Salivary Glands

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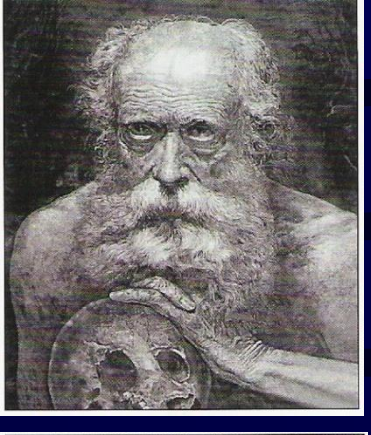


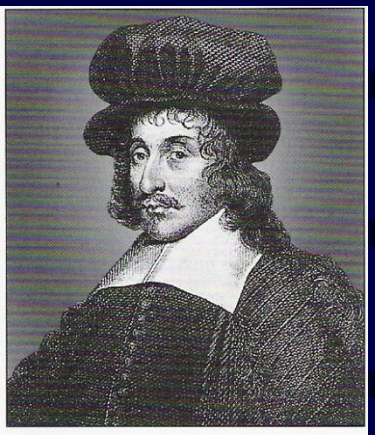


Fig. 1b
Thomas Wharton (1614–1673).

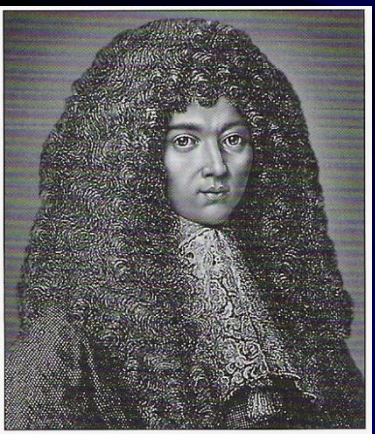


Fig. 1d
Caspar Bartholin (1655–1738).

- ***Hippocrates*** 460-370 BC described first the salivary gland diseases
- 1000 yrs later ***Abulcasis***, islamic surgeon – instruments, ranula
- ***Paulus Aeginata*** and ***Ambroise Paré*** described salivary tumours in 16th century.
- ***Wharton*** – ductal system in 17th century.
- ***Stenon***- anatomy of the parotid gland (Stensen`s)
- ***Bartholinus*** – subling. duct

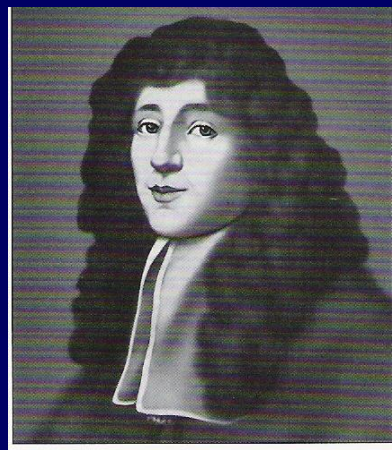
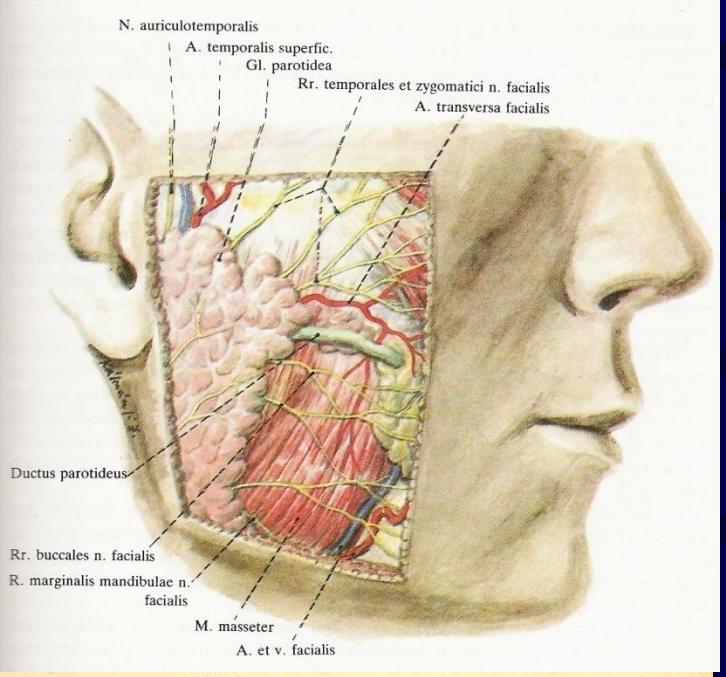
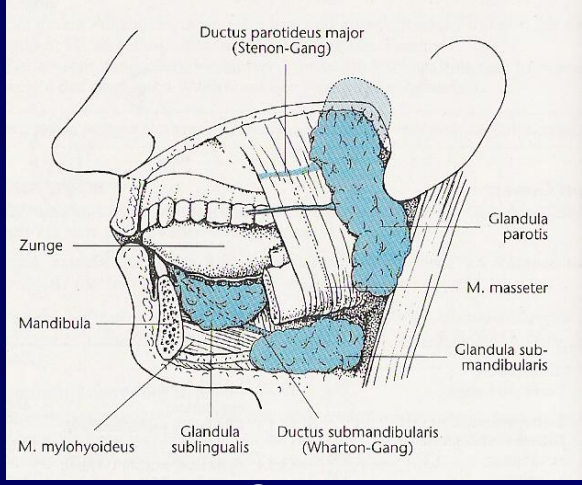
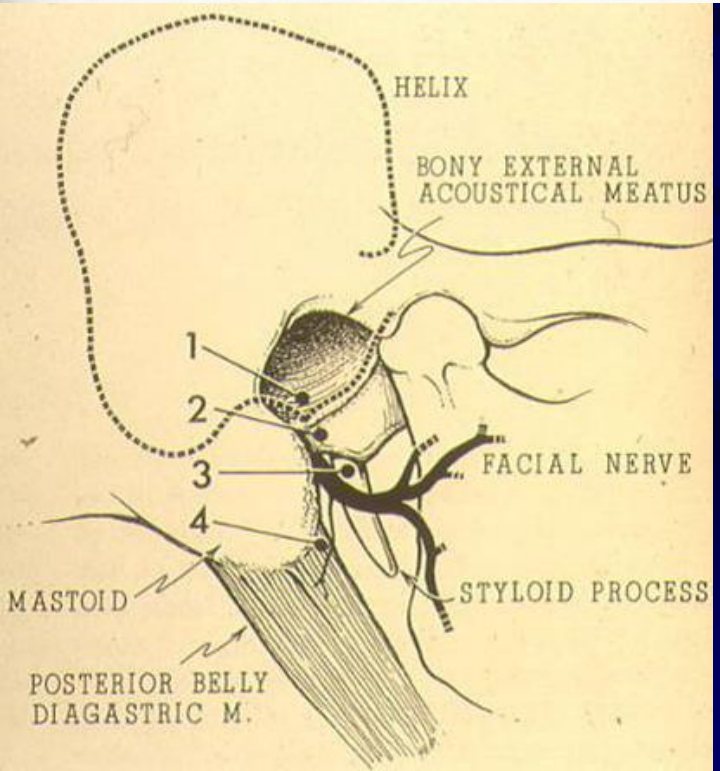


Fig. 1c
Nicolaus Stenonius (1638–1686),
Wellcome Institute Library, London.

Anatomy





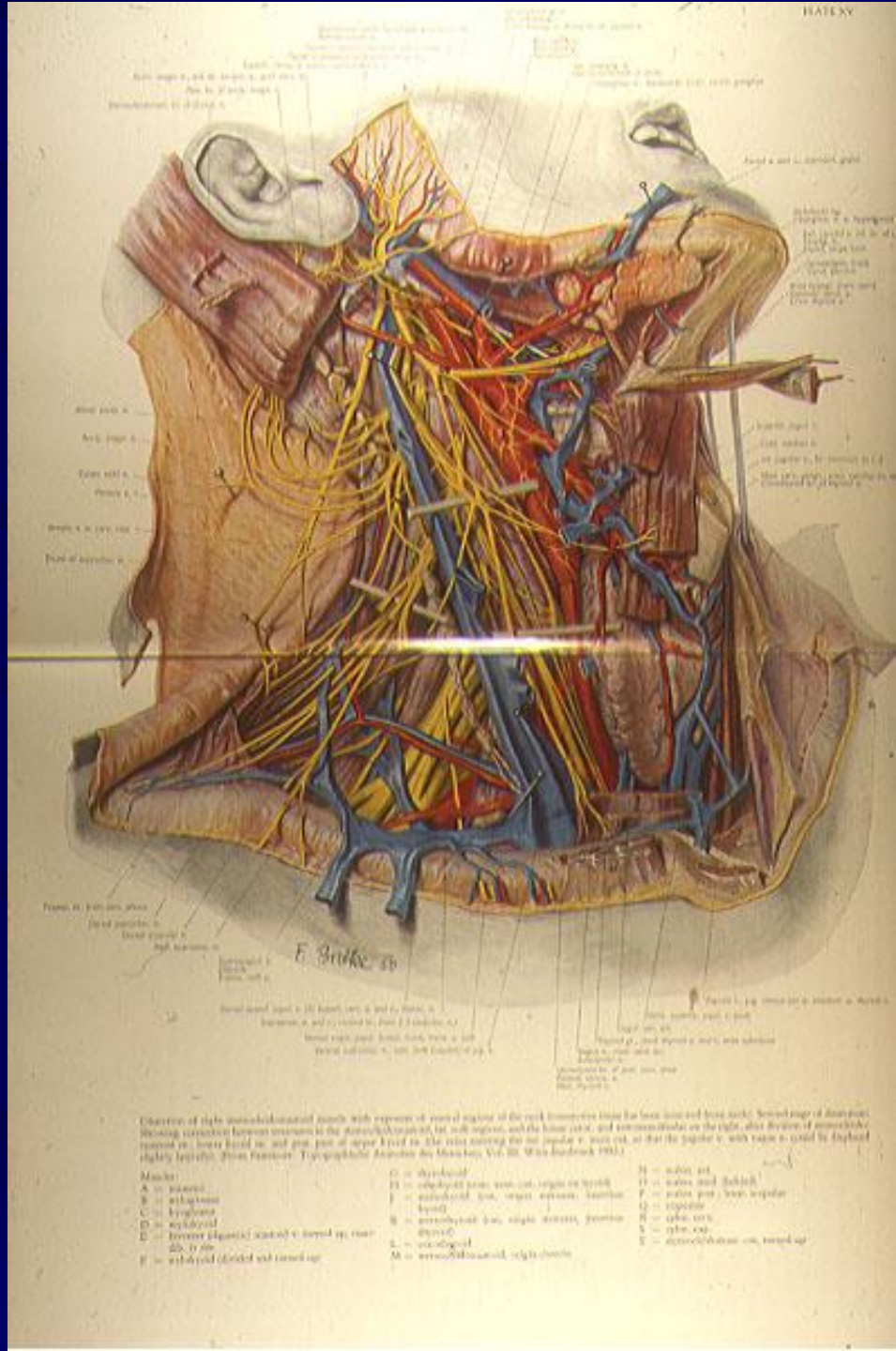


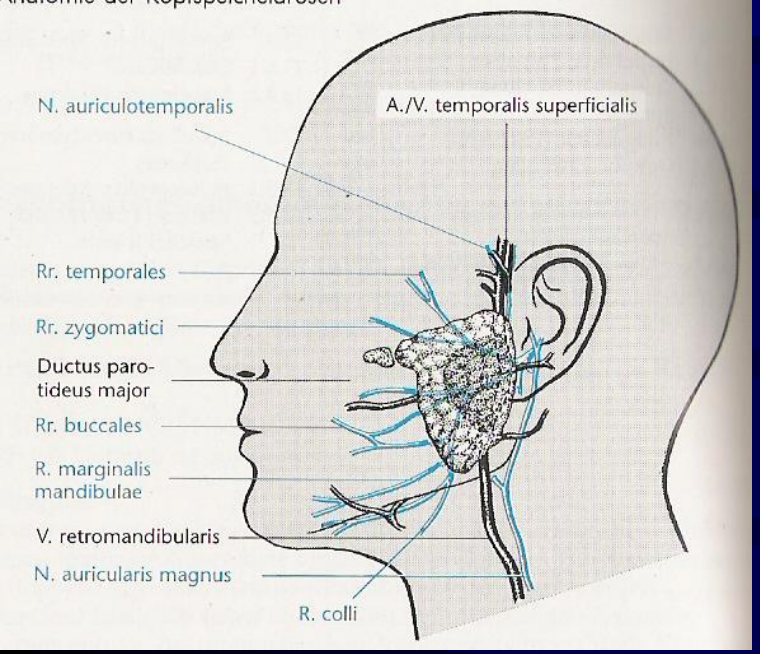
- Parotis – retromandibular fossa
- ***Posteriorly***: m.scm, proc.mastoid, ext. ear canal
- ***Anteriorly***: M. masseter, mandibula
- ***Superiorly***: TMJ, arc.zygomat.
- ***Inferiorly***: ~ 1cm mandib. proc.
- ***Medially***: cranial base, parapharyngeal space, m digatricus (post. belly)
- ***Laterally:*** skin

Nerves:

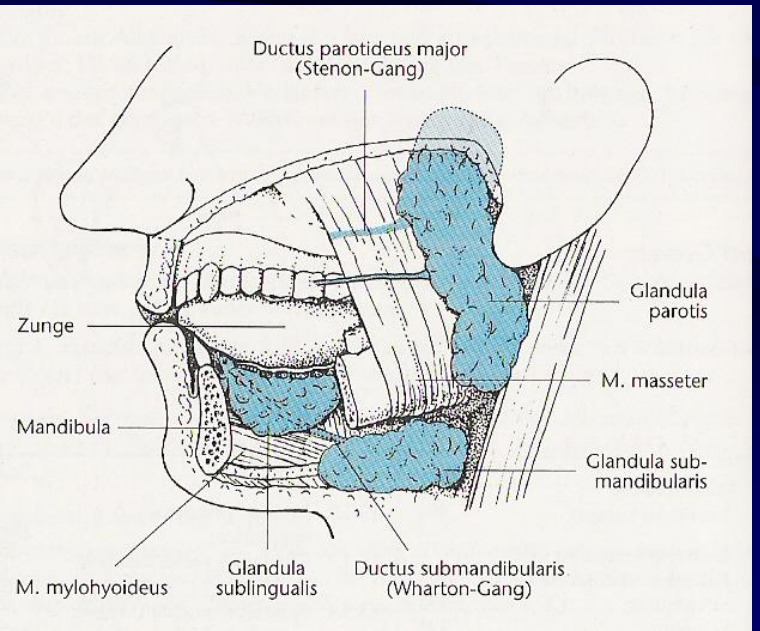
N. Facialis (n.VII.)

