Diagnosis and treatment of Salivary gland diseases, Halitosis

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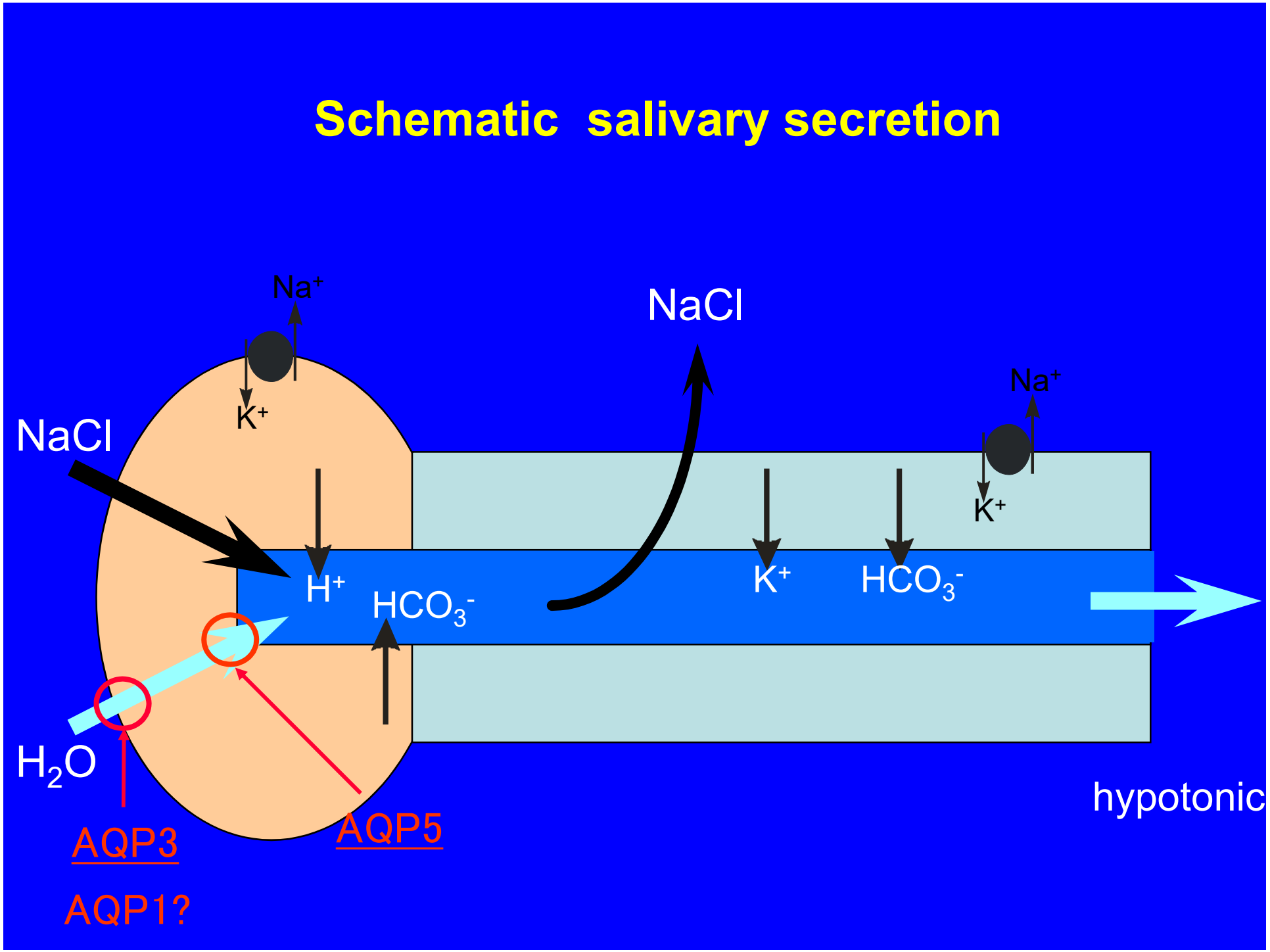
Salivary glands – Salivary secretion

