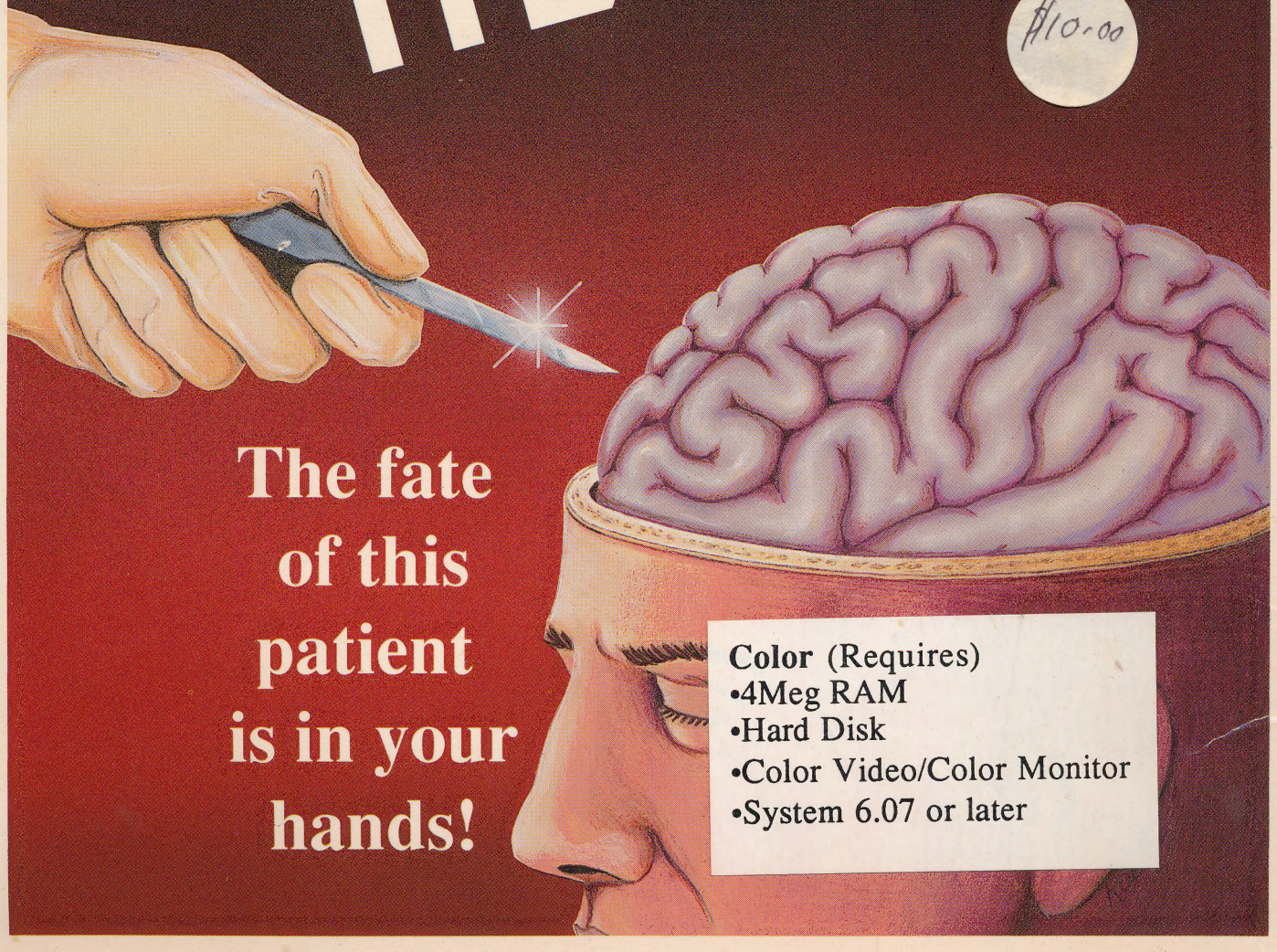
ISM, Inc.

SURGEON 3
THE BRAIN

$10.00



The fate of this patient is in your hands!

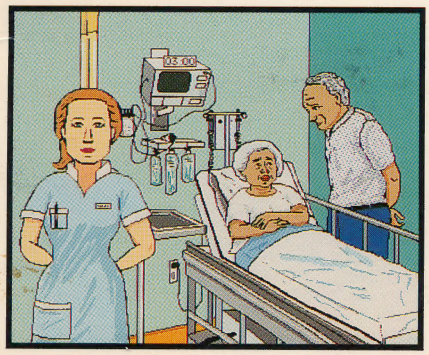
Color (Requires)
- 4Meg RAM
- Hard Disk
- Color Video/Color Monitor
- System 6.07 or later

YOU WILL OPERATE!

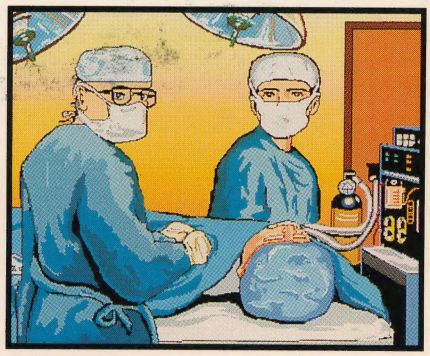
In *"SURGEON 3, THE BRAIN"*, your actions and decisions will determine the outcome of your patients' operations. Will they die under your knife, or survive because of your precise diagnostic and surgical skills?

We provide you with the setting, the players, training and tools to participate in this animated brain surgery game.

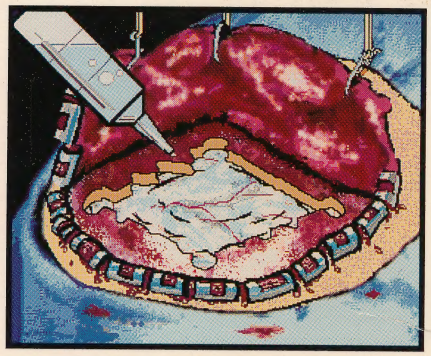
It is up to you, the surgeon, how this game will end. The choices are yours to make, they better be the right ones!



"Are you ready doctor."
The action takes place in a busy hospital. Various characters will lead you through the game.

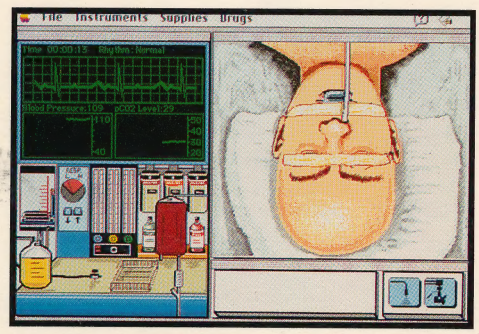


"Are you ready doctor."
In our fully equipped operating room, the real adventure begins!



"Are you ready doctor."
The operation requires knowledge and skill. You must be ready to cut into living tissue to save a life!

Use State of the Art equipment; Magnetic Resonance Imaging (MRI), CAT Scanner, and Ultra Sound, to help diagnose the various neurological problems your patients may have. A full array of surgical tools are also at your disposal.



FEATURES

- Realistic Graphics
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NERVOUS SYSTEM

2nd Edition

Edited by Myo Thant, M.D.,M.E.S.

ISM,Inc.
1992

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NERVOUS SYSTEM

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CHAPTER 1 - Anatomy and Physiology of Nervous System

Structure of the Brain

The brain is not a sturdy tissue. Even moderate pressure can kill brain cells, so nature safeguards the brain-by surrounding them with a tough, fluid-containing membrane called meninges and by surrounding the membrane with the skull bones.
There are three layers of the meninges (figure 1.1).

