Maxillofacial infections

☺ Introduction …

- Last time we talked about the basic path of physiology ,presentation of odontogenic infections & the causes , today we will talk about severe infections or what happens when infections progress and come worse with tissue due to many factors and that is why we call it (the spread to fascial spaces).
- Odontogenic infections are usually mild and treated by antibiotics …
  Odontogenic infections are usually mild as we all see in the clinics especially with the era of really extreme spread of antibiotics , in our countries antibiotics are OTC any body can actually obtain antibiotics and this has a bad side because of resistance & loosing deficiency of antibiotics. On the other hand it can help sometimes to control the spread of infections.
- A vestibular or a fascial space abscess is determined by the muscle attachment level to the point of infection perforation …
  If the infection spreads more suppose you have a necrotic tooth or periapical infection , it spreads to the periapical area then presents to the vestibular area to present as sinus or fistula at the beginning or it might go to somewhere else it depends on the anatomy of the area , it might spread to distant places of the face according to the muscle attachments and anatomical boundaries of the related area.
- The dr showed us a picture ..
  This lady had an odontogenic infection , initially it was localized to a tooth , she is pregnant (as you know pregnancy hormonal changes can make infection worse) , she presented with a form of spread of infection as you can see it is not only localized to the vestibule inside the mouth , you can see a huge swelling affecting the left side of the face and some mandibular area.

☺ Microbiology …

- There are many factors that can control the spread of infection ..

1. **Concentration of the organism** ..
   we have to have a minimum concentration of the microorganisim to cause infection , because as we all know that we have bacteria living in our mouth in balance , if you have disturbance in that balance you might have susceptibility to infection due to increase of the concentration of that microorganisim.

2. **Its virulence (type of microorganism)** ..
   types of bacteria that causes infection in mouth (streptococcus & anaerobes).

3. **Environmental factors** ..
   environmental factors can stimulate the bacteria to cause infections that are not present in the usual status.

4. **Host defense** ..

   * Pregnant lady >> disturbance of her hormones >> immunity is not as good as it is used to be.
   * Diabetic patient >> immunity might be affected in diabetes >> because of migration of WBCs , neutrophils are affected (deficiency in function) & circulation is affected (they don't have a good circulation to the area to allow immune cells to come and defense the body) >> so there are many factors in uncontrolled diabetic patients that can lead to more infections.
   * HIV patients >> they have a decrease level of CD4 >> low immunity >> susceptible to infections
   * That is why when we have a patient in the ER with a huge infection , we always think about systemic factors we try to take blood sugar test , take a good history and make sure that the patient doesn't have a systemic factor that had led to this condition and it's important to control the infection.

☺ Basic steps in management of odontogenic infections …

1. **Determine the severity of infection** ..

   If you miss a severe infection you might loose your patient , you should decide can I treat the patient or antibiotic is enough or does the patient need an admission to the hospital because of temperature or uncontrolled fever that might lead to hypovolemia or shock or whatever.

   So decision is important to decide is it severe enough to be admitted or is it severe enough to have immediate surgery or drainage or it is just a mild case that we can treat it with a usual condition.

   We can get to the right decision by taking a proper history, proper assessment of the patient and taking a proper decision on what to do regarding this patient especially in the infections that progress quickly (especially if you have a patient with an underlining systemic condition).

2. **Evaluate host defenses**..

   Take a proper history & take the necessary investigations according to the condition.

3. **Decide on the setting of care**

   Is it in our clinic or is it in the hospital.

4. **Treat surgically**

   We always think about Incisional drainage if we have suspicion of any abscess present, we should not always leave the patient on antibiotics or untreated abscess when we suspect the presence of abscess, because abscess is a pus containing cavity does not have any circulation and no immune cells will reach the area it will just stay there get larger and make patient worse unless you open and drain , and actually many cases simple incisional drainage is enough without the usage of antibiotics , so surgical drainage if you suspect the presence of abscess or pus is very very essential.

