


# Maxillofacial Infections

MAGDALEN FOO

DISCIPLINE LEAD ORAL MAXILLOFACIAL SURGERY

# Maxillofacial infections

- Immunology and pathology of infectious disease
- Bacterial and non-bacterial microbiology
- Laboratory diagnostics – identification and antimicrobial susceptibility
- Anatomy of fascial spaces
- Diagnostic imaging (plain film, CT, MRI, Ultrasound)
- Principles of antimicrobial and surgical management

# Maxillofacial infections

Objectives:

1. Recognise clinical features of odontogenic infection – anatomical spread, time scale, signs of inflammation and treatment
2. Distinguish clinical pattern of infection of dental origin from infection of salivary glands, sinuses, skin, eyes and ears
3. Predict the likely course of behaviour of an infection and distinguish unusual presentations and elect to investigate them further

# Maxillofacial infections

Objectives:

4. Select cases requiring surgical treatment

5. Select cases requiring antimicrobial therapy and suggest a regime

6. Appropriately refer cases requiring inpatient treatment and suggest what that treatment would be

# Acute infections

- Acute infections of the oral maxillofacial regions due to pathogens e.g. bacteria, viruses and fungi
- Surgical infections mainly due to bacteria infection
- Organisms vary in their virulence and divided into

- Commensals
- Potential pathogens
- Pathogens

# Commensal organisms

May become pathogenic by *change of site* or *host resistance* e.g. age, concurrent disease, immunosuppressants, chemotherapy, radiotherapy

# Spread of infection

- Once established, infection may spread, depending on host factors and pathogen factors
- Local anatomy important host factor in the direction of spread
- Three serious sequelae of spread of infection in the oral maxillofacial region

- Airway obstruction, intracranial spread, septicaemia

- Infection spread by

- Tissue planes and spaces, lymphatics, blood

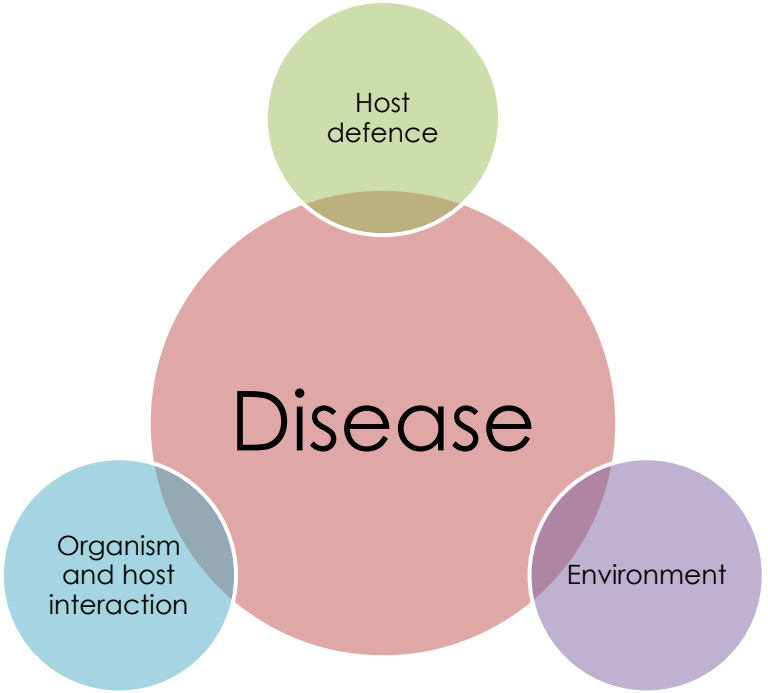
# Immunology of infections

3 factors to consider

Host - humoral and cellular immunity

Environment -

Organism - virulence, quantity



# Host-microorganism interactions

- Initial contact between host and microorganism will usually result in transient relationship where the organism is eliminated by host defences
- If the organism find the host suitable for growth, they may cause an infection
- Host may eliminate the organism or host may die
- Infections can be caused by commensal organisms or invasion by exogenous organisms
- If organism moves from its usual site to an unaccustomed site, it can behave as a pathogen e.g. 'normal' inhabitants of the oral cavity moving into deeper soft tissues or bone, causing infection

# Host-microorganism interactions

- Infections results from disruption of the normal flora
  - use of antibiotics,
  - Immunosuppression
  - Chemotherapeutic agents
- Individuals susceptible to infections that are opportunistic or minimally pathogenic e.g. viridans streptococci causing sepsis in patient with neutropenia
- Infections may occur when natural defences compromised e.g. burns patients
- Oral microorganisms (commensals) enter the circulation and lodge on prosthetic heart valves

# Effects of infection on host

- Non-specific effects
  - *Inflammation*
- Specific effects
  - Release of toxins or inducing altered host inflammatory response

# SIRS and sepsis

- Systemic inflammatory response syndrome (SIRS) in response to severe clinical insults manifested by
  - Temperature >38 or <36 degree Celsius
  - Heart rate >90 beats/min
  - Respiratory rate >20 breaths/min
  - WBC >12,000 <4000 per mm3
- Sepsis is systemic inflammatory response, to a documented **infection**
- Severe sepsis occurs with associated **hypotension, hypo perfusion or organ dysfunction**

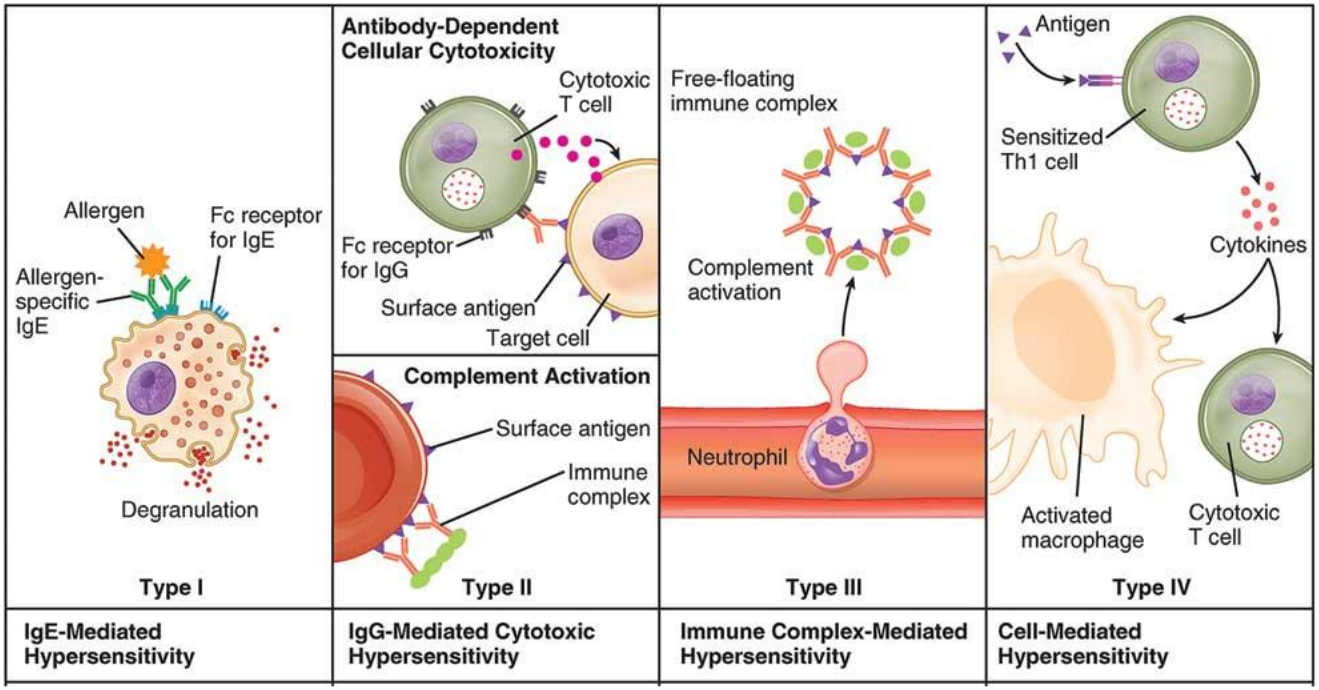
# Mechanisms of immunological injury

Immune response exists to protect the host. However its effects are not always beneficial to the host.

Immunological injury can be immediate or delayed.

