

**A Thesis in General Surgery**

**CLINICAL AND PATHOLOGICAL STUDY OF  
SALIVARY GLAND SWELLINGS**

Submitted in partial fulfillment of the  
Requirements for the Degree of  
M.S General Surgery  
(Branch I)



**Kilpauk Medical College  
The Tamilnadu Dr. M.G.R. Medical  
University Chennai**

**APRIL – 2016**

## **DECLARATION BY THE CANDIDATE**

I hereby declare that this dissertation titled “**CLINICAL AND PATHOLOGICAL STUDY OF SALIVARY GLAND SWELLINGS**” a bonafide and genuine research work carried out by me under the guidance of Dr. R.KANNAN, M.S., Professor, Department of General Surgery, Kilpauk Medical College, Chennai.

This dissertation is submitted to THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI in partial fulfillment of the requirements for the degree of M.S. General Surgery examination to be held in April 2016.

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**CERTIFICATE OF APPROVAL**

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "Clinical and Pathological Study of Salivary Gland Swellings" - For Project Work submitted by Dr.T.T. Senthilnathan, M.S. Post Graduate, Department of General Surgery, Govt.Kilpauk Medical College, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.



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INTRODUCTION Salivary glands are classified as

**21** major and minor glands. They comprise a complex anatomic and physiologic organ systems. They produce enzyme lubrication, mixing agent and immune factors.

They are affected by

**21** host of pathologic conditions. They are infection, immune disorder, hypertrophy and atrophy, systemic diseases and "neoplasms."

Salivary gland swellings

**41** can be broadly classified into inflammatory, non-inflammatory and neoplastic

swellings like calculi, benign tumours such as pleomorphic adenoma, oncocytoma, warthin's tumour or malignant tumours like adenocarcinoma, adenoid cystic carcinoma and undifferentiated carcinoma. Connective tissue diseases like haemangioma, lymphangioma, neurofibroma and other auto immune diseases like Sjogren's syndrome, Mikulicz disease etc. Acute inflammatory conditions generally can be diagnosed by history and physical examination alone, whereas chronic inflammatory diseases and granulomatous disorders require supplemental diagnostic information including lab tests, imaging studies and biopsy. Accurate pathological diagnosis is necessary for proper management of neoplastic disorders'. Most of

**40** primary epithelial tumours occur in parotid glands. 7- 11% in the submandibular glands are

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## **ABSTRACT**

### **OBJECTIVES**

1. To study the age and sex distribution among patients presenting with Salivary Gland Swellings.
2. To study the mode of clinical presentation of various Salivary Gland Swellings.
3. To study the accuracy of Fine Needle Aspiration Cytology (FNAC) in the diagnosis of Salivary Gland Swellings.
4. To study the methods of current surgical treatments of Salivary Gland Swellings.

### **BACKGROUND DATA**

Salivary Gland Swellings are one of the most common clinical conditions encountered by the general surgeon. There are various causes of salivary swellings and they arouse much interest and debate because of their remarkable variability in structure, clinical presentation and behavior. This study was done with a interest to know the incidence, clinical presentation of swellings of the salivary glands, management, complications and correlation of the FNAC with the histopathology.

### **METHODOLOGY**

50 cases of salivary gland swellings presenting to Surgery Dept. and Surgical Oncology Dept. of Govt. Royapettah Hospital and Surgery Dept. of KMC Hospital at Chennai, from November 2014 to August 2015 were prospectively studied. Age, Sex distribution, mode of clinical presentation would be entered in the proforma. Also

correlation of FNAC with histopathological findings would be analysed. The various treatment options of different etiologies of Salivary Gland Swellings will also be studied.

## **RESULTS**

Salivary gland swelling occurred more commonly in 3<sup>rd</sup> and 4<sup>th</sup> decades of life (28.57%) and 65% of salivary swellings were present in females. All patients presented with salivary gland swelling (100%), 65% of patients presented with pain and 55% of patients presented with tenderness. Among the non-inflammatory and neoplastic swellings, 65% of salivary swellings were neoplastic and 35% non-inflammatory swellings. Among non-inflammatory swellings 80% was sialolithiasis and 20% was ranula. 100% of sialolithiasis were present in submandibular salivary glands. 100% of ranula was present in sublingual salivary glands. Among the neoplastic swellings, 100% of the neoplastic swellings were present in parotid glands. FNAC has overall diagnostic accuracy of 100%. Superficial parotidectomy is the most common surgery performed for neoplastic lesions (56.4%). Wound infection is the most common post operative complications.

## **CONCLUSION:**

Non-inflammatory and neoplastic salivary swellings are common in the middle age group and in females. Non-inflammatory swellings are more common in submandibular salivary glands. Sialolithiasis predominated the non-inflammatory swellings. Neoplastic swellings are more common in parotid gland and pleomorphic

adenoma dominates the neoplastic swellings. FNAC has got a good accuracy in diagnosing salivary gland tumours. Pain X ray has got accuracy in diagnosing sialolithiasis. Surgery is the main modality in the treatment in both non inflammatory and neoplastic salivary gland swellings. Early diagnosis of the condition with subsequent surgical management carries a very good prognosis.

**KEYWORDS:**

Parotid gland; Submandibular gland; sublingual gland; pleomorphic adenoma; adenoid cystic carcinoma; superficial parotidectomy; excision of submandibular salivary glands.

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## INTRODUCTION

Salivary glands are classified as major and minor glands. They comprise a complex anatomic and physiologic “organ” systems. They produce enzyme lubrication, mixing agent and immune factors. They are affected by host of pathologic conditions. They are infection, immune disorder, hypertrophy and atrophy, systemic diseases and “neoplasms.

Salivary gland swellings can be broadly classified into inflammatory, non-inflammatory and neoplastic swellings like calculi, benign tumours ( pleomorphic adenoma, oncocytoma, warthin's tumour) or malignant tumours (adenocarcinoma, adenoid cystic carcinoma and undifferentiated carcinoma) and connective tissue diseases like haemangioma, lymphangioma, neurofibroma and other auto immune diseases like Sjogren's syndrome, Mikulicz disease etc.

Acute inflammatory conditions generally can be diagnosed by history and physical examination alone, whereas chronic inflammatory diseases and granulomatous disorders require supplemental diagnostic information including lab tests, imaging studies and biopsy. Accurate pathological diagnosis is necessary for proper management of neoplastic disorders'.

Most of primary epithelial tumours occur in parotid glands. 7- 11% in the submandibular glands are malignant. Less than 1% occur in the sublingual glands. 9-23% occur in the minor glands. 15-30% of tumours of parotid gland are malignant. 40% in the submandibular gland are malignant. 50% in the minor salivary gland are malignant. 70-90% of sublingual glands are malignant.

These salivary gland tumours usually occur in adults with a female predominance. Warthins tumour(WT) are more common in males<sup>56</sup>.

FNAC of salivary gland tumours is helpful to both the patient and the clinician. Its immediate results, accuracy, lack of complications and economy are favourable. Appropriate treatment management can be planned earlier, local excision for benign neoplasm or radical surgery for malignancy. With non-neoplastic lesions, metastasis and lymph proliferative disorders, conservative management, chemotherapy or radiotherapy might be respectively preferable.

In this dissertation an attempt has been made to present various conditions of the salivary gland swellings admitted in Govt.Royapettah hospital and kilpauk medical college hospital Chennai, from NOV 2014 to AUG 2015. All the cases are analysed and compared to the data available in literature.

## **OBJECTIVES OF THE STUDY**

- 1) To study the age and sex distribution among cases of salivary gland swellings.
- 2) To study the mode of clinical presentation of various salivary gland swellings.
- 3) To study the accuracy of FNAC in the diagnosis of salivary gland swellings
- 4) To study the methods of current surgical treatment of salivary glands swellings.

## REVIEW OF LITERATURE

### HISTORICAL ASPECT

- History of salivary gland disease date backs to times of Hippocrates.
- Earliest reports of parotid extirpative surgery were recorded in Dutch literature of late 1600<sup>10</sup>.
- **Riolan (1648)**: First to recognize the glandular substance of parotid glands.
- **Lorenzo-Heister (1765)**: Described the earliest parotidectomy performed.
- Early successful parotidectomies include a publication by Siebold in 1781, McClellan in 1824 and Lisfranc in 1826.
- **Heyfelder (1825)** was able to avoid facial paralysis while performing parotidectomy.
- According to **Foote and Frazel**, term mixed tumour dates from **Minssen's** review in 1874- Which is cited by **Ahlbom**.A name change to pleomorphic adenoma was suggested in 1948<sup>11</sup>.
- Use of RT for treatment of parotid mixed tumour was done by Kirmission in 1904.
- Papillary cystadenoma lymphomatosum was described by **Hildebrad** in 1895, **Nicholson** in 1923 and **Warthin** in 1929<sup>12</sup>.
- In 1926, **Schutz** reported a case of basal cell adenoma. **Kleinasser** and **Klein** were the first to suggest using this term.
- The oncocyte, which is derived from Greek word `onkoushtai' meaning swollen or enlarged, was initially described in 1897 by Schaffer, McFarland in 1927 and in 1931 by **Hamper**<sup>12</sup>.
- **Schaffer** drew the attention to the high recurrence associated with enucleation.
- Nasse, in 1892 and In 1953, Buxton and colleagues were to describe a malignant potential to many of acinic cell tumours<sup>12</sup>.

- The preferred terminology for malignant pleomorphic adenoma is the carcinoma ex pleomorphic adenoma coined in 1970. A 'surgical' superficial lobe could be dissected away from the 'surgical' deep lobe maintaining the continuity and integrity of facial nerve during the dissection (Furstenberg, McWhorter, Beahrs, Kidd H.A.) was found.
- First Facial nerve preserving parotidectomy was performed by Carwardine in 1907<sup>10</sup>.
- Superficial parotidectomy with conservation of facial nerve was suggested by Taylor and Garcelon in 1948.
- Patey (1940) recognized that frequent recurrence after enucleation was the result of capsular defect <sup>15</sup>.
- Bailey (1941): stressed importance of capsule and anatomy of VII cranial nerve in parotid gland.<sup>16</sup>
- In 1942, **Kaplan** recommended RT for parotid malignancy.
- In 1942 **Ledeman** suggested the routine use of post op RT.
- In 1943 R.M.James developed approach of identifying the facial nerve<sup>17</sup>.
- Nerve grafts using great auricular nerve was reported in 1945 by Furstenberg and Beahrs.<sup>18</sup>
- Patey (1954) fully defined and described conservative radical parotidectomy.<sup>19</sup>
- Karolinske (1960) popularized the use of FNAC in parotid tumours in Karolinska Institute of Stockholm. Cohen ET al in 1990 achieved an overall Accuracy of 88% for FNAC of salivary gland tumours.
- Richard L. Fabian in 1994 reported that salivary neoplasms are encountered at all ages.<sup>21</sup>
- Gordon T. Deans et al in 1995 found that superficial parotidectomy is advised for superficial lobe involvement <sup>22</sup>.

- McGraw M. and K.Husan in 1997 studied that FNAC can distinguish benign from malignant parotid disease in 93%.<sup>23</sup> .
- **Joseph Califano**, et al in 1999 reported that approximately 80% salivary gland tumours are found in parotid remaining in others<sup>24</sup> .
- A two year study of clinic-pathology of primary salivary gland tumours conducted at SMHS hospital in Kashmir from AUG-1998 to AUG-2000 revealed, median age of benign tumours is 4th decade; malignant tumours are in 5th decade. Out of 100 cases parotid was involved in 70 percent of the cases with pleomorphic adenoma forming the largest group of tumour sites, FNAC diagnosis correlated with histopathological diagnosis in 98.4 percent of cases.
- A 12 year study by a Turkish literature, conducted by department of pathology and otorhinolaryngology, CUKUROVA University concerning FNAC, revealed that FNAC has 94% sensitivity and 100% specificity in diagnosing salivary gland conditions<sup>29</sup> .
- The major salivary gland lesions yield good ultrasound results because of their location and soft tissue characteristics. They are the initial imaging modality of choice for investigating focal salivary gland lesions and with good interpretation obviating the need for CT/MRI<sup>30</sup> .
- In the Journal laryngoscope 2010 may, old trans cervical route submandibular excision was replaced by endoscopic hairline incision<sup>31</sup> .



# ANATOMY

## **Definition:**

Salivary gland is a cell or organ. It discharges secretion into oral cavity.

## **Major salivary glands:**

They lie at a distance from oral mucosa. They communicate through one or more extra glandular duct. Comprise 3 pairs namely,

- Parotid gland
- Submandibular gland and
- Sublingual gland .

Parotid gland is largest (14 to 28gm). The submandibular gland about 1/4th the Size of parotid (7-8gm) and the sublingual gland is about 1/3rd the size (3g) of Submandibular gland.

## **Minor salivary glands:**

They lie in mucosa or sub mucosa and open directly or indirectly via many short excretory (collecting) ducts, on to the epithelial surface of the mucosa. They comprises anterior lingual gland, mucus membrane of tongue, small labial, buccal and palatal gland in relation to mucus membrane of the lips, cheek and roof of mouth respectively.

## **Ectopic salivary glands:**

Present in any of the following sites i.e. eyelid, lacrimal gland, middle ear, PNS, nose, jaws, skin of the face and neck.

## EMBRYOLOGY

Salivary glands are derived from ectoderm layer of the oral cavity. There are 3 stages of development of salivary glands.

1. Branching dichotomous ducts (solid epithelial bud) develop from the salivary anlagen.
  2. Duct acquires lumen and gland lobular form and continues through 7th embryonic month.
  3. Begins in 5th embryonic month, as differentiation of acini and maturation of gland, surrounding mesenchyma forms the capsule and interlobular septet for parotid and submandibular gland.<sup>33</sup>
- Parotid gland development, beginning in 6 week of intrauterine life. An elongated furrow running posteriorly from angle of mouth between mandibular arch and maxillary process is formed. Groove is converted into a tube and it persists as a parotid duct and its blind end proliferates to form the gland. The interstitium in which parotid gland develop is rich in lymphoid tissue and this feature is almost totally absent in Submandibular and Sublingual glands. Sebaceous glands are rare in parotid gland. The acinar cells occur from pre-existing acini and other cells of ductal origin. As the gland arborises posterior, the facial nerve migrates anteriorly through it.
  - Submandibular gland begins to develop in the 6 week of IUL. Unlike parotid, it develops as a relatively discrete structure with early condensation of its mesenchyma it develops as an epithelial outgrowth from the floor of the linguo-gingival groove.
  - Sublingual gland begins to develop in 8 week of IUL.

## **HISTOLOGY**

Both major, minor Salivary glands possess acinar and duct system. These glands may be of the serous, the mucous, or the mixed, sero-mucous type. The parotid and the von Ebner's glands of the tongue are exclusively of serous make up. The palatal Salivary gland and those situated at base and lateral border of tongue are predominantly of mucous type. The submandibular gland is mixed as it has both serous and mucous components, but predominantly serous; while Sublingual gland is also mixed but predominantly mucous.

Saliva is formed by the acinar cells which contain well-developed endoplasmic reticulum and Golgi bodies with abundant secretory granules and unmyelinated nerve terminals with numerous synaptic vesicles just between the acinar cells indicating autonomic innervations.

The myoepithelial cells (Zimmerman's cells), also referred to as basket cells, as they ensheath the individual acini. They appear to have the ability to contract and expel saliva from the acini. The myoepithelial cells play an important role in transport and basement membrane function.

### **HISTOLOGY OF THE DUCTAL SYSTEM**

The cells of the striated ducts are well differentiated and show features common to the renal proximal tubule cells. These cells play an important role in water and electrolyte transportation. The intricate duct system is composed of 3 distinct elements, namely, the intercalated, the striated, and the interlobular ducts. The most important function of these ducts is active saliva secretion. The terminal portion of the duct system is formed by intercalated ducts. Depending on the circumference of these ducts, multiple striated layers of

epithelial cells are present. Elastic and collagen fibres surround the periphery, facilitating the active transport of saliva through the system<sup>34</sup>.

The intercalated ducts and acini represent the terminal position of the system (duct acinar unit) under normal conditions; the reserve cells of the intercalated ducts are the source of regeneration of the acinar tissue and the terminal duct system and are thought to be the progenitors of most salivary gland tumours.

The lymphoid tissue of the region is represented by small nodes located near or within the parotid gland and by scattered lymphoid cells located in the connective tissue around the acini and ducts. The latter are thought to be a part of the MALT.

## **SURGICAL ANATOMY**

### **PAROTID GLAND:**

(Para-otic means by the side of ear) It is the largest and has an average weight of 25gms. It forms irregular, lobulated, yellowish mass, below external acoustic meatus and is wedged between mandible and mastoid; it projects forward on surface of the masseter.

The parotid gland is like an inverted, flattened 3 sided pyramid, bases of which is the superior pole and tail/apex- inferior pole; 3 borders, namely, anterior, posterior and medial; 3 surfaces namely, lateral, antero-medial and postero-medial. Although not found in every gland, 3 - 5 process of parotid gland exist, making it extremely difficult to perform a total parotidectomy.

Three superficial processes:

- 1) Condylar process near the TM joint,
- 2) Meatal process in the medial area of the incisura of external auditory canal,
- 3) Posterior process- projecting between the mastoid and S.C.M. muscle.

Two deep processes:

- 1) Tympanic process rest on temporal bone.
- 2) Stylomandibular process projects anteromedially above the stylomandibular ligament.

**Structure within parotid substance:** These from without inwards are

- Facial nerve and branches,
- Retromandibular vein and its tributaries (superficial temporal and maxillary veins)
- External carotid artery and its branches (superficial temporal and maxillary arteries).
- The retromandibular vein joins posterior auricular vein to form external jugular vein.
- Facial nerve has 2 divisions namely temporo-facial and cervico-facial. A plane formed by joining the facial nerve and the retromandibular vein is called the facio-venous plane of ptery. This plane divides the parotid into a superficial lobe (constitute 4/5 of the gland bulk) and deep lobe.

**Parotid duct:**

It arises from deep surface of gland on its ventral aspect. It unites with the duct from the superficial lobe and accessory gland at anterior border of masseter. It runs an inch below zygoma and is 5cm long. At anterior border of masseter, it runs inwards to pierce successively the corpus adiposum, bucco pharyngeal fascia and the buccinators to open upon a small papilla in the vestibule of mouth opposite crown of upper second molar tooth<sup>32</sup>.

**Surface marking:**

Parotid gland is marked by lines connecting the following points successfully.

- 1) A point on the mastoid tip.
- 2) A point on the condyle of the mandible.
- 3) A point on the middle of the masseter muscle.
- 4) A point below and behind angle of the mandible.

The parotid duct is marked by the mid third of a line joining the philtrum of the upper lip to the tragus of the ear.

**Histology:** It shows 3 characteristics.

- 1) Serous acini and few mucous acini
- 2) Plenty of ducts,
- 3) Fat in between these two.

**Blood Supply:**

- Arterial supply from external carotid artery, 2 terminal branches.
- Venous drainage is to retrorandibular and external jugular veins.
- Lymphatic drainage: Parotid nodes and upper deep cervical nodes.

**Nerve Supply:**

*Parasympathetic nerve* fibres are secreto-motor in nature and arrive to gland through auriculotemporal nerve from inferior salivary nucleus, present at the medulla.

*Sympathetic nerve* fibres are vasomotor in nature and arise from the plexus on the external carotid artery with the superior cervical ganglion as the primary source of supply.

*Sensory supply* is from the auriculotemporal nerve to the gland and the greater auricular nerve (C2) to the fascia.

Facial Nerve: It arises from 2 nuclei in the lower Pons, namely the main motor nucleus and the smaller nucleus giving rise to the nervus intermedius, which contains parasympathetic and sensory nerve fibres. The facial nerve enters the internal acoustic meatus and after variable course in the petrous temporal bone exits through the stylomastoid foramen. It enters parotid gland and divides into 2 main divisions, upper temporo facial and lower cervico facial. The 2 main divisions, in turn again divide into 5-6 terminal branches.

These form an appearance of a duck's feet and are called pesanserinus. The terminal branches are temporal, zygomatic, buccal, from the zygomatico-facial division and mandibular and cervical from the cervicofacial division.

