SALIVARY GLAND TUMORS

By- Dr. Jigar Dhuvad

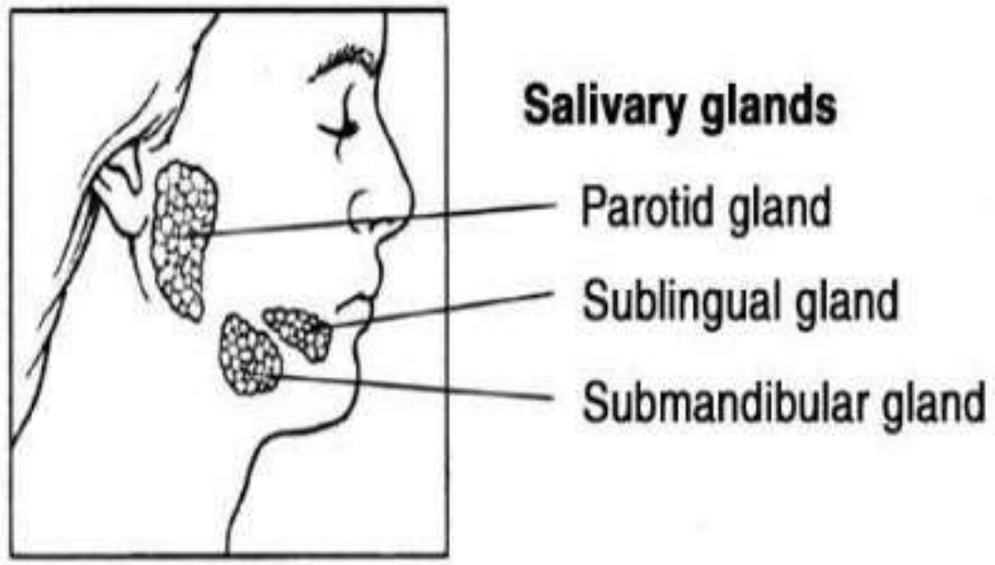
INTRODUCTION

- Tumors of the salivary glands are:
- Most heterogeneous group of tumors.
- Greatest diversity of morphologic features.
- uncommon.
- The majority of these neoplasms are benign 80% and only 20% are malignant.
- The various types of salivary gland tumors are best distinguished by their histologic patterns.

ANATOMY

3 major salivary glands:

1. The parotid glands
2. The submandibular glands
3. The sublingual glands



Other locations: lateral margin of tongue, palate, lips, buccal mucosa.

•The parotid gland - largest of the three major glands and weighs on average between 14 and 30 g.

•Composed almost entirely of serous cells.

•Sebaceous glands may be observed in 10% to 42% of normal parotid glands .

•The parotid glands contain 3 to 32(average: 20) intraglandular lymph nodes.

•The submandibular gland is the second largest salivary gland, weighing approximately 7 to 8 g.

•Mixed, with both serous and mucous cells; serous units predominate, accounting for approximately 90% of the acinar cells.

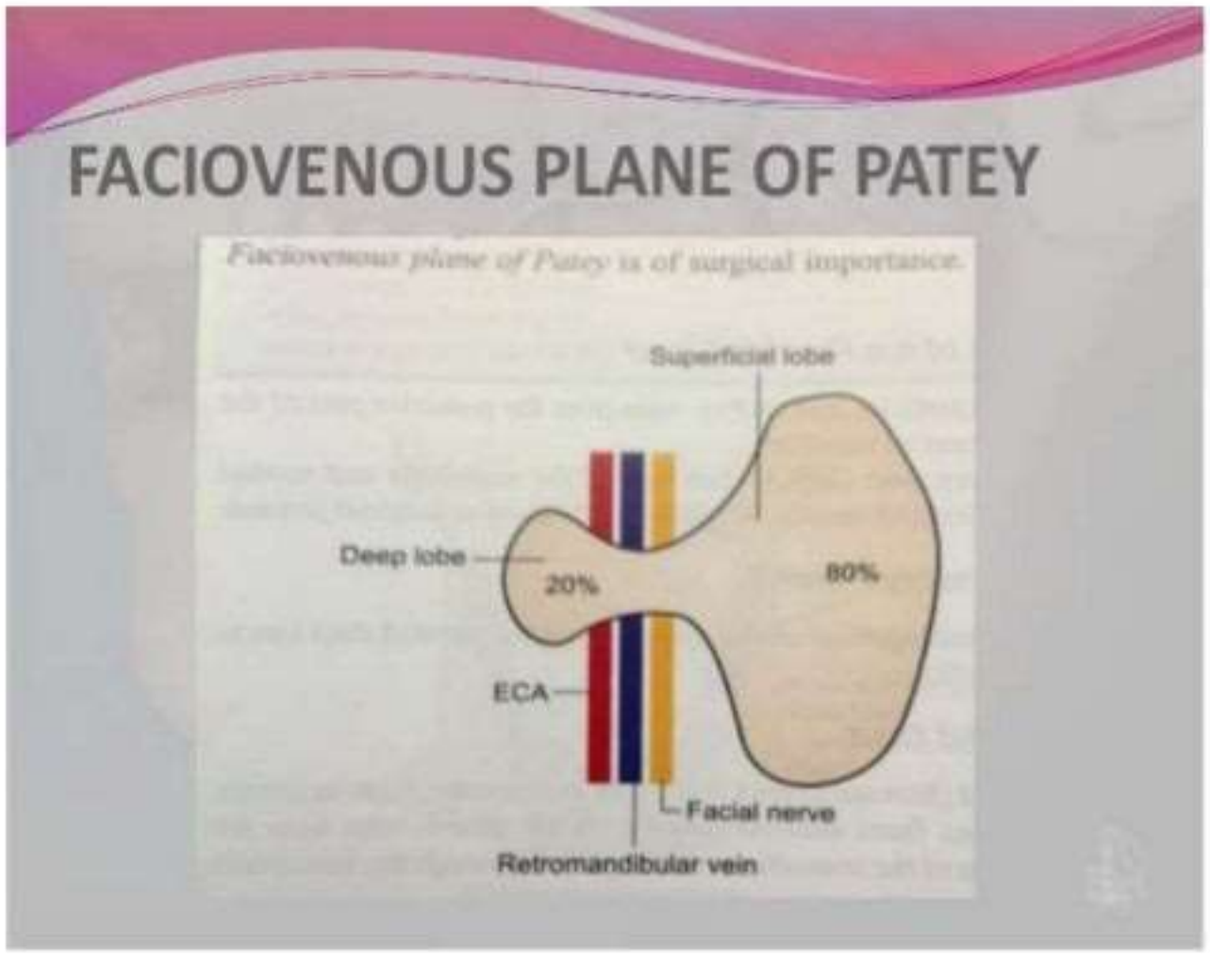
•Sublingual gland is poorly encapsulated, smallest major salivary gland, weighing approximately 2 to 3 gm.

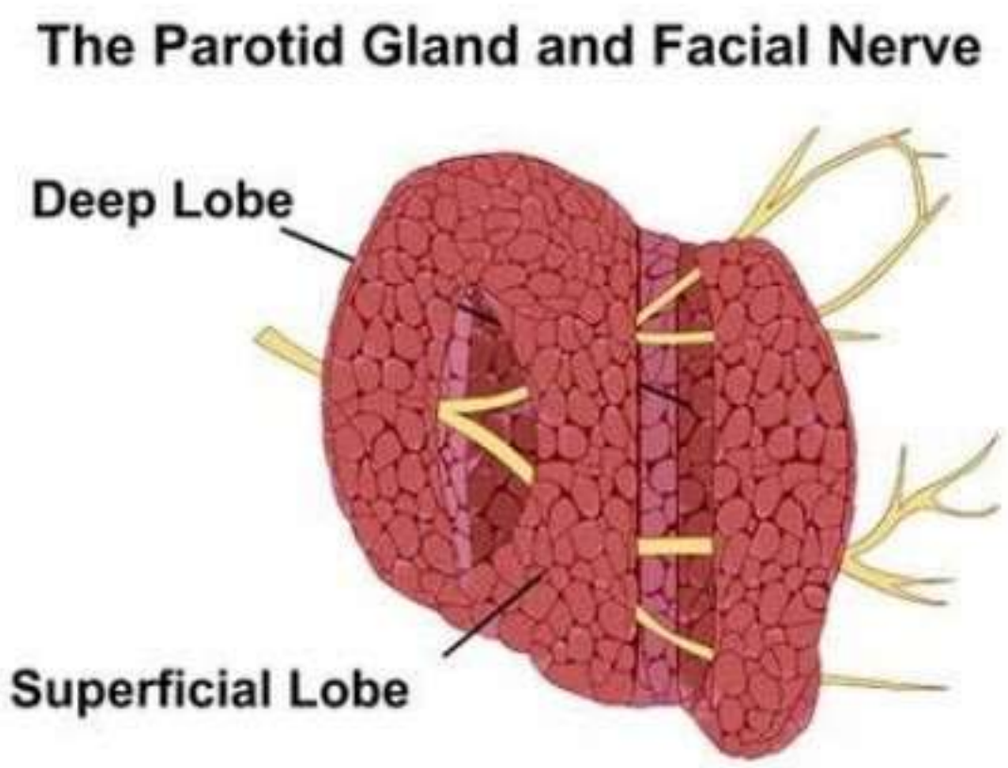
Parotid gland

- Largest salivary gland.
- Lies b/w Sternomastoid and mandible below the EAM.
- Coverings :
  - True capsule
  - False capsule – a layer from the deep cervical fascia.

Lobes of parotid gland

- Parotid divided into superficial and deep lobes by the facial nerve.
- Fasciovenous plane of Patey.





Structures within the parotid gland

1. **External carotid artery :**

   Gives terminal branches in the gland

   Maxillary artery and superficial temporal artery.

2. **Retromandibular vein :**

   Formed by union of sup. Temporal and maxillary vein joins post. Auricular vein to form the external jugular vein.

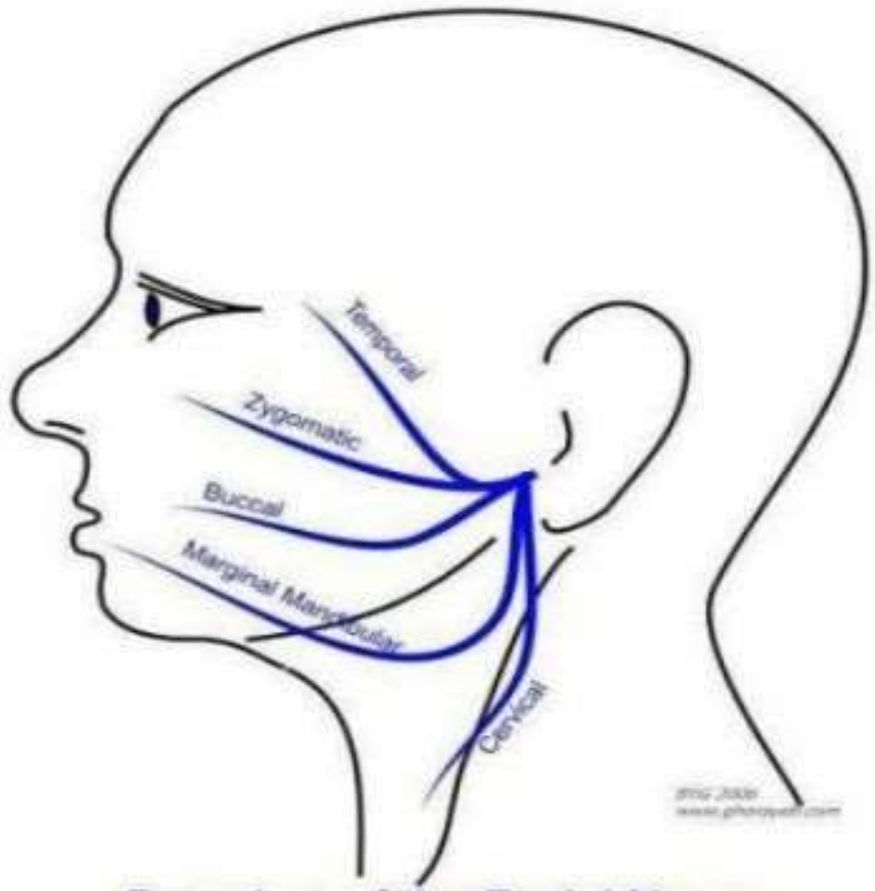
3. The facial nerve:

Enters upper part of posteromedial border and divides into:

Structures:

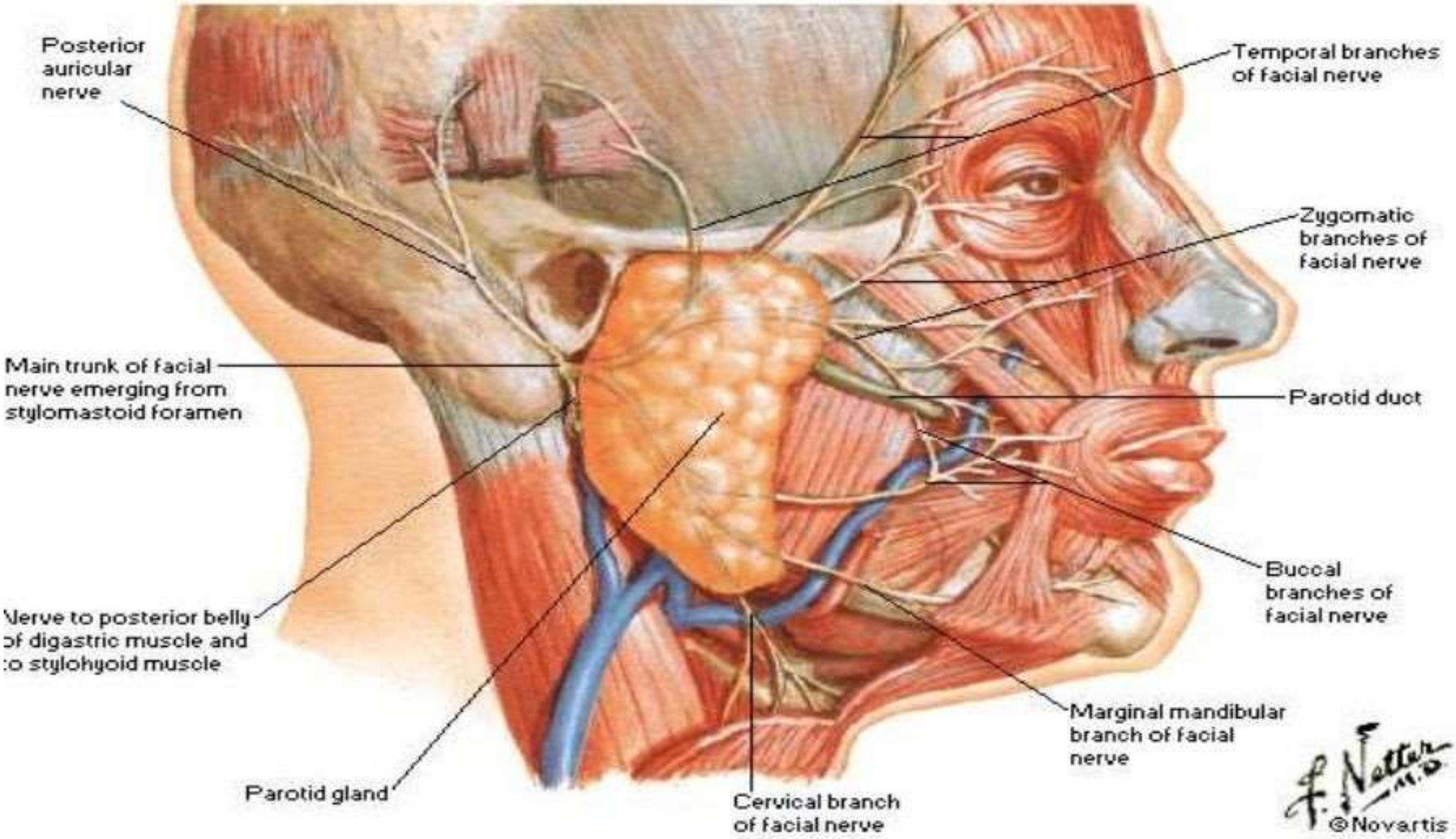
From lateral to medial

- **Facial nerve**
- **Retromandibular vein (Patey's fascio venous plane)**
- **External Carotid artery**



Branches of the Facial Nerve

Facial Nerve Branches and Parotid Gland in Situ



EPIDEMIOLOGY

- Uncommon neoplasms.
- 2%-3%of all head and neck neoplasms.
- Most salivary gland tumors originate in the parotid glands (64%-80%), malignancy (15%- 32%).
- 7-11% occur in the submandibular glands, malignancy (37% - 45%).
- less than 1% in the sublingual glands, malignancy (70%-90%), 9%-23% in the minor glands.
- Benign tumors account for 63% to 78% of all salivary gland neoplasms.

ETIOLOGY

- Viruses- **EBV, CMV, Polyoma virus**
- Ionizing radiation.
- Increased occupational risks- asbestos, nickel compounds or silica dust.
- Employment in the woodworking, rubber industries and beauty saloons.
- Lifestyle- Warthin's tumors showed a strong association with cigarette smoking.
- Endogenous hormones.

Cellular origin for salivary gland tumour

Clear understanding

- Two major theories of histogenesis:

    1) The Bicellular reserve cell theory

    2) The Multicellular theory

The Bicellular Reserve Cell Theory

- Basal cells of the excretory or intercalated duct can acts as a reserve cell with the potential for differentiation into a variety of intercalated cells.

- **Excretory duct cell**:-
  1) Squamous cell carcinoma
  2) Mucoepidermoid carcinoma

- **Intercalated duct cell**:-
  1) Mixed tumours
  2) Warthin tumour
  3) Oncocytoma,
  4) Adenoid cystic carcinoma
  5) Oncocytic carcinoma

The Multicellular Theory

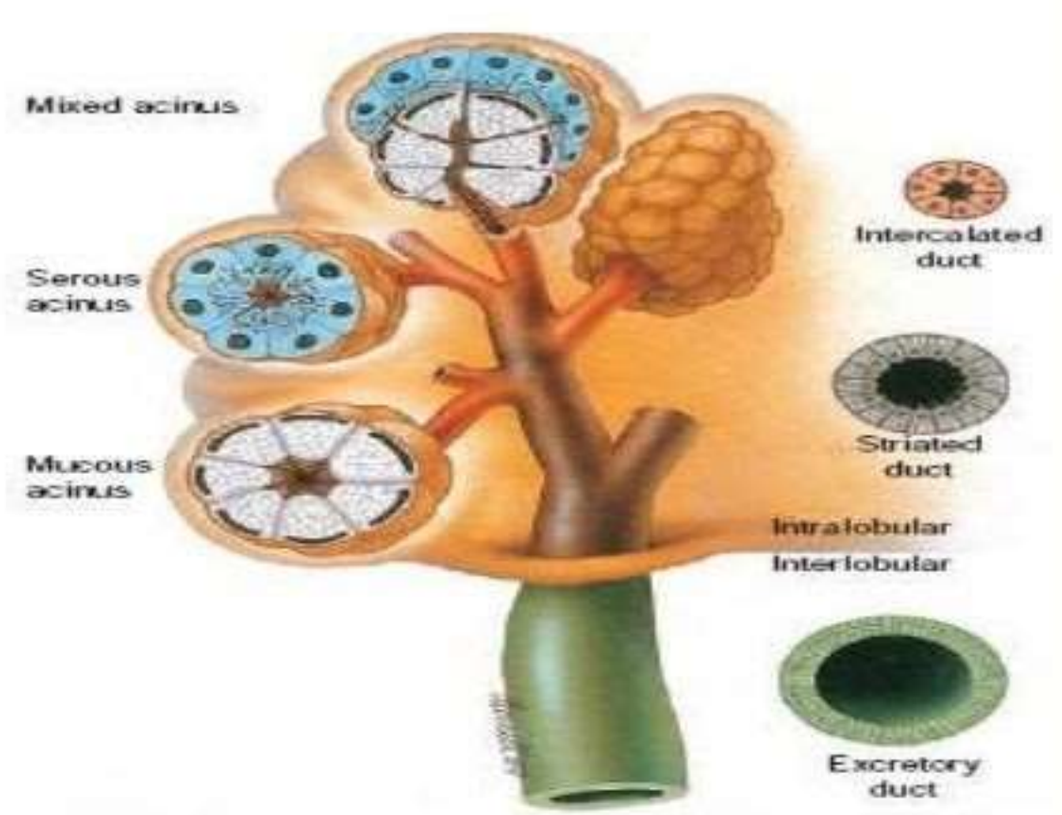
Salivary neoplasm arise from already differentiated cells along the salivary gland unit.

1) Oncocytic tumours→ Striated ductal cells

2) Acinous cell tumour→ Acinar cell

3) Sq & mucoepidermoid→ Excretory ductal cell

4) Mixed tumour→ Intercalated ductal cell & myoepithelial cells



Rule of 80's:

- 80% of parotid tumors are benign.
- 80% of parotid tumors are Pleomorphic adenomas.
- 80% of salivary gland Pleomorphic adenomas occur in the parotid .
- 80% of parotid Pleomorphic adenomas occur in the superficial lobe.
- 80% of untreated Pleomorphic adenomas remain benign.

WHO CLASSIFICATION

7 Categories: 1) Adenomas, 2) Carcinomas

3) Malignant melanoma 4) Non epithelial tumours

5) Secondary tumour 6) Undifferentiated tumours

7) Tumour like lesions

Histologically, carcinomas are probably best classified as below

1) Acinic cell Ca. 2) Mucoepidermoid Ca.

3) Adenoid cystic Ca. 4) Adenocarcinoma

5) Polymorphous low-grade adenocarcinoma

6) Papillary cystadeno Ca 7) Squamous cell carcinoma

8) Mucinous adenocarcinoma

9) Carcinoma ex pleomorphic adenoma;

10) Malignant mixed tumour 11) Undifferentiated ca

General features of Salivary glands

Adults

- Salivary gland tumors occur primarily in older adults
- Females more commonly affected, except Warthin's tumor and high-grade carcinomas
- Epithelial (80%) tumors predominate
- Benign neoplasms are more common (75%) among the epithelial tumors
- The smaller the salivary gland, the higher the proportion of malignant tumors:
  parotid gland (15–32%);
  submandibular gland (41–45%);
  sublingual gland (70–90%);
  minor salivary gland (>50%)

Children (under age of 18)

- Rare in general; only 1.7–3% of all salivary tumors occur in children
- In infants, mesenchymal tumors (hemangioma and lymphangioma) are the commonest tumors; in older children, epithelial tumors predominate
- Malignant neoplasms are common (60%) among the epithelial tumors
- Most malignant tumors in children are low grade, hence tumor mortality and morbidity are low

Behaviour of Salivary gland carcinomas

Low grade	Intermediate grade	High grade
• Acinic cell carcinoma	• Adenoid cystic carcinoma	• Mucoepidermoid carcinoma, high grade
• Mucoepidermoid carcinoma, low to intermediate grade	• Sebaceous adenocarcinoma	• Adenocarcinoma, NOS, high grade
• Polymorphous low-grade adenocarcinoma	• Malignant myoepithelioma	• Squamous cell carcinoma
• Basal cell adenocarcinoma	• Lymphoepithelioma-like carcinoma	• Salivary duct carcinoma
• Hyalinizing clear cell carcinoma		• Malignant mixed tumor, high grade
• Epithelial-myoepithelial carcinoma		• Oncocytic carcinoma
• Malignant mixed tumors, low grade		• Large cell undifferentiated carcinoma
• Cystadenocarcinoma		• Small cell carcinoma
• Adenocarcinoma, NOS, low grade		• Dedifferentiated acinic cell or adenoid cystic carcinoma

Pleomorphic adenoma

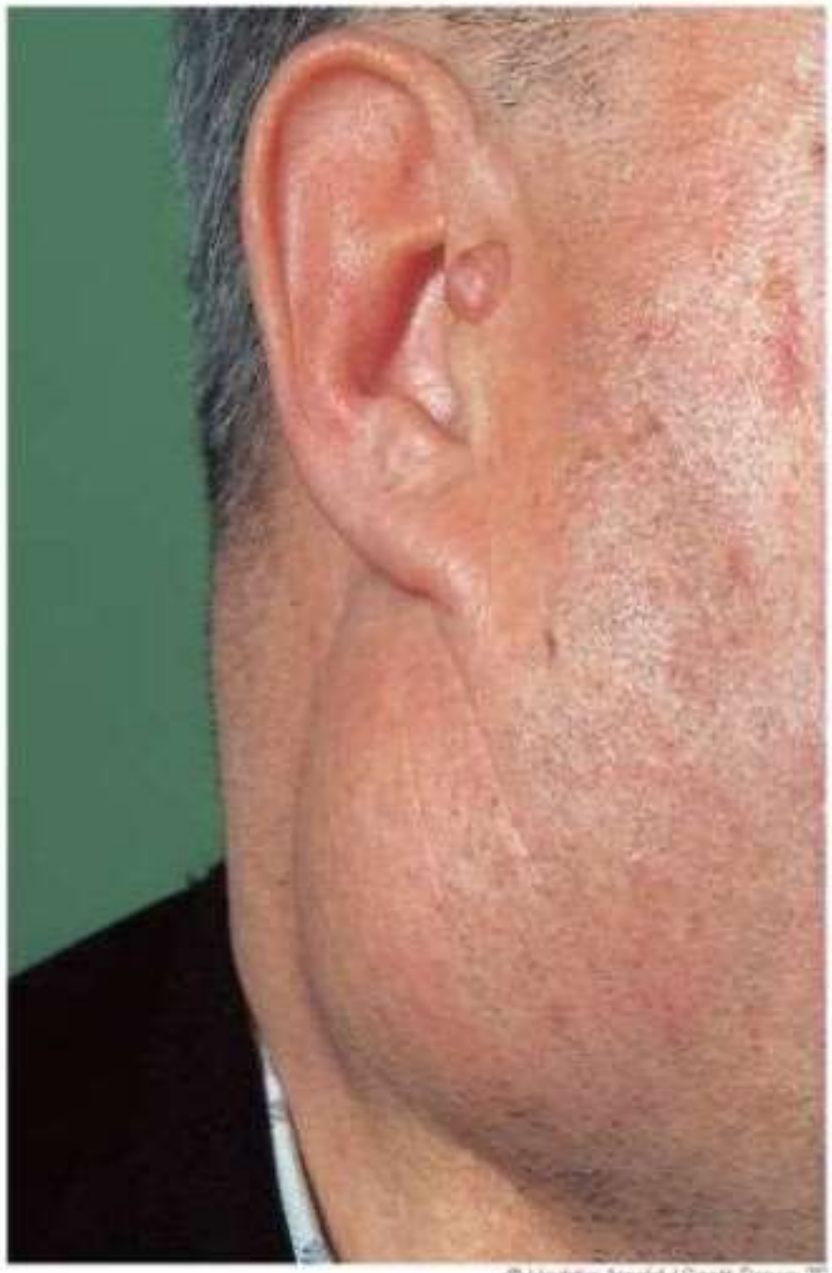
- Most common tumor.