- Type I reaction (anaphylactic)
- Type II reaction (cytotoxic antibody)
- Type III reaction (immune complex)
- Type IV reaction ( delayed type hypersensitivity)

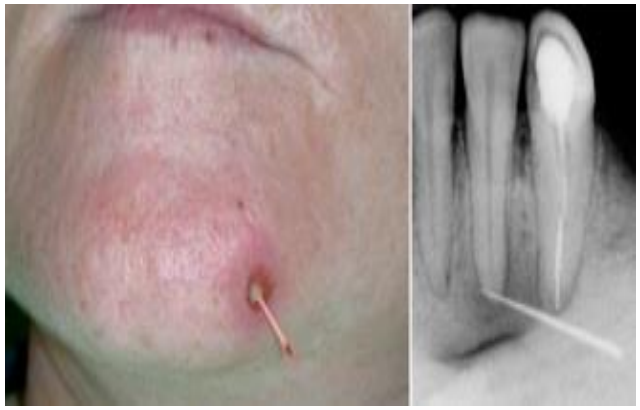
# Mechanisms of immunological injury



# Maxillofacial infections

- Dental pulp
- Periodontium
- Odontogenic infections of fascial spaces
- Osteomyelitis of the jaws
- Salivary gland infections
- Infections of the facial skin and scalp
- Orbital infections
- Infections of the ear and mastoid
- Nasal and Para-Nasal Sinus infections
- Oropharyngeal and Tonsillar infections

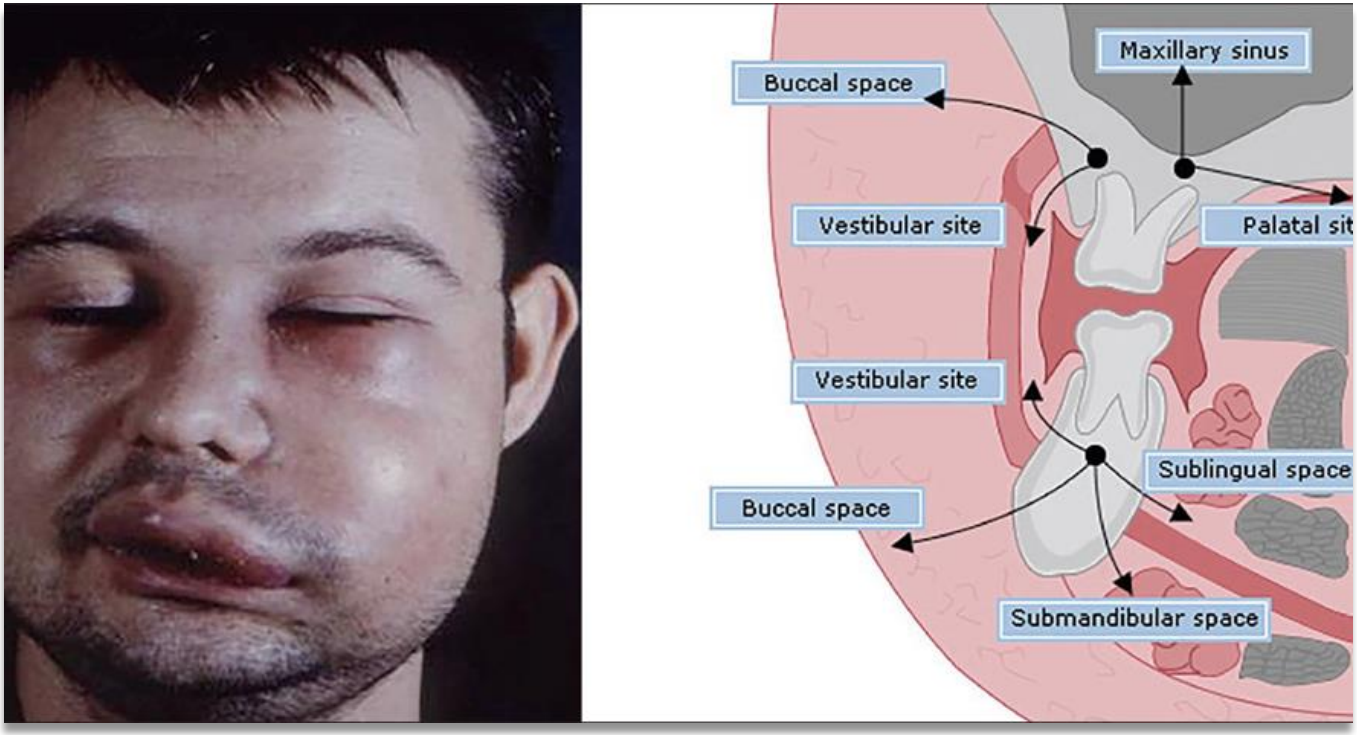
# Infection of dental pulp and periodontium











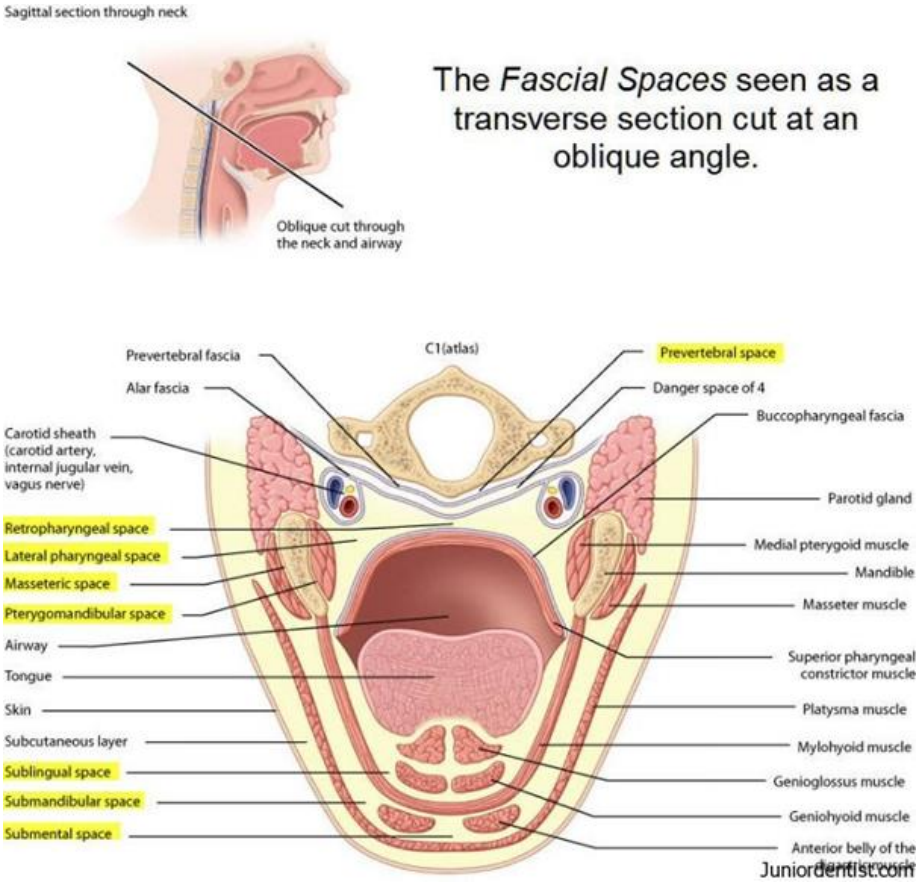

# Fascial spaces

Potential spaces between layers of fascia that do not exist in healthy individual but become filled during infections

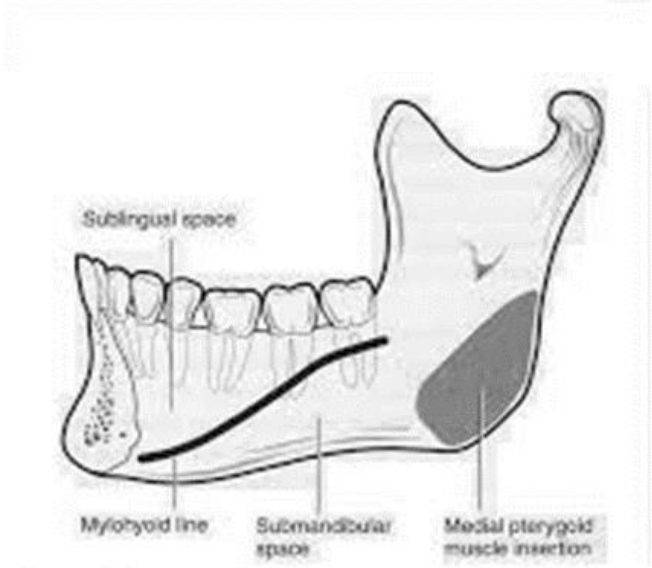
Spaces have boundaries formed by muscles, fascia, periosteum, bone, mucous membranes