5. **Support medically** ..
   If your patient is feverish , weak , have malnutrition or hypovolemic you should think about all of these things to support him by admission to hospital and giving him IV line of fluids , proper medications and antibiotics according to the condition that you have.

6. **Choose and prescribe antibiotic therapy** ..
   We always teach you how to choose the antibiotic by culture & sensitivity but actually in the real life culture & sensitivity are not practical, because we know the usually microorganisms that cause the infection and that is why we treat them accordingly (amoxicillin , augmentin , metronidazole) they are known to fight gram positive bacteria &anaerobes (which are common pathogenic microorganisms) and usually patients improve without any problem.
   If you have a patient who is not improving (he is taking antibiotic with no response with a bad systemic condition) you stop and think about culture and sensitivity before proceeding to the right choice of antibiotics.
   We do culture & sensitivity by taking a swab.
   A patient with cellulitis , fever and no collection of pus , and he is not improving by the usual antibiotics , so we have to do culture and sensitivity >> we do the test (culture & sensitivity) by taking blood instead of pus , so draw the blood in special bottles to do the test.

7. **Administer the antibiotic properly** ..
   We have different routes (oral or IV).
   IV is faster if your patient is ill.

8. **Evaluate the patient frequently**.

☺ Severity of infection …

- How to predict or determine the severity of infection ..
  1. **Anatomic location**.
  2. **Rate of progression** (if your patient is getting worse very quickly this is alarming , you should think about admission and being aggressive with treatment).
  3. **Airway compromise** (especially if you have some mandibular infections that are causing pressure to the airway , your patient might complain that he is having problem in breathing , so you should think about maintaining the airway by intubation or surgery in severe cases).

☺ Anatomy …

- Infections find **the path of least resistance** to spread and form a collection of pus or edema in that area .

☺ Fascial spaces …

- They are **potential spaces** (they are not real spaces and they are not present in normal codition , the normal patient doesn't have any spaces but we have fascia , and if we have pressure from fluid or pus, it might swell like a balloon)
- They have a certain anatomical boundaries.
- Bound by the fascial layers investing muscles of the body.
- Contain many vital structures.
- We have 2 types of fascial spaces :
  1. **primary spaces** (commonly gets involved in odontogenic infections) ..
     * related to maxilla: canine, buccal, infratemporal.
     * related to mandible: Submandibular, Sublingual, Submental.

  2. **secondary spaces** ..
     Masseteric, pterygomandibular, superficial and deep temporal, Lateral pharyngeal, Retropharyngeal, prevertebral.

☺ Canine space …

- Infection in canine space is relatively common.
- Potential space that is not usually present , limited by the anatomical factors ..

1. Superior .. Origin of levator muscles
2. Inferior .. Orbicularis oris
3. Anterior .. Skin & subQ tissue
4. Posterior .. Anterior wall of maxilla
5. Medial .. Levator labii alaquae nasii
6. Lateral .. Zygomaticus major

- In normal teeth (incisors, premolars …) usually they have short roots , so suppose they have infection >> necrotic tooth >> periapical infection >> infection will reach the vestibule.
- **Canine** is very long tooth with a very long root that enters the area of canine space >>suppose we have infection of the apex >> pus is trying to escape to the vestibule but the apex is above the level of vestibule >> so the area of canine space will swell and that is what we call canine space infection.
- Canine root has a sufficient length to erode through the alveolar bone superior to the muscles of facial expressions.
- A patient presented to the clinic .. RCT was done to the canine before 3 years , then he had failure in the treatment >> canine apex infection >> canine space infection >> skin fistula (looks like ulcer) connected above orbicularis oris >> treatment was simple excisional drainage of the sinus.
- Clinically .. facial swelling that obliterates the nasolabial fold
- Drainage can happened extra orally leading to fistula or sinus (spontaneous drainage occurs just inferior to the medial canthal ligament).