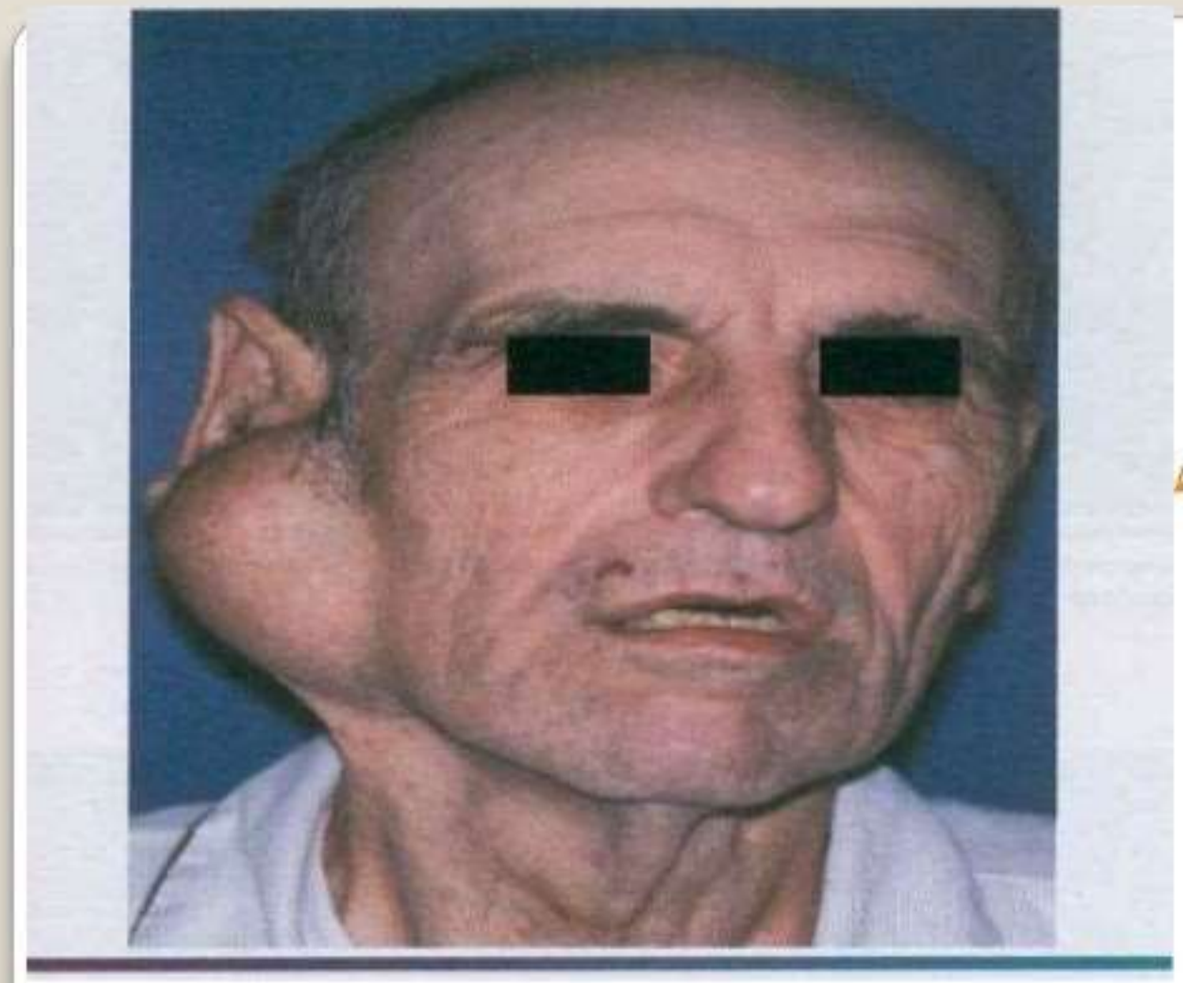
  60-70%- Parotid glands

- 40-60%- Submandibular glands
- 40-70%- Minor salivary glands
- Seldomly- Sublingual glands
- Age: 30-50 years
- Sex: female> male – 3:1 – 4:1
- In Parotid- Presents in the lower lobe of the superior lobe as a mass over the angle of the mandible, below and infront of the ear.

Clinical presentation:

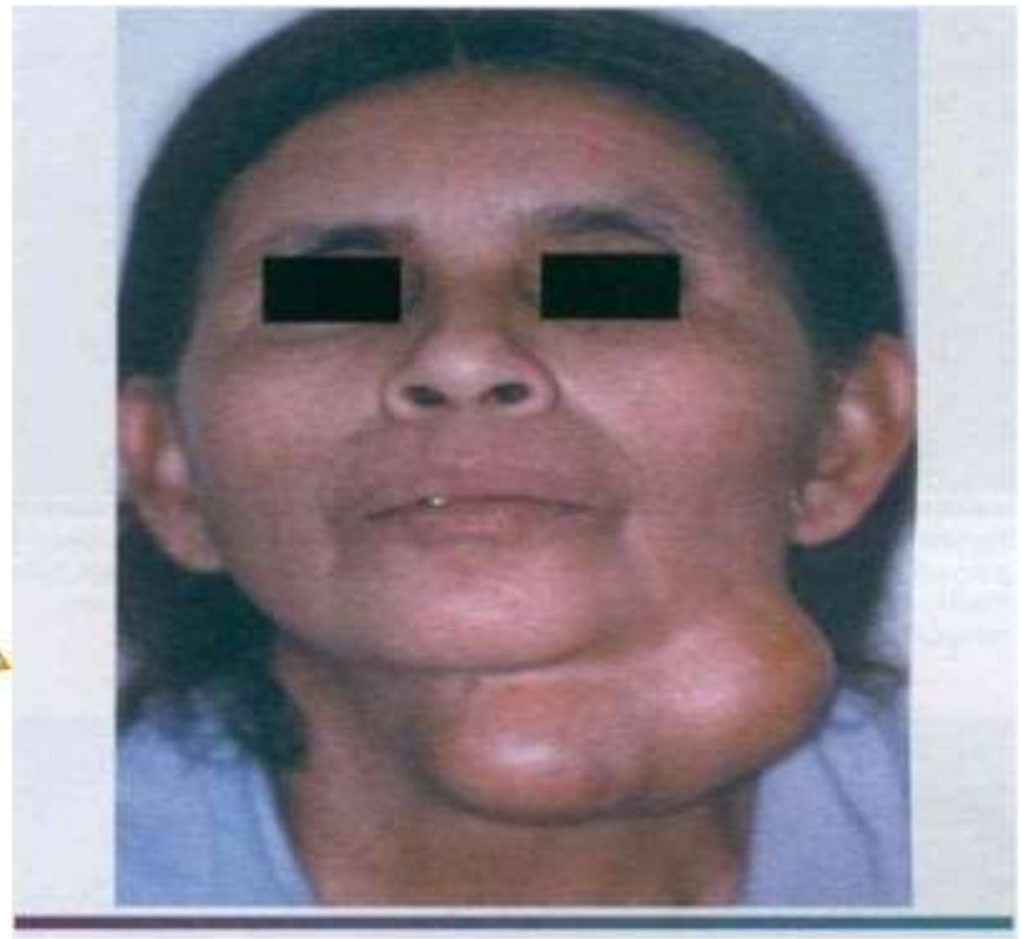
1. Painless, slow growing, firm mass, initially small in size and begins to increase in size.
2. Recurrent tumor- multinodular, fixed on palpation.
3. Palate – intraorally common site.





Slowly growing tumor of the parotid gland

Tumor of the submandibular gland



INVESTIGATION

1. MRI

2. CT SCAN

TREATMENT AND PROGNOSIS

- Superficial Parotidectomy with preservation of the facial nerve.
- Local enucleation should be avoided - resulting in seeding of the tumor bed.
- **Deep lobe of the parotid-** total parotidectomy is usually necessary also with preservation of the facial nerve.
- **Submandibular tumors-** total removal of the gland along with tumor is done.

The **MALIGNANT COMPONENT** is most commonly classifiable as:

1. Mucoepidermoid carcinoma
2. Adenoid cystic carcinoma
3. Adenocarcinomas:

a. Acinic cell carcinoma

b. Polymorphous

lowgrade adenocarcinoma(PLGA)

c. Adenocarcinoma, not otherwise specified(NOS)

Malignant mixed tumors

There are 3 types of malignant mixed tumors:

1) Carcinoma ex pleomorphic adenoma

2) Carcinosarcoma

3) Metastasizing mixed tumor

Other rare salivary gland cancers

1. Squamous cell carcinoma
2. Epithelial myoepithelial carcinoma
3. Anaplastic small cell carcinoma
4. Undifferentiated carcinomas

Other cancers that can affect the salivary glands

1. Non hodgkins lymphoma
2. Sarcomas
3. Secondary salivary gland tumors

MUCOEPIDERMOID CARCINOMA

- Most common malignant salivary gland tumor in adult & childrens → 29 – 34%.
- Parotid gland MC involved. (80-90%),
- Intraorally MC→ Palate

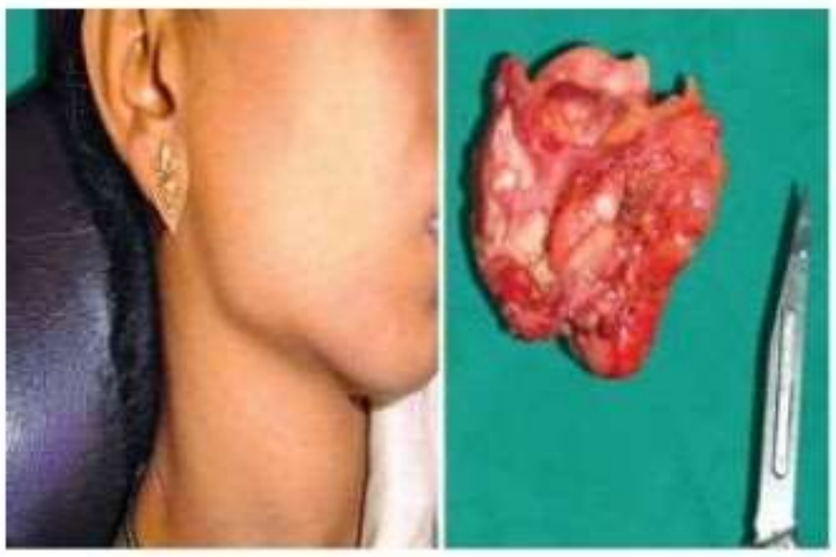
CLINICAL FEATURES

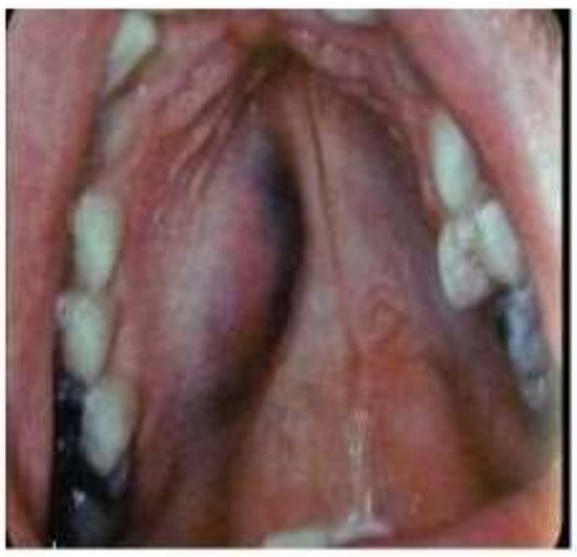
1) Appears as asymptomatic swelling,

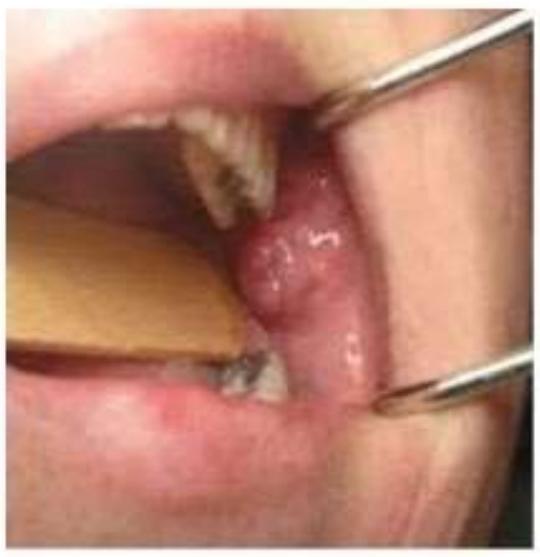
F>M→ 3rd -5th decade.

2) Aware of lession for yr or less.

3) Fluctuant & blue/red color.





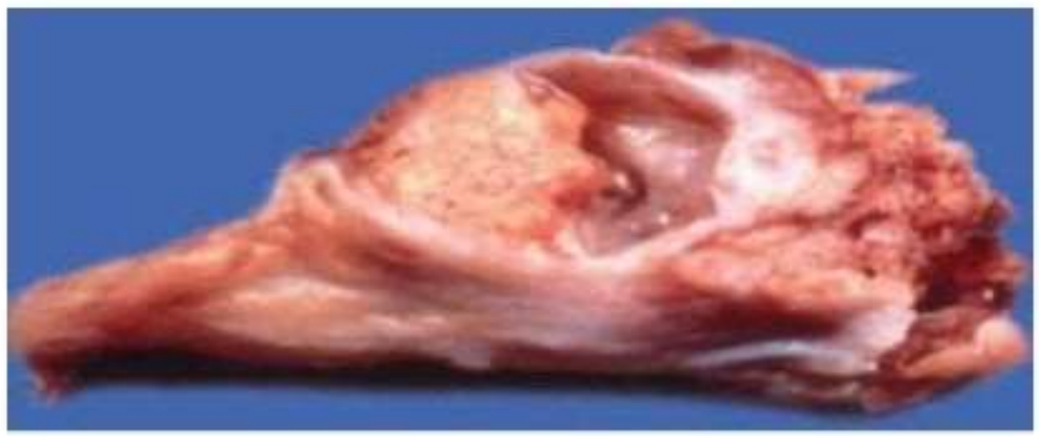


Low grade malignancy

- 1) Slowly enlarging, painless, <5mm
- 2) Not comp. encapsulated
- 3) Intraoral lessions→ buccal mucosa, tongue, retromolar area
- 6) C/S:- solid white mass

High grade malignancy

1) Grows rapidly with pain & infiltrate
2) FN palsy→ Parotid tumors
3) Trismus, dysphagia, ulceration & numbness of adj area
4) Metastasis to regional LN
5) Lung, bone, brain metastasis
6) C/S - mucinous fluid & high ratio of epidermoid cells



TREATMENT

1) For the most favorable tumours→ Superficial parotidectomy with facial nerve preservation, if possible.