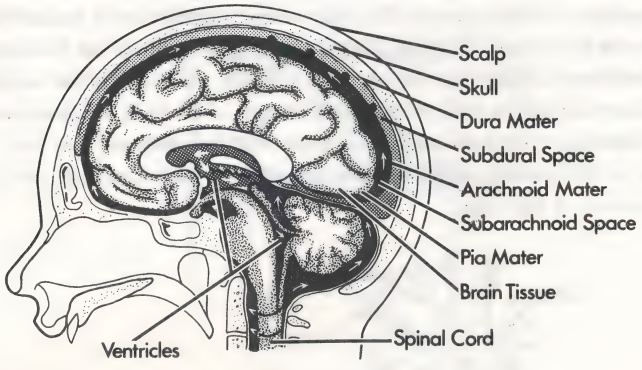


Figure 1.1

The outermost layer just beneath the skull is called the dura mater.
The next membrane layer is called the arachnoid mater. The arachnoid membrane resembles a cobweb with fluid filling in its spaces. The word "arachnoid" comes from *arachne*,the Greek word for spider.
The deepest layer close to the brain tissue is called the piamater. Piamater is a very thin and transparent membrane almost stuck to the brain tissue.
Between the dura mater and the arachnoid membrane is a subdural space, which is filled

with fluid.
Between the arachnoid and the pia is the subarachnoid space. This space contains a free flowing fluid called cerebrospinal fluid. The cerebrospinal fluid protects the brain and the spinal column from injury by acting as a cushin.
If the brain is cut into halves from side to side, the ventricles will be seen. Ventricles are cavities that lie on each side of the brain. Within the ventricles is the cerebrospinal fluid that connects the cerebrospinal fluid of the brain with the fluid in the spinal column and the blood circulation.

Function of the Brain.

Brain cells are specialized cells called *neurons*. Neruons specialize in the function of transmitting nerve impulses. Each neuron (figure 1.2) consists of three main parts: a body called the *neuron cell body*, one or more branching projections called *dendrites*, and one elongated projection known as an *axon*. The brain neurons coordinate all the activities of the rest of the cells in the body. Thinking, hearing, seeing are many of the functions controlled by the brain. Different sensations such as anger, joy, fear, sorrow are parts of the functions controlled by the brain. Movements of parts of the body are also coordinated by the brain. A damage to the brain will impair many vital functions and may lose consciousness. Stroke is a term used when one side of the brain is damaged resulting in paralysis on one side of the body.

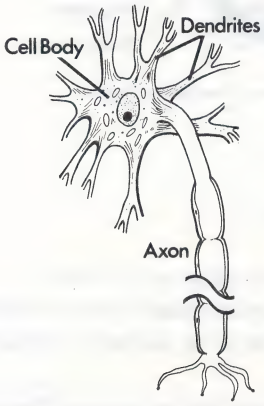


Figure 1.2

Structure of the Spinal Cord

The spinal cord is also covered by the same three layers of the meninges. The meninges that form the protective covering around the spinal cord also extend up and around the brain. The spinal cord is about 17 or 18 inches long. It connects the brain and extends almost all the way down to the waist. Cross section of the spinal cord (figure 1.3) shows that the cord is composed of interior gray matter surrounded by white matter.
The gray matter of the spinal cord is composed mainly of denrites and cell bodies of neurons. The white matter form the outer portion of the cord, and bundles of nerve fibers (motor and sensory) make up the white matter.

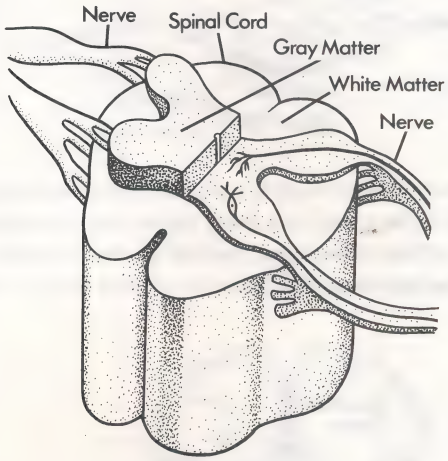


Figure 1.3

Function of the Spinal Cord

Thirty-one pairs of nerves attach to the spinal cord. The spinal nerve contains both sensory and motor fibers. Spinal nerves therefore function to make possible both sensations and movements.
Motor Pathway - Movement of the muscles is controlled by the motor nerve. The stimulus for movement travels from the cerebral cortex of the brain to the midbrain. At the midbrain, it crosses over to the other side and travels down the spinal cord to the peripheral nerve and to the muscles. Stimulation of one side of the cerebral cortex, therefore, causes movements on the opposite of the body (figure 1.4).

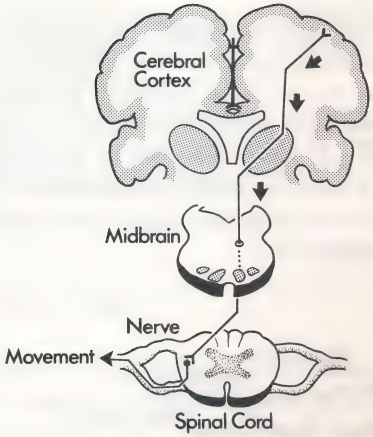


Figure 1.4

Sensory Pathway - Sensations such as pain, touch, and temperature travel along sensory nerve fibers in the body to the spinal cord. In the spinal cord, the nerve fibers cross over to the other side. The nerve fibers travel along the spine up into the cerebral cortex. Therefore, each side of the brain registers sensations from the opposite side of the body (figure 1.5).

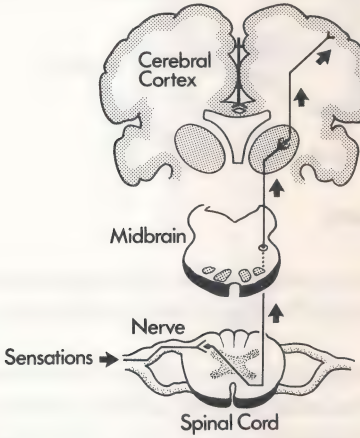


Figure 1.5

Reflexes - Reflexes are spontaneous reactions to sudden stimuli. In the case of knee, bicep,

and tricep muscle jerks, a sudden stretch in the muscles causes a stimulus to travel along the special nerve fibers to the spinal cord (figure 1.6). The stimulus then travels back down an appropriate motor nerve fiber and causes the muscle to jerk. Note that the stimulus does not travel to the brain first. This is to increase the reaction time. Reflexes are exaggerated if there is a lesion or injury in the brain or the spinal cord. Reflexes are absent if the lesion or injury damages the nerve fibers distal to the spinal cord or in the muscles.

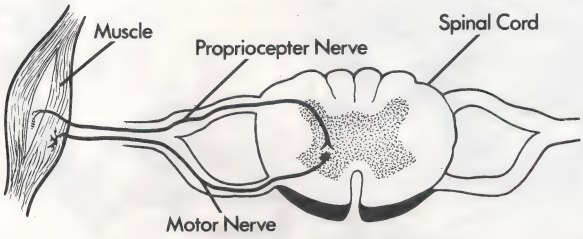


Figure 1.6

CHAPTER 2: RADIOLOGY OF THE BRAIN

Angiography.

Angiography is a procedure where a dye is injected into the blood vessel and x-rays are taken to view the integrity of the vessel (figure 2.1).

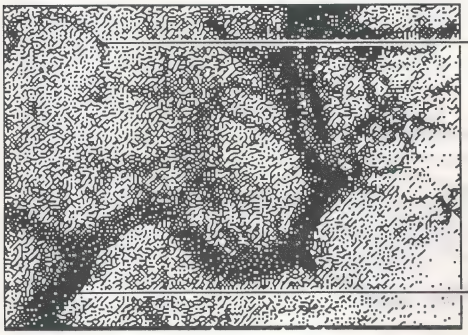


Figure 2.1

The contours and positions of the blood vessels can give significant information of the conditions and diseases in the brain. Figure 2.2 shows a normal angiogram where the blood vessels are seen as smooth and symmetrical shadows.

