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SALIVARY GLAND PATHOLOGIES AS DETECTED ON ULTRASOUND EVALUATION OF NECK IN A TERTIARY CARE HOSPITAL IN SRINAGAR GARHWAL

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ABSTRACT The present record based study of salivary gland diseases as assessed by ultrasound was performed in department of Radiology in HNB Base government teaching hospital situated in hills of Garhwal in the state of Uttarakhand in year 2016 and 2018. The study was to assess the burden of salivary gland diseases in the hills of Garhwal. Ultrasound is easily available and convenient to use to evaluate superficially located salivary glands in head and neck region.

KEYWORDS : Salivary Gland, Ultrasound, Salivary Stones, Sialadenitis, Parotitis

Introduction:-

Ultrasound is able to image all three major salivary glands viz. parotids, submandibular and sublingual glands and is used as the first imaging modality of choice to diagnose salivary glands diseases as they are superficial in location in head and neck region. High resolution ultrasound (HRUS) is used to assess the glands along with color Doppler study to localise the focal lesion, presence of local invasion, any adenopathy in neck, to assess whether benign or malignant or something else like infection or inflammatory or simply salivary stones for example. Cystic lesions like ranula or abscess can be assessed. USG guided aspirations of focal abscess can be done so also a guided FNAC or FNAB. Various other associated conditions in neck can be evaluated like adenopathy, resectability of lesion or tumor, invasion of facial nerves, vessels etc can also be assessed by ultrasound aided with Color Doppler. We will discuss in detail the various salivary gland diseases we found in our study and elaborate on pathophysiology of such various disease conditions with stress on ultrasound findings with differentials of such salivary gland diseases with relevant clinical material required in an honest approach browsing and review available standard literature on the said subject.

Materials and methodology:-

The present record based study was performed in department of Radiology, HNB Base Government teaching hospital, Srinagar Garhwal situated in hills of Garhwal in mid-Himalayan range. Total 3385 non-antenatal patients were scanned in year 2016 and 18 over a period of one and half years with total 108 cases referred for neck ultrasound. Patients of all age group and both sexes were included in study. Neck ultrasound was performed with linear array transducer with 7-10 MHz frequency on L& T Sonalisa USG machine and Toshiba Nemio SSA 510A (Toshiba Inc Corporation, Tokyo, Japan) color Doppler machine with patient in supine position with neck slightly extended by placing a soft pillow behind shoulders for proper visualization of salivary glands. Scanning is done in both longitudinal and transverse planes, entire parotid gland is visualized behind retroauricular regions on both sides, with evaluation of submandibular glands in submandibular region along with scanning for any adenopathy in neck, submental region for any ranula, for vessels coursing through parotids along with visualization of carotids and jugulars was performed in all cases. The data thus obtained was retrieved on a Microsoft excel datasheet and variables like age, sex, clinical symptomatology and ultrasound findings assessed and tabulated with statistical methods using percentage prevalence of each variable.

Results: - (Kindly refer to Tables I to IV)

The present record based study was performed in department of Radiology in year 2016 and 2018 with about 3385 non-antenatal ultrasound cases referred out of which 108 neck ultrasounds were performed, the records of which were evaluated and the pathologies pertaining to salivary glands were identified. Total 24 positive cases (n=24) of salivary gland diseases were identified. Nine cases showed involvement of parotid glands, whereas eleven cases involved submandibular glands and four cases involved sublingual glands. The predominant age group of patients studied was from 11 to 60 years out of which there were 13 male patients and rest were females (male : female ratio = 13:11). Only two patients who had fascial space infections were very young, one was three months old and other was six years old. **[Figures 1, 2 and 3]**

As expected as in other North Indian states, the incidence of salivary calculi was high (seven cases) as good as other calculous disease of gall bladder and kidneys due to calcinated water in hills of Garhwal. Eight cases of sialadenitis were found out of which five showed involvement of submandibular glands and rest three involved parotid glands. There was a case of sialectasis involving parotid glands. Cervical adenopathy was seen in 3 cases and ranula of floor of mouth was seen in four cases. Salivary stones were seen involving only submandibular gland and duct and not parotid in our study. Right was involved in five cases as opposed to two cases involving left gland. The age of involvement was as low as 13 year and as high as 60 years. The male female ratio was 5:2. Parotitis was seen in three cases and adenitis involving submandibular glands was seen in five cases, with a three months baby having right Parotitis [**Figure 7**]. The age group of cases with adenitis was 23 to 60 years with male female ratio of 5:3. Intraparotid adenopathy was seen in two cases who were teenagers. Suppurative lymphadenopathy of neck was seen in one case of seven years which had submandibular adenopathy on left side.