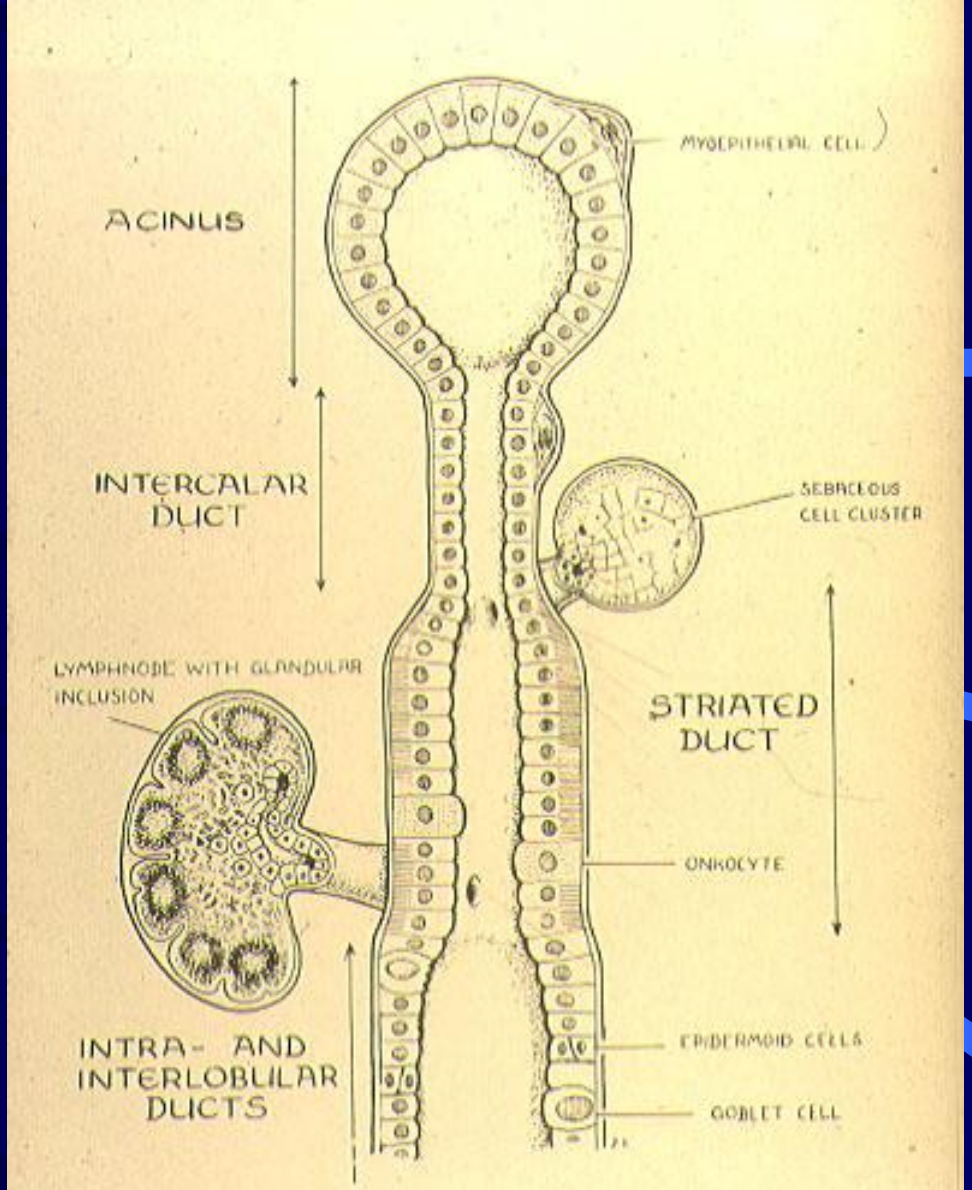
- n. petrosus major
- n. stapedius
- chorda tympany
- r. digastricus et stylohyoideus
- motor fibres





Serous and mucinous saliva





4–1: Schematic drawing of the histology of a normal parotid gland. The different cell types correspond to particular forms of tumors and hamartomas.

Parasympatic innervation of salivary glands

- N. petrosus major---ggl.pterigopalatinum---n. lacrimalis (V/1) et n. zygomaticus(V/2)

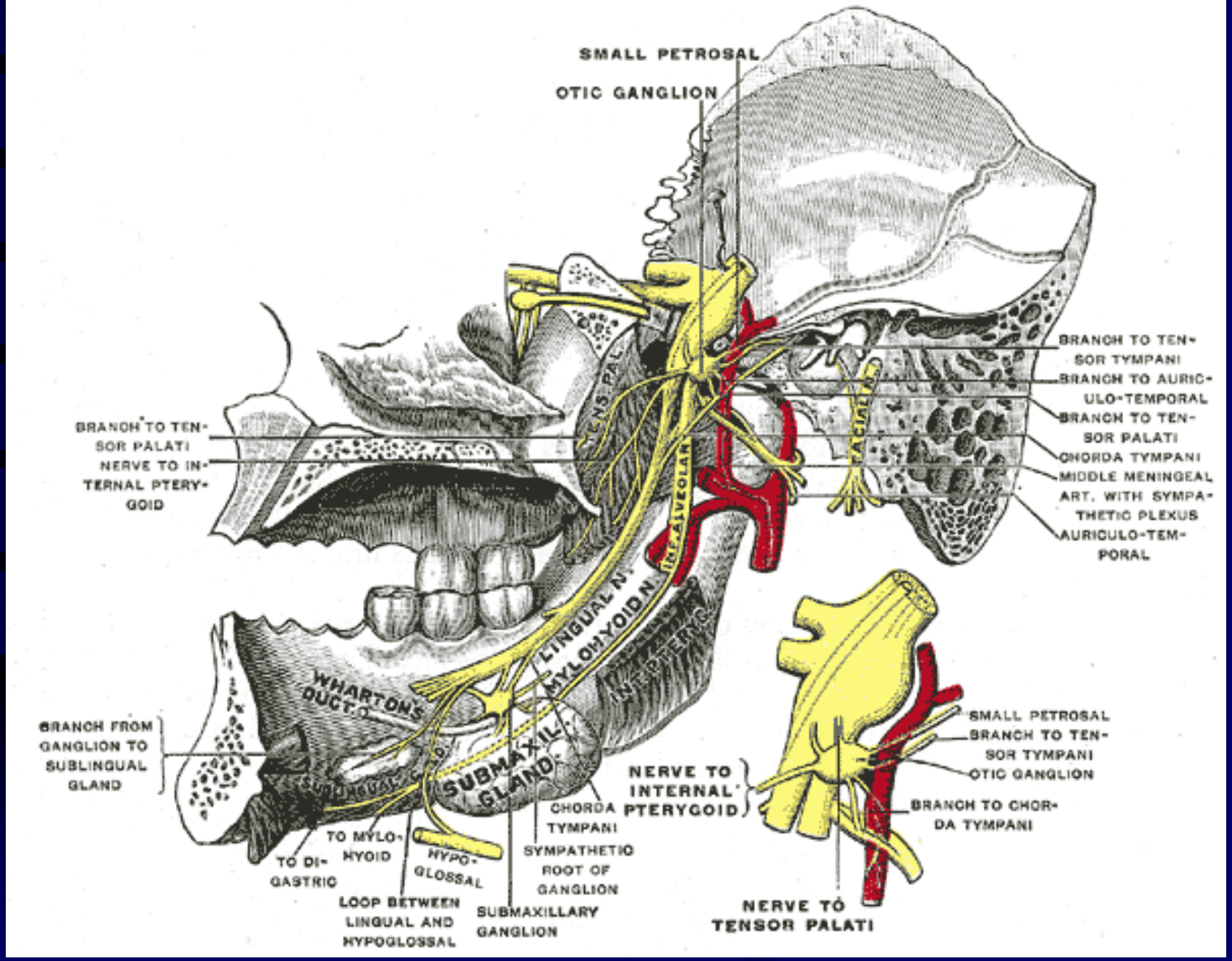
  Lacrimal gland, nasal and oral mucosa

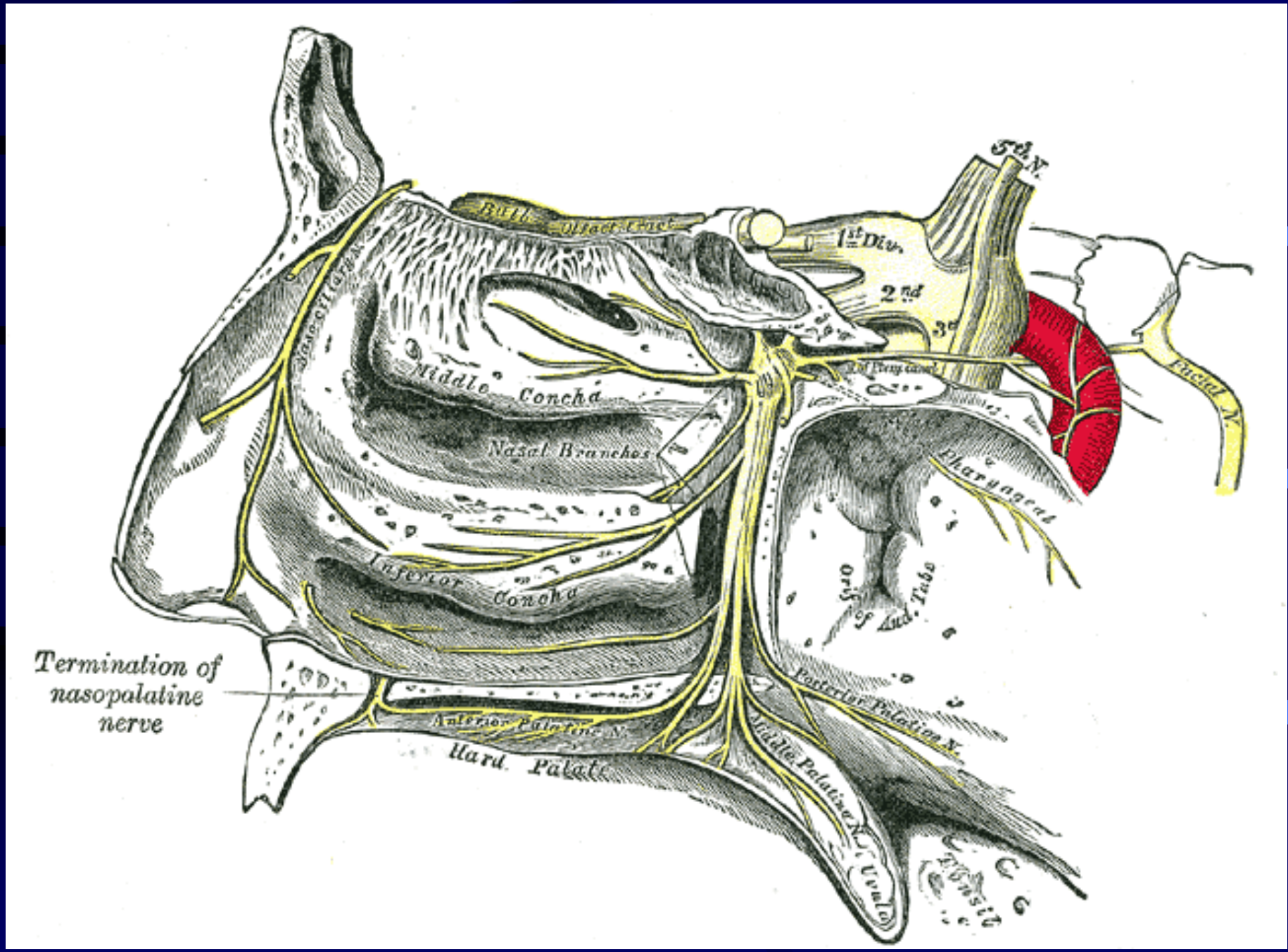
- Chorda tympani --- ggl.submandibulare --- n. lingualis (V/3)

  Gl. Submandibular and gl. sublingual

- N. petrosus minor (n.IX) --- ggl.oticum --- n. auriculotemporalis (V/3)

