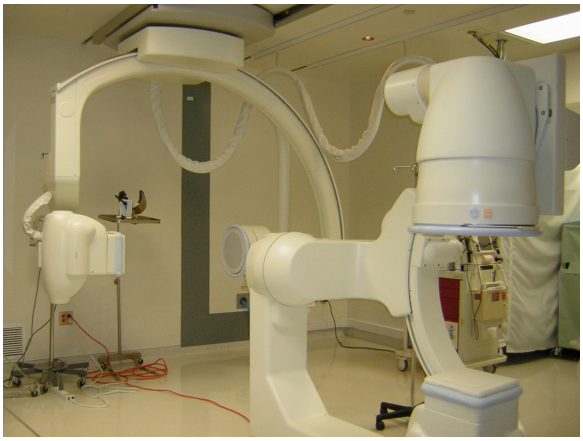
Stroke Lab Overview

In this virtual experience, students role-play a radiologist in a special clinic located in the SEPA/NCRR Virtual Research & Medical Center. After familiarizing themselves with the clinic, students receive an urgent message that a patient, who may be the victim of a stroke, awaits diagnosis in the emergency room. The student consults the patient's history and checks to see if he has any of the risk factors for stroke. A decision then has to be made about what diagnostic procedures are required. In this case, the proper choice is a CT scan. The student takes the patient into the CT Room and performs the scan.

The results of the CT scan justify a further diagnostic procedure – a CT angiogram. (See photo.) The results of the CT angiogram indicate that the patient has an aneurysm. The student must decide what do next, which is a process called



embolization (in this case, a "coiling" procedure) on the patient – sending a thin wire up from the femoral artery in his leg to the spot of the aneurysm in his brain. The CT angiogram machine is used to track the progress of the wire through the various arteries. When the wire reaches the aneurysm, the student feeds wire coils into the aneurysm, filling up the balloon in the artery wall, expelling the blood and solving the medical problem.

Stroke was chosen for this lab for a number of reasons. First, radiology is an increasingly important specialization and many people know relatively little about it. It is a very interesting field and has the potential of attracting quality students to the medical profession who might not have otherwise considered medical school. It was also chosen because stroke is a serious health problem in this country and one where a timely diagnosis is vital. Brain damage occurs very quickly and the sooner the patient receives proper medical care, the more likely that permanent damage can be reduced or averted. Thus, even for those students who never consider a career in the medical field, this becomes a valuable lesson, which could one day help save a person's life.

This lab also has the potential to reach an important audience beyond that of K-12 classrooms. The radiologist who served as our consultant on this lab, Dr. Ajeet Gordhan, volunteered his time because he wants to make this available to his patients who are going through procedures similar to the coiling procedure featured in this lab. This can play an important role in helping patients and their families and friends better prepare for these procedures, make better choices about their own medical health, and reduce stress in the process.

Standards

Illinois State Learning Standards

IL.12.A.5b
Analyze the transmission of genetic traits, diseases and defects.

IL.12.A.4c
Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record,
genetics and biochemistry.

IL.13.B.5d
Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access).

IL.22.A.5a
Explain strategies for managing contagious, chronic and degenerative illnesses (e.g., various treatment and support systems).

IL.22.A.5c
Explain how health and safety problems have been altered by technology, media and medicine (e.g., product testing; control of polio; advanced surgical techniques; improved treatments for cancer, diabetes and heart disease; worksite safety management).

IL.23.B.2
Differentiate between positive and negative effects of health-related actions on body systems (e.g., drug use, exercise, diet).

IL.23.B.3
Explain the effects of health-related actions upon body systems (e.g., fad diets, orthodontics, avoiding smoking, alcohol use and other drug use).

B1.2B
Identify and critique argument s about personal or societal issues based on scientific evidence.

B1.2C
Develop an understanding of a scientific concept by accessing information from multiple sources.
Evaluate the scientific accuracy and significance of the information.

B1.2E
Evaluate the future career and occupational prospects of science fields.

B1.2i
Explain the progression of ideas and explanations that leads to science theories that are part of the current scientific consensus or core knowledge.

B1.2j
Apply science principles or scientific data to anticipate effects of technological design decisions.

B2.3d
Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other.

B4.2D
Predict the consequences that changes in the DNA composition of particular genes may have on an organism (e.g., sickle cell anemia, other).

National Science Education Standards

Science and Technology

Content Standard E: As a result of activities in grades 9-12, all students should develop...

- Abilities of technological design
- Understandings about science and technology

Science in Personal and Social Perspectives

Content Standard F: As a result of activities in grades 9-12, all students should develop understanding of...

- Personal and community health
- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

National Health Education Standards

Health Education Standard 1 - Students will comprehend concepts related to health promotion and disease prevention to enhance health.

Health Education Standard 3 – Students will demonstrate the ability to access valid information and products and services to enhance health.

Health Education Standard 5 – Students will demonstrate the ability to use decision-making skills to enhance health.

Health Education Standard 7 – Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.

Stroke Lab Objectives

The students will explain the importance of early treatment in stroke patients.

The students will distinguish between the different types of primary diagnostic tests for stroke, determine their pros and cons, and choose the best test for a patient.

The students will distinguish between the different types of secondary diagnostic tests for stroke, determine their pros and cons and choose the best test for a patient.

The students will interpret the results of a CT scan to determine the location of a bleed.

The students will interpret the results of a CT angiogram to check for an aneurysm.

The student will identify an aneurysm and also explain the potential causes, and risk factors.

The student will perform a simulation of embolization (coiling) and also describe its advantages and risk factors.

The student will describe the process of clipping, and also describe its advantages and its risk factors.

The student will analyze how technology has impacted the diagnosis and treatment of stroke patients.

The student will describe the function of a radiologist in neurology.

Teacher's Lab Guide

Lab Organization

The Stroke lab is divided three sections. Students get a congratulations screen after each section. These are good places to stop if the lab is to be completed over the course of several days.

Section 1

Initial diagnosis in the Emergency Room

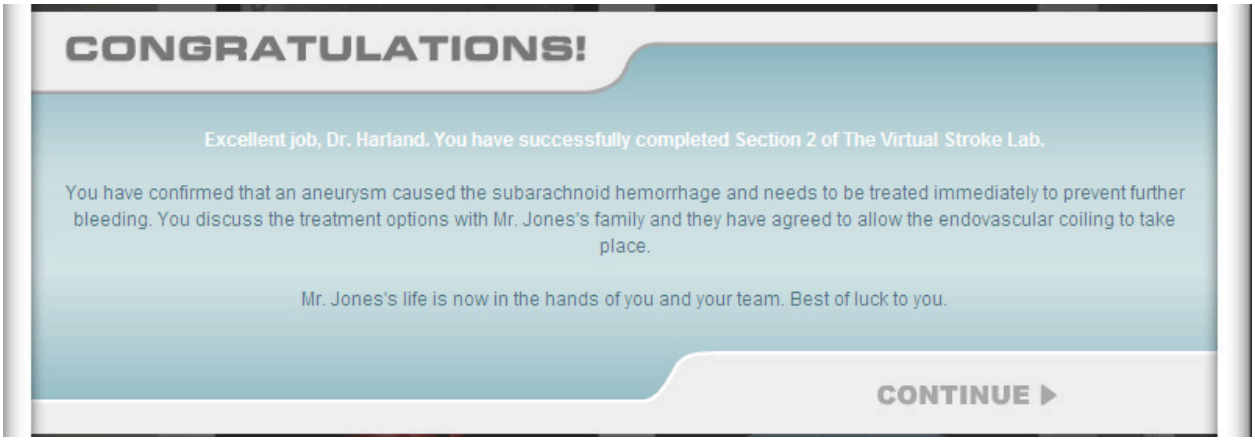
Section 2

Primary Diagnostic Tests in the CT Room
- CT Scan
- 3D CT Head Angiogram

Secondary Diagnostic Tests: in the Neuroendovascular Suite
- Digital Subtraction Angiography (DSA)
- 3D Reformations
- Working Projection

Section 3

Treatment: Coiling Procedure: in the Neuroendovascular Suite



Implementation Ideas

The stoke lab could be integrated into a number of different courses—from health to biology classes; from anatomy and physiology to advanced biology courses. Here are some suggestions to help you decide how to use the stoke lab as a supplement to your curriculum.