- This canine space actually is dangerous, because it contains angular artery and vein that are very close to the infraorbital foramen.
- These veins are emissary veins (valve-less veins) so they go by direction , so the infected blood can go all the way up and down and can reach the mid cranial fossa (valveless veins of head and neck result in a "venous lake" throughout the midface and skull base).
- Through the ophthalmic vein the infection can reach the cavernous sinus , leading to **cavernous sinusitis** and it can go posteriorly to the brain stem leading to brain abscess or death.
- So the infection is really dangerous and should be treated quickly due to anatomical causes.

☺ Cavernous sinusitis …

- It's a serious problem
- Cavernous sinus contains many **cranial nerves CN III, IV, divisions of V, VI and internal carotid artery**.
- That is why when the patient has cavernous sinusitis , he can present with **lat gaze palsy** of the eye or left side
- Infection may spread from midface to cavernous sinus and other parts of brain via sup. and inf. ophthalmic veins, or emissary veins connecting pterygoid plexus through ovale and lacerum foramina to the cranial vault.
- It's not very common because of the wide spread of antibiotics, but in really compromised patients with very bad immunity you might see those infections easily.
- The earliest sign is lat gaze palsy affecting CN VI, since it is not covered by periosteum.
- Sometimes the patient may present with : nausea, vomiting, diplopia, visual impairment, ophthalmoplegia, photophobia, papilledema .
- The dr showed as a picture of a patient with a severe infection of the periocular tissues .. he has severe redness of the skin , pus and destruction of the eye. This can spread to the mid cranial fossa and may be fetal.

☺ Buccal space …

- anatomical boundaries ..

1. Superior .. Zygoma (the area of cheek)
2. Inferior .. Inferior border of mandible
3. Anterior .. Modiolus (the angle of the mouth)
4. Posterior .. Masseter
5. Medial .. Buccinator
6. Lateral .. Skin & subQ tissue

- It's a contained space , it's not in the vestibule as we see usually , this space is behind the buccinators , it gets localized in the cheek and become swollen and there is no drainage , because it's contained by the muscle .
- It's not very common because of the wide spread of antibiotics.
- What causes the spread of infection to the buccal space ?
  Infection from maxillary or mandibular teeth (but mainly maxillary teeth) , because buccinator usually is attached to zygoma or mandible at certain levels either above the routes or below the routes. So if the routes are below the attachment of buccinator , the infection will escape behind the muscle and it will reach the buccal space.
- The dr showed as a picture of a lady with buccal space infection and some spread to the submandibular space.
- It contains vital structures such as facial artery, vein, and nerve ; Stenson's duct (parotid duct) and buccal fat pad.
- The buccal fat pad can prevent the spread of infection from buccal to lateral pharyngeal space.
- Clinically: swelling below the zygomatic arch and above the inferior border of mandible.

☺ Infratemporal space …

- It's more difficult anatomically.
- lies posterior to the maxilla (behind the maxilla , behind the last third molar).
- anatomical boundaries ..

1. Superior .. Infratemporal crest of sphenoid bone
2. Inferior .. Lateral pterygoid
3. Anterior .. Maxillary tuberosity
4. Posterior .. Mandibular condyle
5. Medial .. Lateral pterygoid plate
6. Lateral .. Coronoid process

- Why do we get infection of the infratemporal space?
  It's usually related to the **upper third molars**

☺ Submental space …

- Bilateral submental spaces.
- Anatomical boundaries ..

1. Superior .. Mylohyoid
2. Inferior .. Skin & subQ tissue
3. Anterior .. Lingual side of mandible
4. Posterior .. Hyoid
5. Medial .. Common space, no medial wall (joint between the 2 submental spaces)
6. Lateral .. Medial side of Mandible

- When do we get infection of these spaces?
  It is very common to have infection to the submental space after having infection related to **the lower incisors**.
- Trauma to lower incisors >> necrotic pulp >> spread of infection from the apex to the submental space
- Primarily infected by mandibular incisors sufficiently long to erode through labial bone apical to the attachment of the mentalis muscle
- Clinically : swelling of the submental area

☺ submandibular space …

- It's commonly infected.
- Submandibular space & sublingual space are separated by the mylohyoid muscle.
- Anatomical boundaries ..

