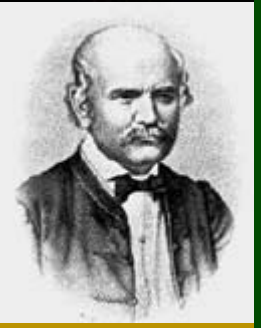

Head-and-Neck Radiology

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Lecture
4th year

Guide-line

- Parts and borders of head-and-neck's region
- Clinician's expectationable radiology knowledge:
  - Examination methods / limitations
  - Patient preparation
  - Ability to choose the adequate modality

Major regions I.

- Skull base
  - Exits of nerves and vessels, synchondroses, cavernous sinus, connection with neighbouring compartments
- Temporal bone
  - outer, middle, inner ear, sigmoid sinus, apex, relations of dura, meatus ac. int., facial canal
- Orbit
  - extra-, intraconal space, pre-/ postseptal space, connenction with neighbouring compartments, thin walls

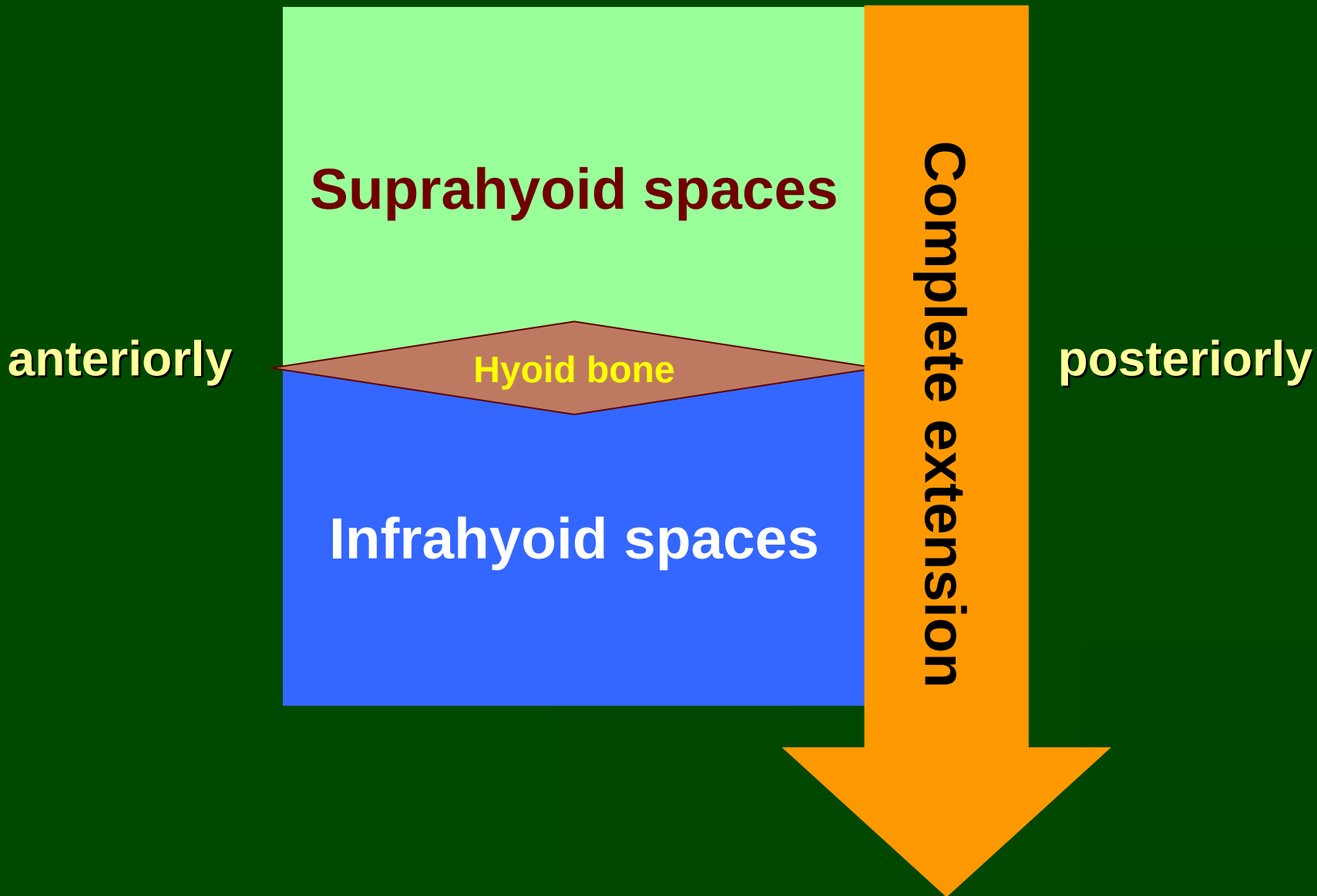
Major regions II.