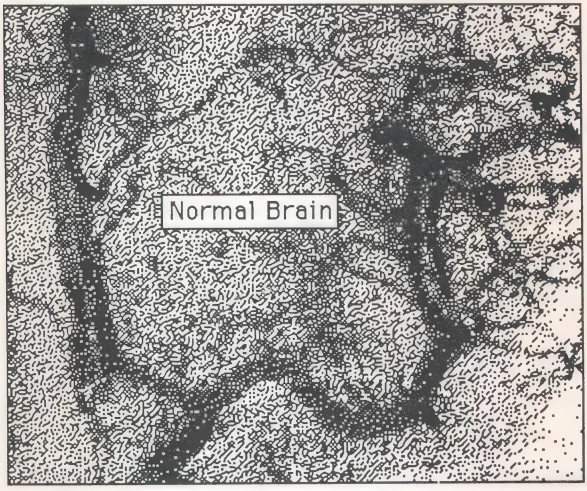


Figure 2.2

Angiography is useful in determining the abnormalities of the blood vessels as in aneurysm, where a dilatation of the blood vessel can be seen clearly as a small balloon

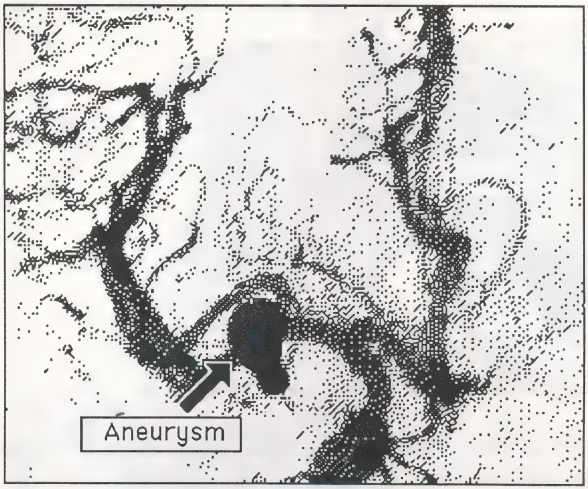


Figure 2.3

The positions of the blood vessels can also be assessed by angiography. The blood vessels may be displaced by a mass such as a tumor or a blood clot.

Figure 2.4 shows an angiogram of a patient with a brain tumor. Notice the blood vessels being pushed away and almost no blood vessels present in the portion of the brain where the tumor is located.

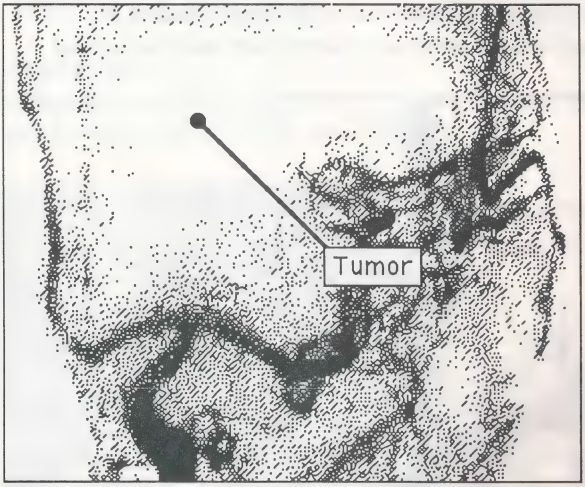


Figure 2.4

Cerebral infarction (or stroke) is caused by a blood clot blocking the blood vessel. The part of the brain that is supplied by the blood vessel dies. The angiogram shows the dye in the blood vessel being cut off (figure 2.5).

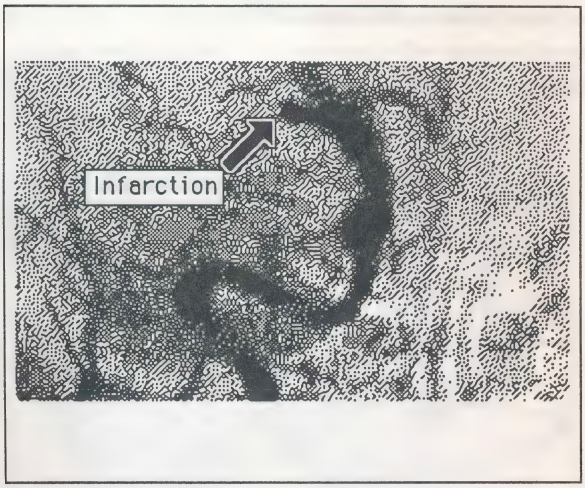


Figure 2.5

In subdural hematoma blood vessels are displaced by the blood clot from the side. It is best seen in the frontal view (figure 2.6)

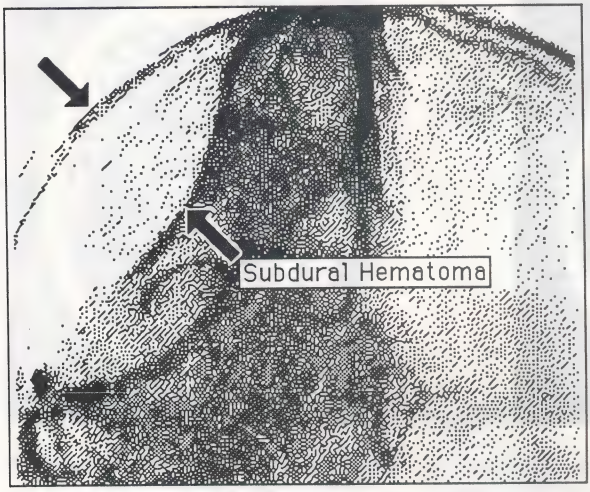


Figure 2.6

CAT (Computer Assisted Tomography) SCAN

A CAT scan is a specialized x-ray technique, where parts of the patient's body are x-rayed in sections. A computer then calculates the density of the tissues and organs in the body and displays the computerized image.
Because it uses iodine to contrast various tissues, patients allergic to iodine should not have a contrast used for the CAT scan.
In addition, the dye can further damage an already damaged kidney. Therefore, the dye should not be used on patients who have kidney damage or renal failure.

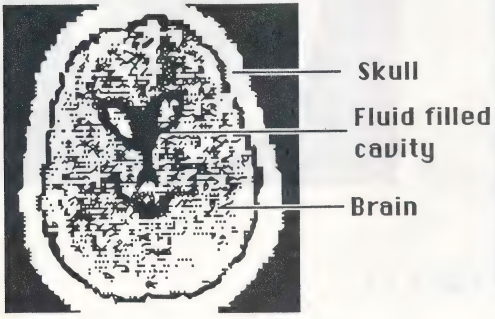


Figure 2.7 normal

In patients with aneurysm, the site of aneurysm shows a contrast showing the site of dilated blood vessel (figure2.8).

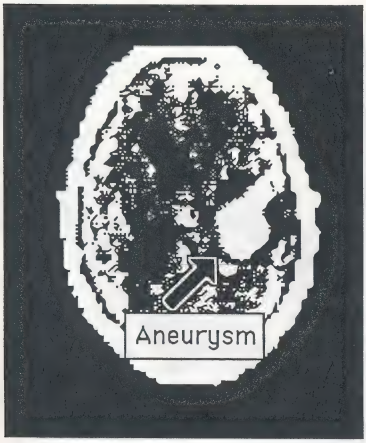


Figure 2.8

The CAT scan of the patient with brain tumor shows a defect at the site where the tumor is located (figure 2.9).

