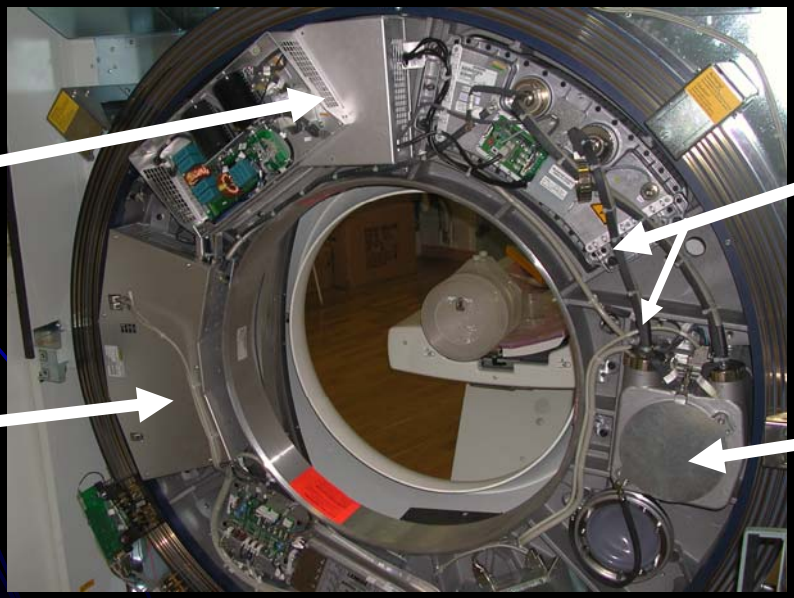
The CT - principle



The scheme of X-ray computer tomography

1 - the tube; 2 - the circular detector; 3 - the computer; 4 - system of processing the image



High-voltage generator

Cooler system

Detectors

The tube

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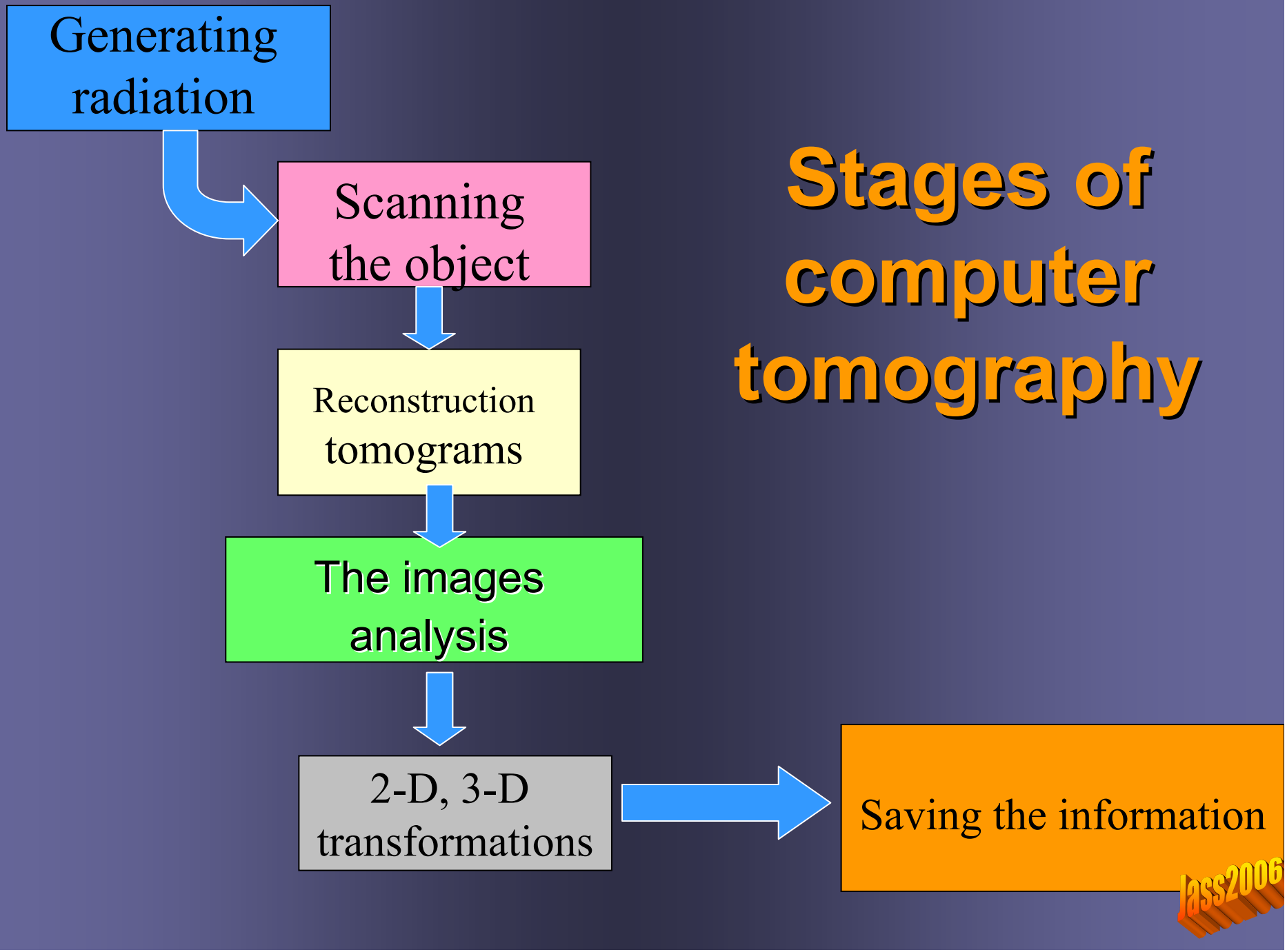
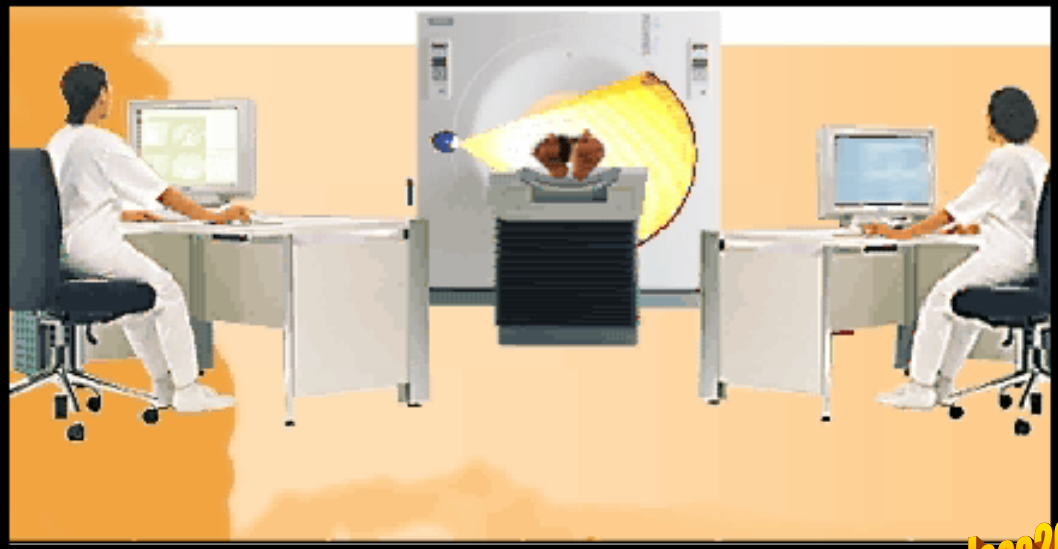
Stages of computer tomography

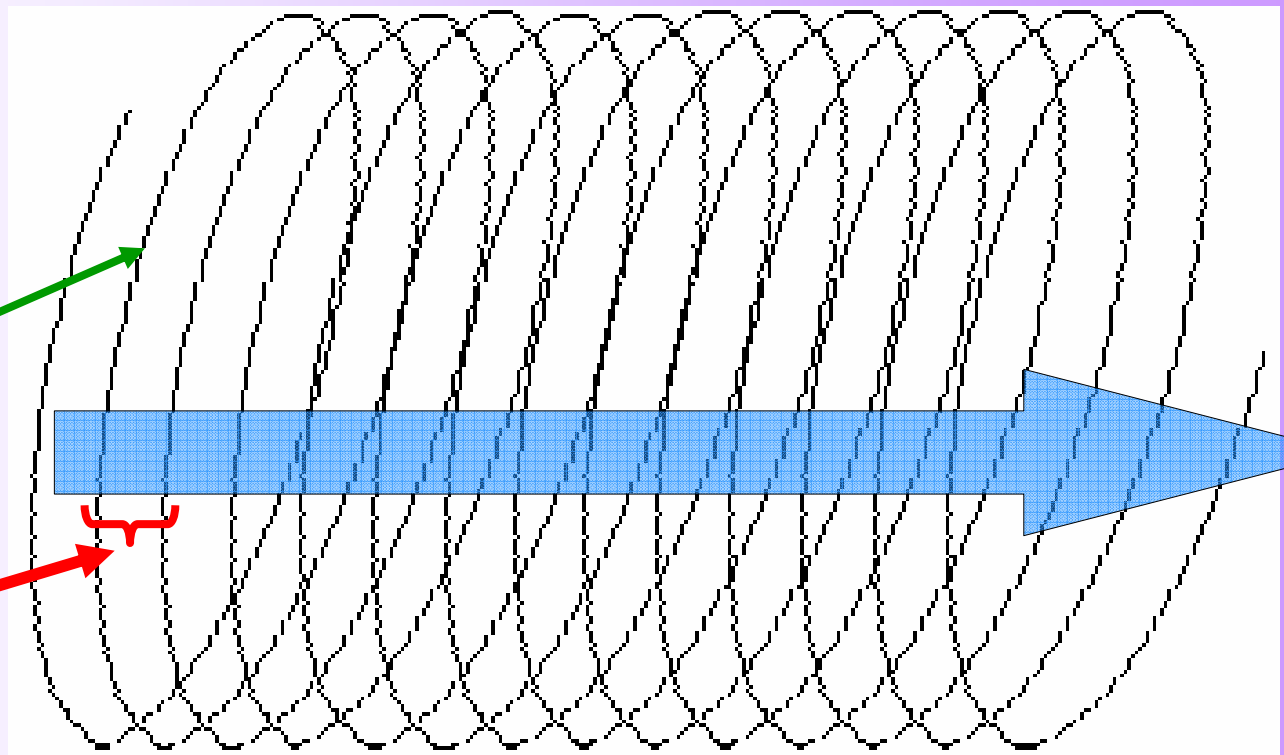


Step-by-step scanning

Spiral scanning



Spiral scanning



$$\text{Step of spiral} = \text{pitch} = \frac{\text{Table feed per rotation (mm)}}{\text{Slice collimation (mm)}}$$