Health:

Use *The Virtual Stroke Lab* to introduce the importance of recognizing stroke symptoms. You can also emphasize the two major types of strokes; ischemic and hemorrhagic. Or the importance of performing the correct diagnostic tests in order to get the best treatment for patients can be the angle.

Biology:

Use *The Virtual Stroke Lab* to reiterate how structure affects function, discussing vessel structure in particular; types of aneurysm, and the importance of the neck size of aneurysms for treatment. Or, how to read CT scans could be a way to help teach brain anatomy and function; getting students to predict what functions would be affected by bleeds in different locations.

Anatomy & Physiology:

Use *The Virtual Stroke Lab* as a transition between the cardiovascular system and the nervous system. After learning about the cardiovascular system, give students the prompt. “In general, what do you think happens when blood flow is cut off?” Then have students apply this to specific parts of the body; in an extremity, heart, or brain. Get students brainstorming about the short-term and long-term effects, and possible symptoms. See if students can determine the names of what those medical conditions are called.

Advanced Biology:

Use *The Virtual Stroke Lab* after learning about molecular and cell issues; emphasizing what is going on at the cellular level (cell death, pooling blood etc…) Or importance could be placed on the treatment options (clipping or coiling of the aneurysm), discussing the significance of having the correct information in order to weight the dangers of the procedure with the benefit to the patient.

Guidance Counselor:

Not only could this lab be used by classroom teachers, but also by a guidance counselor who knows students who might be interested in careers in health and science. *The Virtual Stroke Lab* could be used to give students a real-world feel for what a career in medicine might be like.

Emergency Room

Overview

In this scene, the student participant is paged to the emergency room to see a patient just admitted. Students will be asked to use the patient's history and information they have read in the EMR to determine primary diagnosis and the first test to be administered to the patient.

Protocol Tasks (& questions) student participants must complete

1) Familiarize Yourself with the Main Menu

   Protocol

   This small window will need to be consulted throughout the Virtual Stroke Lab. It contains step-by-step instructions for each part of the lab.

   EMR

   The Electronic Medical Record provides you with detailed descriptions, history, and other useful information on the different procedures and aspects covered in the simulation. Be sure to check this section often because thorough research and knowledge not only result in safe practices, but may result in tips and answers as well.

Teacher's Tip: The Protocol and EMR buttons will be highly utilized throughout the lab. When students call you over for help, chances are, they haven't been using one of these buttons to its full potential. Any reminders you can give students to use these buttons, will be beneficial for students.

Doctor's Notes

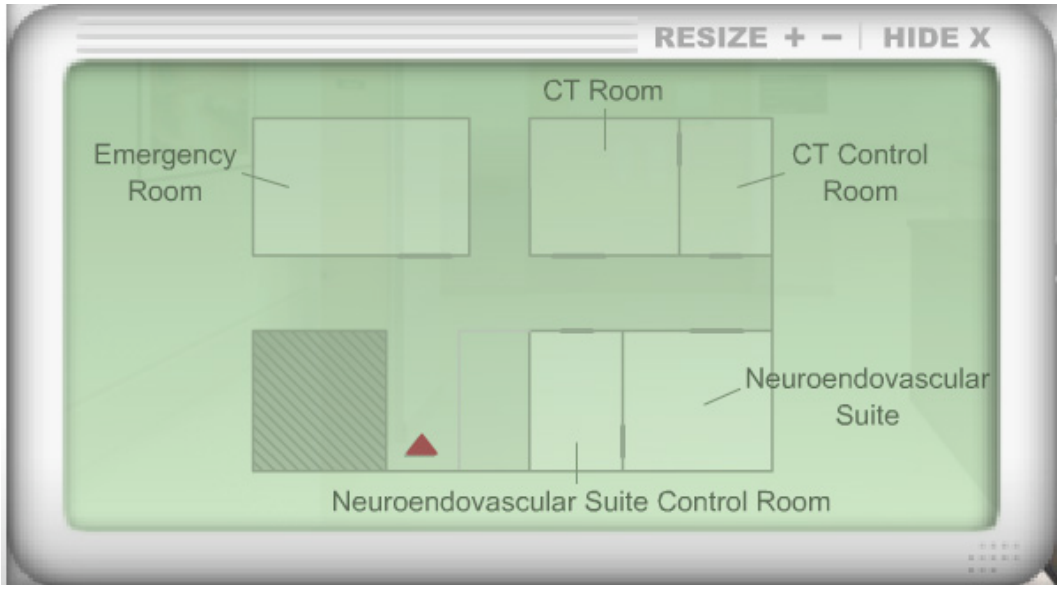
As you progress through the simulation important observations and notes will be recorded here. Feel free to access this section any time you would like to check your progress and/or review useful information you've collected along the way.

Patient Data

Here you can access medical records and other information about any patient(s) you may encounter during the course of the lab. A patient's life depends on you being fully aware of their specific health factors, so make sure you are up-to-date on their medical history before making any diagnosis or treatment decisions.

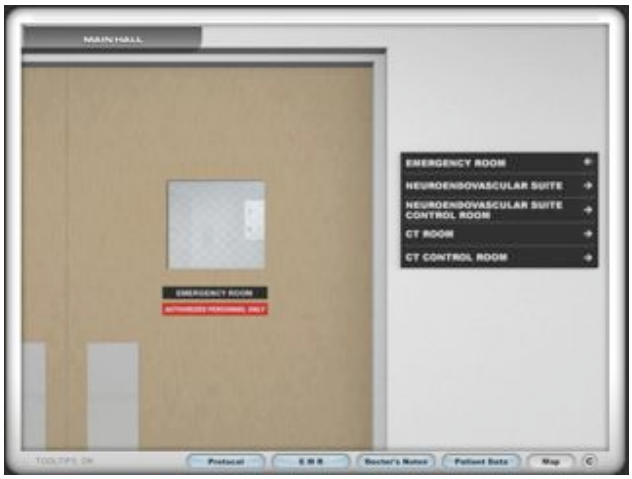
Map

This gives you a bird's eye view of the hospital layout and a red triangle lets you know where you are located so you can navigate easily.



Navigation Tip: The dialog box can be resized and moved anywhere on the screen. Keep in mind that at times, students may need to hide the box completely in order to see everything on the screen. The box reappears by clicking on any of the main menu buttons.

2) Go to Emergency Room



3) Check patient's symptoms, medical history, vitals, then determine risk factors for stroke.

   Question: Below is Mr. Jones' patient history. Which of the following are considered risk factors for Stroke? (all correct EXCEPT allergy to penicillin)

   Answers: High Blood Pressure, History of Brain Aneurysm, Allergy to Penicillin, History of Smoking, Recent Severe Headache and High Cholesterol.

4) Determine if treatment will help or hinder Mr. Jones's recovery.