  Gl. parotis


SMALL PETROSAL
OTIC GANGLION
BRANCH TO TENSOR TYMPANI
BRANCH TO AURICULO-TEMPORAL
BRANCH TO TENSOR PALATI
CHORDA TYMPANI
MIDDLE MENINGEAL ART. WITH SYMPATHETIC PLEXUS
AURICULO-TEMPORAL
BRANCH TO TENSOR PALATI
NERVE TO INTERNAL PTERYGOID
TENS. PAL.
INF. ALVEOLAR
LINGUAL N.
MYLOHYOID N.
INF. PTERYG.
WHARTON'S DUCT
SUBLINGUAL G.
SUBMAXILLARY GLAND
BRANCH FROM GANGLION TO SUBLINGUAL GLAND
TO DIGASTRIC
TO MYLOHYOID
HYPOGLOSSAL
LOOP BETWEEN LINGUAL AND HYPOGLOSSAL
SUBMAXILLARY GANGLION
CHORDA TYMPANI
SYMPATHETIC ROOT OF GANGLION
NERVE TO INTERNAL PTERYGOID
SMALL PETROSAL
BRANCH TO TENSOR TYMPANI
OTIC GANGLION
BRANCH TO CHORDA TYMPANI
NERVE TO TENSOR PALATI

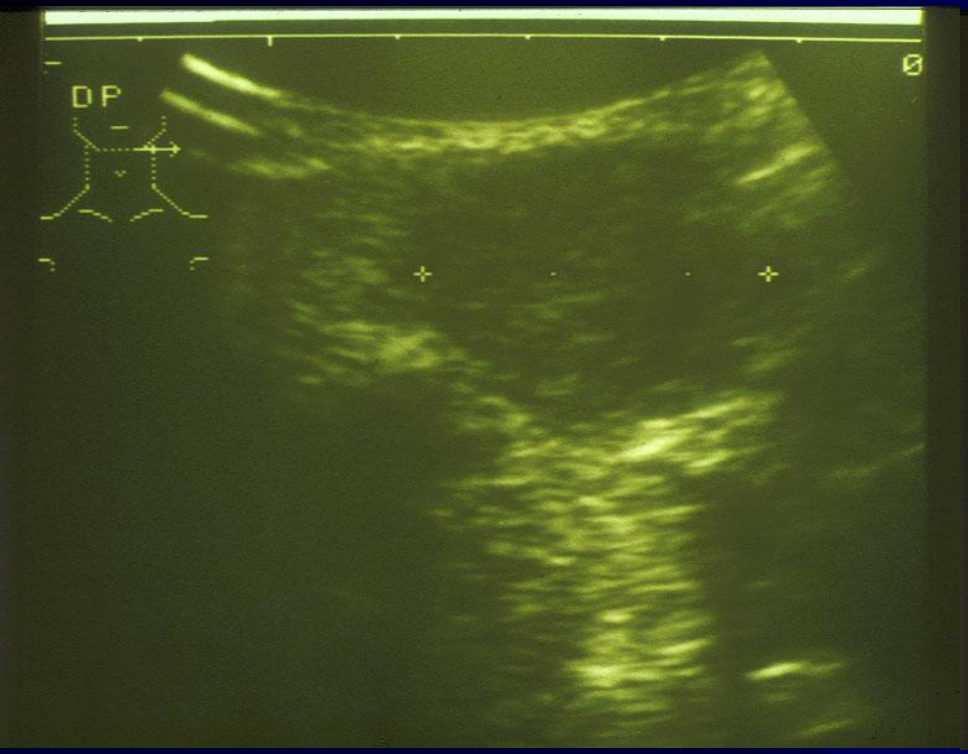

5th N.
1st Div.
2nd
3rd
Middle Concha
Nasal Branches
Inferior Concha
Pharyngeal
Orif. of Aud. Tube
Termination of nasopalatine nerve
Posterior Palatine N.
Anterior Palatine N.
Middle Palatine N.
Hard Palate
Uvula
Facial N.

Formation and function of saliva

- 1000-1500 ml/day, 99,5% is water, pilocarpin stimulates production
- Parotid serous, subling. mucous,
- Electrolytes, protein, amylase, IgA, Alb, Lysosome, Kallikrein, Trypsine inhibitor
- Protection, digestive, excretion of aoutgenous or foreign materials (iodine, coag.factors, alkaloids, viruses, coxackie, cytomegaly, hepatitis, EBV), protection of teeth (fluor), mediates the sense of taste.
- Xerostomia (eg. Sjogren`s, RT, dehidration)
- Sialorrhea (oral cavity diseases)
- Ptyalismus (Parkinson`s, drooling)

Diagnostical procedures

- Hx (eating-pain-sialolith, sex-female-Sjogren`s)
- Inspection (bilat-mumps) and Examination and bimanula palpation
- Ultrasound
- X-ray (mandibula), Sialography
- Biopsy (FNA, open)
- CT
- MRI
- Thermograpy, scintigraphy, endoscopy, chemical analysis of saliva, lymphography…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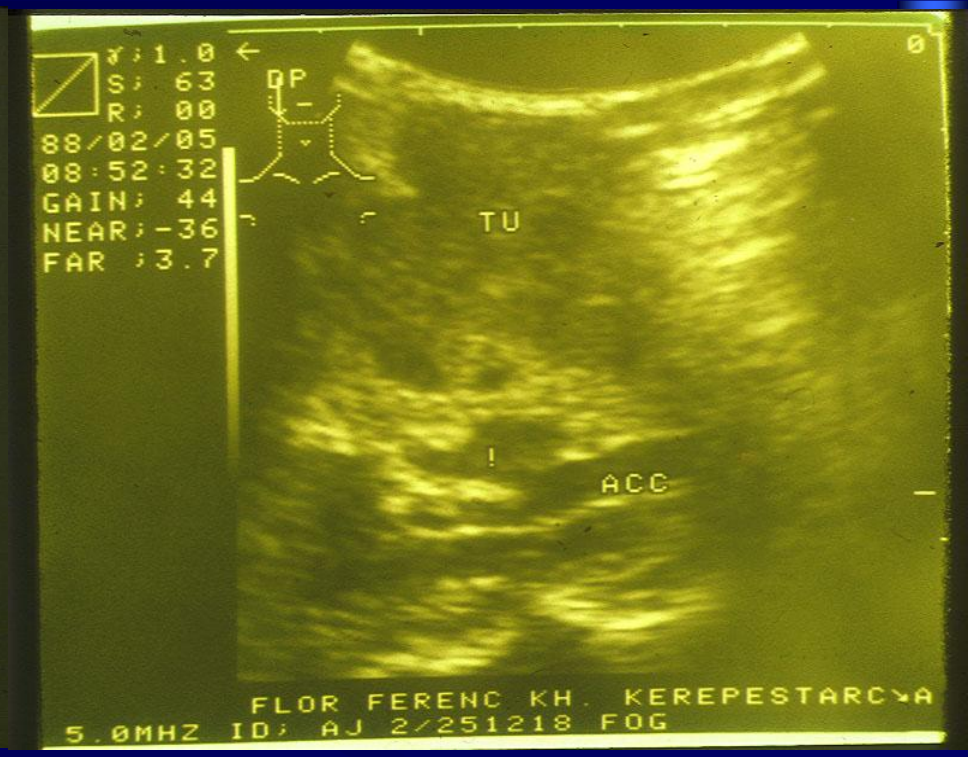
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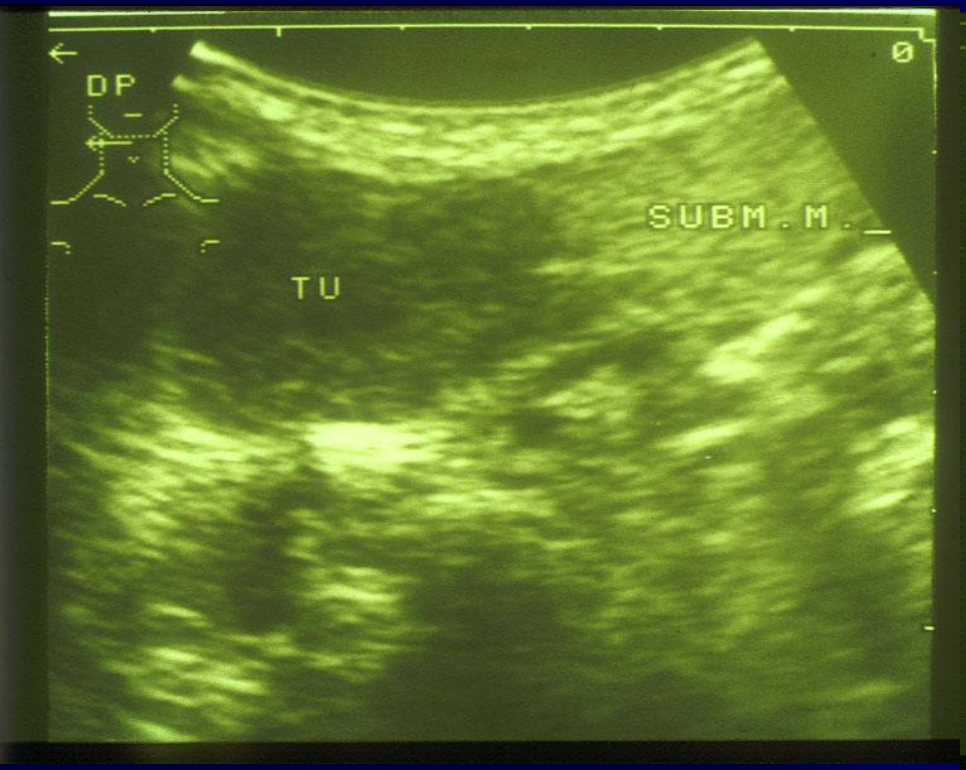
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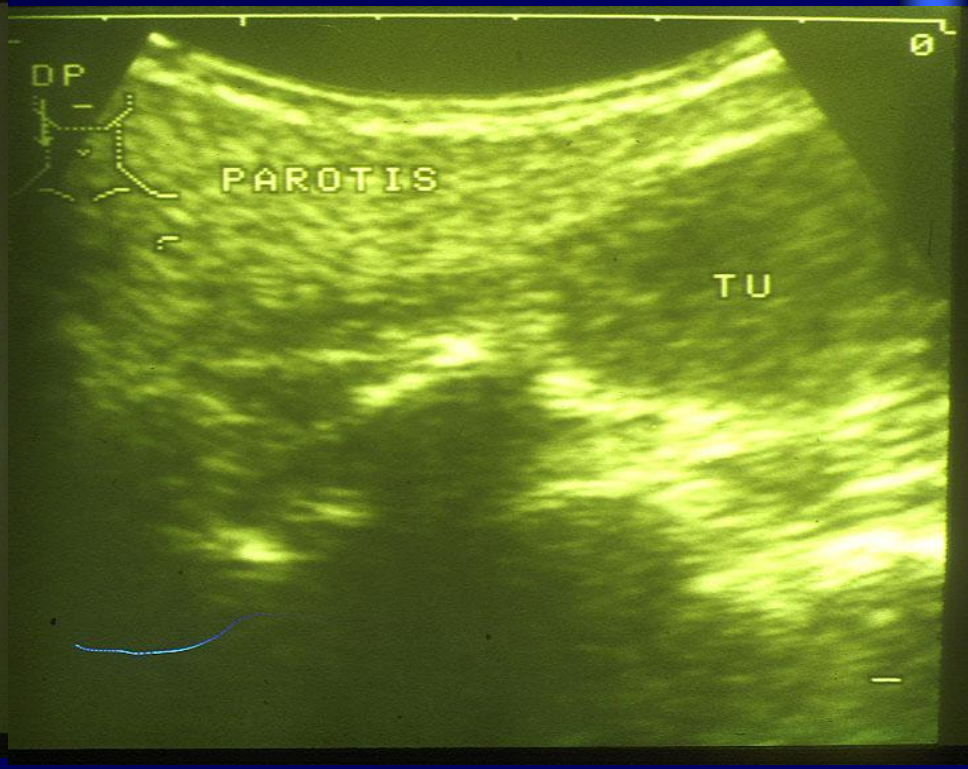
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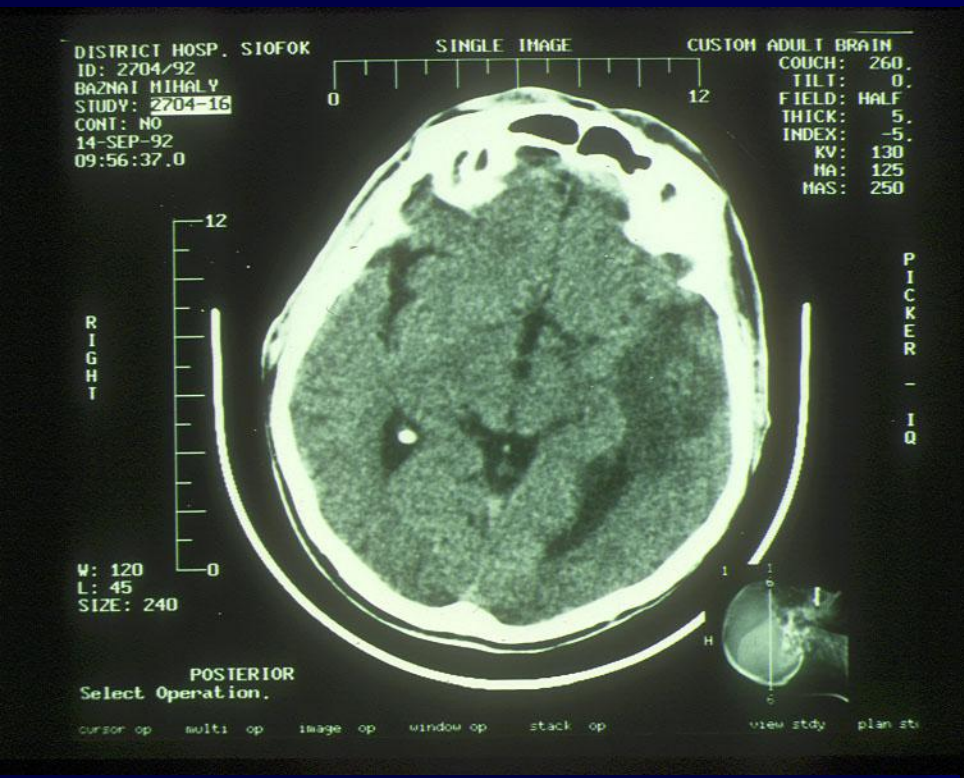
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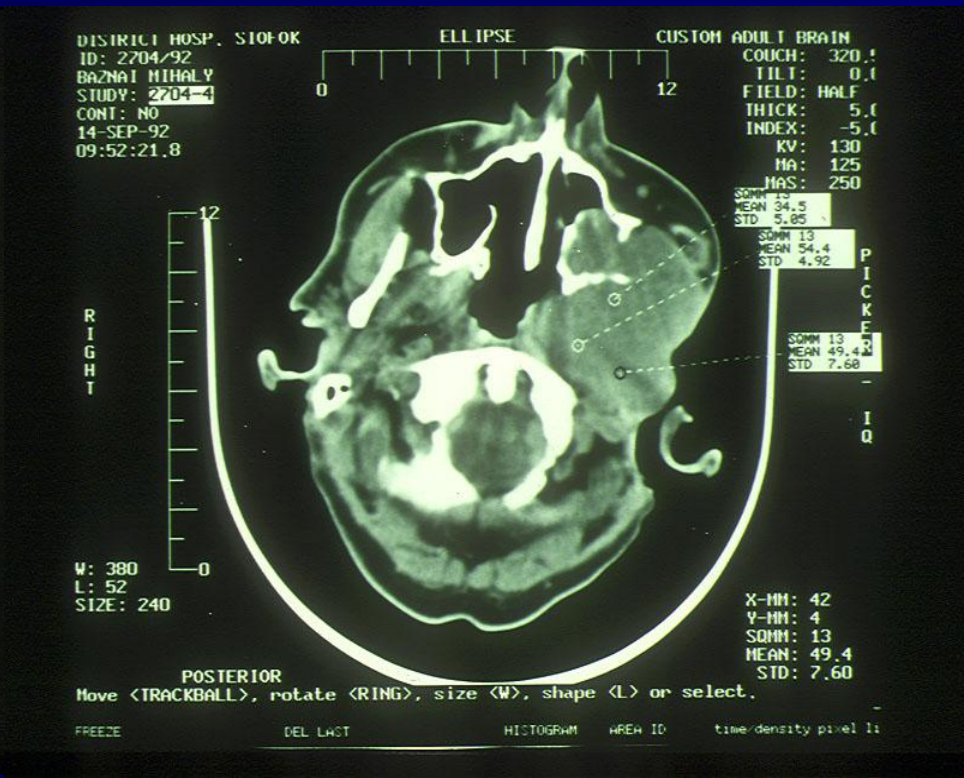
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FREEZE
DEL LAST
HISTOGRAM