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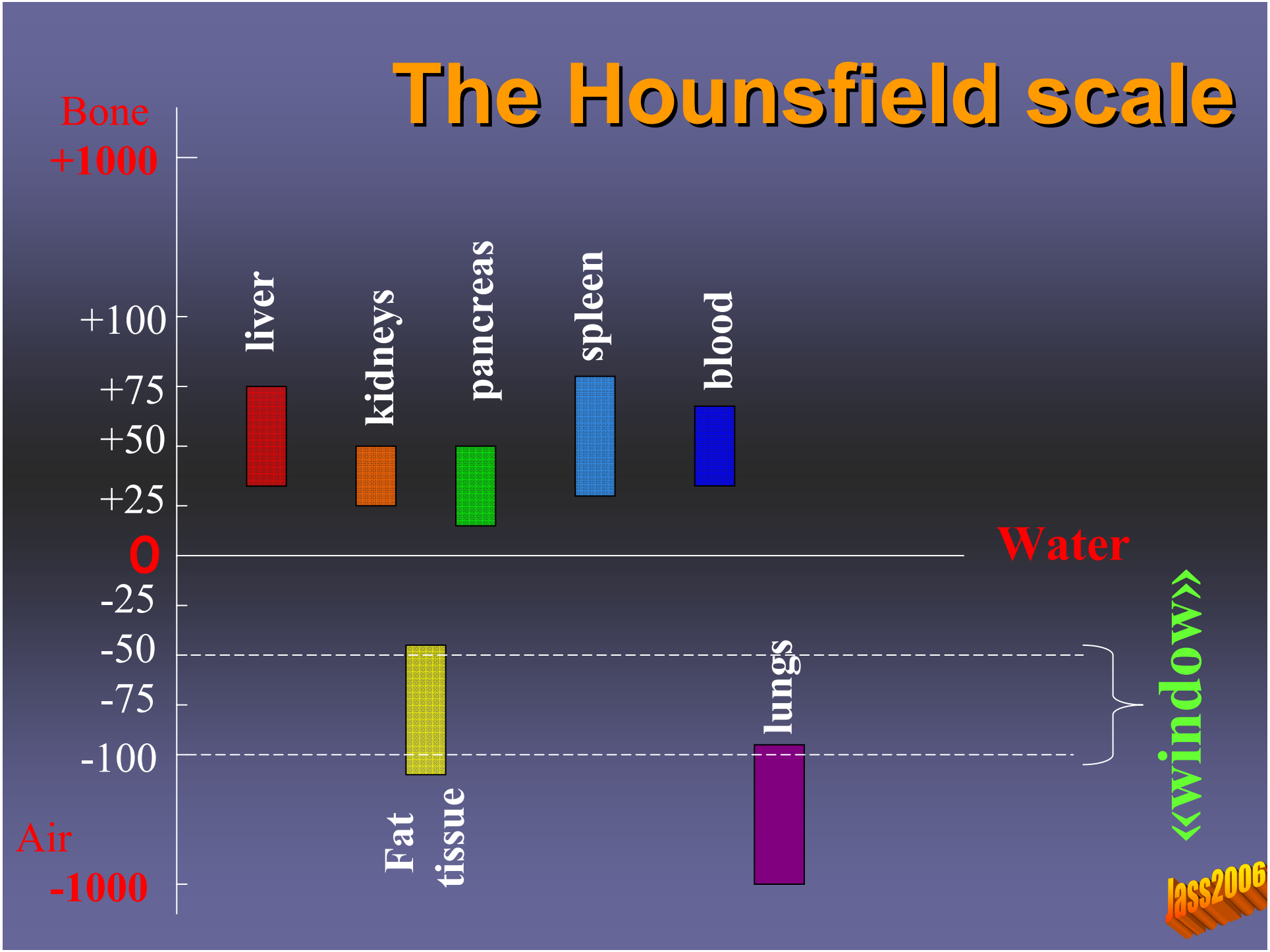
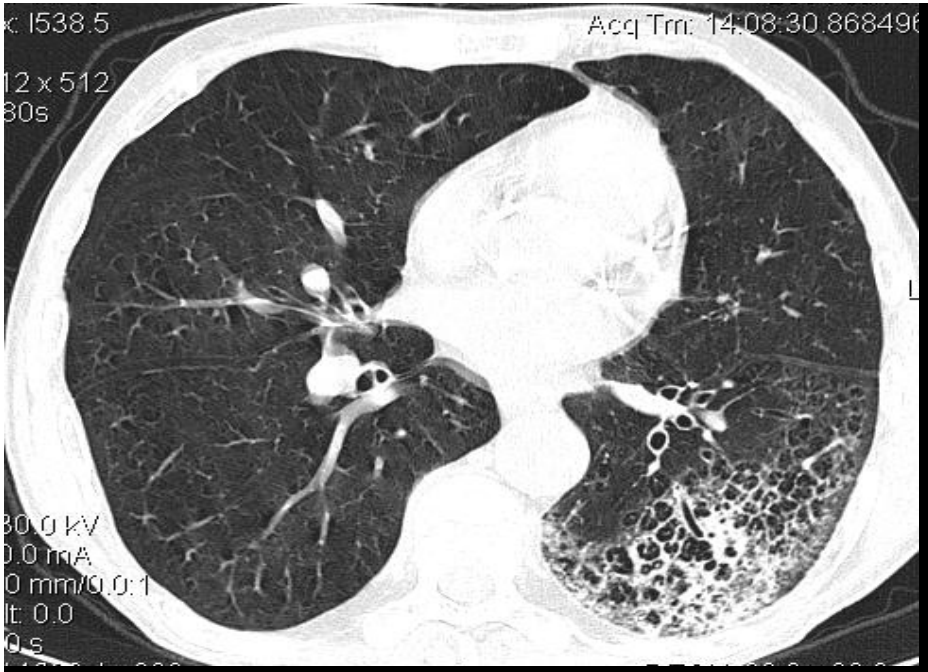
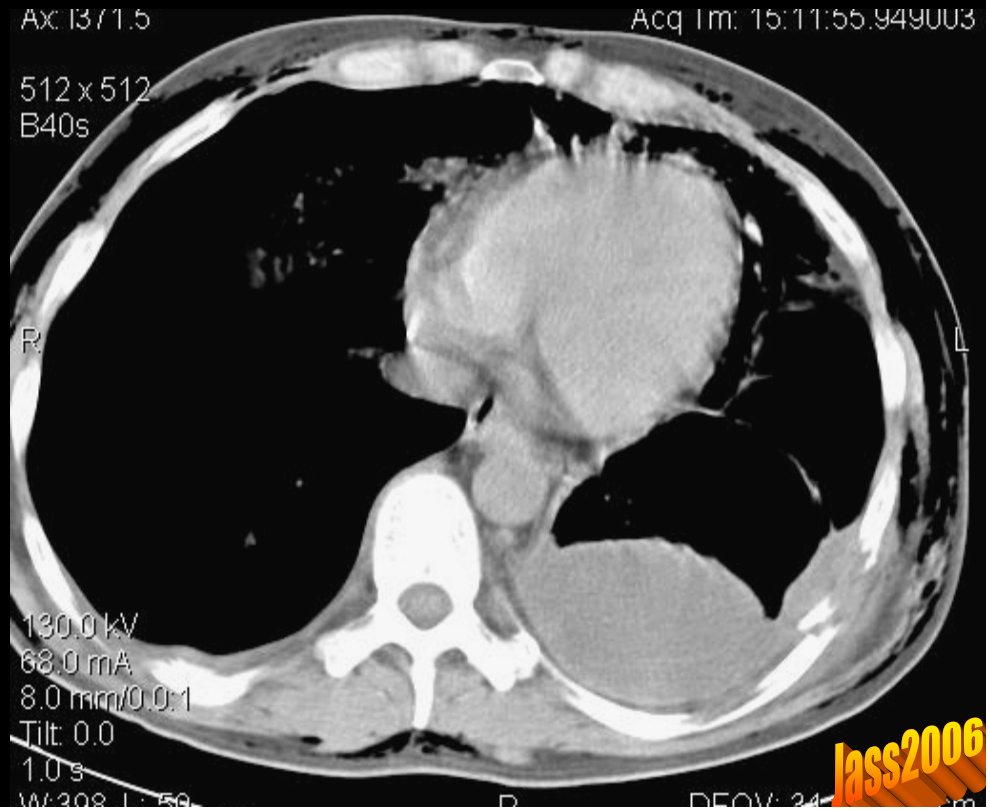

The Hounsfield scale
Bone
+1000
+100
+75
+50
+25
0
-25
-50
-75
-100
Air
-1000
liver
kidneys
pancreas
spleen
blood
Water
Fat tissue
lungs
«window»
Jass2006



Pulmonary window

Soft-tissue window



The CT- technologies

- Traditional CT — 1972
- High-resolutional CT — 1985
- Spiral CT — *1989*
- Multispiral CT — *1999*

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The modern spiral computer tomograph

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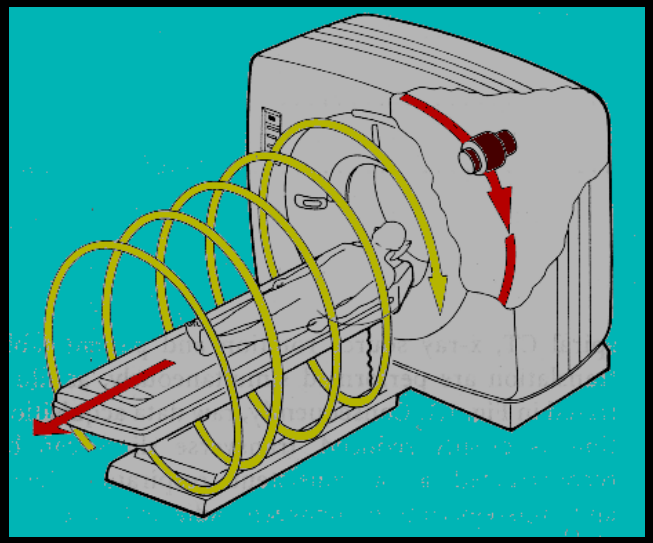
Spiral computer tomography



Continious tube rotation

Continious moving a table with the patient

- High speed of research
- 3-D reformation
- CT-angiography
- Great opportunities of image processing

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The comparison TR and CT

Parameters		Traditional roentgenography	Computer tomography
Sensitivity	Brain tumor	≈ 10-20%	≈ 95%
	Lung cancer	≈ 60-80%	≈ 95%
Specificity	Brain tumor	≈ 1%	≈ 70%
	Lung cancer	≈ 70%	≈ 95%
Resolution		≈ 3 - 5 mm	≈ 1.0 mm
Ray's loading		≈ 0.5 mZv	≈ 5 mZv

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Methods of image transformation

- **Multiplanar Reformation, MPR**
- **Three-dimensional transformation (three dimensional rendering, 3-D)**
  - Shaded Surface Display, SSD
  - Volume rendering

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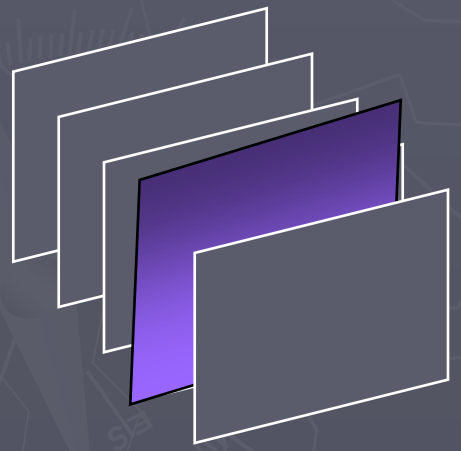
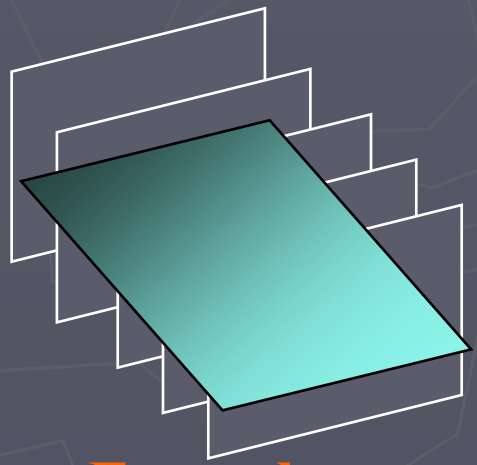
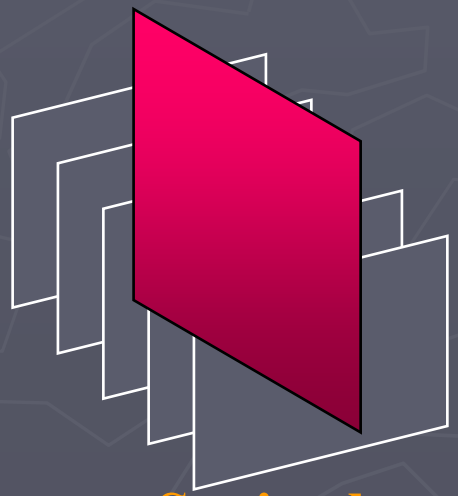
Image reconstruction and multiplanar reformation



Axial plane



Frontal plane



Sagittal plane

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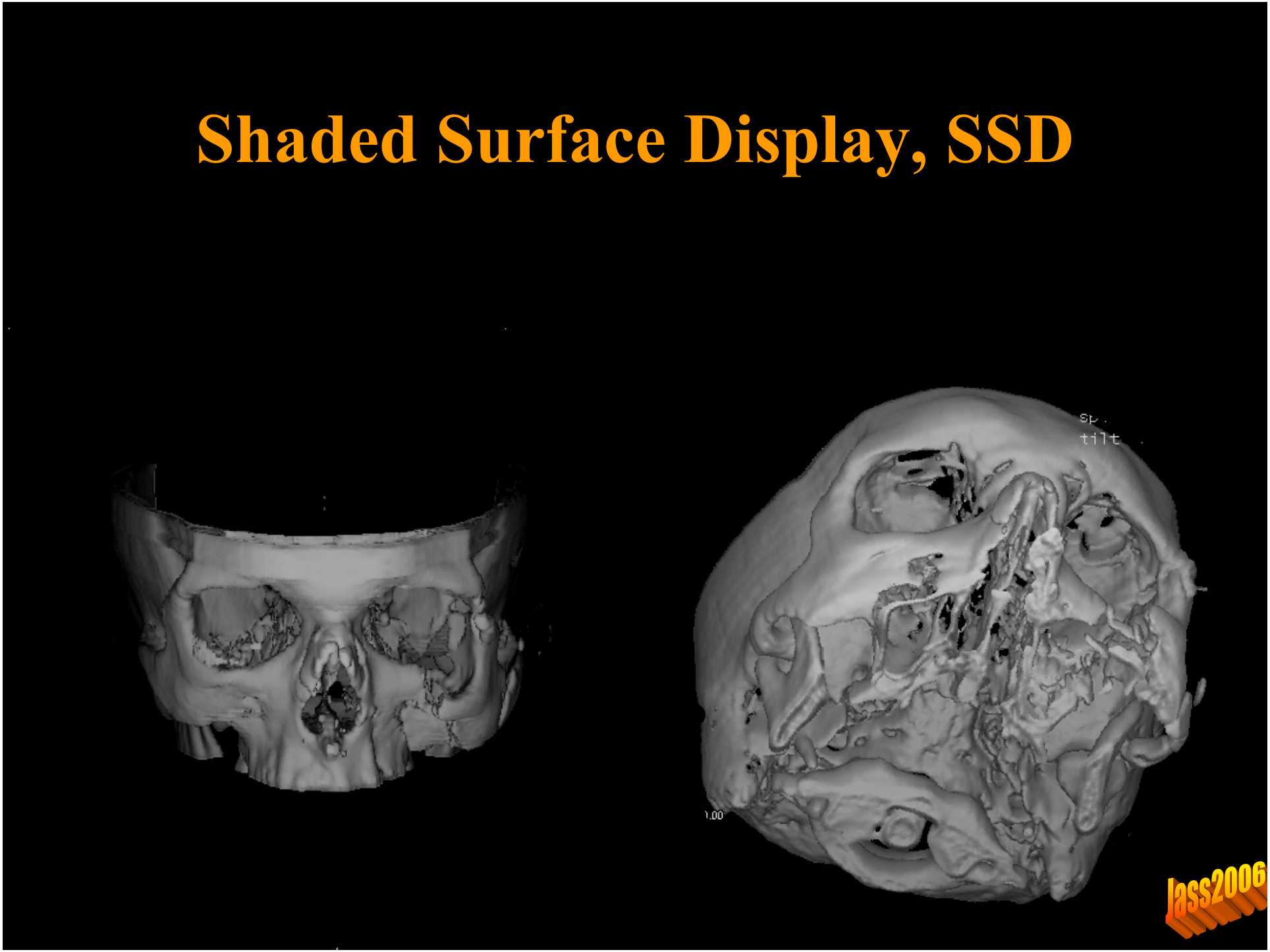
Shaded Surface Display, SSD