- Unstimulated secretion:
  70% gl submandibularis, 30% gl parotis
- Stimulated secretion: Parotid secretion ↑↑ (can be more than the other glands!)
- Sublingual and minor sal. gl. Secretion remains always at a constant low level

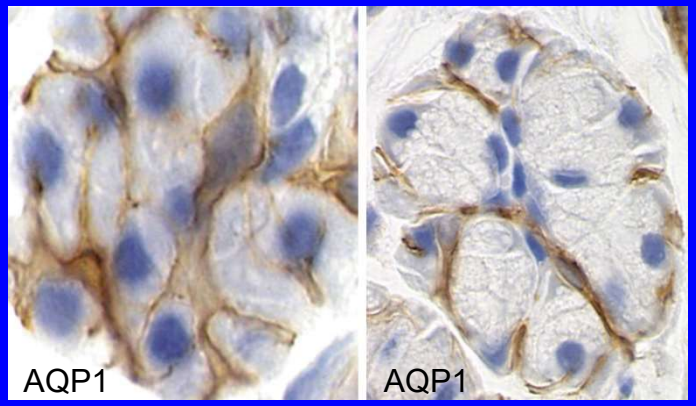
Minor salivary glands
Glandulae salivatorie minores

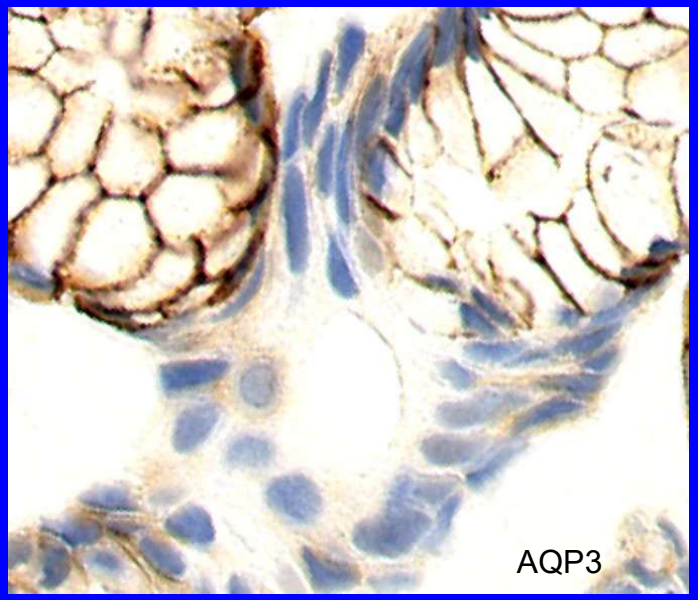
- Glandulae labiales (mixed seromucinous)
- Glandulae buccales (mixed seromucinous)
- Glandulae molares (mixed seromucinous)
- Glandulae palatinae (mucinous)
- Glandulae linguales (serous at the circumvallate papilla)

Schematic salivary secretion



Immunolocalization of AQP water channels in human salivary glands





Diagnostic process

- Anamnesis
- Physical examination
- Radiography
- Sialometry
- Sialochemistry
- Biopsy/histology

General Anamnesis

- Metabolism diseases
- Medication (Antihypertensive, Antidepressive)

Dental anamnesis

- Pain?
- Fever, Foetor ex ore?
- Swelling (Symmetry)?
- Consistency?
- Xerostomia?
- Taste disturbance?
- Sialorrhoea?
- Periodic complaints

Swelling with pain

- Acute sialoadenitis
- Sialolithiasis (Stimulation!)
- Mild pain: TumorS (Parotid)

Acute viral sialadenitis (Mumps)

- 90% Parotid
- rarely extraglandular:
  orchitis, meningoencephalitis, pancreatitis

Acute bakterial infections

Obstructive Diseases

- sudden
- Mainly in the submand. gland
- Complication: bakterial infektion

Swelling without pain

- Tumors!!!! (malign, bening)
- Iodine, lead, mercury toxicosis– bilateral swelling without pain
- Sialadenitis chronica
- Sjögren-syndrom (uni oder bilateral)

- Superinfektion might occur at hyposalivation!