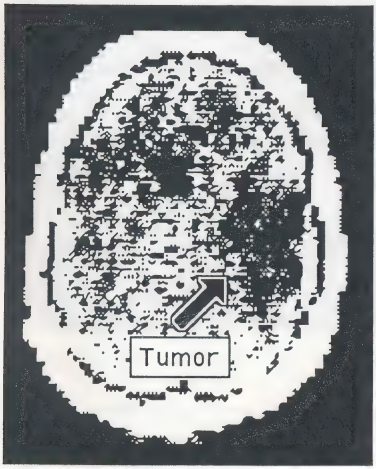


Figure 2.9

In a patient with stroke the CAT scan shows a defect at the site of the lesion (figure 2.10). The findings are similar to the findings of a tumor except the defect becomes more pronounced when the dye is injected in the tumor.

Figure 2.10

The CAT scan findings of a patient with a subdural hematoma shows a defect at the edge of the brain. The brain is pushed aside by the blood. (figure 2.11).

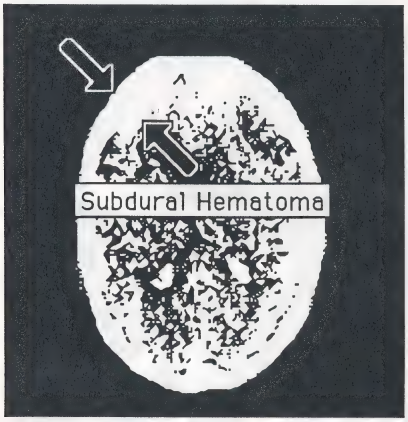


Figure 2.11

Magnetic Resonance Imaging (MRI)

MRI scans are created by placing the patient in a strong magnetic field and subjected them to short radiofrequency pulses. The atoms comprising the patient's body respond by discharging bursts of radio waves which are interpreted by a computer and converted into images. Because of the strong magnetic field involved, patients with pacemakers should not be subjected to MRIs.

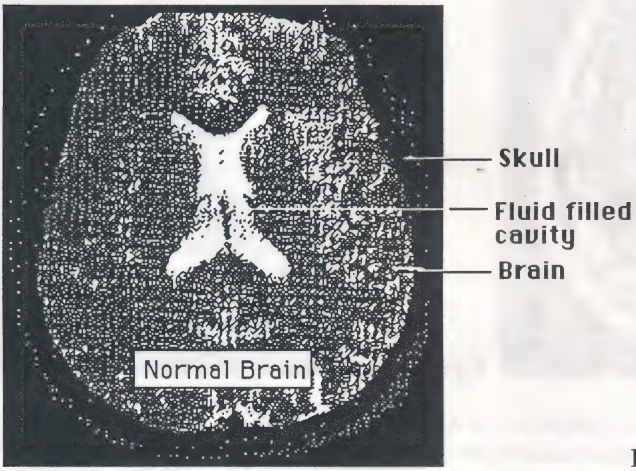


Figure 2.12 Normal

MRI of an aneurysm sometimes may not show any abnormality (figure 2.13).

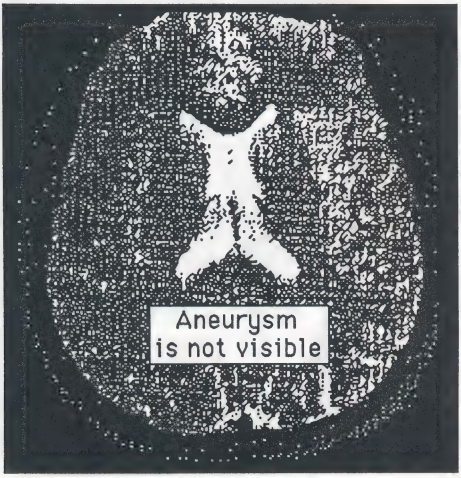


Figure 2.13

MRI is particularly useful in detecting tumors in the brain (figure 2.14). It is very sensitive and may even detect tumors that can be missed by CAT scan.

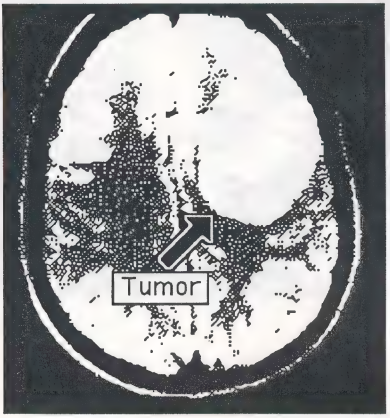


Figure 2.14

MRI can also detect brain infarction and strokes (figure 2.15).

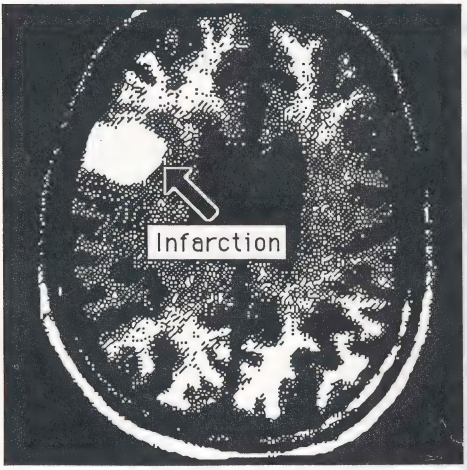


Figure 2.15

In subdural hematoma, MRI shows a defect at the side of the architecture of the brain (figure 2.16). This is because the blood clot pushes the brain.

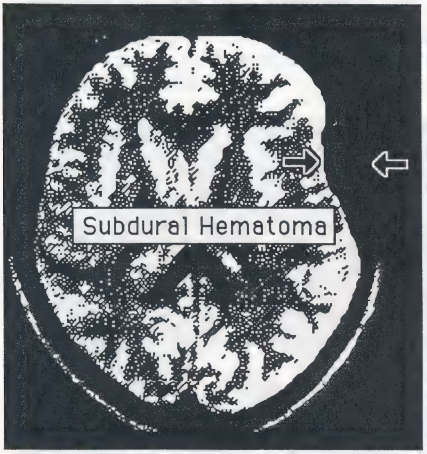


Figure 2.16

SKULL X-RAYS

X-rays of the skull are ordered if an injury to the head is suspected (figure 2.17). When there is a head injury a crack or a fracture of the skull is seen (figure 2.18).

Figure 2.17 Normal

Figure 2.18 Fractured skull

Chapter 3- Diseases of the Nervous System

Examination of the Nervous System

The neurological examination involves testing the muscle strength, sensation, and reflexes. The following tests can be performed on the head:

[1] SENSATION. Sensation on one side of the face is lost if there is a lesion or injury on the opposite side of the brain. Use a pin to test the sensation.
[2] SPEECH. The speech center is located on the left side of the brain. A lesion or injury to that side may cause speech impairment. Ask the patient to speak words printed on the card.
[3] EYE MOVEMENT. Movement of the eyes is tested to determine whether the eye muscles are paralyzed, indicating an injury or lesion on the opposite side of the brain. Movement is tested by dragging an object in front of the patient's eyes and watching for movement.
[4] PUPIL REACTION. The size of the pupils in the patient's eyes provides a great deal of valuable information. Dilation of the pupil can occur when there is an injury on the same side of the brain. A cocaine addict will have both pupils dilated while a morphine addict will have both pupils constricted. The pupil reaction is tested by shining a light in the patient's eyes. If the reflexes are intact, both will contract. If there is an injury to one side of the brain, the opposite side's pupil reaction will be paralyzed.

The following tests can be performed on the arms:

[1] STRENGTH. Test the strength of the patient's muscles by lifting the arm with your hand, then letting go. If the muscles are flaccid, the arm will drop rapidly. Weakness can be caused by a lesion or injury on the opposite side of the brain or a injury to a peripheral nerve located on the same side.
[2] SENSATION. Sensation is tested by a pin prick. Loss of sensation indicates either a lesion or injury on the opposite side of the brain or an injury to the peripheral nerve located on the same side.
[3] REFLEX. Biceps reflex is tested by hitting the elbow from inside and triceps reflex is tested by hitting the elbow from outside with a rubber hammer. Reflexes are exaggerated if there is a lesion in the brain. The reflexes are absent if there is an injury to the peripheral nerves.