# Fascial spaces

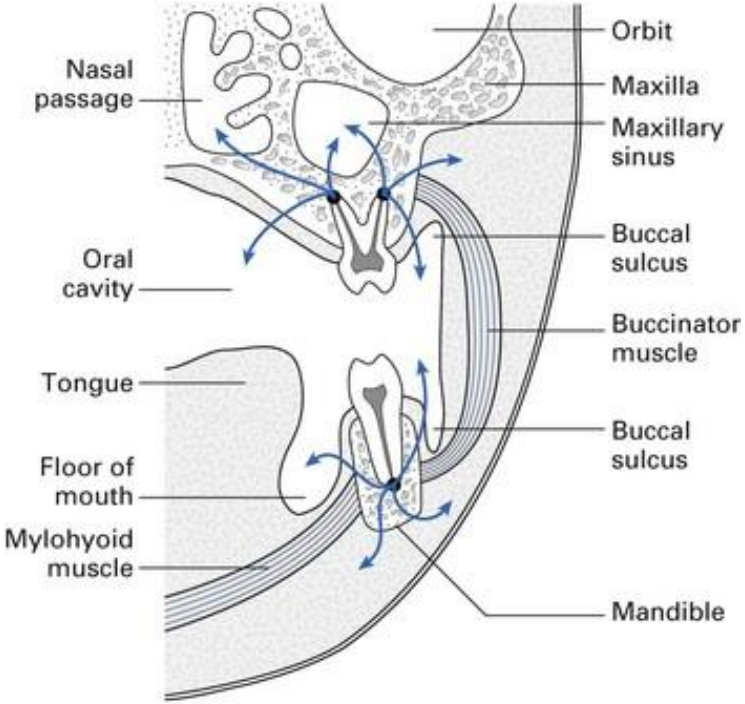
- Infection in these spaces may progress from superficial infection to cellulitis to the formation of an abscess requiring immediate drainage
- Spread of infection between spaces depends on anatomic location



# Spread of odontogenic infection




Floor of the mouth divided by *mylohyoid muscle* into ***Sublingual Space*** above and ***Submandibular Space*** below (note the relationship of the *Mylohyoid Line* to the apices of the mandibular teeth).