Dysfunction of salivary glands

- Hypersalivation
- Hyposalivation
- Xerostomie

Hypersalivation

Drooling or ptyalism or sialorroea: is caused either by

- increased salivary flow that cannot be compensated for by swallowing,
- poor oral and facial muscle control in patients with swallowing dysfunktion
- anatomic or neuromuscular anomalies.

Sialometry: non stimulated > 1 ml/min, stimulated > 3,5 ml/min

Hyposalivation

- Unstimulated: <0,1 ml/min
- Stimulated: <0,5 ml/min

Causes of salivary hypofunction

I. ***Water- and electrolyte loss***

(sweating, vomiting, diabetes mellitus)

II. Salivary gland damage

(salivary gland diseases, radiotherapy, autoimmune diseases, e.g. Sjögren, SLE, RA, scleroderma, cysticus fibrosis, HIV, aging)

III. Innervation problems of salivary glands

(medications, Alzheimer-disease, psychiatric diseases)

Xerostomia

Xerostomia is a subjectiv complain,it meens, that the patient has a feeling of dry mounth.

This subjectiv sense may be due:

- Reduced salivary flow
- Changed salivary composition

Diseases of the salivary glands

I. Inflammatory diseases
II. Cysts and cysts-like lesions
III. Tumors
IV. Sialadenosis
V. Diseases of minor salivary glands

I. **Inflammatory diseases**
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Inflammatory diseases

1. Acute bacterial salivary gland infektions
2. Viral salivary gland infektions
3. Chronic bacterial infektions
4. Sialolithiasis – obstructive sialadenitis
5. Chronic sclerosing sialadenitis of the submandibular gland (Küttner Tumor)
6. Immunsialadenitis
7. Radiation injury of the salivary glands

1. Acute bacterial sialadenitis

- In the parotid gland is common
- The major cause of ABS is a retrograde bacterial infektion
- Most common is in elderly and immuncompromized patients.

Background

- Classic risk factor is the hospitalized patient who recetly underwent surgery with general anaesthesia. Dehydration may exacerbate this condition – decreased salivary flow, stasis.
- Medikations and comorbid diagnoses may also contribute to this problem. (Diuretics, tricyclic antidepressants, antihistamines, barbiturates, antihypertensives, anticholinergics)

- Responsible bacteria : Streptococcus species, Staphylococcus aureus, E. coli, Pseudomonas aeruginosa, Haemophylus influenzae.

Diagnosis

- A thorough history and physical examination followed by laboratory and radiographic corroboration.
- Abrupt history of painfull swelling – often displacing of the earlobe
- Tenderness on palpation
- The overlaying skin is redenned
- Intraorally: the Stenon duct is inflamed
- Milking the gland may produce pus
- Constitutional symptoms: fever, chills, failing

Infektion: retrograd, sometimes haematogene or lymphogene

- **Laboratory values:** Leukocytosis with left shift, elevated haematocrit, CRP and ESR.
- **Mikrobiology**: culture and sensitivity
- **Radiographic assesment**: plain radiography, CT, MRI, in case of intra-parotid abscess: ultrasound for incision and drainage.

Therapy

- In easy cases: stimulation of salivary flow (digital massage, lemon, chewing gum, sugarless candy), adequate hydratatation
- Early species specific antibiotic therapy (anti-staphylococcal penicillin or a first generation cephalosporin), in elderly, and debilitaded patients intravenous antibiotic therapy should be instituted.
- In some cases: extraoral incission and drainage – guided by CT scans (Injury of the facial nerv!)

2. Parotitis epidemica

Pathogenic agent:

Paramyxovirus (RNA virus)

- This is an acute, nonsuppurativ communicable disease
- often occurs in epidemics during the spring and winter mounth.
- Latent period is 5 to 24 days.