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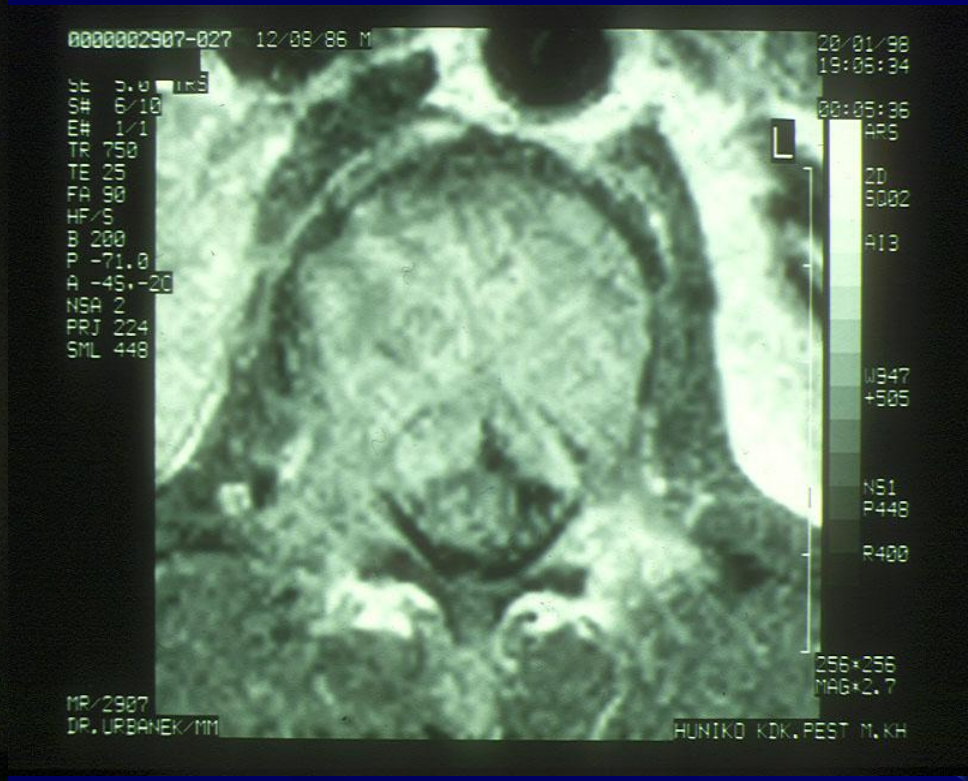
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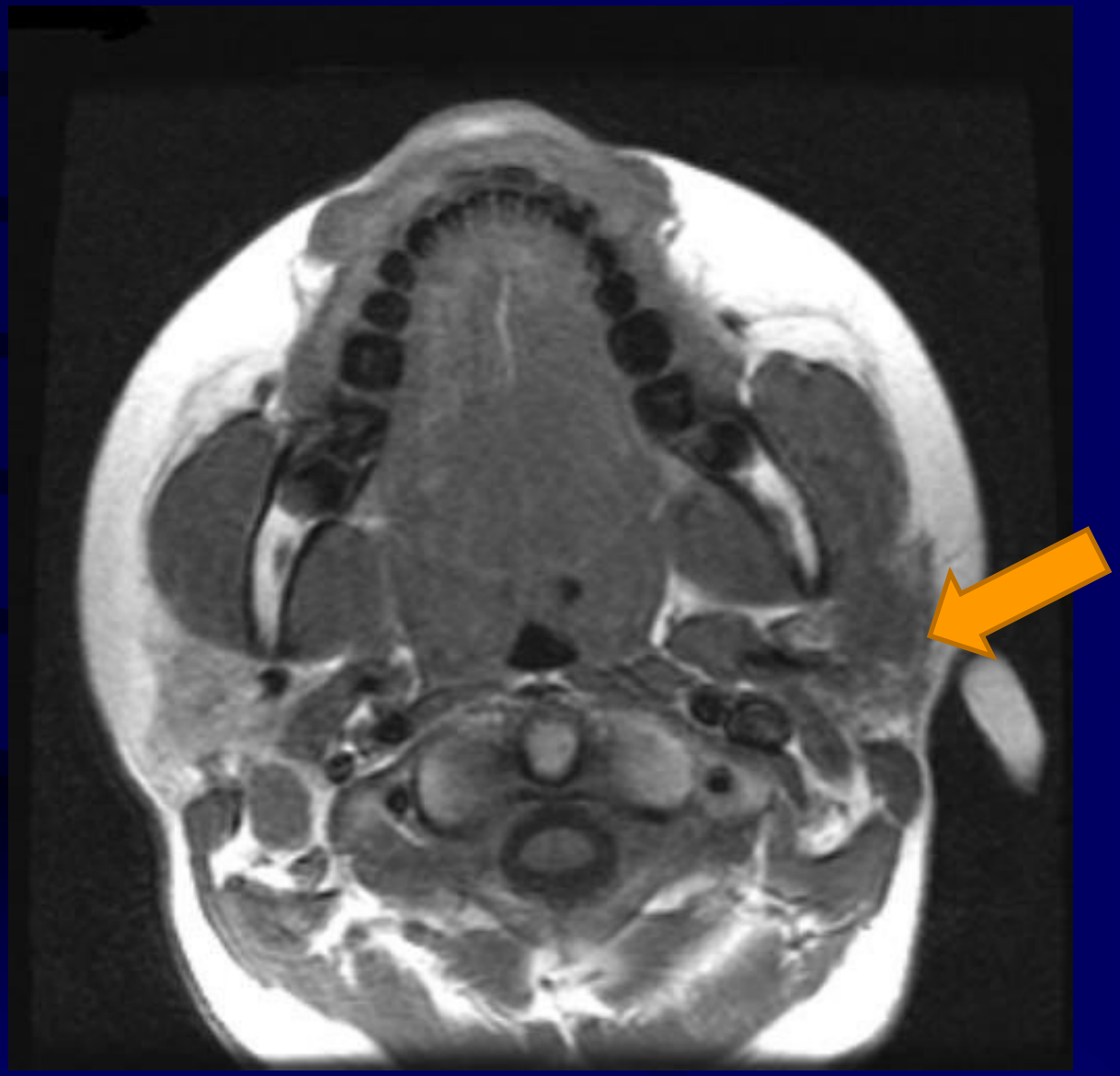
DR.URBANEK/MM
HUNIKO KOK.PEST M.KH