# Maxillary periapical abscess



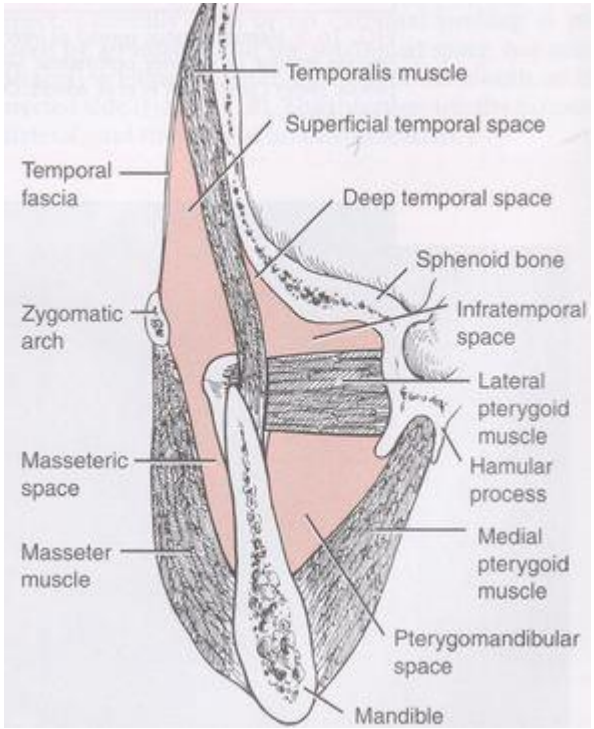




# Infratemporal space infection



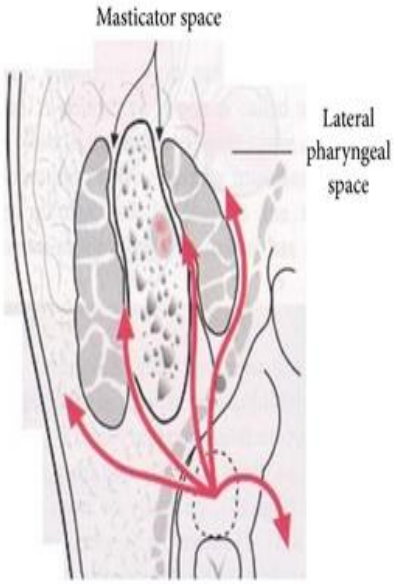
# Temporal space infection

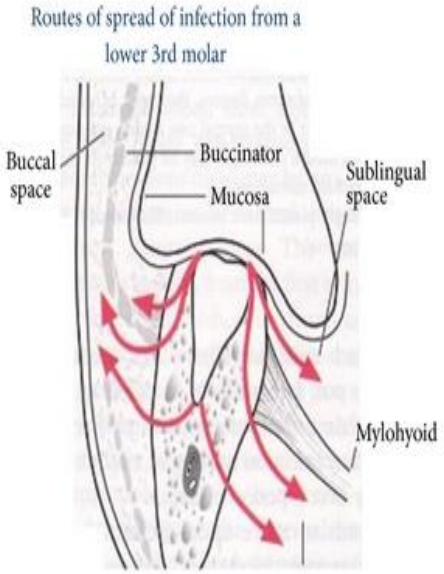




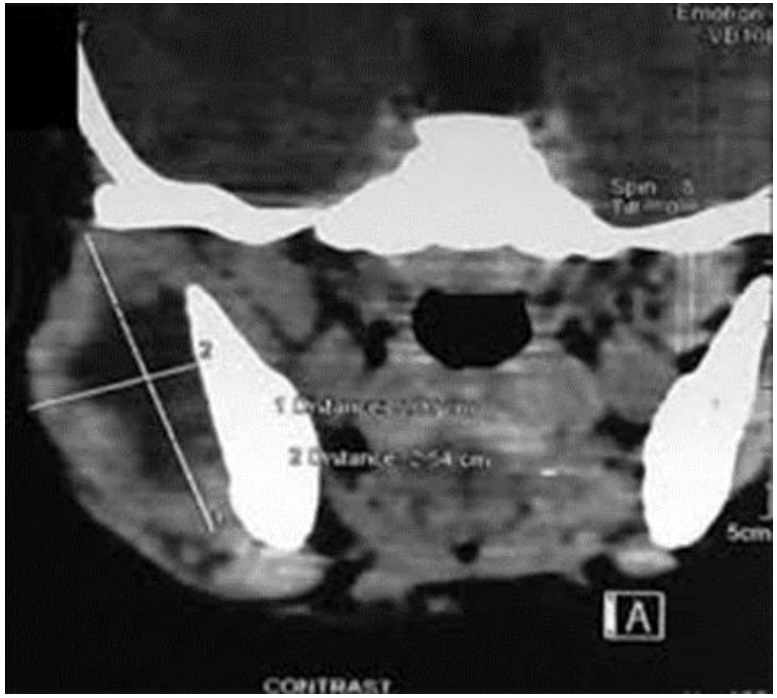

# Pericoronitis

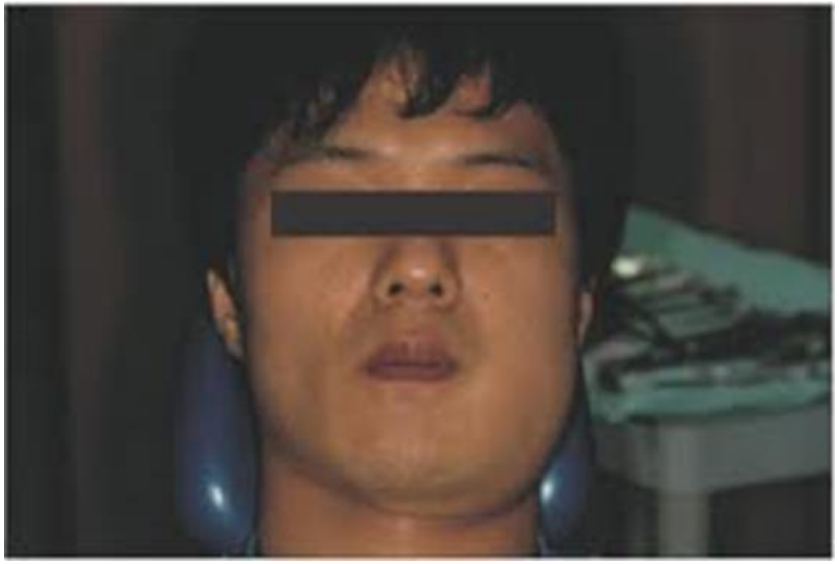




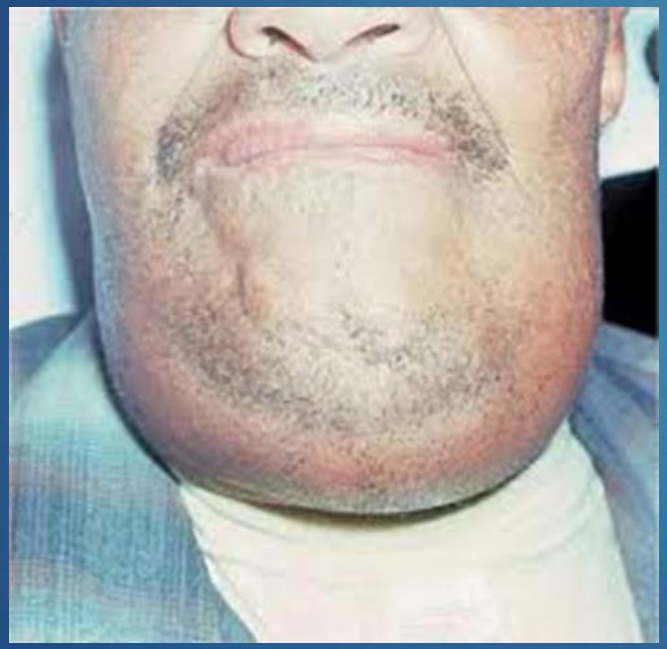



# Submasseteric space infection



# Deep neck space infections



- Commonly from septic focus of mandibular teeth, tonsils, parotid gland, deep cervical lymph nodes, middle ear, or sinuses
- Submandibular space, lateral pharyngeal space, retropharyngeal space
- Relatively uncommon in the post antibiotic era
- Can progress to life-threatening complications due to proximity to airway and potential spread into carotid sheath, cavernous sinus, cranium and mediastinum

# Cervical fascia

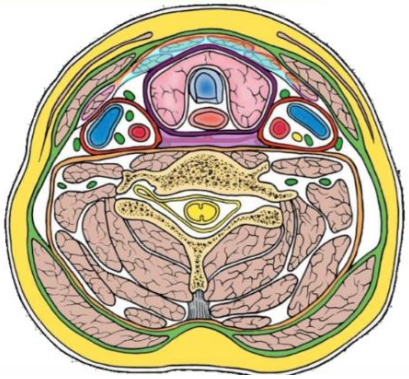
**Neck fascia** — Clinical concerns

**Infections:**

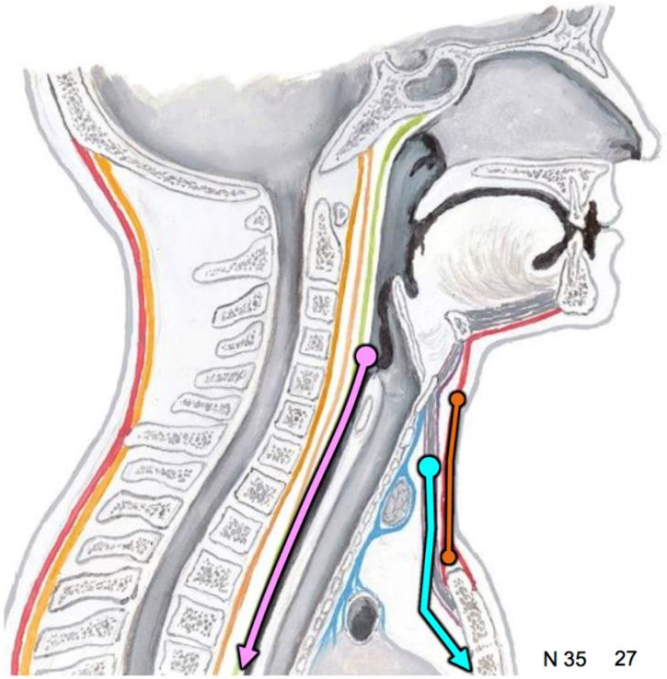
***between investing & muscular pretracheal***
**-typically stops at manubrium**

***between investing & visceral pretracheal***
**-will likely spread to anterior thorax**

***within retropharyngeal space***
**-swelling affecting swallowing, speech, may spread to thorax**



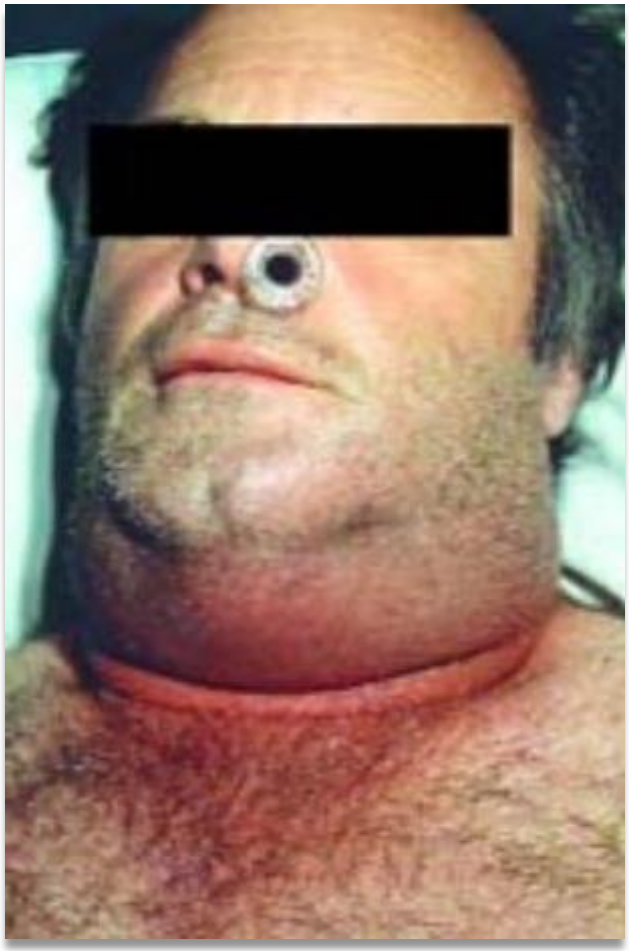
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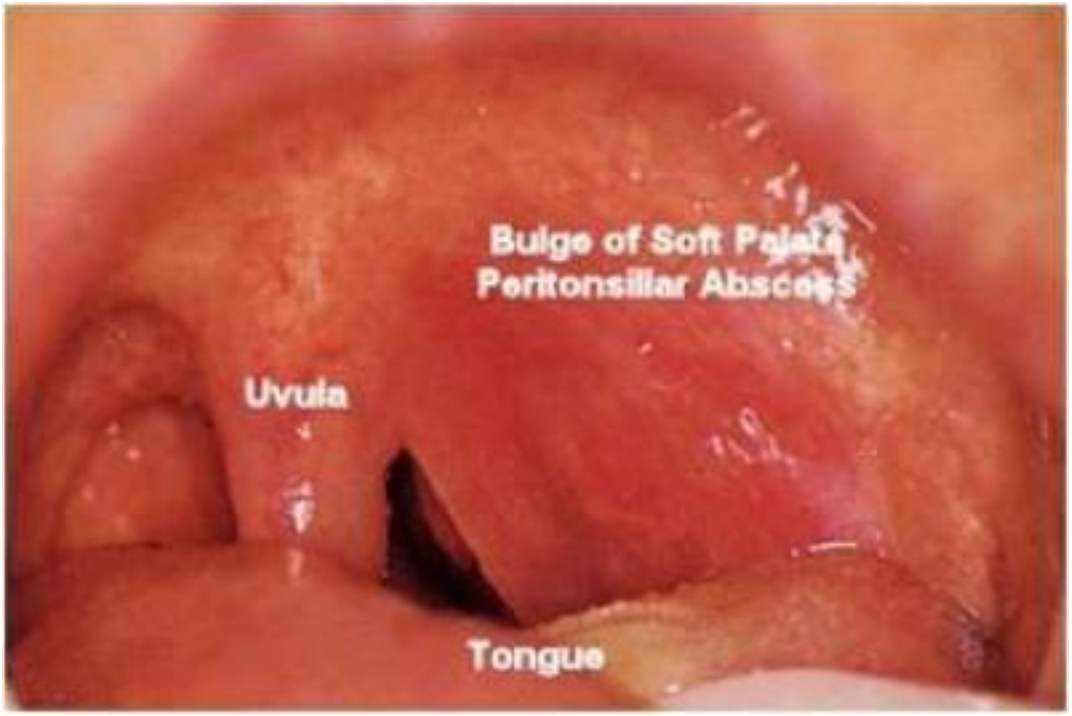
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# Ludwig's angina