The following tests can be performed on the legs

[1] STRENGTH. Test the strength of the patient's muscles by lifting the leg with your hand, then letting it go. If the muscles are flaccid, the leg will drop rapidly. Weakness can be caused by a lesion or injury on the opposite side of the brain or injury to the peripheral nerve located on the SAME side.
[2] SENSATION. Sensation is tested by a pin prick. Loss of sensation indicates either a lesion or injury on the opposite side of the brain or injury to a peripheral nerve located on the same side.
[3] REFLEX. Leg reflexes are tested by hitting the patient's knee with the rubber hammer. Reflexes are exaggerated if there is a lesion or injury to the opposite side of the brain. Reflexes are absent if there is some injury to peripheral nerves on the same side.

Aneurysm

Aneurysms are abnormal dilations of the blood vessels in the brain. The dilations gradually enlarge until finally they rupture and bleed into the brain. The resultant bleeding causes severe headache or unconsciousness. Most of the time, before rupture, the weakness of the arms and legs are absent but can occur, usually on the opposite side. Abnormal pupil dilation, no response to light reaction, and absent movement occur on opposite side. The CAT scan or MRI of the brain may or may not pick up the aneurysm if the bleeding is small. Angiogram shows the dilated blood vessel. The skull x-rays are usually normal.

Cocaine Addiction

Patients overdosed with cocaine do not have weakness in the arms or legs but their pupils will be dilated. CAT scan, MRI, angiography and skull x-rays are all normal.

Hysterical Reaction

Some patients develop weakness in the arms and legs on one side just from anxiety reaction. A sensory defect may also be present. This commonly occurs in women. CAT scan, MRI, angiography and skull x-rays are all normal.

Simple Headache

Some patients have pain in the head due to simple headaches. CAT scan, MRI, angiography and skull x-rays are all normal.

Subdural Hematoma

Subdural hematoma is a collection of blood clots in the subdural space between the brain and the dura mater. It occurs when there is an injury to the head, which may go unnoticed by the patient. Weeks may pass before there are any signs of neurological damage. Headache, confusion and other mental changes are all symptoms. Neurological examination reveals a dilatation of the pupil on the same side as the injury. Weakness occurs on the same side of the injury. If hematoma occurs on the left side, speech will be slurred. The CAT scan or MRI of the brain shows an abnormal blood clot and indentation of the brain. The angiogram shows displacement inside of the blood vessels by the blood clot. The skull x-rays may show a fracture.

Infarction

Infarction (stroke) occurs when a blood vessel that supplies to the brain becomes blocked, often by a small blood clot. Because of the resultant loss of blood supply, the portion of the brain supplied by the blood vessel dies. This results in weakness and loss of sensation on the opposite side of the body. Pupil dilation, light reaction, and movement will also be affected on opposite side. If the infarction is on the left side, speech will also be affected. CAT scan and MRI show a damaged area in the brain. The angiography often reveals the occlusion. Skull x-rays are normal.

Migraine

Migraine headache occurs when the blood vessels in the brain dilate or go into spasm periodically. There are various types of migraine headache. One of the types can cause

weakness of the arm and leg on one side similar to a stroke. Reflexes will be aggravated also. Speech will be slurred. CAT scan, MRI, angiography and skull x-rays are all normal.

Morphine Overdose

Patients addicted to morphine do not have weakness in the arms or legs but their pupils will be narrowed. They will have gooseflesh, and twitching of the muscles. CAT scan, MRI, angiography and skull x-rays are all normal.

Peripheral Neuropathy

Peripheral neuropathy is simply an injury to a nerve connecting the central nervous system to one of the patient's extremities. It is characterized by weakness and lack of sensation in one of the patient's limbs, depending on the nerves affected. CAT scan, MRI, angiography and skull x-rays are all normal.

Brain Tumor

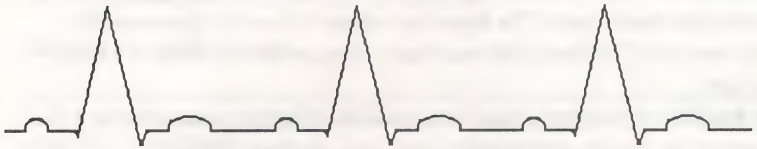
A brain tumor usually grows gradually. The tumor presses on the normal brain causing headache or weakness in the arms or legs. Reflexes will be aggravated. The pin test will reveal a sensory defect on the opposite side from the tumor. If the tumor is on the left side of the brain, speech will be slurred. The CAT scan or MRI shows a tumor in the brain. The angiogram shows an invisible mass compressing the blood vessels. The skull x-ray is usually normal.

Chapter 4: Cardiovascular Problems in Neurosurgery

1. Basic Electrocardiography
2. Cardiac Arrythmias
3. Blood Pressure Regulation

Basic Electrocardiography

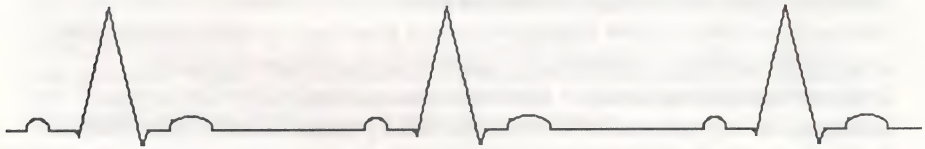
Embedded in the wall of the heart are structures that conduct impulses through the heart muscle and cause the heart to beat. These structures cause the heart to beat at regular intervals. The average heart beats at 70 to 80 per minute.
The pattern of the heart beat is monitored by a machine called electrocardiography.



Normal Electrocardiogram

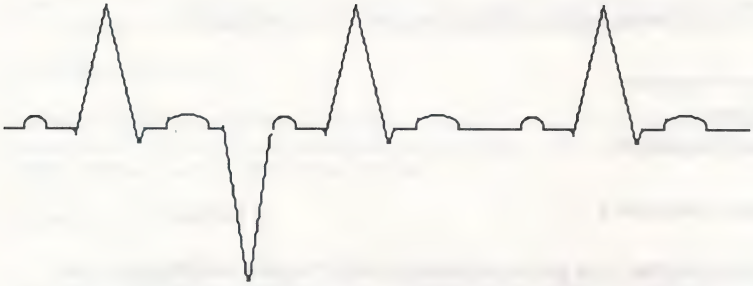
Cardiac Arrythmias.

Older patients or patients under prolonged anesthesia tend to have irregular heartbeats. Bradycardia is slowing of the heart beat. It is important to recognize bradycardia, because if it is left untreated the heart will stop. Bradycardia is treated with drugs such as Atropine.



Bradycardia

Premature ventricular contractions (PVC) are irregular heart beats caused by irritation of the heart sometimes from prolonged anesthesia. If they are not treated they will go into ventricular fibrillation and the heart may not be able to pump the blood to sustain life. PVCs need to be treated with drugs such as lidocaine.



Premature Ventricular Contraction

Blood Pressure Regulation

Blood pressure, in simple term, means push of blood. It exists in all the blood vessels but we normally measure the blood pressure in the arteries. Blood pressure is caused by the volume of blood in the blood vessels. The larger the volume of blood in the arteries the higher the blood pressure. Conversely, the less blood in the arteries, the lower the blood pressure tends to be.

Blood pressure has two components: systolic and diastolic. Systolic occurs when the heart pumps the blood into the vessels and diastolic occurs when the heart relaxes.

The normal blood pressure ranges between systolic 120 and 90mm mercury and diastolic between 90 and 60 mm mercury. The average normal blood pressure is systolic 110mm mercury and diastolic 70mm mercury (110/70 mmHg).