- Paranasal sinuses
  - ostiomeatal complex, conchae and connections, pars papyracea, blow-out fracture, lamina cribrosa → frontal scala, nasal bone
- Face
  - suprahyoid compartments: parapharyngeal-, retropharyngeal- (spread to the mediastinum), masticator-, parotid-, prevertebral space, pterygopalatine fossa, buccal space, submandibular space

Major regions III.

- Neck
  - pharynx
    - epi- ,meso- (tonsillar fossa, base of tongue), hypopharynx (epiglottic vallecule, piriform sinus)
  - larynx
    - supraglottic space (preepiglottic), glottis (paraglottic space), subglottic space
  - lymphatics
  - thyroid gland/ parathyroid glands
  - cervical, brachial plexus

Classification of major spaces of the neck



Compartments of head-and-neck

Above hyoid bone

- pharyngeal mucosal space
- masticator space
- parapharyngeal space
  - prestyloid / poststyloid comp.
- sublingual space
- submandibular space
- buccal space
- parotid space

Below hyoid bone

- anterior cervical space
- anterior visceral space
- posterior cervical space

Complete extension

- retropharyngeal sp.
- danger space
- carotid sheat
- perivertebral space
  - prevert./ paraspin.

Guide-line

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Modalities can be applied in H & N

- Ultrasonography
- Conventional x-ray (+ fluoroscopy)
  - plain radiograph (unenhanced)
  - contrast-enhanced (water-soluble, non-soluble)
- CT (spiral, multislice, cone-beam) / MRI
- Angiography
  - DSA (digital subtraction angiography)
  - CT-, MR-angiography
- Nuclear medicine
  - scintigraphy
  - SPECT (single photon emission computed tomography)
  - PET (positron emission tomography), PET-CT

Ultrasonography

Indication

- face
- floor of the mouth
- superficial tissues of the neck
- superficial to bones
- most lymphatic regions

Patient preparation

- get off jewels (necklace, bigger ear-ring)
- get off bandage (if possible)
- pull out of tracheostomy canule (if possible)
- Before contrast-enhanced examination
  - patient consent
  - empty stomach

Conventional x-ray
unenhanced

- image: shadow of the atom's electron shell
- radiopaque/ dense → high atomic number
  - bones, calcified structures
- significance decreased due to the application of modern techniques (CT)

Conventional x-ray
unenhanced

Indication

- panoramic view / tooth x-ray
- fracture suspicion on the face
- Inflammation of paranasal sinus
- mastoid cells

Patient preparation

- get off jewels (necklace, ear-ring, piercing)

Conventional x-ray
with CM

- advantage of fluoroscopy: functional information
  - moving of calcified lesions (nodule in thyroid gland)
- swallow examination
  - hypopharynx – tumorous stricture; Zenker-diverticule
- sialography (refill of salivary gland and duct)
  - stones
- easily achievable, rapid, still has its significance

Conventional x-ray
with CM

Indication

- stop caused by a foreign body
- suspicion of perforation
- diverticule
- calcified lesion on the neck
- tumor - stricture

Patient preparation

- get off jewels (necklace, ear-ring, piercing)
- empty stomach
- cooperability is important


swallow study

Un- and contrast-enhanced CT

- technique based on x-ray
  - optional CT angiography
  - better resolution of soft tissues
    ↔ conventional x-ray
  - less good spatial resolution /512x512 px/
    ↔ conventional x-ray
  - higher dose of radiation exposure