   Question: What clinical grade is Mr. Jones on the Hunt and Hess Scale

   Answers: 5, 3 (correct answer), or 1

   Answer feedback: Based on his current symptoms, Mr. Jones scores a 3 on a Hunt and Hess Scale. If he was fully alert, a lower score might be more appropriate. On the other end of the spectrum, a higher grade would be assigned if he was unresponsive or showed signs of moderate to severe muscle weakness, especially on one side of his body.

5) Make an initial diagnosis on the type of stroke:

   Question: What's your initial diagnosis for Mr. Jones? Judging by the characteristics of different stroke types which type of stroke do you think Mr. Jones has suffered?

   Answers: Ischemic Stroke or Hemorrhagic Stroke (correct answer)

   Answer Feedback: Mr. Jones most likely has a Hemorrhagic Stroke. The symptoms and clinical presentation are compatible with a Subarachnoid Hemorrhage (SAH), specifically. However, more tests are needed to confirm this.

6) Order the appropriate primary diagnostic test

Question: Which primary diagnostic test should be ordered? Select the primary diagnostic test that will best indicate if Mr. Jones has a hemorrhagic or ischemic stroke?

Answers: Skull X-ray, Chest X-ray, CT Head Angiogram , CT Head Scan (w/o iodinated contrast) (correct answer)

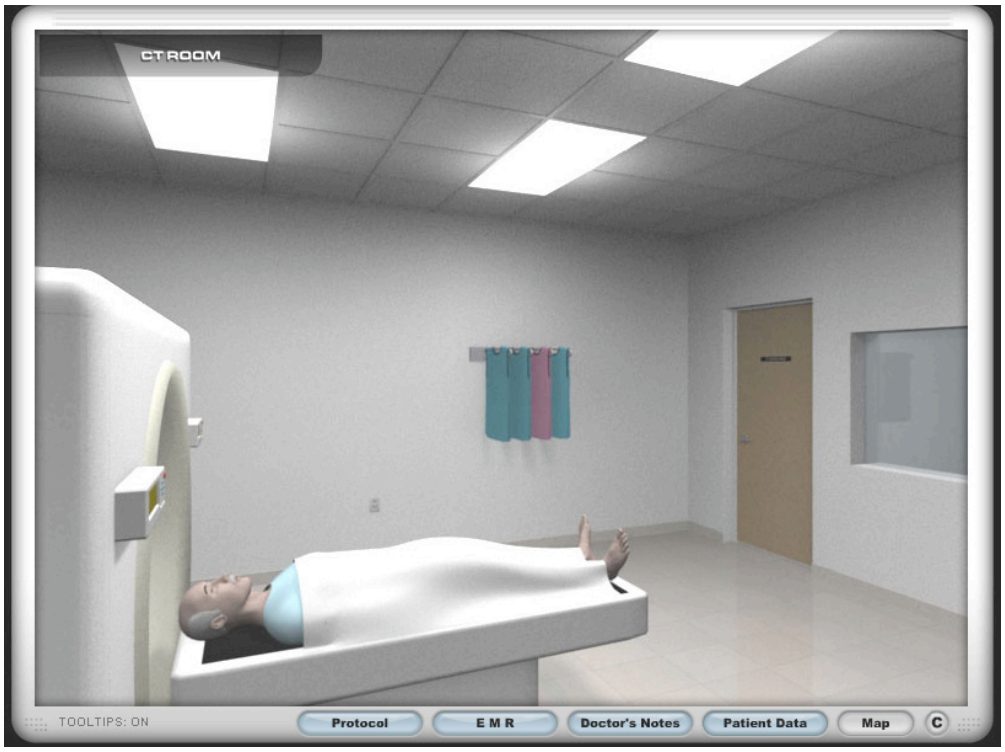
Answer Feedback: Precisely! A CT Head Scan without iodinated contrast will immediately differentiate between an ischemic stroke and a hemorrhagic stroke.

End of Section 1 of *The Virtual Stroke Lab*

Head CT Scan

Overview

In this scene, the patient has been prepped and taken to the CT Room. Students will position the patient in the CT Machine, run both the primary and secondary diagnostic tests in order to determine whether Mr. Jones had an ischemic or hemorrhagic stroke and then will need to determine whether or not the bleed was caused by an aneurysm.



Protocol Tasks (& questions) student participants must complete

1) Go to the CT Room
2) Access the CT Machine's Control Panel

   Students will click on the control panel located near the top of the CT machine
3) Align Mr. Jones inside of the CT Machine

   Students will use arrow keys to position Mr. Jones in the CT Machine.
4) Go to the CT Control Room
5) Access the CT Control Room Computer

   Students do this by clicking on the chair

6) Order a Primary Diagnostic Test:

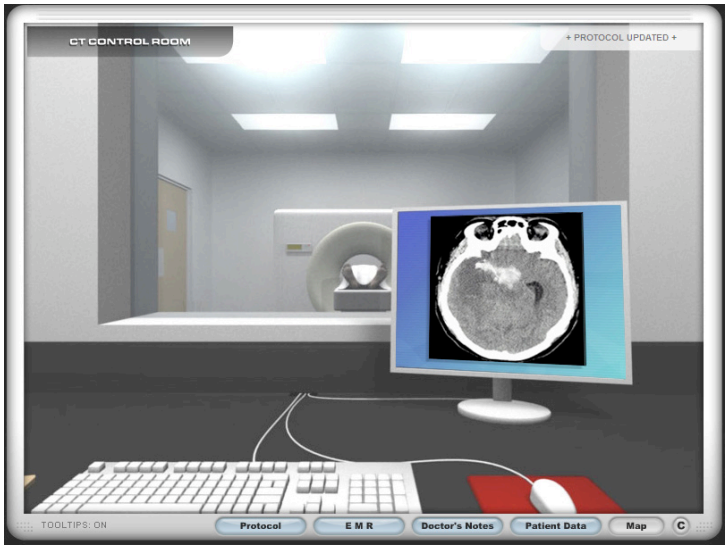
Students are prompted to select the "CT Head Scan without Iodinated Contrast" option on the monitor.

7) Perform a CT Head Scan on Mr. Jones:

Encourage your students to read the EMR that describes how CT scans work. There are no questions that address this, but it could be used for an extension activity for students who move through the module quicker than others.

8) Locate and Highlight the Suspected Bleed

The EMR will help students on how to interpret the CT Scan. It describes what dark, light and grey parts of the scan may indicate. When students highlight the correct area, they are told of the confirmed report that the bleed indicates a Hemorrhagic stroke and that the blood's location in Mr. Jones's case classifies it as a Subarachnoid Hemorrhagic Stroke (SAH). SAH strokes are normally caused by either trauma to the head or an aneurysm, and since there is no record of trauma in Mr. Jones's recent patient history, a 3D CT Head Angiogram must be run to determine if the bleeding is caused by an aneurysm.



Students can read in the EMR about the causes of SAH stokes.