If a patient loses excessive blood such as in bleeding, the blood pressure falls. If the blood pressure falls too low, life cannot be sustained. Blood pressure can also drop when the patient is under prolonged anesthesia. Therefore, it is important to maintain the blood pressure during the operation. When the blood pressure drops, saline drip may temporarily maintain it. Drugs such as Dopamine can also elevate the blood pressure. If the blood pressure drops from excessive bleeding however, it is necessary to replace the blood by giving blood transfusion. However, only a limited supply of blood is available.

Irregular heart beats can also cause the blood pressure to drop.

Blood pressure can be elevated if there is an increased pressure inside the brain. The patient can not tolerate the increased pressure and can not survive.

CHAPTER 5: OPERATIVE SURGERY

Success in surgery is a matter of applying the appropriate tools in the proper sequence to the correct tissues of the patient.
In the OR, select a tool by pulling down the proper menu and position the cursor over the desired tool. When you release the mouse button, the tool will be "picked up" and the cursor will change its appearance to that of the tool. When you are done with a tool, either drop it by clicking on the tool tray just underneath the respirator controls or select a new tool. When you have no tool from the trays selected, the "hand " is the cursor. You use the tools by clicking on or dragging them over the patient. Keep an eye on the message window at the lower right edge of the screen for important information and keep another eye on the EKG, Systolic Blood Pressure, and pC02 monitors on the upper left of the screen. Be quick to remedy any complications that may arise. By the way, you did remember to scrub and get a gown from the nurse before beginning the operation, didn't you? If you complete the operation successfully, you will return to the Emergency room for your next patient, and perhaps receive a certificate.

Surgical Complications:

In addition to the operation proper, you will have to contend with complications that may crop up in all operations (See Problems in Neurosurgery by Dr. David Cook. The book is apparently misplaced).

IV DRIP: Do not let the IV drip bag run dry, or it will clot shut and kill the patient. IV bags can be found in the DRUGS menu.

ARTERIAL BLOOD GASES: Keep track of the pCO2 level (partial pressure of carbon dioxide) with the pCO2 monitor, located in the upper left hand portion of the screen.

HEART RHYTHM: Observe the patient's heart rhythm with the EKG monitor and treat accordingly.

SYSTOLIC BLOOD PRESSURE: Normal blood pressure is 110. This may drop due to bleeding, or as a random effect of prolonged anesthesia. If this drops below 40, the patient will not survive.

URINE OUTPUT: Monitor the patient's urine output by inspecting the renal output bag, located to the left of the tool tray. If low urine output is not treated, the patient will suffer shock due to renal failure.

BRAIN TIGHTNESS: Pressure in the cranial cavity will cause the normally relaxed brain to become "tight". Click with the hand on the exposed brain to see if it is relaxed or tight. Remedy a tight brain by clicking on the spinal tap, located on the end of the tube to the left of the tool tray. Click to close it when the brain relaxes.

Reflecting the Scalp Flap

From your neurological examination you should know which hemisphere of the patient's brain has the lesion. With your hand, click-drag on the patient's head to turn that side uppermost (i.e., drag the patient's head to the right to turn the left side uppermost).

Select iodine from the SUPPLIES menu, and swab it over the patient's scalp, covering the entire area above the eyes. *By the way if you are using System 7.0 you can identify the instruments by using the balloon help.* Now select the drape from the same menu to cover the patient. Select the drape clips from the same menu and click on the patient to hold the

drapes in place. If you forget to secure the drapes, they'll fall off during the operation exposing to infection.

Now it is time to make the scalp incision. After selecting the scalpel from the INSTRUMENTS menu, you will see the scalp with the proposed line of incision marked with dye. You must cut accurately along this line, starting at the left end and ending on the right. Position the scalpel at the left end, click-hold, and drag the scalpel along the line to the right end. Release the mouse to finish the cut.

The cut will start to bleed profusely. Select the Rainey's clip from the INSTRUMENTS menu, and click along both edges of the cut until the cut is totally lined with clips.

Click with the hand to raise the scalp flap. Select the fishhooks from the INSTRUMENTS menu and click to secure the scalp flap. If you don't secure it, the flap may flop down at inconvenient times causing infection.

You are now ready to deal with the patient's specific ailment.

Subdural Hematoma Operation

At this point, you should have the scalp flap reflected, and there should be a fracture visible. If there is no fracture you have either made an incorrect diagnoses or turned the patient's head the wrong way. If that is the case the operation will automatically end and you are in trouble.

Select the irrigation tool (the "turkey baster") from the SUPPLIES menu, position it over the center of the fracture and click. The irrigation tool will appear, dripping water. Select the trephine drill from the INSTRUMENTS menu. Position it over the center of the fracture and click-hold. Do not move the mouse! The drill must be under the water drip of the irrigation or the heat of the drill will cause brain damage. Listen to the drilling sound. You must IMMEDIATELY let go of the mouse button when the sound rises in pitch. Otherwise the drill will plunge into the patient's brain, with lethal results.

You should see a cylindrical opening. If you see a curved hollow instead, you have not drilled long enough and should drill some more. Select the bone wax from the INSTRUMENTS menu and click on the hole to stop the bleeding.

Use the scalpel to make a short cut in the hole. Select the suction tool (not the bipolar suction tool) from the INSTRUMENTS menu, click in the hole, and hold until the tube in the suction tool turns white. Immediately let go of the mouse button.

Select the drain from the INSTRUMENTS menu and click on the hole. The drain will appear. Select the vicroil suture from the SUPPLIES menu and click on the drain where it lies on the scalp. Do not click on the drape or the skull.

Now turn in the book to "Closing the Scalp Flap".

Exposing the Brain

At this point, you should have the scalp flap reflected (see Reflecting the Scalp Flap). You must now drill three or more burr holes around the edge of the exposed skull to help start a hole in the skull. Four or five holes are most convenient, so we'll assume that four holes have been made.

Select the irrigation tool (the "turkey baster") from the SUPPLIES menu, position it at the edge of the exposed skull where you want to start the burr hole, and click. The irrigation tool will appear, dripping water. Select the trephine drill from the INSTRUMENTS menu. Position it Just under the dripping water from the irrigator and click-hold. Do not move the mouse! The drill must be under the water drip of the irrigation or the heat of the drill will cause brain damage. Listen to the drilling sound. You must let go of the mouse button when the sound rises in pitch, otherwise the drill will plunge into the patient's brain, with lethal results.

You should see a cylindrical opening. If you see a curved hollow instead, you have not drilled long enough and should drill some more. Select the bone wax from the INSTRUMENTS menu and click on the hole to stop the bleeding.

Click on the tool tray to put the bone wax down, click on the irrigation tool to pick it up, and repeat the entire procedure for the other burr holes. When done with all of the holes, pick up irrigation tool and put it in the tool tray.

Select the dissector from the INSTRUMENTS menu and click in each burr hole to separate the dura from the skull. If you don't do this, the dura will adhere to the bone flap and will tear when the flap is removed.

Select the gigli saw drill bit from the INSTRUMENTS menu. This will replace the trephine drill bit on the drill with the gigli saw. Now select the drill. Using the drill, cut a line between adjacent burr holes, starting in one hole and stopping in another. If you make four holes, this will result in a diamond shaped flap of bone which you can now remove.

Place the drill in the tool tray. Place your hand on the bone flap and click to lift it. Lifting the bone flap may take a moment, so just hole the button until the cursor changes from the watch back to a hand. Drag the bone flap so it floats in the air to one side, not covering any of the skull surface.

Bleeding spots will appear on the dura. Use bone wax to staunch the bleeders on the bone edge, and the bipolar suction tool to stop bleeders on the dura. You may have to try both tools on a bleeder to stop it. If the sound is on, the tool will make a sound when it successfully stops the bleeder. If the a bleeder gets too big, you may have to swab it with a cottonoid from the SUPPLIES menu to reveal the center of the bleeding.

The rough edges of the bone must be smoothed otherwise the edges will tear up the brain. From the INSTRUMENTS menu, select the smoothing burr bit. It will appear on the drill. Select the drill, and drag it along the bone edge, and over the dark, arrow-shaped sphenoid ridge at the top of the hole in the skull. Be sure to remove all of it. Use bone wax to stop the new bleeders.

