Laryngology seminar

Hyoid bone fracture

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Embryology of hyoid bone

- **Second pharyngeal arch** (hyoid arch): Reichert’s cartilage ➔ lesser horn of the hyoid bone + upper portion of body

- **Third pharyngeal arch:**
  ➔ greater horn + lower portion of body
Anatomy of hyoid bone

- Derived from Greek word *hyoeides*
  meaning “shaped like the letter upsilon”
- (Os hyoideum; ligual bone)
- U-shaped or horseshoe shaped bone in the anterior neck
- C3 : angle between thyroid cartilage and mandible
- The only bone not articulated to any other bone
- Suspend from tip of the styloid process of temporal bone by stylohyoid ligament

- Consist of 5 segments
  - 1. body
  - 2. greater cornua
  - 3. lesser cornua
- **Body**: (corpus oss. hyoidei)
  - **Anterior surface**:
    - geniohyoideus (most)
    - hyoglossus notch (lateral)
    - mylohyoideus
    - sternohyoideus
    - omohyoideus

- **Superior surface**: genioglossus

- **Lateral border**: connect greater cornu by synchondroses or bony union
The Greater Cornua (cornua majora)

- Protect backward from lateral border of body

- **Upper surface**: hyoglossus and constrictor pharyngis medius

- **Near junction**: digastricus and stylohyoideus

- **Medial border**: hyothyroid membrane
The Lesser Cornua (cornua minora)

- Two small, conical eminences, attach their base to junction
- Body: fibrous tissue
- Greater cornua: diarthrodial joint
- Apex: attach to stylohyoid ligament
- Ossified : 6 centers
- Body (2) : end of fetal life
- Greater cornua (1) : end of fetal life
- Lesser cornua (1) : 1\textsuperscript{st} or 2\textsuperscript{nd} year after birth
Function:

- Production of human speech
- Wider range of tongue and laryngeal movement
- Hyoid biodynamic system → regulate mastication, deglutition and phonation
<table>
<thead>
<tr>
<th>Suprahyoid muscle</th>
<th>Styloid process</th>
<th>Elevate and retract hyoid bone</th>
<th>VII</th>
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</thead>
<tbody>
<tr>
<td>Styloid process</td>
<td>Styloid process</td>
<td>Styloid process</td>
<td>VII</td>
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<tr>
<td>Body of hyoid</td>
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<tr>
<td>Elevate and retract hyoid bone</td>
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<thead>
<tr>
<th>Geniohyoid</th>
<th>Inf. mental spine of mandible</th>
<th>Pull the hyoid b.</th>
<th>C1 via XI</th>
</tr>
</thead>
<tbody>
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<td>Pull the hyoid b.</td>
<td>Pull the hyoid b.</td>
<td>C1 via XI</td>
</tr>
<tr>
<td>body</td>
<td>body</td>
<td>Anteriorly and superiorly</td>
<td>C1 via XI</td>
</tr>
<tr>
<td>Mylohyoid</td>
<td>Mylohyoid line</td>
<td>Elevate floor of mouth, tongue and hyoid during speech and swallowing</td>
<td>V</td>
</tr>
<tr>
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<td>Elevate floor of mouth, tongue and hyoid during speech and swallowing</td>
<td>V</td>
</tr>
<tr>
<td>body of hyoid</td>
<td>body of hyoid</td>
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<td>V</td>
</tr>
<tr>
<td>Digastric</td>
<td>Ant belly</td>
<td>Digastric fossa of mandible</td>
<td>V</td>
</tr>
<tr>
<td>Ant belly</td>
<td>Digastric fossa of mandible</td>
<td>Digastric fossa of mandible</td>
<td>V</td>
</tr>
<tr>
<td>Post belly</td>
<td>Mastoid notch of temporal bone</td>
<td>Mastoid notch of temporal bone</td>
<td>VII</td>
</tr>
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<td>Mastoid notch of temporal bone</td>
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<td>VII</td>
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<tr>
<td>Digastric</td>
<td>Post belly</td>
<td>Mastoid notch of temporal bone</td>
<td>VII</td>
</tr>
</tbody>
</table>
## Infrahyoid muscle (Strap muscle)