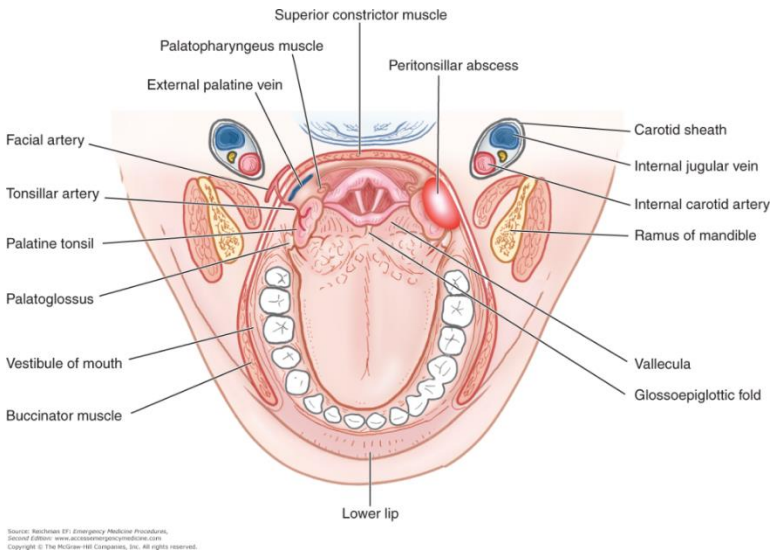
- Cellulitis of sublingual and submandibular space
- Life threatening airway compromise
- Organisms *Strep. viridans* and *Staph. Aureus*