parotid gland tu axial T1 MRI low signal mass Left mucoepidermoid cc

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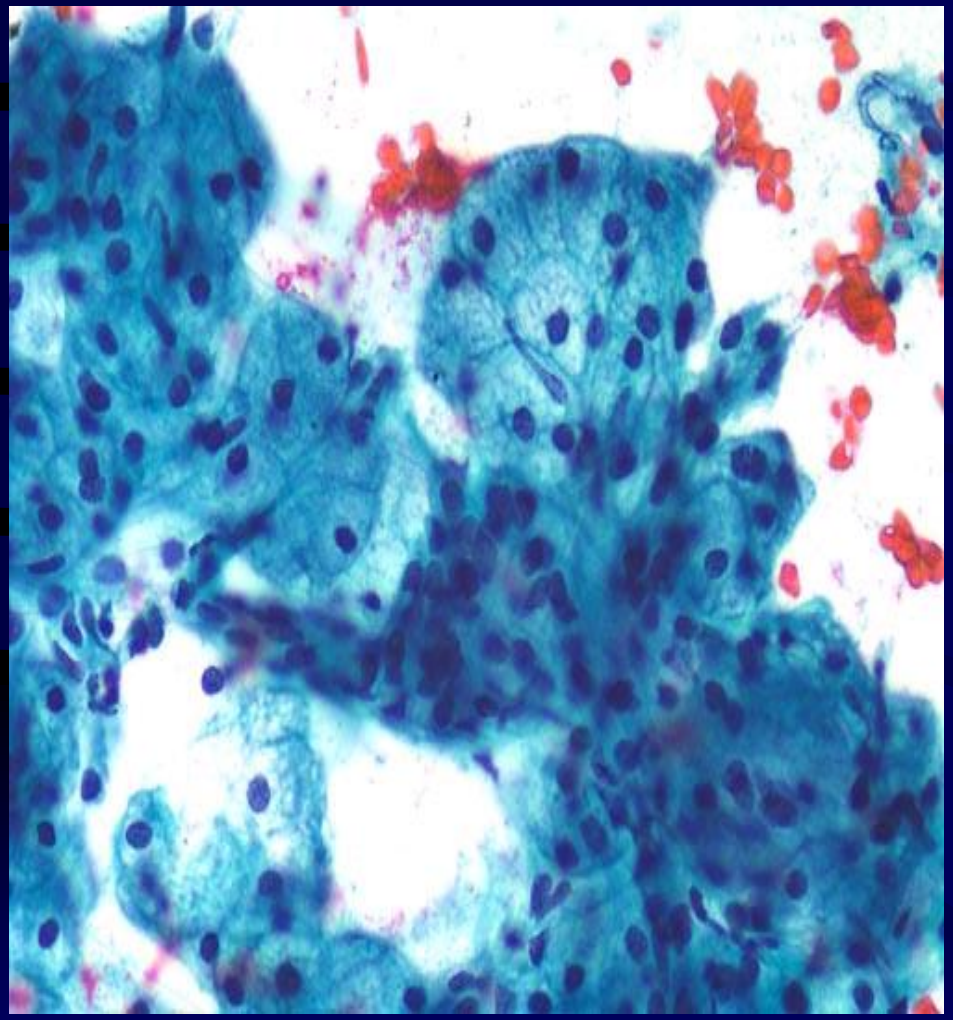
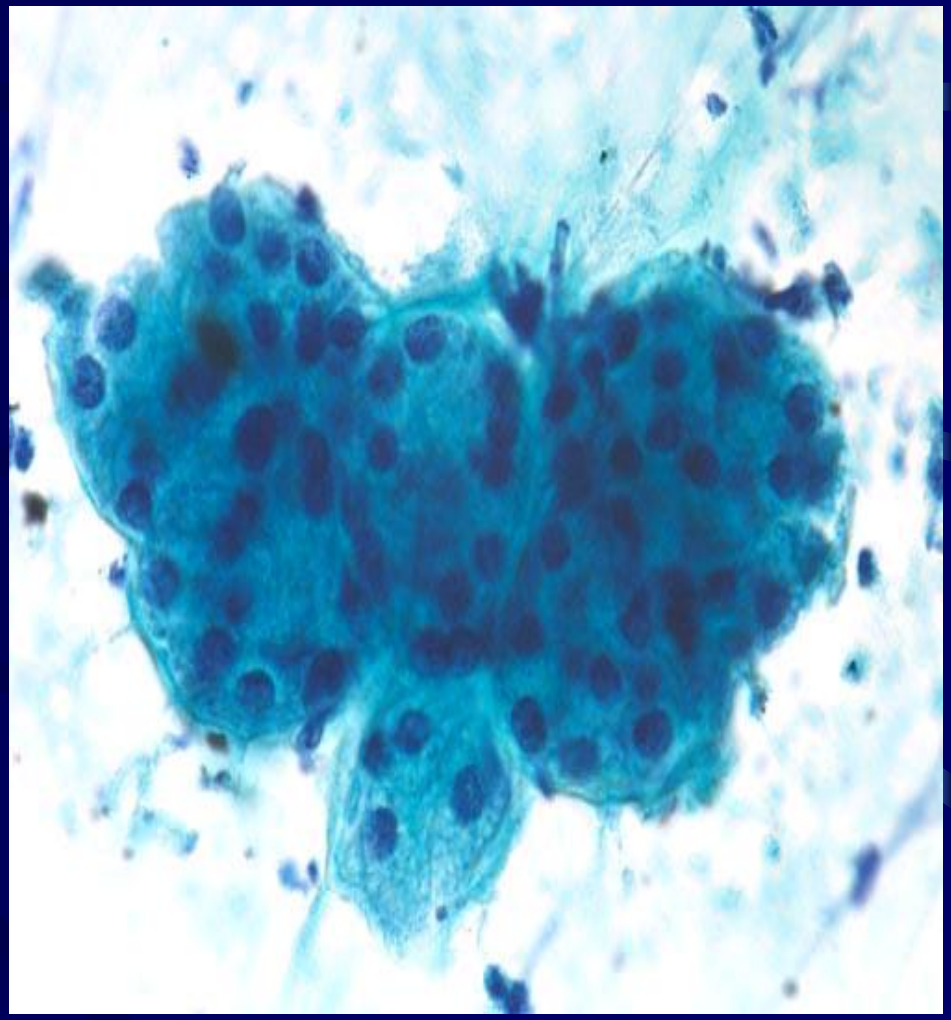
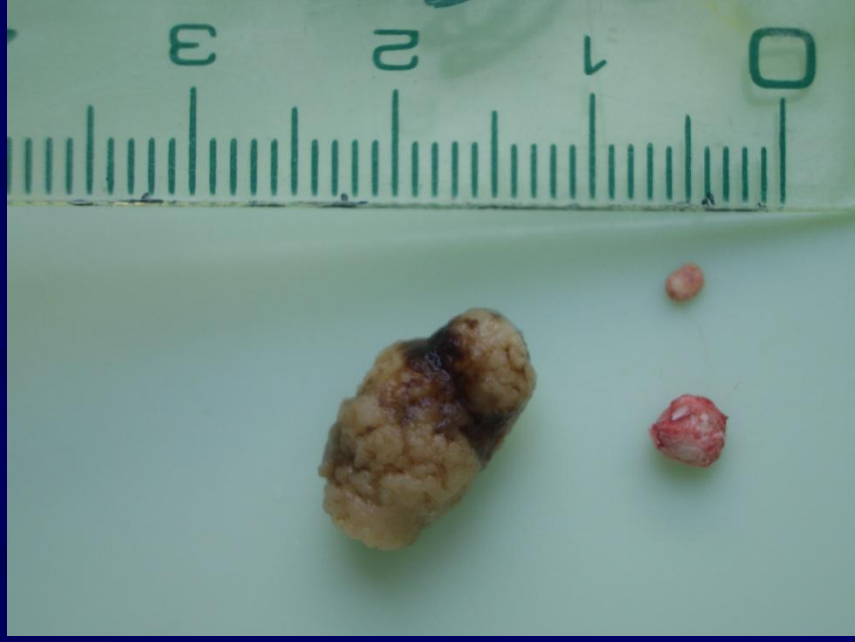




Diseases



- I. Siololithiasis (85% submandib, 15% parotis).
  hx, palpation, X-ray. US, sialogram > removal

- II. Sialoadenitis
  - *acut Bacterial* (swallen, tender, ear protrudes)
  - *Viral* (mumps, cytomegaly, coxackie, AIDS)
  - *Allergy* (drugs, food… very rare)

Diseases

- II. Sialoadenitis

  - *Chronic*

    # Chr. Sclerosing Sialadenitis of submandib.gl.
    Kuettner`s tumor

    # Chr. recurrent parotitis

    # Sjogren`s sy. sicca sy. of upper airway mucosa
    xerostomia, bilat parotid swelling
    keratoconjunctivitis sicca, joint disorders, rheumatic purpura, periarteritis nodosa, scleroderma

    autoimmune

    # Mikulicz sy symmetric swelling of salivary & lacrimal glands

    # Heerfordt sy = Uveoparotid fever (extrapulmonary sarcoid)
    parotis↑, lacrim.gl.↑
    uveitis, n.VII.palsy, SNHL, saliva↓,
    amylase ↓,

    # TB, radiotherapy….

Diseases

- III. Sialadenosis

  recurrent or persistent bilat painless swelling

  cause: endocrine and metabolic disorders

  (eg. alcoholism, DM, puberty, menopause, avitaminosis…)

- IV. Tumors 2/3 benign, 1/3 malignant

CLASSIFICATION OF SALIVARY GLAND TUMORS(AFIP)

BENIGN

- Pleomorphic adenoma
- Warthin's tumor
- Basal cell adenoma
- Myoepithelioma
- Canalicular adenoma
- Oncocytoma
- Cystadenoma
- Sebaceous adenoma
- Siladenoma
- Ductal papillomas
    - Siladenoma papilliferum
    - Inverted ductal papilloma
    - Lymphadenoma
    - Intraductal papilloma

CLASSIFICATION OF SALIVARY GLAND TUMORS (AFIP)

MALIGNANT

- **Adenocarcinomas**
  - Acinic cell adenocarcinoma
  - Basal cell adenocarcinoma
  - Clear cell adenocarcinoma
  - Cystadenocarcinoma
  - Sebaceous adenocarcinoma
  - Lymphadenocarcinoma
  - Adenoid cystic carcinoma
  - Mucinous adenocarcinoma
- **Malignant mixed tumor**
  - Carcinoma ex mixed tumor
  - Metastasizing mixed tumor
  - Carcinosarcoma

Carcinomas

Squamous cell carcinoma
Mucoepidermoid carcinoma
Adenosquamous carcinoma
Epithelial-myoepithelial carcinoma
Oncocytic carcinoma
Salivary duct carcinoma
Myoepithelial carcinoma

Others

Mesenchymal tumors
Lymphomas
Metastatic tumors

Hystology classification of parotis tumors

- ***1 Adenomas***
- 1.1 Pleomorphic adenoma
- 1.2 Myoepithelioma (myoepithelial adenoma)
- 1.3 Basal cell adenoma
- 1.4 Warthin tumor (adenolymphoma)
- 1.5 Oncocytoma (oncocytic adenoma)
- 1.6 Canalicular adenoma
- 1.7 Sebaceous adenoma
- 1.8 Ductal papilloma
  - 1.8.1 Inverted ductal papilloma
  - 1.8.2 lntraductal papilloma
  - 1.8.3 Sialadenoma papilliferum
- 1.9 Cystadenoma
  - 1.9.1 Papillary cystadenoma
  - 1.9.2 Mucinous cystadenoma

Hystology classification of parotis tumors

- ***2 Carcinomas***
- 2.1 Acinic cell carcinoma
- 2.2 Mucoepidermoid carcinoma
- 2.3 Adenoid cystic carcinoma
- 2.4 Polymorphous low-grade adenocarcinoma
- 2.5 Epithelial-myoepithelial carcinoma
- 2.6 Basal cell adenocarcinoma
- 2.7 Sebaceous carcinoma
- 2.8 Pillary cystadenocarcinoma

2.9 Mucinous adenocarcinoma
2.10 Oncocytic carcinoma
2.11 Salivary duct carcinoma
2.12 Adenocarcinoma
2.13 Malignant myoepthelioma (myoepithelial carcinoma)
2.14 Carcinoma in pleomorphic adenoma (malignant mixed tumor)
2.15 Squamous cell carcinoma
2.16 Small cell carcinoma
2.17 Undifferentiated carcinoma
2.18 Other carcinomas

Hystology classification of parotis tumors

- ***3 Nonepithelial tumors***
- ***4 Malignant lymphomas***
- ***5 Secondary tumors***
- ***6 Unclassified tumors***
- ***7 Tumor-like lesions***
- 7.1 Sialadenosis
- 7.2 Oncocytosis
- 7.3 Necrotizing sialometaplasia (salivary gland infarction)
- 7.4 Benign lymphoepithelial lesion
- 7.5 Salivary gland cysts
- 7.6 Chronic sclerosing sialadenitis of (terminal duct adenocarcinoma)
- submandibular gland (Kiittner tumor)
- 7.7 Cystic lymphoid hyperplasia in AIDS

Benign

- Pleomorhic adenoma

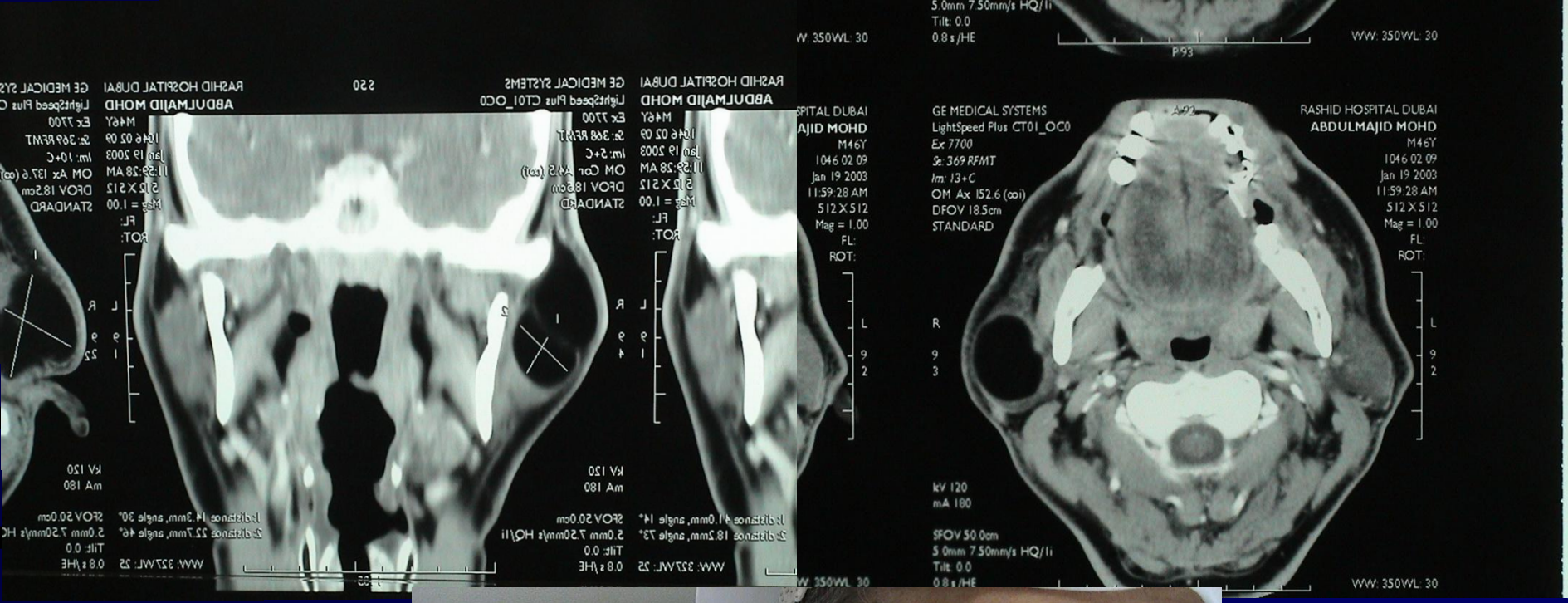
  80% in parotis, unilateral, grows slowly(yrs), female, no pain, dumbbell - swallowing!, recurrent multicentric!, malignant degeneration in 3-5%
- Wharin`s tumor

  10% bilateral, in elderly, from salivary ducts (inf.)