Un- and contrast-enhanced CT

Indication

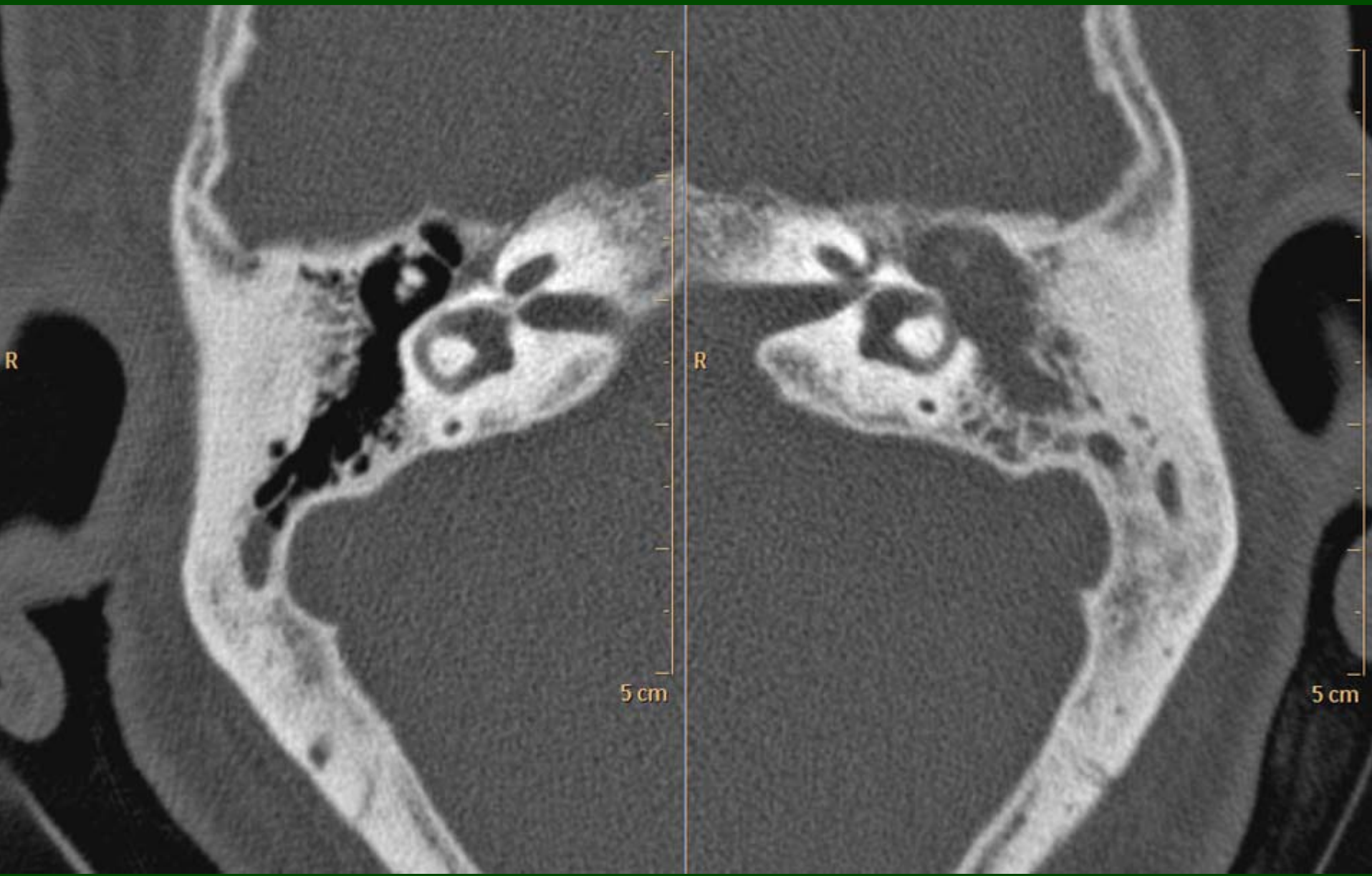
- tumor TNM classification
- regions which are covered by bones (deep face)
- to assess bony relations (fracture, detailed relations of the paranasal sinuses)
- in the suprahyoid region the use of CT is to consider instead of MR based on the question
- infrahyoid neck (the fatty tissues separate the compartments well)

Patient preparation

- get off things made of metal in the examined region
- patient consent – empty stomach
- iv. CM – DM (metformin)