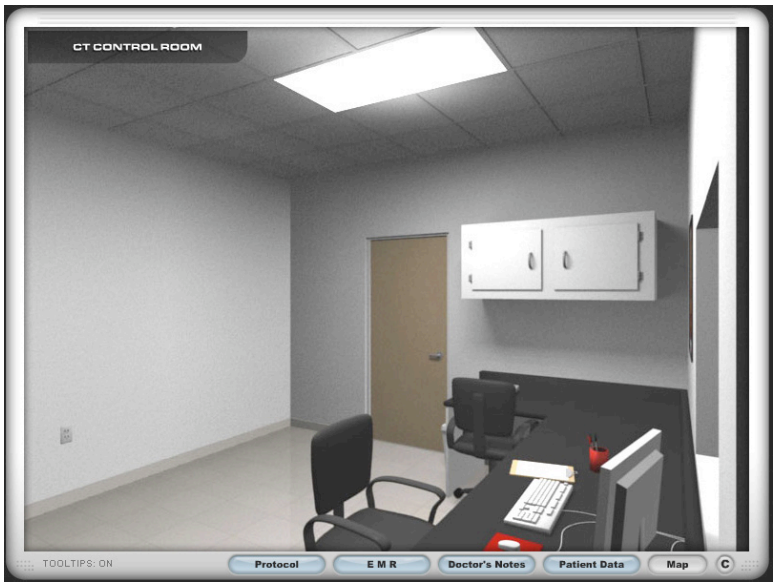
9) Order a Secondary Diagnostic Test

Students can read in the EMR about how 3D test work. Students will be prompted to select "3D CT Head Angiogram."

10) Inject Dye and Run Head CT Scan

11) Locate and Highlight the Suspected Aneurysm.

Like the first CT, students are asked to click and drag to pinpoint the aneurysm's location.



Feedback: Well done. You have confirmed that the brain aneurysm caused the subarachnoid hemorrhage. Using the series of images collected during the last scan, you can now also generate a 3-Dimensional model of Mr. Jones' blood vessels for even closer inspection.

12) Create 3D Reformations

Feedback: Although the 3D Head Angiogram helped to indicate that an aneurysm caused the subarachnoid hemorrhage, a Digital Subtraction Angiogram (DSA) will confirm the findings and provide a much greater detail of the aneurysm. Head over to the Neuroendovascular Suite.

Neuroendovascular Suite

Overview

In this scene, performing several diagnostic tests is crucial in order to determine whether or not an aneurysm is the cause of the SAH bleed. Students simulate a Digital Subtraction Angiogram (DSA) on Mr. Jones' head. Students will insert introducer needles, guidewires, sheaths, and catheters into the femoral artery and then slowly move toward the brain injecting dye every once in a while in looking for an aneurysm. Once located, the student then is given options on how to treat the aneurysm.

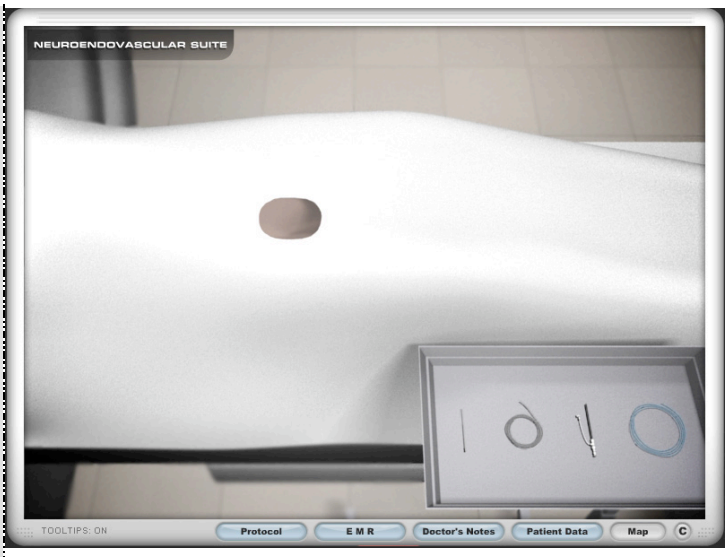
Navigation Tip: You can mouse over the tools to see its label. You can turn this feature on or off.

Protocol Tasks student participants must complete:

1) Go to the Neuroendovascular Suite

2) Click on Mr. Jones to begin

Feedback: Digital Subtraction Angiography (DSA) is a medical diagnostic treatment imaging tool that allows blood vessels and organs to be clearly visualized. The first step in the DSA process is to gain access to Mr. Jones' femoral artery so a catheter can be inserted. The tool tray in the lower-right portion of the screen will provide you with the necessary tools to perform the procedure.



3) Insert needle into femoral artery

The student inserts an introducer needle into the patient's femoral artery. This is done be clicking on the needle in the tool tray on the lower right hand side and dragging to the opening located around the patient's upper thigh. In real life, this needle penetrates the skin and tissues and allows the surgeon access to the femoral artery.

4) Thread the guidewire through the needle

The student then inserts a guidewire into the introducer needle, which allows it to penetrate the femoral artery. As its name indicates, this wire will act as a guide for the introducer sheath to follow.

5) Remove needle from femoral artery

The introducer needle is then removed and put into the biohazardous waste container as its role is now done.

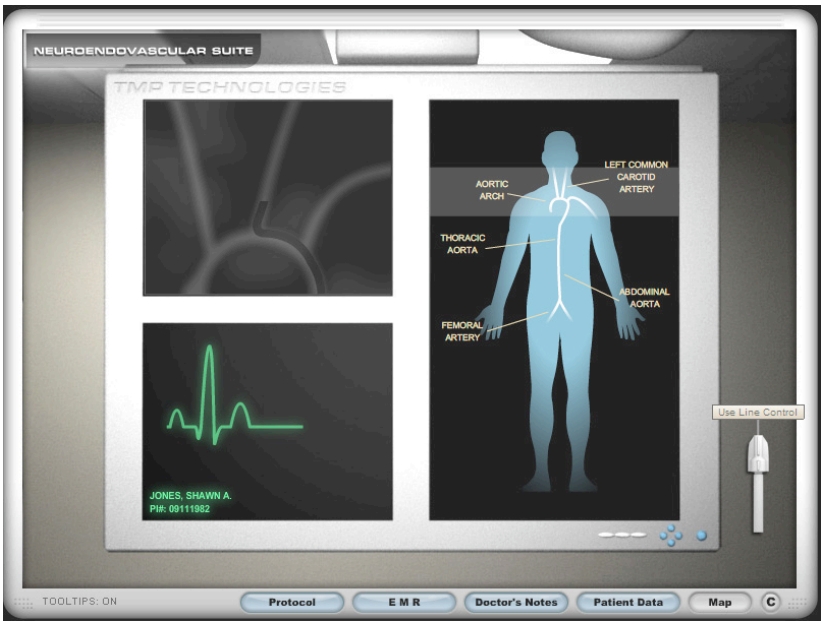
6) Insert introducer sheath

The student then threads the introducer sheath over the guidewire, providing a pathway for the wider catheter to follow.

7) Slide main catheter over guidewire

The main catheter is then threaded through the introducer sheath and over the guidewire to provide a pathway into the femoral artery.

Once students have completed this, it is explained how the monitors will be used for reference. This part of the lab is interactive as students are asked to use the line control to advance the main catheter from the femoral artery to the area near the bleed. There are several screens students will be viewing while doing this next part of the lab.



Upper left screen: shows the live view via the fluoroscopy machine.

Right screen: displays a reference map of the arteries relevant to this particular procedure and also indicates the positing in the body.

Lower left screen: will show any 3D models or other images taken during the procedure.

Real World Procedure: If the process to enter the body and access the brain via the femoral artery seems tedious and complex, it is. In reality, this process can take several hours. The reason that so many different guidewires and catheters are needed is that the blood vessels narrow and become more fragile as one gets closer to the brain. Too narrow or flexible of a catheter in the larger blood vessels will not make sufficient progress towards the brain. Too large or rigid of a catheter can damage or rupture the smaller blood vessels.

Protocol Tasks student participants must complete: to confirm presence of an aneurysm

8) Advance main catheter/guidewire combo through the femoral artery and into the abdominal aorta.