### **Applied Anatomy:**

1. The parotid gland is considered to be a 'u' shaped structure . Patey's plane divides the gland into 2 lobes arbitrarily, and forms a convenient level for dissecting out tumours confined to the superficial part.
2. Malignant tumours of the gland infiltrate and invade the facial nerve, causing partial or total paresis.
3. The preauricular lymph nodes are superficial to the parotid capsule and constant in location viz., anterior to the tragus. But parotid nodes are deeper to the capsule and can be found in 3 location viz., on surface of gland, within the parenchyma of gland and deeper to gland between it and the lateral wall of the pharynx. It is important to remove all nodes in total parotidectomy.

### **SUBMANDIBULAR SALIVARY GLAND**

It is the 2nd largest salivary gland, situated in digastrics triangle. It is about size of walnut, horizontally placed 'U' shaped, with the limb of U wrapping posterior free edge of mylohyoid muscle. Upper limb of U is deep to mylohyoid (deep lobe). Lower limb is superficial to mylohyoid (superficial lobe).

### **Facial covering:**

The investing layer of deep cervical fascia splits as 2 leaves to enclose the superficial lobe.



**Relations:****The superficial lobe has 3 surfaces**

- 1) Inferior surface.
- 2) Lateral surface.
- 3) Medial surface.

**Submandibular Duct:**

It is 5cm long and 3mm wide. It begins as numerous branches in superficial region and runs through deep lobe passes upwards and backwards 4-5 mm and then turns forward to run between mylohyoid and the hyoglossus. It opens into sublingual papilla through an ostium, one on either side of fraenum of the tongue.

**Blood Supply:**

- **Arterial supply** is from facial artery and a few twigs of the lingual artery.
- **Venous drainage** is to common facial and lingual veins.
- **Lymphatic drainage** is to submandibular and upper deep cervical nodes.

**Nerve Supply:**

- Parasympathetic nerve fibres (secretomotor) come through the lingual nerve and its chorda tympani branch from the superior salivary nucleus in the lower Pons in the brain.
- Sympathetic nerve fibres (vasomotor) arrive to gland from plexus on facial artery, primary source of supply being the superior cervical ganglion.

**Histology:** It has serous and mucinous acini in equal in number and few ducts.

### **Applied Aspects:**

1. Submandibular gland is related to 2 nerves on superficial aspect (marginal mandibular and cervical divisions of facial nerve) and 2 nerves on its deeper aspect (lingual and hypoglossal). These should be protected during surgery.
2. Submandibular gland is palpable bi digitally only when the whole gland is enlarged.

## **SUBLINGUAL GLAND**

Sublingual gland is smallest of paired salivary glands. It weighs 3-4 gm each and is narrow, flattened and almond shaped.

- Ducts: 8-20 in number and open directly and separately into floor of mouth near summit of sublingual fold or indirectly into the submandibular duct. These ducts are called the ducts of Rivinus.

### **Blood supply:**

- Arterial supply from facial and lingual arteries.
- Venous drainage through lingual veins.
- Lymphatic drainage is to submandibular lymph nodes.

### **Nerve supply:**

Parasympathetic fibres are secretomotor and arrive from superior salivary nucleus. Sympathetic is from same source as submandibular gland.

- **Histology:** It has purely mucinous acini and plenty of ducts.

## **ANATOMY OF MINOR SALIVARY GLANDS**

Minor salivary glands are located in the submucosa of oral cavity.

- The anatomic distribution of minor salivary glands show that hard and soft palate are the most common anatomic sites, followed by maxillary sinus, upper lip mucosa, oral mucosa of the cheek area, gingiva, nasopharynx and pharynx, tongue, lower lip mucosa and larynx
- More in posterior hard palate
  - salivary unit with own simple duct
  - Most minor salivary glands are mucinous with main exception of Ebner's glands which are serous glands located in circumvallate papillae of tongue.
- Minor salivary glands are important in oral cavity and their secretions directly bathe the tissues. Individual glands are in submucosa between muscle fibres, and consist of groups of secretory endpieces made of mucous acinar cells and serous or seromucous demilune cells<sup>112</sup>.

## **PHYSIOLOGY**

The total salivary secretion is 1 to 1.5 litres per day with a pH between 7.0 - 8.0.

### **ACTIONS OF SALIVA:**

1. Moistens dry foods to aid swallow.
2. Provides medium for dissolved food materials chemically stimulating taste Buds.
3. Buffering of the contents of oral cavity through its high HCO<sub>3</sub> ions concentration.
4. Digestion by amylase.

### **Control of Salivary Secretion:**

Parasympathetic nerve stimulation causes, profuse watery secretion and sympathetic nerve stimulation causes thick scanty secretions. There are phases of secretion, namely

- **Cephalic phase:** In which smell sight and the thought of the food causes salivation;
  - **Oral phase:** in which when food enters the mouth the salivation is induced.
  - **Gastric phase:** In which food entering the stomach causes salivary secretion.
- Salivary gland controlled mainly by PNS from salivary nuclei.

Salivary secretion is also controlled by CNS. The appropriate areas in brain are located near parasympathetic centres of anterior hypothalamus, from taste and smell areas of cerebral cortex or amygdala. Salivation occurs by reflexes originating in stomach and upper intestine.

Salivary Gland	Histology	Nature of Secretion	Quantity of Secretion (%)
Parotid	Serous	Watery	20
Submandibular	Seromucinous	Moderately Viscous	70
Sublingual	Mucinous	Viscous	5

Sympathetic nerves arise from superior cervical ganglia. They travel along blood vessel to salivary gland<sup>11,37</sup>.

## BIOCHEMISTRY

The specific gravity of saliva varies from 1.002 to 1.012. Viscosities of the 3 major Salivary glands are Parotid-1.5, Submandibular-3.4 and Sublingual-13.4 centipoises. Majority of total volume of saliva comes from parotid and submandibular glands. Sublingual glands contribute 3%<sup>37</sup>.

## Composition of Saliva:

Substance Mean Value	Parotid	Submandibular
Flow rate (ml/min/gland; stimulated)	0.7	0.6
Inorganic analytes (meq/l)		
K+	20	17
Na++	23	21
Cl-	23	20
HCO <sub>3</sub>	20	18
Ca++	2	3.6
Mg++	0.2	0.3
HPO <sub>4</sub> <sup>2-</sup> (mg/dl)	6	4.5
Organic analytes (mg/dl)		
Urea	15	7
Protein	250	150
Substance Mean Value	Parotid	Submandibular
Ammonia	0.3	0.2
Uric acid	3	2
Lysozymes	2.3	105
Glucose	<1	<1
IgA	4	2.0
Amylase	0.1	0.002
Cholesterol	<1	-
pH	5.92	5.73
fatty acids	1	-
total lipids	12-6	2-6
amino acids	1.5	-

## CLASSIFICATION

Salivary gland disorders can be broadly classified as

- Acute Inflammatory Lesions

- Mumps

- Acute Suppurative Sialadenitis
- Chronic Inflammatory Disorders
- Granulomatous Diseases
  - Primary Tuberculosis of the Salivary Glands
  - Animal Scratch Disease
  - Sarcoidosis
  - Sjogren's Syndrome
  - Sialolithiasis
- Cystic Lesions
- Radiation Injury
- Trauma
- Sialadenosis
- Other Disorders
- Neoplastic Disorders
  - Benign
  - Malignant

**“WHO CLINICAL CLASSIFICATION OF SALIVARY GLAND TUMOURS”**

**(1991)<sup>38</sup>**

**I. “Adenomas”**

- 1) Pleomorphic adenoma
- 2) Warthin's tumour

**II. “Carcinomas”**

- 1) Acinic cell carcinoma

- 2) Mucoepidermoid carcinoma
- 3) Adenoid cystic carcinoma
- 4) Adenocarcinoma
- 5) Squamous cell carcinoma
- 6) Undifferentiated carcinoma
- 7) Carcinoma in pleomorphic adenoma

### **III. Non-Epithelial Tumours**

- 1) Haemangioma
- 2) Lymphangioma
- 3) Neurofibroma
- 4) Neurilemoma

### **IV. Malignant Lymphoma**

### **V. Unclassified and Allied Conditions**

## **ETIOLOGY OF SALIVARY GLAND SWELLINGS**

Salivary gland is affected by various disorders<sup>39</sup>.

### **1. Acute Bacterial and Viral Infection of Salivary Glands**

**Bacterial infection:** It plays a most important role in the etio-pathogenesis of salivary gland swellings. Bacterial infections of the salivary gland swellings results from two important physiological mechanism.

- Retrograde contamination of salivary ducts and parenchyma tissues by bacteria inhabiting oral cavity
- Stasis of salivary flow through ducts.



## 2. Chronic Sialadenitis

Chronic sialadenitis is due to decreased secretion rate and salivary stasis, like acute sialadenitis it is more common in parotid gland and usually occurs from permanent damage to the gland from acute suppurative infection<sup>41</sup>.

## 3. Sialolithiasis:

Sialolithiasis is one of the most common causes of salivary gland swellings. Origin of calculi lies in relative stagnation of calcium rich saliva<sup>42</sup>.

## 4. Sialadenosis

Sialadenosis is non-inflammatory, non-neoplastic enlargement of salivary gland, usually parotid. Bilateral parotid gland swelling is common in obesity<sup>43</sup>.

## 5. Mucoceles:

These are pseudocyst with extravasatory mucus. Common in sub lingual and sub mandibular glands.

These lesions are divided into 2 types, oral ranulas, cervical or plunging ranula.

### Pathophysiology of Mucus Retention Cyst

- The development depends on disruption of flow of saliva from secretory apparatus of salivary glands
- Accidental injury.

## 6. Salivary Gland Tumours

Many factors have been implicated in the cause of the salivary gland tumours.

- **Viruses:** The Epstein- bar virus, polyoma virus, CMV and human papilloma virus types 16 and 18<sup>2</sup>.
- **Radiation:**

- a) Japanese people, who were exposed to radiation generated by the atomic bombs dropped on Hiroshima and Nagasaki, have demonstrated increased risk for developments of salivary gland tumours.
- b) The tumorigenic effects of therapeutic radiation to the head and neck on salivary gland tissue have been assessed in Michael Reese hospital in Chicago.
- Occupation: Asbestos mining, manufacturing of Rubber products and industries such as Shoe manufacturing, Plumbing and Wood working in the Automobile industries<sup>45</sup>.
- **Hormones:** Salivary gland tumours in woman have increased estrogens receptor levels and also prolactin binding activity<sup>45</sup>.

### **Histogenesis of Salivary Gland Neoplasms** <sup>47</sup>

- **Multicellular THEORY.**

Oncocytic Tumours	derived from	Striated duct cells
Acinous Tumours	derived from	Acinar cells
Squamous cell carcinoma	derived from	Excretory duct cells
Mucoepidermoid Carcinoma	derived from	Excretory duct cells
Mixed Tumours	derived from	Intercalated duct cells and Myoepithelial cells

- **Bicellular Theory**

Intercalated duct reserve cells	<ul style="list-style-type: none"> <li>• Pleomorphic adenoma</li> <li>• Warthin's tumor</li> <li>• Oncocytoma</li> <li>• Acinous cell tumors</li> </ul>
Excretory duct reserve cells	<ul style="list-style-type: none"> <li>• Squamous cell carcinoma</li> <li>• Mucoepidermoid carcinoma</li> </ul>

## **PATHOLOGY**

A salivary gland tumour, by its complex histological appearance, makes interpretation Difficult. One of the pre-requisites for comparative studies is agreement on criteria for classification of tumours and a standardized nomenclature.

### **Classification by Foote and Franzell 1954**

<b>Benign</b>	<b>Malignant</b>
1. Papillary Cystadenoma lymphomatosum	1. Malignant mixed tumor
2. Oxyphil adenoma low grade and high grade	2. Mucoepidermoid tumor, low grade and high grade
3. Sebaceous cell Adenom	3. Squamous cell Carcinoma
4. Benign Lymphoepithelial lesion	4. Adenocarcinoma
5. Unclassified	5. Adenoid cystic Carcinoma
	6. Trabacular or solid Carcinoma
	7. Anaplastic Carcinoma
	8. Mucous cell Carcinoma
	9. Pseudo adamantine Carcinoma
	10. Acinic cell Carcinoma

### **Revised WHO Histological Classification (Siefert & Sobin 1992)**

#### **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 Intraductal papilloma
  - 1.8.3 Sialadenoma papilliferum
- 1.9 cystadenoma
  - 1.9.1 Papillary cystadenoma
  - 1.9.2 Mucinous cystadenoma

## **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 carcinoma
- 2.7 Sebaceous carcinoma
- 2.8 Papillary cystadenocarcinoma
- 2.9 Mucinous adenocarcinoma
- 2.10 Oncocytic carcinoma
- 2.11 Salivary duct carcinoma
- 2.12 “Adenocarcinoma” (nos)
- 2.13 Malignant myoepithelioma (myoepithelial carcinoma)
- 2.14 “Carcinoma in pleomorphic adenoma”
- 2.15 “Squamous cell carcinoma”
- 2.16 Small cell carcinoma

2.17 Undifferentiated carcinoma

2.18 Other carcinoma

**3. Nonepithelial tumors**

**4. Malignant lymphomas**

**5. Secondary tumors**

**6. Unclassified tumors**

**7. Tumor like condition**

7.1 Sialadenosis

7.2 Oncocytosis

7.3 Necrotizing sialometaplasia (salivary gland infarction)

7.4 Benign lymphoepithelial lesions

7.5 Salivary gland cyst

7.6 Chronic sclerosing sialadenitis of submandibular gland (kuttner tumor)

1.7 Cystic lymphoid hyperplasia in AIDS.

**1) Pleomorphic adenoma (PA):**

***Morphology:***

The tumour is typically well circumscribed, thinly encapsulated and solitary, smooth or lobulated. C/S shows greyish white areas rubbery, fleshy, mucoid or glistening, depending on the content and amount of the stroma, with translucent bluish areas which represent cartilage with a myxoid stroma may have slimy consistency<sup>11</sup>.

***Microscopy:***

Growth Pattern: It shows pseudo encapsulation, which sends extensions or pseudopodia, called satilosis. Hence, simple enucleation is associated with high rate of recurrence. For this reason, mixed tumour was thought to be a low grade malignancy, earlier. Occasionally tumour islands may appear outside the capsule.

***Basic cellular organization:***

There is an epithelial component and a stromal component, and both can be remarkably pleomorphic. The epithelial component consists of epithelial and myoepithelial cells. Epithelial component may be arranged in anastomosing tubules, small cysts, ribbons and solid sheets.

***Stroma:***

Extracellular stroma is one of the defining components of PA. The stroma takes the form of a mixture of chondroid (hyaline cartilage), myxoid, chondromyxoid, hyaline. Tyrosine and oxalate crystals can develop and are unique to PA<sup>11</sup>.

**2) Warthin's tumour (Adenolymphoma/Papillary cystadenoma lymphomatosum):**

***Morphology:*** The tumour is well encapsulated with thin tough capsule which is usually intact, fluctuant to firm rubbery in consistency. C/S is solid or papillary reddish grey and shows multiple cysts few mm to cm which is nearly pathognomonic, its fluid is serous/mucoid/ chocolate or semisolid caseous material.

***Microscopy:*** Irregular cystic structures in which the lining epithelium is thrown into papillary folds. A distinct layer of basement membrane separates the papillae or cystic lining from the lymphoid stroma. The lymphoid stroma consists of small lymphocytes, plasma cells, histiocytes, germinal centre and sinusoids. Combination of lymphoid matrix and papillation of eosinophilic epithelial cells forming cystic spaces presents a distinct and pathognomonic histological feature. 4 subtypes are recognized by Siefert:

- Subtype 1 (classic WT) is 50% epithelial,
- Subtype 2 (stroma poor) is 70-80% epithelial,
- Subtype 3 (stroma rich) is only 20-30% epithelial and
- Subtype 4 is characterized by extensive squamous metaplasia<sup>51</sup>.

### 3) Monomorphic adenoma:

Characteristic feature is monomorphic cellular composition, probable origin from the intercalated duct reserve cell. They manifest as purely epithelial or purely mesenchymal growth pattern.

a) **“Basal cell adenoma”**: most common monomorphic adenoma and likely represents the isocellular counterpart of PA.

**Morphology**: Well encapsulated, well circumscribed. C/S is uniform and varies from light tan to brown, homogenous. Surface is usually multifaceted and multinodular.

**Microscopy**: Small basaloid cells possessing round, uniform, basophilic nuclei and scant cytoplasm. Nuclear pleomorphism and mitosis are not seen. There are 4 morphological patterns.

1. Solid type: most common pattern. Basaloid cells form broad bands, smooth contoured islands and solid masses with peripheral palisading which can be so prominent as to mimic Ameloblastoma.
2. Tubular Type: Least common type, in which discrete or anastomosing tubules predominate. The tubules are lined by two distinct layers of cells, with inner cuboidal ductal cell.
3. Trabacular Type: This type consists of narrow and broad trabeculae of cells interconnected with one another, producing a reticular pattern.
4. Membranous Type: This differs from other subtypes by the presence of abundant, thick, eosinophilic and PAS +, hyaline basal lamina material around the smooth contoured tumour islands.

#### a) Myoepithelioma:

**Morphology**: Well circumscribed, frequently well encapsulated.

**Microscopy:** This type of adenoma consists entirely of myoepithelial cells. The different type described are, the spindle and stellate myoepithelioma, clear cell variant and a malignant. Tumours have scanty intervening hyalinised stroma.

Three morphological patterns

1. Spindle cell- most common especially in parotid.
2. Plasmocytoid- commonly seen in palatal tumours.
3. Epitheloid/clear cell- Stroma contains chondroid material <sup>52</sup>.

**a) Oncocytoma (oxyphil adenoma):**

**Morphology:** Well circumscribed and thinly encapsulated. External surface of the tumour is smooth. The C/S is mahogany brown, solid with focal areas of red brown haemorrhage.

**Microscopy:** Hallmark of this is presence of oncocyte, polygonal cells possessing abundant eosinophilic granular cytoplasm as it contains large number of mitochondria, central round nuclei and often-distinct nucleoli, arranged in solid sheets or in nests and cords, which form alveolar or organoid patterns, which are separated by thin fibrous septa or scanty loose vascularised stroma<sup>53, 54</sup>.

**a) Canalicular Adenoma:**

It is an uncommon benign salivary gland tumour in intra oral glands. The average age for canalicular adenoma is 65 y. The female to male ration is 1.7 to 1. Most commonly in upper lip and buccal mucosa.

**Gross:** The gross appearance varies from encapsulated nodule to circumscribed, but unencapsulated. The size is about 1.7 cm in diameter. The colour has been reported to range from pink to tan or brown or yellow. Cut surface shows cystic spaces with gelatinous mucoid material.



**Microscopy:** The cells are uniformly cuboidal or columnar. They usually have scanty eosinophilic cytoplasm with indistinct borders and the nuclear chromatin is diffuse and granular. The cells produce long “canals”. Typically, the rows are separated periodically producing ductal structures. The stroma is delicate, richly vascular and sparsely cellular.<sup>64</sup>

## **5. Sebaceous Adenoma :**

It is a rare tumour and accounts for 0.1% of all salivary gland neoplasm. There is a male preponderance and parotid glands are commonly involved. This is the only type of sebaceous neoplasm included in the WHO classification.

**Gross:** it is encapsulated or circumscribed, varies in colour from gray white to pinkish white.

**Microscopy:** These tumours have sebaceous cell nests with minimal atypia and pleomorphism. Many tumours are micro cystic or ectatic salivary ducts with focal sebaceous differentiation. Sebaceous glands are embedded in fibrous stroma<sup>65</sup>.

## **6. Ductal Papilloma:**

Seifert and colleagues apparently included sialadenoma papiliferum, intraductal papilloma and inverted ductal papilloma with a broad category of monomorphic adenoma that they called ductal papilloma or adenoma

### **I. Intraductal Papilloma:**

Intraductal papillomas of salivary glands are rare. Male to female ratio is equal. Minor salivary glands are the most common site.