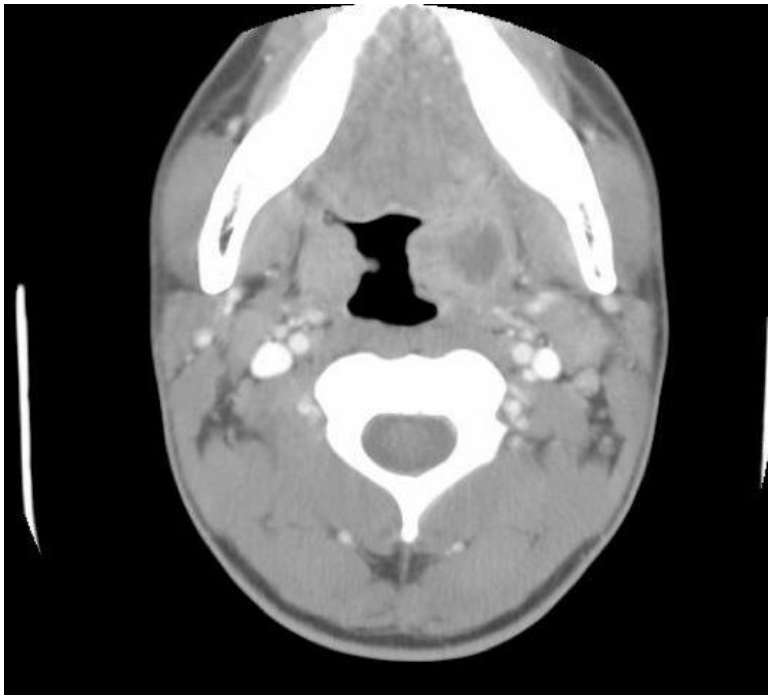


# Peritonsillar abscess

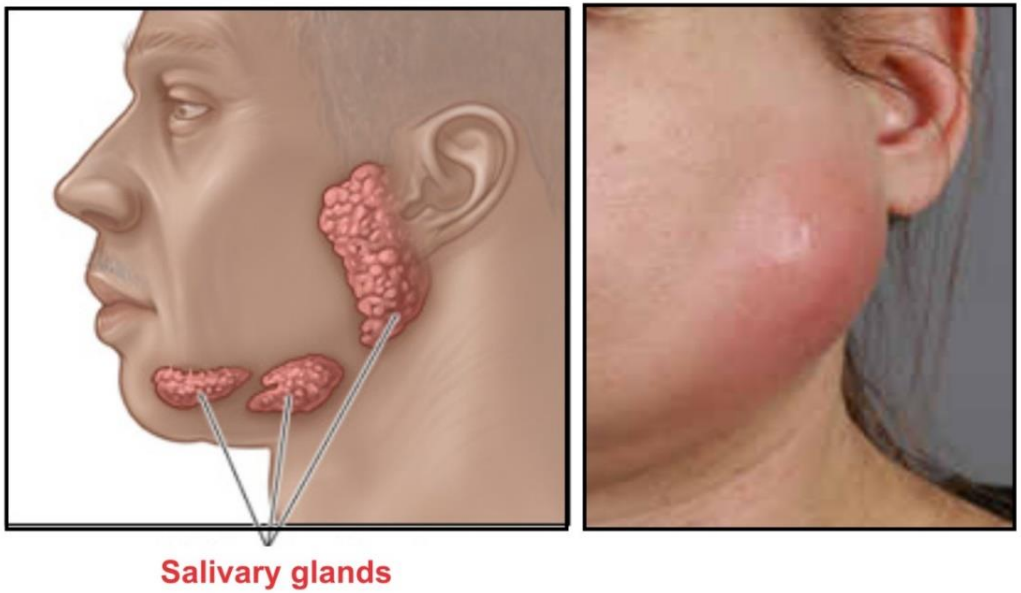


# Peritonsillar abscess



# Infection of the salivary glands



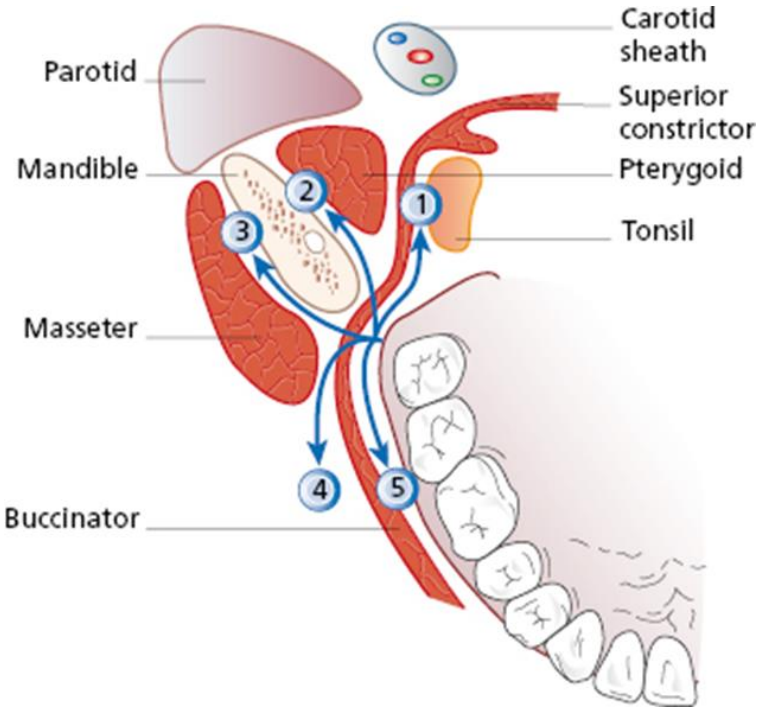
# Parotid gland infection





# Proximity of parotid and tonsil to lateral pharyngeal space

- Potential to cause airway compromise



# Floor of mouth swelling

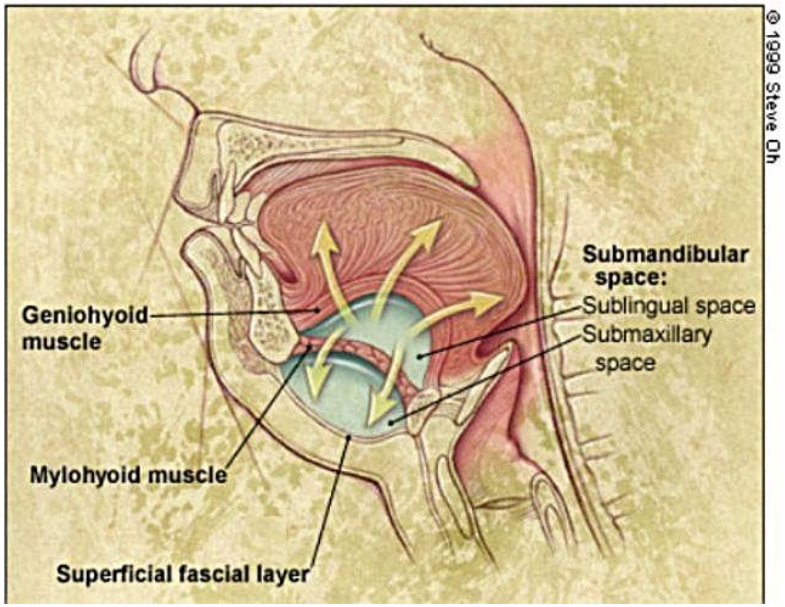
- Causing potential airway compromise



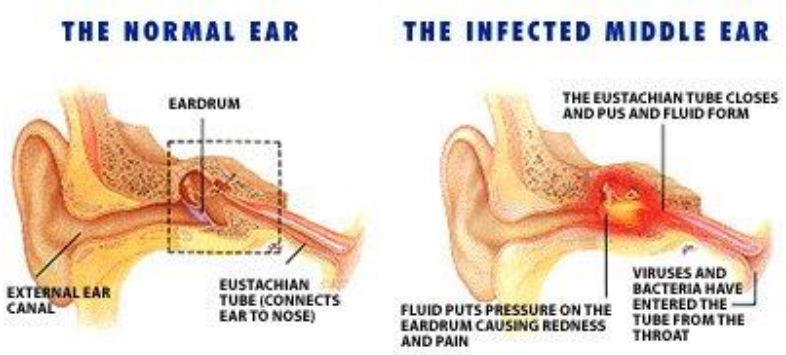
# Floor of mouth swelling

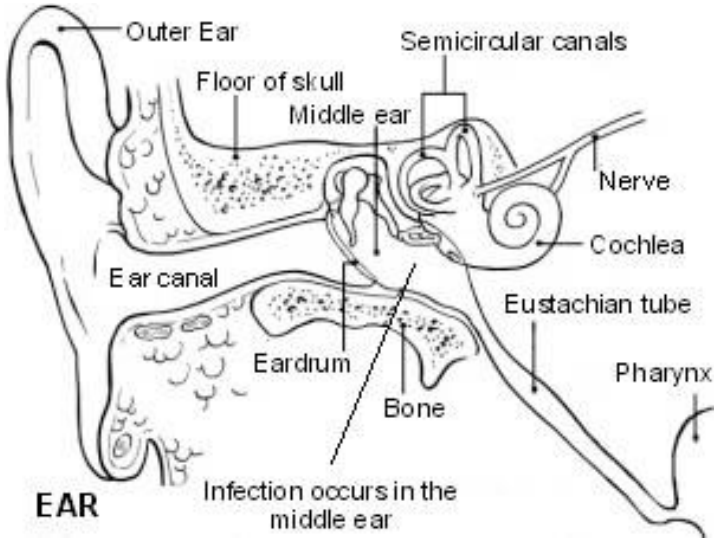


Figure 3: Clinical appearance. Swelling of the floor of the mouth.



# Middle ear infections



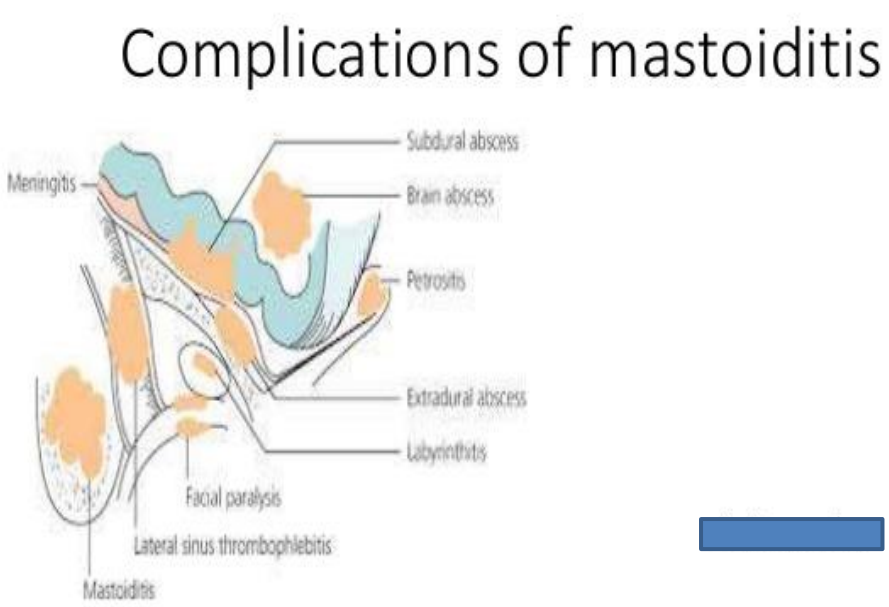



# Middle ear infections

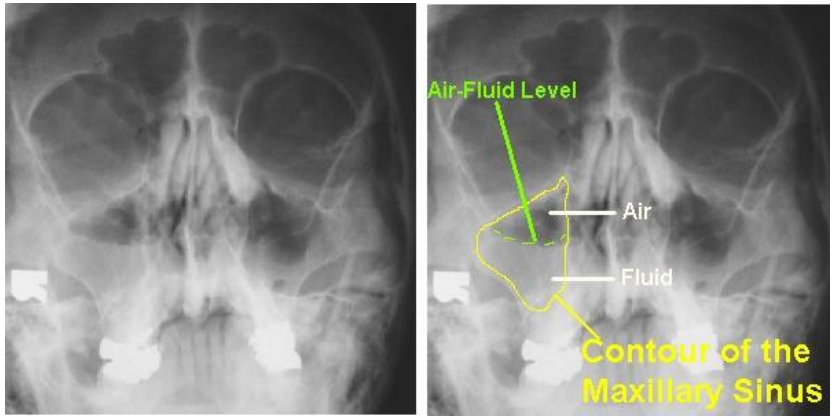


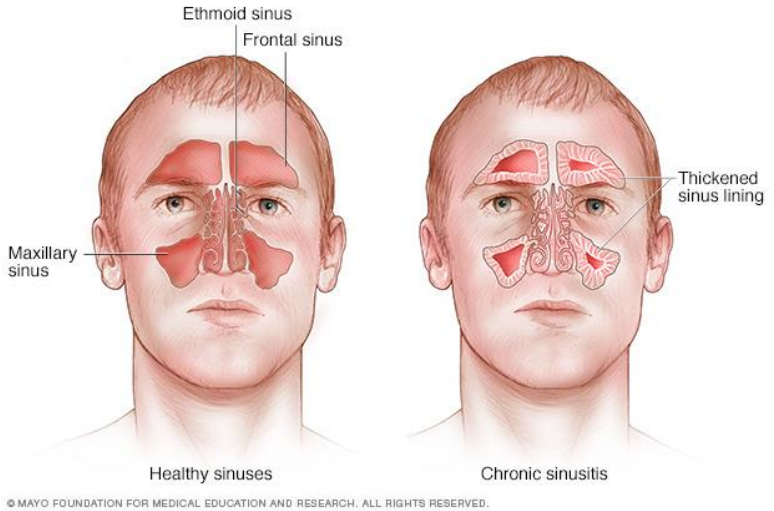
# Mastoiditis





# Sinus infection




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# Orbital complications of sinusitis

- Orbital cellulitis
- Intracranial infections
- Cavernous sinus thrombosis
- Septic emboli of optic nerve
- Optic nerve ischemia may result in visual loss

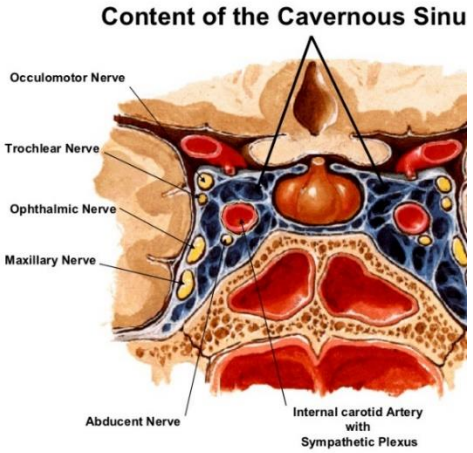




# Orbital cellulitis

- The complications of orbital cellulitis are ominous and include optic neuropathy, retinal vein occlusion, cavernous sinus thrombosis, meningitis and death



