Anterior aspect of face and skull

Muscles of facial expression

Interior of skull
Learning objectives

1. To learn the development and osteology of facial and cranial bones
2. To describe the superficial face, the muscles of facial expression, blood supply, nerve innervation (cranial nerve V and VII) and other structures
3. To study osteology, interior of skull, cranial fossa, neurocranium and venous sinuses
4. To describe all 12 pairs of cranial nerves. To be able to deduce and anticipate symptoms from lesions to an area. Conversely, given the symptoms, to be able to locate the probable area of lesion
5. To describe the blood supply to the brain (Circle of Willis)
6. To learn the meninges that envelop the brain, dural venous sinuses, epidural, subdural space and blood supply in the area
7. Cavernous sinus, relevant anatomy and clinical significance
Development of face
Craniofacial development and malformations

Cleft lip with cleft palate
Cranial neural crest cells and craniofacial development
Neural crest cells
Craniofacial development

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By Keith Moore
medial nasal prominences merging with each other and the maxillary prominences

nasolacrimal groove

intermaxillary segment

philtrum of lip
Different components of the pharyngeal arches
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**Structures derived from different pharyngeal arches**

<table>
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<th>ARCH</th>
<th>NERVE</th>
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<th>SKELETAL STRUCTURES</th>
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<td>First (mandibular)</td>
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<td>Malleus</td>
<td>Anterior ligament of malleus</td>
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<td>Mylohyoid and anterior belly of digastric</td>
<td>Incus</td>
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<td>Tensor tympani</td>
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<td>Tensor veli palatini</td>
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<td>Second (hyoid)</td>
<td>Facial (CN VII)</td>
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<td>Stapes</td>
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<td>Styloid process</td>
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<td>Stylohyoid</td>
<td>Lesser cornu of hyoid bone</td>
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<td>Cricothyroid</td>
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<td>Levator veli palatini</td>
<td>Cricoid cartilage</td>
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<td>Constrictors of pharynx</td>
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<td>Intrinsic muscles of larynx</td>
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<td>Striated muscles of esophagus</td>
<td>Cuneiform cartilage</td>
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</tbody>
</table>

*The derivatives of the aortic arch arteries are described in Chapter 13.
†The ophthalmic division fifth cranial nerve (CN V) does not supply any pharyngeal arch components.
‡Temporalis, masseter, medial, and lateral pterygoids.
§Buccinator, auricularis, frontalis, platysma, orbicularis oris, and orbicularis oculi.
†The fifth pharyngeal arch is often absent. When present, it is rudimentary and usually has no recognizable cartilage bar. The cartilaginous components of the fourth and sixth arches fuse to form the cartilages of the larynx.
Human palatogenesis

6 wks

- Median palatine process
- Nasal cavity
- Oral cavity
- Tongue
- Olfactory nerves
- Eye
- Nasal septum
- Maxillary prominence
- Lateral palatine process
- Nasal conchae
- Olfactory nerves
- Nasal septum
- Bone developing in maxillary prominence
- Lateral palatine process
- Oral cavity
- Mandible
- Nasal septum
- Bone developing in maxilla
- Fused lateral palatine processes
- Tongue

12 wks

- Median palatine process
- Developing gum
- Maxillary prominence
- Nasal septum
- Incisive papilla
- Hard palate
- Soft palate
- Nasal cavity
- Nasal septum
- Uvula
- Primary palate
- Site of incisive foramen
- Secondary palate
- Nasal septum
- Uvula
Sensory innervation to the face

*Trigeminal Nerve*

*CN V*
Figure 7.07. Skin incisions.
Trigeminal Nerve (CN V): Overview

Somatosensory nerves from V₁ (red), V₂ (blue) and V₃ (green)
Cutaneous Innervation of the Face

V₁  Supraorbital Foramen/Notch
    Supraorbital nerve, artery & vein
    (from Frontal n. and Superior ophthalmic artery and vein)

V₂  Infraorbital Foramen
    Infraorbital nerve, artery & vein

V₃  Mental Foramen
    Mental nerve, artery & vein
    (from Inferior Alveolar n.a.v.)
Trigeminal Nerve (CN V): Overview

Nerve components

*Somatomotor to muscles of mastication* (temporalis, masseter, medial pterygoid, lateral pterygoid) and *associated muscles around the mouth* (anterior belly of digastric, mylohyoid, tensor veil palatini) and middle ear (tensor tympani).

Somatosensory from the skin of the face, *anterior 2/3 tongue, and *elsewhere (e.g., teeth, mucosa).

Trigeminal (Gasserian, semilunar) Ganglion (cell bodies for somatosensory axons: equivalent to a DRG; middle cranial fossa)
Trigeminal Nerve (CN V): Overview

V₁ Ophthalmic Division (nerve)
Leaves the skull through the **superior orbital fissure** to enter the **orbit**
Cutaneous branches of V1

- Supraorbital nerve
- Supratrochlear nerve
- Infratrochlear nerve
- External nasal nerve
Trigeminal Nerve (CN V): Overview

$V_2$

Maxillary Division (nerve)
Leaves the skull through the foramen rotundum to enter the pterygopalatine fossa
Cutaneous branches of V2

Infraorbital nerve
Zygomaticofacial nerve
Zygomaticotemporal nerve
Trigeminal Nerve (CN V): Overview

V₃
Mandibular Division (nerve)
Leaves the skull through the foramen ovale to enter the infratemporal fossa
Cutaneous branches of V3

Auriculotemporal nerve

Buccal nerve

Mental nerve
Cutaneous Innervation of the Face

Cranial nerves innervate the front of the skull.