9) …through the abdominal aorta and into the thoracic aorta.

10) …through the thoracic aorta and into the left common carotid artery.

11) …through the left common carotid artery and into the left internal carotid artery

The student advances the guidewire from the femoral artery to the left anterior communicating artery using the control, virtual image, and artery map to assist.

Navigation Tip: The control for advancing the guidewire is located on the right hand side of screen. The student can see the guidewire advance in the screen on the upper left hand side of the screen In order to turn the guide wire right or left, the student needs to manipulate the control right or left in a twisting motion. This is similar to how the surgeon actually controls the guide wire. The right hand image is a map that students can use as a reference for cardiovascular mapping. Students need to advance the guide wire up through the left carotid artery to the left anterior communicating artery. This is a common location of aneurysms.

After students advanced the catheter up to the brain, they get this feedback.

Feedback:

Now that the main catheter is in place near the area of interest, you can begin the scanning process.

DSA works by first simultaneously injecting contrast dye into the blood vessels while taking a series of scans with the fluoroscopy machine. Then, the computer interprets the scans and removes everything except the areas where the dye has flowed through, leaving a pristine image of only the blood vessels and organs.

Detailed 3D images can also be created using a process called 3D Digital Subtraction Angiography (3D DSA), where the fluoroscopy machine completely rotates around the patient and takes scans while the contrast dye is injected.

Finally, you can also generate 3D models from the images acquired and use those models to create a working projection.

12) Inject dye and run scan

The student runs a contrast scan where dye is injected to get a better image of the bleed area.

In Reality: In real life, the radiologist does several contrast dye injections to make sure he or she knows where the guidewire is located and to keep track of the blood vessel anatomy.

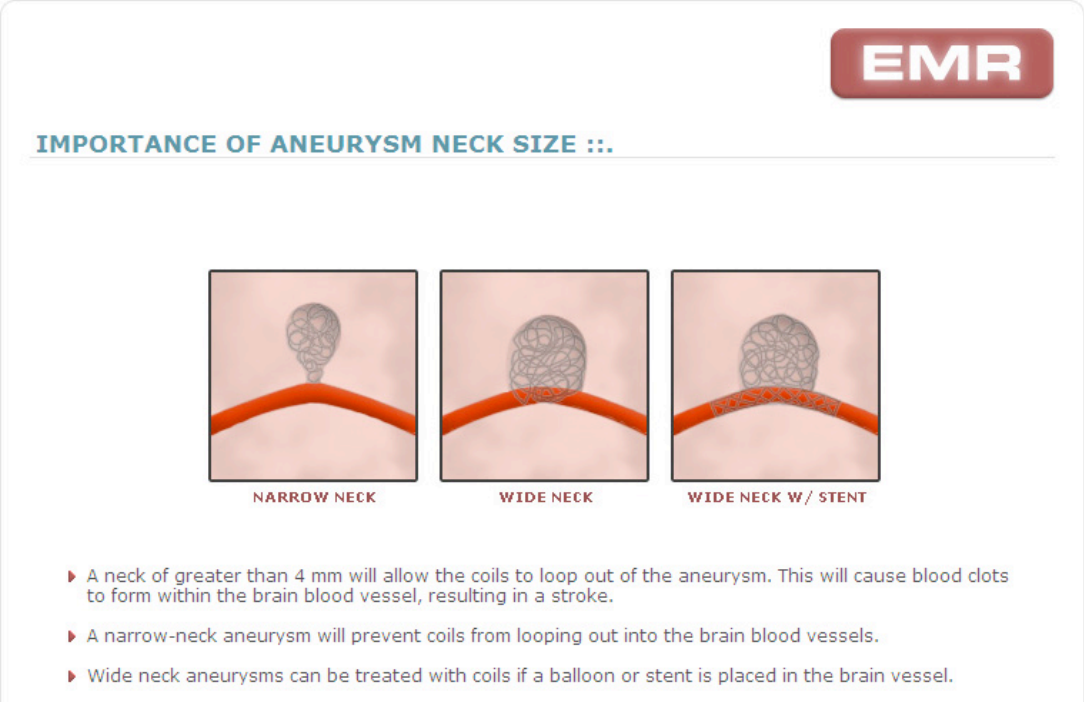
13) Perform Digital Subtraction Angiography

The student performs a Digital Subtraction Angiography to get a better image of the hemorrhaging area.

14) Create 3D Reformations

Once that image is obtained, the student creates a 3D image of the hemorrhaging area to determine how to treat it.

In Reality: Procedures such as Digital Subtraction Angiography and 3D modeling seem simple in this virtual lab but are actually quite complex in real life. They are tools that have become invaluable in the world of interventional cardiovascular and neurology surgery. The contrast dye highlights blood flow, enabling the surgeon to see the outline of the blood vessels.



15) Create a Working Projection

The fluoroscopy machine is positioned so that the aneurysm neck is clearly visualized.

Feedback: The DSA and 3D DSA confirmed that an aneurysm is present in Mr. Jones' left internal carotid artery and was the cause of the subarachnoid hemorrhage. Measurements indicate a 5 mm aneurysm with a 2 mm neck.

Mr. Jones requires treatment right away to prevent a rebleed. Be sure to check the EMR and brush up on your aneurysm treatment knowledge before proceeding.

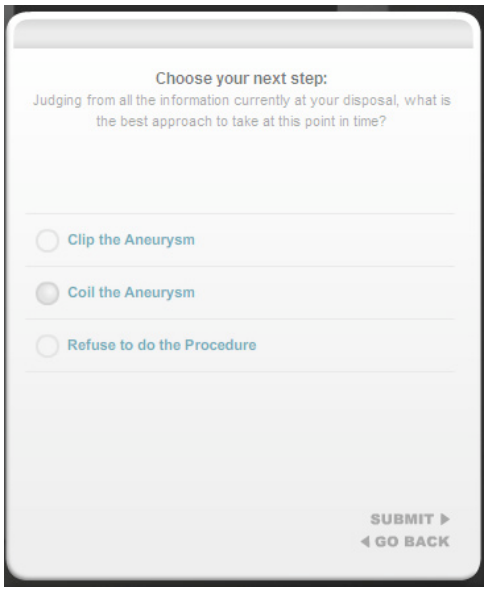
16) Determine if Aneurysm is safe for Coiling

Treatment decision time! The student can now have a variety of data—images and information about the aneurysm and will be asked how to treat it. Students should refer to the EMR and read about "Aneurysm Treatment Options", "Importance of Aneurysm Neck Size", "What is a Working Projection?", and "Complications from Coiling."

Question: Based on its shape and size, is the aneurysm safe for coiling without the risk of the coils looping into the brain blood vessel?

Answers: Yes (correct answer), No, or Inconclusive- More test are required to confirm

Feedback: The shape of this aneurysm, especially its neck (or the "opening", makes it a perfect candidate for the coiling technique. The aneurysm's 2 mm neck is small enough to allow coils to remain inside without slipping out.



17) Choose the Best Surgical Procedure for Treating the Aneurysm

Question: Choose Your Next Step: Judging from all the information currently at your disposal, what is the best approach to take at this point in time?

Answers: Clip the Aneurysm, Coil the Aneurysm (correct answer), Refuse to do the Procedure

Feedback: Correct! Coiling the aneurysm is the best choice at this point in time to prevent a rebleed.

Section 2 Completion Feedback:

You have confirmed that an aneurysm caused the subarachnoid hemorrhage (SAH) and needs to be treated immediately to prevent further bleeding. You discuss the treatment options with Mr. Jones' family and they have agreed to allow the endovascular coiling to take place.