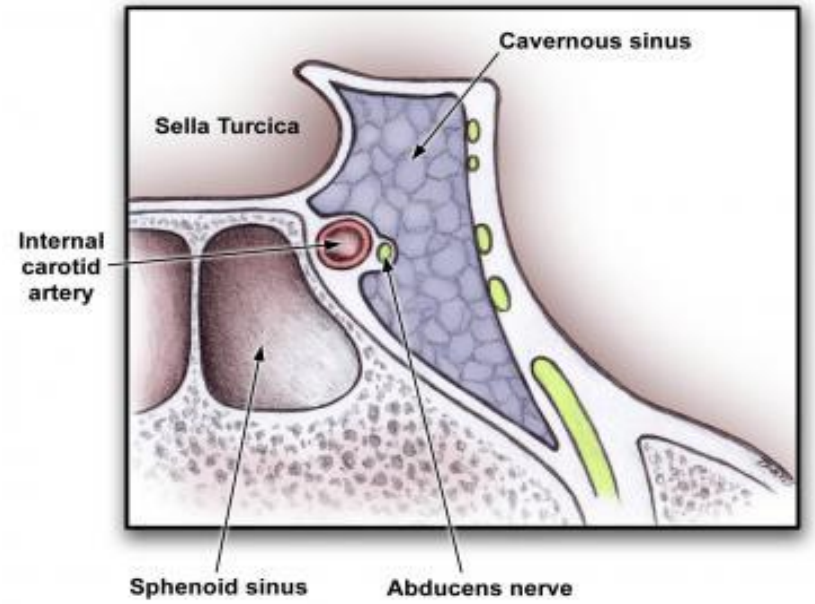


# Cavernous sinus thrombosis

- Fevers, rigors, malaise, severe frontal and periorbital pain
- Exopthalmos
- Oedema of eyelid and chemosis of conjunctiva
- Opthalmoplegia
- Ptosis
- Dilated pupil with loss of accommodation reflex

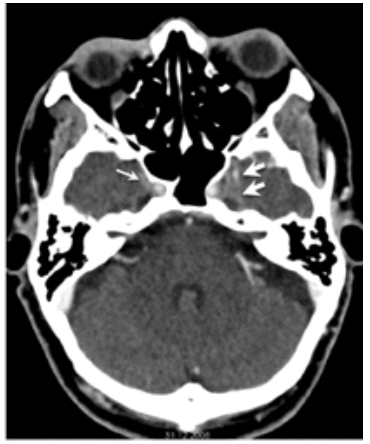


# Cavernous sinus thrombosis





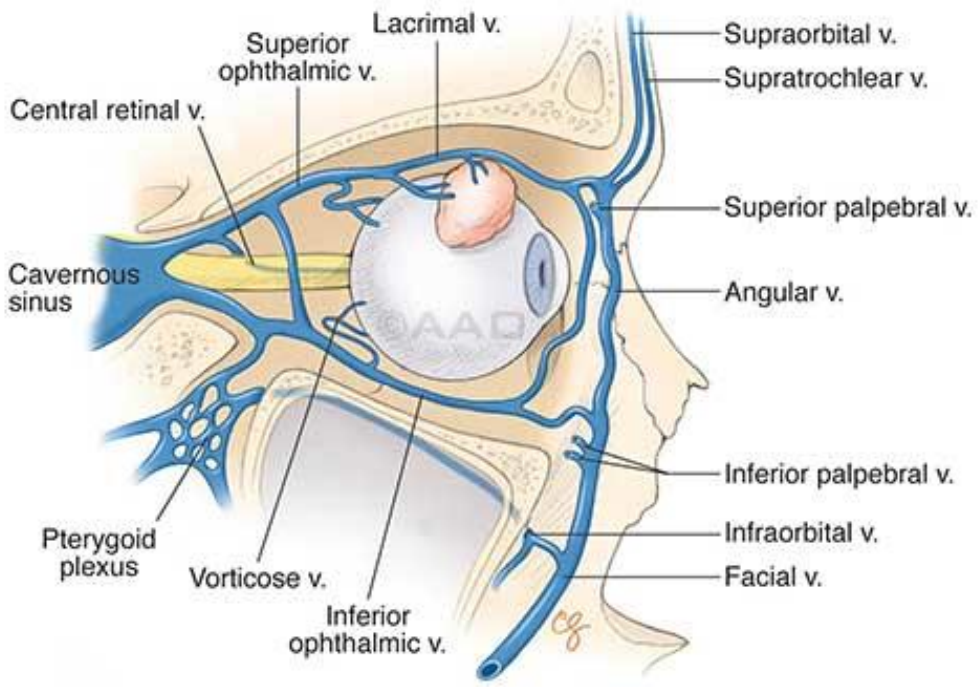

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# Cavernous sinus thrombosis

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# Skin infections

## Erysipelas



## Impetigo



# Skin infections

- Herpes zoster opthalmicus
- Can lead to chronic ocular complications, reduced vision, even blindness



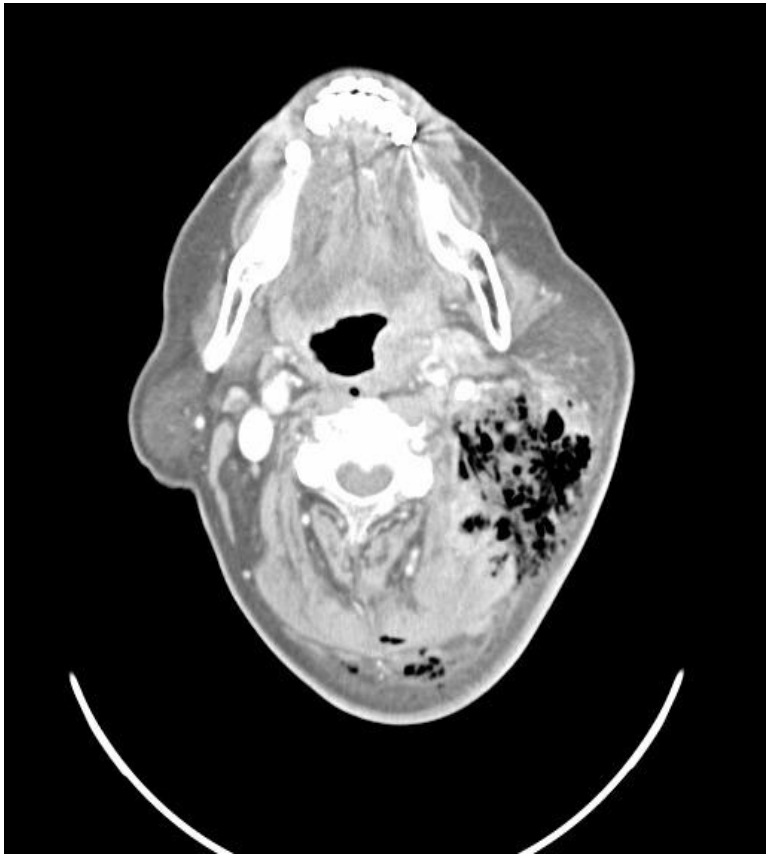
# Necrotising fasciitis



- Rapidly progressing necrosis of the subcutaneous tissue and overlying skin
- Type I : polymicrobial flora
- Type II : Group A Beta-Streptococcus bacteria
- Type III gas gangrene, or clostridial myonecrosis

# Necrotizing fasciitis

- presence of gas-forming organisms, subcutaneous air is classically described in necrotizing fasciitis



# Cancrum oris



- Orofacial gangrene which causes mutilating destruction of soft and hard tissues of the oral and perioral structures
- Typically affects children who are malnourished, with poor oral hygiene and concurrent debilitating illnesses

# Steps in management of odontogenic infections

- Severity of infection
- Host defences
- Setting of care
- Surgical treatment
- Medical support
- Antibiotic therapy
- Frequent evaluation

# Steps in management of odontogenic infections

- The possibility of deep space infection should be considered in any patient who does not respond to the usual treatment of an abscessed tooth or tonsillitis
- This type of infection also should be considered in a toxic patient who has a fever of unknown origin, with or without blood cultures that show anaerobic organisms.

# Severity of infection – Anatomical location

- Buccal space spreading to submandibular space




- Submandibular space spreading to mediastinum



# Fascial space infections

**Severity Scores of Facial Space Infections**

| Severity Score | Anatomic Space |
|---|---|
| Severity Score = 1 | Vestibular |
| (low risk to airway or vital structures) | Subperiosteal |
| | Space of the body of the mandible |
| | Infraorbital |
| | Buccal |
| Severity Score = 2 | Submandibular |
| (moderate risk to airway or vital structures) | Submental |
| | Sublingual |
| | Pterygomandibular |
| | Submasseteric |
| | Superficial temporal |
| | Deep temporal (or infratemporal) |

# Fascial space infections

**Severity Scores of Facial Space Infections**

| Severity Score | Anatomic Space |
|---|---|
| Severity Score = 3 | Lateral pharyngeal |
| (high risk to airway or vital structures) | Retropharyngeal |
| | Pretracheal |
| Severity Score = 4 | Danger space (space 4) |
| (extreme risk to airway or vital structures) | Mediastinum |
| | Intracranial infection |

# Severity of infection

- Rate of progression



# Severity of infection

- Airway compromise may require a tracheostomy to secure airway



# Airway obstruction

- Ominous sign- Pulse oximeter O2 saturation of below 94% in an otherwise healthy patient
- Indication for immediate establishment of a secure airway