Shaded Surface Display, SSD

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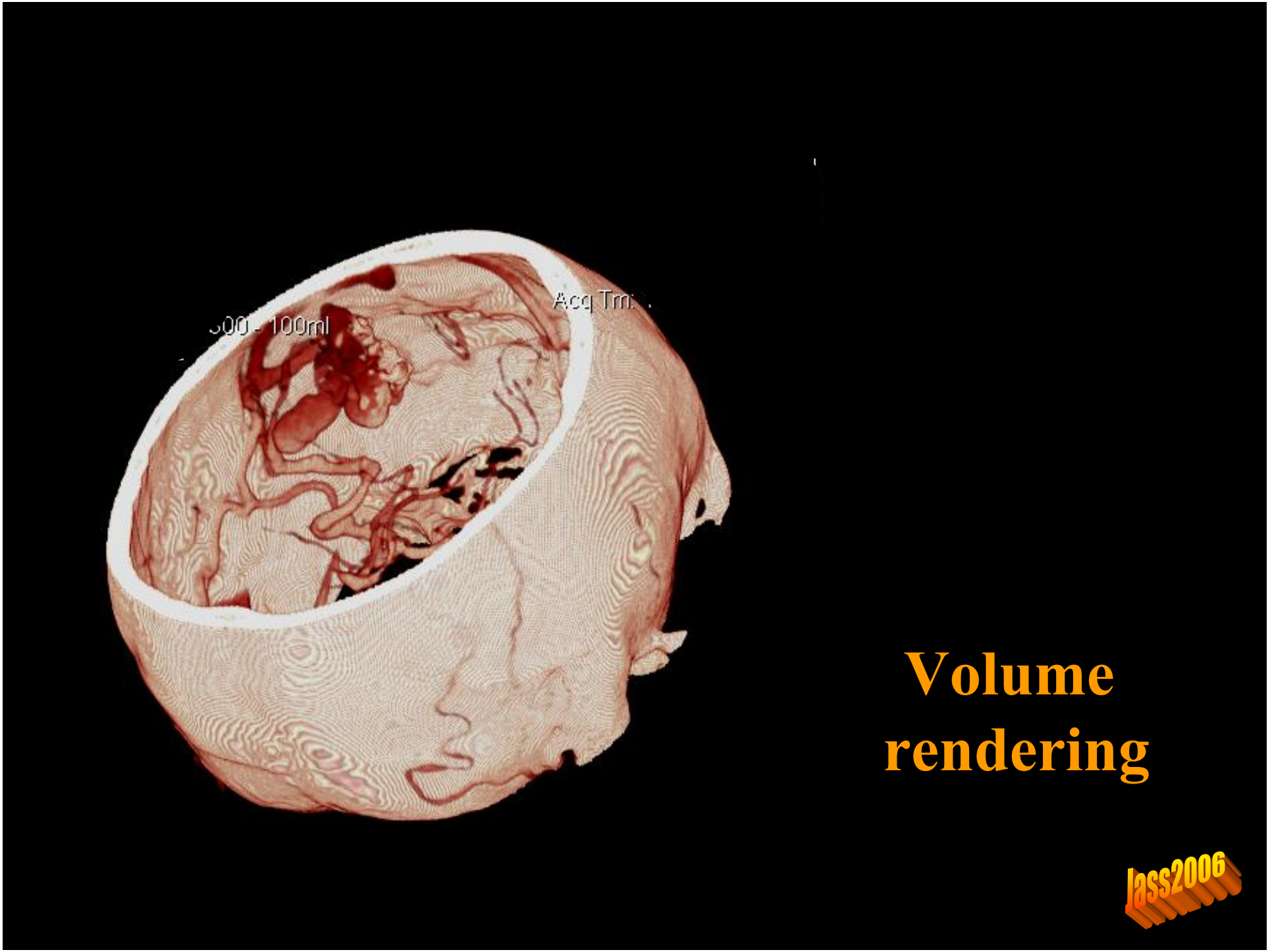
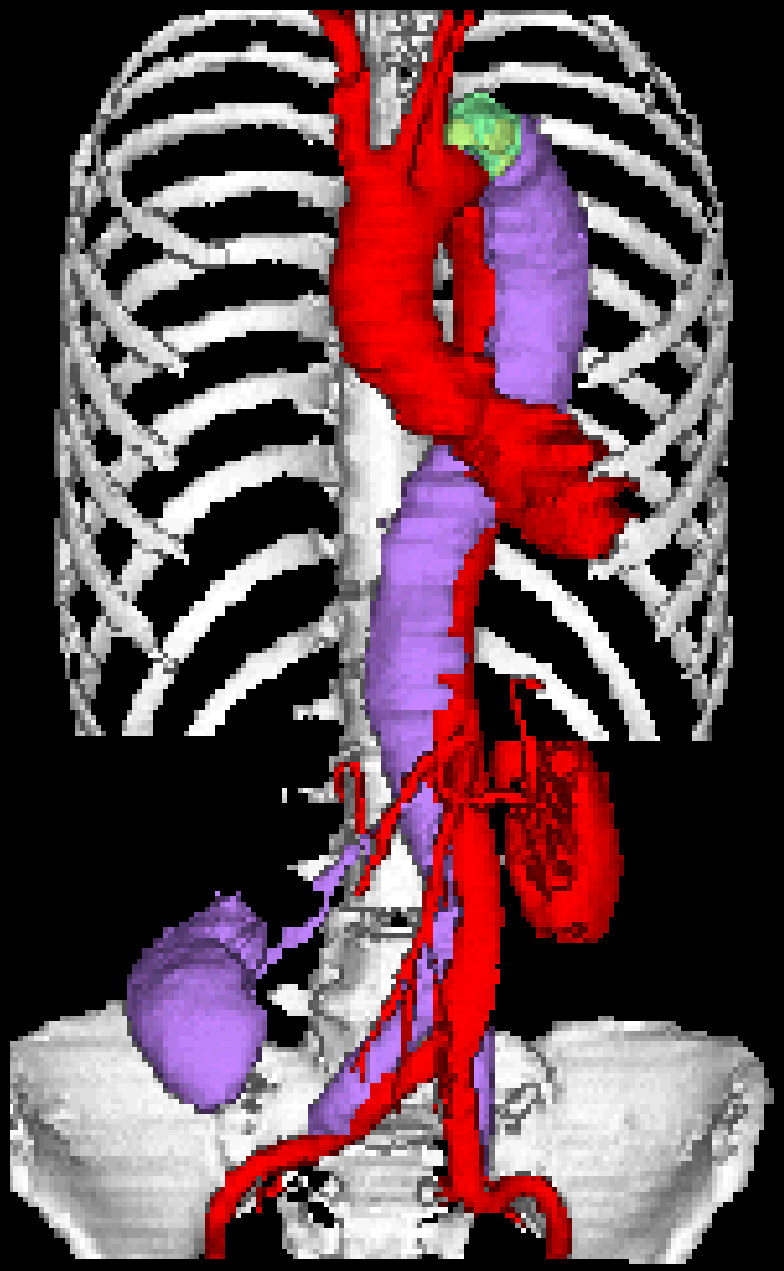
Shaded Surface
Display, SSD
Jass2006

Shaded Surface
Display, SSD
lass2006



Volume rendering

lass2006



Volume rendering

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Volume rendering

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SCT-angiography, volume rendering