From the INSTRUMENTS menu, select the fine drill bit to place it on the drill. Select the drill. On the floating skull flap, drill five holes. Drill one near the center of each edge, and one right in the center of the flap. Place the drill in the tool tray.

From the SUPPLIES menu, select the metal ribbon. Click it on the edge of the skull running from upper center to extreme right. The ribbon will appear, sticking under the edge of the bone. This will protect the brain when you drill through the skull. Select the drill and click it on the bone edge the ribbon is under, at a point about halfway between the bone edge and the scalp incision. This will create a suture hole. Make sure that the point is within the outline of the ribbon as it continues under the bone or you will drill into the brain and kill the patient.

Click on the tool tray to drop drill. Click on the ribbon to pick it up. Now repeat the same procedure on the other three bone edges.

When done with all three, place the ribbon in the tool tray. Select the vicroil suture from the SUPPLIES menu. Click in each suture hole to place suture. Click once in the center of the dura. Also click once in each of the five holes of the floating bone flap.

Place the vicroil suture tool in the tool tray. Click-hold on the floating skull flap and drag it to the tool tray. It will appear in the INSTRUMENTS menu.

Induce hypotension in the patient (reduce the patient's blood pressure) by selecting Nitroprusside from the DRUGS menu and clicking on the IV drip connector. If you fail to do so, cutting the dura will kill the patient. Place your hand on the dura and click to see if the brain is tight. If it is, open the spinal tap. Close the tap when the brain finally relaxes.

Select the scalpel and click-hold on the dura near the bone edge, just a little to the right of the top corner. Continue the cut by dragging the scalpel clockwise around the edge of the skull hole. The cut will automatically stop when you get near the top. Use the bipolar

suction tool to cauterize bleeders.

Select the cotton gauze strips from the SUPPLIES menu and click on the scalp flap. You will see a layer of moist gauze appear on the flap. Place your hand on the dura and click. A flap of dura will be lifted exposing the brain. While the brain is exposed, it must be irrigated every five minutes or the brain will dry out and the patient will die.

Click with the hand on each of the four sutured holes. A line of suture will appear, cinching the cut edge of the dura to the bottom of the skull.

If your patient has a tumor, turn to "Removing Brain Tumors". If your patient has an aneurysm, turn to "Removing Cerebral Aneurysms".

Removing Brain Tumor

At this point, you should have the brain exposed. Remember to irrigate the brain.

Click on the Ultrasound scanner button. The ultrascan window will appear. Click and hold the mouse over the exposed brain while watching the ultrascan window. Move the mouse until the window shows a large whitish spot, the tumor. Move the mouse to center the tumor within the ultrascan window. Make note of the X and Y coordinates in the ultrascan window. Click the ultrascan button again to turn it off.

Now, click on the microscope button. The horizontal scale is the X coordinate and the vertical scale is the y coordinate. Using the arrow buttons, make the scales match the ultrascan coordinates. The tumor is near the center of the field of view, but not visible just yet.

The brain has five layers of tissue, in increasingly darker shades of grey. The tumor itself is black, and is at a medium depth.

Select the bipolar suction tool. You will use this to bore down to the tumor and suck it out. When you click-hold on the brain, a small circular hole appears. As you suck deeper the hole will get darker. Move slowly outwards in a spiral until you think you have removed all of the tumor material. Try to remove all of the black tumor while removing as little brain tissue as possible.

If you cannot find the tumor, you have either [a] gotten incorrect coordinates, [b] misdiagnosed the patient, or [c] turned the patient's head the wrong way. If so, give up and close the scalp.

When you are done, place the bipolar suction tool on the tool tray, and click the microscope button. Turn to "Closing the Skull".

Removing Cerebral Aneurysm

At this point, you should have the brain exposed. Remember to irrigate the brain.

Click on the microscope button. If you do not see a subtle line running down the center of the view (the sylvian fissure), you did not remove enough of the sphenoid ridge. Click on the microscope button, lower the dural flap, and use the smoothing burr to run over the entire sphenoid area. Lift the dural flap again and turn the microscope back on.

Select the jeweler's forceps from the INSTRUMENTS menu and click to the left of the sylvian fissure. This will lift the arachnoid membrane preventing damage to the underlying tissue when you cut it. Select the Rhoton knife or the microscissors from the INSTRUMENTS menu. Draw a short line down the sylvian fissure. Replace both the knife and the jeweler's forceps in the tool tray.

Select the retractor from the INSTRUMENTS menu. Click on the left brain lobe (to the left of the sylvian fissure) and hold the mouse button until the retractor appears. Drag the lobe to the left . Do not drag too far, no more than half an inch. The connecting blood vessels will be exposed. Select the microscissors and make a single click on the vessels.

Use the bipolar suction tool to cauterize the bleeder.

Select the retractor again from the menu and place it on the right lobe, so that two retractors are on the brain. Moving one then the other, expose the central artery. Use the microscope buttons to move right or left depending on which side the aneurysm is located on (the same side as the hemisphere of the brain you are in). Drag the retractors until a thickening is exposed in the blood vessel. Select the rhoton dissector from the INSTRUMENTS menu. Drag it twice over the thickening to expose the aneurysm. The aneurysm looks like a ball at the fork of the artery. If no aneurysm is revealed, you have either misdiagnosed the patient or are in the wrong brain hemisphere. If so, the operation will automatically stop at this point.

Drop the dissector into the tool tray and select the Rhoton hook from the INSTRUMENTS menu. Move it over the veins covering the aneurysm. Click and drag until the veins are no longer covering the aneurysm. Select the Rhoton dissector and click on the aneurysm to raise it. Select the hook and drag across the tissue under the aneurysm. The aneurysm will raise higher, exposing it's neck. Select the aneurysm clip from the INSTRUMENTS menu and click on the neck of the aneurysm.

Now remove both retractors (by making a short click on each with your hand) and place them on the tool tray. Click on the microscope button to turn the microscope off. Turn to "Closing the Skull."

Closing the Skull

Lower the dural flap by clicking on it with your hand. Select the vicroil suture and click at least ten times around the edge of the dural incision.

Select the bone flap from the INSTRUMENTS menu. Drag it so that the upper edge matches the skull hole. Release the mouse button, and it should drop in. Click with the hand on each suture around the edge of the skull and then on the central hole to suture the bone flap in. Turn to "Closing the Scalp."

Closing the Scalp

Click on the fishhooks with your hand to pick them up, and place them in the tool tray. Click on the scalp flap to fold it down, if it hasn't fallen already. Remove each Rainey clip with your hand. Finally get the skin clip tool and apply a clip near each bleeder. When the enough clips have been placed to secure the scalp, the operation will automatically end.

SURGEON 3 THE BRAIN

USER'S MANUAL

SURGEON 3 - THE BRAIN

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Introduction:

Surgeon 3-The Brain is meant for entertainment purposes only. It is not intended as a real life simulation of brain surgery. True neurosurgical operation is far more complex and sophisticated. Under no circumstance should any person attempt to make a medical diagnosis or perform a surgical procedure based upon the knowledge learned or received from *Surgeon 3- The Brain.* The medical information contained in *Surgeon 3- The Brain* does not represent accurate fact or information of health matters. ISM,Inc. wishes you much enjoyment with *Surgeon 3- The Brain.*

Acknowledgements:
ISM,Inc. would like to extend appreciation to the following three, great (at least to us) neurosurgeons:

David Cook,MD
Lee Russo,MD
Hatim Abdo,MD

Without their help and advice *Surgeon 3- The Brain* would never have materialized.

Object:

To successfully and correctly diagnose and perform surgery (if necessary) on your patients.