**Gross:** The tumour is well circumscribed cyst with lumen filled with a friable tissue.

**Microscopy:** It arise in the duct system. This is unicystic and composed of papillary fronds. The projections have delicate fibro vascular cores . Mucous cells may be interspersed among the ductal cells.

## **II. Sialadenoma Papilliferum:**

It constitutes 0.1% of epithelial salivary and 0.6% of benign epithelial tumours of minor salivary glands. Most common site is minor salivary glands.

**Gross:** It is a round or oval, well circumscribed lesion. The lesions may be broad based or pedunculated. The surface of the tumour appears rough, pebbly, verrucous or overtly papillary. The lesion is often reddish. Cut sections reveal cauliflower like surfaces and circumscribed nodules of the tumour tissue that extend below the level of the mucosa.

**Microscopy:** It has exophytic and endophytic components.

## **III. Inverted Ductal Papilloma:**

It is a rare tumour and occurs in adults. Minor salivary glands are most common in lower lip and buccal mucosa.

**Gross:** Inverted ductal papilloma occurs within the terminal portion of minor salivary gland excretory duct and therefore resembles a sialadenoma papilliferum.

**Microscopy:** The microscopic features are different from sialadenoma papilliferum. It produces a bulging growth but it does not extend above the surface mucosa like the papillary fronds of sialadenoma papilliferum. Well circumscribed mass of basaloid and squamous cells are arranged in papillary configuration into luminal cavity. They appear to fill the cavity and extend outwardly into the surrounding lamina propria of the oral mucosa. The ductal lumen from which the inverted papilloma arises may communicate with the surface through an opening. It is covered by cuboidal duct cells and occasionally scattered mucosal cells.<sup>66,67</sup>

## **7. Cystadenoma:**

These tumours constitute 2.2% of all benign epithelial tumours. These are most common after the 8<sup>th</sup> decade of life. Major salivary glands are involved in 65% of the cases and minor glands in 35% of the cases.

**Gross:** Slowly enlarging swelling, minor salivary gland tumours produce smooth nodule that may be compressible. Often the swelling represents a mucocele.

**Microscopy:** Diagnostic histology criteria of cystadenoma are debated. The tumour is multicystic, well defined and may be encapsulated. The epithelial lining of the cysts can be cuboidal, flat or columnar. Oncocytic, as well as mucous changes of the lining may exist and occasionally are dominant.<sup>65</sup>

## **MALIGNANT NEOPLASM**

### **1) Acinic cell carcinoma**

**Morphology:** It is often circumscribed with an incomplete capsule. The C/S is solid, with or without cystic areas. It is the most common parotid tumour to present as a cystic mass. The cyst may comprise only a small portion of the tumour or may be large with only small solid or papillary foci.

**Microscopy:** They typically form a solitary mass or multiple nodules and invade in broad fronts. There can be variably prominent lymphoid aggregates, with or without lymphoid follicle formation. The neoplastic elements recapitulate the appearance of the acinar-intercalated duct unit. Cells are arranged most commonly in organoid sheets traversed by ramifying delicate blood vessels. 3 histological patterns are recognized.

- a) **Microcystic pattern:** This is the most common pattern with multiple small empty spaces (micro cysts) producing lacy appearance. The neoplastic acinar cells possess basophilic granular cytoplasm and basally located nuclei.
- b) **Papillary cystic variant:** This is characterized by large cystic spaces with papillary projections. Hobnail cells, intercalated duct like cells, vacuolated cells and non-specific glandular cells cover the papillae.

- c) **Follicular variant:** It comprises multiple, round cystic spaces filled with homogenous eosinophilic colloid material, highly reminiscent of thyroid follicles<sup>55</sup>.

## 2) Adenoid Cystic Carcinoma (Cylindromatous carcinoma)

**Morphology:** C/S shows tan, fleshy, firm invasive tumour.

**Microscopy:** Infiltrative growth is usually obvious and perineural invasion is very common. There is no melting of basaloid cells in the stroma. The stroma is fibrous with variable amounts of myxo-hyaline material. 3 histological patterns are recognized

- a) **Cribriform pattern:** This is the most characteristic feature giving rise to a sieve like “Swiss Cheese” pattern. They are variable sized, smooth contoured, discrete to coalescent islands, comprising small, uniform basaloid cells punctuated by round sized spaces. Nuclear pleomorphism is usually mild and mitotic figures are usually few or absent.
- b) **Tubular pattern:** A single layer of ductal epithelial cells with a single or multiple layers of basaloid cells line the elongated tubules.
- c) **Solid pattern:** Smooth contoured or focally jagged sheets of closely packed basaloid cells characterize this type. These cells exhibit more significant nuclear pleomorphism and mitotic figures. The solid growth pattern is rarely present and if so, may not be recognizable as ACC.

## 3) Mucoepidermoid Carcinoma

**Gross:** They have ill-defined mass, which may be partially encapsulated.

**Microscopy:** It comprises haphazardly dispersed mucin filled cysts, irregular tumour nests composed of mucous, squamous (epidermoid) and nondescript intermediate cells. Although the tumour borders can be circumscribed, most cases exhibit irregular invasive border at least focally.

- **Low grade MEC:** Mucin filled cystic structures constitute large proportions of the tumour and there are abundant mucous cells. Cells have bland nuclei and mitosis rarely seen. The intracellular mucin can be demonstrated readily by mucicarmine or diastase-PAS stain
- **High grade MEC:** Contains more solid areas and few cystic spaces, perineural and intravascular invasion are common. The solid areas are formed by large polygonal squamoid cells with pale to eosinophilic cytoplasm and distinct cell borders, as well as intermediate cells.
- **Intermediate Grade:** The intermediate grade tumour is histological between low and high-grade tumours. Some degrees of nuclear pleomorphism are observed in the tumour cells. Cystic spaces do not constitute a significant portion of the tumour.

**Variants:** Pan Sclerosing variant shows keloid like sclerosis and peripheral lymphoid response<sup>57</sup>.

#### 4) Adenocarcinoma

**Gross:** Poorly circumscribed with irregular infiltrative borders. The C/S is tan and solid, with areas of haemorrhage or necrosis.

**Microscopy:** Resembles gastro-intestinal carcinoma with mucin production and even signet ring cells. Tumours are characterized by glandular or ductal structures with variable organization. The glandular structures are composed of nondescript cuboidal cells<sup>58</sup>.

#### 5) Malignant mixed tumours - Includes:

- a. A neoplasm with the basic pattern of mixed tumours, but in which all the epithelial elements are malignant.
- b. A true carcino-sarcoma where in both a carcinoma and recognizable mesenchymal malignancy co-exists.

**Gross:** Tumour may be obviously invasive or may grossly resemble a circumscribed benign mixed tumour. Necrosis, haemorrhage and cyst formation is common.

**Microscopy:** There is histological evidence of destructive and infiltrative growth of a malignant neoplasm and there is pre-existing neoplasm with the features of a benign mixed tumour. The malignant component may be characteristic of adeno-carcinoma, squamous cell carcinoma or undifferentiated carcinoma<sup>54</sup>.

#### **6) Epithelial-Myoepithelial Carcinoma:**

- They are more common tumour of low-grade malignancy mainly seen in the parotid gland. The cells form ball-like or trabecular clusters and are both basaloid with scanty cytoplasm and myoepithelial with abundant pale, vacuolated cytoplasm. Nuclei are mildly atypical with a pale chromatin and discrete central nucleoli. Hyaline stromal material is present<sup>60</sup>.

#### **7) ‘Basal Cell Adenocarcinoma’:**

This accounts for 1% of malignant epithelial tumours of salivary glands. These tumours occur in adults. There is equal sex distribution for these tumours. Parotid gland is the most common site.

**Gross:** These tumours are firm and cut surface, shows uniform tan to gray white surface, often with a coarse and fine nodularity.

**Microscopy:** The tumour is composed of various sized nests of cords of cells, a histological appearance similar to that of basal cell adenoma. However, unlike basal cell adenoma, the tumour grows in an infiltrative, destructive fashion. Necrosis and an increased mitotic rate are also seen in some cases. Perineural and intravascular invasion may be seen.

#### **8) Sebaceous Carcinoma:**

These tumours composed of nests or sheets of sebaceous cells. The cells show different degree of maturity, pleomorphism, nuclear atypia and invasiveness. Cellular

pleomorphism and cytological atypia are uniformly present. The tumour cells have hyperchromatic nuclei and are surrounded by abundant clear to eosinophilic cytoplasm.<sup>61</sup>

### **9) Papillary Cystadenocarcinoma**

These are rare tumours; the commonest sites of involvement are major salivary glands. Males and females are equally affected.

**Gross:** These tumours are usually encapsulated, but may range from being encapsulated to being invasive. Cut surface, shows cystic areas. Lesions may be unicystic or multicystic, which range in size from 0.4 to 6cm.

**Microscopy:** Tumour is composed of large cystic spaces lined by epithelium that often exhibit a papillary growth pattern. The cells lining the cystic spaces vary from tall columnar to cuboidal to simple squamous and may be mucous secreting.

### **10) Oncocytic Carcinoma:**

This neoplasm is one of the least common of all the salivary gland malignancies. There is a male predilection for these tumours.

**Gross:** Tumour size ranges from 0.5 to 8 cm with infiltration into surrounding structures.

**Microscopy:** These are arranged in an alveolar or syncytial pattern and sheets or in cords. There is a much greater degree of nuclear and cellular pleomorphism and the number of mitotic figures is greater than that found in benign oncocytoma. Non encapsulation and vascular or neural invasion or both may be noted.<sup>61,67</sup>

### **11) Salivary Duct Carcinoma:**

The incidence of salivary duct carcinoma is difficult to assess because most of the published surveys of salivary gland tumours do not include this specific category of tumour.

These neoplasms have a predilection for older males. The parotid gland is the commonest site.

**Gross:** These tumours vary in size from less than 1 cm to greater than 6 cm in diameter and are usually yellowish grey to gray white. Sometimes they are multinodular but these tumours are usually infiltrative and poorly circumscribed.

**Microscopy:** histological features show resemblance to that of ductal carcinoma of the breast. It is composed of atypical cells usually containing abundant eosinophilic cytoplasm that form back to back glands and often exhibit cribriform, papillary or solid patterns.<sup>61</sup>

### **12) Adenocarcinoma, Not Otherwise Specified (NOS):**

It affects patients primarily in the 4<sup>th</sup> to 8<sup>th</sup> decade of life. There is a male predilection. Parotid gland is the most common site.

**Gross:** A firm to hard mass replaces glandular parenchyma and compresses surrounding tissue. Tumour invasion into the muscle and bone may be recognised. Cut surface is white or yellowish white and may reveal focal areas of haemorrhage and necrosis.

**Microscopy:** The histological diagnosis of adenocarcinoma, NOS depends more on the exclusion of other characteristic types of salivary carcinomas than on the recognition of histomorphological features that are specific to adenocarcinoma, NOS.

The common pattern in adenocarcinoma, NOS is glandular or duct like structures. The tumours may range from low to high grade.<sup>70</sup>

### **13) Malignant Pleomorphic Adenoma:**

Salivary origin and relatively uncommon.

Malignant pleomorphic adenomas include three clinical and pathological entities.



- a) Carcinoma Ex pleomorphic adenoma (carcinoma arising in a pleomorphic adenoma)
- b) Carcinosarcoma (true malignant pleomorphic adenoma)
- c) Metastasizing pleomorphic adenoma

The first accounts for most of the malignant pleomorphic adenomas and second and third are extremely rare. These tumours constitute 12% of malignant salivary gland tumours and 3.6% of all salivary gland neoplasms.<sup>72,73</sup>

**a) Carcinoma Ex Pleomorphic Adenoma:**

These tumours accounts for 95% of all malignant pleomorphic adenomas and 6.5% of all malignant tumours. They occur in the 6th to 8th decade of life with the mean age 56 years. These tumours are common in females.

**Gross:** Poorly circumscribed and extensively infiltrative. Occasionally, they may be encapsulated or well circumscribed. Cut-surface shows white or tan-gray colour and are hard in consistency.

**Microscopy :** Most of the tumours are composed of typical benign pleomorphic adenoma with only small foci of carcinomatous tissue. Malignant areas consist of epithelial cells with increased nuclear cytoplasm ratio, prominent nucleoli and mitotic figures. The most common histological patterns in these areas are poorly differentiated adenocarcinoma or undifferentiated carcinoma. Destructive infiltrative growth is the most reliable histological criterion for the diagnosis.

**b) Carcinosarcoma:**

This is also called true malignant pleomorphic adenoma. It is a tumour in which both stromal and epithelial components fulfil histological criteria of malignancy.

**Gross :** The majority of carcinomas are grossly infiltrative with poorly defined margins. Occasionally, tumours are partially or totally encapsulated. Tumours range in size from 2 to 9 cms in greatest dimension. Cut surfaces are usually grayish in colour and occasionally areas show cystic change, haemorrhage and calcification.

**Microscopy :** Each of these tumours is biphasic, with varying proportions and types of sarcomatous and carcinomatous elements. Sarcoma is the dominant tissue in the majority of tumours with chondrosarcoma being the commonest. Tumours may manifest areas of osteosarcoma, fibrosarcoma, high grade sarcoma and malignant fibrous histiocytoma.

**c) Metastasizing Pleomorphic Adenoma:**

It is common of the three types and here both the primary salivary gland tumour and its metastatic lesions are composed of typical benign appearing pleomorphic adenoma. Earlier literature has referred to these tumours as “benign metastasizing mixed tumours”<sup>67,70</sup>

**14) Squamous Cell Carcinoma:**

In one of the first comprehensive reviews of tumours of salivary glands in 1953, Foote and Frazell reported 39 primary squamous cell carcinomas.

Squamous cell carcinoma represents 1.6% of all primary epithelial salivary gland tumours. Most cases occur between 7 to 65 years.

There is a 2 to 1 male predilection. It accounts for 6.3% of parotid, 8.3% of submandibular and 3% sublingual epithelial malignancies.

**Gross :** these tumours are unencapsulated, poorly demarcated and firm to hard in consistency. Cut surface is light gray or white.

**Microscopy :** These tumours are similar to squamous cell carcinoma from other sites, ranging from low grade, highly keratinized neoplasm to poorly differentiated sheets of tumour cells with minimal keratinisations. Adjacent soft tissue invasion and regional metastasis are common. Trabeculae of desmoplastic fibrous connective tissue often separate the tumour into

multiple nodules. Islands of squamous cell carcinoma occasionally have marked infiltrates of lymphoid tissue in close apposition.<sup>59, 67.</sup>

### **15) Small Cell Carcinoma**

These are extremely rare and account for less than 1% of major salivary gland tumours and account for 2.8% of minor salivary gland tumours. They are common between 5<sup>th</sup> and 7<sup>th</sup> decade of life. There is a male predominance. 85% of the small cell carcinomas arise from parotid glands and remainder from submandibular gland.

**Gross:** the tumour margins are usually poorly demarcated with infiltrating edges and rarely circumscribed. These tumours are firm to hard in consistency. Cut surface shows variegated appearance.

**Microscopy:** The tumours are composed of infiltrating large sheets, ribbons, cords or nests of anaplastic cells. The tumour cells are round to oval in shape, having minimal cytoplasm with hyperchromatic nuclei containing finely dispersed chromatin and inconspicuous nucleoli

### **16) Other Tumours:**

#### **a) Undifferentiated carcinomas:**

These are uncommon. 1 to 4.5% of the malignant parotid tumours. Parotid is most common site then submandibular and Minor salivary gland origin is extremely rare.

Typically they demonstrate increased mitotic figures with a significant degree of cellular pleomorphism. Because of the bizarre cells and the lack of organization into a recognizable arrangement, there is great difficulty in distinguishing the origins of the tumour, thus it is placed into the undifferentiated category.

#### **b) Malignant lymphoma:**

Primary malignant lymphoma of salivary glands is rare and virtually always occurs in parotid gland, divided into 2 sub groups:

1. Arising in the intra parotid and Para parotid nodes,

## 2. Salivary parenchyma.

Primary nodal lymphoma presenting as a parotid lesion is often a stage I lesion and is associated with a good prognosis. Parenchyma lymphomas usually arise in the setting of lymphoepithelial lesions with or without Sjögren's syndrome<sup>62</sup>.

### c) Metastatic Carcinoma:

Reach the gland by direct spread, lymphatic or haematogenous spread. Malignant melanoma and squamous cell carcinoma of mucosa of upper aerodigestive tract via the lymphatics account for 80% of the parotid metastasis. Haematogenous spread is most often from carcinoma of the lung, kidney, breast and colon.

## COMMON SOFT TISSUE TUMOURS OF THE SALIVARY GLANDS

### 1) Haemangioma :

Haemangioma accounts for 50% of all parotid tumours in children. It is uncommon in other salivary glands and in adults. The capillary haemangioma are probably neoplasm or vascular malformations, whereas the cavernous haemangioma are best regarded as reactions to trauma or else vascular malformations. The capillary haemangioma show the modest female predominance. 61% are present at birth and 86% appear within the first month

**Gross: structure** of an excised specimen of a capillary haemangioma reveals a spongy purple lobular mass, which infiltrates the gland.

**Microscopic:** Shows endothelial proliferation with vascular differentiation, which is the hallmark of this disease. Microscopic examination of cavernous haemangioma reveals dilated blood vessels and sinuses lined by endothelium. It is un-encapsulated and infiltrating.<sup>73,74</sup>

### 2) Lymphangioma:

Lymphangiomas (cystic hygromas) were first recognised as being of lymphatic origin in 1828. These vascular malformations are not true neoplasm. Salivary gland involvement is very rare.

**Gross:** Reveals a spongy, cystic multi-loculated lesion containing fluid that is either cloudy or yellow tinged.

**Microscopy:** Demonstrates endothelial lined spaces with a connective tissue stroma.

### **3) Lipoma:**

Lipomas are uncommon and account for 0.6 to 4.4% of all parotid tumours. They are less common in the submandibular gland. They most commonly occur in the fifth to sixth decades and are rare in children.

**Gross:** Reveals them to be smooth well demarcated and yellow.

**Microscopy:** shows them to be composed of mature fat cells with an enveloping capsule. In pure form, fatty infiltration is referred to as lipomatosis. Glands displaying acinar cell hypertrophy with or without fatty changes have been called sialosis, sialoadenosis or nutritional mumps<sup>74</sup>.

### **4) Neurofibroma:**

This tumour also arises from the Schwann cells but behave much differently. This may be solitary or part of neurofibromatosis. They are usually present as encapsulated lobulated swelling.<sup>74</sup>

Based on an institutional data from 1990 to 1997 Brandon G. Bentz et al, indicates that less than 5% of the neoplasm, benign or malignant present in patients who are 16 years of age or younger. Several features distinguish the neoplasm in this age group, as compared those in adults:

- A much greater frequency of non epithelial tumours, parotid haemangioma are most common.
- Preponderance of parotid gland involvement with submandibular glands<sup>74,75</sup>

## **TUMOURS OF MINOR SALIVARY GLANDS**

Tumours of the minor salivary glands comprise less than 2% of all tumours of the head and neck, and 37% to 48% of these arise from the palate. Minor salivary gland tumours also occur in the upper lip, buccal mucosa, pharynx, larynx, nasal cavities, and sinuses. Minor salivary gland tumours of hard palate have a propensity to arise at junction of hard and soft palates, followed by hard palate.

#### **Age and Sex Incidence:**

- There is a slight preponderance of lesions in females, with a peak incidence in the third to fifth decades. Despite their relative rarity among head and neck neoplasm, minor salivary gland tumours continue to generate notable academic interest, likely due to their potential for aggressive behaviour.

#### **Histology:**

- Adenoid cystic carcinoma, adenocarcinoma, and mucoepidermoid carcinoma have been referred as most common malignant tumour of palatal minor salivary glands. Other malignant tumours encountered include low grade polymorphous adenocarcinoma, carcinoma ex pleomorphic, acinic cell carcinoma, and undifferentiated carcinoma.
- The majority of benign minor salivary gland tumours of the palate are pleomorphic adenomas, with scattered monomorphic adenomas and basal cell adenoma.

### **CLINICAL FEATURES**

The appearance of a lump in or near salivary glands is most common mode of presentation which may or may not be associated with pain.