Benignus

- Pleomorhic adenoma
  (epithelial lining of ducts)
  - 80% parotid gl,
  - 8o% of all benign. tu.
  - unilateral,
  - Grows SLOWLY(years),
  - female>male,
  - NO pain !!!!!!!!,
  - „egg timer” like swelling
  - recurrance rate 1-5 %, multicentric localization
  - turns into malignant tu in 2-10%

Wharin`s tumor
(papillare cystadenoma lymphomatosum)
- 5% of all
- 10% bilateral, multicentric
- Starts in elderly, males >
-Origanates mostly from inf.pole of parotid gland(inf.)
- Almost never turns malignant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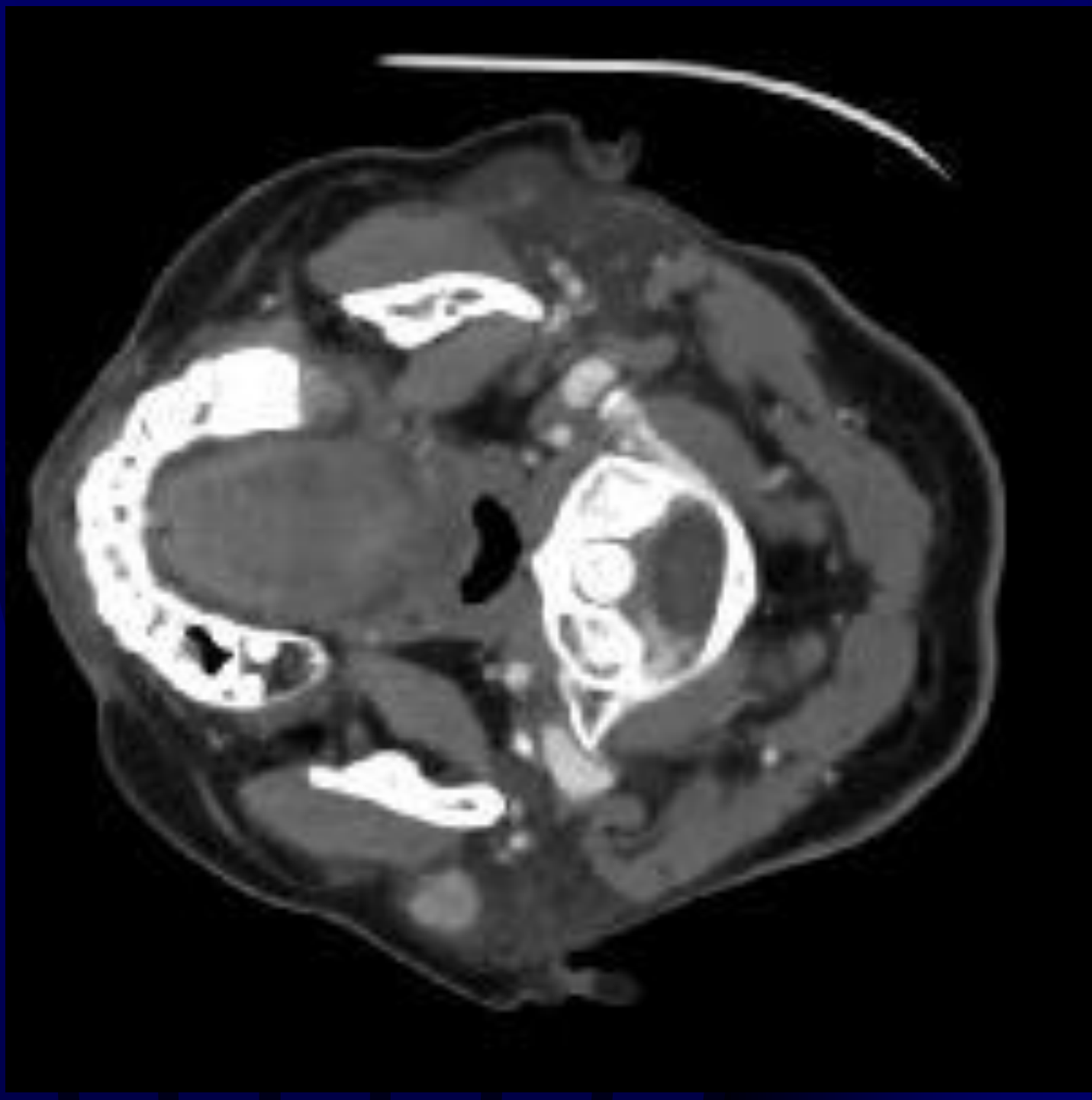
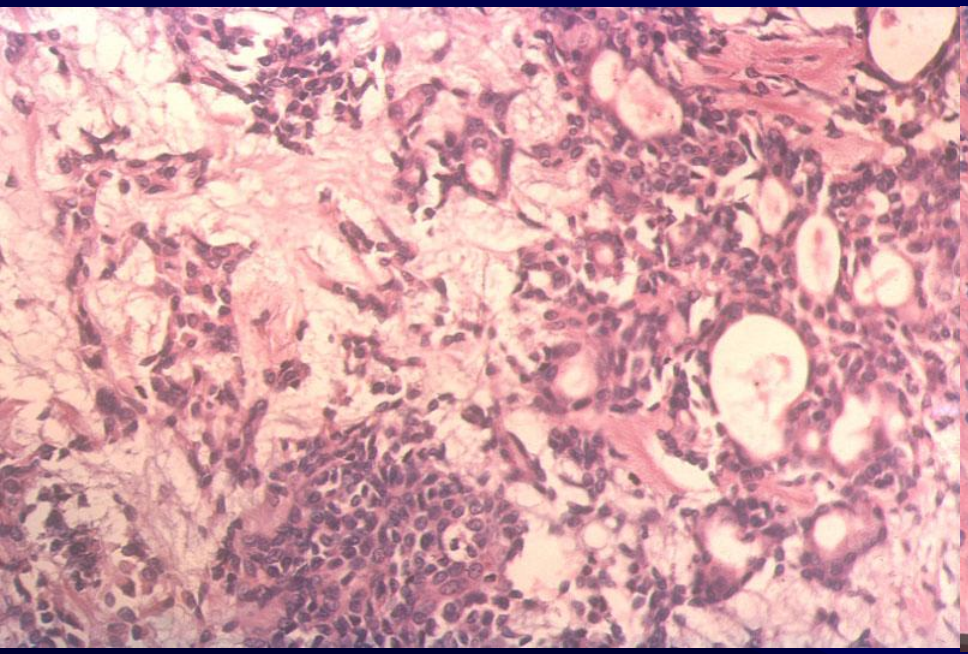
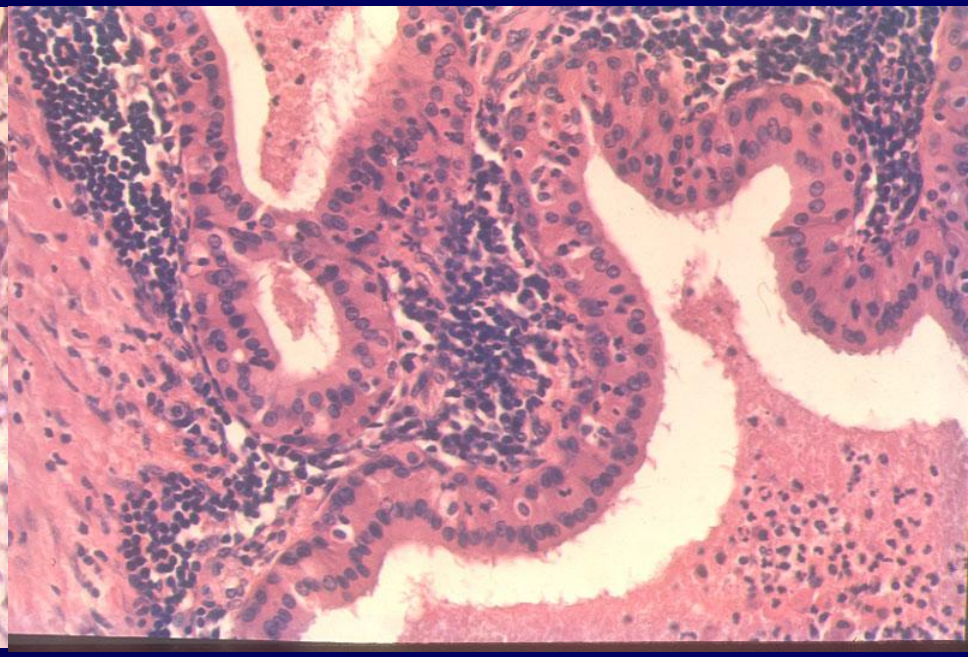
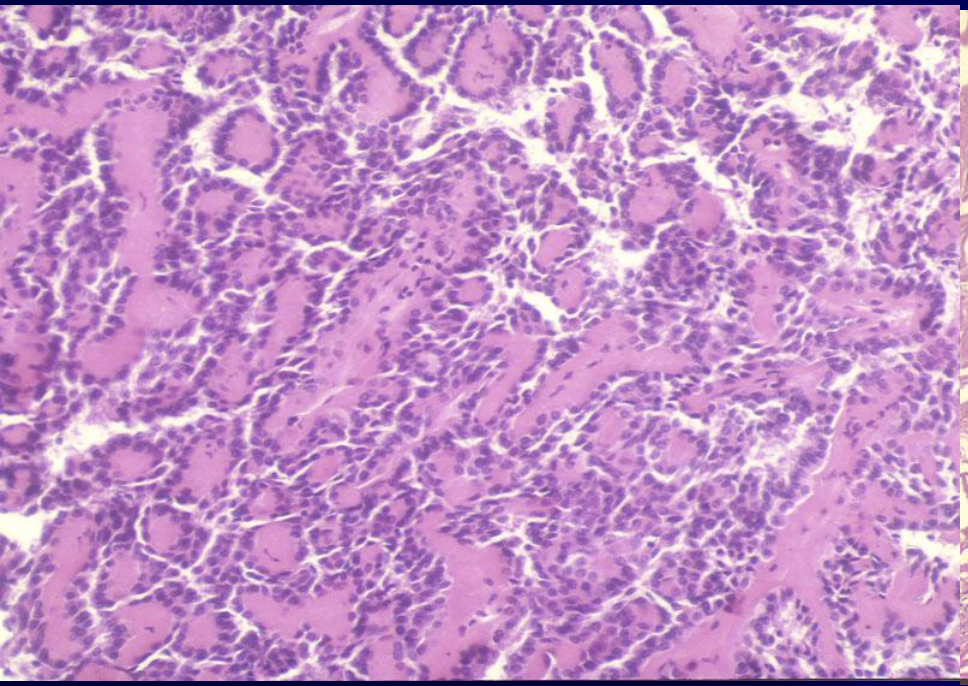
Left pleomorhic adenoma

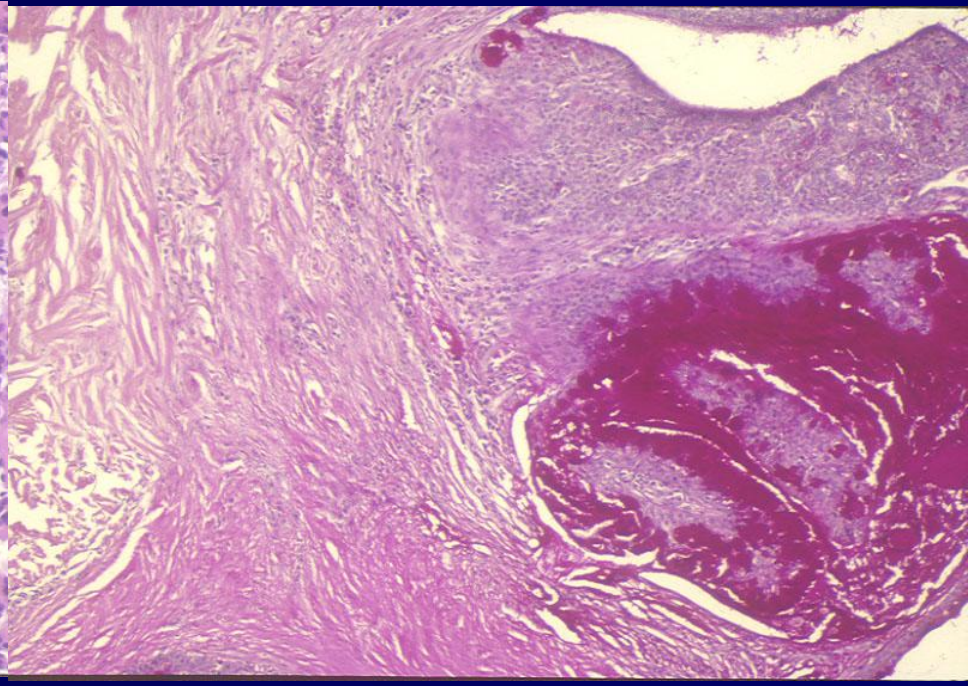


Adenocc R Parotid gl.