System Requirements:

Surgeon 3- The Brain requires the following:

- A Macintosh computer with a minimum of 2 megs of memory for the black and white version.
- A Macintosh computer with a minimum of 4 megs of memory, color video card and color monitor for the color version.
- A hard disk with a minimum of 5.5 megabytes of space available.

Installation:

-Insert **DISK ONE** into the computer and open it on your desktop.

-Locate the ***Surgeon 3- The Brain*** **Installer** icon and double-click it to begin the installation.

-Select the hard disk drive where you wish to install *Surgeon 3- The Brain* by clicking on the **[DRIVE]** button. Each time you click on the **[DRIVE]** button, a new destination drive will be displayed.

-When the desired destination drive has been selected, click the **[INSTALL]** button.

-When the installation is complete, a message will appear informing you if the installation was successful. Click the **[OK]** button to continue.

Starting Surgeon 3- The Brain:

-Open the hard disk drive where you installed *Surgeon 3- The Brain.*
-Double-click on the folder named "Surgeon 3 *f*" to open it.
-Inside the "Surgeon 3 *f*" folder, click on the **Surgeon III** icon.
-Enter your name on the medical graduation certificate and press **[RETURN]**.
-You may print the certificate by clicking the **[PRINT]** button. If you do not wish to print the certificate, simply click anywhere else on the screen.
-Select your appropriate skill level at the prompt- Intern (Novice),Resident (Intermediate) or Attending Physician (Expert).

Moving around Surgeon 3- The Brain:

To enter rooms in the hospital, simply click on the door you wish to enter. If the door is not visible on the screen, click on the sign pointing towards the room you wish to enter.

Examination Guidelines:

Once in the examination room, a nurse will provide you with some information on your patient. You are required to examine the patient's head, arms and legs. You cancall up a close-up window of each body section by clicking on that area of the patient.

Tool Descriptions

In each close-up, you will be provided with tools to work with at the lower portion of the window. In the close-up of the head, you will have the following:

Wand - Used to test eye movement.

Light - Used to test pupil reaction.

Pin - Used to test for sensation.

Speech Card - "Say Alice" to test if damage has occurred in the part of the brain that contains the speech center. If damage has occurred, speech will be slurred.

In the close-ups of the arms and legs, you will have the following:

Rubber Hammer - Used to test reflexes.

Hands - Used to lift arms and legs to test strength.

Pin - Used to test for sensation.

In all of the close-up windows, you will notice a chart in the bottom right corner. Display the chart by clicking on it. At the intern level, this chart automatically keeps track of the results of your examination. At higher levels, you have to fill the chart in manually.

Completing the Examination

Using the patient's chart and Chapter 3 of the manual *"Nervous System"* which you received with the package, determine how to diagnose your patient. If the supplied data is insufficient, you may order additional tests.
Click on the nurse for additional test options or to make a diagnosis.

Making a diagnosis

If you have selected a diagnosis that does not require surgery, you will immediately be notified of whether your diagnosis was correct.
If you have selected a diagnosis that requires surgery, you will be required to report to the operating room.

Surgical Tool Descriptions

(refer to the figures on pages 10-12)

1. *Skull Flap* - After removing the skull flap, you may place it in the tool tray.

2. *Jeweler's Forceps* - When using the microscope, this tool is used to lift the arachnoid membrane before making the initial incision in it.

3. *Microscissors* - When working with the microscope, this tool is used to make incisions.

4. *Gilgi Saw Bit* - Used to make cuts in the skull between burr holes.

5. *Fine Drill Bit* - Used to make small holes in the bone flap and skull which you can use to suture the flap back down.

6. *Trephine Drill Bit* - Used to make the initial burr holes in the skull.

7. *Smoothing Drill Bit* - Used to remove the sphenoid ridge and rough bone edges after removing the bone flap.

8. *Suction* - Used to suck the blood from a hematoma.

9. *Skin Clip Gun* - Used on the scalp incision to staple the scalp flap closed at the end of the operation.

10. *Irrigator* - Used to keep the skull cool when using the trephine drill to make burr holes

and to keep the brain moist after the dural flap has been reflected.

11. *Vicroil* - Used to stitch the dural flap closed, to thread the fine drill holes in bone flap and skull, and to stitch the drain to the scalp when performing a hematoma operation.

12. *Rhoton Hook* - When working with the microscope, this tool is used to pull the perforator vessels out of the way and to remove the material adhering to the aneurysm once it has been lifted with the Rhoton Dissector.

13. *Scalpel* - Used to make incisions.

14. *Dissector* - Used to separate the dura from the skull before removing the bone flap.

15. *Fishhooks* - Used to keep the scalp flap from falling and causing infection.

16. *Rongeurs* - Used to remove the sphenoid ridge and rough bone edges after removing the bone flap.

17. *Bipolar Suction* - Used to cauterize the bleeders not on bone, and to suck the tumor material when using a microscope.

18. *Drain* - Place this in the burr hole over a hematoma to prevent further buildup after the scalp has been closed.

19. *Rhoton Dissector* - When working with the microscope, this tool is used to remove the material obscuring the aneurysm and to lift the aneurysm after the perforator vessels have been moved.

20. *Rhoton Knife* - When working with the microscope, this tool is used to make incisions.

21. *Cotton Strips* - Used at the base of the dural flap to keep it from drying out when it is reflected.

22. *Sterile Drape* - Apply the drape to the patient after sterilizing the scalp to help maintain a sterile working area.

23. *Iodine* - Used as an antiseptic to sterilize the scalp before making the initial incision. Never use within the body!

24. *Aneurysm Clip* - Used to permanently prevent the aneurysm from rupturing once it has been freed.

25. *Retractor* - When working with the microscope, this tool is used to separate the lobes of the brain.

26. *Bone Wax* - Used to stop bleeders on bone.

27. *Rainey Clips* - Used around the edge of the scalp incision to stop bleeding.

28. *Cottonoids* - Used to sop up excess blood.

29. *Drape Clips* - Used immediately after applying the sterile drape to keep it from falling off the patient and causing infection.

30. *Metal Ribbon* - Used to protect the brain when using the fine drill to make holes in the edge of the skull.

Surgical Tools

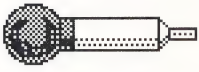
1. Skull Flap

8. Suction

2. Jeweler's Forceps

9. Skin Clip Gun

3. Microscissors



10. Irrigator

4. Gilgi Saw Bit

11. Vicroil

5. Fine Drill Bit

12. Rhoton Hook

6. Trephine Drill Bit

13. Scalpel

7. Smoothing Drill Bit

14. Dissector

15. Fishhooks

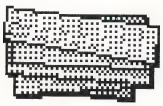
16. Rongeurs

17. Bipolar Suction

18. Drain

19. Rhoton Dissector

20. Rhoton Knife



21. Cotton Strips

22. Sterile Drape

23. Iodine

24. Aneurysm Clip

25. Retractor

26. Bone Wax

27. Rainey Clips

28. Cottonoids

29. Drape Clips

30. Metal Ribbon

Hints and Tips

-Pay careful attention to the malpractice letters your receive. They will inform you of everything you did wrong, and will usually tell you what you should have done.

-Always click on the patient's relatives BEFORE you start the physical examination in order to get the patient's medical history.

-Pay attention to your patient's name. You will need to know it when performing the additional tests.

-Be careful when ordering additional tests. Some patients may have adverse reactions to certain tests regarding their medical history. See chapter 2 of the *"Nervous System"* manual for specifics.

-Scrub down before your operations! Click on the sink in the OR to wash your hands.

-When entering the surgery room, be sure to click on both the nurse and the anesthesiologist before clicking on the head to start the surgery! The nurse on the left will provide you with a gown,

and the anesthesiologist on the right will administer anesthesia to your patient.

-Refer to chapter 5 of the *"Nervous System"* manual for step-by-step operation procedures.

-Listen to Dr. Michael Scott. He is the Chief of the Neurosurgical Department. He may help you out from time to time.

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