The salivary gland swellings can be presented as acute inflammatory condition, chronic inflammatory condition, calculus diseases, a benign or malignant tumours, manifest as congenital abnormalities or represent involvement of systemic disorders of various salivary glands. So the clinical features of these are considered individually.<sup>76,54,39</sup>

### **1. Acute Suppurative Sialadenitis:**

The clinical presentation of acute salivary infection is sudden onset of pain and swelling overlying the affected gland. It most commonly affects the parotid gland. Examination reveals indurations, erythema, edema and extreme tenderness over the affected gland.

### **2. Chronic Recurrent Sialadenitis:**

Chronic recurrent sialadenitis may follow an acute of suppurative sialadenitis. The recurrent attacks of pain and swelling usually associated with eating and drinking and accompanied by the discharge of flecks of pus in the saliva. The disease is much more common in the parotid salivary gland.

### **3. Sjogren's Syndrome:**

It is autoimmune disease, symptoms and signs were first described by Hadden in 1883. Sjogren's syndrome has been classified into primary and secondary.

Sjogren's syndrome described by Sjogren's in 1933. Triad of dry eyes, dry mouth and rheumatoid arthritis. The combination of dry eye and dry mouth without connective tissue disorder is known as primary Sjogren's syndrome. The combination of dry eye, dry mouth and rheumatoid arthritis is called as secondary Sjogren's syndrome<sup>38,78</sup>.

### **4. Granulomatous Diseases:**

They may occur with or without systemic manifestations. Generally both parotids enlarge simultaneously, and submandibular, sublingual and lachrymal gland may involve. Granulomatous disease may present as

- a. Mycobacterium infections: presenting as tumour like swelling with little pain.
- b. Cat scratch disease: In these condition children are mostly affected. Cervical lymphadenitis and mild pyrexia is present which is self limiting.

## **5. Viral Infections:**

Mumps is most common viral disease to involve salivary glands. It is commonly recognised in 4 to 6 year old age group. The incubation period is 2 to 3 weeks.

Clinical onset is characterised by pain and swelling in one or both the parotids. Systemic symptoms include fever, malaise, myalgia and headache and usually resolve before the parotid swelling. One episode of infection confirms lifelong immunity<sup>38</sup>.

## **6. Sialolithiasis:**

Calculi may form in any of the salivary glands. The submandibular gland is the most common (80%), parotid gland (20%) followed by sublingual glands and minor salivary glands (1-2%) follow at a lower rate of recurrence.

Commonly, patient gives history of recurrent swelling and pain in involved gland, associated with eating. With repeated episodes, infection may intervene. Occasionally patient will present with a stone that is palpable in the salivary duct without any history of salivary swelling or inflammation.

## **7. Cystic Lesions:**

Congenital cysts usually manifests immediately after birth or in the childhood. Presents as fluctuant swelling both in floor of mouth and in submandibular triangle.

Acquired cysts are usually dominated by the clinical features of the causative agent such as calculus, neoplasm, trauma, parotitis etc<sup>82</sup>.

## **8. Sialadenosis:**

Painless diffuse enlargement of salivary glands, either unilateral or bilaterally, most commonly associated with metabolic disorders, nutritional deficiencies and reaction to some drugs. Parotid gland is involved commonly<sup>43</sup>.



## 9. Mucoceles:

Ranula tends to occur most frequently in second and third decades of life, with age range of 3 - 61 years.

Ranulae are usually either one-side or other in floor of mouth and 2 - 3 cm in diameter. Occasionally, they extend across the whole of floor of mouth. A ranula is most commonly observed as a bluish cyst located below the tongue. It may fill mouth and raise tongue. Typically, these are painless masses that do not change in size in response to chewing, eating or swallowing but may interfere with these functions (speech or chewing / eating). Occasionally, pain may be involved.

## 10. Clinical Features Of Salivary Neoplasm

Clinical feature of salivary neoplasm can be described under following headings.

1. **Rate of growth of the swelling:** The average duration before seeking treatment is described as 4-5 years by different authors for a benign tumour. The duration in carcinoma is in months rather than years. The rate of growth varies greatly from tumour to tumour and even in the same tumour from time to time.
2. **Pain:** benign tumours of the salivary glands are painless. Pain is the most presenting symptom in cases of malignant tumours. Sudden onset of pain in a mixed salivary gland tumours always denotes some complication like malignancy. Pain is of dull, boring when present. It is usually localized to the region of the tumour. Sometime pain may be referred to the corresponding ear, along the branches of auriculotemporal nerve.
3. **Facial palsy:** Facial nerve is never involved in benign tumours, however large the tumour may be. Involvement of the facial nerve in the course of mixed tumours always indicates a malignant change. In cases of carcinoma the most striking and

important clinical manifestation is facial palsy. But absence of facial palsy does not rule out possibility of the tumour being malignant.

4. **Ulceration:** benign tumours never ulcerate. Ulceration of benign tumours occurs when they turn malignant or when some counter irritant applied to the tumours. In the advanced cases of carcinoma, skin may be fixed, reddened, and give rise to ulceration

### **Signs of Salivary Tumours:**

1. **Swelling:** The characteristic features of the swelling are globular or ovoid in shape, well defined margins; surface is lobular and nodular in some cases. Rarely the swelling may be diffusing in parotid gland and submandibular gland tumours, where as it is common feature in sublingual and minor salivary glands.
2. **Local invasion:** In advanced carcinoma, skin may be fixed, reddened and give rise to ulceration. Tumour is often fixed to the underlying deeper structure (external auditory canal, mastoid tip, zygomatic arch, mandible, masseter muscle, pterygoid muscles or sternomastoid). The TM joint should be examined for signs of direct tumour extension.
3. **Nodal involvement:** Regional lymph nodes are never enlarged in benign tumours, lymph node metastasis occur when these turn malignant, commonest lymph node that are enlarged are upper deep cervical group, submandibular and sub mental group. Regional metastasis correlates strongly with a diminished overall survival<sup>86</sup>.
4. **Oral cavity examination** should include inspection of duct opening for evidence of abnormal or purulent drainage. These findings are more often associated with inflammatory disease. Trismus should be identified because it may be indicative of invasion of the masseter or pterygoid muscles. The oropharynx must be carefully evaluated for signs of parapharyngeal space involvement. Typically this will be manifested by a sub mucosal bulge in the soft palate or tonsillar regions<sup>83</sup>.

A complete head and neck examination is essential. Malignancy below clavicle present as metastasis in parotid gland years after initial disease (e.g. breast, lung and kidney). Note: non-Hodgkin's lymphoma is a likely diagnosis in elderly<sup>83,84,85</sup>.

### **Clinical features of specific neoplasms:**

#### **A. 'Pleomorphic adenoma' :**

This is commonest benign salivary gland tumour and is virtually only benign neoplasm to occur in submandibular, sublingual and minor salivary glands. PA present as slow growing painless mobile, firm and circumscribed mass. If arises in deep lobe of parotid gland it may present as parapharyngeal mass. There is seldom any compromise of 7<sup>th</sup> nerve. Most tumours are located in the tail of the parotid gland, also in other parts of gland. 10% of PA occurs in deep lobe of parotid gland. Incidence of recurrence after parotidectomy in PA is 5%.

Incidence of malignant transformation is 3 - 15%. Except for recurrence prognosis is excellent. Recurrence in PA may be due to (1) Inadequate surgery

(Enucleation) (2) Inadvertent spillage (3) Tumour removal with inadequate margin (4) Multicentricity<sup>11</sup>.

#### **B. Warthins tumour(WT) :**

WT present as well defined, soft to firm mass. It is usually asymptomatic. However, 18% of patients in the series complained of pain, and there has been one report of facial paralysis. Characteristically arises in inferior pole of parotid gland and occasionally originates in lymph nodes adjacent to that part of the gland. This tumour scans 'hot' with technetium<sup>51</sup>.

#### **C. Oncocytoma:**

It accounts for less than 15% of all salivary gland tumours. It usually occurs in parotid gland and is quite unusual elsewhere. It presents as well defined, lobular mass with

firm to hard consistency. In reported series, bilaterally and multi-centricity have been conspicuous. Most tumours occur in the 6<sup>th</sup> decade. There is 2:1 F: M ratio. This is one of salivary gland tumours that scan 'hot' with technetium<sup>53</sup>.

#### **D. Mucoepidermoid tumour:**

Attention is usually drawn to a painless solitary enlargement of the body or tail of the parotid gland or the submandibular gland. Duration usually averages less than 1 year.

The tumour is relatively well circumscribed and movable, and it may mimic a mixed tumour. Pain, facial paralysis, and fixation to the overlying skin are not common but when present are usually harbingers of high grade lesions. High-grade tumours have a high recurrence rate (15-75%).

#### **E. Acinic cell tumour:**

Tumour growth is usually slow; rarely may they have a more rapid enlargement. Pain or tenderness is experienced frequently. Facial nerve paralysis is infrequent but is an ominous prognostic sign. It is generally regarded as a low-grade malignancy<sup>87</sup>.

#### **F. Adenoid cystic carcinoma:**

Typically it grows slowly. Pain and tenderness generally occur during the course. Fixation to skin and the surrounding deeper structures develops in the later stages. Regional lymph nodes involvement is found in 10-15% of cases. Distant metastasis to lung and bone occurs late in the course of the disease<sup>56</sup>.

#### **G. Adenocarcinoma:**

About 25% of patients complain of the effects of the nerve involvement. Facial nerve irritability occurs first and muscle spasm can be produced if the tissues over the nerve are trapped. A few patients present with skin involvement. The risk of lymph node metastasis is 24 - 36%<sup>70</sup>.

## **H. Malignant mixed tumor:**

Long history of slow growing parotid swelling, with recent rapid growth brings them to medical attention. Pain, skin ulceration, facial nerve weakness, attachment to skin, and telangiectasia can occur and should lead the clinician to suspect malignancy in a mixed tumour. Pain has been described in 4 to 55% of patient, and appears to be more common in submandibular gland tumours<sup>52</sup>.

## **I. Miscellaneous malignant tumours:**

- a. Squamous cell carcinoma:** It grows rapidly and half of the patients have metastatic lymph node involvement at the time of presentation. It causes pain, facial nerve paralysis, commonly associated with early skin fixation and ulceration<sup>59</sup>
- b. Malignant lymphoma:** Primary lymphomas are uncommon. Occur in the 5- 6<sup>TH</sup> decade of life, F>M, H/O Sjogren's syndrome or arthritis is elicited in majority of patients. They run an indolent clinical course where as lymphoma arising in intra salivary gland lymph nodes usually present as rapidly enlarging swelling within the gland<sup>62</sup>.
- c. Undifferentiated carcinoma:** they are highly malignant. Approximately 33% have partial or total facial paralysis 40% beyond the parotid on presentation. 13% present with regional metastasis<sup>61</sup>.

## **J. “Tumours of Minor Salivary Glands”:**

Most of tumours are detected by the patient as an asymmetric swelling of the palate; sometimes tumours are completely asymptomatic and were detected only on routine dental examination. Other symptoms encountered include pain, ulceration, and dysesthesias.

A painless swelling of the palate is the most common presenting symptom for tumours of the palatal minor salivary gland tumours. Both pain alone and neural complaints including pain and dysesthesias exhibit a statistically significant association with a histopathologic diagnosis of adenoid cystic carcinoma.

**Some common soft tissue tumours of the major salivary gland:**

- a) **Haemangioma (capillary or cavernous):** most often presents during childhood and accounts for almost half of the hamartomatous and neoplastic parotid lesions seen in this age group. The capillary haemangioma are far more common. **Lymphangiomas** are painless, trans-illuminate, and usually slowly enlarging. 50% of them present at birth. There is an equal sex distribution.
- b) **Schwannoma, neurofibromas** are slowly growing tumours with an equal sex distribution. Paraesthesias are common, it is tender, 50% of these have facial weakness when seen<sup>74</sup>.

**DIFFERENTIAL DIAGNOSIS**

- 1) Sialadenosis refers to non inflammatory and non neoplastic Salivary gland enlargement. When the tumour begins it is very difficult to differentiate from calculus disorders, inflammation etc, especially when these are Unilateral and small.
- 2) Enlarged lymph nodes within the parotid gland or cervical region may be mistaken for a gland tumour. Hence, it is very important to examine all the drainage areas, to rule out any other cause.
- 3) Lipomatous pseudo hypertrophy of a gland can be mistaken for a tumour. This happens because of infiltration of the gland by fatty tissue.

**TNM STAGING OF SALIVARY GLAND TUMORS (1997):”**

Proposed Staging System for Major Salivary Gland Cancers by American Joint Committee For Cancer Staging (AJCC).

T	Primary Tumour
TX	Primary Tumour Cannot be Assessed.
T0	No Evidence of Primary Tumour.
T1	Tumour 2 Cm of less in greatest dimension without extraparenchymal Extension.

T2	Tumour more than 2 cm but not more than 4 comes in greatest dimension without extraparenchymal extension.
T3	Tumour having extraparenchymal extension without seventh nerve involvement and/ or more than 4 cm but not more than 6 cm in greatest Dimension.
T4	Tumour invades base of the skull, seventh nerve and / or exceeds 6 cm in Greatest dimension.
N	Regional lymph nodes
Nx	Regional lymph nodes cannot be assessed.
No	No regional lymph node metastasis.
N1	N1 Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest Dimension.
N2	N1>3and <6 cm, or bilateral or contralateral lymph nodes.
N2a	Single ipsilateral node > 3 cm, < 6 cm in diameter.
N2b	Multiple ipsilateral node, none > 6 cm.
N2c	Bilateral or contra lateral nodes, none > 6 cm.
N3	Metastasis in a lymph node more than 6 cm in greatest dimension.
M	Distant Metastasis
Mx	Distant Metastasis cannot be assessed.
M0	No distant Metastasis.
M1	Distant Metastasis.

### “STAGE GROUPING”

Stage I	T1 N0 M0 T2 N0 M0
Stage II	T3 No Mo
Stage III	T1 N1 M0 T2 N1 M0
Stage IV	T4 N0 T3 N1 M0 T4 N1 M0 Any T N2 M0 Any T N3 M0 Any T M0 Any N M1

### INVESTIGATIONS:-

Acute inflammatory conditions generally can be diagnosed by history and physical examination alone, whereas chronic inflammatory diseases, granulomatous disease and

neoplastic disorders require supplemental diagnostic information including laboratory tests, images studies, or biopsy<sup>54</sup>.

With careful history and physical examination, it is not difficult to diagnose a case of salivary gland swelling. Apart from the routine blood examinations, the following investigations are commonly used for diagnosis of salivary swellings<sup>89,90</sup>.

1. Plain X-ray
2. Sialography
3. Radiosialography
4. Ultrasonography
5. Computed tomography
6. Magnetic resonance imaging
7. FNAC, Biopsy

#### **1. Plain X Ray:**

- Most submandibular calculi are radio opaque and about 94% can be diagnosed by the plain x ray taken in intra oral view. Stones in the superior gland or proximal Wharton's duct may be hard to visualise on plain lateral projections radiographs because the stones may be superimposed on the teeth or mandible. Anteroposterior view with mouth open allows visualisation.
- Parotid stones are more likely to be radiolucent and nearly 40% can be diagnosed by plain X ray.

#### **2. Sialography:**

Sialography is used to evaluate calculi, obstructive disease, inflammatory lesions, penetrating trauma and mass lesions. Sialograms are effective in finding ductal and intraglandular calculi.



**Equipment:**

To perform a sialogram, the following equipment should be available, water soluble contrast media, such as meglume diatrizote 76%, a good light source, a topical anaesthetic for ductal orifice, lachrymal dilators, a lachrymal cannula, a syringe, polyethylene tubing, a Rabinov cannula, and a tapered side hole needle.

**USE:**

It helps in detection of occlusion of the duct, a salivary cutaneous fistula or a salivary oral fistula or development of a sialocele.

**Disadvantages:**

- It may cause infection or inflammation.
- Extravasations of the dye may result in severe inflammatory reaction preventing a clear demarcation of clear tumour margin and may also delay the planned surgical procedure and high pressure generated during the procedure disseminates the tumour cells.

**Contraindications:**

- Acute sialadenitis and in patients with allergy to iodine.

**3. Radio Sialography:**

Current radioactive scanning of the major salivary glands is done with technetium tetra-oxygenated form-pertechnate. Radio isotope scanning is used for evaluation of the parenchymal function and detects mass lesions. It is used for detecting mass lesions of the parotid and submandibular gland. Scanning has little to offer in the evaluation of the sub lingual and minor salivary glands. The scan should be performed in the resting state because uptake in the parotid is greater.

## **Ultrasonography:**

Bozin et al (1971) first reported the use of ultrasonography to study the salivary glands. High resolution ultrasound (7.5-10 MHz) helps in differentiating intra-glandular from extra-glandular tumours and benign from malignant tumour, where in benign show variable reflectivity with well defined borders, malignant tumour show low reflectivity with poorly defined border and Inflammatory lesions show high reflectivity with diffuse borders. In a study from Spain, specificity and sensitivity for malignancy was 96.4% and 81.8% respectively. It is also used to delineate whether the mass is cystic or solid.

Ultrasound imaging also helps in direct needle aspiration of parotid abscess. It is also used to localise the calculus. As many as 90% of the stones greater than 2mm in size can be detected as an echo dense spot in an ultrasound.

## **4. Computed Tomography**

CT has largely replaced other diagnostic studies for the study of salivary masses, since 1979, when it was first introduced.

CT scans delineate solid from cystic masses and can detect masses as small as 1cm within the substance of the salivary glands. The anatomic delineation of a mass involving any of the salivary glands can be well defined by ct scanning.

Byrne MN et al. Studied that CT scans of 110 resected parotid masses shows following characteristics:

- a) For tumours with clear borders, homogenous appearance and high signal density, diagnosis will be benign or low grade malignant tumour.
- b) For tumours with ill defined borders, heterogeneous appearance and high density, diagnosis will be high grade malignant tumour.

- c) Ill defined borders, heterogeneous appearance and mixed signal density will be consistent with an inflammatory process.

This is a valuable supplement to MRI in evaluating the bone adjacent to tumour. CT combined with sialography is excellent for differentiating intrinsic from extrinsic masses, benign from malignant masses, superficial from deep lobe tumour and showing the relationship of the mass to the facial nerve.

## **5. Magnetic Resonance Imaging:**

It is superior to CT for better identification of internal architecture of the gland and better definition of tumour border. It provides direct multi-planar imaging without the need for contrast agents and ionizing radiation. Recent advances in MRI are gadolinium (a Paramagnetic compound which enhances vascular lesions) and MRA.

The contrast between the tumour and surrounding tissue is greater than with CT scanning but tissue details are less well defined.

- It helps in differentiating benign from malignant nature of salivary tumour by knowing margin (smooth/infiltrative), solid/cystic, necrosis or hemorrhagic areas within the tumour and malignant tumour show gadolinium enhanced images.
- Deep lobe tumour of parotid can be differentiated from a parapharyngeal mass, wherein later shows fatty plane all around, but parotid tumour shows attachment to the superficial lobe. Also helps in differentiating postoperative fibrosis from recurrent nodules.

### **Disadvantage:**

- It does not show stone and bone. Many attempts to determine benign from malignant nature have shown misdiagnosed interpreting benign as malignancy(CT-39% and

MRI-35%). The consensus is that MRI cannot be used confidently to distinguish benign and malignant masses.

### **Indication of CT/MRI:**

- Malignant or recurrent tumours
- Big neoplasm
- Doubtful carotid artery involvement
- Involvement of local structure (including nerves which suggest inoperability).

### **6. Radio-nucleotide scan (PET)**

It is done using technetium 99m (t1/2 is 6 1/2 hours). Scan is performed in resting state because uptake in parotid is greater. Little useful in other salivary glands. Warthins and oncocytoma show hot spots. Also helps in differentiating benign from malignant tumour on basis of malignant lesions having higher metabolic rate and increased incorporation of radio-labelled deoxy-glucose than benign lesions.

### **7. CT Sialography**

It is found that useful in tumour mapping preparation for surgery. Specifically the tumours location in relationship to deep lobe, facial nerve and the Para pharyngeal space can be assessed. CT sialography cannot definitely diagnose or rule out the malignancy to avoid the need for surgery.