2) Radical excision is necessary for pts with large &/or high-grade lesions.

3) Associative elective ND .

4) With more severe neck disease→ RND.

5) High grade tumours→ Require post op RT.

ADENOID CYSTIC CARCINOMA

- Slow growing, aggressive neoplasm.
- 2nd MC malignant tumor.
- Common malignant tumor- submandibular, sublingual & minor salivary ,
- 2/3rd – occurs in minor salivary glands.
- **C/F** 1) MC seen in females→ 5th-6th decade.

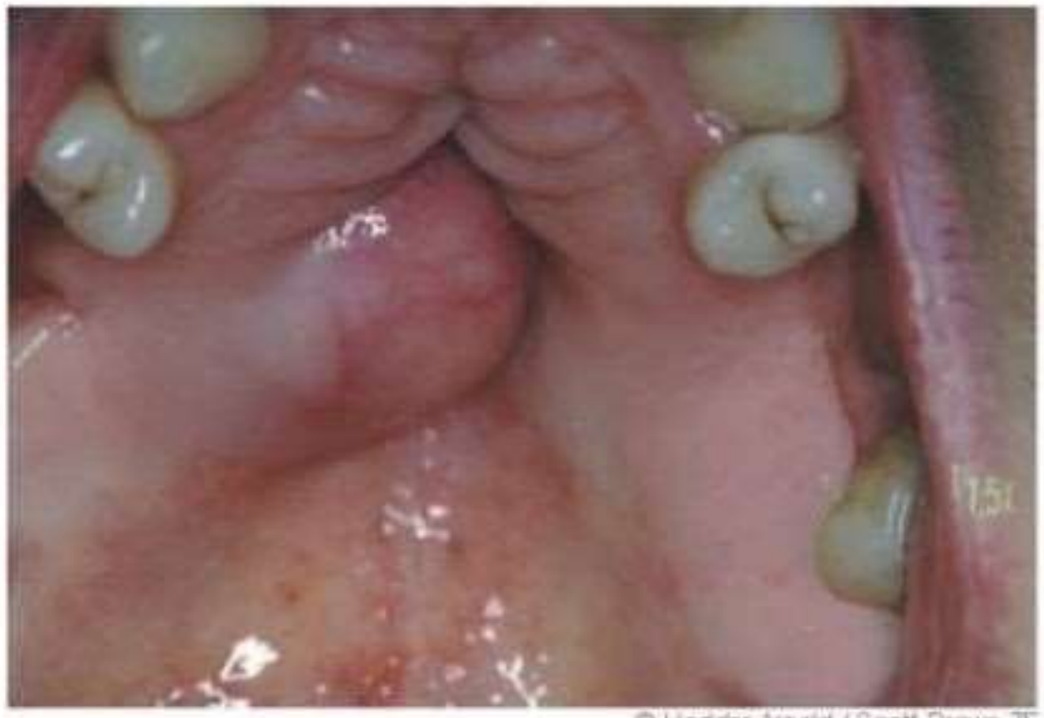
  Local recurrence common (30-50%).

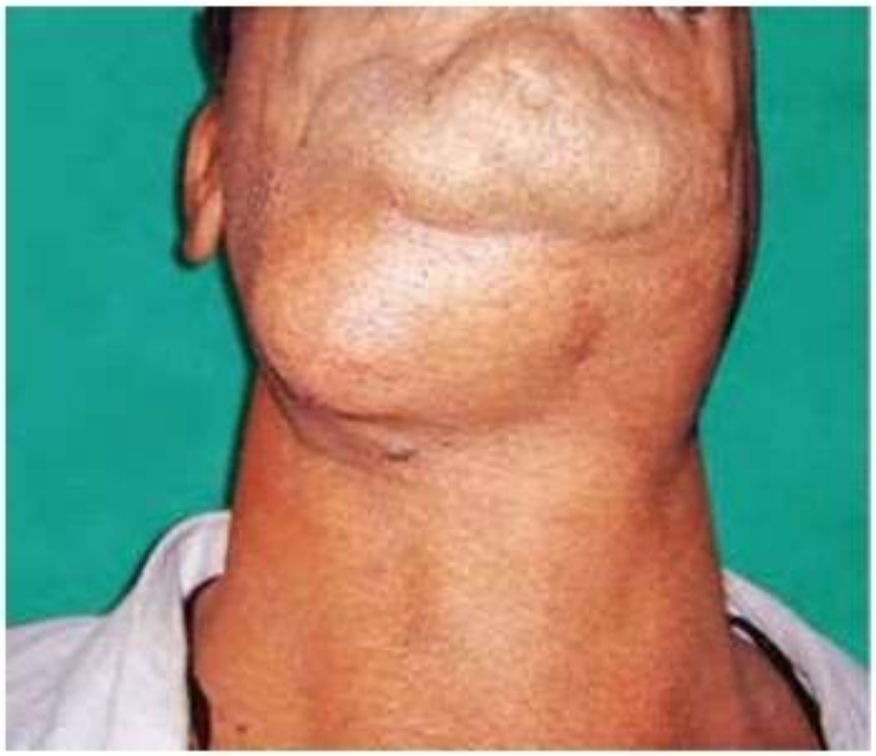
  2) Parotid, submaxillary, palate & tongue - MC involved.

- 3) Early local pain (surface ulceration), FN palsy, local invasion & fixation to deeper structure.

  LN metastasis→ 10%-30%.

- 4) Tendancy to spread through perineural spaces (20%-30%)



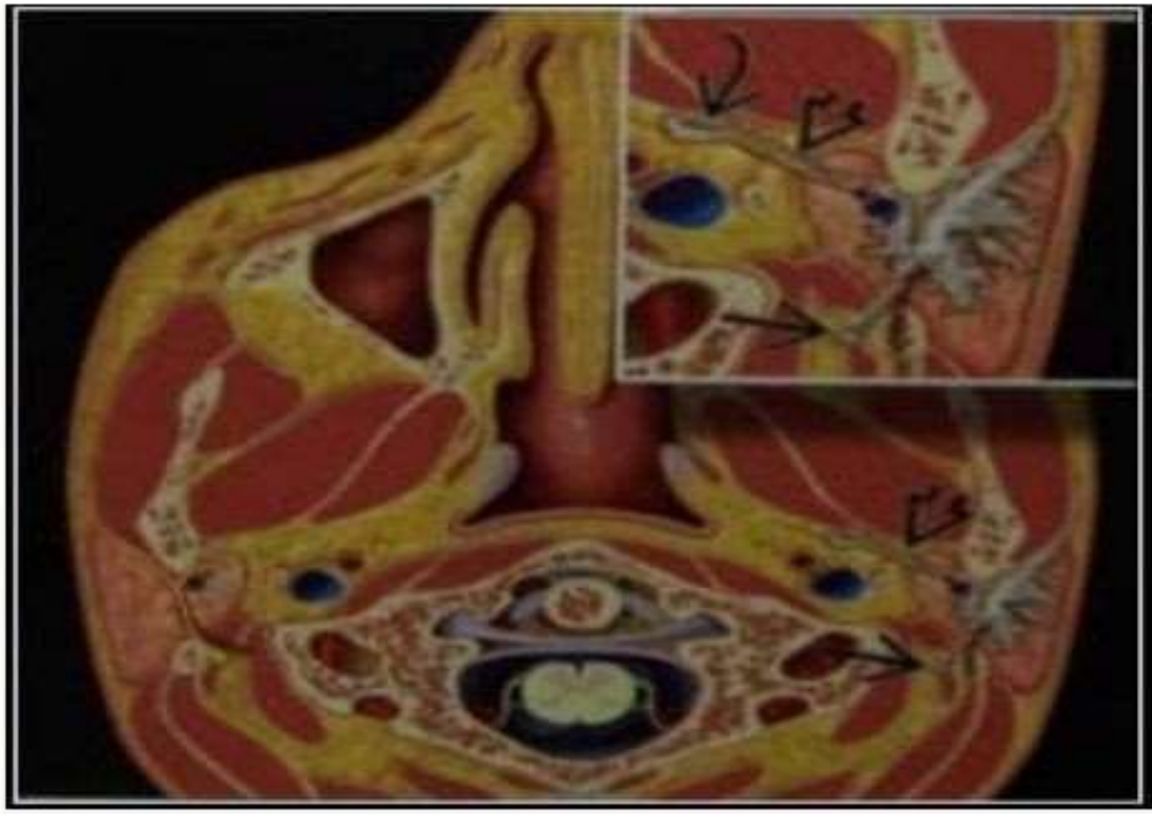


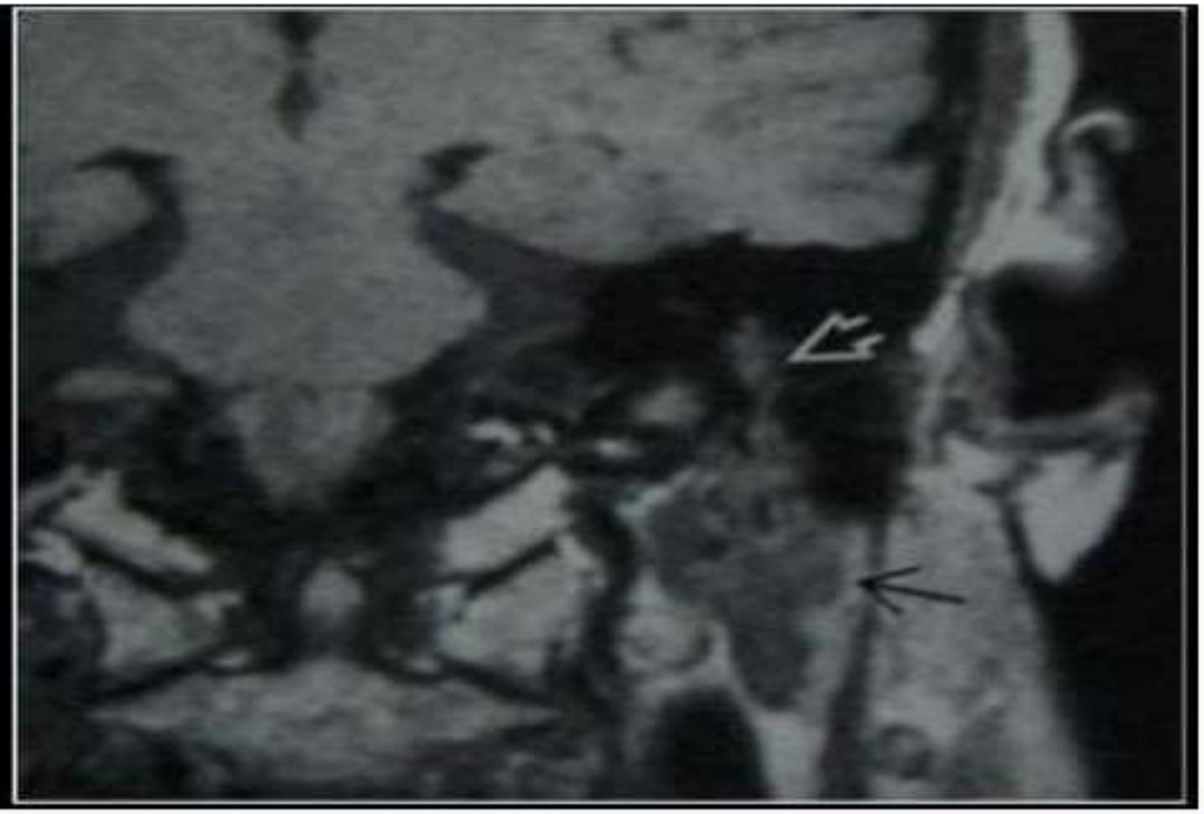
Adenocystic carcinoma of hardpalate

- Perineural spread→ 50%

- Commonly involved nerves- Facial nerve, mandibular & maxillary nerve→ Pathway for invasion of the skull base

- More frequent- advanced, recurrent & high grade tumors.





TREATMENT

1) Radical primary surgery→ Best survival rates at 20 yrs.

2) Postoperative irradiation→ Integral part of treatment.

3) No prophylactic neck dissection required (like in mucoepidermoid ca)

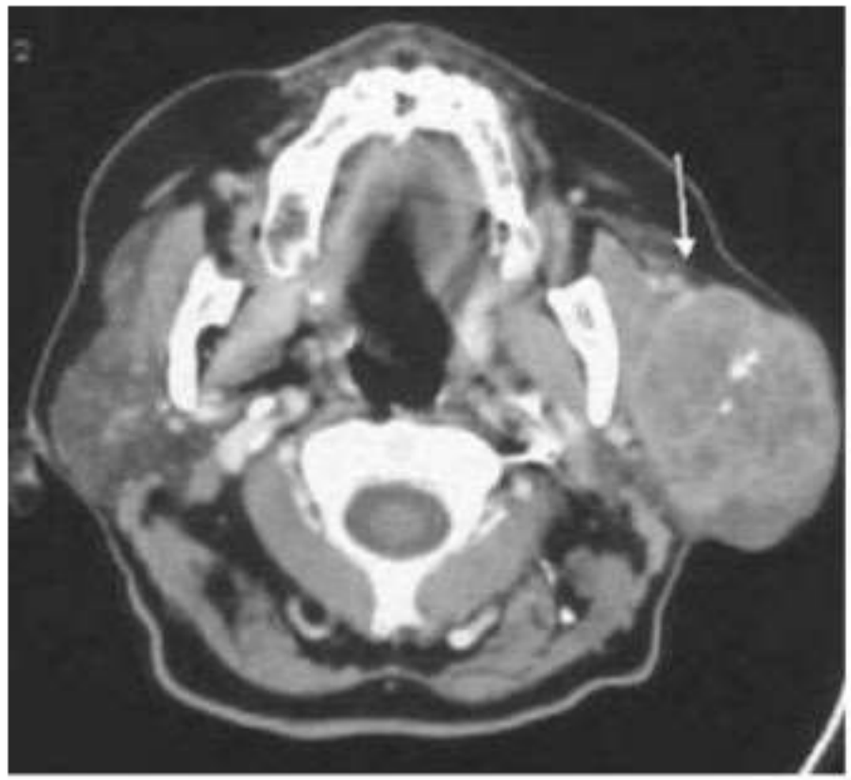
4) Limited role of chemotherapy→ Cisplatin + Doxorubicin.