There were two cases of benign neoplasm (pleomorphic adenoma and lipoma) and another single case of malignant neoplasm of parotid gland. Right parotid neoplasm was seen in a 16 year old male which had invasion of overlying massetter muscle and had local adenopathy. Benign pleomorphic adenoma was seen in 23 year male with pathognomonic ultrasound appearance and involved right parotid gland [**Figure 5**]. A lipoma in adult male patient with typical feathery pattern and oval shape was seen on USG [**Figure 4**].

We found four cases of ranula along the floor of mouth, two in male patients and other two in females. 34 x 22 mm sized plunging ranula was seen in a forty years old man and an infected bigger ranula of 6.2 x 2.4 cm size was seen in left sublingual region in a 25 years old male patient. Two adolescent girls had also small ranulas along floor of mouth.

General considerations (Discussion):-

Embryology, anatomical and physiological considerations of salivary glands

Major and minor salivary glands anterior to the anterior tonsillar pillars are ectodermal in origin whereas the rest are endodermal in origin[7]. Intraglandular lymph nodes are seen in parotid glands as gland gets capsulated even before nodes develop embryologically.

Sonography of parotid glands:-

Parotid glands lie anterior and inferior to the ear overlying the upper quarter of sternocleidomastoid muscle and the masseter muscle[3, 5, 6]. Parotid glands are the largest salivary glands one on each side, overlying the ascending ramus of mandible with superficial retro-

auricular lobe and deep lobe in front of styloid process in the lateral parapharygeal space. It has typical homogeneous ultrasound appearance with fine parenchymal echoes and has highly reflective lines within the gland representing normal intraglandular ducts and also has important structures like facial nerves and its branches, the Stenson's duct, and large vessels of neck crossing the gland substance[5]. Normally few lymph nodes are seen in the both parotid glands[5, 6]. Adults have a relatively fatty parotid gland and children have low fat content[6].

Sonogram of submandibular glands:
Submandibular glands occupy the submandibular triangle adjoining the anterior and posterior bellies of digastric muscles[3, 5]. There are two glands on each side in anterior part of submandibular space, in close relation to mylohyoid and hyoglossus muscles which lie medial to gland. This almond shaped gland is separated from the parotids by a prominent lymph node called as Kuttner's node[5]. The echogenecity of glands is similar to parotids and the duct called as Wharton's duct is seen emerging from the inferior surface of gland to terminate on each side of the frenulum of tongue[5]. Thick viscous secretions can be seen in major duct on sonography[6].

Sublingual glands lie below the mucosa of the floor of mouth on each side of the anterior part of tongue, visualized only in thin subjects as small triangular solid nodules cranial to the mylohyoid muscles[3,5].

Salivary glands have acinar cells which can be serous, mucus or mixed in nature, parotids having predominant serous acini, submandibular glands have seromucinous acini whereas sublingual glands have mucus acini[3]. **Saliva** is secreted by these salivary glands and they have important functions[3,4]:

1) Mucus content protects oral mucosal from local irritation and from desiccation, providing lubrication for tongue movements.
2) Mucus sweeps microbes and foreign particles from esophagus to gastrointestinal tract where they are destroyed.
3) It facilities speaking and swallowing by lubrication of tongue.
4) It protects the teeth.

Salivary secretions are controlled by physical and psychic stimuli mediating through autonomous nervous system resulting from taste, smell and sight of food with centers situated in brainstem (superior and inferior salivatory nuclei).[3] 90% of total volume of saliva comes from parotids and submandibular glands in equal amounts[3]. Various diseases which affect salivary glands also affect salivary secretions like dehydration, infection, fatigue, psycopathies, heavy metal poisoning, and use of tranquillizers, pregnancy, cystic fibrosis and others[3,4].