### **8. Biopsy**

#### **FNAC:**

It is a simple and reliable method for obtaining the tissue diagnosis of salivary gland Swellings. The diagnostic accuracy with regard to the benign versus malignancy is about

98% for benign salivary gland swellings, 93% for primary malignant salivary gland swellings, and 88% for metastatic tumours.

This helps in proper counselling of patient regarding surgery and preoperative evaluation which will vary according to whether the mass is primary, neoplastic or lymphoma or metastasis. If malignancy is found, further imaging can be done and non neoplastic causes of salivary swelling can be treated without surgery.

### **Advantages and Uses:**

1. FNAC is usually an office procedure. It is less laborious and cost effective.
2. It is safe, less traumatic and better tolerated by the patients.
3. It is rapid and results are available in less than 20-30 min and the procedure can be repeated as often as necessary.
4. In certain tumours the smears can be easier to interpret than histological sections.
5. It produces enough cellular material for various auxiliary studies (DNA, molecular analysis and immunohistochemistry studies).

### **Complications of FNAC:**

There is a possibility of lymphatic, haematogenous and canalicular dissemination. But this does not have any clinical implication. Several studies have failed to report any such cases. Infection is minimal due to aseptic precautions.

### **Limitations:**

- 1) Specific diagnostic conclusions may not always be reached. Aspirates from MEC, Lymphoma and sometimes PA also give some diagnostic difficulties
- 2) Definitive diagnosis is not drawn if the sample is inadequate or the representative area is not aspirated properly.

- 3) Practice and skill in aspiration techniques are necessary.
  - 4) Experience is required for accurate interpretation.
  - 5) Diagnostic information is limited.
- Sensitivity is 93.3-95.7% (98% for benign; 93% for primary malignancy; 88% for metastatic tumour).
  - Specificity is 98-100%. Lay field et al and Young GA et al found high diagnostic efficiency of FNAC in Salivary gland tumours.

**Open biopsy:** is rarely performed because of risk of injury to facial nerve and tumour implantation and tumour recurrence with both benign and malignant tumours. As a result of high diagnostic Accuracy of FNAC open biopsy is almost contraindicated now days.

**Frozen section:** It is used to assess the margins of resection.

## **TREATMENT:**

Management of the salivary gland swelling depends on the pathology of the swelling. Treatment of Inflammatory and non inflammatory, non neoplastic disease of salivary glands is dependent upon diagnosis and includes antibiotics, supportive therapies, symptomatic management, and Surgical and non surgical interventions. Whereas the surgery is the mainstay of treatment of both Benign and malignant salivary gland tumours. Adjuvant radiation therapy is administered in selected malignant salivary gland tumours and chemotherapy may have palliative benefit in uncontrolled malignant neoplasm.

### **Treatment of Inflammatory and Non Inflammatory Non-Neoplastic Diseases:**

#### **1. Acute Suppurative Sialadenitis:**

Treatment of the acute sialadenitis is directed at reversal of the underlying medical condition responsible for infection. If the patient presents at an early stages before abscess

formation, the infection can usually be controlled by anti-biotics, warm packs and rehydration. Incision and drainage is advised if infection does not subside within 48 hrs with a small incision taken over the most prominent part of the swelling, usually incisions are taken superficially and parallel to the facial nerve branches, pus is drained out by a sinus forceps .

## **2. Chronic Sialadenitis:**

Chronic sialadenitis is more common in submandibular salivary gland and the capacity of the gland to recover is usually is very poor following infection, the gland itself should be removed.

## **3. Sjogren's Syndrome:**

Treatment of Sjogren's syndrome remains largely empirical and symptomatic, and no clinical trial has been proved capable of changing the course of the disease. Patients with keratoconjunctivitis should avoid windy or dry climates, dust or smoke. Oral hygiene after meals avoidance of sugar containing foods is important for the prevention of dental disease. Artificial tears are essential to protect cornea Pilocarpine hydrochloride a saliva secretogauge (5mg 3-4 times a day) can be administered for the treatment of xerostomia. Patients are advised to carry water bottles for frequent drinks. Diuretics, antihypertensive drugs and anti depressants should be used with care.

## **4. Granulomatous Disease:**

Granulomatous disease should be treated according to the pathology and moreover some of them are self limiting and resolve without treatment<sup>38</sup>.

## **5. Mumps:**

Treatments of viral salivary gland infection are primarily supportive, including rest and adequate hydration, since disease is self limiting. The most significant advancement in the treatment of mumps is prevention in the form of vaccination commonly combined with measles and rubella vaccine. A single subcutaneous dose after 12 months of age confers lifelong immunity<sup>77</sup>.

## **6. Sialolithiasis:**

The anatomy of the salivary glands and it's ducts is very pertinent to determine the mode of therapy for sialolithiasis. Submandibular stones are treated surgically either through a transoral sialolithotomy approach or through a complete sialadenectomy through a extra oral approach. If the stones are palpable it can be removed via Trans oral route, especially anterior stone which are palpable. For very anterior stone filleting the submandibular duct is considered the best approach. This can be done under a topical or local anaesthesia. Stones in a slightly more anterior position may be amenable to modification of trans oral. Approach where the stone is cut down directly. Deeper submandibular stones are generally removed through sialadenectomy.

Parotid calculi is more problematic, parotidectomy remains mainstay of surgical management of majority of cases.

Extracorporeal lithotripsy is a new modality that was introduced iin the early 1980s and has revolutionised the treatment of urinary stones. Iro H et al (1989) first reported the use of extracorporeal lithotripsy for the parotid stones. Extracorporeal lithotripsy can be performed without the need for local or general anaesthesia. Extracorporeal lithotripsy appears to be the most effective for the treatment of parotid stones compared to submandibular stones.



## **7. Cystic Lesions:**

True cysts are more common in the parotid. The cysts may be acquired or congenital. Excision during a quiescent period with preserved facial nerve is curative.

## **8. Sialadenosis:**

Mechanism of asymptomatic enlargement of parotid gland is unknown. The prognosis is generally good if the underlying disease can be corrected and the parotid gland generally returns to normal<sup>43</sup>.

## **9. Salivary Gland Tumors**

### **Treatment**

In formulating treatment plan, following points affecting Prognosis:

1. Histopathological diagnosis.
2. Lymphnode metastasis.
3. Facial nerve paralysis.
4. Skin involvement.
5. Recurrent tumour.
6. Distant metastasis.
7. Irradiation sensitivity.

### **SURGERY**

Surgery is the main stay of treatment for salivary gland tumours, both benign and malignant. Surgery For salivary gland tumours never really developed until World War II. Due to fear of injuring the Nerves and partly also due to the ever present risk of spreading infection along facial planes, during the pre-antibiotic era.

- Principles of surgery on salivary gland tumour:
  1. “Removal of entire tumour mass should be achieved in toto, without breaching capsule or producing spillage.”
  2. “The integrity of important nerves should be maintained when practicable. We have to identify facial nerve and its branches by meticulous dissection”.
  3. “Avoidance of parotid duct injury which may lead to salivary fistula”

## **Surgery for Parotid Gland**

### **Procedures:**

#### **1) Superficial parotidectomy:**

##### ***Definition:***

Superficial parotidectomy involves removal of only superficial lobe of parotid gland.

**Indication:** All benign parotid tumours confined to superficial lobe.

#### **2) Conservative Superficial parotidectomy:**

Here 7<sup>th</sup> cranial nerve is conserved after open dissection.

##### ***Indications:***

Only superficial lobe lesion with facial nerve at distance.

#### **3) “Total conservative parotidectomy”:**

This involves removal of both outer and inner parts of parotid salivary gland, which are separated by nerve that moves face, while avoiding damage of nerve.

##### ***Indications:***

1. Conditions involving the deep lobe or both the outer/ superficial and the deep part of the gland:

- Usually benign deep lobe pleomorphic adenoma or large dumb bell shaped pleomorphic adenomas involving both lobes.
  - Recurrent pleomorphic adenoma.
  - Malignant parotid neoplasms without preoperative facial nerve palsy and where tumour can be separated off from the nerve.
  - Small intraglandular deep lobe malignant tumours.
  - Other benign progressive conditions involving the whole gland such as recurrent severe suppurative parotitis secondary to intraglandular stones or ductal narrowing.
2. Conditions requiring access to deep structures whilst preserving the facial nerve, eg, parapharyngeal space or infratemporal fossa tumours not involving the facial nerve.

#### 4) “Total Radical Parotidectomy” :

Involves removal of both the outer and inner part of the parotid salivary gland (which are separated by the nerve that moves the face) as well as the facial nerve. A neck dissection may be performed at the same time.

##### *Indication:*

- Preoperative facial nerve palsy.
- If intra-operative evidence of gross infiltration or encasement of nerve by the tumor, even in presence of normal preoperative facial function.
- Recurrent pleomorphic adenoma.
- Conditions requiring access to deep structures where preservation of facial nerve is impossible, eg, parapharyngeal space or infratemporal fossa tumours.

#### 5) “Extended Radical Parotidectomy” :

This includes all the components of a total radical parotidectomy, as well as adjacent structures involved with disease. This may involve bone (lower jaw, jaw joint, mastoid), muscle (from the neck and face) and cartilage from the ear canal. Total radical parotidectomy

involves removal of both the outer and inner part of the parotid salivary gland (which are separated by the nerve that moves the face) as well as the facial nerve. A radical or modified radical neck dissection is usually performed at the same time.

***Indications:***

- Conditions involving deep lobe or both the outer/ superficial and the deep part of the gland, as well as adjacent structures.
- Recurrent pleomorphic adenoma after repeated revision operations where nerve goes through recurrent tumour and involves adjacent structures such as skin, muscle and cartilage.

**Facial nerve identification during parotid surgery:**

The most constant landmark for facial nerve is at stylomastoid foramen, between styloid and mastoid process. During routine parotidectomy, however, complete access to this region is difficult. The following landmarks and techniques can be used for identification of the facial nerve.

- 1 cm deep, 1cm inferior and 1cm anterior to triangular end of tragus called trigonal pointer.
- More constant landmark is tympano-mastoid suture line. It is a groove that is easily palpated between mastoid and tympanic portions of the temporal bone. Nerve exits from stylomastoid foramen 7 mm medial to suture line.

**Surgery for the Submandibular Gland**

**1. Total excision:**

***Indication:*** All benign and malignant tumours of submandibular gland.

## **2. The commando operation:**

### ***Indication:***

Malignant submandibular tumour which is fixed to the mandible with cervical lymph node metastasis.

## **Surgery for the Sublingual Gland**

### **1) Treatment of Ranula:**

- a) Aspiration.
- b) Excision with removal of gland.
- c) Marsupialisation.

## **Surgery of Minor Salivary Glands:**

The treatment of choice of minor salivary gland neoplasm is surgery. Surgical approach to tumours depends on site and histology of tumour. Neck dissection are recommended for clinically positive necks and in those with high grade tumours. Similarly radiation is used as adjuvant therapy in high grade tumours.

- Low grade malignant tumours of the palatal mucosa such as pleomorphic adenoma and low grade mucoepidermoid carcinoma and adenocarcinoma is usually treated by a soft tissue excision with documented margins of 1 cm clinically uninvolved tissue around it's periphery and including the palatal periosteum followed by healing by secondary intention, palatal periosteum serves as an effective anatomical barrier, the palatal bone is not excised even if cupped out pressure resorption has taken place.
- Malignant tumours of the palatal mucosa such as intermediate and high grade adenocystic carcinoma, wide excision in the form of partial or hemimaxillectomy is

done followed by radiotherapy for high grade lesions. Chemotherapy could also be used as an adjuvant.

### **Management of the Neck Node:**

Comprehensive neck dissection either a MRND or RND is indicated when there are clinically positive nodes. Armstrong and associates in 1992, suggested elective treatment of neck in patient with

- High grade tumours of any size or low grade tumours of at least 4 cm in size.
- Dissecting level I, II and III to identify occult disease.

### **COMPLICATIONS OF SURGERY**

**The complication of salivary gland surgery can be summarized as follows:**

#### **1. Injury to the Nerves**

- a) **The marginal mandibular nerve** is the commonest to be injured at surgery for parotid gland and submandibular gland, because it is thinner than other branches and also it is more vulnerable, due to its proximity to surgical incisions. An Injury of this nerve produces drooping of the lower lip on the same side. This is called “wry neck”.
- b) **Greater auricular nerve** injury results in numbness of pinna, but some amount of recovery takes place due to overlapping by the surrounding sensory nerves in the neighbourhood. Recovery will take 6-9 months to occur.
- c) **Lingual Nerve** can be injured during surgery on the submandibular gland very rarely; this causes ipsilateral anaesthesia of the tongue. Still rarer is injury to the hypoglossal nerve, causing deviation of the tongue onto the same side.
- d) **Facial Nerve:** 7<sup>th</sup> cranial nerve dysfunction is common after surgery.

Temporary facial nerve paresis is also common.

## **1. Facial Nerve Reconstruction**

A number of procedures are available to treat this, both nerve repair and plastic surgical correction. A Hypoglossal nerve transposition (graft) can also be tried; temporalis and masseter muscle transfer are other alternatives.

## **2. Haemorrhage and Hematoma:**

As the operative site is dependent area, collection of serum and blood is not infrequent.

**3. Gustatory Sweating:** Also called as freys syndrome. Sweating and flushing of facial skin after parotid surgery is the clinical feature. For treatment anti cholinergics and stellate ganglion blockade are tried. Superficial temporal artery fascial flap has better results. Botulinum toxin injection is also useful.

## **4. Parotid Fistula and Sialocele**

### **Definition:**

A parotid fistula is a communication between the skin and a salivary duct or gland, through which saliva is discharged. Parotid salivary fistula is a relatively common complication after parotidectomy.

### **Pathogenesis:**

Salivary fistula or sialocele occurs if the resected edge of the remaining salivary gland leaks saliva and drains through the wound or collects beneath the flap (sialocele). Flow through the fistula increases during meals, particularly during mastication. In dubious cases, analysis of the fluid can confirm parotid secretion due to high amylase content.

## **Types**

a) Caused by the opening of Stenson's duct, b) Sinus tracts originating in the glandular structure

## **Treatment**

a) Aspiration and pressure dressings, b) Anti-Sialogogues, c) Radiation therapy, d) Parasympathetic denervation, e) Cauterization of the Fistula, f) Reconstruction of the duct, g) Superficial or total parotidectomy with tract

## **Conservative Management**

- A conservative modality is based on the regular aspiration of the content and compression dressing. This mode of treatment is mainly employed in sialoceles. Anticholinergic agents are used to suppress the glandular function during healing or in an attempt to close a fistula or a sialocela. Propantheline bromide is commonly used.
- **Radiation Therapy** is especially considered for refractory salivary fistulas. It induces fibrosis and atrophy of the gland. Approximately 1800 rads for more than 6 weeks is required.

## **Surgical Therapy:**

Surgical excision of fistulous tract followed by tight pressure dressing of wound is an effective management option.

Three operative techniques are described

1. Repair of the duct over a stent
2. Ligation of the duct
3. Fistulisation of the duct into the oral cavity



### **Tympanic neurectomy:**

Trans tympanic sectioning of the Jacobson's nerve is done here.

### **Botulinum Toxin Injection:**

**Botox injections are useful in managing sialoceles and salivary fistula.**

#### **4. Cosmetic deformity:**

Barely noticeable scar is possible with placement of the incision in skin fold. Another source of aesthetic concern is the depression or hollow resulting from the parotid gland resection, particularly following total parotidectomy.

#### **5. Recurrence:**

Occurs in both, benign and malignant tumour; may recur loco-regionally or present as distant metastasis up to 20 years after assumed curative local treatment. In case of pleomorphic adenoma recurrence has declined from the range of 20-30% to 0.7%, as superficial parotidectomy has become the standard procedure.

### **RADIOTHERAPY (RT):**

Major role is adjunctive to the surgery in form of postoperative radiotherapy, improve survival and cure rates (Armstrong J.G.). This will decrease the recurrence rate from 26.6 to 9.1% (Guilla mondegui O.M.1975). The indications for RT are: Postoperatively for all high grade tumors including adenoid cystic carcinoma.

- Extra-parotid extension/perineural invasion (Locally advanced) - involvement of skin, nerve and bone.
- Facial nerve involvement.

The radiation dose is 6000cgy in 30 fractions is given over 6 to 7 weeks.

ACC is poorly sensitive to RT; so adequate surgical excision is the main stay of treatment.

### **RT for inoperable tumour:**

Aim is to irradiate the planned volume to 6,500 CGY in 6 - 7 weeks giving daily Treatments of 200 CGY.

### **CHEMOTHERAPY**

There is no established standard chemotherapy because of the lack of formal trails with adequate number of patients. Indications are limited to diseases that are metastatic or locally advanced and unresectable. The most commonly used drugs in combination CT are cisplatin, 5 Flurouracil & doxorubicin or 5-flurouracil, adriamycin and methotrexate has given variable success in some cases.

**Figure 1: Photograph of Modified Blair Incision**



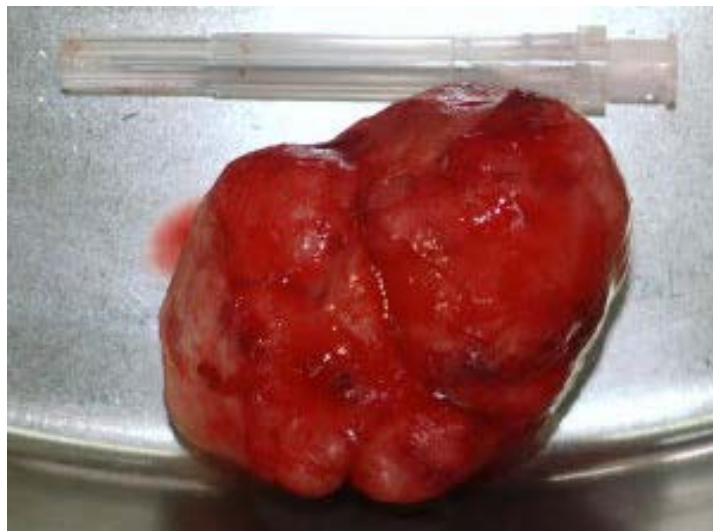
**Figure 2: Photograph Showing Facial Nerve**



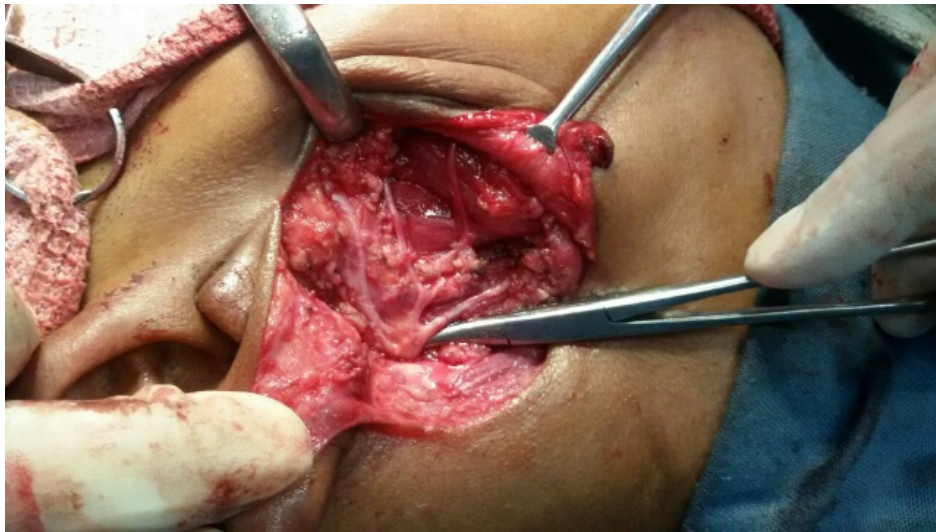
**Figure 3: Photograph Showing Deep Lobe of Parotid Gland with Facial Nerves**



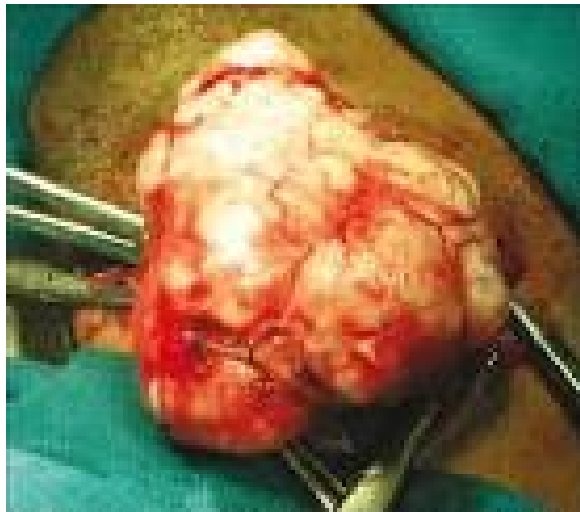
**Figure 4: An Excised Speciment of Pleomorphic Adenoma of Parotid Gland**



**Figure 5: Photograph after Superficial Parotidectomy**



**Figure 6: Photograph Showing Surgery of Submandibular Gland**



## METHODOLOGY

This prospective study of consecutive cases of salivary gland swellings is based on 50 cases admitted in various surgical units in Govt.Royapettah hospital and kilpauk medical college hospital Chennai from Nov 2014 to Aug 2015.. 50 cases of salivary gland swelling are studied and data is presented here, which were analyzed and conclusion drawn, presented in tabular form with explanatory notes below each table. The statistics have been compared with different standard studies conducted on same subject by various authors around world.