Carcinoma ex-pleomorphic adenoma

- 2nd MC parotid gland tumor →

Malignant form of pleomorphic Ca.

- Primary malignant mixed tumor.
- Typical history of slowly growing mass demonstrating sudden increase in the growth.



TREATMENT

- Aggressive Tumour

  1) Total parotidectomy with facial nerve conservation is ideal.

- Poor prognosis

Malignancy should be suspected when::

- Rapid growth
- Facial nerve palsy
- Painful
- Skin infiltration
- Get fixed to massester muscle → Trismus
- Feels stony hard
- Presence of lymph nodes in neck

Recurrent pleomorphic adenoma

- Possible reasons for recurrences or persistence in pleomorphic adenoma include:

  - The diffluent nature of predominantly mucoid tumors.
  - The variability of the thickness of the capsule, together with the tendency of the tumor to invade the capsule.
  - Tumor protuberances bulging through the capsule.
  - Intratumoral splitting beneath the capsule.

Metastasizing pleomorphic adenoma

- A histologically benign pleomorphic adenoma that inexplicably manifests local or distant metastasis.
- Probable mechanism: vascular permeation secondary to mechanical implantation.
- Common sites – bone, lung, lymph nodes.
- Characteristically retains the benign histologic features of pleomorphic adenoma.

Acinic cell carcinoma

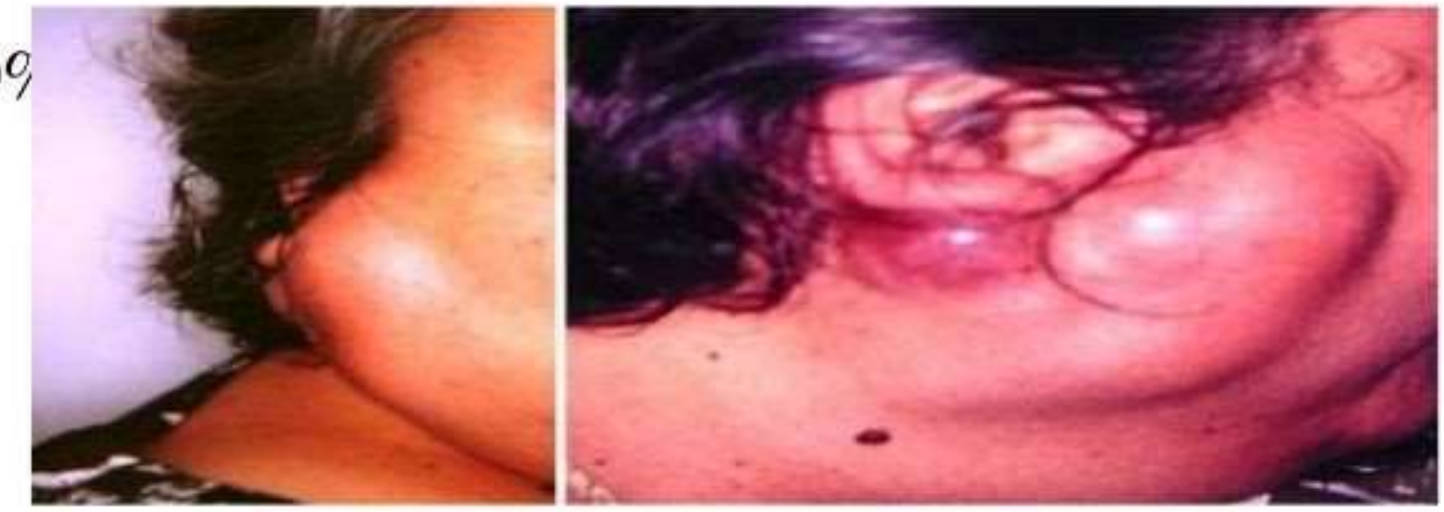
- 3rd most comman malignant Ca. of parotid gland.
- Low malignancy. M:F=3:2,

  mainly in middle ages (44yrs)
- Tumor may be multifocal or B/L.

Clinically – Painless lump,

- Encapsulated & lobulated.
- Chiefly occurs→ Parotid (80%
- Most common intraoral

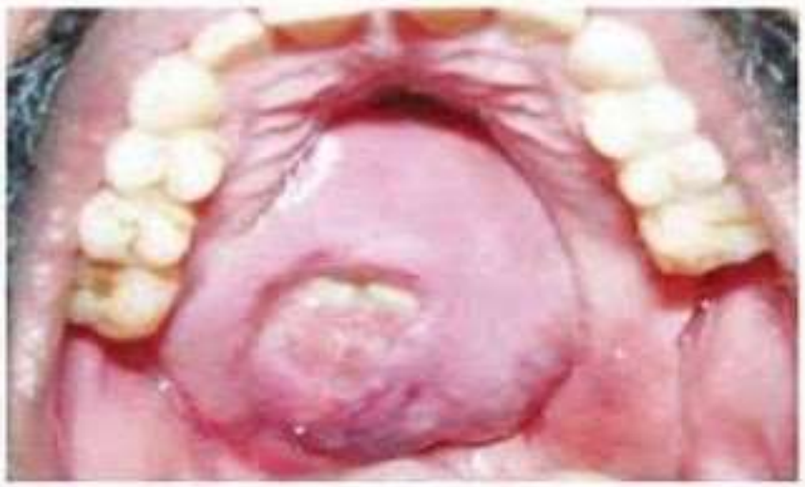
  site→
- Lips & buccal mucosa



- Local recurrence & distal metastasis.
- Has the best survival rate of any salivary cancer.
- Excision of a facial nerve is not justified unless it is involved.

Polymorphous Low-Grade Adenocarcinoma

- 2^{ND} most common malignant intraoral tumor of the salivary glands.
- Palate (60-70%) > buccal mucosa (16%) > upper lip, retromolar area, base of tongue.
- F:M = 2:1 & common in 5^{th} to 7^{th} decade.
- A painless mass in the palate is the most common presentation.



Squamous cell carcinoma

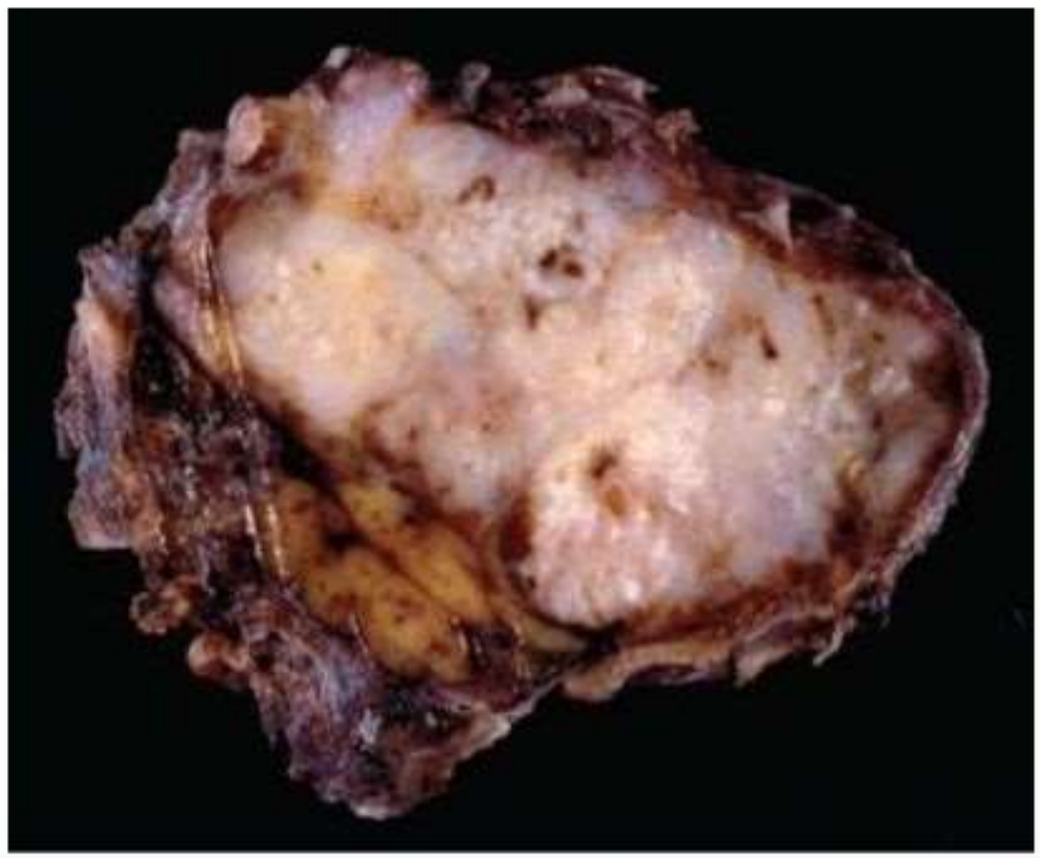
- Primary salivary gland SCC is very rare(<1%)

  Parotid (80%), submandibular gland(20%)
- Age : 60 to 65years, M:F= 2:1.
- History of previous radiotherapy.

Salivary duct carcinoma

- An aggressive adenocarcinoma which resembles high-grade breast ductal carcinoma.

- M>F, after 50 years of age.
- Site- parotid(~80%).
- Present with a rapidly enlarging parotid mass associated with facial nerve palsy , pain and cervical lymphadenopathy.



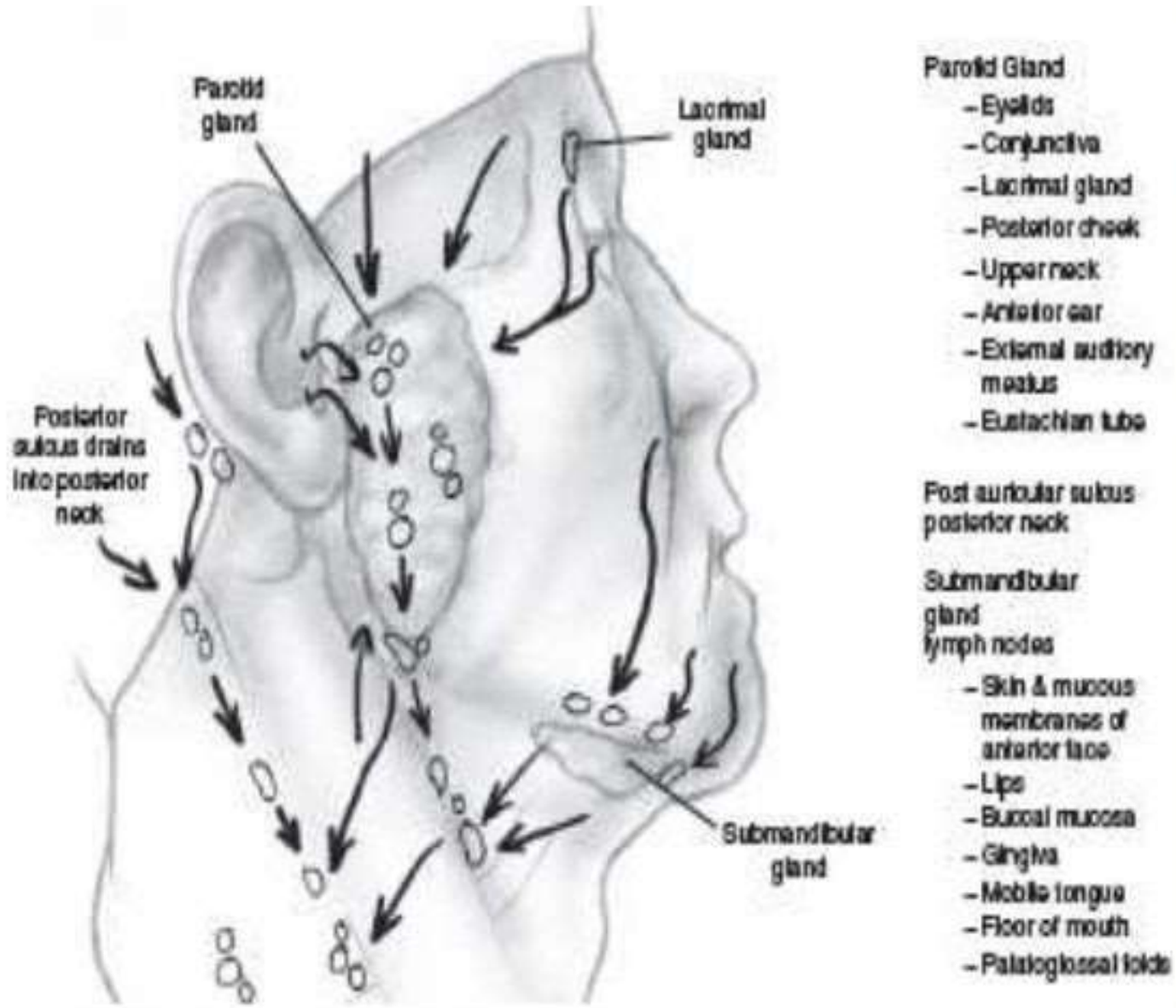
Secondary (metastatic) tumors

• Hematogenous metastasis – lung, kidney & breast

• Parotid gland most common site

• Lymphatic spread from cutaneous malignancy of head & neck
<10% -Malignant parotid tumors,
40%-melanomas,
40% -Sq. cell ca.