# Host defences

- Immune system
- Systemic reserve



# In-patient

- Indications for hospital admission
  - Temperature > 38.3 degree Celcius
  - Dehydration
  - Threat to airway or vital structures
  - Infection in moderate or high severity anatomic spaces
  - General anaesthesia
  - Inpatient control of systemic disease

# Surgical treatment

Airway security – immediate establishment of airway by early intubation or tracheostomy

Surgical drainage – Early surgical intervention



# Surgical treatment

- Surgical drainage











# Surgical treatment

- Expectant approach to surgical drainage of deep neck infections or undertake surgical drainage undertaken early
- Deep space infection may be occult, a high index of suspicion is required for diagnosis
- Early recognition is necessary to avoid tissue damage, bacteremia or airway compromise

# Surgical treatment

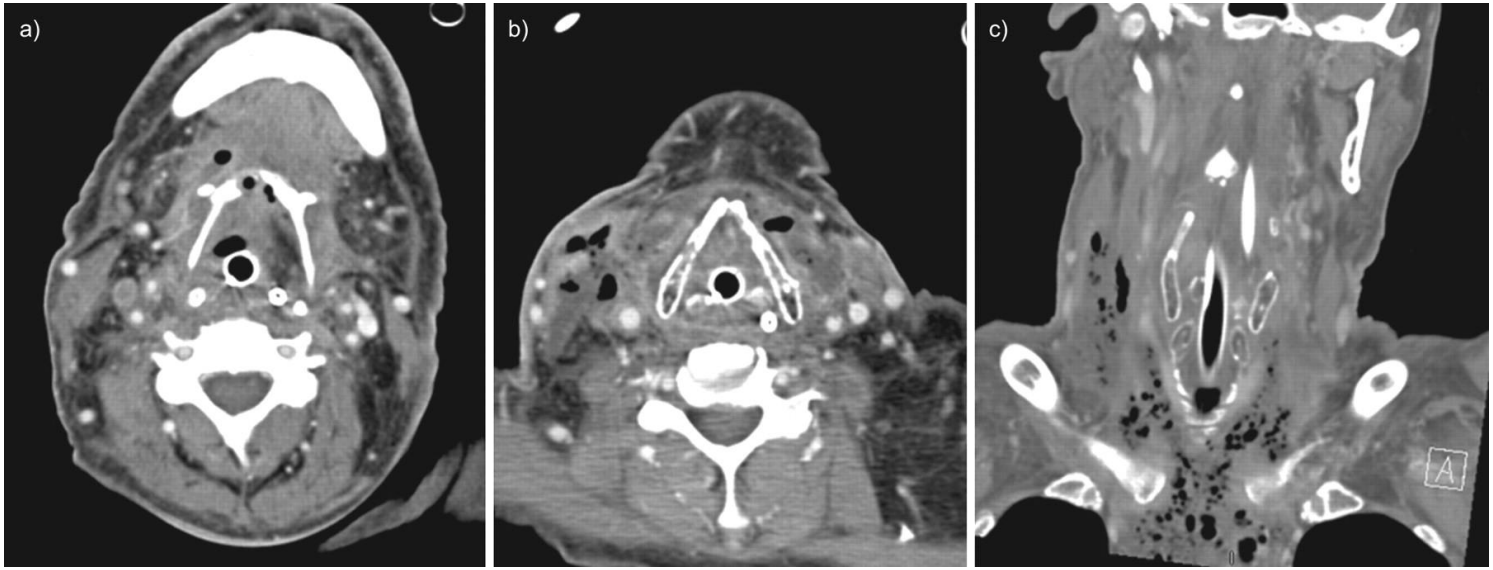
- Culture and sensitivity testing

  - infection involves anatomic spaces of moderate or greater severity

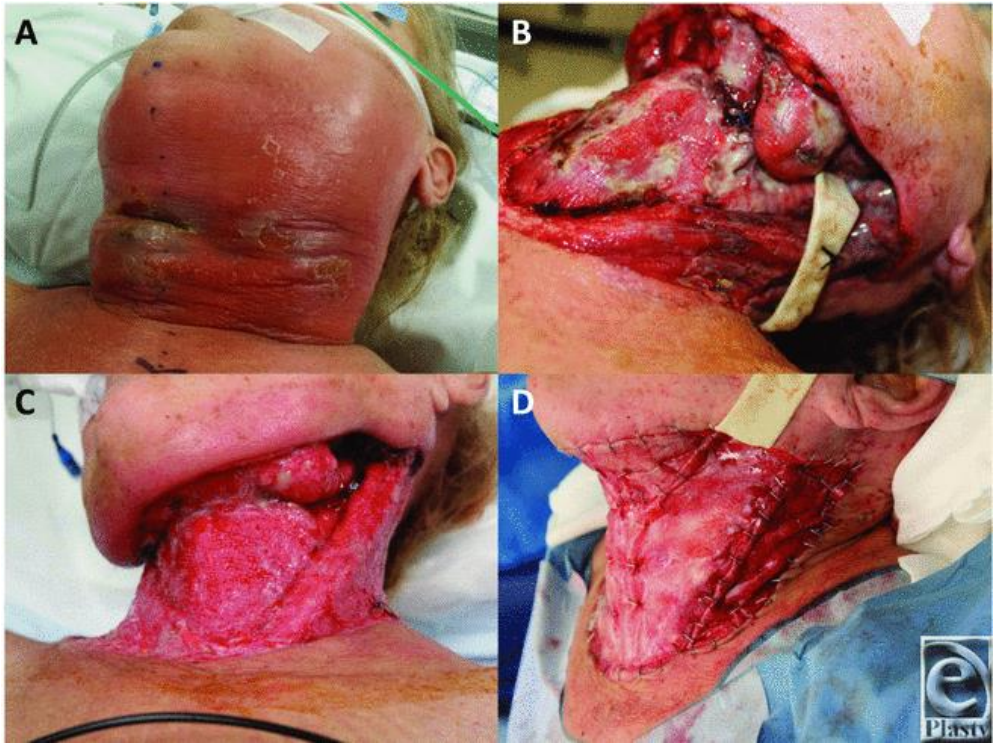
  - significant medical or immune system compromise

  - chronic infections recalcitrant to therapy

# Gas-forming organisms



# Aggressive debridement



# Aggressive debridement



# Medical support

- Hydration, nutrition and control of fever

# Antibiotic therapy

- Empiric antibiotics for odontogenic infections requiring only outpatient management

  - Penicillin, Clindamycin, Cephalexin

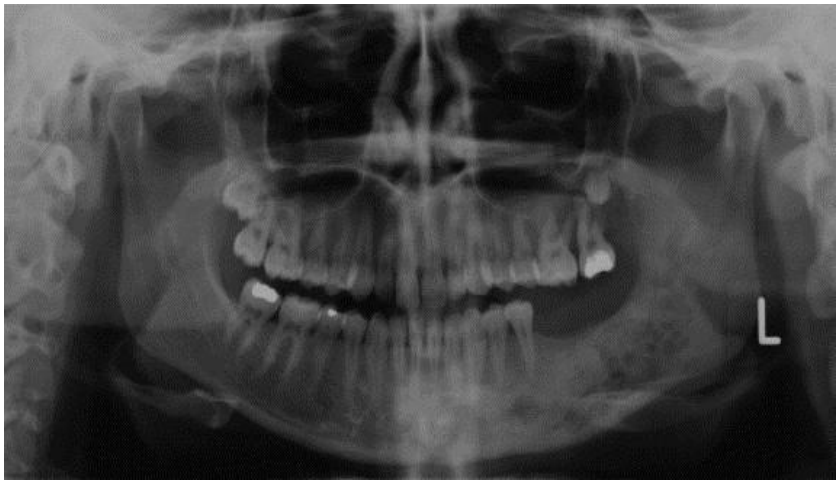
- Empiric antibiotics for odontogenic infections requiring inpatient management

  - Clindamycin, Third generation cephalosporin Intravenous route, Metronidazole

# Frequent evaluation

- Improvement in signs and symptoms – decreasing swelling, cessation of wound drainage, declining white cell count, decreased malaise, decrease airway swelling

# Osteomyelitis




- Bacteria induced inflammatory process ( extractions, RCT, fractures )
- Inflammation of the bone marrow and extending to involve periosteum
- Incidence higher in the mandible
- Diminished host defences, medications, local pathology, odontogenic infections, trauma
- Acute or chronic ( 1 month duration )
- Pain, swelling, lymphadenopathy, fever, paraesthesia, trismus, malaise, fistulas

# Osteomyelitis

- CT evaluation
- Medical management – antibiotic treatment
- Surgical options

  - sequestrectomy

  - reconstruction type plate to prevent pathological fracture
- Hyperbaric oxygen treatment

# Osteomyelitis –pathological fracture



# Reconstruction type plate