Salivary gland diseases are usually classified as, 1) inflammatory 2) non-inflammatory 3) non-neoplastic 4) neoplastic[3]. Various diseases affecting salivary glands are:

1) Hypertrophy of glands[5]: it may be due to obesity or racial factors like in Africans and Egyptians or secondary to diabetes, liver cirrhosis or uremia.

2) Salivary calculi /stones: Salivary stones are calcified concrements in the parenchyma or ductal system of salivary glands and is the most common condition affecting salivary glands, characterized by obstruction of salivary flow[4]. It accounts for one-third of salivary gland diseases[4]. They typically present with pain and swelling of glands during mealtimes[4]. Sialolithiasis commonly affects submandibular glands as it has thick viscous mucoid secretions as compared to parotids which has serous secretions so also the Wharton's duct has cranial course and thus is vulnerable to stasis, and obstruction; especially if any disease process hampers secretions and promotes infection leading to duct structures[4, 5]. Studies in UK reveal overall prevalence of 0.45% of sialolithiasis in general population. It commonly affects fourth and fifth decades of life with male predominance of 2.5:1[4].

Submandibular glands are affected in 72 to 80% cases whereas parotids are affected only in 4 to 28 % cases.[4] It rarely affects minor salivary glands of oral cavity, tongue and palate (0.4 to 7%).

In submandibular glands the stones are seen in duct in 80-90% cases (57% at hilum and 34% in distal duct) and rest in glandular ducts[4]. In parotids, the stones are seen mostly in distal duct (64%), 13% in hilum and 23 % in glandular ducts. The risk factors[4] for formation of salivary calculi are, 1) higher calcium content in saliva with reduced crystallization inhibition factor called phytates, magnesium and citrates. 2) renal or gall stones 3) diabetes mellitus 4) hypertension 5) use of diuretics, atropine like agents 6) gout 7) Sjogren's disease 8) hard water areas like in hills. All these conditions lead to reduced salivary secretions and flow which facilitates stone formation. 8) Streptococcus and peptostreptococci are isolated in the calculi which might implicate these microbes[4].

Various factors which affect flow and composition of saliva are[3,4];

1) Drugs like cocaine, morphine, strychnine, digitalis, quinidine, muscle relaxants, antiparkinsonism drugs, theophylline and adrenaline
2) Loss of functioning gland substance like in irradiation, aphasia, chronic inflammation and ductal strictures.
3) Hormonal changes as in Cushing disease, Addison disease, Conn syndrome, menstruation and pregnancy.
4) Mucous membrane irritation due to smoking, quinine and peppermint
5) Disrupted fluid and electrolyte balance like in diabetes insipidus, diuretics, dehydration and uremia.

Aetiopathogenesis of Sialolithiasis[4]:
A sialomicrolith /microconcretion forms in a duct of gland which contains crystals of calcium and phosphorus with organic matrix, necrotic cell residue; which in turn forms a nidus continuously aggregating over years to form a calculus due to predisposition of stasis, hard water, infection, decreased saliva flow, with a calculus typically showing central organic nucleus surrounded by laminated layers of organic and inorganic substances. Stones weigh from 1 mg to almost 6 gm. Average weight of a salivary calculus is 300 mg. The size varies from 2 to 10 mm diameter[4].

Effects of calculous disease on glands
They produce accumulation of saliva and increased intraglandular pressure, stasis and eventually infection develops in 90 % cases.[3, 4] There is reduced salivary flow rate and long-term obstruction leads to destruction of glands due to ductal, periductal and intralobular fibrosis, acinar cell atrophy and lymphocyte infiltration.[3,4]