Spinal nerves innervate the posterior side (dorsal and ventral rami).
Cutaneous Innervation of the Face

- Supraorbital n.
- Infraorbital n.
- Mental n.
Cutaneous Innervation of the Face
Cutaneous Innervation of the Face

“SHARED ZONES”

1. Conjunctiva of Eyelids
   Upper eyelid: \( V_1 \)
   Lower eyelid: \( V_2 \)

2. Mucus membrane of Lips
   Upper lip: \( V_2 \)
   Lower lip: \( V_3 \)
Muscles of facial expression

- Occipitofrontalis
- Corrugator supercilli
- Procerus + transverse part of nasalis
- Orbicularis oculi
- Lev. labii sup. alæque nasi + alar part of nasalis
- Buccinator + orbicularis oris
- Zygomaticus major + minor
- Risorius
- Risorius + depressor labii inferioris
- Levator labii superioris + depressor labii
- Stylators of mouth: nasus + levator labii superioris + depressor labii inferioris
- Orbicularis oris
- Depressor anguli oris
- Mentalis
- Platysma
Parotid gland and its duct
Facial Nerve (CN VII)
Facial Nerve (CN VII): Overview

- Petrous Part of the Temporal Bone
- Squamosal Part of the Temporal Bone
- Internal Acoustic Meatus (exit for CN VII)

*Facial Canal (not shown) is inside petrous temporal*
Facial Nerve (CN VII): Overview

Styloid Process

Stylomastoid Foramen (exit for CN VII)

Mastoid Process
Facial Nerve (CN VII): Somatomotor Branches

Branches of CN VII:
1. Posterior auricular
2. Temporal
3. Zygomatic
4. Buccal
5. Marginal mandibular
6. Cervical

- Epicranial aponeurosis
- Temporal fascia
- Occipital belly of occipitofrontalis
- Auricularis
  - Superior
  - Anterior
  - Posterior
- Frontal belly of occipitofrontalis
- Orbicularis oculi (orbital and palpebral parts)
- Nasalis
- Levator labii superioris alaeque nasi
- Levator labii superioris
- Zygomaticus minor
- Zygomaticus major
- Orbicularis oris
- Oral fissure
- Risorius (cut)
- Buccinator
- Depressor anguli oris
- Mentalis (cut)
- Depressor labii inferioris
- Platysma (cut)
Facial Nerve (CN VII): Somatomotor Branches

- Posterior Auricular (P)
- Temporal (T)
- Frontalis
- Zygomatic (Z)
- Orbicularis oculi
- Buccal (B) / Buccinator
- Orbicularis oris
- (Marginal) Mandibular (M)

Helps you wiggle your ears

Cervical (C) / Platysma

Hard to find

*Mtiny Zebra Bite My Cheek (Please)*

Along squamosal part of temporal bone

Don’t call this “mandibular nerve” b/c that’s V3
1. Peripheral nervous system
2. Influences the function of internal organs
3. Control of respiration, cardiac regulation, vasomotor, and reflex actions (coughing, sneezing, and etc.).
4. ANS is divided into sympathetic (T1-L2) and parasympathetic [craniosacral, (CN3, 7, 9 &10, S2-4)] nervous system.
5. Sequential two-neuron efferent pathway
Where are the cell bodies for different fibers within the lingual nerve??

Somatosensory Semilunar ganglion

Special sensation-taste fibers Geniculate ganglion

Para-Pre- from Pons to SMG
2 cm superior to the supraorbital margin

2 cm superior to the external occipital protuberance (very thin)

Figure 7.13. How to reflect the scalp and mark the calvaria for sawing.
Cut the tentorium cerebelli before removing the brain.
Vessels dissected out: inferior view

- Anterior cerebral artery (A2 segment)
- Anterior communicating artery
- Anterior cerebral artery (A1 segment)
- Ophthalmic artery
- Internal carotid artery
- Middle cerebral artery
- Posterior communicating artery
- Posterior cerebral artery (P2 segment)
- (P1 segment)
- Superior cerebellar artery
- Basilar artery
- Pontine arteries
- Anterior inferior cerebellar artery
- Vertebral artery

- Medial striate artery (recurrent artery of Heubner)
- Anteromedial central (perforating) arteries
- Hypothalamic artery
- Anterolateral central (lenticulostriate) arteries
- Superior hypophyseal artery
- Inferior hypophyseal artery
- Anterior choroidal artery
- Thalamotuberal (premammillary) artery
- Posteromedial central (perforating) arteries
- Thalamoperforating artery
- Posteromedial central (paramedian) arteries
- Labyrinthine (internal acoustic) artery

Vessels in situ: inferior view

- Anterior cerebral artery
- Hypothalamic artery
- Internal carotid artery
- Superior hypophyseal artery
- Middle cerebral artery
- Inferior hypophyseal artery
- Posterior communicating artery
- Efferent hypophyseal veins
- Posterior cerebral artery

- Anterior communicating artery
- Optic chiasma
- Cavernous sinus
- Infundibulum (pituitary stalk) and long hypophyseal portal vein
- Adenohypophysis (anterior lobe of pituitary gland)
- Neurohypophysis (posterior lobe of pituitary gland)
- Posteromedial central (perforating) arteries
- Superior cerebellar artery
- Basilar artery