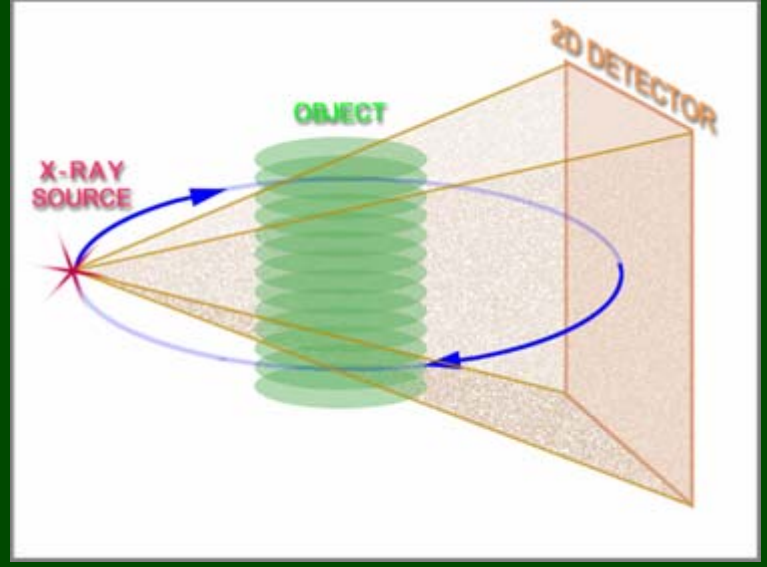
HRCT (temporal bone)

- based on X-ray
- unenhanced ultrathin slices (0.3 mm)
  - increased exposure


R
5 cm
R
5 cm

Conebeam CT

- technique based on x-ray
- unenhanced technique
  - 2D flat panel detector (0.4 mm resolution)
  - significantly less radiation exposure
    - max 100 µSv (↔multidetector CT cca. 1200-3300 µSv)
    - panoramic view film 10-12 µSv (daily background rad 8 µSv)


2D DETECTOR
OBJECT
X-RAY
SOURCE

Conebeam CT

Indication

- implantology
- maxillo-facial surgery
- impactation
- TMJ evaulation
- airway study
- spinal examination
- orthodontics

Un- & contrast-enhanced MRI

- image: map of H atoms in tissues
- best soft tissue contrast
- non-ionizing radiation
- more expensive relatively
- more difficult to available
- temporal resolution is low (30-50 min)

Un- & contrast-enhanced MRI

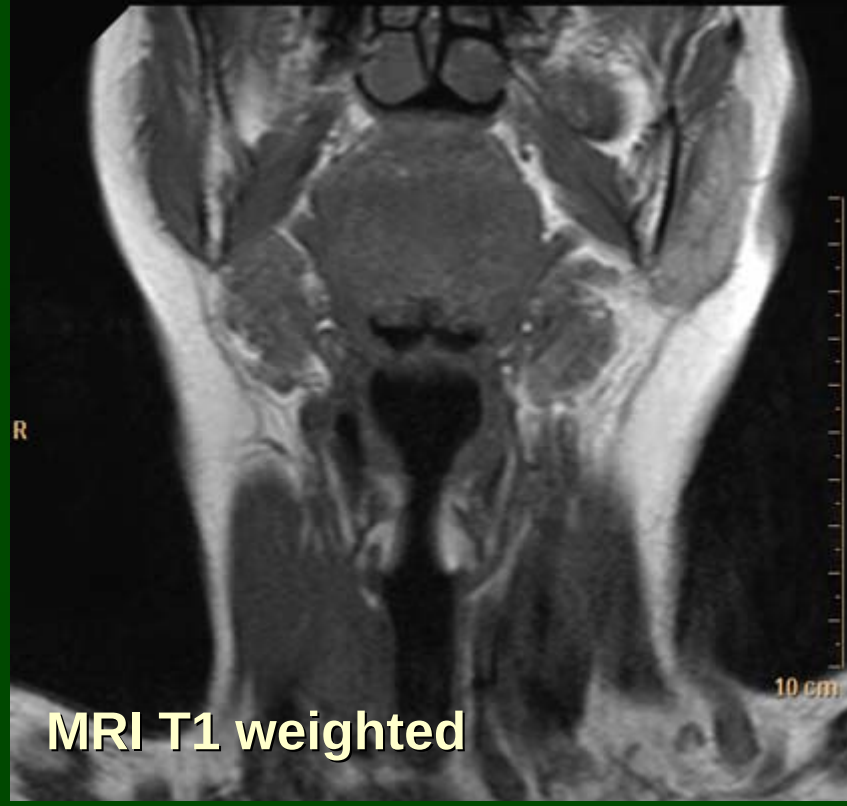
Indication

- suprahyoid region
- evaluation of scull base
- Q's on tumorous infiltration (scarr ↔ recidiva tissues)

