Unit 24: Cranial Cavity and Contents

Dissection Instructions:

The calvaria is to be removed without damage to the dura mater which is attached to the inner surface of the calvaria. Cut through the outer table of bone all the way around the skull (Figure 24-1), staying one-fourth inch above the orbits and one-fourth inch above the external occipital protuberance (A in Figure 24-2). Remember that the skull is very thin in the temporal region. Using chisel and mallet, break through the inner table of bone until the calvaria is attached only by the dura mater. Using first a chisel to pry up the calvaria, push the dura mater away from the bone with your index finger (Figure 24-3 & 24-4). Work all the way around the cut. Continue to separate the dura and bone upward until the calvaria is removed. Note the small vessels which communicated between the dura and the diploe of the bone. Observe the dura in place and note the middle meningeal artery.
Open the **superior sagittal sinus** and clean it out so **arachnoid villi and venous lacunae** can be inspected (*Plates 100, 102, 103; 7.18A&D, 7.19, 7.20, 7.21A*). Using your scissors, make two incisions in the dura parallel to the mid-line and one-half inch lateral to the sinus from anterior to posterior. From the superior aspect of the dura covering the brain, make incisions through the dura laterally to the ears and reflect the four flaps of dura downward. Study the **arachnoid mater**. This is a thin membrane internal to the dura which bounds the **subarachnoid space** containing the **cerebrospinal fluid**. In life, it is opposed to the dura with only a small amount of fluid in the **subdural space**. Note the cerebral veins entering the **superior sagittal sinus** (*Plates 100, 102; 7.19, 7.21*). Carefully lift the arachnoid and note that it crosses over the sulci of the cerebral hemispheres. Carefully separate the **cerebral hemispheres** and study the **falc cerebri** (*Plates 103; 7.18A, 7.20, 7.21A*). Cut it from its attachment to the **crista galli of the ethmoid bone**.

Elevate carefully the frontal lobes of the cerebral hemispheres enough to see the olfactory tracts and bulbs. The **olfactory bulbs** should lie on the **cribriform plate** on each side of the crista galli. With a probe, loosen them from the cribriform plate if they are still attached. The nerve processes passing through the cribiform plate to the nasal mucosa are actually the **olfactory nerves** for the sense of smell. Elevate the cerebral hemispheres enough to see the **optic nerves** medial to the **anterior clinoid processes**. They form the **optic chiasma** where they appear to join each other. Using a new scalpel blade, cut both optic nerves leaving half of the nerve on the brain and half in the cranial cavity. Immediately posterior to the optic nerves are the **internal carotid arteries**. Cut them. In the mid-line, the **stalk of the pituitary gland/infundibulum** may be seen. It is usually black because of the blood it contains. It descends from hypothalamus of the brain and the inferior surface of the optic chiasma and enters the **hypophyseal fossa of the sella turcica of the body of the sphenoid**. Immediately posterior to the internal carotid arteries are the **oculomotor nerves**. They pierce the dura to pass in the dural wall of the **cavernous sinus** to the **superior orbital fissure** to enter the **orbits**. Cut the **pituitary stalk, internal carotid arteries** (if not already cut) and **oculomotor nerves**. (When cutting the cranial nerves attempt to leave part of the nerve on the brainstem and part in the cranial cavity).

Without breaking the **brainstem**, elevate the **frontal and temporal lobes** of the cerebral hemispheres until the attachment of the **tentorium cerebelli** to the apex and ridge of the petrous portion of the temporal bone can be seen (*Figure 24-5*). With the TIP of the scalpel blade carefully cut through the attachment of the tentorium cerebelli from the petrous bone as close to the bone as possible (A to B in *Figure 24-5*). **This cut must extend along the petrous ridge posteriorly and onto the occipital bone at the transverse sinus.**
Immediately inferior to the tentorium cerebelli is the trigeminal nerve which leaves the lateral side of the pons to enter the middle cranial fossa. It may or may not have been cut when the tentorium was cut. It must now be cut. Look into the posterior cranial fossa along its anterior wall. The abducens nerve leaves the brainstem at the pontomedullary junction to enter the dura covering the clivus. The nerves are less than a cm apart when they leave the brainstem. Cut them. Lateral to the abducens nerves are the facial and vestibulocochlear nerves within the pontocerebellar angle. They enter the internal auditory meatus on each side of the posterior cranial fossa. Cut them. Inferior to the latter two nerves is the glossopharyngeal, vagus and accessory nerves exiting the brainstem and entering the jugular foramen to leave the skull. Do not break the brain stem in trying to see these nerves. Identify the surface of the clivus. Look also for the vertebral arteries which enter the cranial cavity though the foramen magnum. Place the scalpel on the clivus and parallel to clivus insert the scalpel through the foramen magnum as far as possible. Now cut the spinal cord and vertebral arteries, keeping the scalpel blade against the clivus and deep in the vertebral canal. When the spinal cord and vertebral arteries are cut, the brain should be free and can be removed by lifting it carefully away from the cranial floor. The tentorium cerebelli must slip out from between the occipital lobes of the cerebral hemispheres and the cerebellum.