Mr. Jones' life is now in the hands of you and your team. Best of luck to you.

End of Section 2 of *The Virtual Stroke Lab*

Coiling the aneurysm

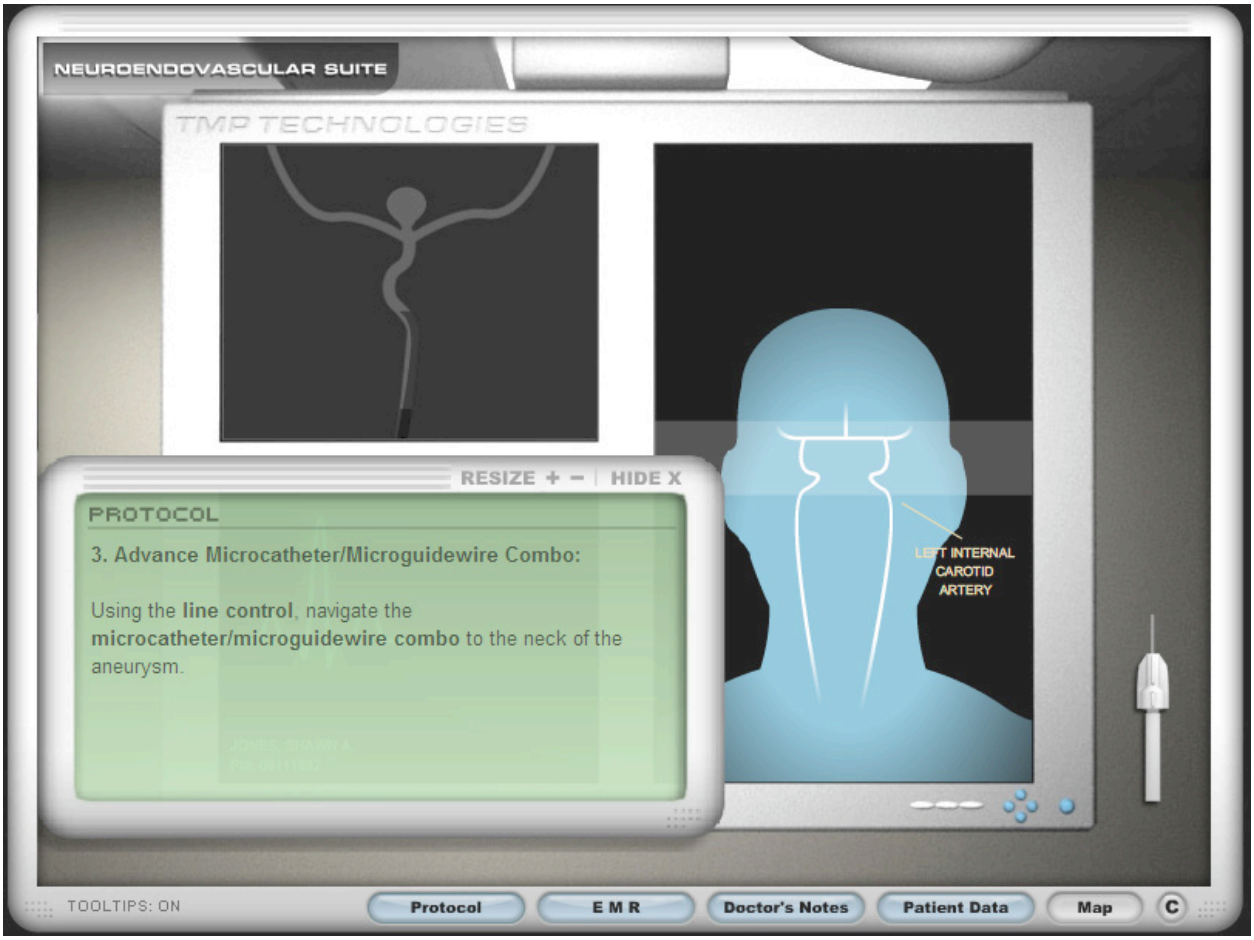
Overview

The last part of the module is where the student simulates a coiling treatment procedure on Mr. Jones' aneurysm. Students will gain direct access to the aneurysm by inserting the coils inside of it. Students will thread a microguidewire and microcatheter through the main catheter and up to the neck of the aneurysm.

Protocol Tasks student participants must complete: Coiling the aneurysm

1) Thread microguidewire through the main catheter

> **In Reality:** Since the main catheter is still in place, it provides a pathway through the arteries to the brain. However, the brain's blood vessels are so small that a micro system is needed to reach the aneurysm.



2) Slide microcatheter over microguidewire

3) Advance microcatheter/microguidewire combo into the neck of the aneurysm

Feedback: In order to embolize the aneurysm, you must now thread coils of various sizes through the microcatheter and into the aneurysm. The object is to insert just enough coils to block off the aneurysm.

4) Thread 5mm coil through microcatheter

5) Advance 5mm coil into aneurysm

6) Detach 5mm coil from delivery wire

7) Retract the coil delivery wire

8) Thread 4mm coil through microcatheter

9) Advance 4mm coil into aneurysm

10) Detach 4mm coil from delivery wire

11) Retract the coil delivery wire

12) Thread 3mm coil through microcatheter

13) Advance 3 mm coil into aneurysm

14) Detach 3mm coil from delivery wire

15) Retract the coil delivery wire

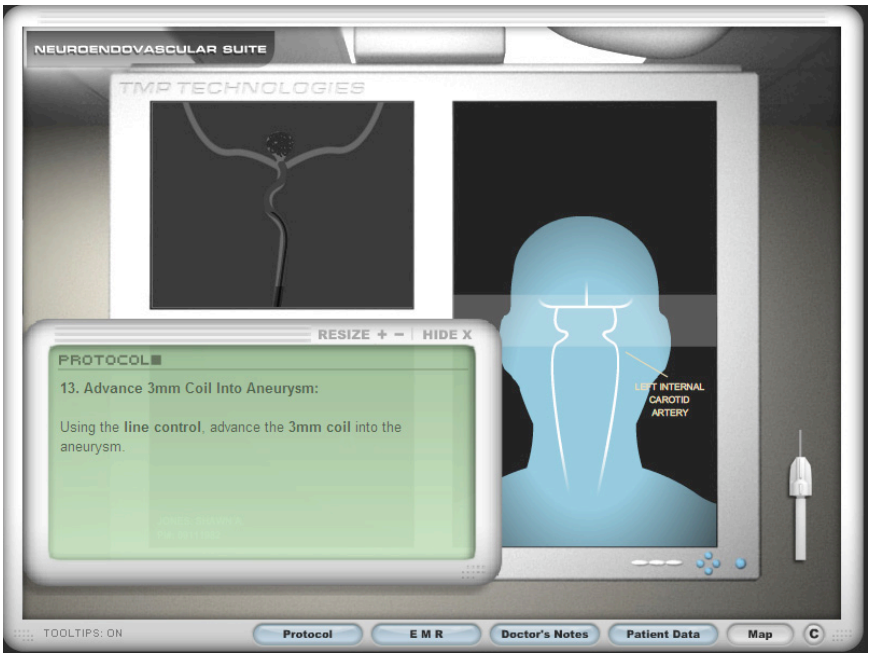
16) Retract the Microcatheter

In Reality

When coiling an aneurysm in real life, a surgeon will study the 3D image of the aneurysm in great length to determine how many coils he or she will need to use to fill the aneurysm and what size they should be. The number of coils varies based on the size of the aneurysm. Usually, as in this lab, the larger coils are inserted first with the smaller coils used to fill in gaps. In reality, these coils are spring loaded. When pushed out of their sheath, they take on their preformed shape and are then detached from their wire. That wire is then removed from the body.