Clinically salivary stones are equally distributed between right and left side of oral cavity and usually 70-80% cases have single stone whereas two stones are found in 20% cases, rarely 3 or more stones are seen in 9% cases[3,4]. 60% parotid calculi are radioopaque, the rest having urates are radiolucent. Occasionally salivary gland calculi are asymptomatic and may appears as acute suppurative sialadenitis, intraglandular calculus is associated with less severe symptoms. Usually after clinical palpation of stones in floor of mouth the diagnosis of the stones is done by intra-oral dental occlusive film or oral pantomography.[3, 4] In addition, extra-oral radiography and ultrasound is used whenever required, precise ultrasound localization of salivary calculi, whether intraductal or intraglandular, is important to decide treatment modality. CT may be useful in select cases. USG allows detection of salivary stones as small as 2 mm and can be used in presence of adenitis wherein sialography is contraindicated. As salivary calculi are radioopaque in 80 to 90 % cases, radiography is useful. Sialography is 100% effective to demonstrate calculus.[3, 4, 5] Sialography and sialendoscopy is done as per the clinicians' preference.[4]

Treatment includes operative removal of ductal stones with preservation of gland function, by transoral removal[4,5]. Salivary gland massage with sour diet and use of sialogogues is advised in some cases or after surgery[4]. Extracorporeal shock wave lithotripsy is used rarely[4]. Complete excision of gland as it is curative is done in recurrent stones or when symptoms are unacceptable or when fungal infection occurs[3]. If recurrent stones occur in parotid gland, parotidectomy is advised. Recurrence rate by transoral route of salivary gland calculi is about 18%[3].

3) Inflammatory salivary gland diseases include following conditions:-

i) Acute Suppurative sialadenitis
This condition predominantly involves parotids and sometimes submandibular glands as parotid secretions have less bacteriostatic activity than that of submandibular glands[3, 5]. It is reported to occur in 0.03 % of hospital admissions. Causes include postoperative status (after GI tract procedures), calculi, duct strictures, decreased salivary production, poor oral hygiene, parenteral nutrition in indoor patients[3]. It occurs most commonly in 6th to 7th decades of life with equal sex

predilection[3]. Clinically they present with diffuse swelling of gland, with induration, tenderness of glands with purulent saliva expressing out on gland pressure[3]. It can be bilateral in 20% cases. Microorganisms usually implicated are coagulase positive staphylococcus aureus, pneumococci, E coli, H influenzae and anaerobic bacteriodes[3]. Enlarged inflamed glands appear hypoechoic and have probe tenderness; some may show enlarged intraglandular lymph nodes. Large abscesses are seen in association with adenitis seen as fluid filled hypoechoic areas in gland substance with irregular borders and internal debris[5]. USG can assist in guided drainage of such abscess percutaneously[5] and a plastic sheath wide bore branula can be kept in situ for continued drainage of pus under antibiotic cover.

ii) Chronic recurrent sialadenitis[3] is caused by decreased secretions with subsequent stasis due to repeated acute episodes of adenitis or a severe episode of Suppurative sialadenitis, occurring mainly in parotids as it has longer and narrower duct. The disease leads to sialectasis, ductal ectasia, and acinar destruction with lymphocytic infiltration[3]. Recurrent Parotitis occurs in children, more in boys than girls, presenting with sudden unilateral or bilateral parotid swelling, mild pyrexia may be present along with leucocytosis[1,3,5]. Sialography is utilized usually in parotid gland for detection of sialectasis[1]. USG is used for follow up of cases of sialadenitis as it avoids radiation and precludes use of sialography especially in children[1]. On ultrasound, inflamed gland appears swollen with heterogeneous appearance and multiple hypoechoic foci within. Reactive lymph nodes are seen in neck. Intraglandular lymph nodes develop as gland becomes encapsulated before lymph node development occurs embryologically[1]. Differential diagnosis is Sjogren's syndrome.[1]

iii) Sjogren's syndrome is a lymphocyte mediated exocrine glandular destruction leading to xerostomia, keratoconjunctivitis sicca and bilateral parotid swellings, it is supposed to be autoimmune disorder, occurring in women greater than 50 years age.[2,3] Diagnosis is done by sialography showing ductal ectasia[3]. Treatment is symptomatic[3].

iv) Granulomatous diseases which affect salivary glands are tuberculosis, actinomycosis, sarcoidosis, uveoparotid fever (Heerfordt's syndrome) which has sarcoidosis lung disease, uveitis, parotid swelling and facial palsy[3]. Sarcoidosis is a multisystem Granulomatous disease seen in adults. It may be associated with arthritides, interstitial pneumonia, dry skin, Raynaud's phenomenon, hepatosplenomegaly, achlorhydria, genital dryness and pancreatitis.[2,3] Though rare worldwide, it is seen in some areas of India in Western Maharashtra and Goa according to our past clinical experience. It involves parotids as well as lacrimal glands.[2] Laboratory tests reveal raised ACE levels[2]. Uveitis and cranial nerve palsy is common[2].

