The Pharyngeal Arches

Dr. Archana Rani
Associate Professor
Department of Anatomy
KGMU UP, Lucknow
What is Pharyngeal Arch?

• Rod-like thickenings of mesoderm present in the wall of the foregut.

• They appear in 4\textsuperscript{th}-5\textsuperscript{th} weeks of development.

• Contribute to the characteristic external appearance of the embryo.

• As its development resembles with gills (branchia: Greek word) in fishes & amphibians, therefore also called as branchial arch.
Formation of Pharyngeal Arches

Diagram showing the development of the pharyngeal arches and related structures.
Pharyngeal Apparatus

Pharyngeal apparatus consists of:

- Pharyngeal arches
- Pharyngeal pouches
- Pharyngeal grooves/clefts
- Pharyngeal membrane
Pharyngeal Arches

• Pharyngeal arches begin to develop early in the fourth week as neural crest cells migrate into the head and neck region.

• The first pair of pharyngeal arches (primordium of jaws) appears as a surface elevations lateral to the developing pharynx.

• Soon other arches appear as obliquely disposed, rounded ridges on each side of the future head and neck regions.
Pharyngeal Arches

- By the end of the fourth week, four pairs of pharyngeal arches are visible externally.

- The fifth and sixth arches are rudimentary and are not visible on the surface of the embryo.

- The pharyngeal arches are separated from each other by fissures called pharyngeal grooves/clefts.

- They are numbered in craniocaudal sequence.
Pharyngeal Arch Components

• Each pharyngeal arch consists of a core of mesenchyme.

• Is covered externally by ectoderm and internally by endoderm.

• In the third week, the original mesenchyme is derived from mesoderm.

• During the fourth week, most of the mesenchyme is derived from neural crest cells that migrate into the pharyngeal arches.
Structures in a Pharyngeal Arch

- Nerve
- Aortic arch
- Cartilage
- Muscle
- Ectoderm
- Endoderm
Arrangement of nerves supplying the pharyngeal arch (in lower animals)
Fate of Pharyngeal Arches

A typical pharyngeal arch contains:

• An aortic arch, an artery that arises from the truncus arteriosus of the primordial heart.

• A cartilaginous rod that forms the skeleton of the arch.

• A muscular component that differentiates into muscles in the head and neck.

• A nerve that supplies the mucosa and muscles derived from the arch.
Derivatives of the skeletal elements
# Nerve & muscles of Pharyngeal arches

<table>
<thead>
<tr>
<th>Arch</th>
<th>Nerve of Arch</th>
<th>Muscles of Arch</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Mandibular</td>
<td>Medial and lateral pterygoids, Masseter, Temporalis, Mylohyoid, Anterior belly of digastric, Tensor tympani, Tensor palati.</td>
</tr>
<tr>
<td>Second</td>
<td>Facial</td>
<td>Facial Muscles, Occipitofrontalis, Platysma, Stylohyoid, Posterior belly of digastric, Stapedius, Auricular muscles.</td>
</tr>
<tr>
<td>Third</td>
<td>Glosso-pharyngeal</td>
<td>Stylopharyngeus</td>
</tr>
<tr>
<td>Fourth</td>
<td>Superior laryngeal</td>
<td>Muscles of larynx and pharynx</td>
</tr>
<tr>
<td>Fifth</td>
<td>Recurrent laryngeal</td>
<td></td>
</tr>
</tbody>
</table>
Fate of Ectodermal Clefts

• 1\textsuperscript{st} cleft:
  
  Dorsal part- \textit{Ext.}
  acoustic meatus &
  Pinna
  
  Ventral part-
  obliterated

• Cervical sinus:
  Branchial cysts/sinus
Fate of the Endodermal Pouches
Development of Parathyroid glands

- Third pouch
- Fourth pouch
- Parathyroid III
- Parathyroid IV
- Thyroid gland
  - Superior parathyroid
  - Inferior parathyroid
Development of the Thyroid gland

- Tuberculum impar
- Lingual swelling
- First arch
- Second arch
- Third arch
- Fourth arch
  - Fifth arch has disappeared
- Sixth arch
- Hypobranchial eminence
- Foramen caecum (blue dot)
- Tracheal groove

**Site of foramen caecum**

A. Floor of pharynx
B. Thyroglossal duct
C. Thyroid developing from thyroglossal duct
D. Lateral thyroid (?) from 4th pouch

Bifid lower end
Anomalies of shape of thyroid gland
Anomalies of position of thyroid gland
Other anomalies of thyroid gland

• Ectopic thyroid tissue

• Remnants of thyroglossal duct:
  (a) Thyroglossal cysts
  (b) Thyroglossal fistula
  (c) Carcinoma
REFERENCES


1. The cartilage of 2\textsuperscript{nd} pharyngeal arch gives origin to:

a) Incus
b) Malleus
c) Stapes
d) All of the above
2. All are derivatives of 1st arch except:
   a) Anterior ligament of malleus
   b) Sphenomandibular ligament
   c) Stylohyoid ligament
   d) Temporalis
MCQs

3. Tonsil is derived from which endodermal pouch?

a) 1\textsuperscript{st}

b) 2\textsuperscript{nd}

c) 3\textsuperscript{rd}

d) 4\textsuperscript{th}
4. Superior parathyroid glands develop from endoderm of which pharyngeal pouch?

a) 1\textsuperscript{st}
b) 2\textsuperscript{nd}
c) 3\textsuperscript{rd}
d) 4\textsuperscript{th}
5. Parafollicular cells of thyroid gland are derived from which endodermal pouch?

a) 1\(^{st}\) and 2\(^{nd}\)
b) 2\(^{nd}\) and 3\(^{rd}\)
c) 3\(^{rd}\) and 4\(^{th}\)
d) 4\(^{th}\) and 5\(^{th}\)