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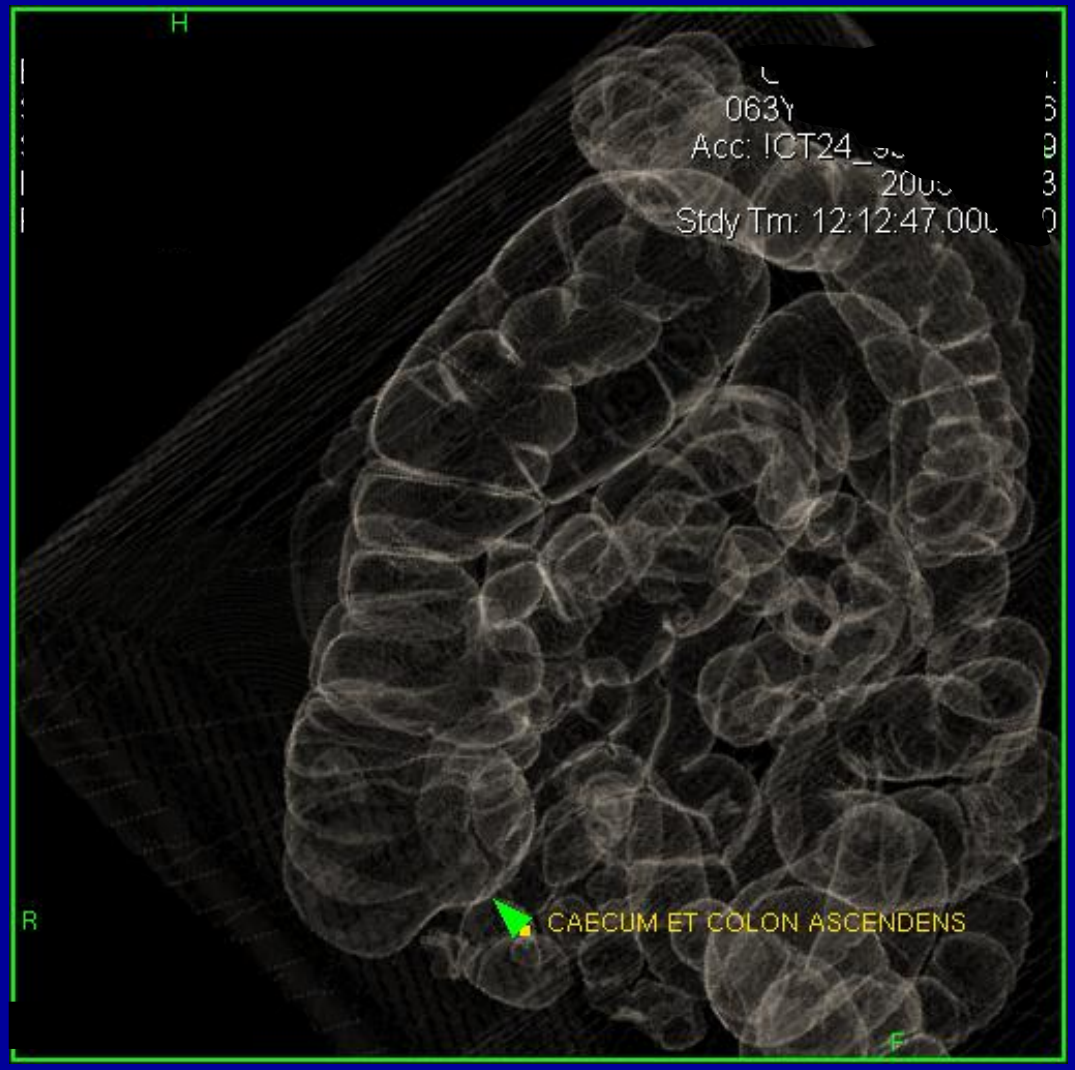
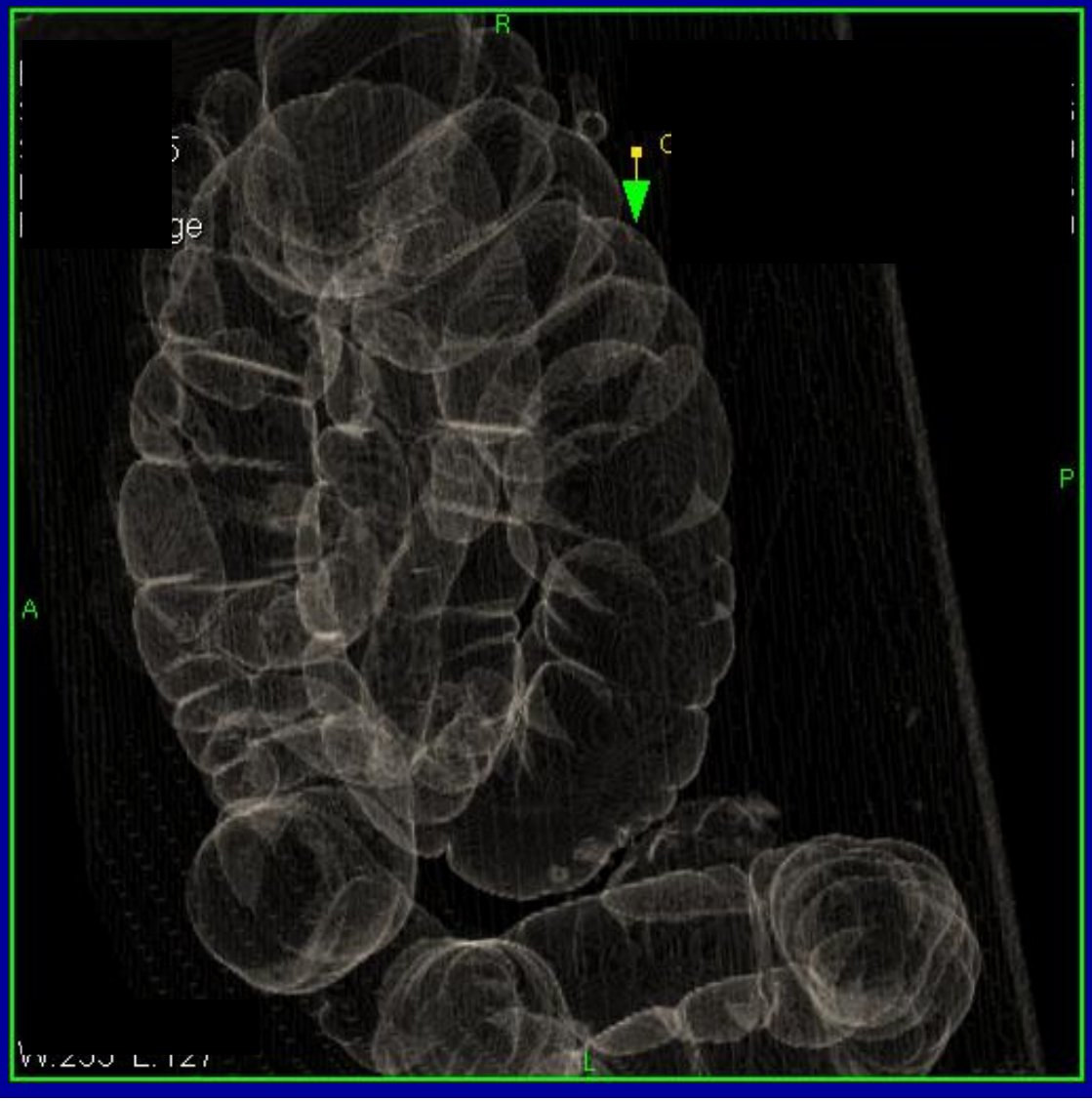
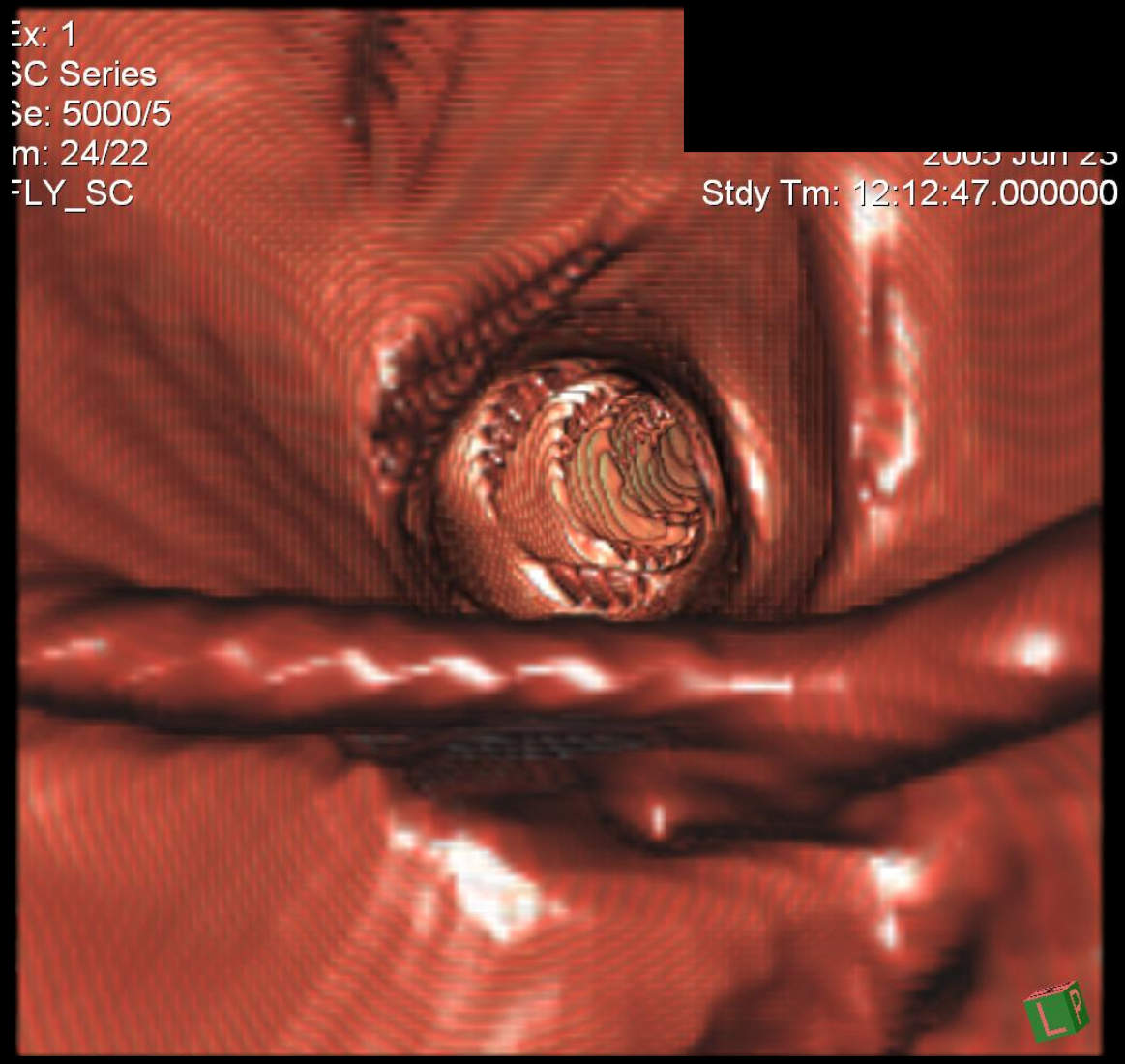
Virtual 3-D endoscopy



Virtual 3-D endoscopy

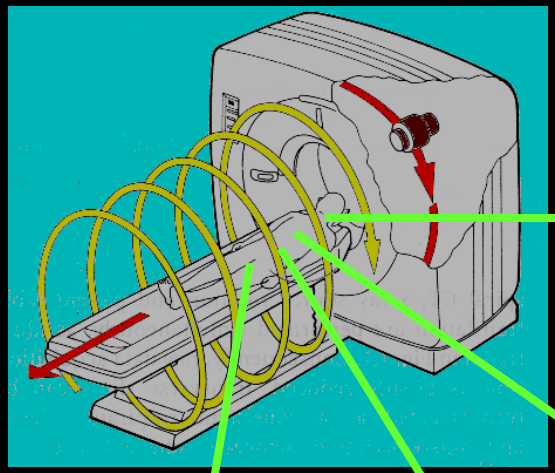


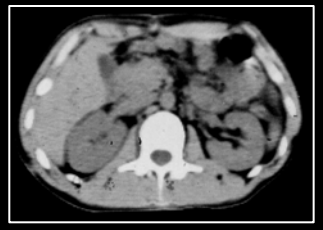
Virtual 3-D endoscopy (view from inside)

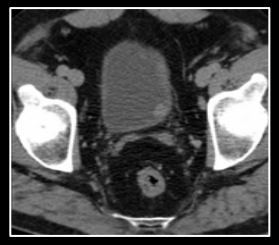


Gems1

Summary







The diagnostic opportunities of modern CT

Trauma
Tumors
Infection
Anomalies
Degenerative lesion
Inflammation processes

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The throat cancer makes 1 - 4 % of all malignant tumors

Frequency of throat cancer through all malignant tumors of otolaryngological organs makes 50 - 60 %

In oncological disease structure at men takes 5-th place

Clinical symptoms of throat cancer are:

- hoarseness, continuous and increasing (87 % patients). It may be the first symptom
- breathing defeat, down to asphyxia - later symptom specifying slow narrowing by tumor
- bloody cough, a smell from a mouth (the tumor's disintegration), reduction of weight of a body
- painful swallowing an intoxication, change of mentality - latest symptoms of illness

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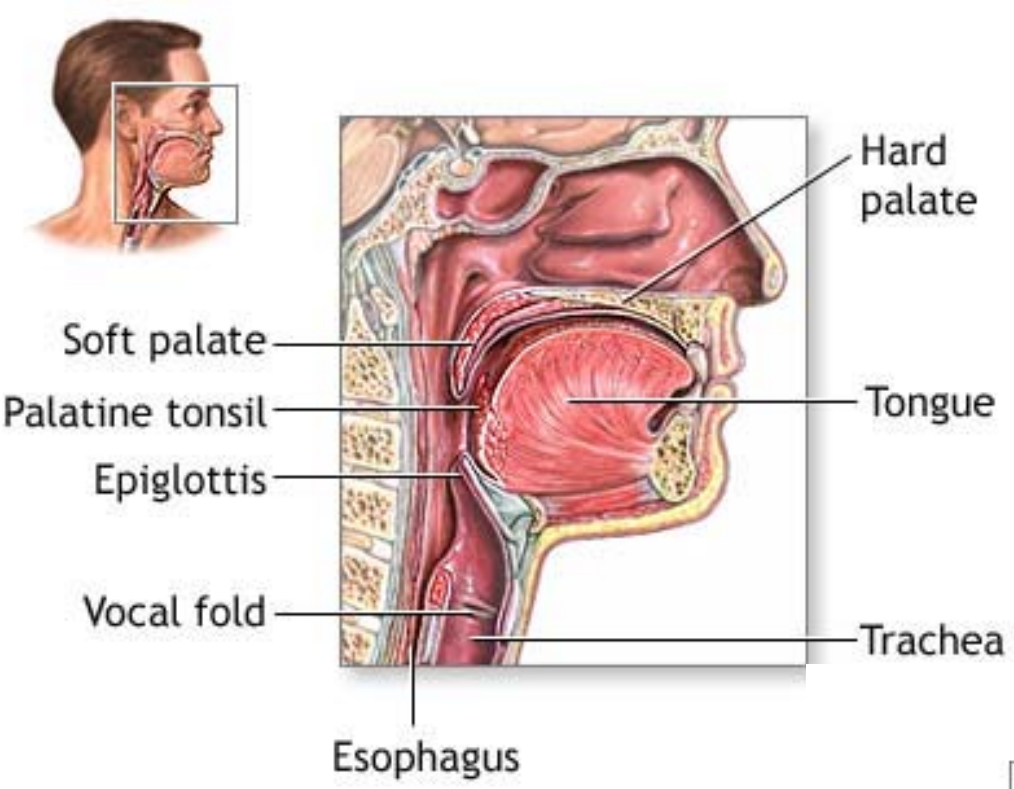
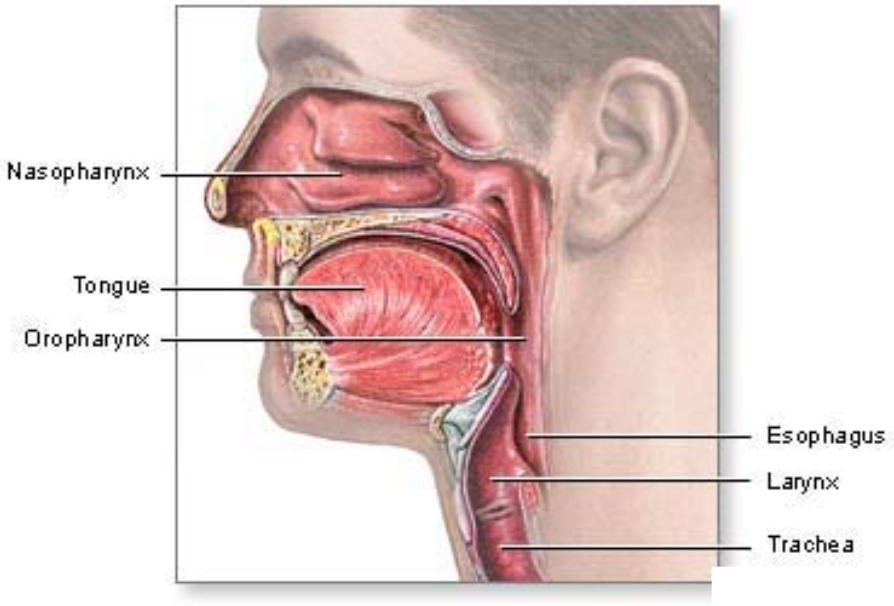
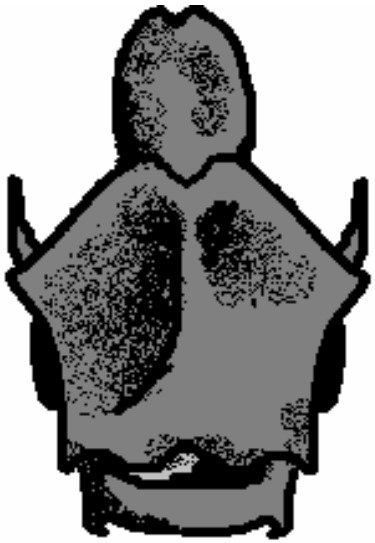

Hard palate
Soft palate
Palatine tonsil
Epiglottis
Tongue
Vocal fold
Trachea
Esophagus