v)Viral infections affect 4- 6 years age group and mumps is common cause of viral parotid adenitis with incubation period of 2-3 weeks, clinically presenting as pain, swelling more on both sides, fever, malaise, myalgia, and headache. Salivary gland inclusion disease (cytomegalic inclusion disease) involves newborns lead to mental and physical retardation, hepatosplenomegaly, jaundice and purpura[3].

4) Trauma to salivary glands[3]
Penetrating injuries lacerate the glands and duct. It can lead to salivary -cutaneous fistula, which can be diagnosed by sialography. Facial nerve injury can occur with transection of nerve or its branches. Blunt trauma leads to contusion, edema, and hemorrhage in gland. This episode ends in fibrosis and scarring of gland, duct obstruction and cosmetic deformity.

5)Sialadenosis[3] is a nonspecific entity used to describe a non-inflammatory non-neoplastic enlargement of salivary gland usually involving parotid gland like in obesity, diabetes mellitus, hypertension, malnutrition, pellagra, alcoholic liver cirrhosis, beriberi, kwashiorkar, hypovitaminosis A, celiac disease, uremia hypothyroidism etc.

6) Ranulas [2] are mucous retention cysts of salivary glands in the floor of mouth. If they are confined to sublingual space, they are called as simple ranulas whereas if they extend below the mylohyoid muscle into submandibular space, they are termed as plunging ranula or diving ranula[2]. Plunging ranulas lack true wall, are usually unilocular but can get infected. Differentials include thyroglossal cyst, dermoid cyst, epidermoid cyst and venolymphatic malformation[2].

7) Salivary gland neoplasm represents less than 3% of all tumors[3]. Neoplasms usually require surgical resection whereas the rest require conservative therapy. In malignant neoplasm, usually facial nerve preservative surgery is done, followed by postoperative radiotherapy[3]. About 75 to 85% of all neoplasms occur in parotid glands. It is worthwhile to note that about 80% of parotid neoplasm, 65% of all submandibular gland neoplasm, and 80% of all minor salivary glands neoplasm, 20% of all sublingual glands neoplasm are benign in nature as revealed in one literature[3]. 80% of parotid gland tumors occur in inferior aspect of superficial lobe of gland, so any subcutaneous mass in the region of inferior attachment of the ear, should be considered as suspicious as neoplasm.[3] Risk factors for salivary gland neoplasm are 1) prior irradiation 2) prior Ca breast[3]. Treatment depends on histological and clinical staging of lesion and usually less aggressive surgical procedures are used with liberal use of postoperative radiotherapy[3].

Various salivary gland tumors are as follows:-
a) Pleomorphic adenoma is a benign neoplasm commonly affecting parotids, of all benign tumors pleomorphic adenoma is most common (80%). It is reported in middle aged adults seen as asymptomatic palpable mass[2]. Lesion is well circumscribed usually round or oval or lobulated mass seen in superficial lobe of parotid gland[2]. Pleomorphic adenoma called also as mixed tumor seen as on ultrasound as a solid homogeneous hypoechoic lesion with sharp margins and posterior acoustic enhancement, without any adenopathy[5]. It is benign slow growing tumor and on Doppler shows typical peripheral 'basket ' like pattern of flow. They tend to recur locally after resection[5].

b) Warthin's tumor is also called as papillary cystadenoma lymphomatosum[2]. It is second most common tumor and seen in middle aged men. It can be multifocal and bilateral, well circumscribed lesion with solid and cystic components[2]. It forms about 6 to 10% of all salivary gland neoplasms. On ultrasound, it appear as an echopoor lesion with sharp margins but less homogeneous than pleomorphic adenoma, having mixed appearance[5].

c**) Lipomas** have typical oval or ellipsoid shape with irregular margins and typical striped and feathery appearance on ultrasound[5].

d) Ca parotid malignant subtypes are:
1) **Mucoepidermoid carcinoma**, most common in parotid gland, seen as well defined to ill-defined mass with infiltrative appearance[2,5].