Patient preparation

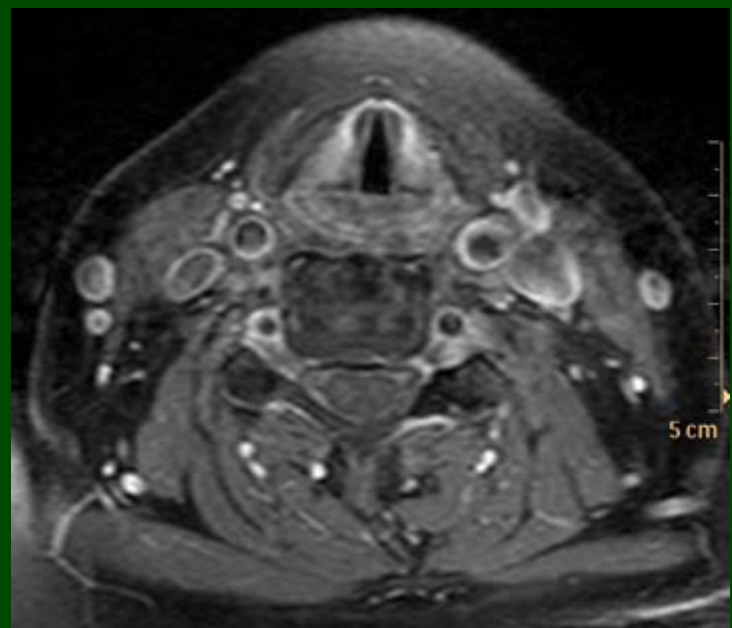
- remove things made of metal
- pacient consent – empty stomach
- contraindication: prothesis made of metal, pacemaker
- rel. contraindication: claustrophoby

MRI T2 weighted



MRI T1 weighted

MRI T2 weighted



Digital subtraction angiography

Indication

- assess of vasculature of tumors in order to apply consecutive intervention (RFA-radiofrequency ablation, chemoembolisation, chemoablation, embolisation)
- paragangliomas localised in carotid sheat

Patient preparation

- patient consent – empty stomach
- aseptic circumstances

Nuclear medicine

- low resolution in morphology
- rich in metabolic information
- Tc isotope
  - gamma camera (thyroid gland scintigraphy)
  - SPECT – single photon emission CT
- FDG-PET
  - F^{18} glucose – positron rad.
  - search for primary tumor or metastasis, inflammation
  - PET-CT image fusion