The dura mater must be kept moist or it will dry out quickly.

Identify the cranial nerves at the point they leave the brain (Plates 114, 118; 7.23, 7.24, 9.1).

I olfactory tracts and bulbs (CN1/I)
II optic nerves (CN2/II)
III oculomotor nerves (CN3/III)
IV trochlear nerves (CN4/IV) - the only nerves which leave the posterior aspect of the brainstem. Only identify, at this time, the part of the trochlear nerves as they lie between the cerebral hemispheres and the cerebellum.
V trigeminal nerve (CN5/V)
VI abduces nerve (CN6/VI)
VII  facial (CN7/VII)
a. between facial and vestibulocochlear nerve is usually found the nervus intermedius, which belongs to the facial nerve
b. nervus intermedius nerve contains taste fibers and parasympathetic fibers
VIII  vestibulocochlear (CN8/VIII)
IX  glossopharyngeal nerve (CN9/IX)
X  vagus nerve (CN10/X)
XI  accessory nerve (CN11/XI)
XII hypoglossal nerve (CN12/XII) - arises from fibers anterior to the inferior olive

Place the brain in a container covered with fluid until the cranial cavity has been studied.

Attempt to restore the dura (Plates 103, 104; 7.20A, 7.21), including the falx cerebri and tentorium cerebelli, to their original positions within the cranial cavity before the brain was removed. Identify all the dural sinuses (Plate 103, 104, 109, 144; 7.20A, 7.21, 7.24B). The inferior sagittal sinus is located along the inferior margin of the falx cerebri. The straight sinus is located in the junction of the falx cerebri and tentorium cerebelli. Its anterior end is continuous with the inferior sagittal sinus and it also receives the great cerebral vein of Galen, probably represented now by a hole. The straight sinus empties into the confluence of the sinuses, the blood usually flowing primarily through the left transverse sinus while the blood from the superior sagittal sinus usually flows through the right transverse sinus. The transverse sinus extends laterally until it reaches the petrous bone, then continues to the jugular foramen as the sigmoid sinus. The superior petrosal sinus lies in the attachment of the tentorium cerebelli on the petrous ridge. It connects the cavernous sinus to the sigmoid sinus. The cavernous sinus also connects directly to the jugular foramen by the inferior petrosal sinus. These sinuses should be opened to verify their presence.

Identify all the cranial nerves in the cranial cavity and note their relationship to the dura (Plates 104; 7.22, 7.24-7.27, 9.2). The olfactory bulb, in removal of the brain, may either have stayed on the brain or remained in the midline of the anterior cranial fossa. The olfactory bulb sits on the cribriform plate which has foramina through which the olfactory nerves traverse from the olfactory mucosa to the olfactory bulb. The optic nerve exits the cranial cavity through the optic canal. The ophthalmic artery, a branch of the internal carotid artery, also traverses the optic canal to the orbit.

Identify again the oculomotor, trochlear, trigeminal and abducens nerves in the cranial cavity. These should be followed carefully through the dura into the cavernous sinus to the superior orbital fissure by carefully cutting and pulling away the dura (Plates 86, 104; 7.18, 7.25-7.27, 9.2). The trochlear nerve can be found near the posterior clinoid processes. Clean the trigeminal nerve as it enters the middle cranial fossa under cover of extensions of the tentorium cerebelli. It does not enter the dura until it expands as the trigeminal ganglion (Plates 86, 104; 7.26). Identify and follow the ophthalmic, maxillary and mandibular divisions of the trigeminal nerves as they leave the ganglion. Dissect the abducens nerve, trochlear nerve,
oculomotor nerve, ophthalmic nerve, and maxillary nerve in the cavernous sinus (Plates 86, 104; 7.26, 7.27, 9.2). In their course to the superior orbital fissure, relationships between the oculomotor, trochlear, ophthalmic division and abducens nerves change and need to be follow (Plates 86, 104; 7.26, 7.27A, 9.2):