Malignant

- Rapid grows (exept adenoid cystic ca.)
- Pain
- Firm, perivasc.-perineural infiltration, fixed to its base
- Skin, facial nerve involvement,
- Cervival lymph nodes

Therapy

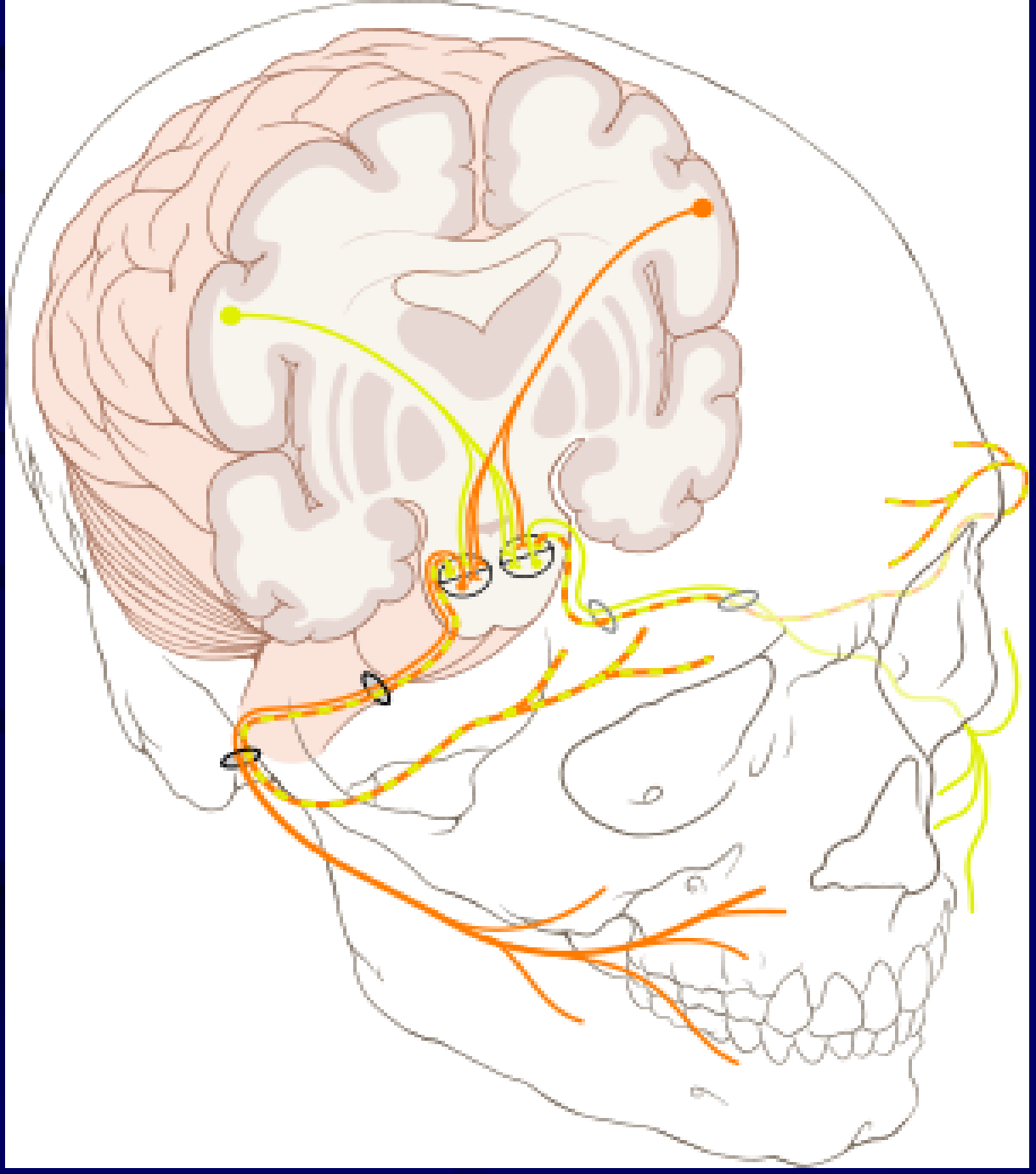
- Superficial parotidectomy
- Total parotidectomy (without facial nerve resection)
- Radical parotidectomy (with facial nerv resection) and reconstruction of nerve
  - same stage
  - second stage
- Radiotherapy

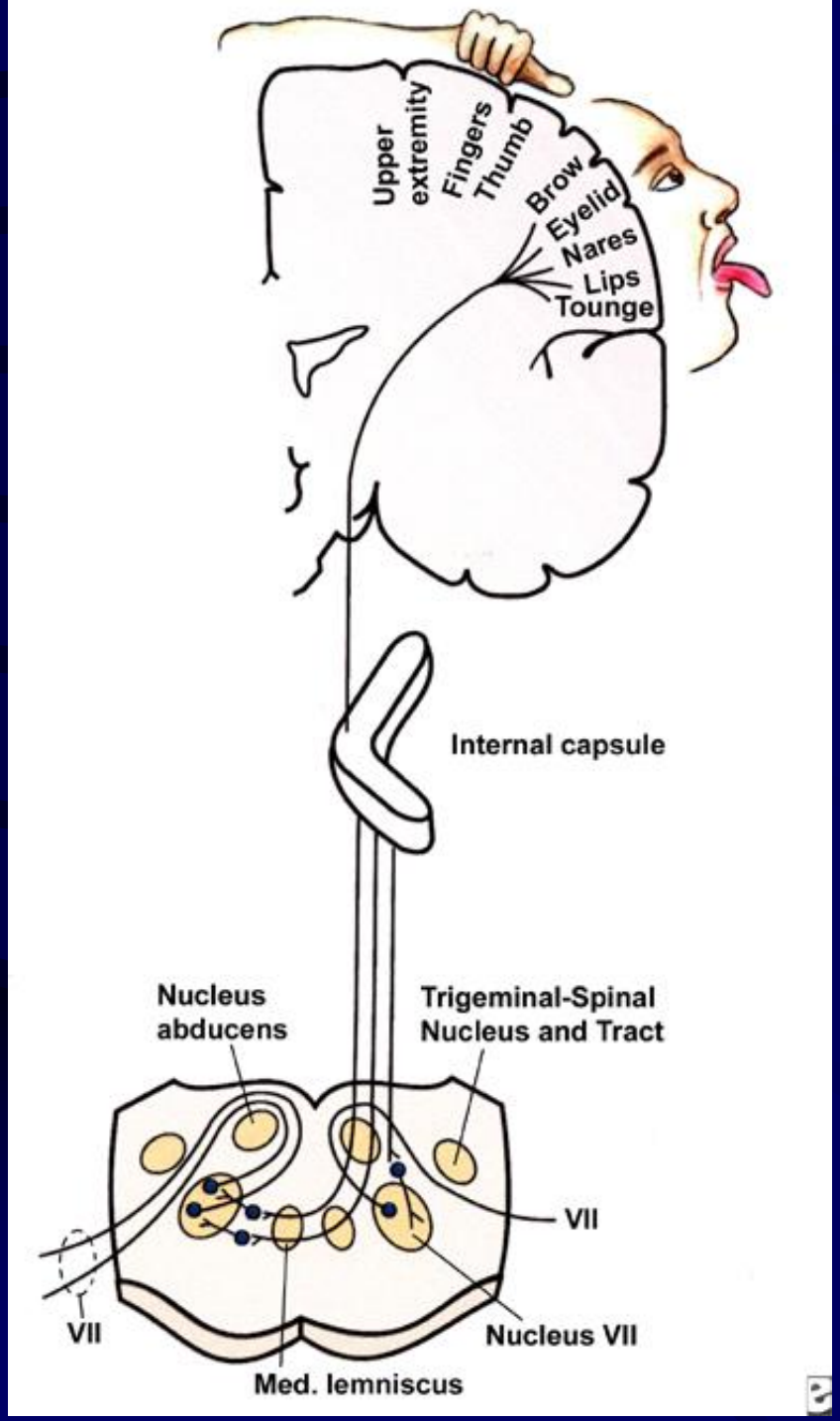
Postoperative pittfalls

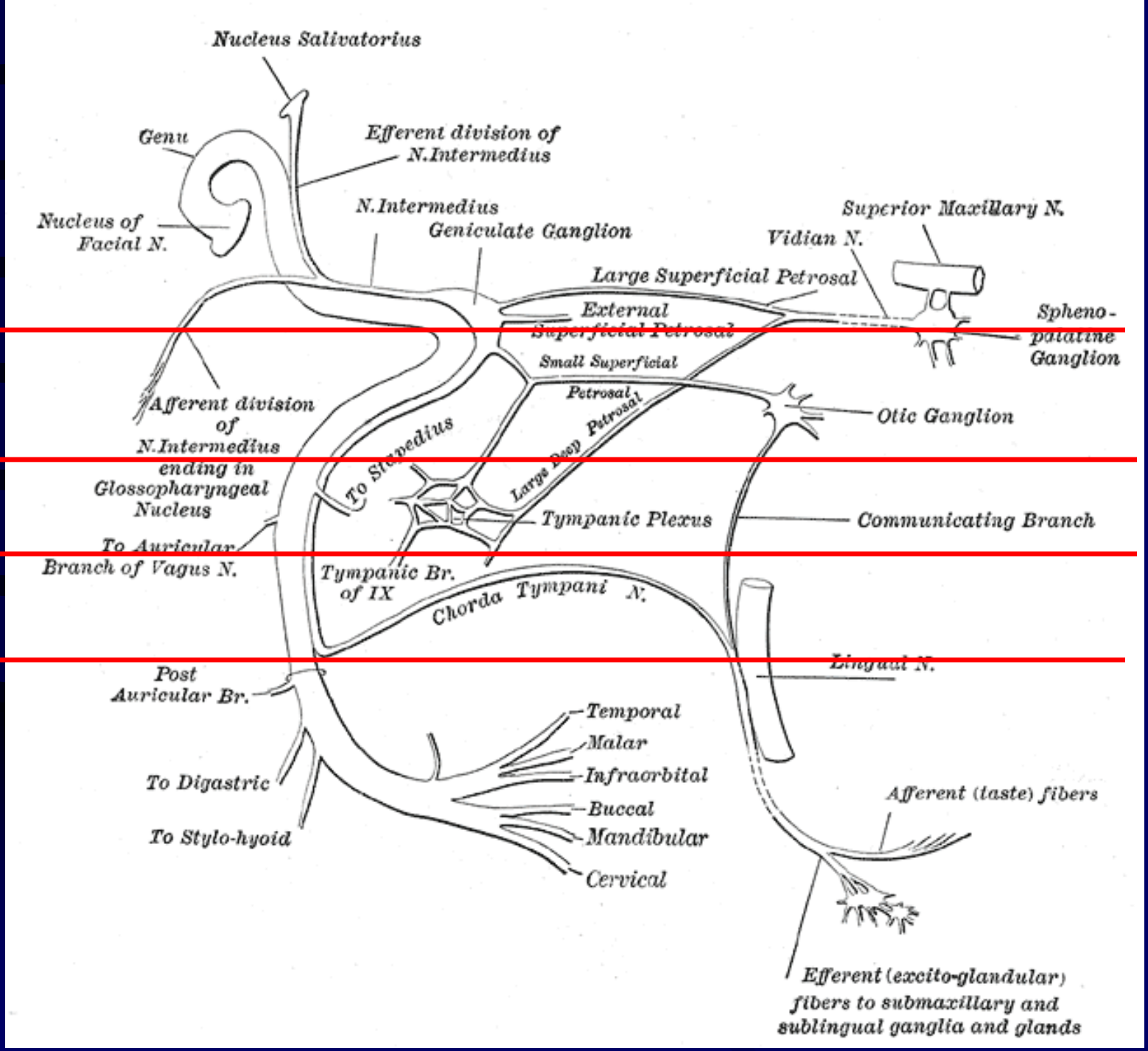
- Frey`s syndrome (auricotemporal nerve carries sympathetic fibers to the sweat glands of the scalp and parasympathetic fibers to the parotid gland. As a result of severance and inappropriate regeneration, the fibers may switch courses, resulting in "Gustatory Sweating" or sweating in the anticipation of eating, instead of the normal salivatory response.)
- Synkinesis "simultaneous movement." occurs secondary to abnormal facial nerve regeneration facial nerve fibers can implant into the different muscles or reconnect to the wrong nerve group causing undesired and simultaneous facial movement.
- Crocodile tears syndrome pts shed tears while eating (spontaneous lacrimation occurs with the normal salivation of eating.) , due to faulty regeneration of facial nerve as the straying of the regenerating nerve fibers, some of those destined for the salivary glands going to the lacrimal glands.
- Hemifacial spasm disorder that typically involves contractions of the muscles on one side of the face.

Facial nerve

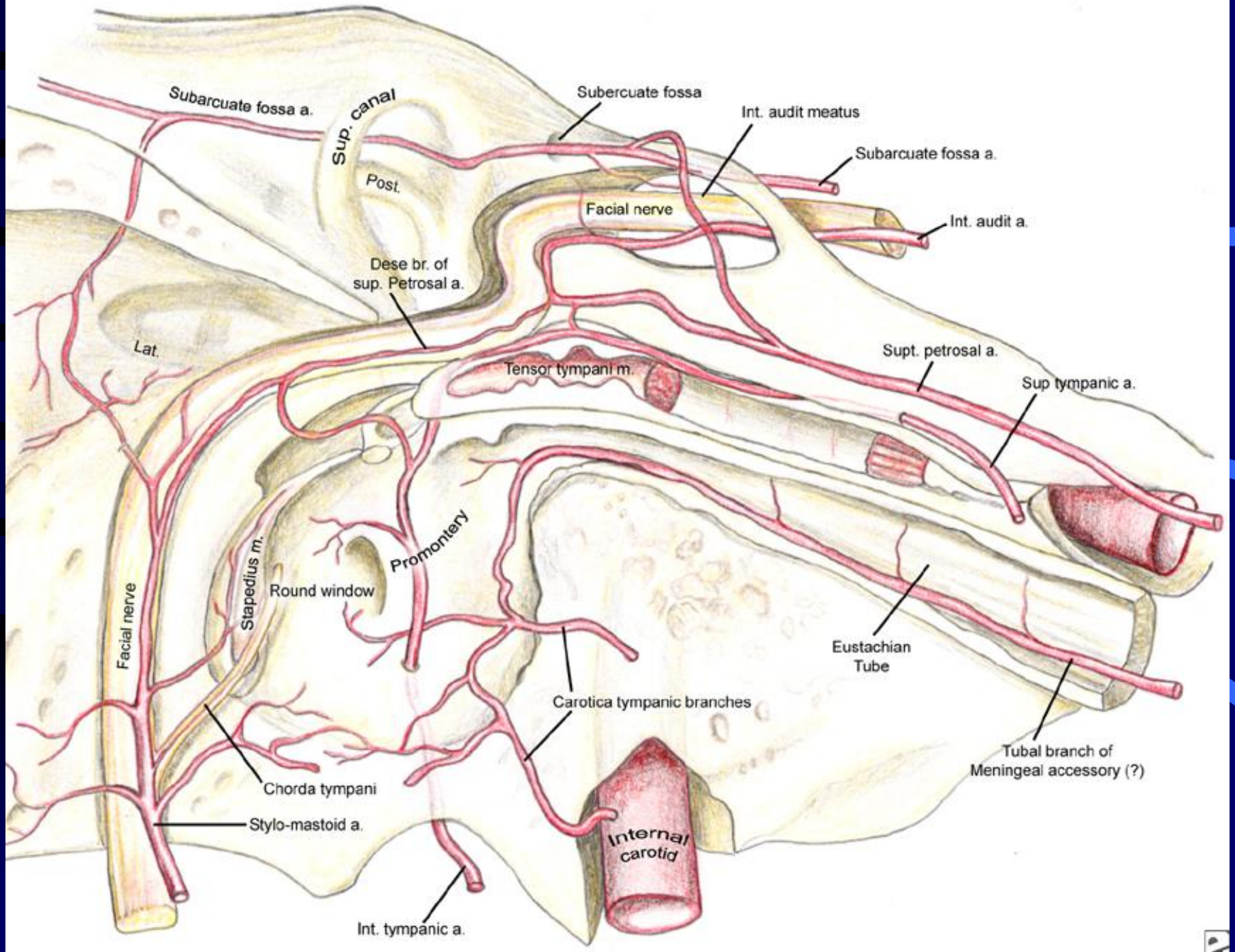
n.VII.