1. Superior .. Mandible & mylohyoid
2. Inferior .. Hyoid bone
3. Anterior ... Anterior pelly of Digastric
4. Posterior .. Posterior pelly of Digastric
5. Medial .. Mylohyoid, hyoglossus
6. Lateral .. mandible, skin & subQ tissue

- Infection of submandibular space causes swelling of the neck laterally.
- It contains submandibular gland, facial and lingual arteries and lymphatics.
- It's the most commonly infected space in our area.
- Lingual perforation of mandibular molars and may be involved by premolars , but mainly **lower third molar** lead to leak of pus and communication of the infection to the submandibular space.
- Clinically: swelling, pain , redness & dysphagia (which might affect the airway that is why you have to monitor closely and your patient should be in the hospital to control different signs and symptoms).

☺ sublingual space …

- Anatomical boundaries ..

1. Superior .. Sublingual mucosa
2. Inferior .. Mylohyoid
3. Anterior .. Lingual border of mandible
4. Posterior .. Hyoid bone
5. Medial .. Genioglossus
6. Lateral .. Medial mandible

- It contains sublingual gland, lingual nerve, submandibular duct (Wharton's duct) & hypoglossal cranial nerve.
- Lingual perforation of **mandibular first molar and premolars** mainly will cause infection of the sublingual space (because in those teeth the apex is above the mylohyoid)

- So **mylohyoid is the barrier** ...
  below it >> **submandibular space** involvement
  above it >> **sublingual space** involvement
  but still it varies between different people according to anatomical variations (the more posterior is more likely to affect submandibular space & the more anterior is more likely to affect sublingual space).
- Submandibular & sublingual spaces might communicate with each other, infection might spread from sublingual space posteriorly through mylohyoid to reach submandibular space.
- Open posterior border, therefore communicates freely with the submandibular space and secondary spaces.
- Clinically: dysphagia, pain, elevation of the floor of mouth and superior displacement of tongue.

☺ Ludwig's Angina …

- **Infection of 5 spaces all together : submental , and bilateral submandibular and sublingual spaces**.
- It's a serious condition.
- **Brauny edema** of the spaces.
- No pus
- No lymphadenopathy
- minimal inflammation of pharynx
- severe elevation of the floor of the mouth and extra oral swelling.
- Severe swelling, elevation of tongue and hard submandibular region.
- Trismus, drooling of saliva and difficulty with swallowing and breathing.
- Can progress rapidly and produce upper airway obstruction that can lead to death (that is why it needs immediate admission to the hospital to do incision and drainage to relieve the interstitial edema trying to decompress the swelling that cause the pressure on the airway)
- It's commonly streptococcal infection.
- Treatment: vigorous incision and drainage to relieve interstitial edema and aggressive antibiotic therapy

☺ Notes & examples ..

- Lower third molar >> infection >> non vital >> necrotic pulp >> infection of periapical area >> not treated yet >> infection progress in periapical area >> resorption of bone >> perforatin of lingual plate >> pus exits from the lingual aspect of the mandible >> below the level of mylohyoid >> pus will go down >> contained between mylohyoid and mandible >> inferiorly we have skin, platysma and cervical fascia >> so the pus is contained >> ballooning and swelling >> submandibular space infection

- Infection is guided by the anatomy of the area , simply we have muscles and fascia which are tough layers , so they resist the infection and make it contained.
- Potential space normally is not present , but due to certain anatomical factors gets guided.
- Canine >> infection >> go up >> can't reach the vestibule because of the presence of orbicularis oris >> go above the skin (least resistance) >> valveless veins >> communication with mid cranial fossa

☺ *Good Luck* ☺

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