Symptoms

- Typically the patients suffer an acute onset of painful salivary swelling, bilaterally, (in the early stages only one parotid gland may be involved) – eminence of the earlobe
- The swelling persists for about 7 days
- Fever, chills, headache
- Relative leukocytosis in blood count
- Diagnosis can made by demonstrating complement-fixing soluble antibodies to the nucleoprotein core of the virus.

Treatment

Supportive:

- Bedrest
- Proper hydration
- Dietary modifikations to minimize glandular activity
- Analgetics
- Antipyretic agents

Life-term immunity after the infektion

Complications

- Meningoencephalitis,
- Epididymitis,
- Orchitis,
- Pankreatitis,
- Hearing impairment

Active immunization is possible .

Viruses may causing viral parotitis – chronic immunsialadenitis

- Coxackie
- HIV
- Cytomegaloviruses

3. Chronic bacterial infektions

- Etiology and pathogenesis: congenital secretorial disturbance, abnormal duct system
- Fluctuant fever, palpation of the glands is hard, and they are swollen between the acute periods.
- The main pathogens are Staphylo- and Streptococci, in some cases tuberculosis may be responsible.

- The result is scarring in the gland with a marked reduction of salivary flow.
- Pus is rarely observed.
- Rule out the presence of a sialolith is very important!
- Sialographie: dilatation of glandular ducts, accumulation of saliva

Treatment

- Culture specific systemic antibiotics
- Ductal antibiotic irrigations during periods of remission
- Analgetics
- Avoidance of dehydration and antisialogogue medications
- In some therapy-resistent cases: nerve sparing parotidectomy

Chronic recurrent juvenile parotitis

- This is commonly noted prior to puberty
- 10 times more common in children than in adults
- CRJP is manifested by numerous episodes of painful enlargements
- Many cases will be resolved prior to the onset of puberty, such that conservative measures are recommended – long term antibiotics and analgesia,
- In some cases spontaneous regeneration of salivary function has been reported.

4. Obstruktive Sialadenitis Sialolithiasis

This is a relativly common disorder, characterized by the development of calculi, represents more than 50% of major salivary gland disease, and it is the most common cause of acute and chronic salivary gland infektions.

Sialadenitis and sialolithiasis go hand in hand…

Sialolithiasis

Epidemiologie:

It occurs more often in males, with a peak age of occurence between 20 and 50 years of age.

The submandibular gland is the most common site of involvement (80 to 90%) The parotid gland is involved in 5 to 15% of cases,and 2 to 5% of cases occur in the sublingual or minor salivary glands.

It is believed that the higher rate of sialolith formation in the submandibular gland is due to:

- the torturous course of Wharton's duct
- higher calcium and phosphate levels, and
- the dependent position of the submandibular glands, which leave them prone to stasis

Pathophysiology

- Sialolithiasis results from the deposition of calcium salts within the ductal system of salivary glands.
- They are comprised primarily of calcium phosphate with traces of magnesium and ammonia with an organic matrix consisting of carbohydrates and amino acids.
- Stagnation of saliva enhances the development of the sialolith.
- SM stones are located in the duct 75-85%.

Clinical Symptoms

- The magnitude of symptoms seems to vary according to the gland involved,and the location and size of the sialolith.
- Most commonly presents with painfull swelling.
- This is a spasmodic pain during eating.
- Purulent infektion may accompany sialolithiasis.

Diagnosis

Bimanual palpation of the floor of mouth may reveal evidence of a stone in a large number of patiens.

Plain radiography: Lower occlusal and oblique lateral or orthopantomogram may show submandibular calculi.

Calculi may not be radio-opaque. 20% of SM and 60% of P, and 80% of SL stones!

Indirekte examination : **Sialography:** it is not commonly use, because it may cause pain or sialadenitis.

Ultrasound, MRI may be helpful .

Treatment

- General principles include conservativ measures: effectic hydration, the use of heat, gland massage , sialogogues.
- In case of inflammation: antibiotics.
- In case of inrtaductal stones: Transoral sialolithotomy with or sialodochoplasty (it permits shortening the duct and enlargement of salivary outflow)
- Sialoliths located within the submandibular gland or its hilum are most commonly managed with gland excision.