1. the trochlear nerve crosses lateral to the oculomotor nerve and become located superiorly to it
2. the oculomotor nerve divides into upper and lower divisions before entering the orbit
3. the ophthalmic division of the trigeminal nerve divides into three branches, the frontal, lacrimal and nasociliary nerves before entering the orbit
4. the frontal and lacrimal nerves remain superior within the superior orbital fissure, but lateral to the trochlear nerve
5. the nasociliary nerve passes lateral to the oculomotor nerve, then passes between its divisions as it goes through the superior orbital fissure

While the nerves are being cleaned, also clean the internal carotid artery in the cavernous sinus (Plates 104; 7.26, 7.27, 9.2). Note the close relationship of the abducens nerve as it travels lateral to the internal carotid artery. Anteriorly, the cavernous sinus receives the ophthalmic veins from the orbit (Plates 85-bottom; 7.21A). Small sphenoparietal sinuses are located in the dura on the free margin of the lesser wings of the sphenoid bone.

The facial nerve and the vestibulocochlear nerves exit the posterior cranial fossa at the internal auditory meatus on the medial aspect of the petrous portion of the temporal bone. As the nerves enter the internal auditory canal the facial nerve is in an anterosuperior position and the vestibulocochlear nerve divides into its two parts with the cochlear nerve located anteroinferiorly and the vestibular nerve located posteriorly. The latter further divides into superior and inferior divisions. The nervus intermedius travels with the facial nerve and becomes incorporated in it (Plates 104; 7.23, 9.1).

The glossopharyngeal, vagus, and accessory nerves all leave the posterior cranial fossa through the jugular foramen. They pierce the dura and travel in the middle section of the foramen. Entering into the foramen, but separately from the nerves, are the sigmoid sinus, posteriorly, and the inferior petrosal sinus anteriorly. The accessory nerve is formed from the spinal cord and brainstem. Those filaments arising from the upper cervical spinal cord segments ascend along the spinal cord, enter the posterior cranial fossa through the foramen magnum and join with the fibers that arise from the brainstem. Identify both parts of the accessory nerve. The hypoglossal nerve enters by itself into the hypoglossal canal (Plates 104; 7.23, 9.1).

Now remove the arachnoid mater from the base of the brain so that the blood supply to the brain can be studied (Plates 139-143; 7.28, Table 7.5 figures-p. 647).

1. Identify the vertebral arteries, Identify the posterior and anterior spinal arteries and posterior inferior cerebellar arteries which arise from the vertebral artery.
2. Identify the basilar artery formed by the two vertebral arteries as it lies on the anterior surface of the pons.
3. Identify branches arising from the basilar artery: anterior inferior cerebellar.
labyrinthine, pontine and superior cerebellar arteries. The basilar artery ends by dividing into posterior cerebral arteries. Identify the arteries.

4. Observe that the superior cerebellar and posterior cerebral arteries are close together, but are separated by the oculomotor nerves and the tentorium cerebelli.

5. Identify the arteries that make up the cerebral circle of Willis: posterior cerebral arteries, posterior communicating arteries, internal carotid arteries, anterior cerebral arteries and anterior communicating artery.
Be sure to identify all of the following in this unit:

calvaria  inferior sagittal sinus
sagittal sinus  straight sinus
arachnoid villi  great vein of Galen
venous lacunae  confluence of the sinuses
arachnoid  transverse sinuses
subarachnoid space  cavernous sinus
subdural space  sigmoid sinus
cerebral hemisphere  inferior petrosal sinus
falx cerebrae  ophthalmic artery
crista galli  superior orbital fissure
olfactory bulbs  posterior clinoid processes
cribiform plates  trigeminal ganglion
optic nerves  ophthalmic nerve
optic chiasma  maxillary nerve
internal carotid arteries  mandibular nerve
stalk of pituitary gland  cochlear nerve
brainstem  vestibular nerve
frontal lobe  nervus intermedius
temporal lobe  hypoglossal canal
tentorium cerebelli  vertebral arteries
trigeminal nerve  posterior & anterior spinal arteries
pons  posterior inferior cerebellar arteries
middle cranial fossa  basilar artery
posterior cranial fossa  anterior inferior cerebellar artery
abducens nerve  labyrinthine arteries
clivus  pontine arteries
facial nerve  superior cerebellar arteries
internal auditory meatus  posterior cerebral arteries
glossopharyngeal nerve  posterior communicating arteries
vagus nerve  internal carotid arteries
gasserian ganglion  middle cerebral arteries
accessory nerve  anterior cerebral arteries
jugular foramina  anterior communicating artery
vertebral arteries  circle of Willis
foramen magnum  oculomotor nerves
cerebellum  trochlear nerves
ependyma  hypoglossal nerve