Nuclear medicine

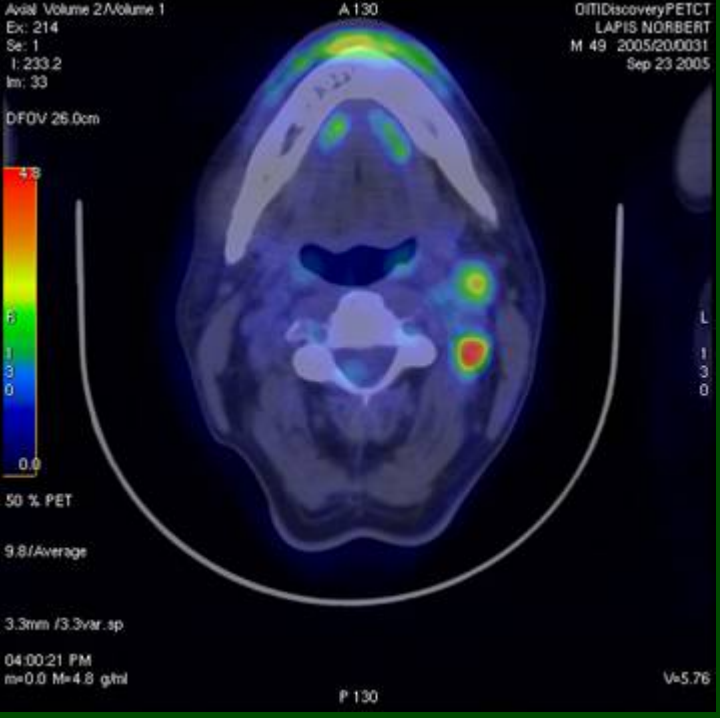
Indication

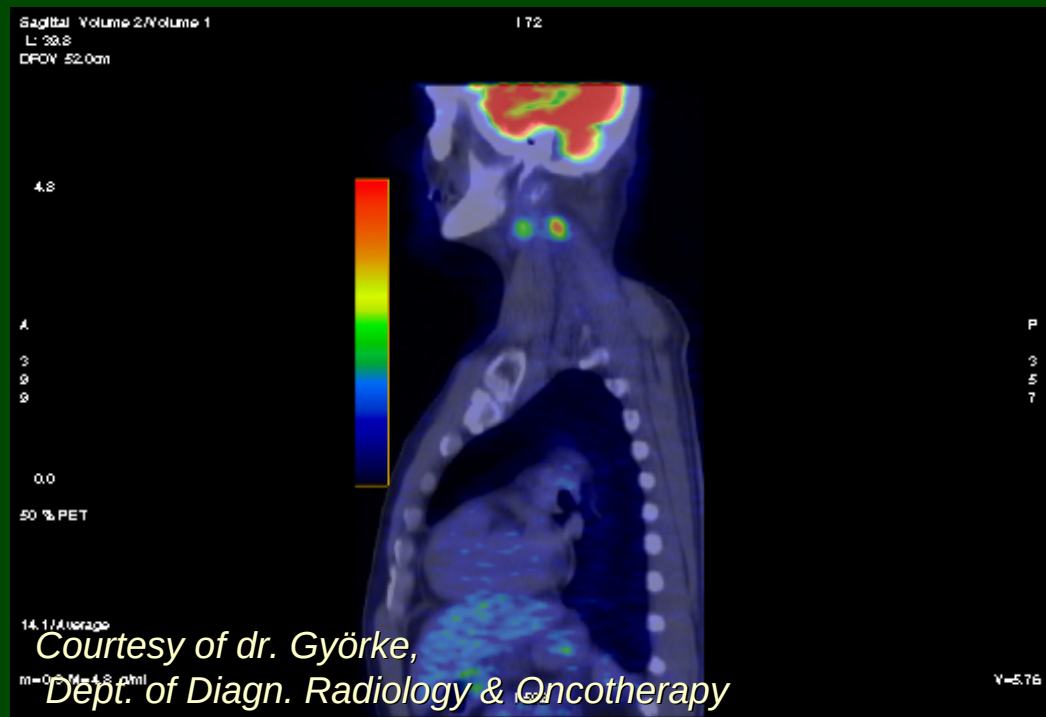
- tumors
- follow-up examination
- inflammation
- thyroid & parathyroid gland scint.

Patient preparation

- patient consent – empty stomach & urinary bladder
- previous history! (old fracture, degenerative lesion)

- treated hypopharyngeal cancer
- known solitary hepatic metastasis
- SOLITARY?
  NO: lymphnode metastases present