New technics: lithotripsy:

- Extracorporeal sonographicaly controlled lithotripsy
- Intracorporeal endoscopically guided lithotripsy

5. Chronic sclerosing Sialadenitis of the submandibular gland

- Synonym: Küttner-Tumor
- Etiology: an initial disturbance of secretion with an obstructive electrolyte sialadenitis with an immun reaction of the salivary duct system.
- Currently: it is not just a solitary tumor of sbm. gland, but a more systemic IgG related disease – may be treated by steroids to prevent other complikations.
- Enlarged, unilateral, hard, painlass salivary gland, with decreased salivary flow.

6.Immunsialadenitis

Inflammatory autoimmun disease

- Sjogren syndrom is belived to affect 0.2-3.0% of the population.
- It predminatly occurs in women between 40 and 60 years of age with a 9:1 female:male ratio.of first
- Because of the insidious onset of symptoms, an average time of 10 years occurs between the development of first symptoms and the diagnosis of the disease.

Primary Sjögren syndrome

- Uncommon
- Dry eyes, dry mouth
- No releted connective tissue disease
- Sometimes termed „sicca syndrome”

Secondary Sjögren syndrome

- More common
- Dry eyes and dry mouth are seen together with other autoimmune diseases:
  - Rheumatoid arthritis
  - Systemic LE
  - Polymiositis
  - Mixed connectiv tissue disease

Clinical manifestations

Most patients with SS develop symptoms related to decreased salivary gland and lacrimal gland function.

- They generally complain of dry eyes, sandy or gritty feeling under the eyelids.
- Eye fatique, encreased sensitivity to light
- The second principal symptom is xerostomia – burning oral discomfort, difficulty in chewing and swallowing dry foods, changes in taste, inability to speak longer than several minutes.
- Bilateral painless parotid gland enlargement
- Accelerated development of dental caries

Investigations in Sjogren syndrome

- **Sialometry**: reduced salivary flow rate
- **Lacrimal-flow**: reduced on Schirmer –test
- **Autoantibodies:** (ANA, RHF, SS-A, SS-B)
- **Ultrasonograhy** : low echogenicity
- **Salivary gland biopsy:** (focal lymphocytic infiltrate, acinar atrophy, fibrosis)
- **Sialography:** - sialectasis

Laboratory evidences

- Increased ESR
- Leukopenie
- CRP is normal
- antinuklear antibodies (ANA)
- Special antibodies of ANA: SS-A or Ro-antibody, SS-B-La-antibody, rheumatoid factor may be positiv.

European diagnostic criteria

I . Dry eyes

II. Dry mouth

III. Keratoconjunctivitis sicca

IV. Focal sialadenitis also in the minor salivary glands

V. Salivary gland infection

VI. Autoantibodies

Diagnosis is based on the presence of 4 criteria from above

Treatment

- Collaboration with internist, immunologist, rheumatologist…
- Only symptomatic treatment is available….
- Effectiv hydration is necessary.
- Dietetic guidance – no alkohol, coffeine, spicy foods
- High level oral hygienie
- Arteficial saliva equivalent
- Ernährungsberatung – kein Alkohol, koffeinhaltiges Getränk, pikantes, scharfes Essen vermeiden, u
- Künstliche Mundbefeuchtung

Prognosis

The progression is irreversible, we can make only **symptomatic treatment.**

7. Radiation injury

- There is no universal agreement over the dose required to produce xerostomia.
- The serous cells found in the parotid gland are extremly sensitive to apoptotic death following even moderate doses of radiation.

- The effects of radiation damage are difficult to treat or reverse so much effort has been aimed at prevention:
- 3-D conformal planning
- Intensity-modulated radiation therapy
- Drugs: growth factor, cholinergic agonists, cytoprotective agents.

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Ranula

Clinical term for a pseudocyst that is associated with mucus extravasation into the surrounding soft tissues. These lesions occur as the result of trauma or obstruction. Ranulas are mucoceles that occur in the floor of the mouth and usually involve the sublingual glands.