• 2/3rd of metastatic sq. cell Ca to parotid occurs within 1st yr after T/t of the primary skin cancer



TNM classification of carcinomas of the major salivary glands

Primary Tumor (T)	
TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
T1	Tumor 2 cm or less in greatest dimension without extraparenchymal extension*
T2	Tumor more than 2 cm but not more than 4 cm in greatest dimension without extraparenchymal extension*
T3	Tumor more than 4 cm and/or tumor having extraparenchymal extension*
T4a	Moderately advanced disease Tumor invades skin, mandible, ear canal, and/or facial nerve
T4b	Very advanced disease Tumor invades skull base and/or pterygoid plates and/or encases carotid artery
Regional Lymph Nodes (N)	
NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension
N2	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension, or in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension, or in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
N2a	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension
N2b	Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension
N2c	Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
N3	Metastasis in a lymph node, more than 6 cm in greatest dimension

Staging

ANATOMIC STAGE/PROGNOSTIC GROUPS

Stage I	T1	N0	M0
Stage II	T2	N0	M0
Stage III	T3	N0	M0
	T1	N1	M0
	T2	N1	M0
	T3	N1	M0
Stage IVA	T4a	N0	M0
	T4a	N1	M0
	T1	N2	M0
	T2	N2	M0
	T3	N2	M0
	T4a	N2	M0
Stage IVB	T4b	Any N	M0
	Any T	N3	M0
Stage IVC	Any T	Any N	M1

Evaluation of patient

A] History:- Important points in the history:

1) Mass (duration, rate of the growth, presence of pain)

2) Facial paralysis, B/L 3) Cervical lymphadenopathy

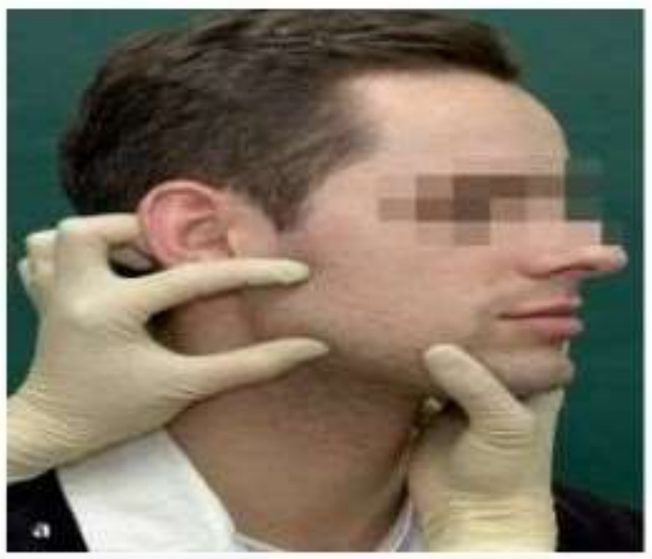
4) Eyes and joints symptoms 5) H/O exposure to radiation

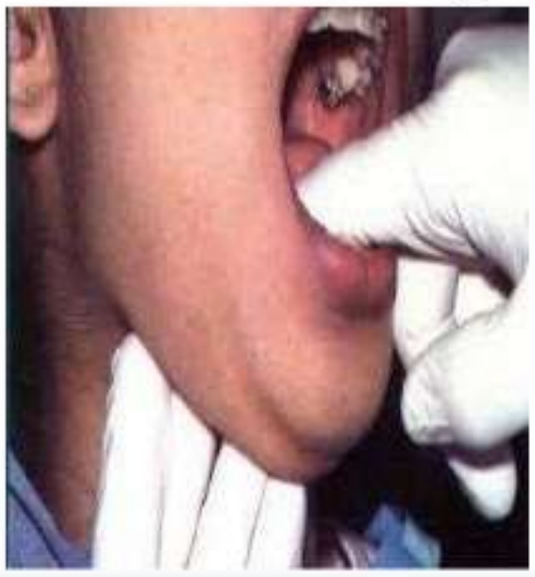
6) Ipsilateral weakness or numbness of tongue

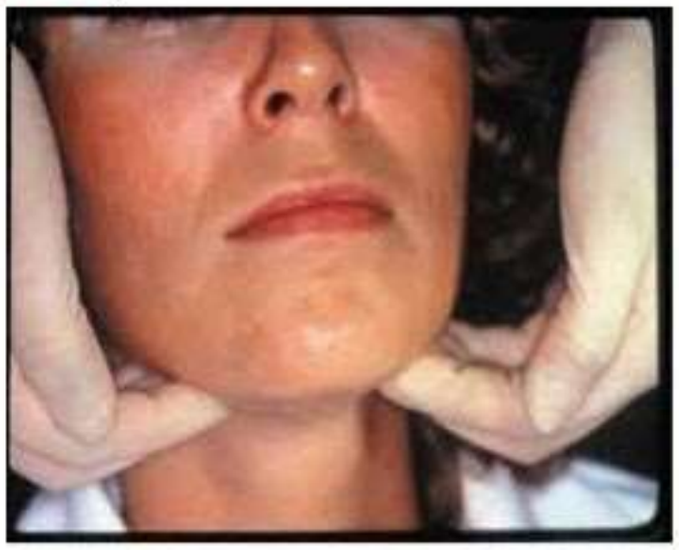
B] Examination:-

1) Size of the mass 2) Overlying skin, Skin fixation, mobility

3) Lymphadenopathies 4) Cranial nerves esp. **CN V,VII**,







Investigations

1)Plain X ray
2) X ray chest→ To R/O secondaries.
3) OPG→ To R/O mandibular involvement.
4) Open biopsy→ Rarely used due to risk of recurrence & FN damage→ Useful HP guidance for use of palliative CTRT, poor surgical candidate, obvious malignancy.
5) Sialography:-
   a) C/I:-Acute infection, Iodine allergy, Multiple myeloma.
   b) Limitation:- Mass < 2mm, Deep lobe pathology.
6) Radiosialography→ Tc99→ To detect mass lesion & parenchyma function→ No use in ductal system study.
7) Colour doppler sonography→ Non invasive → Evaluates vascular anatomy.
8) PET→ Differentiate benign from malignant lesions.

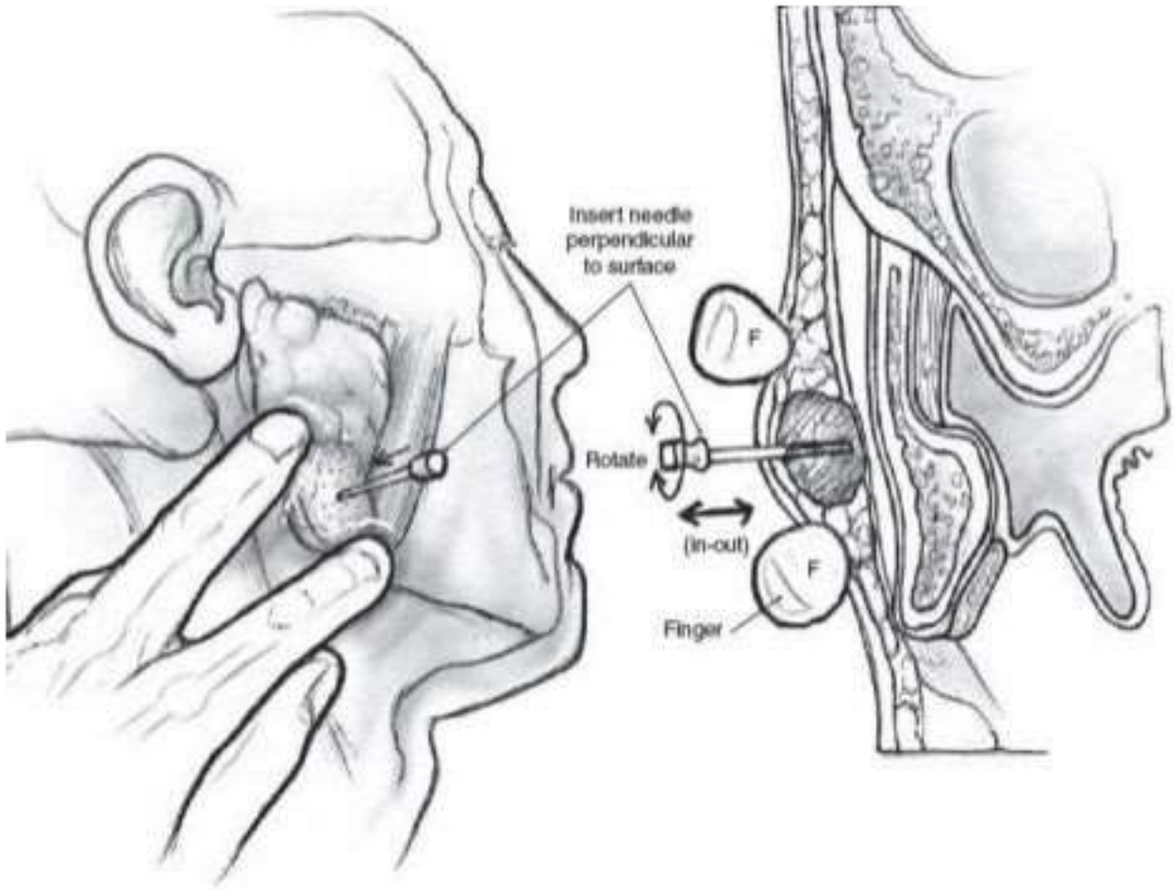
Main investigations

FNAC:-

1) Accuracy→95-98%

2) Diff benign from malignant disease.

2) The key to successful FNAC is immediate evaluation of the specimen for adequacy.

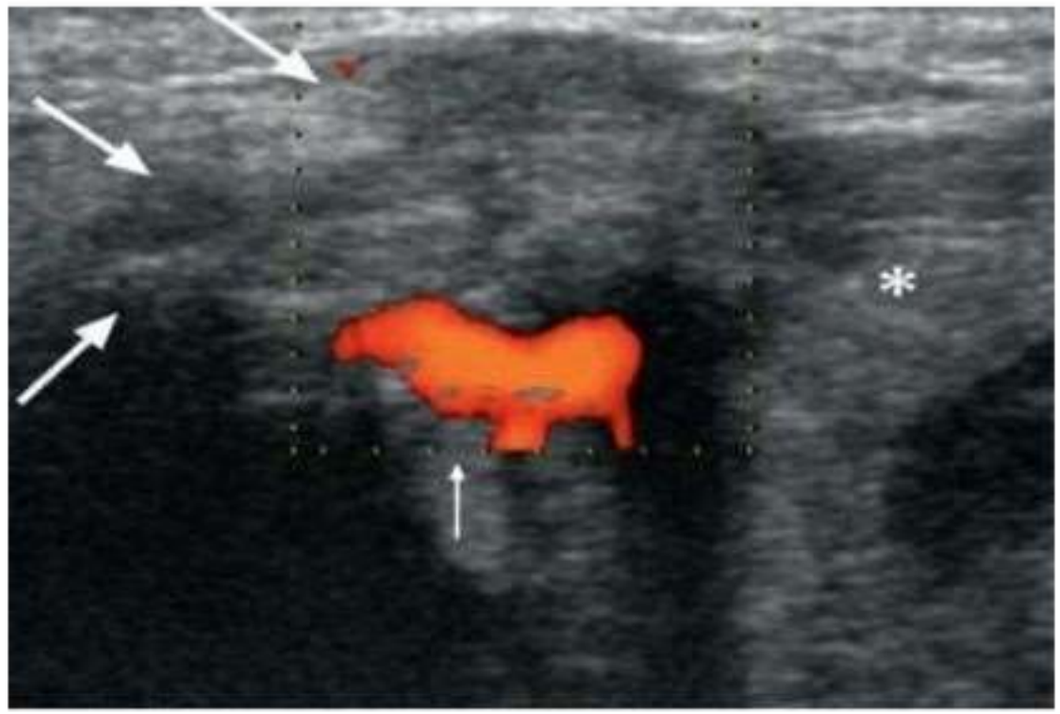


The technique of fine-needle aspiration cytology (FNAC) for a tumor of the parotid gland.

Ultrasound

1) Ideal tool for the initial assessment of superficially located tumors of the parotid and submandibular gland→ Distinguish intrinsic from extrinsic neoplasm.

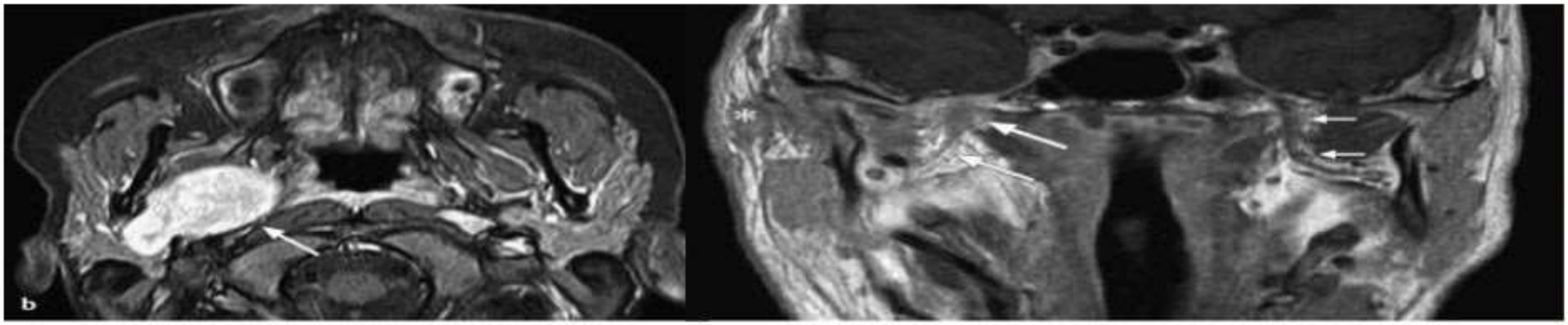
2) USG f/o malignant tumors include
ill-defined margins,
heterogeneous architecture,
subcutaneous invasion,
& the presence of LN metastases.



