Anatomy and Physiology of the Salivary Glands

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Grand Rounds Presentation
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Introduction

- The Major Salivary Glands
  - Parotid
  - Submandibular
  - Sublingual
- The Minor Salivary Glands
Embryology

- 6th-8th Weeks of Gestation
- Parotid
  - First to develop
  - Last to become encapsulated
- Autonomic Nervous System Crucial
Embryology
Anatomy: Parotid Gland

- Wedge shaped with 5 processes
  - 3 Superficial
  - 2 Deep
- Parotid Compartment
  - Superior – Zygoma
  - Posterior – EAC
  - Inferior – Styloid, ICA, Jugular Veins
Anatomy: Parotid Gland

- 80% overlies Masseter & Mandible
- 20% Retromandibular
- Stylomandibular Tunnel, Isthmus of Parotid
- Tail of Parotid
Anatomy: Parotid Gland

- Parapharyngeal Space
- Prestyloid Compartment
- Poststyloid Compartment (Paragangliomas)
Anatomy: Parotid Gland

- Stensen’s Duct
  - Arises from anterior border
  - 1.5 cm inferior to Zygomatic arch
  - Pierces Buccinator at 2\textsuperscript{nd} Molar
  - 4-6 cm in length
  - 5 mm in diameter
Anatomy: Parotid Gland

- Parotid Capsule
  - Superficial layer
  - Deep cervical fascia
- Superficial layer
- Deep layer
Anatomy: Parotid Gland

- CN VII
- 2 Surgical zones
- 3 Motor branches immediately
- Pes Anserinus – 1.3 cm
- Temperofacial Division
- Cervicofacial Division
- 5 Terminal branches
Anatomy: Parotid Gland
Anatomy: Parotid Gland

- Localization of CN VII
  - Tragal pointer
  - Tympanomastoid suture
  - Posterior belly Digastric
  - Styloid process
  - Retrograde dissection
  - Mastoidectomy
Anatomy: Parotid Gland

- Great Auricular nerve
- Auriculotemporal nerve
- Superficial Temporal vessels
- Frey’s Syndrome
Anatomy: Parotid Gland

- Neural compartment
  - VII, Great Auricular, Auriculotemporal
- Venous compartment
  - Retromandibular vein
- Arterial compartment
  - Superficial Temporal/Transverse Facial
Anatomy: Parotid Gland

- Lymphatics
  - Paraparotid & Intraparotid nodes
  - Superficial & Deep Cervical nodes
Anatomy: Submandibular Gland

- The ‘Submaxilla’
- Submandibular Triangle
- Mylohyoid ‘C’
- Marginal Mandibular branch
- Capsule from superficial layer of Deep Cervical fascia
Anatomy: Submandibular Gland

- Wharton’s duct
  - Exits medial surface
  - Between Mylohyoid & Hyoglossus
  - 5 cm in length
  - Lingual nerve & CN XII
Anatomy: Submandibular Gland
Anatomy: Submandibular Gland

- Innervation
  - Superior Cervical Ganglion (symp)
  - Submandibular Ganglion (para)
- Artery: Submental branch of Facial a.
- Vein: Anterior Facial vn.
- Lymphatics: Deep Cervical and Jugular chains
  - Facial artery nodes
Anatomy: Sublingual Gland

- Between Mandible & Genioglossus
- No capsule
- Ducts of Rivinus +/- Bartholin’s duct
- Sialogram not possible
- Innervation: Same as Submandibular
- Artery/Vein: Sublingual branch of Lingual & Submental branch of Facial
- Lymphatics: Submandibular nodes
Anatomy: Sublingual Gland
Anatomy: Minor Salivary Glands

- 600-1,000
- Simple ducts
- Buccal, Labial, Palatal, Lingual
- Tumor sites: Palate, upper lip, cheek
- Lingual & Palatine nn.
Imaging

- CT – Inflammatory
- MR – Tumor
- Children: U/S & MR
- NO sialogram during active infection
- Parotid is fatty
Microanatomy

- The Secretory Unit
  - Acinus (serous, mucous, mixed)
  - Myoepithelial cells
  - Intercalated duct
  - Striated duct
  - Excretory duct
Microanatomy

- Striated & Intercalated ducts well developed in serous, NOT mucous glands
- Striated duct: HCO3 into, Cl from lumen
- Intercalated duct: K into lumen, Na from lumen, producing hypotonic fluid
- Excretory ducts do NOT modify saliva
Microanatomy

- The Bicellular Theory
  - Intercalated duct
  - Excretory duct
- The Multicellular Theory
Microanatomy

- Parotid: serous & fatty
- Submandibular: mixed serous
- Sublingual: mixed mucous
- Stroma: Plasma cells
Microanatomy
Microanatomy
Function of Saliva

- Moistens oral mucosa
- Moistens & cools food
- Medium for dissolved food
- Buffer (HCO3)
- Digestion (Amylase, Lipase)
- Antibacterial (Lysozyme, IgA, Peroxidase, FLOW)
- Mineralization
- Protective Pellicle
Function of Saliva

- Salivary hypofunction
  - Candidiasis
  - Lichen Planus
  - Burning Mouth
  - Aphthous ulcers
  - Dental caries
  - Xerostomia not reliable
Production of Saliva

- Primary secretion
- Ductal secretion
- The “secretory potential” (hyperpolarizes)
- Increased flow rate yields decreased hypotonicity & K

### TABLE 15.1. Composition of Unstimulated Saliva

<table>
<thead>
<tr>
<th>Organic Constituents</th>
<th>Mean (mg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>220.0</td>
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<tr>
<td>Amylase</td>
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<tr>
<td>Lysozyme</td>
<td>22.0</td>
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<tr>
<td>IgA</td>
<td>19.0</td>
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<tr>
<td>IgC</td>
<td>1.4</td>
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<tr>
<td>IgM</td>
<td>0.2</td>
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<tr>
<td>Glucose</td>
<td>1.0*</td>
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<tr>
<td>Urea</td>
<td>20.0</td>
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<tr>
<td>Uric acid</td>
<td>1.5</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.1</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>8.0</td>
</tr>
<tr>
<td>cAMP</td>
<td>7.0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Inorganic Constituents</th>
<th>Mean (mg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>15.0</td>
</tr>
<tr>
<td>Potassium</td>
<td>80.0</td>
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<tr>
<td>Thiosulfate</td>
<td>9.0</td>
</tr>
<tr>
<td>Smokers</td>
<td>9.0</td>
</tr>
<tr>
<td>Nonsmokers</td>
<td>2.0</td>
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<tr>
<td>Calcium</td>
<td>5.8</td>
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<tr>
<td>Phosphate</td>
<td>16.8</td>
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<tr>
<td>Chloride</td>
<td>50.0</td>
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<tr>
<td>Fluoride</td>
<td>Traces (according to intake)</td>
</tr>
</tbody>
</table>

Autonomic Innervation

- **Parasympathetic**
  - Abundant, watery saliva
  - Amylase down

- **Sympathetic**
  - Scant, viscous saliva
  - Amylase up
Salivary Flow

- 1-1.5 L/day (1 cc/min)
- Unstimulated state
  - Submandibular
- Stimulated state
  - Parotid
- Sublingual & minor
  - Mucin
Effects of Aging

- Total salivary flow independent of age
- Acinar cells degenerate with age
- Submandibular gland more sensitive to metabolic/physiologic change
- Unstimulated salivary flow more greatly affected by physiologic changes