### **Inclusion criteria:**

- All patients admitted to surgical and surgical oncology wards of govt.royapettah hospital and kilpauk medical college hospital chennai with salivary gland swellings due to obstructions of the salivary duct and neoplasia.
- Patients who are willing for investigation and treatment.

### **Exclusion criteria:**

- All salivary gland swellings arising as a result of congenital conditions.
- Salivary gland swellings arising as a result of inflammation. (ex. Mumps, Parotitis).
- Salivary swellings associated with systemic diseases. (Sjogren's syndrome). All patients admitted were evaluated by documenting the history, through clinical examination, routine laboratory investigations and specific investigations. In history, importance was given to presenting complaints, duration of lump, rapid increase in size, associated symptoms of facial nerve involvement, previous surgical treatment or any medical problem. Associated medical conditions like diabetes, hypertension and anemia were managed and controlled before surgery with the patient's advice.

As a part of general work up of surgery in all patients, hemoglobin level, bleeding time, clotting time, urine, sugar albumin, microscopy, chest screening, ECG, Blood urea, serum Creatinine, RBS was estimated. Specific investigations like FNAC, X-rays of Mandible were done for all patients in the study group. Ultrasound, Sialography, C T Scan, MRI was not done for any of these patients in the study group, as there was no facility for these investigations in the hospital and because of the poor economic backgrounds of the patients.

After evaluation of the swellings by clinical examination and by specific investigations, a surgical plan was formulated. The final decision was taken per operatively by the surgeon. The required specimen was sent for histopathological examinations. Appropriate antibiotics and analgesics are administered post operatively for all cases. Drainage tube was removed when the drain was less than 20ml and sutures were removed on 5th day. The adjuvant treatment was decided depending on the final HPE report.

Different modalities of treatment adopted in this study are

1. Surgery alone
2. Surgery and post operative radiotherapy

The follow up period of these patients ranged from 1 month to 10 months. All patients were asked for follow up after 15 days of surgery then every month to detect morbidity and recurrence. Long term follow up is necessary to study the actual prognosis of the patients and tumour recurrence and to know the ideal mode of treatment for each condition which was not possible in this study. Statistical analysis was done with SPSS software.

## RESULTS

**Table -1: Incidence of Salivary Gland Swellings at Govt. Royapettah Hospital and KMC Hospital, Chennai**

Year	Total No. of surgical admissions	Total No. of salivary gland swellings	Percentage
November 2014 to August 2015	12361	50	0.4%

Total number of admission to Department of General Surgery and Surgical Oncology were 12361, 50 cases of salivary gland swellings were admitted during November 2014 to August 2015. This constitutes 0.4% of total admissions.

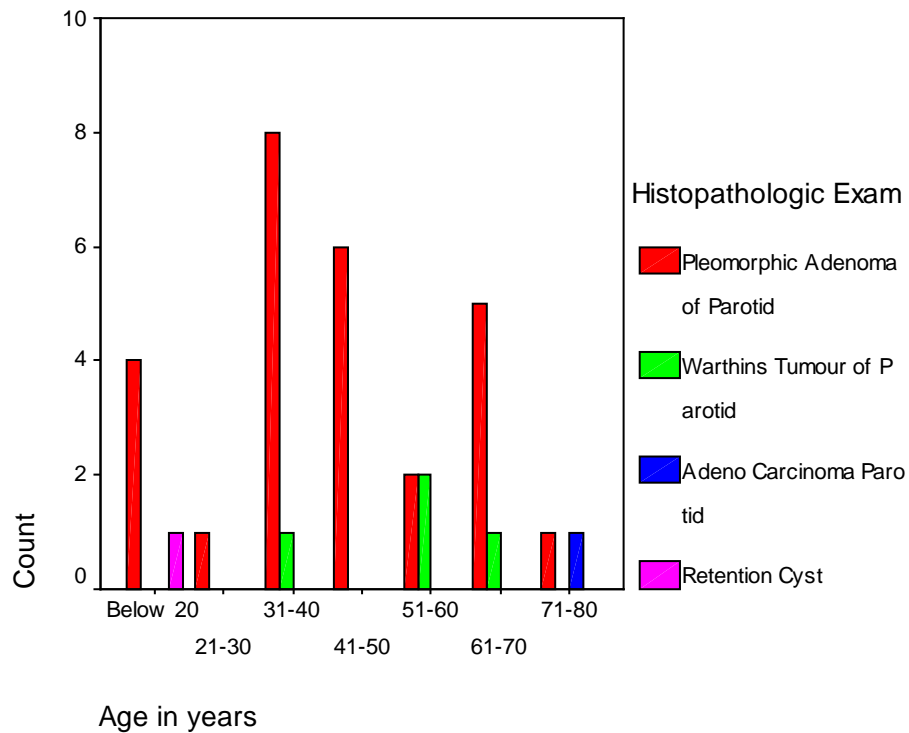
**Table – 2: Age Incidence of Salivary Gland Swellings**

Age	Frequency	Percent
Below 20	6	12
21-30	4	8
31-40	15	30
41-50	9	18
51-60	6	12
61-70	8	16
71-80	2	4

In our study, age of the patients varied from 18 years to 80 years, Average age of the patient was 40 years.

The case of lowest age group i.e., 18 years was of non inflammatory swelling and the case of highest age i.e., 80 years was of tumor swelling.

**Graph 1: Showing Age Incidence**



On descriptive statistical analysis, of age in year with HPE reports P value was found to be = 0.052, which was > 0.050 and hence P value was not significant. It indicates not significane between age group and HP reports in our study.



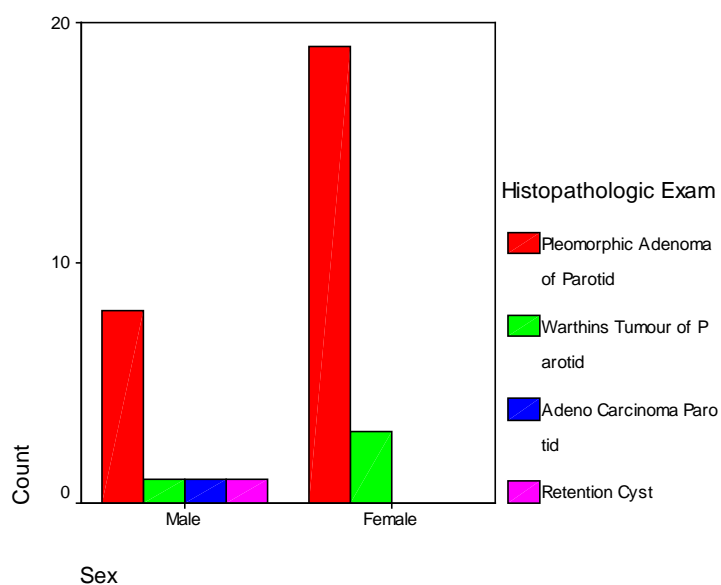
**Table – 3: Correlation of Sex with HPE Reports**

Age in years	Number (%)	Histopathologic Examination Result				Total	P value
		Pleomorphic Adenoma of Parotid	Warthins Tumour of Parotid	Adeno Carcinoma Parotid	Retention Cyst		
Below 20	Count	4	0	0	1	5	<b>0.052</b>
	% within Age in years	80.0%	.0%	.0%	20.0%	100.0%	
	% within Histopathologic Examination Result	14.8%	.0%	.0%	100.0%	15.2%	
21-30	Count	1	0	0	0	1	
	% within Age in years	100.0%	.0%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	3.7%	.0%	.0%	.0%	3.0%	
31-40	Count	8	1	0	0	9	
	% within Age in years	88.9%	11.1%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	29.6%	25.0%	.0%	.0%	27.3%	
41-50	Count	6	0	0	0	6	
	% within Age in years	100.0%	.0%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	22.2%	.0%	.0%	.0%	18.2%	
51-60	Count	2	2	0	0	4	
	% within Age in years	50.0%	50.0%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	7.4%	50.0%	.0%	.0%	12.1%	
61-70	Count	5	1	0	0	6	
	% within Age in years	83.3%	16.7%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	18.5%	25.0%	.0%	.0%	18.2%	
71-80	Count	1	0	1	0	2	
	% within Age in years	50.0%	.0%	50.0%	.0%	100.0%	
	% within Histopathologic Examination Result	3.7%	.0%	100.0%	.0%	6.1%	
Total	Count	27	4	1	1	33	
	% within Age in years	81.8%	12.1%	3.0%	3.0%	100.0%	
	% within Histopathologic Examination Result	100.0%	100.0%	100.0%	100.0%	100.0%	

**Table – 4: Sex Incidence**

Sex	No.of Patients	Percentage
Male	17	34
Female	33	66

**Graph 2: Correlation of Sex with HPE Reports**



In our study of, salivary gland swelling due to various causes, out of 50 cases 17(34%) cases was of male and 33(66%) cases of female.

On descriptive statistical analysis, of sex distribution with HPE reports P value was found to be = 0.232 (> 0.05) so not significant.

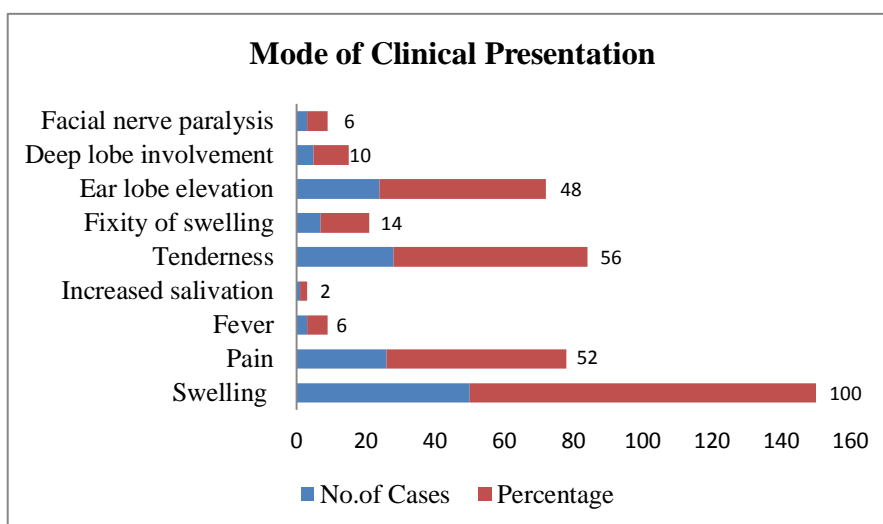
**Table – 5: Correlation of Sex with HPE Reports**

Sex	Numbe (%)	Histopathologic Examination Result				Total	P value
		Pleomorphic Adenoma of Parotid	Warthins Tumour of Parotid	Adeno Carcinoma Parotid	Retention Cyst		
Male	Count	8	1	1	1	11	<b>0.232</b>
	% within Sex	72.7%	9.1%	9.1%	9.1%	100.0%	
	% within Histopathologic Examination Result	29.6%	25.0%	100.0%	100.0%	33.3%	
Female	Count	19	3	0	0	22	
	% within Sex	86.4%	13.6%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	70.4%	75.0%	.0%	.0%	66.7%	
Total	Count	27	4	1	1	33	
	% within Sex	81.8%	12.1%	3.0%	3.0%	100.0%	
	% within Histopathologic Examination Result	100.0%	100.0%	100.0%	100.0%	100.0%	

**Table – 6: Mode of Clinical Presentation**

Mode	No.of Cases	Percentage
Swelling	50	100.0
Pain	26	52.0
Fever	3	6.0
Increased salivation	1	2.0
Tenderness	28	56.0
Fixity of swelling	7	14.0
Ear lobe elevation	24	48.0
Deep lobe involvement	5	10.0
Facial nerve paralysis	3	6

**Graph 3: Showing Mode of Clinical Presentation**



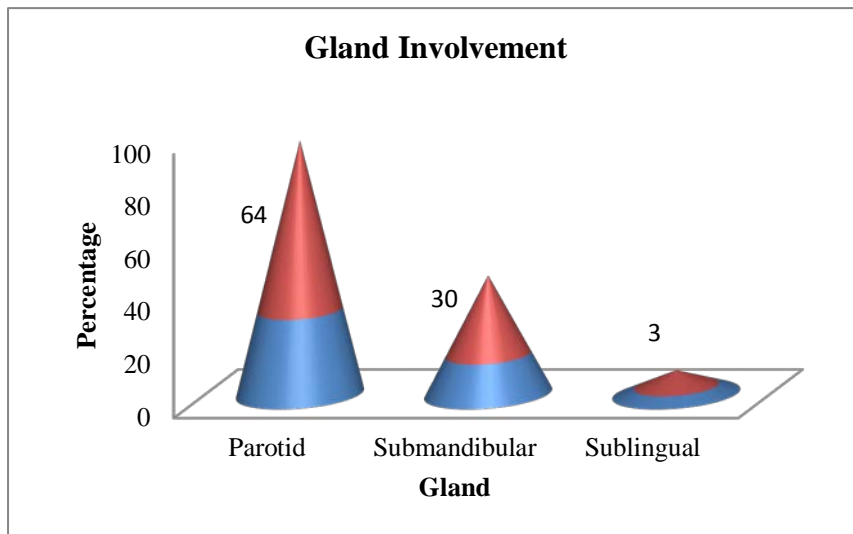
In our study, all cases presented with, symptoms of swelling (100%), 52% (26) presented with pain. 56% (28) presented with tenderness. Five cases were with deep lobe involvement (10%), 24 cases of ear lobe elevation (48%). Facial nerve paralysis occurred in three case (6%).

**Table – 7: Site for Various Salivary Gland Swellings**

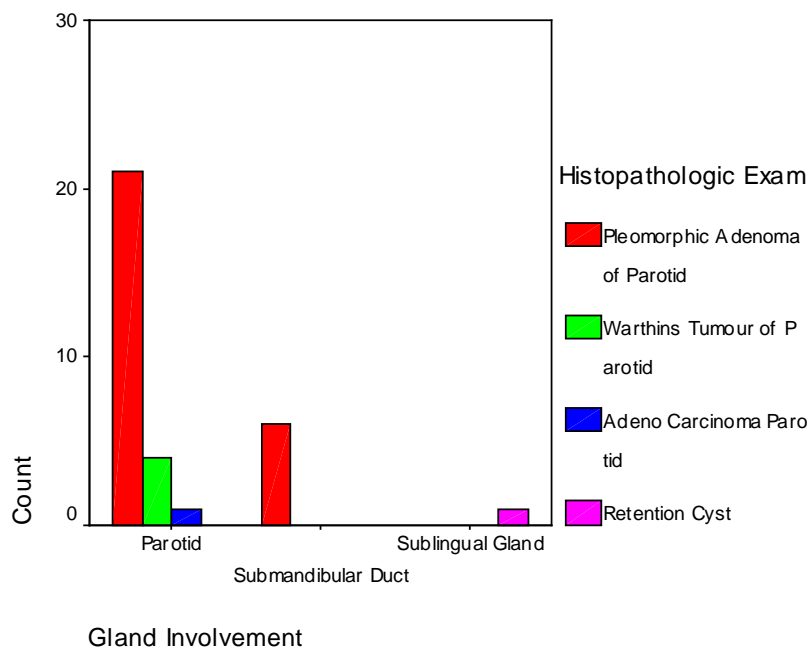
No.of cases	Parotid	Submandibular	Sublingual
50	32	14	4
%	64	28	8

In our study, 64% (32 cases) were found in the parotid gland, 28% cases (14) in submandibular gland and 8% cases (4) in the sublingual gland.

**Graph 4: Showing Sites of various Salivary Swellings**



**Graph 5: Correlation of Site with HPE Reports**



On the descriptive statistical analysis of Gland Involvement with HP reports P value was found to be = to 0.000 ( $< .01$ ) highly significant. Therefore correlation of Gland involvement with HP reports were highly significant.

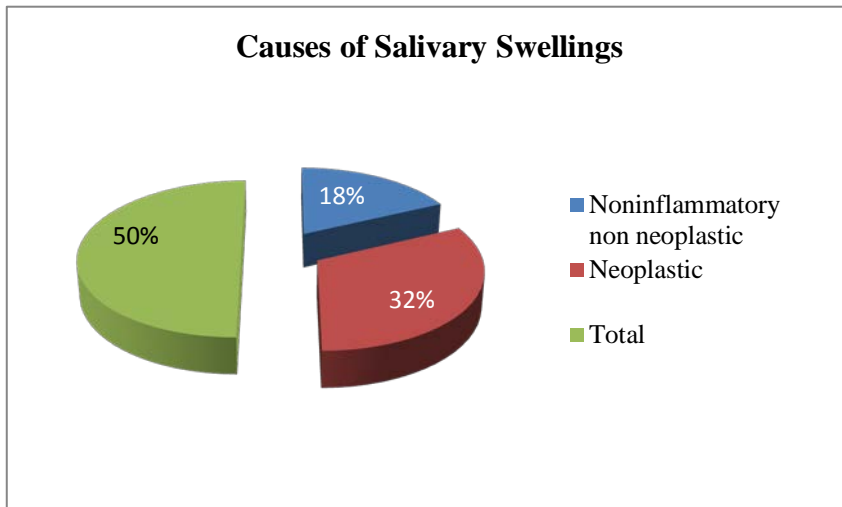
**Table – 8: Correlation of Site with HPE Reports**

Gland Involvement	Number (%)	Histopathologic Examination Result				Total	P value
		Pleomorphic Adenoma of Parotid	Warthins Tumour of Parotid	Adeno Carcinoma Parotid	Retention Cyst		
Parotid	Count	21	4	1	0	26	<b>&lt;0.001</b>
	% within Gland Involvement	80.8%	15.4%	3.8%	.0%	100.0%	
	% within Histopathologic Examination Result	77.8%	100.0%	100.0%	.0%	78.8%	
Submandibular Duct	Count	6	0	0	0	6	
	% within Gland Involvement	100.0%	.0%	.0%	.0%	100.0%	
	% within Histopathologic Examination Result	22.2%	.0%	.0%	.0%	18.2%	
Sublingual Gland	Count	0	0	0	1	1	
	% within Gland Involvement	.0%	.0%	.0%	100.0%	100.0%	
	% within Histopathologic Examination Result	.0%	.0%	.0%	100.0%	3.0%	
Total	Count	27	4	1	1	33	
	% within Gland Involvement	81.8%	12.1%	3.0%	3.0%	100.0%	
	% within Histopathologic Examination Result	100.0%	100.0%	100.0%	100.0%	100.0%	

**Table – 9: Various Causes of Salivary Gland Swellings**

Lesions	No.of Cases	Percentage
Noninflammatory non neoplastic	18	36.0
Neoplastic	32	64.0
<b>Total</b>	<b>50</b>	<b>100.0</b>

**Graph 6: Showing Causes of Salivary Swellings**

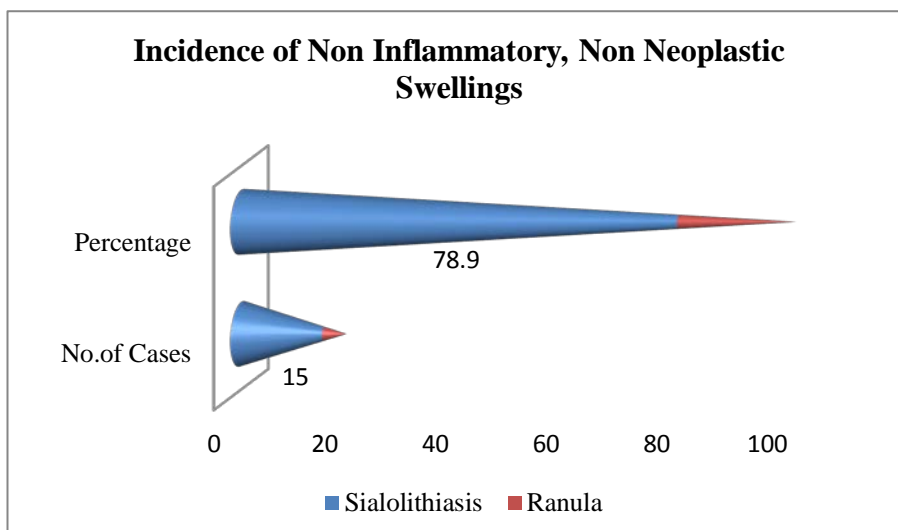


In our study, out of 50 cases, neoplastic lesions of 64.0% (32 cases) and non inflammatory non neoplastic lesions of 36% (18 cases) were seen.