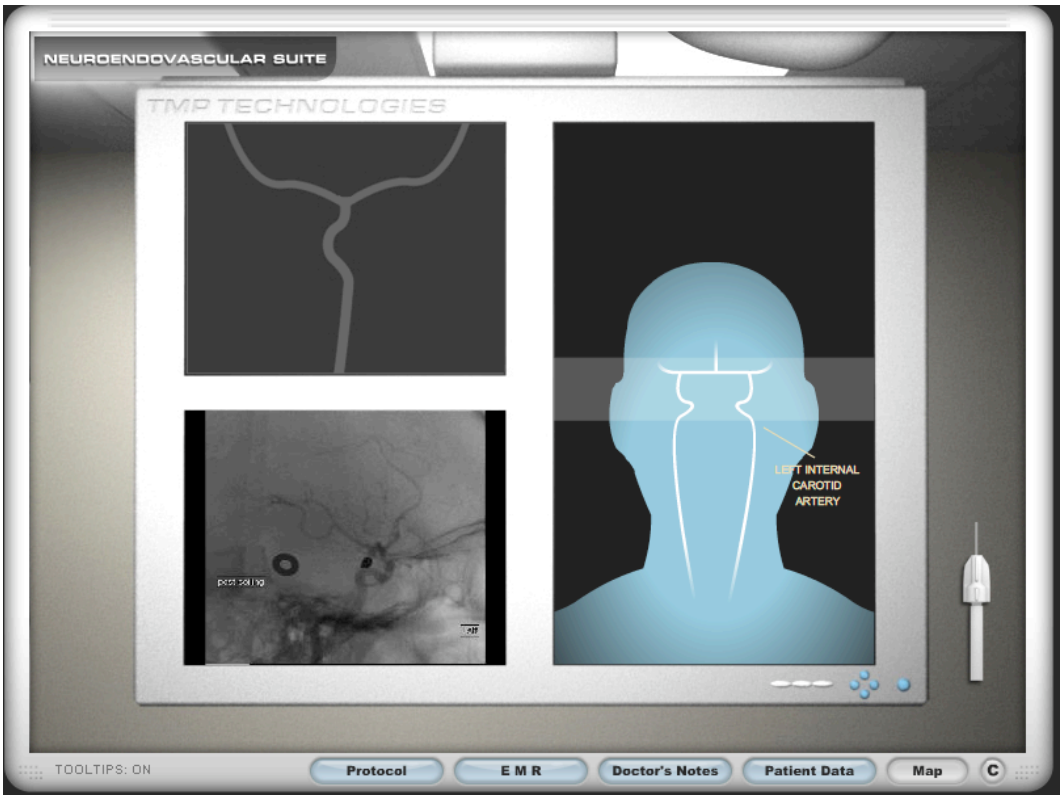
Feedback: Don't forget—the artery images you are currently viewing on the upper-left screen are simply roadmaps created through DSA, not real-time images of the arteries.

In light of this, you will need to inject contrast dye and run one last scan, resulting in an updated image of the arteries that you can use to ensure that the coils have completely blocked off the aneurysm.



17) Take Final Scans: both a DSA and a 3D DSA

Extra Info: The final scan doesn't show an aneurysm because the contrast dye shows blood flow. Since the aneurysm is completely coiled, no blood can enter the aneurysm, which is why it no longer shows up on the scan.



Feedback: Superbly executed! According to the final scans, you have completely embolized the aneurysm without vessel injury, coil loops, or clots.

The main catheter is removed along with the introducer sheath, and the surgery is now complete.

Congratulations! Excellent job. You have successfully completed The Virtual Stroke Lab.

Mr. Jones awoke from his procedure without any neurological change. He then spent 14 days in the intensive care unit (ICU) for observation. Thanks for your hard work, quick thinking and determination. Mr. Jones went on to make a full recovery.

Thank you very much for participating in this simulation. Please feel free to visit The Mind Project's Official Website.

Extension & Supplemental Activities

Design a brochure, poster, or YouTube video

Have students make brochures or a YouTube video about a specific aspect of the lab. Its purpose could be based on the angle you approached *The Virtual Stroke Lab*. For example, if you focused on students understanding blood vessel structure and the impact of an aneurysm, then the product could be about that.

Prevention or awareness plan

Have students design a stroke prevention or awareness campaign. Their goal is to inform others on the topic of stroke or on the new and exciting treatments available to patients.

Interview a stroke victim (or have a stroke victim come in as a speaker)

Students could interview a stroke victim to learn about the personal impact of having a stroke.

Research health careers & volunteer opportunities

The Virtual Stroke Lab highlights the Radiologist who specializes in neuroscience. However there are many different medical/health workers who would have come into contact with a stroke victim. Students could choose a career from the list below to research and share with a group. You could also encourage students interested in health careers to research volunteer opportunities.

Possible careers:

Emergency Medical Technician (EMT), ambulance driver, ER nurse, MD Doctor (radiologist, anesthesiologists, or neurologist), radiology technician, ICU nurse, nurse anesthetist, mental health professional, or hospital parishioner.

Extension Activity: Medical TV Drama? How Realistic Are They?

Introduction (Set Induction)

Get students interested by assigning the Forbes article titled “Playing Doctor: Medical TV isn’t always accurate” (pages 35-37). Allow students to discuss the pros and cons of having so many medical shows on TV.

Or go to You Tube and choose a 2 minute clip of a Medical TV Drama to entice students into the topic of the day!

TV Critique

Ask students chose a medical TV drama to critique--many can be watched online—that addresses an issue with stroke or some sort of clot (thrombus). Have them analyze the show for accuracy, taking notes on what is portrayed about the specific medical condition, and highlighting any misconceptions the show may give its viewers. Student reproducible included on pages 32-34. (If you have students whose parents won’t allow them to watch a Medical TV Drama, have the student watch a documentary on stroke and do a similar assignment.)

Finished Product

You could have students simply turn in a paper that answers the questions on the student worksheet. If you want students to share their findings, students could do presentations. If you wanted to allow students to pick, they could make a poster, brochure or a digital story (a You Tube video) that highlights their TV Medical Drama and stroke issues.

Name _____ Class _____ Date _____

Medical TV Dramas on the Topic of Stroke

"The problem is people get a lot of information from TV shows on many subjects — including medicine and health care — without realizing it. After a while, you may not remember where the details or your impressions came from, you're just sure they're true."

From "Playing Doctor: Medical TV isn't always accurate" Forbes; By Allison Van Dusen on MSNBC.com (Thurs., Sept. 20, 2007)

Your Assignment

Chose a medical TV drama to critique--many can be watched online—that addresses an issue with stroke or some sort of clot (thrombus). Analyze the show for accuracy, taking notes on what is portrayed about the specific medical condition, and highlighting any misconceptions the show may give its viewers. Use the attached sheet to guide your research. Your goal is to learn about the specific type of stroke featured in the episode, then research it to find possible inconsistencies or incomplete information.