2) **Adenoid cystic carcinoma**, second most common aggressive infiltrative mass associated with perineural spread and can have facial neuropathy especially when deep lobe is involved[2]. Mucoepidermoid carcinoma of salivary glands has propensity to spread locally into adjacent tissues, whereas adenoid cystic carcinoma tends to infiltrate facial nerve and its branches[2,5].

3) **Undifferentiated salivary gland carcinomas** [5] tend to exhibit massive invasion of cervical spaces with large vessel encasement and are usually greater than 2 cm in size. They appear as heterogeneously hypoechoic lesions with irregular margins.

4) **Lymphoma** present as bilateral diffuse infiltrative pattern[2].

5**) Squamous cell carcinoma metastasis** from head neck region, skin melanoma leads to **intraparotid adenopathy[2].**

Minor salivary gland tumors[2]:-
Benign pleomorphic adenoma and malignant tumors like mucoepidermoid carcinoma can rarely develop in minor salivary glands of oral cavity and then can invade surrounding pharyngeal mucosal space. Usually they are ill-defined and heterogeneous lesions with cranial nerve involvements along skull base.

Role of ultrasound in salivary gland neoplasms is well established and is utilized to[5]:-
1) to confirm presence of the mass and determine whether it is intraglandular or extraglandular.
2) to determine the relationship of mass with facial nerve and major vessels.
3) to determine the nature of the mass, whether benign or malignant or something else.
4) to perform local staging of mass, detect any cervical adenopathy, local spread and invasion of surrounding structures.

The differentials of neoplasm include[2]:

1) **Intraparotid cyst**, they are branchial cleft cyst (type I), usually asymptomatic but can get infected presenting with tender palpable mass[2].

2) **Lymphoepithelial lesions** are benign cystic lesions seen in association with AIDS, presenting as bilateral parotid swelling due to lymphocytic infiltration of the glands and in Sjogren's syndrome. Associated lymphadenopathy is common[2].

3) Sjogren's syndrome is also characterized by dry mouth and bilateral parotid gland swelling.

Cervical phlegmon (Fascial space infections) involves subcutaneous fascial spaces and are pyogenic in origin, resulting from cutaneous head and neck infection, dental infection, or oropharyngeal cavity infections. It can lead to IJV thrombosis. On ultrasound, it is seen as echopoor fluid collections with ill-defined irregular margins extending through fascial and muscular planes associated with adenopathy.[5]

Now a word about lymph node assessment in neck[5]. We need to measure on ultrasound the longest and smallest diameter of node and determine roundness index (long/short axis). If ratio is less than 1.5 cm, it suggests a round shape, common in malignant nodes. A reactive or normal node has an elongated shape or oblong shape with an echogenic fatty hilum[5]. This hilum gets thinned out or is completely lost or destroyed in malignant or metastatic nodes. Some metastatic lymph nodes show extracapsular spread. On Doppler metastatic nodes have enhanced vascularity. Lymphoma has typical homogeneous deeply hypoechoic nodes and later due to chemotherapy related fibrosis show increased echogenecity[5]. Large cortical calcifications in nodes are seen in Granulomatous diseases like tuberculosis, sarcoidosis and metastatic nodes following radiotherapy[5].

Conclusion:

The present hospital based study based on records of non-antenatal ultrasound cases done in our tertiary care hospital in Srinagar Garhwal shows predominant presence of sialadenitis, salivary stone and ranula in the locals of hills of Garhwal with less incidence of malignant neoplasms. We found two benign tumors - pleomorphic adenoma and myolipoma both involving parotid gland. HRUS is now being used as first diagnostic modality of choice to investigate superficially located salivary gland diseases, as it is easily available and convenient to use and requires short time to scan with high patient acceptance. Main limitation is it cannot locate deep parotid lesions in parapharygeal spaces.