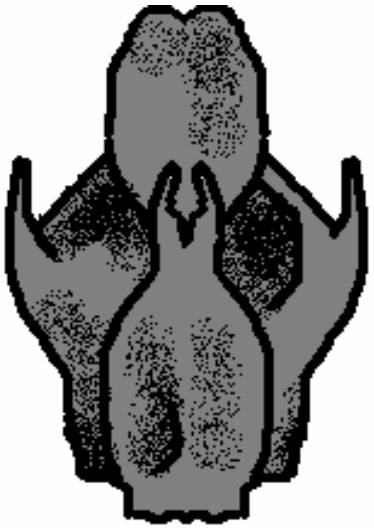

Nasopharynx
Tongue
Oropharynx
Esophagus
Larynx
Trachea

Throat cartilages structure



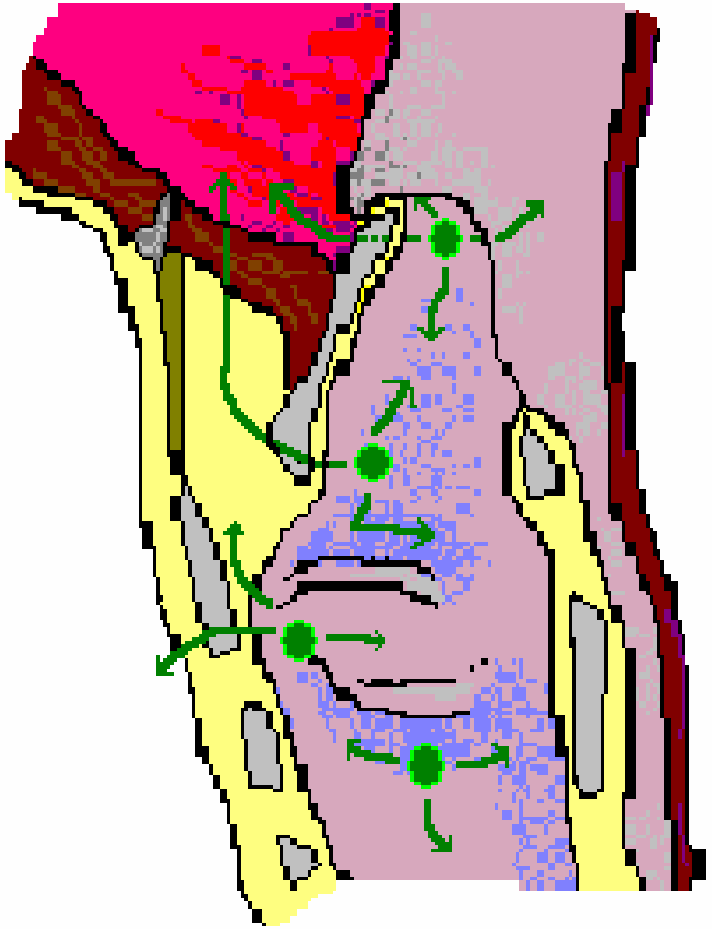
In front

Lateroview



Behind

Sagittal throat plane and ways of cancer distribution (⟶)



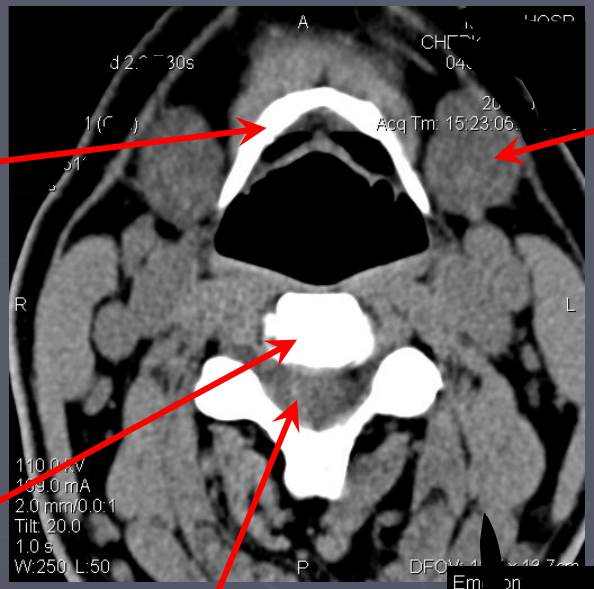
With the purpose of studying the computer tomography opportunities in diagnostic and an estimation of throat cancer computer tomograms of

45 patients were analyzed

Parameters of throat scanning

- Prone patient's position on a back side
- Axial scanning parallel vocal cords
- Optimum layer thickness – 3 – 5mm
- Spiral step 1,5

Normal throat CT (upper part)



Hypoglossal bone

Submaxillary salivary gland

Cervical vertebrae

Spinal cord

Epiglottis

The big horns of hypoglossal bone

The skin and hypodermic fat

Carotid artery

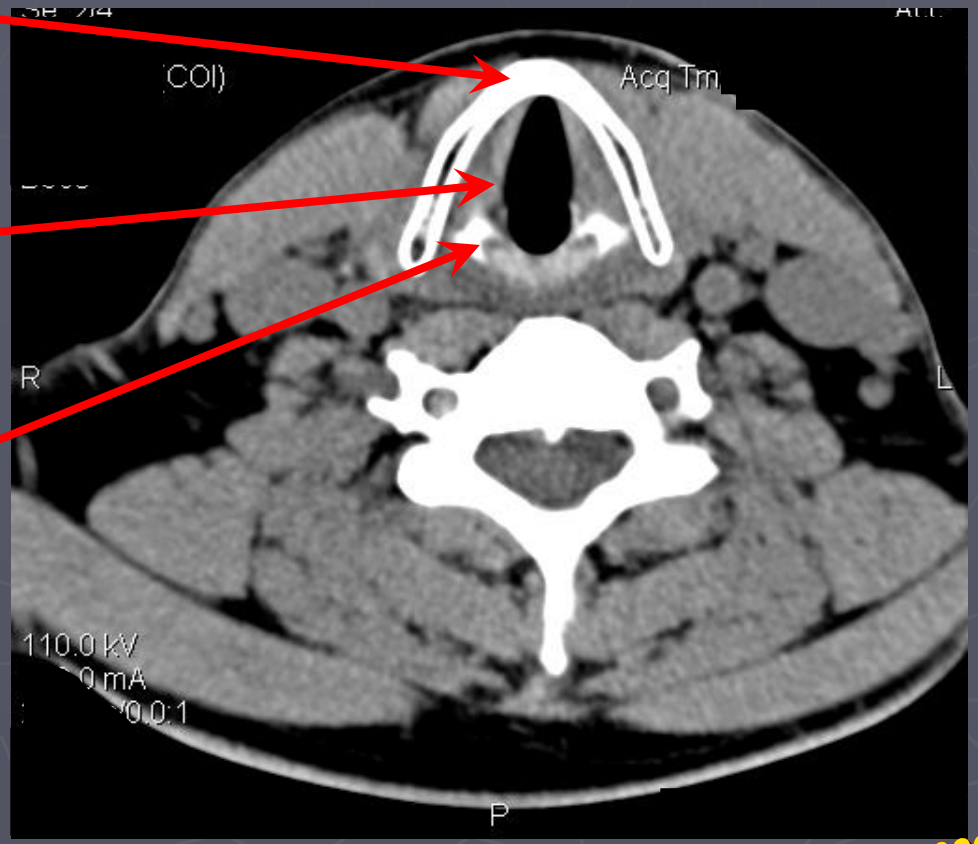
Back group of neck muscles

Normal throat CT (middle part)

Plate of thyroid cartilage

Vocal cords

Small throat cartilages



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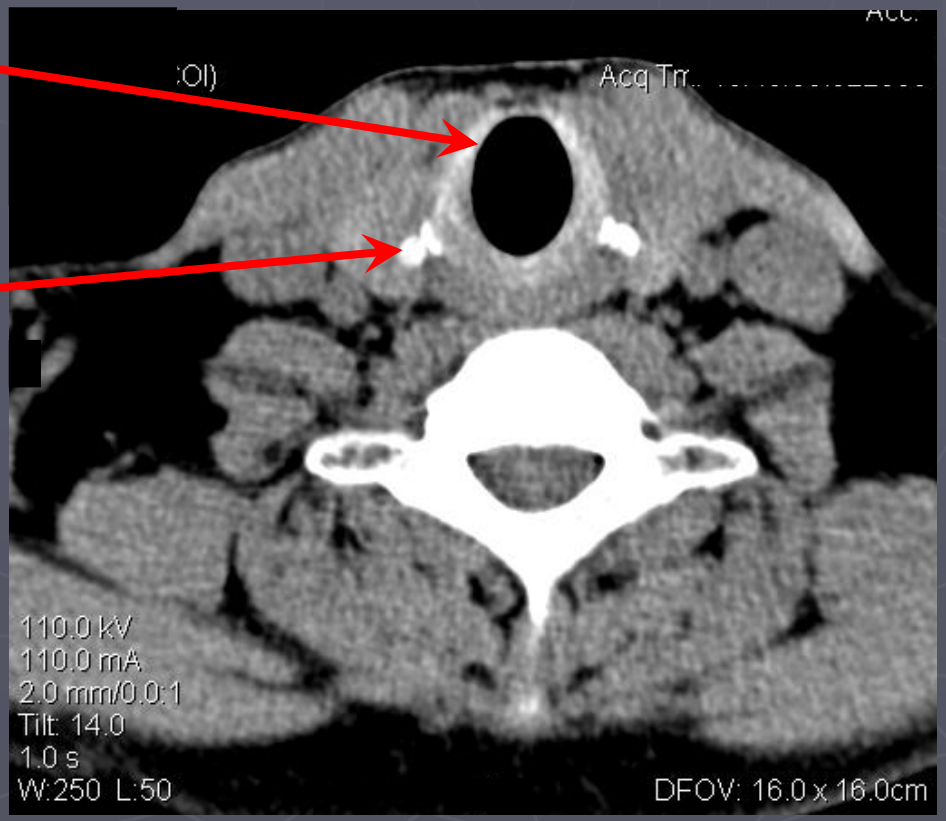
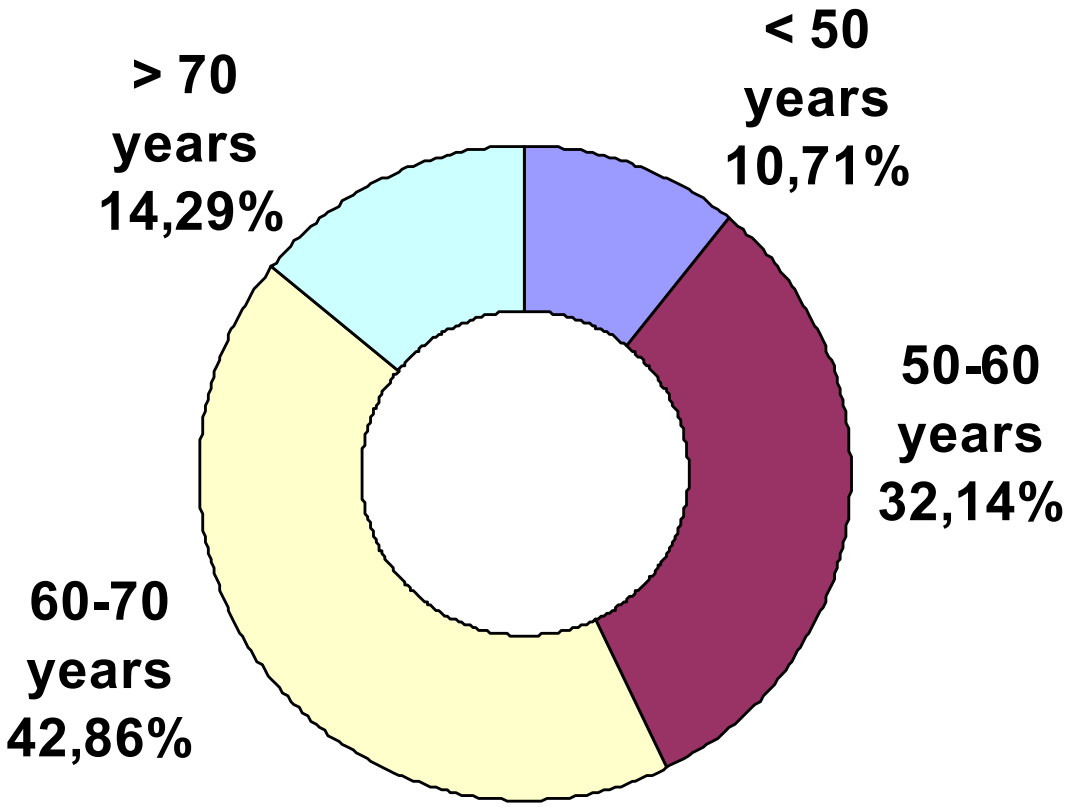
Normal throat CT (lower part)