Specifically, the ranula originates

- in the body of the sublingual gland,
- in the ducts of Rivini of the sublingual gland

They are most common in young people.

Treatment

Marsupialisation (*'*unroofing' the *cyst* and tacking the edges of the *cyst* to adjacent tissue), *excision of the ranula* alone and *excision of the sublingual gland* combined with the *ranula.*

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Tumors

- Benigne neoplasms
- Malignant neoplasms

Pleomorphic Adenoma

- Benigne mixed tumor is the most common salivary gland neoplasm, representing 35% of all salivary gland tumors.
- 50% of all Parotistumors, , 85% of benigne Parotistumors are Pleomorphic adenomas.
- Middle aged women patients are the target group.

- This tumors are growing slowly.
- 60% of them are localized in the lateral part of the parotid gland.
- Tumors with inward accession are called Eisbergtumor.
- In this case the swelling appears on the pharynxwall or on the palate.

PA exhibits wide cytomorphologic and architectural diversity. The tumor has the following 3 components:

- An epithelial cell component
- A myoepithelial cell component
- A stromal (mesenchymal) component

Identification of these 3 components, which may vary quantitatively from one tumor to another, is essential to the recognition of pleomorphic adenoma.

Monomorphic Adenoma

- All nonpleomorphic adenomas
- 15% of benigne salivary tumors
- Clinical signs, diagnostic and treatment - as the pleomorphic adenoma
  - **cystadenolymphoma**
  - **onkocytoma**

Malignant tumors– 1% in the head and neck region

Normal salivary glands are made up of several different types of cells, and tumors can start in any of these cell types. Salivary gland cancers are named according to which of these cell types they most look like when seen under a microscope.

25-30% of salivary gland tumors are malignant..

- **Mucoepidermoid carcinomas** are the most common type. Most start in the parotid glands. These cancers are usually low grade, with a much better prognosis than high-grade ones.
- ***Adenocarcinoma*** is a term used to describe cancers that start in gland cells (cells that normally secrete a substance):
- **Acinic cell carcinomas** start in the parotid gland. They tend to be slow growing and tend to occur at a younger age than most other salivary gland cancers. They are usually low grade,

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Sialadenosis

- Uncommon, benign, non-neoplasmatic, non inflammatory, bilateral, symmetrical painless general enlargement of salivary glands.

Etiology

- Malnutrition – achalasia, bulemia, alcoholism
- Hormonal problems – sex hormons, diabetes, thyroid diseases, adenocortical disorders
- Neurohumoral - peripherial neurohumoral sialosis or central neurogenous sialosis
- Dysenzymatic – hepatogenic, pancreatogenic, nephrogenic, dysproteinemic
- Drug induced – sympathomimetic, antithyroid drugs

Clinical manifestation

- Sialosis is characterised by chronic, afebrile, slowly groving salivary enlargement
- This disease is limited to the major salivary glands

Treatment

- Treatment of the underlying disease
- Symptomatic treatment – arteficial saliva

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- Mucoceles
- Stomatitis nikotina palati
- Cheilitis glandularis
- Necrotizing sialometaplasia

Mucoceles

Cystic leasions of minor salivary glands

Pathogenesis: is caused

- by trauma of the duct (extravasation mucocele),
- by saliva retention (retention mucocele).

TH: surgical removal

Stomatitis nikotina palati

Specific white lesion with red spots, that develops on the hard and soft palate in heavy cigarette, pipe and cigar smokers.

It is completly reversible once the habit is discontinued.

Cheilitis glandularis

- CG is characterized by progressive enlargement and eversion of the lower labial mucosa that results in obliteration of the mucosal-vermilion interface. With externalization and chronic exposure, the delicate lower labial mucous membrane is secondarily altered by environmental influences, leading to erosion, ulceration, crusting, and, occasionally, infection.
- Praecancerous lesion

Necrotizing sialometaplasia

- It can be seen in any of the salivary glands but is most commonly diagnosed in the minor salivary glands of the palate.
- It is a spontaneous lesion. Causes: local ischemia with secondary necrosis of the gland, or may be secondary to trauma or surgery.
- Biopsy will often be required to rule out malignancy.
- Healing may take 2-3 months.