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Attachments</th>
<th>Movement</th>
<th>Neural Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sternohyoid</td>
<td>Manubrium and med aspect of clavicle ➔ Body of hyoid</td>
<td>Depress hyoid bone following elevation during swallowing</td>
<td>C1-C3 Ansa cervicalis</td>
</tr>
<tr>
<td>Omohyoid</td>
<td>Scapula near the suprascapular notch ➔ inferior aspect of hyoid</td>
<td>Depress and retract hyoid bone</td>
<td>C1-C3 Ansa cervicalis</td>
</tr>
<tr>
<td>Sternothyroid</td>
<td>Post aspect of manubrium ➔ thyroid cartilage</td>
<td>Depress the larynx and thyroid</td>
<td>C1-C3 Ansa cervicalis</td>
</tr>
<tr>
<td>Thyrohyoid</td>
<td>Oblique line of thyroid cartilage ➔ inferior aspect of body and greater horn</td>
<td>Depress the hyoid and elevate the larynx</td>
<td>C1(XIII)</td>
</tr>
</tbody>
</table>
莖突舌骨肌

STYLOHYOIDEUS

顏面神經的莖突舌骨肌枝

Stylohyoid branch of facial nerve

面動脈的肌枝

Muscular branches of facial artery

枕動脈的肌枝

Muscular branches of occipital artery
頦舌骨肌

*GENIOHYOIDEUS*

- 舌骨 (Hyoid bone)
- 舌外動脈 (External carotid artery)
- 舌動脈的舌下枝 (Sublingual branch of lingual artery)
- XII舌下神經 (XII glossopharyngeal nerve)
- CI第一頸神經 (CI first cervical nerve)
下頜舌骨肌 (or 頜舌肌)

**MYLOHYOIDEUS**

下齒槽動脈的下頜舌骨肌枝
Mylohyoid branch of inferior alveolar artery

下齒槽神經的下頜舌骨肌枝
Mylohyoio branch of inferior alveolar nerve

面動脈的頜下枝
Submental branch of facial artery

舌動脈的舌下枝
Sublingual branch of lingual artery

頸外動脈
External carotid artery
DIGASTRICUS

Mylohyoid branch of inferior alveolar nerve

Facial artery

Trigeminal nerve

Digastric branch of facial nerve

Branches of submental artery

Muscular branches of occipital artery

External carotid artery
胸骨甲狀肌

STERNOHYROIDEUS

甲狀腺上動脈的環甲肌枝
Cricothyroid branch of superior thyroid artery

頸襻的分枝
Branch from ansa cervicalis

舌下神經降枝
Descendens hypoglossi

第2與第3頸神經的分枝
Branches of 2d and 3d cervical nerves

頸降神經
Descendens cervicalis
OMOHYOIDEUS

- 第2與第3頸神經
- 2d and 3d cervical nerves

- 頸降神經
- Descendens cervicalis

- 舌下神經的降枝
- Descendens hypoglossi

- 舌動脈之舌骨上枝
- Suprahoid branch of lingual artery

- 頸襻的分枝
- Branch from ansa cervicalis

- 甲狀腺上動脈的胸鎖乳突肌枝
- Sternocleidomastoid branch of superior thyroid artery

- 頸總動脈
- Common carotid artery
胸骨甲狀肌

*STERNOTHYROIDEUS*

甲狀腺上動脈的環甲肌枝
Cricothyroid branch of superior thyroid artery

第2與第3頸神經的分枝
Branches of 2d and 3d cervical nerves

舌下神經降枝
Descendens hypoglossi

頸降神經
Descendens cervicalis

頸襻的分枝
Branch from ansa cervicalis
甲狀舌骨肌

THYROHYOIDEUS

舌下神經降枝的甲狀舌骨肌枝
Thyrohyoid branch of descendens hypoglossi

甲狀腺上動脈的舌骨下枝
Infrahypoid branch of superior thyroid artery
Classification of hyoid bone fracture

1. inward compression fracture with outside periosteal tears
2. anterior-posterior compression fracture with inside periosteal tears
3. avulsion fracture

Weintraub CM. Fracture of hyoid bone. Med Leg J 1961
1. Inward compression fracture with outside periosteal tears

Manual strangulation, squeezing force pushing two cornua together
2. anterior-posterior compression fracture with inside periosteal tears

- Hanging or other ant-post force
- Hyoid bone against C2

Fig. 2 Anatomical disposition of the hyoid in relation to the C2 Vertebra (after Wartenberg).