C.T. & MRI

1) Effective modalities for imaging the size, the local, and the regional extension of the primary tumor and the neck metastasis & to differentiate intra from extra glandular mass.
2) CT→ IOC for subtle cortical involvement & bone destruction.
3) MRI→ IOC for bone marrow invasion.
3) MRI→IOC for detecting perineural spread.
4) Contrast-enhanced MRI→ IOC for intracranial invasion

Disadvantage Of MRI :- 1) Less sensitive in cystic lesions.
2) Inability to detect calcification.



MRI of adenoid cystic carcinoma arising in the deep lobe of the right parotid gland.

T1-weighted MRI shows enlargement & enhancement of the rt mandibular nerve (thick arrows), extending into the foramen ovale. Histology confirmed perineural spread.

- C.T. Sialography

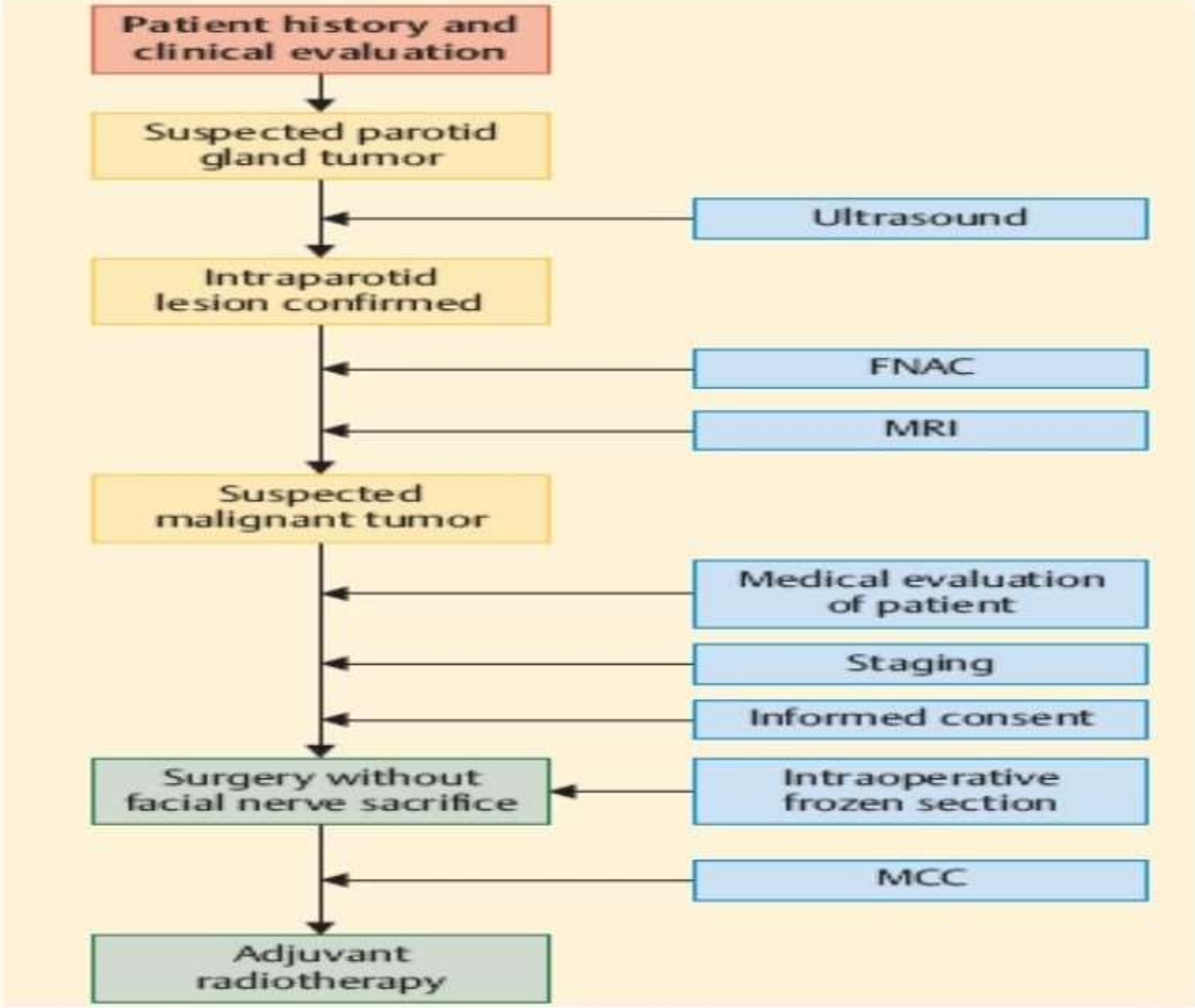
- Quantitative DCE-MRI, DW-MRI, and MRS→ New & evolving techniques for differentiating between benign and malignant salivary gland neoplasms.

- FDG-PET/CT→ For local extent of the tumor and to detect locoregional & distant metastases.

Prognostic factors

1. Histopathological diagnosis
2. Facial nerve paralysis
3. Skin involvement
4. Stage
5. Location
6. Incidence of recurrence
7. Distant metastasis
8. Radiotherapeutic sensitivity
9. Chemotherapeutic sensitivity

T/t plan of Parotid gland neoplasm



TREATMENT PLAN

SALIVARY GLANDS MASS
PAROTID
SUBMANDIBULAR
MINOR SALIVARY GLAND

- **UNTREATED RESECTABLE**
- **PREVIOUSLY TREATED INCOMPLETELY RESECTED**
- **NOT RESECTABLE**

UNTREATED RESECTABLE

Clinically benign <4cm (T1, T2)

Complete surgical excision

Benign

Follow up

Low grade mucoepidermoid

Follow up

Intermediate or high grade

RT

Clinically suspicious of cancer >4cm or deep lobe

CT/MRI Base of the skull or clavicle

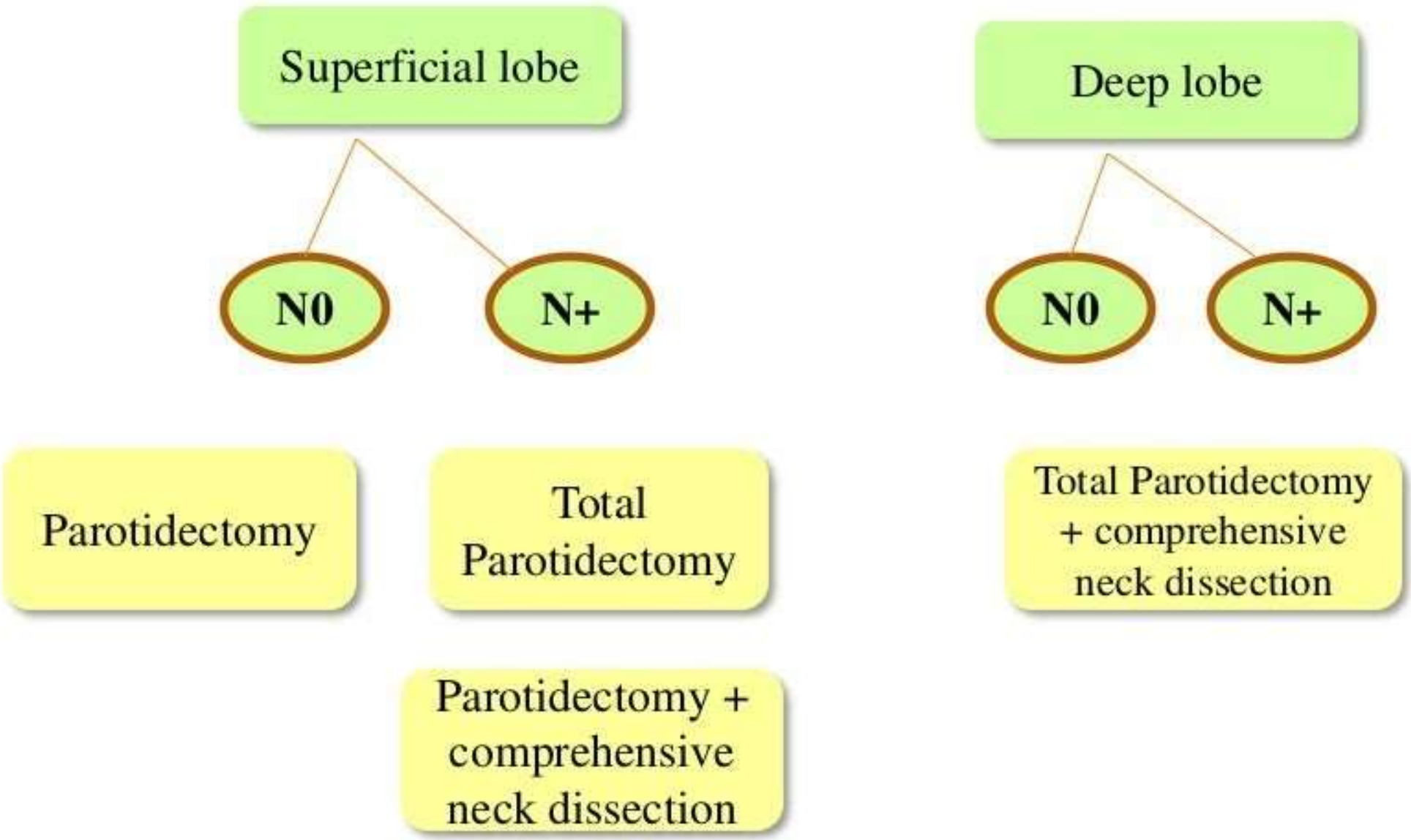
Consider FNA

Surgical resection

Cancer

Benign

Follow up


Superficial lobe
N0
N+
Deep lobe
N0
N+
Parotidectomy
Total Parotidectomy
Parotidectomy + comprehensive neck dissection
Total Parotidectomy + comprehensive neck dissection

INCOMPLETELY RESECTED

H & P
CT/MRI
Pathology
Review

Negative Physical Exam + imaging

Adjuvant RT

Follow up

Gross residual disease on physical examination or imaging

Surgical Resection if possible

Adjuvant RT

Non Surgical resection possible

Definitive RT

Follow up

CANCER
SUPERFICIAL LOBE
DEEP LOBE

Parotidectomy

Completely excised

No adverse characteristics

Adverse characteristics

Adjuvant RT

Incompletely excised gross residual disease No further surgical resection possible

RT

Surgery ± adjuvant RT

Resectable

RT if feasible or clinical trial or single agent chemotherapy or best supportive care

Not Resectable

Chest X-ray annually TSH annually if thyroid irradiated

Physical examination
year 1 (every 1-3 mon)
year 2 (every 2-4 mon)
yr 3-5 (every 4-6 mon)
≥5 (every 6-12 mon)

T1 & T2 LOW GRADE	T1 & T2 HIGH GRADE	STAGE T3	STAGE T4
Submandibular gland excision	1) Wide excision 2) Preserve nerve unless involved 2) PORT	1) Wide excision with neck dissection 2) PORT	1) Surgery to fit extent of disease 2) PORT

Indications of PORT

1) High-grade tumor
2) Deep lobe cancers
3) All T3 and T4 cancers
4) Recurrent disease
5) Documented LN metastasis
6) Extraparotid extension
7) Gross/microscopic residual disease
8) Tumor involving or close to the facial nerve.

Total dose of 60 Gy in fractions of 2 Gy a day

Indications of neck dissection

1) Clinically cervical Lympadenopathies (15%).

2) Parotid tumor bigger than 4cm→ Occult metastasis risk >20%.

3) High grade malignancy→ Occult metastasis risk >25%.

Chemotherapy

Useful in pallation & in inoperable cases. Combination regimen have not proven better results

2 groups

Adeno Ca like tumors i.e.
Adenoid cystic Ca,
Acinic cell Ca,
Ca. ex polymorphic Ca

↓

Adriamycin
Cisplatin
5-flurouracil

Epidermoid like tumor i.e.
Sq. cell CA
Mucoepidermoid Ca.

↓

Methotrexate
Cisplatin

COMPLICATIONS OF PAROTID SURGERY

Acute	Late
Facial nerve palsy	Sensory deficit
Bleeding or hematoma	Cosmetic deformity
Seroma	Frey's syndrome
Salivary fistula	

RT PLANNING AND DELIVERY

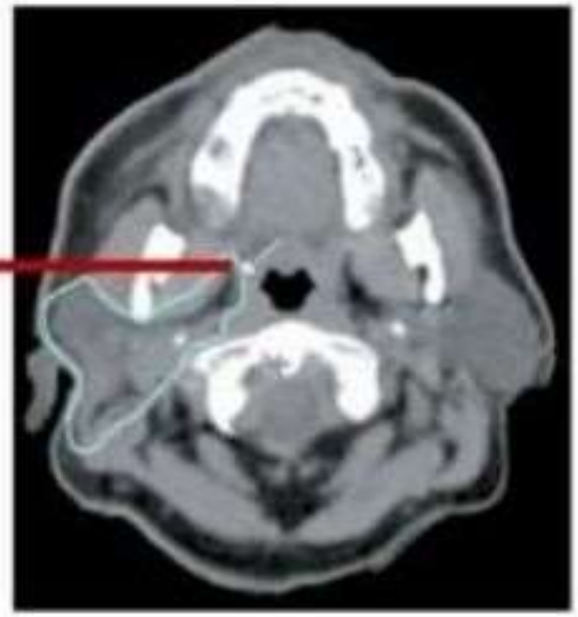
General Considerations & Volume definition:

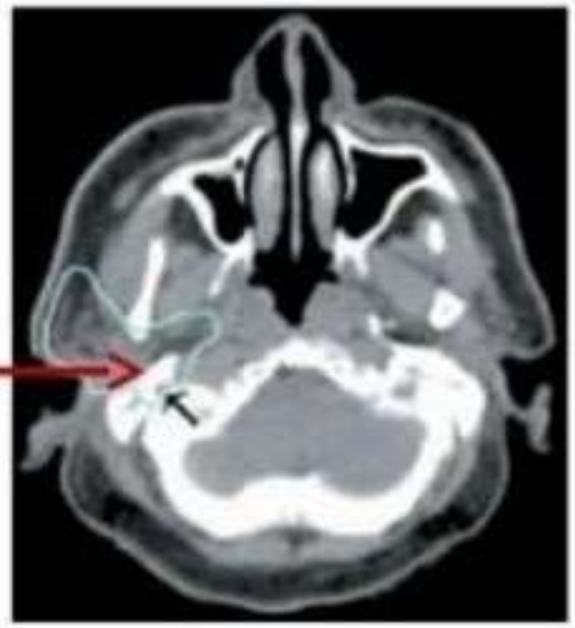
- Parotid gland contains several intraparotid lymph nodes-can spread via the intraparotid nodes to the subparotid nodes in the retrostyloid space and thence to the retropharyngeal nodes, or directly to level II nodes

- Tumours of the submandibular salivary gland can invade locally or perineurally in
  - the marginal branch of the facial nerve,
  - the lingual nerve, nerve to mylohyoid and hypoglossal nerve.