Courtesy of dr. Györke,
Dept. of Diagn. Radiology & Oncotherapy

Guide-line

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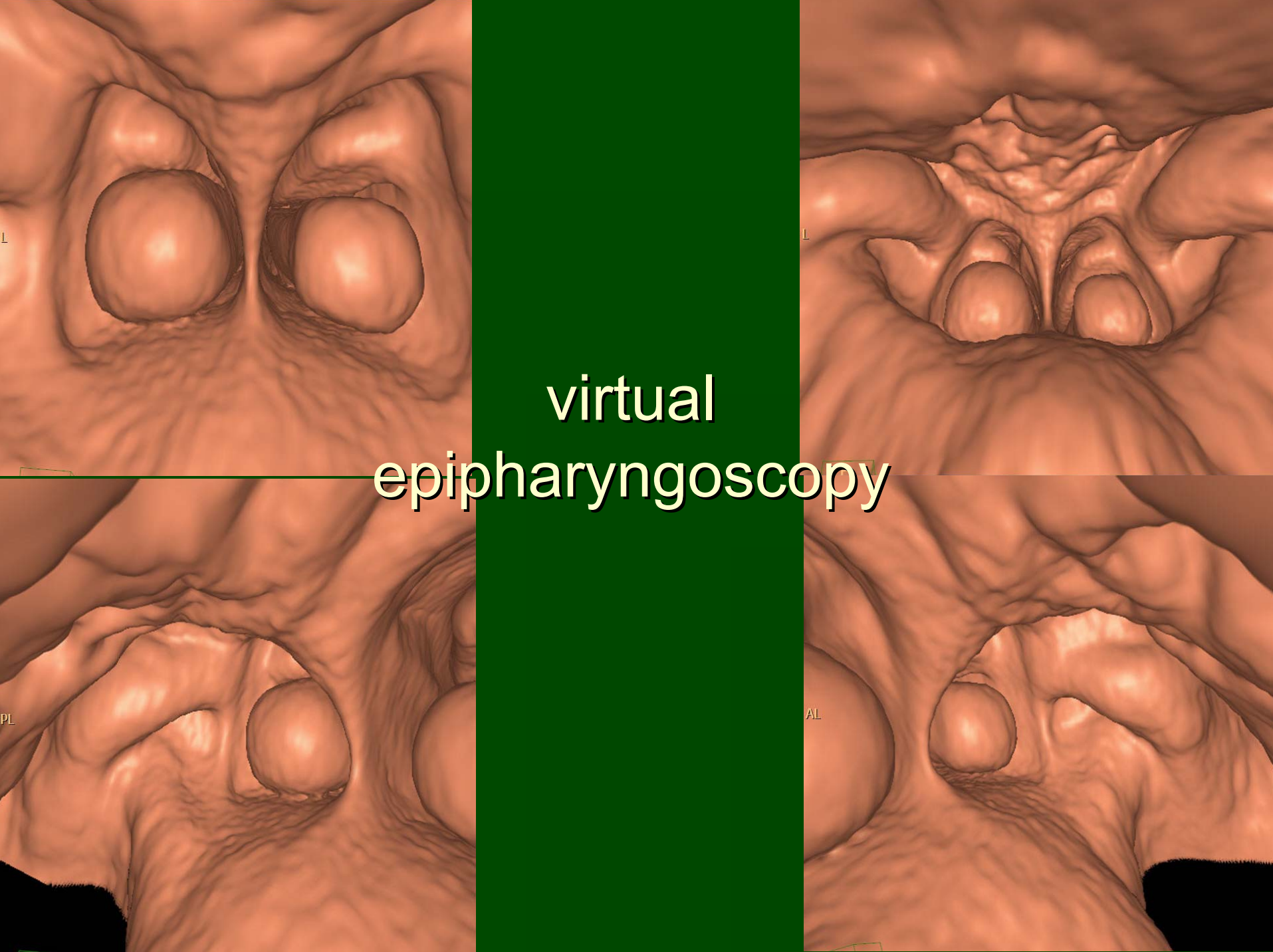
REGION	Modality of choice
Scull base	**CT** *bone* – **MRI** *soft tissue, cranial nerves*
Temporal bone	**HRCT** *bony details* – **MRI** *inflammation* **Schüller radiograph** *inflammation/ opacity*
Orbit	**CT** *bony walls* – **MRI** *inflammation, tumor* **X-ray** *fracture* – **US** *ophthalmology*
Paranasalis sinuses	**X-ray** *acute sinusitis* – **CT** *ostium, tumor* – **MRI** *inflammation, tumor (spreading)*
Face	**CT** *bony walls* – **MRI** *inflammation, tumor (spr)* **X-ray** *fracture* – **US** *buccal space*
Neck	**US** *soft tissues* – **CT** *soft tissues, larynx* – **MRI** *soft tissues, tumor, inflammation*


virtual
epipharyngoscopy

Take home messages…

- Good previous history => Half of diagnosis
- Important to know the technical basics of modalities
  - X-ray: bone, metal, gas
  - CT: as x-ray (bone destruction) + no summarizing effect + good delineation effect due to fatty tissue
  - MRI: best of soft tissue contrast + evaulation of tumor and inflammatory process + no ionizing-radiation (children, pregnants…)
  - Angiography: pathologic vascular pattern + possibility of intervention
  - NM: metabolic information = search for primary TU + distant metastasis