Plate of thyroid cartilage

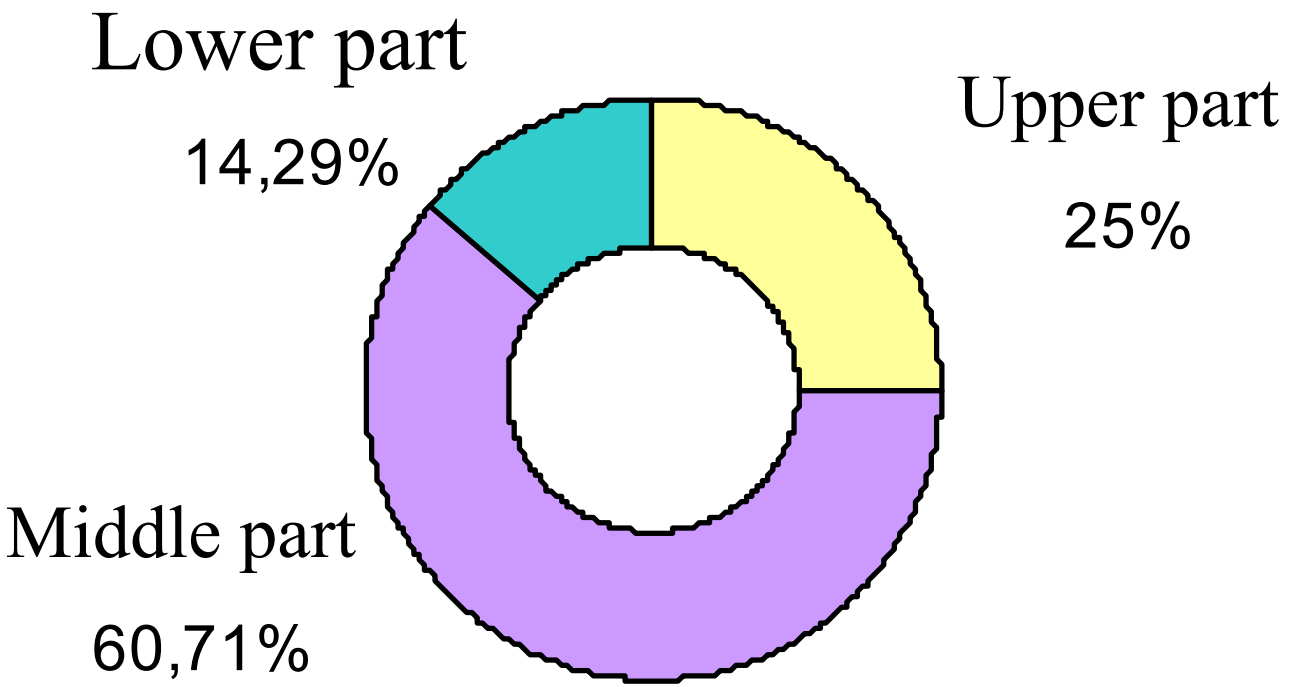
Small throat cartilages



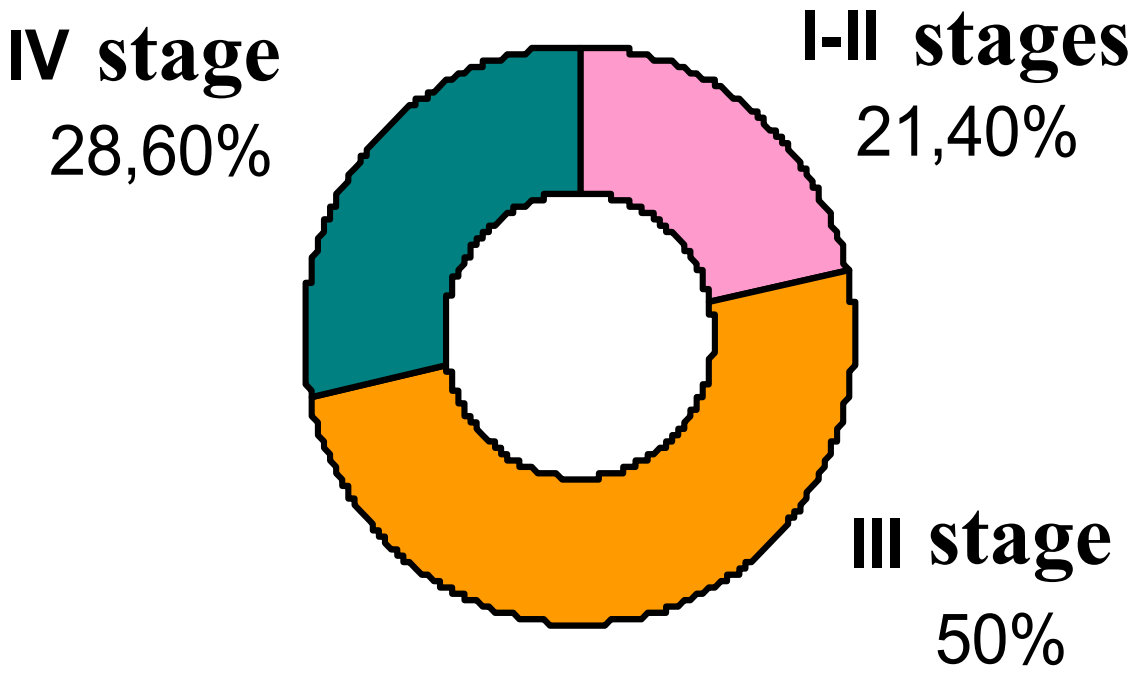
Distribution the throat cancer depending of patient's age



Distribution the throat cancer depending of anatomical localization



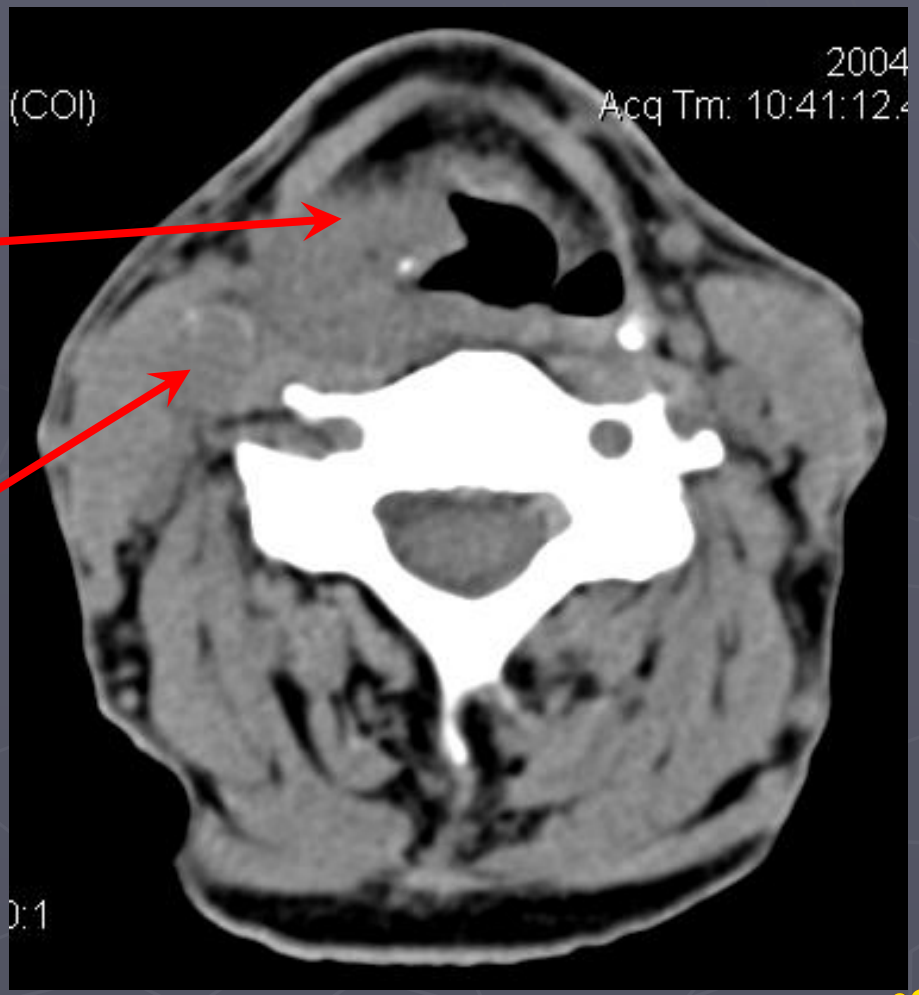
Distribution the throat cancer depending of disease stage



Throat cancer (upper part)