Fig. 3 Fracture of the hyoid due to antero-posterior compression with the periosteal tear on the inside.
The causes of hyoid bone changed

- In the past: strangulations and hanging
- Recently: road traffic accident
Hyoid bone fracture in strangulation

- 1. Fractured in 1/3 all homicides by strangulation
- (14% thyroid and cricoid cartilage fracture)
- 2. Detect hyoid bone fracture → strangulation?
- 3. Lack hyoid bone fracture → not exclude strangulation
Fractured and unfractured hyoids from victims of strangulation

1. age, magnitude of force, nature, instrument (hand or ligature)

2. Fractured hyoid: older victims (39+/−14 years) vs unfractured hyoid (30+/−10 years) → degree of ossification and fusion of synchondroses

3. Fractured hyoid: longer in ant-post plane, more steeply sloping
<table>
<thead>
<tr>
<th>Author</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Cause</th>
<th>Associated injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guernsey (1954)</td>
<td>45</td>
<td>M</td>
<td>Traffic accident</td>
<td>Bilateral mandibular fractures</td>
</tr>
<tr>
<td>Papavasiou &amp; Speas (1959)</td>
<td>23</td>
<td>M</td>
<td>Gunshot wound</td>
<td>Mandibular fracture</td>
</tr>
<tr>
<td>Papavasiou &amp; Speas (1959)</td>
<td>22</td>
<td>F</td>
<td>Assault</td>
<td>Nasal fracture</td>
</tr>
<tr>
<td>Chadwick (1960)</td>
<td>34</td>
<td>M</td>
<td>Traffic accident</td>
<td>Pharyngeal lacerations</td>
</tr>
<tr>
<td>Krekorian (1964)</td>
<td>21</td>
<td>M</td>
<td>Traffic accident</td>
<td>Pharyngeal lacerations</td>
</tr>
<tr>
<td>Graf (1969)</td>
<td>15</td>
<td>M</td>
<td>Traffic accident</td>
<td>Cervical spine injury</td>
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<tr>
<td>Maran &amp; Stell (1970)</td>
<td>22</td>
<td>M</td>
<td>Sports</td>
<td>None</td>
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<tr>
<td>Browne (1973)</td>
<td>16</td>
<td>M</td>
<td>Assault</td>
<td>Bilateral mandibular fractures</td>
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<tr>
<td>Eliachar et al. (1980)</td>
<td>35</td>
<td>M</td>
<td>Traffic accident</td>
<td>LeFort III fracture, bilateral mandibular fractures, pharyngeal lacerations</td>
</tr>
<tr>
<td>Eliachar et al. (1980)</td>
<td>23</td>
<td>F</td>
<td>Traffic accident</td>
<td>Bilateral mandibular fractures, pharyngeal lacerations, cervical spine injury</td>
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<tr>
<td>Whyte (1985)</td>
<td>29</td>
<td>M</td>
<td>Traffic accident</td>
<td>Mandibular fracture</td>
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<tr>
<td>Zachariades (1985)</td>
<td>34</td>
<td>M</td>
<td>Traffic accident</td>
<td>None</td>
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<tr>
<td>Zachariades &amp; Mezitis (1987)</td>
<td>15</td>
<td>F</td>
<td>Traffic accident</td>
<td>LeFort III fracture, multiple mandibular fractures, temporal bone fracture, loss of eye</td>
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<tr>
<td>Padgham (1988)</td>
<td>15</td>
<td>M</td>
<td>Traffic accident</td>
<td>None</td>
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<tr>
<td>Szeremeta &amp; Morovati (1989)</td>
<td>55</td>
<td>M</td>
<td>Traffic accident</td>
<td>None</td>
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<tr>
<td>David &amp; Corrigan (1989)</td>
<td>41</td>
<td>M</td>
<td>Assault</td>
<td>Facial lacerations</td>
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<tr>
<td>Dickenson (1991)</td>
<td>25</td>
<td>M</td>
<td>Industrial accident</td>
<td>None</td>
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<td>Lakhia et al. (1991)</td>
<td>18</td>
<td>M</td>
<td>Unknown</td>
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<tr>
<td>Olu Ibekwe (1991)</td>
<td>37</td>
<td>M</td>
<td>Traffic accident</td>
<td>Pharyngeal lacerations</td>
</tr>
<tr>
<td>Carroll et al. (1992)</td>
<td>23</td>
<td>M</td>
<td>Gunshot</td>
<td>None</td>
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<tr>
<td>Gupta et al. (1995)</td>
<td>28</td>
<td>M</td>
<td>Vomiting</td>
<td>None</td>
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<tr>
<td>Kaufman et al. (1999)</td>
<td>34</td>
<td>M</td>
<td>Traffic accident</td>
<td>Facial lacerations; fracture of the third lumbar vertebral body</td>
</tr>
<tr>
<td>Kaufman et al. (1999)</td>
<td>35</td>
<td>M</td>
<td>Traffic accident</td>
<td>Mid facial fractures</td>
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<tr>
<td>Kaufman et al. (1999)</td>
<td>36</td>
<td>M</td>
<td>Fallen down during seizure</td>
<td>None</td>
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<tr>
<td>Döring &amp; Kahle (2000)</td>
<td>17</td>
<td>M</td>
<td>Sports</td>
<td>None</td>
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<tr>
<td>Anthony et al. (2000)</td>
<td>66</td>
<td>M</td>
<td>Following cervical spine surgery, before 25 years</td>
<td>None</td>
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<tr>
<td>Campbell et al. (2003)</td>
<td>53</td>
<td>M</td>
<td>Unknown</td>
<td>External carotid artery pseudoaneurysm</td>
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<tr>
<td>Dalati</td>
<td>19</td>
<td>M</td>
<td>Fallen down during seizure</td>
<td>None</td>
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<tr>
<td>Dalati</td>
<td>26</td>
<td>M</td>
<td>Sports</td>
<td>None</td>
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</table>
- **Incidence**: 0.002% of all fractures
- **Age**: 15-55, most under 35 y/o
- Male (28 cases) > female (3 cases)
- Rare, because
  - 1. hyoid bone well protected by mandible
  - 2. mobility in all directions
- Rarer in pediatric
  - → Hyoid bone not completely ossified
  - → flexibility and decreased rigidity
Causes and mechanisms:

1. Road traffic accidents (14 cases)
2. Gun shot and knife (3 cases)
3. Basketball, ice hockey (3 cases)
4. Falling assault (3 cases)
5. Iatrogenic, after C spine surgery or resuscitation (2 cases)
Associated fractures

- Isolated hyoid bone fracture: 16 cases
- With mandibular fractures: 5 cases
- With facial bone fractures: 4 cases
- C spine injury: 3 cases
- Thyroid fracture, facial laceration, external carotid artery pseudoaneurysm, cricoid cartilage fractures
Clinical manifestations

- Ecchymosis of the neck, edema, crepitus or stridor
- Ant. Neck pain
- Pain with nose blowing, swallowing
- Dysphonia
- Cough (persistent, painful)
- Gagging
- Decrease range of motion
- Dysphagia
- Dyspnea
- Respiratory distress
- hemoptysis
Diagnosis

- Difficult
- Made with strong suspicious (history + physical examination)
- Radiographic diagnosis:
- Radiograph (Cervical lateral view)
- Computed tomography
- Laryngoscopy
- Surgical inspection (penetrating trauma)
Neck lateral view, soft tissue density demonstrating hyoid bone fracture

- Radiolucent line, interruption of cortical continuity, displacement of the fragment
Neck lateral view, soft tissue density demonstrating hyoid bone fracture
CT demonstrating hyoid bone fracture
Complications

- **Early complications**
  - Subcutaneous emphysema, dyspnea, pharyngeal tears, thyroid cartilage injury

- **Late complications**
  - Dysphagia, stridor, pseudoaneurysm, of external carotid artery
Treatment

- Close observation for minimally 48-72 hours: dysphagia, dysphonia, and dyspnea may develop quickly
- Depend on severity, case by case
- Laryngoscopic examination unless contraindicated
- Associated injuries taken into consideration
- **Asymptomatic**: close observation
- **Symptomatic**
  - mild to severe pain:
    - analgesics
    - limitation of head movement
    - keep soft diet
- pharyngeal laceration
- suture deep wound
- remove fragment of hyoid bone fracture
- fixation of fractured fragments by wiring
- dysphagia → NG feeding
- external laceration of the neck
- primary wound care
- excision of fragment of hyoid bone
- respiratory distress
- endotracheal intubation
- tracheostomy
- surgical exposure and drainage
- of retropharyngeal space
Prognosis

- Good except rare complications (dysphagia, crepitus by neck flexion, pseudoaneurysm of the external carotid artery)
Conclusion

1. Fracture of hyoid bone resulting from trauma other than strangulation is rare.
2. Most: traffic accident.
3. Diagnosis:
   - History, clinical manifestation, laryngoscopy.
   - Radiography.
4. 48-72 hours observation.
5. Prognosis: good.


The end