**Table – 10: Incidence of Non Inflammatory, Non Neoplastic Swellings**

Lesions	No.of Cases	Percentage
Sialolithiasis	14	77.8
Ranula	3	16.7
Retention cyst	1	5.6

**Graph 7: Showing Incidence of Non Inflammatory, Non Neoplastic Swellings**



In our study, out of 19 cases, 14 (78.9%) were sialolithiasis and 3 cases (21.1%) of sublingual ranula and 1 retention cyst.

**Table – 11: Site Involvement in Non Inflammatory Non Neoplastic Swellings**

No.of Cases	Parotid		Sub mandibular		Sublingual	
	R	L	R	L	R	L
18	-	-	6	8	4	-

In our study, 6 of cases of sialolithiasis were in right submandibular gland, 8 of cases in the left submandibular gland and 4 cases of ranula were seen in right sublingual gland only.

**Table – 12: Incidence of Benign and Malignant Salivary Gland Tumours**

Lesions	No.of Cases	Percentage
Benign	31	96.88%
Malignant	1	3.1%

In our study, out of 32 salivary tumors, 93.75% (30) and were benign and 6.25% (2) were malignant.

**Table – 13: Incidence of Various Salivary Glands Tumours**

Lesion	No. of Cases	Percentage
Pleomorphic adenoma	27	84
Warthin tumour	4	14
Adenoid cystic carcinoma	1	2
<b>Total</b>	<b>32</b>	<b>100</b>



In our study, out of 25 salivary gland tumors, pleomorphic adenoma was 84% (27), 14% (4) of Warthin tumour and One case (2%) of adenoid cystic carcinoma.

**Table – 14: Correlation of FNAC and Histopathology**

<b>Lesion</b>	<b>No. of Cases</b>	<b>FNAC (%)</b>	<b>BOIPSY (%)</b>
Pleomorphic adenoma	27	100	100
Warthin tumour	4	100	100
Adenoid cystic Ca.	1	100	100

In our study, the accuracy of FNAC was 100% in case of benign salivary gland tumours, for Pleomorphic adenoma, Warthin tumour, Adenoid cystic Ca.

**Table – 15: Surgical Procedures Adopted for Various Salivary Gland Swellings**

<b>Procedures</b>	<b>No. of Cases</b>	<b>Percentage</b>
Excision of submandibular gland	15	30%
Superficial parotidectomy	26	52%
Total Parotidectomy	5	10%
Excision ranula	3	6%
Retention cyst	1	2%
<b>Total</b>	<b>50</b>	<b>100</b>

In our study, surgery was the treatment for all cases of tumors. Superficial parotidectomy was done in all the 26 cases of parotid tumour (52%) without deep lobe involvement and total parotidectomy was done in 5 cases (10%) with deep lobe involvement.

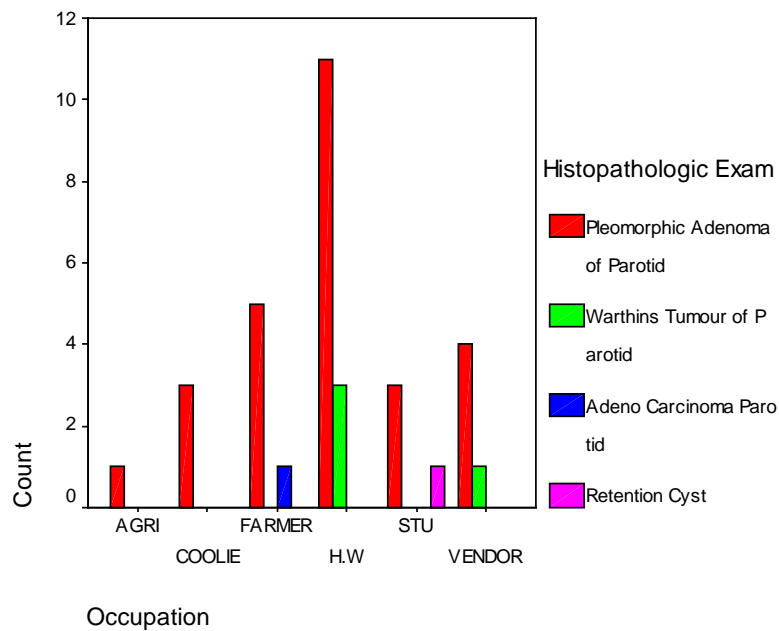
In all the cases of submandibular gland lesions, excision of submandibular gland was done. Excision of the sublingual gland was done in 3 cases of ranula and 1 retention cyst excision.

**Table – 16: Post Operative Complications**

Nature of Complications	No. of Patients	Percentage
Facial nerve paralysis	3	37.5
Wound infection	5	62.5

Post operative complications in my study of 50 cases were low. 3 cases of facial nerve paralysis occurred after parotid tumour surgery and wound infection was noticed in 5 cases.

**Graph 8: Correlation of Post Operative Complications with HPE Reports**

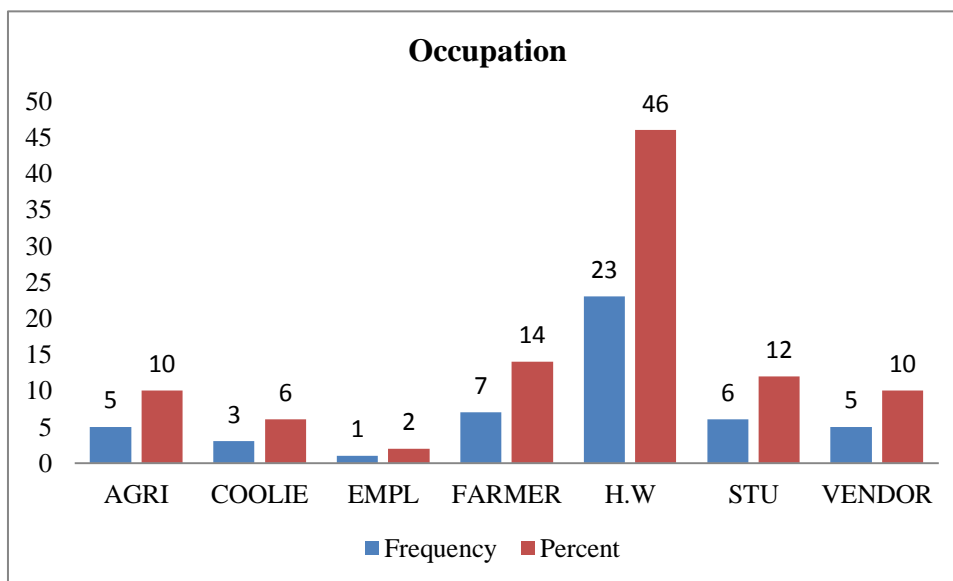


On correlation of Occupation with HP reports P value = 0.458 (> .05) and hence not significant.

**Table – 17: Occupation**

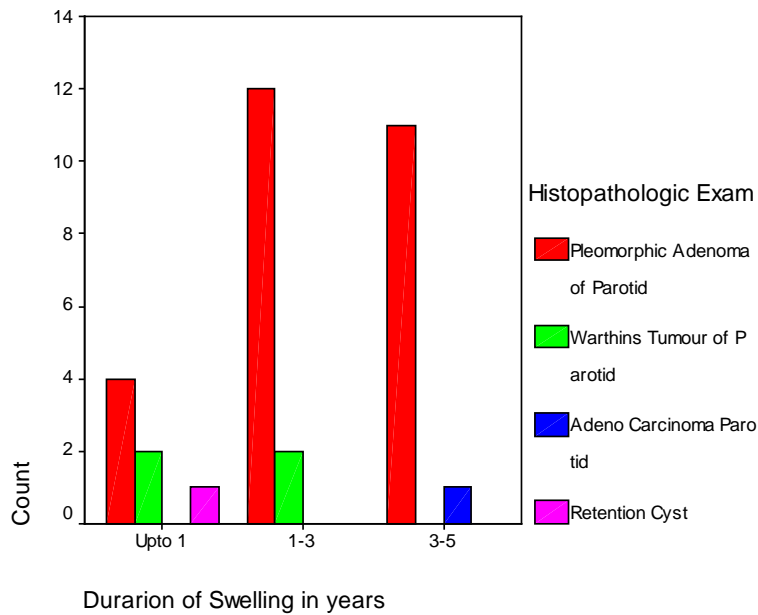
Occupation	Frequency	Percent
AGRI	5	10.0
COOLIE	3	6.0
EMPL	1	2.0
FARMER	7	14.0
H.W	23	46.0
STU	6	12.0
VENDOR	5	10.0

**Graph 9: Occupation**



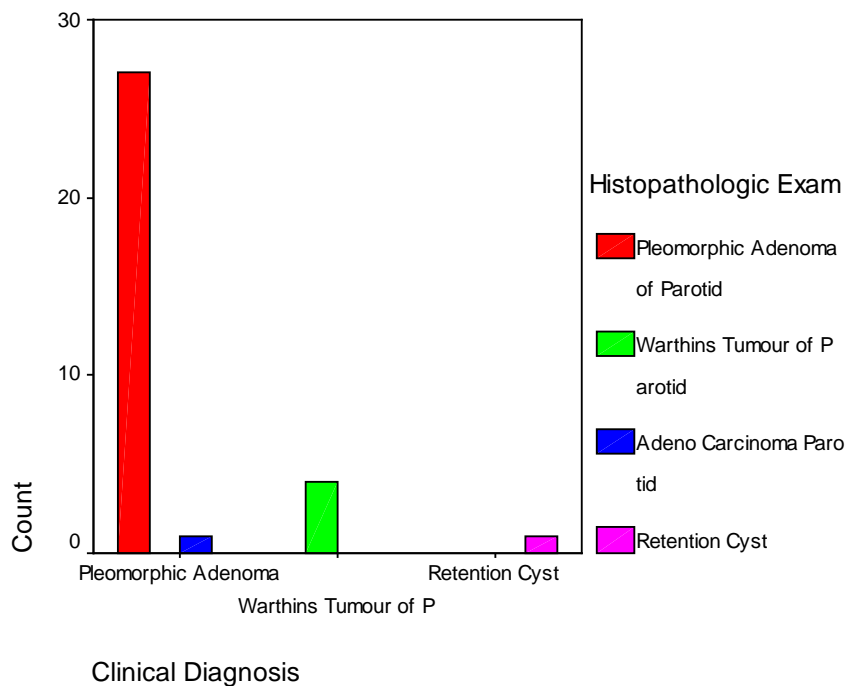
On the bases of occupation house wife were more commonly affected (46%) followed by farmers (14%). Least common were employees 2%.

**Graph 10: Correlation of Duration of Swelling in years with HPE Reports**



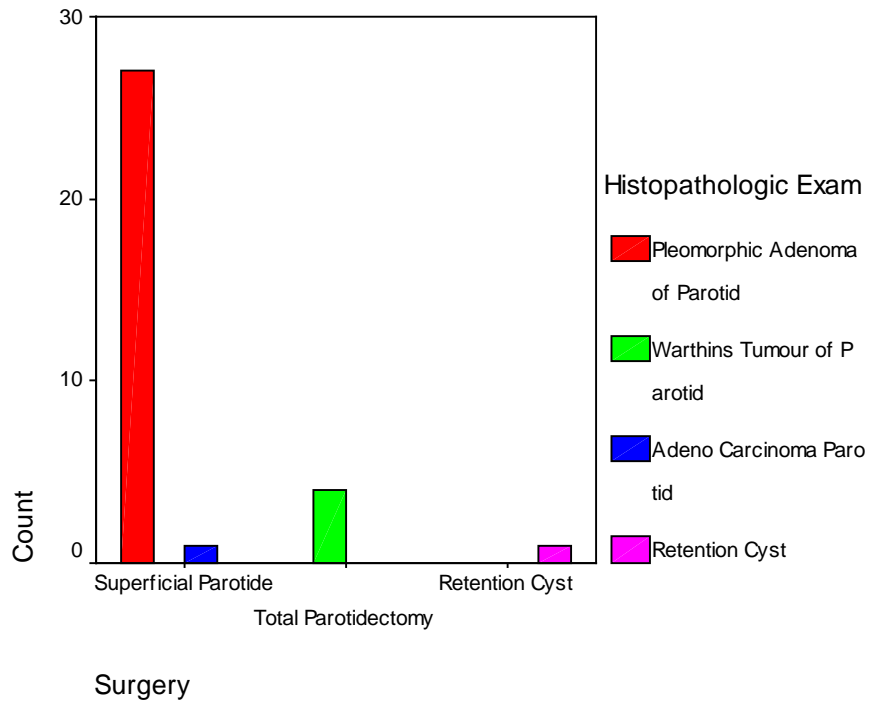
On descriptive analysis of duration of swelling with HPE reports P value = 0.161 (> .05) therefore not significant. On distributive analysis 1 to 3 years swelling were commonets followed by 3 to 5 years. Upto one year was less common.

**Graph 11: Correlation of Clinical Diagnosis with HPE Reports**



On descriptive analysis of Clinical Diagnosis with HPE reports P value = 0.000 (< .01) therefore highly significant. Therefore there is strong association between clinical diagnosis and HP reports.

**Graph 12: Correlation of Surgery done with HPE Report**



On descriptive analysis of Surgery with HPE reports P value = 0.000 (< .01) therefore highly significant. Therefore there is strong association between Surgery done and HP reports.

## DISCUSSION

Comparison of our present series of 50 cases with various series of other authors.

**Table – 18: Incidence per Year of Salivary Gland Tumours in Different Series**

Series	No.of tumours	Period of study	No. of cases per year
Potdaretar <sup>120</sup> 1969	188	10	18
Gupta et al <sup>121</sup> 1975	113	21	05
Khazanchi et al <sup>122</sup> 1988	88	6	15
Fennetal <sup>123</sup> 1982	57	15	04
Renehan et al <sup>123</sup> 1996	1194	45	27
Present study	32	0.9	28

In our series, mean incidence is 28 cases per year. This incidence correlates with most of studies by other authors in the above date.

**Table – 19: Incidence of Sialolithiasis in Various Studies**

Series	No. of cases	parotid	Sub mandibular	Sub lingual
Antognini et al <sup>125</sup> 1971	396	8.3	91.4	0.3
Pizzirani et al <sup>126</sup> 1985	102	7.8	92.2	-
J. Lustmann et al <sup>127</sup> 1990	245	4.5	94.3	0.4
Present study	14	-	100	-

In our study, incidence percentage of sialolithiasis i.e., 14 cases were found in submandibular gland which co-relates with most of the authors in the above table series.

**Table – 20: Frequency of Benign and Malignant Salivary Tumours in Different Series**

<b>Series</b>	<b>No.of tumors</b>	<b>Benign</b>	<b>Malignant</b>
Foote et al <sup>128</sup> 1954	730	68.30%	31.70%
Skolniketal <sup>129</sup> 1977	435	59.34%	30.60%
Khazanchi et al <sup>122</sup> 1988	88	63.60%	36.40%
Renehan et al <sup>124</sup> 1996	1194	80.00%	0.00%
Present study	32	96.8%	3.1%

In accordance with the observation in other series, the benign tumors predominate in our study.

**Table – 21: Location of Various Tumours in Different Series**

<b>Series</b>	<b>Parotid</b>	<b>Submandibular</b>	<b>Sublingual</b>
Budhraja et al <sup>130</sup> 1974	82.10%	12.40%	5.5%
Sharkey F.E. et al <sup>131</sup> 1977	80.50%	6.00%	9.0%
Everson et al <sup>67</sup> 1985	72.90%	10.70%	16.4%
Renehan et al <sup>124</sup> 1996	91.00%	4.0%	5%
Present study	100%	-	-

In our study, all the salivary gland tumors were observed in parotid gland. Comparative study was in accordance to Renehan et al. Tumours of sublingual glands are extremely rare and no cases were recorded with submandibular gland, because of, small number of cases and short study period.

**Table – 22: Incidence of Superficial and Deep Lobe Involvement of Parotid Gland**

**Tumours in Different series**

<b>Series</b>	<b>Total No. of cases</b>	<b>Superficial</b>	<b>Deep</b>
H. Leverstein et al., 1997 <sup>132</sup>	245	192(78.3%)	54(22%)
H. Laccourreve et al., <sup>133</sup> 1994	229	118(51.5%)	111(48.4%)
Present Series	32	27(88.46%)	5(11.53%)

In our study, out of 32 parotid tumours, 27 (88.46%) were seen in superficial lobe of parotid and 5 (11.53%) in deep lobe which is in accordance with the H. Leverstein et al., series.

**Table – 23: Average Age Incidence of Salivary Gland Tumours in Different Series**

<b>SERIES</b>	<b>Average age in years</b>	
	<b>Benign</b>	<b>Malignant</b>
Potdar etal <sup>120</sup> 1969	40	49
budhrajetal <sup>130</sup> 1947	41	41
Skolnik et al <sup>129</sup> 1977	45	56
Khazanchi et al <sup>122</sup> 1988	44	50
Renahan et al <sup>124</sup> 1996	55	59
Present study	47	80

In our series of salivary gland tumors out of 32 cases, 31 cases were benign with mean age 45 and one case was malignant of 80 years age.



The results observed in our study are consistent with other studies shown in the table.

In our study of 50 cases of salivary gland swelling, shows that, surgery is the treatment of choice in all cases of salivary gland swellings. FNAC plays an important role in the diagnosis of salivary gland tumors and accuracy rate was 100% in our series.

In our study, there was no recurrence and nil mortality.

Benign swelling of the salivary gland found in lower decade of life, where as, malignant swelling was found in 8<sup>th</sup> decade of life, which correlates with many authors in other series.

**Table – 24: FNAC Comparison with Pathologic Diagnosis in Different Series**

<b>Series</b>	<b>Benign</b>	<b>Malignant</b>
Frable and Frable 1982 <sup>134</sup>	91%	92%
Spiro RH et al., 1974 <sup>135</sup>	98%	93%
Present Study	100%	100%

In our study of 50 cases, FNAC was in accordance with the other author's series shown in above table.

## CONCLUSION

Following the study of 50 cases of salivary gland swellings, the following conclusions can be made.