We can differentiate superficial lobe lesion of parotid gland from deep lobe lesions. Salivary calculi can easily be located and differentiation between intraductal versus intraglandular calculus or stones can be done which helps to decide mode of treatment like surgical removal of gland or ductal exploration to remove calculus. Local invasion by malignant lesion can be assessed as well as adenopathy can be ascertained for local staging. USG guided aspirations of intraglandular abscess can be performed along with guided fine needle aspiration cytology as well as biopsy by precisely targeting the lesion in the glands.

Table I- Breakup of Neck Ultrasound cases

Sr No	Total Neck USG studies performed	108	100% (percent)
1	**Salivary gland diseases**	24	22.2 %
2	**Thyroid gland diseases**	45	41.7%
3	**Rest of the neck pathological conditions**	39	36.1 % cases

Table II- Disease conditions affecting salivary glands (n= 24) as seen on Ultrasound (Rest of 84 cases of neck ultrasound had normal salivary slands.

Sr No	Salivary gland diseases found	Total cases(n= 24)
1	Sialolithiasis	07 (29.37%)
2	Sialadenitis	08 (33.3%)
3	Sialectasis	01 (4.2%)
4	Ranula	04 (16.3%)
5	Cervical adenopathy with fascial cellulitis	02 (8.4%)
6	Benign neoplasm	02 (8.4%)
7	Malignant neoplasm	01 (4.2%)

Table III: - Neck pathologies on ultrasound other than salivary gland diseases (n= 24).

S.No	Neck pathologies	Number of cases (108)
1	Thyroid gland diseases	45
2	Cervical lymphadenopathy	25
3	Non-Hodgkin's Lymphoma	01
4	Fascial space infections	05
5	Sternomastoid tumor	04
6	Benign cystic neck lesions	03
7	Lipoma	01
8	Brachial plexopathy	01

Table IV:- Salivary glands involved.

Sr No	Parotid gland cases	Submandibular gland cases	Sublingual gland cases
1(number)	09	11	04
2(percentage)	37.5%	45.83%	16.67%

Figure 1: Sonographic image of an intraparotid abscess seen as hypoechoic heterogeneous lesion in gland with irregular wall, internal debris and echoes suggesting anaerobic infection.

Figure 2: Ultrasound image showing three to four intraglandular ductal calculi in both submandibular glands seen as faintly reflective foci with shadowing with increased reflectivity of both the glands suggesting adenitis.

Figure 3: Sonogram showing a small intraparotid abscess in right parotid gland and enlarged right Kuttner's lymph node.

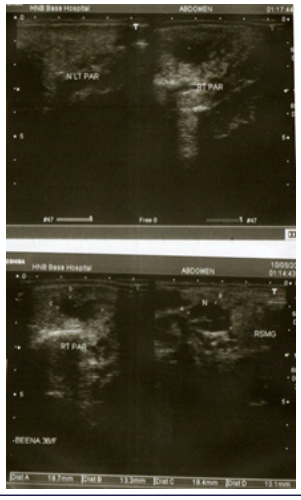


Figure 4: Ultrasonography showing small slightly hypoechoic right intraparotid lesion in a young adult male with oval shape, ill-defined margins and typical feathery pattern and having firm to hard consistency on palpation. (Lipoma)

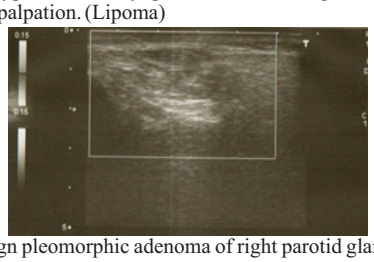
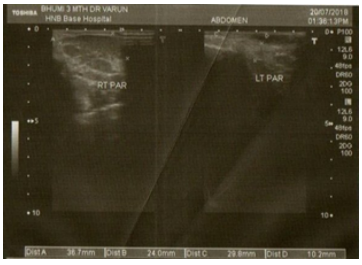


Figure 5: Benign pleomorphic adenoma of right parotid gland seen as a deeply hypoechoic lesion with well-defined margins with internal homogeneous mid-level echoes on ultrasound.

Figure 6: Ultrasound image of a young male showing an irregular hetero-echoic lesion involving right parotid gland with local muscle invasion of massetter and ipsilateral adenopathy.

Figure 7: Three months baby girl with right Parotitis on sonography.



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