Soft tissue increasing

Regional lymph nodes lesion

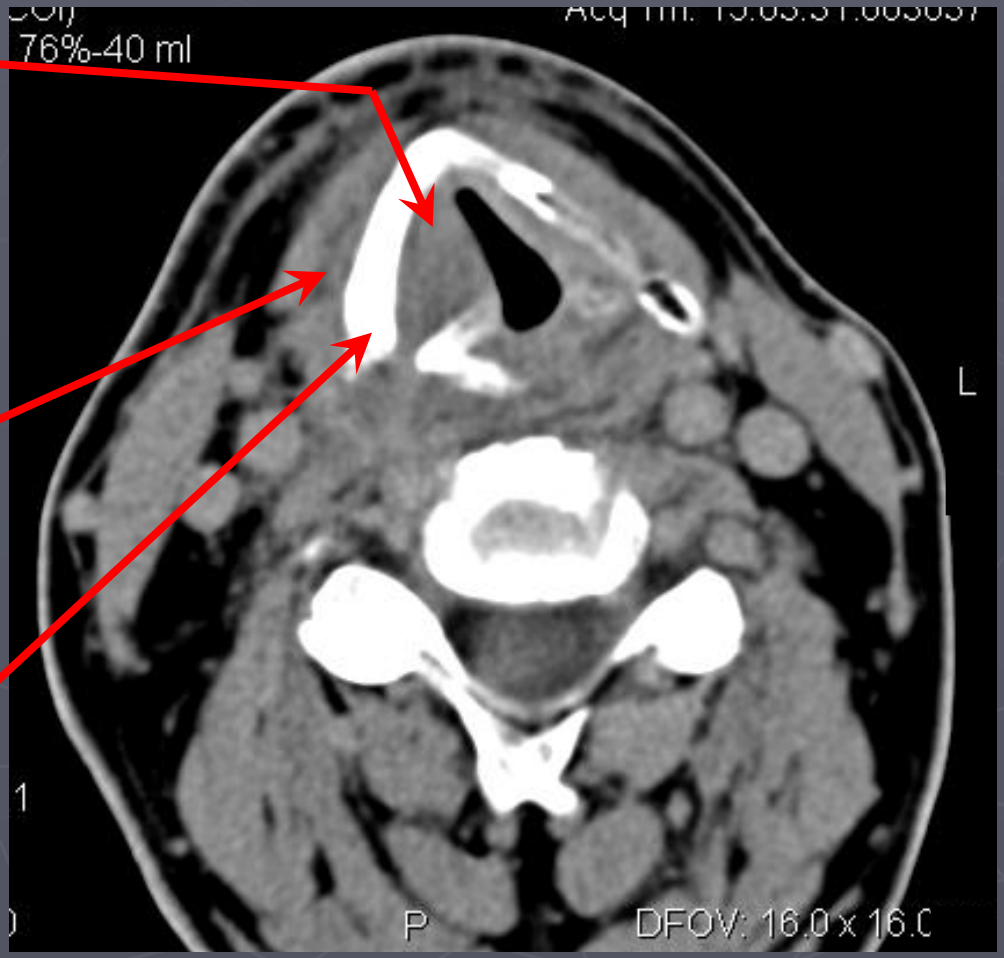


Throat cancer

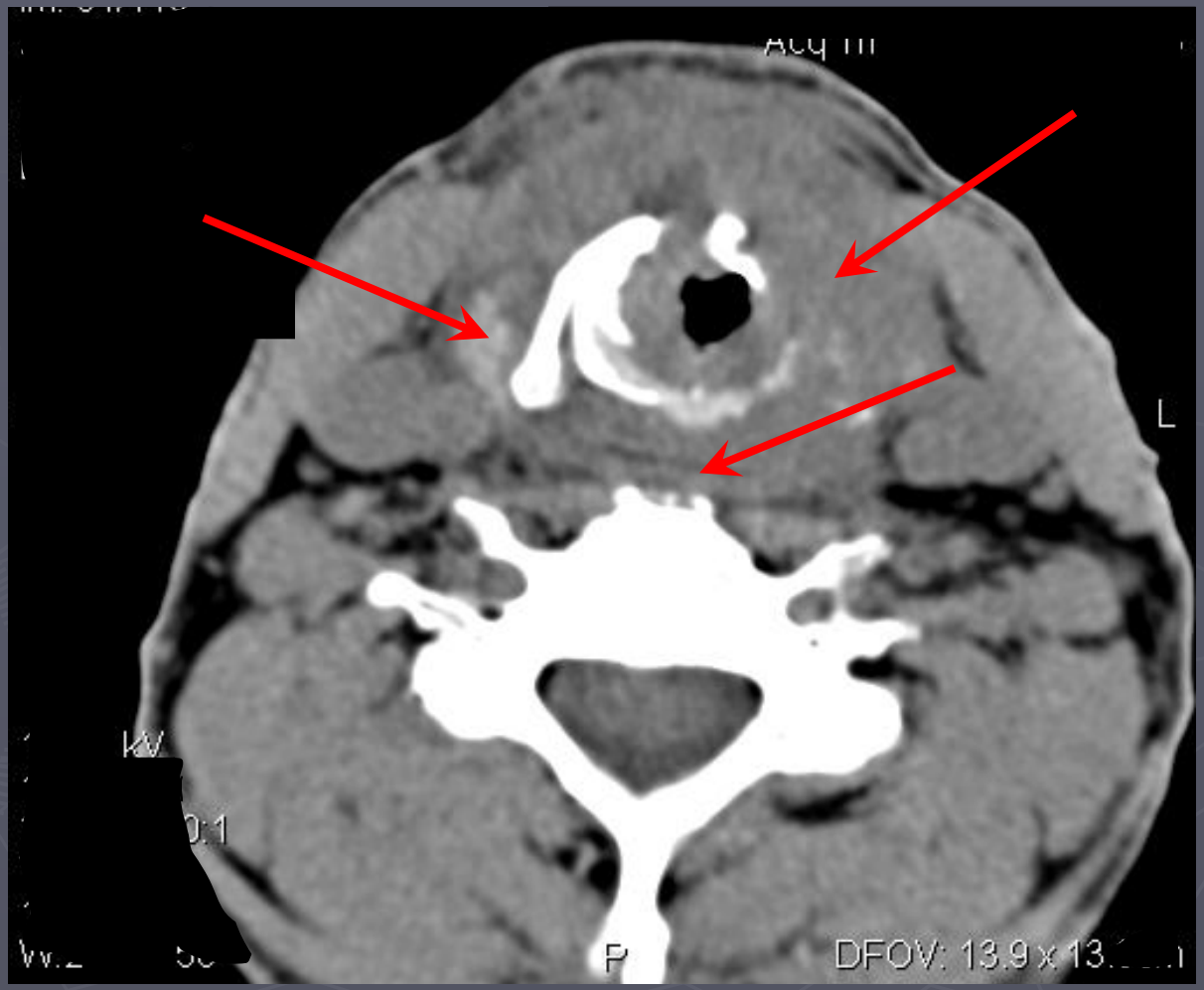
Volume increasing of right vocal cord

Perylaryngeal fatty tissue lesion

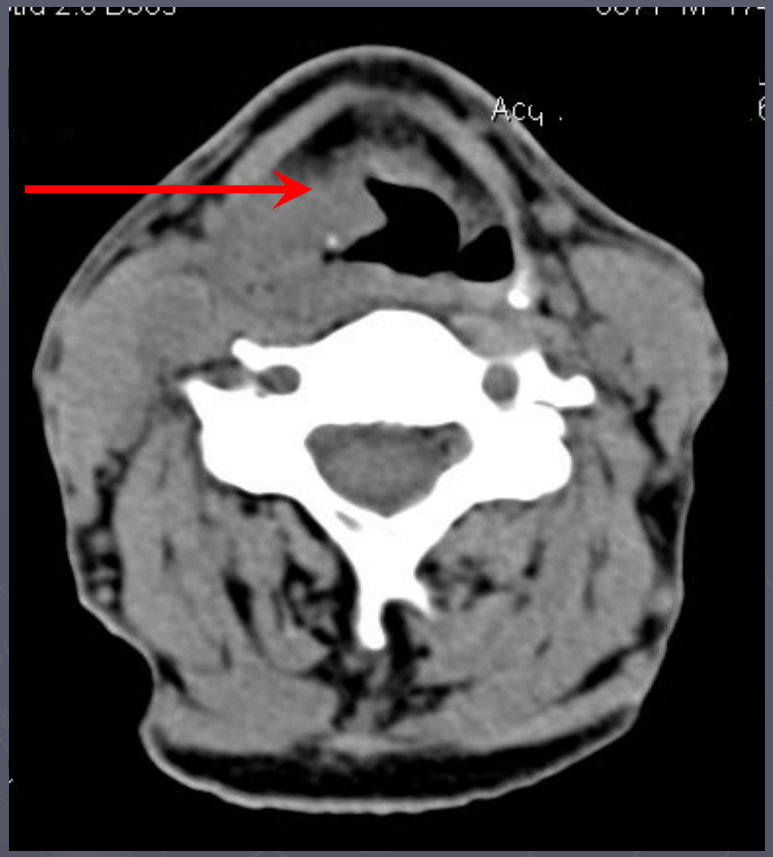
Lesion (calcinosis) of thyroid plate and small throat cartilages



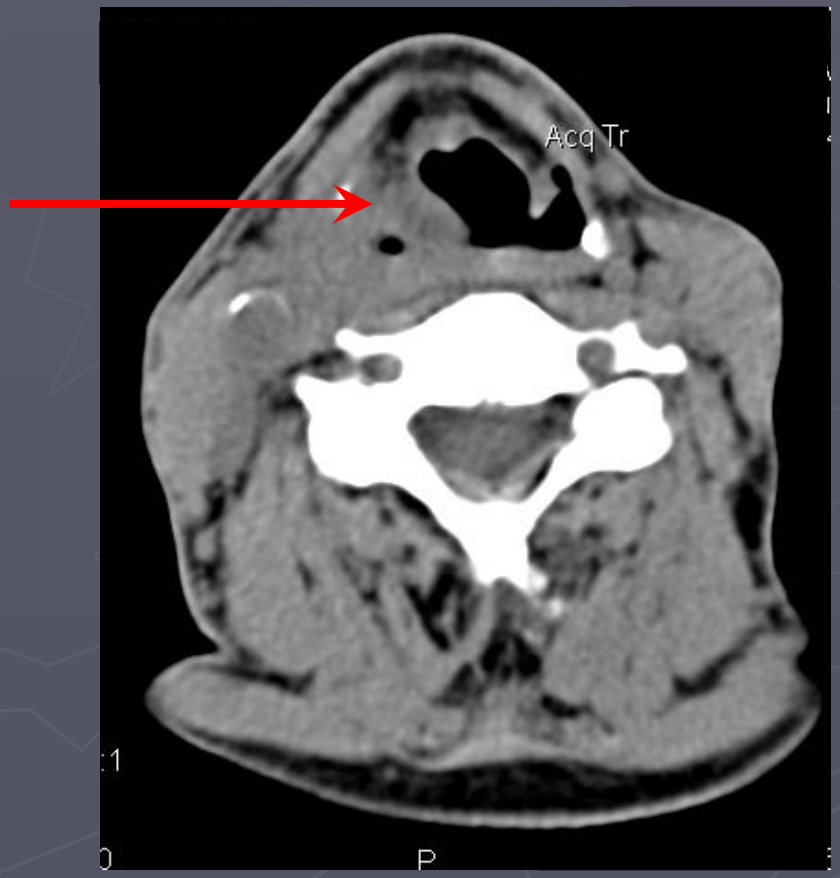
Lesion of soft neck tissues



Throat cancer
68-years-old patient
radiation therapy



before



half month later

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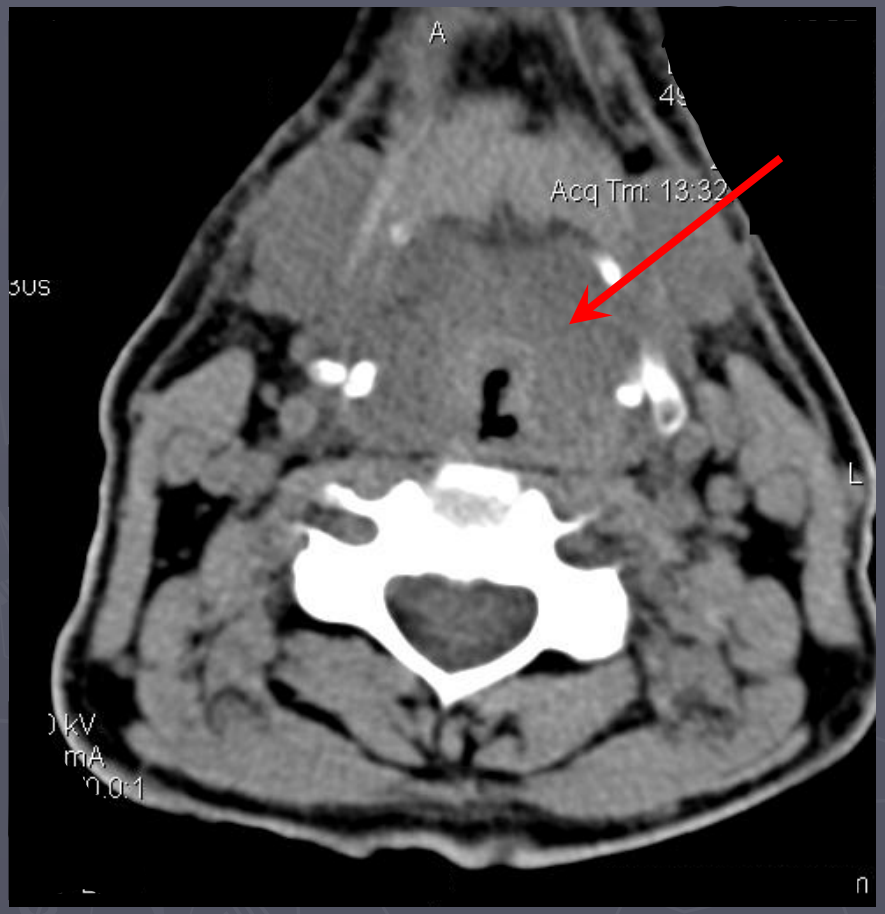
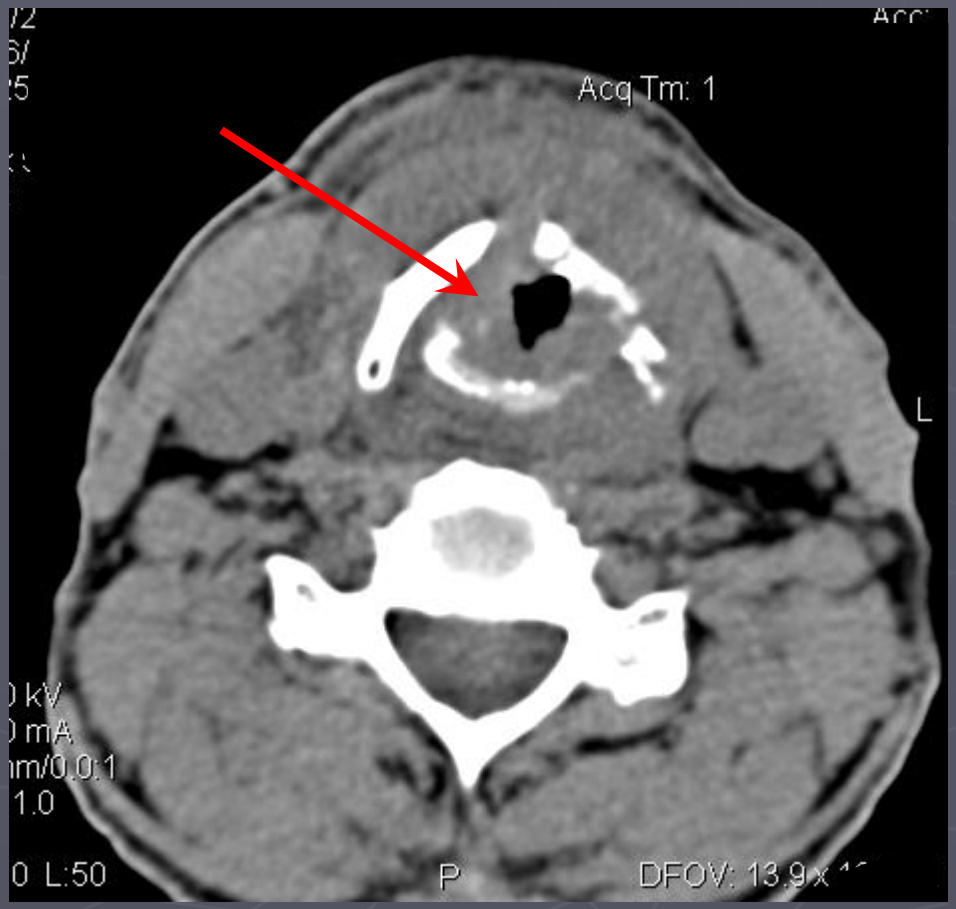
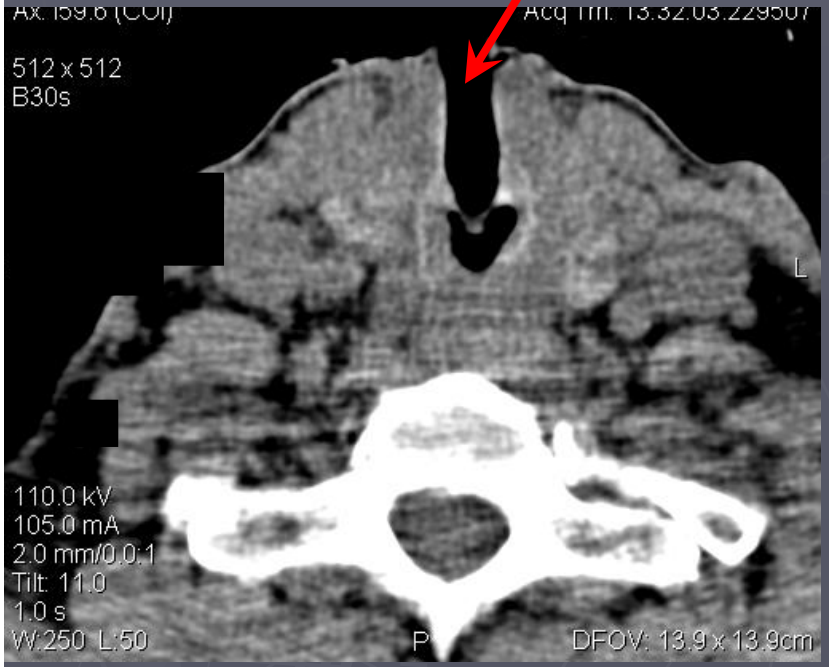
Throat cancer

