Unit 18: 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 18-1), staying one-fourth inch above the orbits and one-fourth inch above the external occipital protuberance (A in Figure 18-2). 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 18-3 & 18-4). 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 sagittal sinus and clean it out so arachnoid villi and venous lacunae can be inspected (Plates 95, 96: 7.13a, 7.14). Using your scissor, 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 top of the brain covered dura.
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 95, 96; 7.14, 7.15). Carefully lift the arachnoid and note the it crosses over the sulci of the cerebral hemispheres. Carefully separate the cerebral hemispheres and study the falx cerebri (Plates 97; 7.15, 7.16). 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 cribriform 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 brain stem, 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 18-5). 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 18-5). 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 brain stem. 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 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 through 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 108, 112; 7.19, 7.24).

I. olfactory tracts and bulbs (CN1/I)
   II. optic nerves (CN2/II)
   III. oculomotor nerves (CN3/III)
   IV. trochlear nerves (CN4/IV) - only nerves which leave the posterior aspect of the brain stem, but only identify at this time part of the trochlear nerves as they lie between the cerebral hemispheres and the cerebellum
   V. trigeminal nerve (CN5/V)
   VI. abducens 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
      a. 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 97, 98; 7.14, 7.18), 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 97, 98, 103, 137; 7.13A, 7.16). 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 confluens 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 98; 7.18, 7.20, 7.21, 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 cribiform 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 82, 98; 7.18, 7.21-7.23, 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 82, 98; 7.18, 7.22). 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 82, 98; 7.22, 7.23, 9.2). In their course to the superior orbital fissure, several relationships between the oculomotor, trochlear, ophthalmic division and abducens nerves change and need to follow (Plates 82; 7.22, 7.23A):

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 98; 7.22, 7.23, 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 81; 7.15A). 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 98; 7.20, 9.2).

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 by filaments ascending along the spinal cord which join with the fibers that arising from the brainstem. Identify both parts of the accessory nerve. The hypoglossal nerve enters by itself into the hypoglossal canal (Plates 98; 7.20, 9.2).

Now remove the arachnoid mater from the base of the brain so that the blood supply to the brain can be studied (Plates 132-136; 7.24, p. 624).

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