- ✓ Diagnosis of the salivary gland tumors must be considered in any patient presenting with salivary gland swelling
- ✓ Salivary gland swelling occur more commonly in 3rd and 4th decades of life and seen most common in females
- ✓ Neoplastic salivary gland swellings were more common than non inflammatory swellings.
- ✓ Sialolithiasis is the predominant non inflammatory swelling.
- ✓ Sialolithiasis occur more commonly in the submandibular salivary glands.
- ✓ Salivary gland tumors occur more commonly in the parotid gland, most often benign, pleomorphic adenoma constitute majority of all neoplasm
- ✓ History and physical examination complement FNAC and help in diagnosis. FNAC has good accuracy in diagnosing salivary gland swellings.
- ✓ Surgery is the main modality of treatment in salivary gland sialolithiasis. Most commonly done surgery is excision of submandibular salivary gland. Most commonly done surgery is superficial parotidectomy.
- ✓ Since most malignant tumors are asymptomatic and long standing benign tumors can undergo malignant change, community awareness and early referral is necessary, as prognosis is good if treated early.

## SUMMARY

- ✓ The clinical material in this study includes the details of 50 cases of salivary gland swellings admitted in surgical units, surgical oncology of Govt. Royapetah Hospital and KMC hospital Chennai from Nov 2014 to Aug 2015.
- ✓ The incidence of salivary gland swellings is highest in the 3rd and 4th decade of life. Benign tumors were more common in 20 - 50 years and malignancy was seen in one patient of age 80 years.
- ✓ In this series, 17 patients were male (34%) and 33 (66%) patients were female. With male to female ratio of 1:1.9
- ✓ Commonest of salivary swellings was seen in parotid gland with 32 cases (64%)
- ✓ In this series, 18 cases (36 %) of salivary swellings was due to non-inflammatory and non-neoplastic swellings and 32 cases (64%) was due to neoplastic swellings.
- ✓ Incidence of non-inflammatory non neoplastic swellings was most often seen in submandibular salivary glands. 80 % (14) were seen affecting the submandibular gland and 20 % (4) was seen affecting the sublingual glands.
- ✓ Incidence of tumours was highest in the parotid. Incidence of benign tumours is 31 (96.8%) and malignant tumors are 1(3.1%). Pleomorphic adenoma is the commonest benign tumour and Adenoid cystic carcinoma was the only malignant tumour.
- ✓ Patients presented with history of swellings varying from 4 months to 5 years. Swelling is the most common symptom. Pain was the second most common symptoms. Pain was noticed in 52% of the cases and tenderness was noticed in 56% of the cases.
- ✓ Patient with malignant tumor had other symptoms in addition to the swelling, like pain, facial asymmetry due to facial nerve paresis.

- ✓ Final diagnosis was arrived at by Physical examination and FNAC. FNAC is the reliable and sensitive tool for diagnosing salivary gland tumours. There was an overall diagnostic accuracy of 100%
- ✓ Surgery is the treatment in all the cases of salivary swelling. Out of 32 cases of parotid tumour. Superficial parotidectomy was done in 28 cases (87.5%) and total parotidectomy for 4 cases (12.5%). For all the submandibular gland lesions sialadenectomy was done. Sublingual gland excision was carried out for 3 cases of ranula and 1 retention cyst excision.
- ✓ Wound infection was the major complication with 5 cases (62.5%) and three cases of facial nerve paralysis (37.5%) was observed.
- ✓ Out of 50 cases, 18 cases (36%) were due to non-inflammatory and non-neoplastic swellings. Out of which 14 cases (77.8%) was due to submandibular sialolithiasis and 3 cases (16.7%) was due to ranula of the sublingual glands and 1(5.6%) case of sublingual retention cyst. 32 Cases (64%) were due to salivary gland tumours. Out of 32 tumours, Pleomorphic adenoma is seen in 27 cases (84.4%), Warthin's tumour is seen in 4 cases (12.5%) and one case of adenoid cystic carcinoma (3.1%).
- ✓ With proper diagnosis and appropriate treatment. Salivary gland swelling can be cured with almost 100%.
- ✓ Successful management of the salivary gland neoplasm depends on accurate clinical assessment and diagnosis, with appropriate use of fine needle aspiration and CT or MR imaging. Moreover, knowledge of the particular behaviour of each tumor type guides the development of an appropriate treatment plan for each individual patient.
- ✓ There was no mortality in our study of 50 cases after follow up for 1 months to 10 months. But follow up period was inadequate as salivary gland tumours are known for

their late recurrence. The adequacy of treatment cannot be commented because of short period of follow up.

- ✓ The study group in this series is small, as compared to large series in western literature. So statistical data in this series may not represent the actual data quoted in western literature.

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## ANNEXURE - 1

### PROFORMA

NAME : DATE OF ADMISSION :  
AGE : DATE OF OPERATION :  
OCCUPATION : DATE OF DISCHARGE :  
ADDRESS : I.P. No. :  
INCOME :

#### PROVISIONAL DIAGNOSIS:

#### COMPLAINTS WITH DURATION:

#### HISTORY OF PRESENT ILLNESS:

- Swelling
  - Onset
  - Site
  - Duration
  - Rate of growth
  - Pain
  - Relation to food
- Ulceration and discharge
- H/o Fever
- H/o dryness of Mouth
- H/o Trauma
- H/o Difficulty in the movement of jaw
- H/o Any other swelling in the opposite side
- H/o Appetite and weight



- Shape
- Size
- Surface
- Borders
- Skin over the swelling
- Ear Lobule raised/not raised
- Fistula and its position over the gland or duct
- Movements of the jaw

**PALPATION:**

- Temperature
- Tenderness
- Size, Shape
- Extent
- Surface, Borders
- Fistula
- Mobility
- Fixity to overlying skin Relation to masseter muscle
- Plane of the swelling
- Jaw movements
- Facial and lingual nerve palsy
- Regional lymph nodes

**INTRAORAL EXAMINATION:**

- Oral Hygiene Caries Tooth Sepsis
- (Cleaning material used)

- (Whether gargling after each meal)
- Bulging or fullness in the floor of the mouth or in the
- Supra-tonsillar region. Opening of the parotid duct
- Opening of the Wharton's duct
- Bi-digital examination
- Any other swelling in the oral cavity

**SYSTEMIC EXAMINATION:**

- Cardiovascular system
- Respiratory system
- GIT Liver
- Genitourinary system
- CNS
- Bones



சுய ஒப்புதல் கடிதம்

ஆய்வு செய்யப்படும் தலைப்பு : உமிழ்நீர் சுரப்பி வீக்கம் பற்றிய ஆய்வு  
(Clinical and Pathological  
study of Salivary Gland Swellings)

ஆய்வு செய்யப்படும் துறை : பொது அறுவை சிகிச்சை மற்றும்  
புற்று நோய் அறுவை சிகிச்சைத் துறை

மருத்துவமனை : அரசு இராயப்பேட்டை மருத்துவமனை  
கீழ்பாக்கம் அரசு மருத்துவமனை மற்றும்  
கல்லூரி, சென்னை

பங்கு பெறுபவரின் பெயர் :

பங்கு பெறுபவரின் வயது :

பங்கு பெறுபவரின் மருத்துவமனை :

எண்

பங்கு பெறுபவர் இதனை (✓) குறிக்கவும்.

1. இந்த மருத்துவ ஆய்வின் விவரங்கள் எனக்கு தெளிவாக விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான விளக்கங்களை பெறவும் வாய்ப்பு அளிக்கப்படும் என அறிந்து கொண்டேன்.
2. நான் இந்த ஆய்வில் தன்னிச்சையாக தான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ நான் இந்த ஆய்வில் இருந்து விலக ஆசைப்பட்டால் எந்த தடங்களும் இன்றி விளகலாம் என்றும் அறிந்து கொண்டேன்.
3. இந்த ஆய்வு சம்மந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற்கொள்ளும் பொழுதோ இந்த ஆய்வில் பங்கு பெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிகிறேன்.
4. இந்த ஆய்வில் பங்கு கொள்ள நான் சுய நினைவோடு முழு சம்மதத்தோடும் ஒப்புதல் அளிக்கிறேன்.

பங்கு பெறுபவரின் பெயர் : ஆய்வாளரின் பெயர் :

பங்கு பெறுபவரின் : ஆய்வாளரின்

கையொப்பம் : கையொப்பம் :

தேதி :

இடம் :

## ABBREVIATIONS

IP NO	IN PATIENT NUMBER
STU	STUDENT
OCCU	OCCUPATION
EMPL	EMPLOYEE
DURN.SWELL	DURATION OF SWELLING
AGRI	AGRICULTURIST
GROWTH RAT	GROWTH RATE
R-PR	RIGHT SIDE PAROTID
H/O SALIV	HISTORY OF SALIVATION
L-PR	LEFT SIDE PAROTID
GL INVOLV	GLAND INVOLVEMENT
R-SMD	RIGHT SIDE SUBMANDIBULAR DUCT
SIZE CMS	SIZE IN CENTIMETERS
L-SMD	LEFT SIDE SUBMANDIBULAR DUCT
T	TENDERNESS
R-SL	RIGHT SIDE SUBLINGUAL GLAND
M	MOBILITY
L-SL	LEFT SIDE SUBLINGUAL GLAND
C	CONSISTENCY
H	HARD
F	FIRM
S	SOFT
7 CN PALSY	7 <sup>TH</sup> CRANIAL NERVE PALSY
SL.NO	SERIAL NUMBER
REL	RAISED EAR LOBULE
M	MALE



F	FEMALE
SKIN CH	SKIN CHANGES
YRS	YEARS
D OPEN	DUCT OPEN
N	NORMAL
D PAR	DEEP LOBE OF PAROTID INVOLVEMENT
ROC	RADIO OPAQUE CALCIFICATION
LN	LYMPH NODE
PLA.PR	PLEOMORPHIC ADENOMA OF PAROTID
XRAY MND	X RAY MANDIBLE
WT.PR	WARTHINS TUMOUR OF PAROTID
SIALO	SIALOGRAM
ACA.PR	ADENO CARCINOMA PAROTID
FNAC	FINE NEEDLE ASPIRATION CYTOLOGY
SM.SIAL	SUBMANDIBULAR SIALOLITHIASIS
C DIAGNO	CLINICAL DIAGNOSIS
RET.CYST	RETENTION CYST
SUR	SURGERY DONE
RANULA.SL	RANULA OF SUBLINGUAL GLAND
HPE RESULT.	HISTOPATHOLOGIC EXAMINATION
SUP.PARO	SUPERFICIAL PAROTIDECTOMY.
F.UP	FOLLOW UP
SMD.EX	SUB MANDIBULAR GLAND EXCISION
H.W	HOUSE WIFE
TOT.PARO	TOTAL PAROTIDECTOMY
CY	CYSTIC

Sl.No	Name	Age	Sex	Ip No.	Occup	Durm.Swel	Pain	Growthrat	Fever	H/O Saliv	Glinvolv	Sizecems	T	M	C	7cm PALS	REL	SKIN CH	D OPEN	D PAR	LN	XRAY MN	SIALO	FNAC	CDIAGNO	SUR	HPE	F.UP
1	SITA	30	F	1833	H.W	2YRS	YES	SLOW	NO	NO	R-PR	3X4	NO	YES	F	NO	YES	NO	NO	NO	NO	N	PLA.PR	PLA.PR	PLA.PR	PLA.PR	GOOD	
2	ROJA	41	F	10952	H.W	1.5YRS	YES	SLOW	NO	NO	L-SMD	1X2	YES	YES	H	NO	NO	NO	YES	NO	NO	ROC	N	SM.SIAL	SUP.PARQ	PLA.PR	GOOD	
3	RADHA	24	F	13400	H.W	0.5YRS	YES	RAPID	NO	YES	L-SMD	2X1	YES	YES	F	NO	NO	NO	YES	NO	NO	ROC	N	SM.SIAL	SMD.EX		GOOD	
4	RADHI	45	F	10357	COOLJE	2YRS	NO	SLOW	NO	NO	R-PR	3X4	NO	NO	H	NO	YES	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
5	DEVI	35	F	14348	COOLJE	3YRS	NO	SLOW	NO	NO	R-PR	3X4	NO	NO	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
6	GANGA	19	F	16692	STU	2YRS	NO	SLOW	NO	NO	R-SMD	2X1	YES	YES	H	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
7	RAJA	17	M	17255	STU	0.25YRS	NO	RAPID	NO	NO	L-SL	2X1	YES	YES	S	NO	NO	NO	NO	NO	NO	N	RET.CYST	RET.CYST	RET.CYST	RET.CYST	GOOD	
8	INDRA	19	F	10080	H.W	2YRS	YES	SLOW	NO	NO	L-PR	3X4	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
9	GOPI	34	M	12143	FARMER	5YRS	NO	SLOW	NO	NO	R-PR	3X4	YES	YES	H	NO	YES	NO	NO	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
10	JANAKI	40	F	31165	FARMER	2YRS	NO	SLOW	NO	NO	L-PR	2X3	NO	YES	F	NO	NO	NO	NO	YES	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
11	LAXMI	45	F	10115	VENDOR	3YRS	NO	SLOW	NO	NO	L-PR	3X4	NO	YES	S	YES	YES	NO	NO	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
12	MALA	55	F	545	H.W	2YRS	NO	SLOW	NO	NO	L-PR	2X3	YES	YES	H	NO	NO	NO	NO	NO	NO	N	WT.PR	TOT.PARQ	WT.PR	WT.PR	GOOD	
13	NADIYA	40	F	10691	H.W	3YRS	NO	SLOW	NO	NO	R-PR	3X3	NO	YES	F	NO	NO	NO	YES	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
14	ORVASI	18	F	12046	STU	2YRS	NO	SLOW	NO	NO	L-SMD	2X1	NO	NO	H	NO	NO	NO	NO	NO	NO	ROC	N	SMD.SIAL	SMD.EX		GOOD	
15	BABU	31	M	15514	FARMER	2YRS	NO	SLOW	NO	NO	R-SMD	2X2	NO	NO	H	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
16	RANI	36	F	26922	FARMER	2YRS	NO	SLOW	NO	NO	L-PR	2X2	YES	YES	S	NO	YES	NO	NO	YES	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
17	DURAI	80	M	2137	FARMER	5YRS	YES	SLOW	NO	NO	L-PR	4X5	YES	YES	F	NO	YES	NO	NO	NO	NO	N	ACA.PR	SUP.PA	ACA.PR	ACA.PR	GOOD	
18	TAMIL	55	F	613067	H.W	3YRS	YES	SLOW	NO	NO	R-PR	5X7	YES	YES	F	NO	NO	NO	YES	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
19	BANU	35	F	615440	H.W	2YRS	YES	SLOW	NO	NO	L-PR	2X3	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PA	PLA.PR	PLA.PR	GOOD	
20	ROBIN	55	M	636198	VENDOR	0.5YRS	YES	RAPID	NO	NO	R-SMD	3X2	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
21	AKILA	33	F	638892	H.W	2YRS	NO	SLOW	NO	NO	L-PR	3X2	YES	YES	F	NO	YES	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
22	VANI	40	F	614149	H.W	2YRS	NO	SLOW	NO	NO	R-PR	2X1	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
23	ANNA	41	F	636299	H.W	3YRS	NO	SLOW	NO	NO	R-PR	3X3	NO	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
24	BOOMIKA	70	F	627961	H.W	3YRS	YES	SLOW	NO	NO	R-PR	3X3	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
25	ELIJ	55	M	629761	VENDOR	1YR	NO	SLOW	NO	NO	R-PR	3X3	YES	YES	H	NO	NO	NO	NO	NO	NO	N	WT.PR	TOT.PARQ	WT.PR	WT.PR	GOOD	
26	HARI	70	M	662500	FARMER	3YRS	NO	SLOW	YES	NO	R-PR	2X1	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
27	ROHINI	32	F	1548	H.W	2YRS	NO	SLOW	NO	NO	L-PR	2X1	NO	NO	C	NO	NO	NO	YES	NO	NO	N	RANULA	EXCISION			GOOD	
28	JOE	42	M	3647	EMPL	0.25YRS	YES	SLOW	NO	NO	R-SL	2X2	YES	YES	F	NO	NO	NO	NO	NO	NO	ROC	N	SMD.SIAL	SMD.EX		GOOD	
29	LAXMAN	18	M	10701	STU	0.5YRS	YES	SLOW	NO	NO	L-SMD	3X5	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
30	MANI	59	M	663490	AGRI	1YR	YES	SLOW	YES	NO	L-PR	3X5	YES	YES	C	NO	NO	NO	YES	NO	NO	N	RANULA	EXCISION			GOOD	
31	URVI	35	F	614325	H.W	1YR	YES	SLOW	YES	NO	R-SL	2X3	YES	YES	F	NO	NO	NO	YES	NO	NO	ROC	N	SMD.SIAL	SMD.EX		GOOD	
32	NANDA	52	M	2108	AGRI	2YRS	YES	SLOW	NO	NO	R-SMD	4X3	NO	YES	H	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
33	PARI	20	M	616303	STU	2YRS	YES	SLOW	NO	NO	L-SMD	2X1	NO	YES	F	NO	NO	NO	YES	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
34	RAVI	65	M	3137	AGRI	5YRS	YES	SLOW	NO	NO	R-PR	5X6	NO	YES	F	NO	NO	NO	NO	YES	NO	N	SMD.SIAL	SMD.EX			GOOD	
35	SANTOSH	31	M	1293	AGRI	1YR	YES	SLOW	NO	NO	L-SMD	2X3	NO	YES	F	NO	NO	NO	YES	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
36	VALLI	61	F	29933	H.W	5YRS	YES	SLOW	NO	NO	R-PR	6X6	NO	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
37	SUNDARI	35	F	36948	H.W	2.5YRS	YES	SLOW	NO	NO	L-PR	7X8	YES	YES	F	NO	YES	NO	YES	NO	NO	N	WT.PR	TOT.PARQ	WT.PR	WT.PR	GOOD	
38	SHEELA	37	F	41319	H.W	5YRS	YES	SLOW	NO	NO	R-PR	3X5	YES	YES	F	NO	NO	NO	YES	NO	NO	N	SMD.SIAL	SMD.EX			GOOD	
39	FATIMA	25	F	52520	H.W	4YRS	YES	SLOW	NO	NO	L-SMD	3X4	YES	YES	S	NO	NO	NO	NO	NO	NO	N	SMD.SIAL	SMD.EX			GOOD	
40	GOWRI	40	F	62511	H.W	3YRS	YES	SLOW	NO	NO	R-SMD	3X6	NO	YES	H	NO	NO	NO	NO	NO	NO	ROC	N	SMD.SIAL	SMD.EX			GOOD
41	ALEX	29	M	4231	STU	3YRS	YES	SLOW	NO	NO	L-SMD	3X5	YES	YES	S	NO	NO	NO	NO	NO	NO	N	SMD.SIAL	SMD.EX			GOOD	
42	ADIL	44	M	4132	FARMER	3YRS	NO	SLOW	NO	NO	R-PR	3X4	NO	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
43	KANNA	47	M	4312	COOLJE	2YRS	NO	SLOW	NO	NO	R-PR	3X3	NO	NO	H	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
44	MEENA	49	F	4123	AGRI	2YRS	YES	SLOW	NO	NO	R-SMD	4X4	NO	YES	H	NO	NO	NO	NO	NO	NO	N	SMD.SIAL	SMD.EX			GOOD	
45	RAMBA	43	F	52210	VENDOR	3YRS	NO	SLOW	NO	NO	L-PR	3X4	NO	YES	S	YES	YES	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
46	MUNIAM	68	F	51239	H.W	1YR	NO	SLOW	NO	NO	R-PR	3X2	YES	YES	H	NO	NO	YES	NO	NO	NO	N	WT.PR	TOT.PARQ	WT.PR	WT.PR	GOOD	
47	KANAMA	62	F	61243	H.W	2YRS	NO	SLOW	NO	NO	L-PR	2X2	NO	YES	C	NO	NO	NO	YES	NO	NO	N	RANULA	EXCISION			GOOD	
48	MUTAMA	64	F	61956	H.W	2YRS	NO	SLOW	NO	NO	L-PR	2X3	YES	NO	S	NO	NO	NO	NO	YES	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
49	RAJAMA	66	F	56321	VENDOR	0.5YRS	YES	RAPID	NO	NO	R-SMD	3X2	YES	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	
50	SELVI	78	F	65561	H.W	2YRS	YES	SLOW	NO	NO	R-PR	4X5	NO	YES	F	NO	NO	NO	NO	NO	NO	N	PLA.PR	SUP.PARQ	PLA.PR	PLA.PR	GOOD	