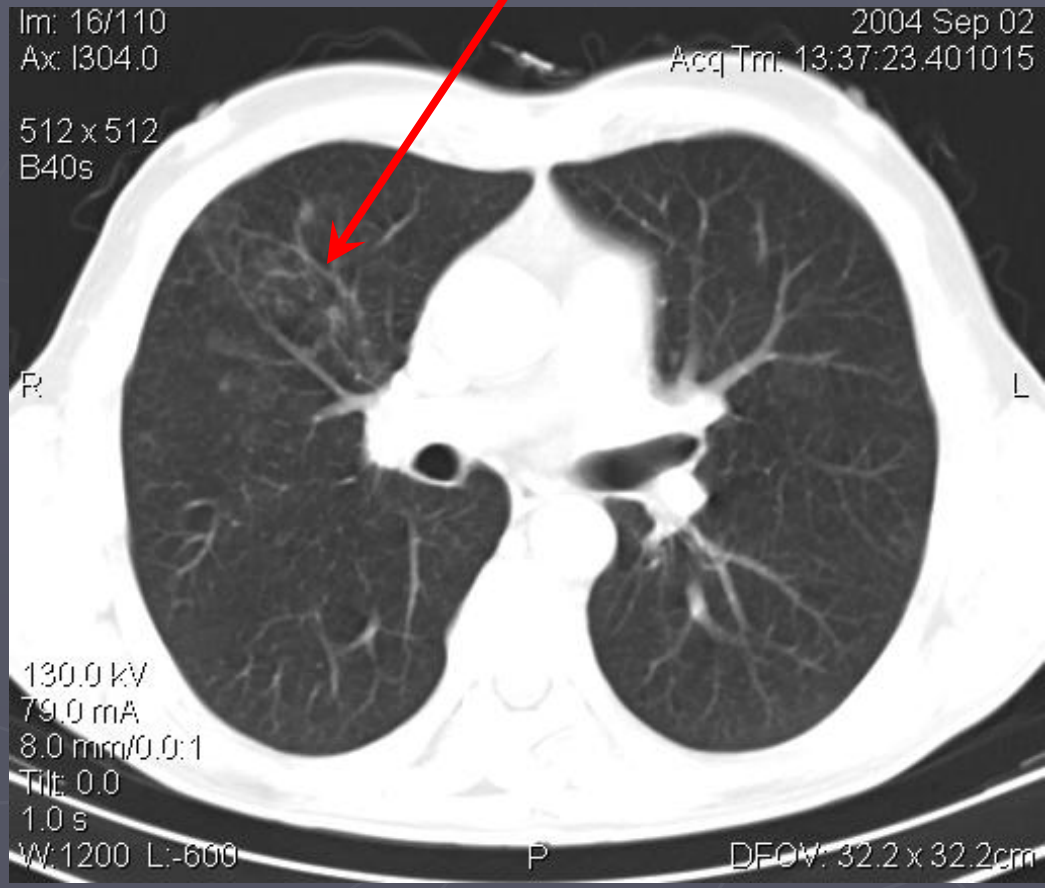




Condition after operative and radiation treatment

Throat cancer





Condition after operative and radiation treatment

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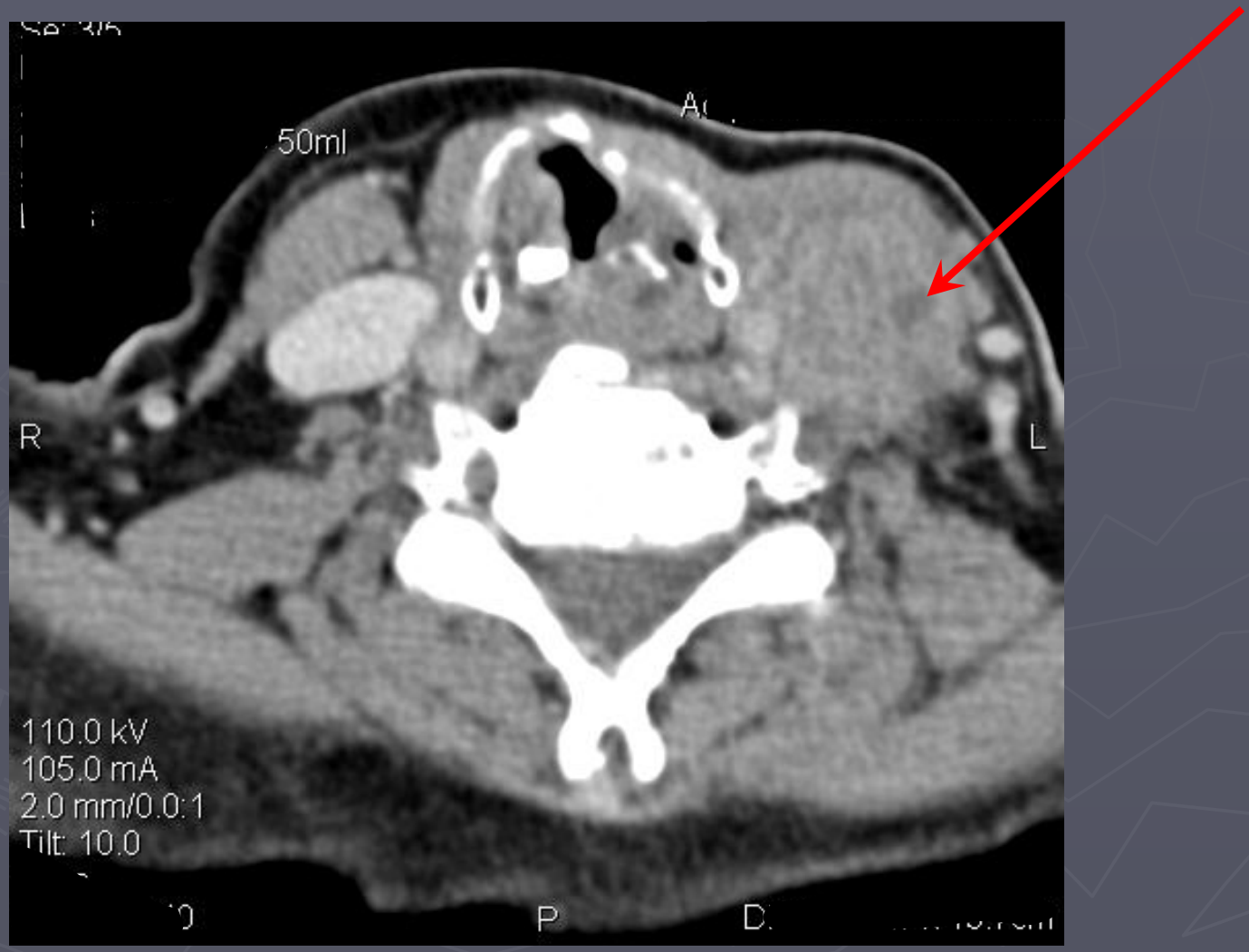
Throat cancer: the lymph nodes lesion



The stages of PET-examination

Entering into patient's body the short-living isotopes

↓

Scanning of radiation

↓

Image reception and its analysis

PET + CT = ?

= PET-CT

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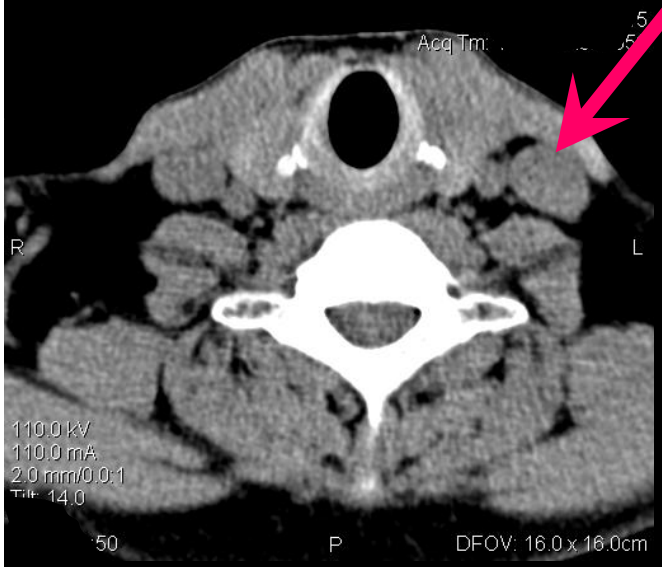
PET-CT – the summary image of the "molecular" + X-ray tomography

?



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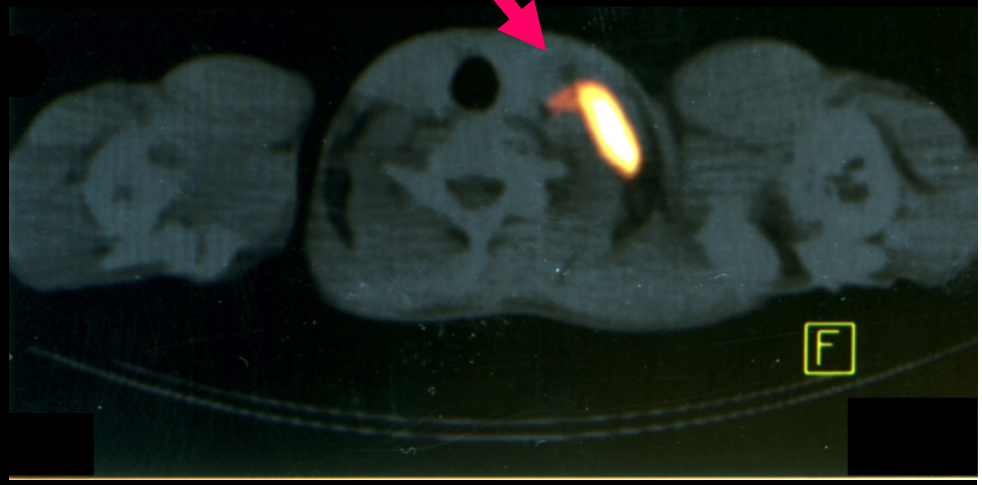

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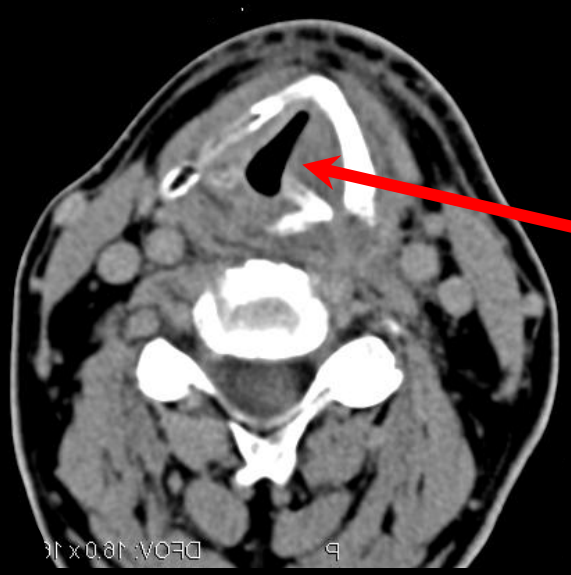
Throat cancer: combined PET-CT



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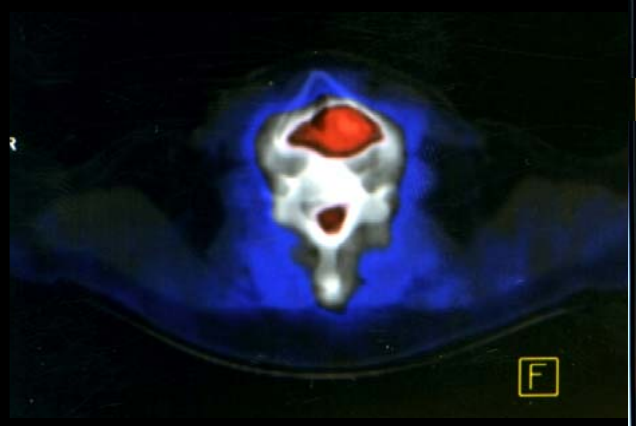

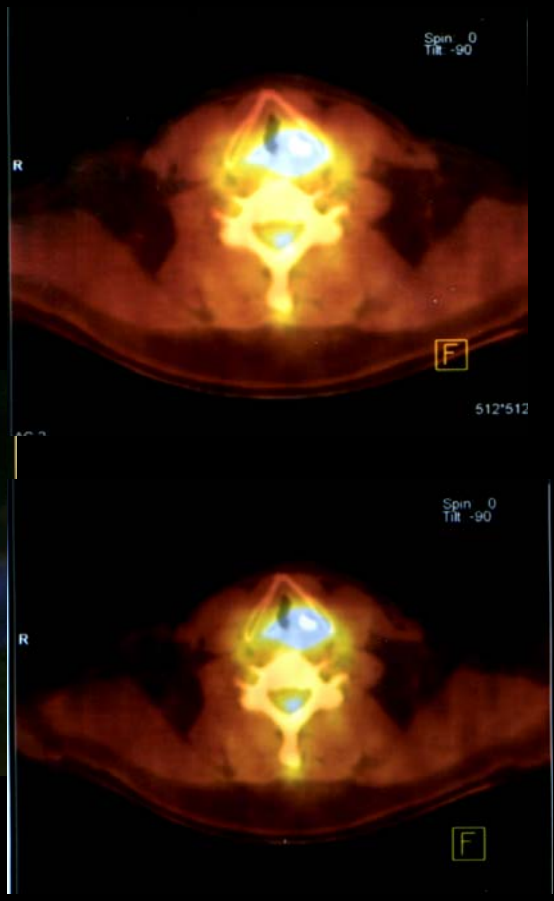

Conclusion

- CT allows to reveal presence of a tumor, its localization and the sizes
- CT would allow to estimate of fatty spaces condition and surrounding soft tissues
- CT would allow to estimate of cartilages lesion and presence of metastases in regional lymph nodes
- CT is necessary for definition of treatment tactics, volume of surgical intervention, a choice of radiotherapy fields
- PET-CT allows to reveal presence of tumoral grouth, would serve for the control and estimation of efficiency radio- and chemotherapy
- PET-CT allows for the revealing remote metastasis

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Thanks for attention!
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