Halitosis

Foetor ex ore – oral malodour means exhaling ill-smelling chemical compounds from the oral cavity.

Diagnostic terminology

- **Genuine halitosis**: objectively confirmed malodour. There are two types: the physiological halitosis and the pathological halitosis.
- **Pseudohalitosis**: there is no objectively confirmed breath odour.
- **Halitophobia**: some patients never doubt they have oral malodour. They may have latent psychosomatic illness tendencies, they need special psychiatric treatment.

Physiological halitosis

- Morning breath – consequence of low salivary flow and oral cleansing during sleep.
- Eating various foods (garlic, onion, cabbage, cauliflower, some spices, etc.)
- After smoking, drinking alcohol
- In use of certain drugs (amphetamin, dimethyl sulpoxide , disulfiram, nitrates and nitrites, etc.)
- In the ovulation phase of the menstrual cycle
- In starvation
- In desiccation of the mouth

Pathological halitosis

Oral causes

- More than 85% of cases are due to oral causes.
- The aetiology is from anaerob bacteria, and from their metabolic product.
- There may be local or systemic aggravating conditions.

Systemic causes

- Respiratory disease: , infection of respiratory tract, paranasal sinuses, bronchiectasis, tumours, insertion of foreign bodies.
- Gastrointestinal disease: reflux, Helicobacter.
- Metabolic disorders (diabetic ketosis, hepatic failure, renal failure)

Aetiology of oral halitosis

- Poor oral hygiene
- Gingivitis (especially necrotizing gingivitis)
- Periodontitis
- Pericoronitis and other types of oral sepsis
- Infected extraction socket
- Residual blood postoperatively
- Debris under bridges or appliances
- Ulcers
- Dry mouth

Micro-organisms in pathogenesis (responsible anaerobes)

- Porphyromonas gingivalis
- Prevotella intermedia
- Fusobacterium nucleatum
- Bacteroides forsythus
- Treponema denticola
- and others…

Chemicals that cause the malodour

- Volatile sulphur compounds (VSCs) (mainly methyl-merkaptan, hydrogen-sulphide, dimethyl sulphide)
- Volatile aromatic compounds (indole, skatole)
- Polyamines (putrescine and cadaverine)
- Short-chain fatty acids (butyric, valeric, acetic and propionic acids)

Treatment

The management of halitosis includes the following:

- After the correct diagnosis we should treat the cause of the probleme.
- Medical help may be required to manage patients with a systemic background to their complaint.
- Patients with halitophobia may need psychological specialist.

Ensuring good oral hygiene

We need the cooperation of our patients. We should educate them.

- Professional cleaning in the office
- Improving individual oral hygiene (Brushing, using dental floss, interdental brushes, etc.)

Tongue cleaning

The top surface of the tongue can be cleaned using a toungue cleaner or a toothbrush for removing the bacterial build-up, food debris, funghi and dead cells.

Using oral healthcare products

- Mouthwashes reduce the amount of oral bacteria, they are antiseptic.
- Mouthwash containing alcohol may cause xerostomia.
- Zinc as an active substance may neutralize VSCs.
- Mouthwashes containing Chlor-dioxide may help in 3 steps:
  - They are antiseptic
  - They can neutralize VSCs
  - Free oxigen molecules may worsen the prolification of the anaerob microbes

Further treatments to do

- Periodontal treatment if necessary (from the cleaning of the subgingival pockets to the high-level periodontal surgery
- Extraction of the hopeless teeth
- Removing caries lesions
- Changing the old fillings, crowns, bridges and protheses

How to moderate aggravating factors

- Eating regular meals and finishing meals with fibrous fruits ans vegetables
- Avoiding foods, such as onions, garlic, cabbage, cauliflower etc.
- Avoiding smoking and drinking alcohol
- Reducing xerostomia