  - Pathway : Lymphatic drainage is to level Ib nodes lying adjacent to(but rarely within) the salivary gland and then to ipsilateral level II nodes

- **The CTV60**
- Particular attention is given to the deep excision margin which is likely to be close or involved if the facial nerve has been preserved.
- As a minimum, the medial extent of the CTV60 should be to the lateral surface of the internal jugular vein, but if the deep lobe of the parotid is thought to contain tumour, the parapharyngeal space should be included
- In adenoid cystic carcinomas, the CTV60 should include the course of the facial nerve up to the stylomastoid foramen at the skull base

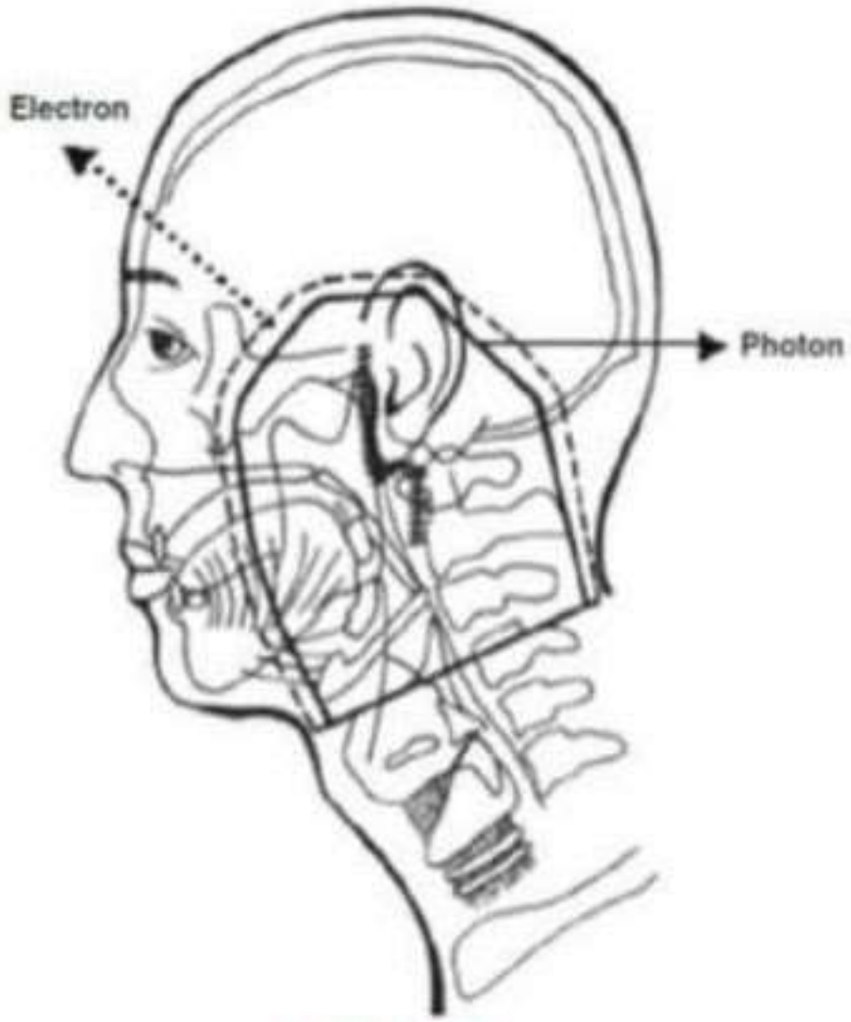




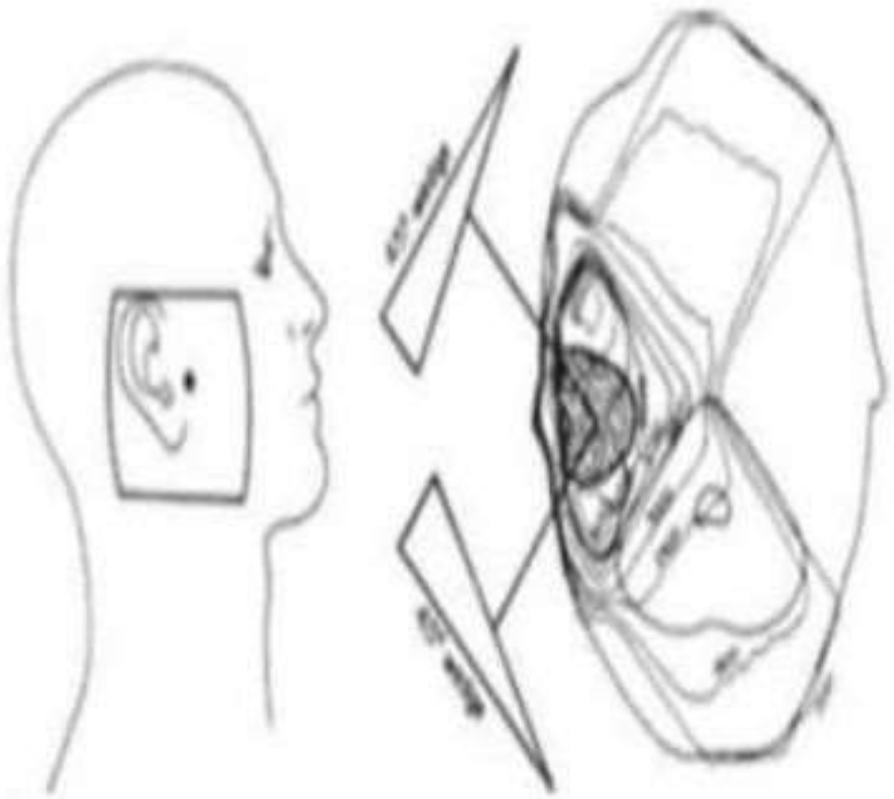
- If Neck dissection is + the levels to be treated are included in the CTV60.
- Retropharyngeal LN to be included for deep lobe tumors of parotid
- For prophylactic neck radiotherapy,(High Grade) the ipsilateral level Ib, II and III nodes should be included in the treated volume.
- A separate CTV44 can be defined to give these sites a prophylactic dose; the proximity of the nodes to the parotid bed are so that including them in the CTV60 and treating the whole volume in one phase can be done.
- Sites where resection margins are involved, or where there was extracapsular nodal extension, should be defined in a CTV66
- CTV is expanded isotropically to form the **PTV** by a margin usually 3–5 mm.

Parotids

- Single field technique with photon–electron combination:
  - Used to deliver a homogeneous dose distribution sparing the contralateral parotid gland
  - *Superior*: above zygomatic bone, including parotid and scar
  - *Inferior*: above thyroid cartilage
  - *Anterior*: anterior edge of masseter muscle
  - *Posterior*: posterior to mastoid
  - Lymph node (+) or neck irradiation is required: posterior to spinous process
  - However, if the accessory parotid gland is involved with tumor, an additional 2-cm margin must be added anteriorly because this is the location of this parotid gland by anatomic variation.
- *Anterior–posterior oblique double wedge technique*
  - This technique allows dose homogeneity and the contralateral parotid gland sparing.
  - However, this technique may cause set-up errors.



Parotid gland
(postoperative)



Parotids

- Electron portal margins should be 1 cm larger than those for photons because of the constriction of the electron isodose curves at depth

- The energy of the electron that has to be chosen depends on the anatomic distance from the skin of the ipsilateral cheek to the oral mucosa and generally ranges between 12 and 16 MeV

- When a combination of electrons and photons are used, either modality can start first.

- There is a weighting between 50% and 80% with electrons.

- By mixing the two different beams, one can decrease the irradiation of the contralateral parotid gland, acute radiation skin reaction, and mucositis.

Parotids

- For majority of cases, 3D-CRT using either a two- or three-field approach including wedges is appropriate
- If adenoid cystic carcinoma, with the increased risk of perineural invasion and travel along the pathways of the adjacent cranial nerves require the treatment volume to include the neural pathways to the base of the skull--IMRT treatment plans give the best approach
- Sparing the contralateral parotid gland is a very important consideration during the complex treatment planning process for 3D-CRT and IMRT

- Dose contraints to the contralateral parotid gland-
  - Mean dose to the gland should be limited to less than or equal to 26 Gy
  - Dose to at least 50% of the gland should be limited to less than 30 Gy

Submandibular glands

- Single field is enough.
- Possible regions that should be included in RT portal: submandibular angle, neighboring oral cavity, pterygomaxillary fossa, cranial base, ipsilateral neck.
- *Superior border*: hard palate;
- *inferior border*: hyoid bone;
- *anterior border*: anterior to mentum;
- *posterior border*: posterior to mandibular angle.

- Four to six megavolt X-rays, Co-60 or 6–18 MeV electrons are used.

Sublingual Gland

•General portal margins that encompass the planning target volume are as follows:

- Superior—1 cm above the upper border of the tongue
- Inferior—hyoid bone–thyroid notch interspace
- Anterior—anterior aspect of the mental symphysis
- Posterior—posterior aspect of the ascending mandibular ramus
- Lateral—2-cm flash of ipsilateral mandible
- Medial—2 cm past midline (however, the entire floor of mouth–submental region usually requires treatment)

•Right and left opposed lateral portals are needed to completely encompass this treatment volume, particularly when the regional lymph nodes are included.

Brachytherapy

- For technically implantable lesions, brachytherapy +/- EBRTfor unresectable malignant parotid tumors or recurrence.

- Armstrong et al. reported on 20 patients with recurrent or advanced disease treated with brachytherapy alone using Ir-192 or I-125 .

- Previously, radiation therapy had been administered to 15 of these patients.

- Implant was to gross disease in 15 of the 20 patients.

- Actuarial local control rate at 5 years was 60%.

Fast Neutron Therapy

- Fast neutrons are a densely ionizing, high LET type of particulate radiation
- They are contrasted with photons in the following fashion
  - Biologic effectiveness of fast neutrons is much less affected by a hypoxic environment
  - Lethal effects of fast neutrons are less dependent on the cell cycle phase compared with photons
  - Repair of sublethal damage in malignant cells matters less
  - Fast neutrons are biologically more effective (relative biologic effectiveness [RBE] > 2.6)
  - Fast neutrons lack skin sparing and thus can cause a more prominent acute dermal reaction than photons

Dosing Definitive Setting (66-74 Gy)

- Phase I
  - 1.8 Gy is administered per fraction @ 1fr/day
  - 5 days per week for 4 weeks
  - Total dosage of 36 Gy
- Phase II
  - Begins with twice-a-day treatment separated by at least 6 hours
  - Morning fraction is a continuation of the initial treatment volume and scheme for phase I for the remaining 2 weeks (10 fractions) to a total of 54 Gy
  - Afternoon fraction is given 6 hours after the morning dose at a fraction size of 1.6 Gy to a cone-down treatment volume that consists of the primary gross tumor area and adenopathy. This is continued for 2 weeks (10 fractions) to a dosage of 16 Gy.
  - Ultimately, the total cumulative dosage from phase I and II to the gross tumor areas is 70 Gy and to the electively irradiated areas is 54 Gy

Dosing in Adjuvant Setting

- A dosage of 1.8 to 2.0 Gy per fraction, one fraction per day, 5 days per week is administered to a total cumulative dosage as follows-
  - High-risk areas for microscopic disease in surgically violated regions: **60 Gy (2.0 Gy/fraction) to 63 Gy (1.8 Gy/fraction)**
  - Small volume of known microscopic disease: **66 Gy**
  - Elective irradiation of areas at risk for microscopic disease: **50 Gy (2.0 Gy/fraction) to 54 Gy (1.8 Gy/fraction)**
  - **Gross** residual disease: **70 Gy.**

Patient Care

- Swallowing problems,mucositis—Symp Care
- Advice on jaw exercises can reduce the risk of trismus and TMJ dysfunction.
- Conductive hearing loss due to middle ear effusions can occur and take several months to improve after treatment has finished.
- If subjective hearing loss persists 2 months after treatment, an audiogram should be performed.
- If there is evidence of conductive hearing loss, a grommet may be indicated.

Prognosticators

- The 10 year disease free survival of salivary gland tumors ranges from 47 to 74%; and 10 year overall survival was 50% in one large study.
- Some prognostic factors associated with poor outcomes are:
  - Extent of disease (Advanced T & N-status)
  - Positive or close resection margins
  - Nerve involvement
  - Perineural invasion
  - Grade: high-grade mucoepidermoid carcinoma, high grade adenoid cystic carcinoma, undifferentiated carcinoma, squamous cell carcinoma,adenocarcinoma NOS, salivary duct carcinoma
  - High Ki-67 and low p27expression: associated with shorter disease-freesurvival in adenoid cystic andmucoepidermoid

THANK YOU