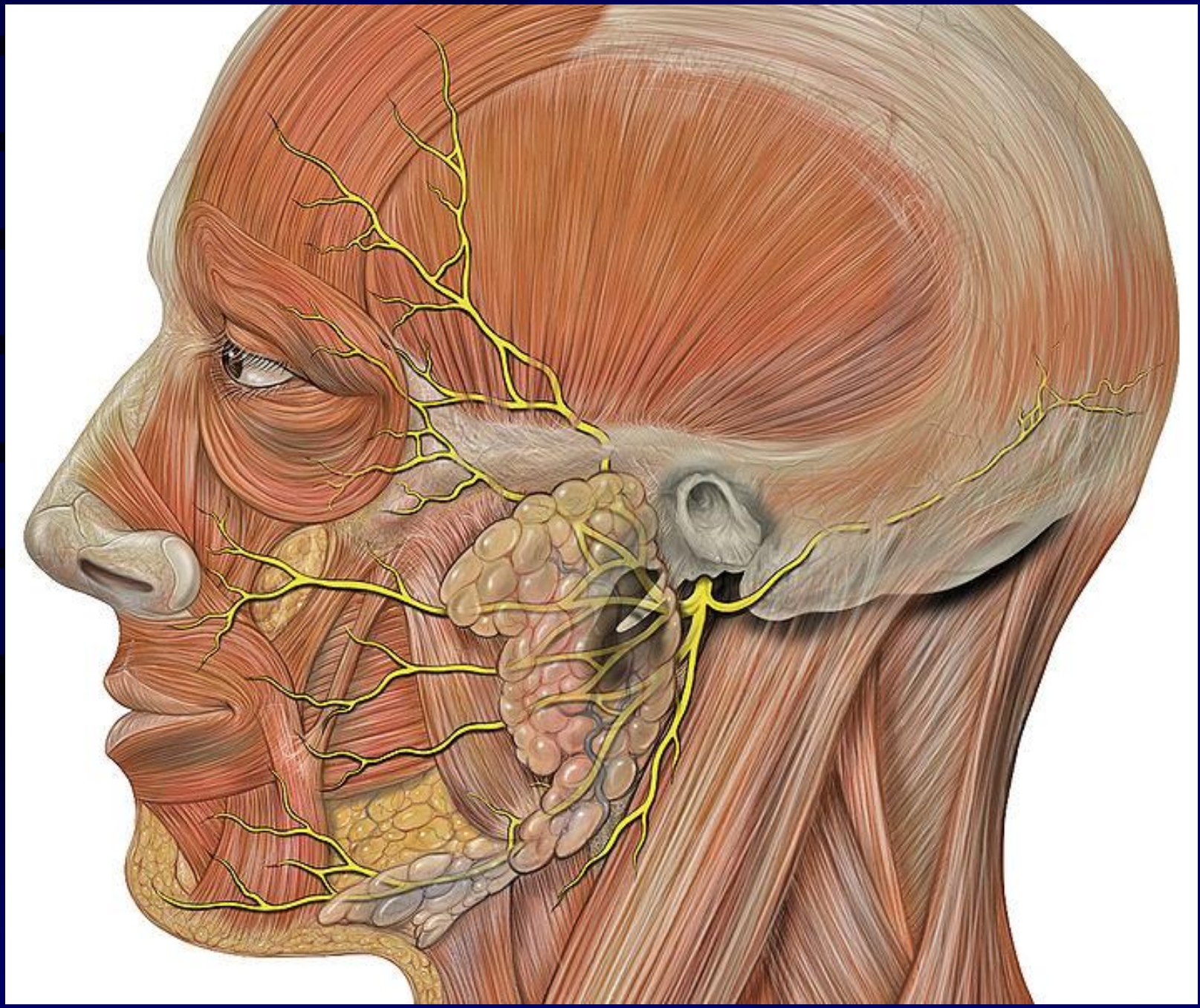



Upper extremity
Fingers
Thumb
Brow
Eyelid
Nares
Lips
Tounge
Internal capsule
Nucleus abducens
Trigeminal-Spinal Nucleus and Tract
VII
VII
Nucleus VII
Med. lemniscus


Nucleus Salivatorius
Genu
Efferent division of N.Intermedius
Nucleus of Facial N.
N.Intermedius
Geniculate Ganglion
Superior Maxillary N.
Vidian N.
Large Superficial Petrosal
External Superficial Petrosal
Spheno-palatine Ganglion
Small Superficial Petrosal
Afferent division of N.Intermedius ending in Glossopharyngeal Nucleus
To Stapedius
Large Deep Petrosal
Otic Ganglion
Tympanic Plexus
Communicating Branch
To Auricular Branch of Vagus N.
Tympanic Br. of IX
Chorda Tympani N.
Lingual N.
Post Auricular Br.
Temporal
Malar
Infraorbital
Buccal
Mandibular
Cervical
To Digastric
To Stylo-hyoid
Afferent (taste) fibers
Efferent (excito-glandular) fibers to submaxillary and sublingual ganglia and glands

LEVELS


Subarcuate fossa a.
Sup. canal
Post.
Subercuate fossa
Int. audit meatus
Subarcuate fossa a.
Facial nerve
Int. audit a.
Dese br. of
sup. Petrosal a.
Lat.
Tensor tympani m.
Supt. petrosal a.
Sup tympanic a.
Promontery
Stapedius m.
Round window
Facial nerve
Eustachian
Tube
Carotica tympanic branches
Tubal branch of
Meningeal accessory (?)
Chorda tympani
Stylo-mastoid a.
Internal
carotid
Int. tympanic a.



Table

Segment	***Location***	***Length in mm***
Supranuclear	Cerebral cortex	NA
Brain stem	Motor nucleus of facial nerve, superior salivatory nucleus of tractus solitarius	NA
Meatal segment	Brain stem to IAC	13-15
Labyrinthine segment	Fundus of IAC to facial hiatus	3-4
Tympanic segment	Geniculate ganglion to pyramidal eminence	8-11
Mastoid segment	Pyramidal process to stylomastoid foramen	10-14
Extratemporal segment	Stylomastoid foramen to pes anserinus	15-20

Level of facial palsy can be determined

Branches

Greater petrosal nerve **Schirmer tests**

provides parasympathetic innervation to lacrimal gland, sinues and nasal cavity, special sensory taste fibers to the palate via the Vidian nerve.

Nerve to stapedius **STR**

provides motor innervation for stapedius muscle in middle ear

Chorda tympani **Taste test, qualitative-quantitative, sialometry**

provides parasympathetic innervation to submandibular gland and sublingual gland special sensory taste fibers for the anterior 2/3 of the tongue.

Outside skull (distal to stylomastoid foramen)

Posterior auricular nerve

- controls movements of some of the scalp muscles around the ear

Branch to Posterior belly of Digastric and Stylohyoid muscle

Five major facial branches (in parotid gland) – motor innervation

Temporal (frontal) branch of the facial nerve **motoric functions**

Zygomatic branch of the facial nerve **Neuromyography NMG**

Buccal branch of the facial nerve **Electromyography EMG**

Marginal mandibular branch of the facial nerve

House-Brackmann scale

Grade	Description	Characteristics
I	Normal	Normal facial function in all areas
II	Mild dysfunction	Slight weakness noticeable on close inspection; may have very slight synkinesis
III	Moderate dysfunction	Obvious, but not disfiguring, difference between 2 sides; noticeable, but not severe, synkinesis, contracture, or hemifacial spasm; complete eye closure with effort
IV	Moderately severe dysfunction	Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure
V	Severe dysfunction	Only barely perceptible motion; asymmetry at rest
VI	Total paralysis	No movement

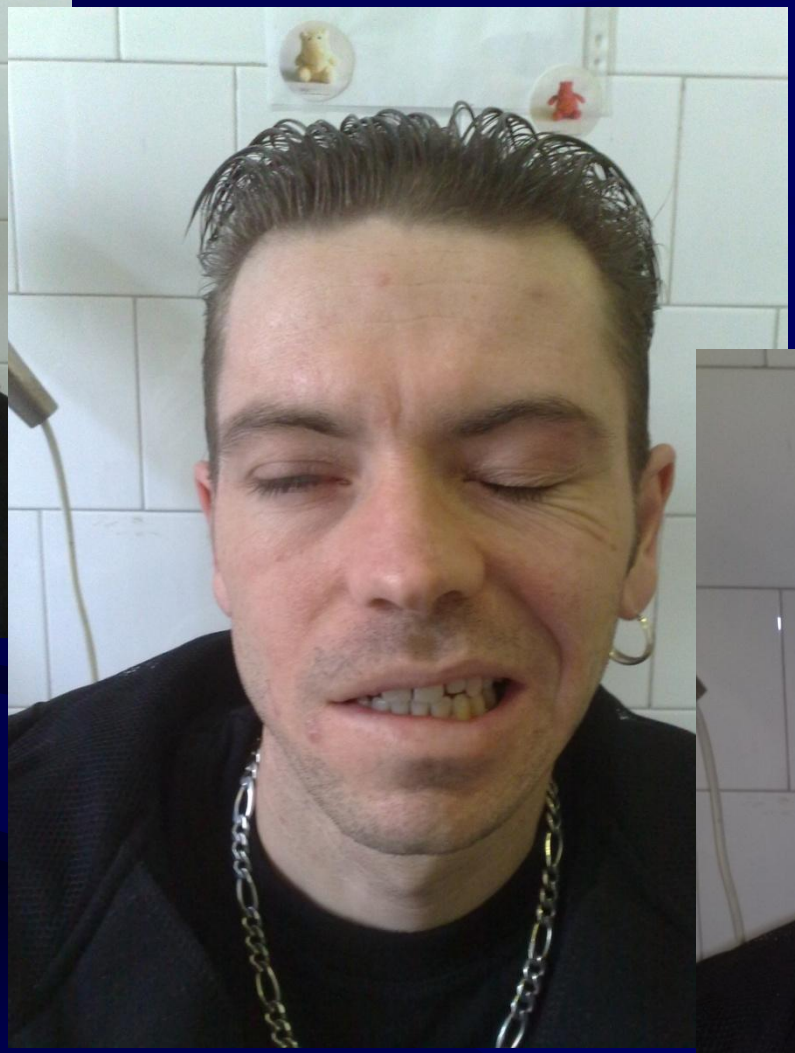
Testing the facial nerve

Voluntary facial movements - wrinkling the brow,- showing teeth, -frowning, --closing the eyes tightly (inability is called lagophtalmos), - pursing the lips - puffing out the cheeks.

Bell Sign Upward rotation of eye ball when closing the eye.

Central facial palsy only the lower part of the face on the contralateral side will be affected, due to the bilateral control to the upper facial muscles (frontalis and orbicularis oculi).

Corneal reflex. *Afferent* is General Sensory afferents of the Trigeminal Nerve. *Efferent* arc occurs via the Facial Nerve. The reflex involves consensual blinking of both eyes in response to stimulation of one eye. This is due to the Facial Nerve's innervation of the muscles of facial expression, namely Orbicularis Oculi, responsible for blinking. Thus, the corneal reflex effectively tests the proper functioning of both Cranial Nerves V and VII.



What can result in facial nerve palsy?

- **Trauma:** such as birth trauma,
  skull base fractures
  facial injuries,
  middle ear injuries,
  surgical trauma.

- **Nervous system disease:** Opercular syndrome, meningitis, stroke, lues…
  Merkelson-Rosenthal syndrome.
  MS
- **Infection:** ear (mastoiditis, cholesteatoma) or face,
  herpes zoster of the facial nerve (Ramsey-Hunt syndrome)
  Lymes disease (Borrelia)

- **Metabolic**: diabetes mellitus or pregnancy

- **Tumors:** acoustic neuroma,
  schwannoma,
  cholesteatoma,
  parotid tumors,
  glomus tumors.

- **Toxins:** alcoholism
  carbon monoxide poisoning

- **Iatrogenic:** Surgery
- **Idiopathic:** Bell`s palsy

Residual symptoms after facial palsy

- Residual motoric palsy
- Motoric synkinesis (e.g. frowns-blinks)
- Autonom synkinesis (crokodile tears-eye watering at eating instead of salivation)
- Pseudospasm (e.g.at blinking sudden spasms on face)
- Contracture

Thank you!