Below is a list of possible TV shows

House MD

ER

Grey's Anatomy

Scrubs

Medical Investigation

Chicago Hope

Crossing Jordan

City of Angels

Emergency

Medical Investigation

Nip/Tuck

Medical Investigation

Private Practice

Dr. Quinn- Medicine Woman

M*A*S*H

Hopkins

Discovery Health

Episode Details

Name of Medical TV Drama:

Episode Title:

URL Link (if watched online) or time/date episode aired:

Specific name of stroke or clot addressed in this episode:

Questions:

1) Give a brief summary of the episode.
2) Using the table on the following page to organize your notes, fill in the first column after watching your episode. Then after doing some research fill in the second column, making sure to keep a bibliography of your reliable resources.
3) Briefly describe any misconceptions the Medical TV drama gives its viewers about strokes. A misconception could anything from a incomplete or inaccurate explanation of the anatomy to only one treatment option given to the patient.
4) Describe the social benefits the show may provide. How might the stroke information in the episode be helpful and possibly save lives?
5) Describe any social problems the show may create. What will the viewers remember from the show that is inaccurate or incomplete? How may that impact the individual?

Medical TV Drama: Episode Worksheet

	TV Drama	Reality
Symptoms		
Anatomy (What's happening to the blood vessel?)		
Causes and/or Prevention		
Treatment		

Your Bibliography: List the resources you used to determine the stroke "reality" column.

Playing Doctor: Medical TV isn't always accurate

Viewers often get wrong ideas, but shows do impart some info, experts say

By Allison Van Dusen
Forbes: MSNBC.com
updated 6:09 p.m. CT, Thurs., Sept. 20, 2007

Tune in to a medical drama today, and you're bound to get an eyeful of blood and guts and lots of banter about diseases, procedures and treatments.

That's the point. Attention to all the gory details by small-screen writers, producers and directors is a must, not only to suspend viewers' disbelief, but also to tell stories responsibly.

To that end, many shows rely on consultations with doctors and medical experts, provided by groups such as Hollywood, Health & Society, a partnership with the Centers for Disease Control and Prevention, the National Institutes of Health and the USC Annenberg Norman Lear Center, a research and public policy center, to help them accurately represent health-related story lines.

As a result, when doctors on "Grey's Anatomy," "ER" and "House" talk shop, they sound like they know what they are talking about.

That doesn't mean, however, that they get everything right. Experts say medical dramas often inaccurately portray organ donation, the range of doctors' expertise and nurses' roles, not to mention the level of hospital romance that takes place.

"If you want to learn how to treat your kidney stones or your kid's rash," says Bob Thompson, director of the Center for the Study of Popular Television at Syracuse University, "you should no more watch a medical drama to get accurate information on how to treat symptoms than watch 'The Simpsons' or 'Married With Children' for clues on how to raise a child."

Sounds reasonable. The problem is people get a lot of information from TV shows on many subjects — including medicine and health care — without realizing it. After a while, you may not remember where the details or your impressions came from, you're just sure they're true.

A recent small study by researchers at Yale University, for instance, showed plastic surgery reality programs such as "Dr. 90210" and "Extreme Makeover" played a significant role in cosmetic surgery patients' perceptions and decisions. Regular viewers cited the shows as influential in their decisions to

consult a surgeon, and knew more about procedures than those who never tuned in.

Another study found organ donation was a primary story line in more than 80 episodes of medical dramas, police shows, comedies and daytime soaps in 2004 and 2005. The research, published this summer in the journal Health Communication, found that with a few exceptions, the topic was consistently presented in a negative or inaccurate light, which some say can ultimately affect people's decisions to become donors.

That's what another study, published in Clinical Transplantation in 2005, also concluded. Its researchers found that people who viewed organ donation unfavorably frequently cited what they'd seen on TV as evidence for their opinions.

"It's hard not to get kind of outraged when you see what's going on," says Susan Morgan, associate professor in the Department of Communication at Purdue, and a co-author of both studies. "You could start drawing this out to real human lives being lost."

Twisted plots

Morgan points to story lines on soap operas such as "One Life To Live," in which the hospital's chief surgeon ran a black market for transplantable organs, and "Grey's Anatomy," in which a patient was prematurely declared brain-dead so her organs could be procured, as prime examples.

Some nurses have taken issue with their portrayal on these programs as well. "ER," for example, commonly depicts physicians doing the work nurses perform in real life, says Sandy Summers, executive director of The Center For Nursing Advocacy.

"People will go into the hospital and remark with surprise that the nurses did everything," Summers says. "They believe from watching these shows that physicians do everything."

Anyone who works in a hospital also will note that in real life there is nowhere near the degree of fraternization among residents, nurses and doctors shown on TV. Hospital staff do not all hang out at the local bar or coffee shop every night after work — and they're not typically having sex in the janitor's closet, either.

"People have families to go home to," says Dr. Jordan Safirstein, a cardiology fellow based in New York who runs StopPagingMe.com, a Web site that looks at the humorous side of being a doctor. "I wish it was more exciting and romantic."

Finding the right balance

While most medical shows make efforts to obtain accurate information, their plots will not always be perfect because they're caught in a balancing act, says Larry Deutchman, executive vice president of marketing and industry relations for the Entertainment Industries Council, a nonprofit founded by entertainment industry leaders to promote awareness of major health and social issues.

"To be entertaining and have your stories told has always got to take first precedent," he says. "Second is what can I do to make a difference with my work or minimize the harm. If you're taking that approach to what you're doing, more often than not you can

come away with doing more good than not."

Do-good doctoring

Small-screen medical dramas aren't always off the mark, though.

Donate Life Hollywood, a campaign launched this summer to eliminate stolen-kidney story lines, among others, from TV and film, heaped praise on "Extreme Makeover Home Edition" producers for featuring a woman whose son had died in a car crash and was an organ donor. After the show aired, online donor registration increased 200 percent in California over the previous week, a spike the campaign attributed to the show. "Intervention," an A&E reality show that profiles people facing drug and alcohol dependencies, and their families' efforts to help, is another example of accurate, gripping TV, says Deutchman.

A new study by researchers at the University of Southern California, published this month in the Journal of Health Communication, also shows viewers of an "ER" story line about teen obesity, hypertension and healthy eating habits were 65 percent more likely to report a positive change in their behavior after watching.

Likewise, every TV producer has probably gotten a letter from a woman who decided to get a life-saving mammogram after being reminded by a program, Thompson says. And while medical shows teach us plenty that isn't accurate, they also can shed light on the health care bureaucracy, insurance issues and disease prevention, something fiction has no obligation to do.

"If you've been logging in from "Chicago Hope" to "Grey's Anatomy," you've gotten a lot of sophisticated information," Thompson says. "Just as you've learned some errors, you've learned some things you wouldn't have otherwise known."

URL:
http://www.msnbc.msn.com/id/20895520/

The Electronic Medical Record in its entirety can be found on pages 39-54. The EMR is the reading tool that students will use as they complete *The Virtual Stroke Lab*. The idea of the EMR was that students only have to read what they need, at the moment they need it. This version of the EMR is in alphabetical order, not the order in which students will come into contact with it while completed *The Virtual Stroke Lab*.

The philosophy of the MIND project is that students shouldn't memorize rote facts, but be able to make sense of the information when exposed to it in a real-life situation/simulation. The EMR is organized to reflect this philosophy. When students click on the EMR button in the Main Menu, the information is organized by question. Only the questions they need to answer are available to them. So at the beginning of the lab, there are fewer questions than at the time they complete the lab. Students can refer to any past question, even after they initially read the material.

It is up to you as the teacher whether or not you want to test students on details in the EMR. However, the lab was designed so that the experience of doing the simulated lab could be sufficient as a stand-alone activity.

3D CT ANGIOGRAPHY (3D CTA)

Iodinated contrast is injected through a small peripheral vein, usually in the arm. The dye flows through the body and is imaged as it passes through the brain. These images can be used to create a computer generated 3D model of blood vessels in the brain.

3D CT Angiogram

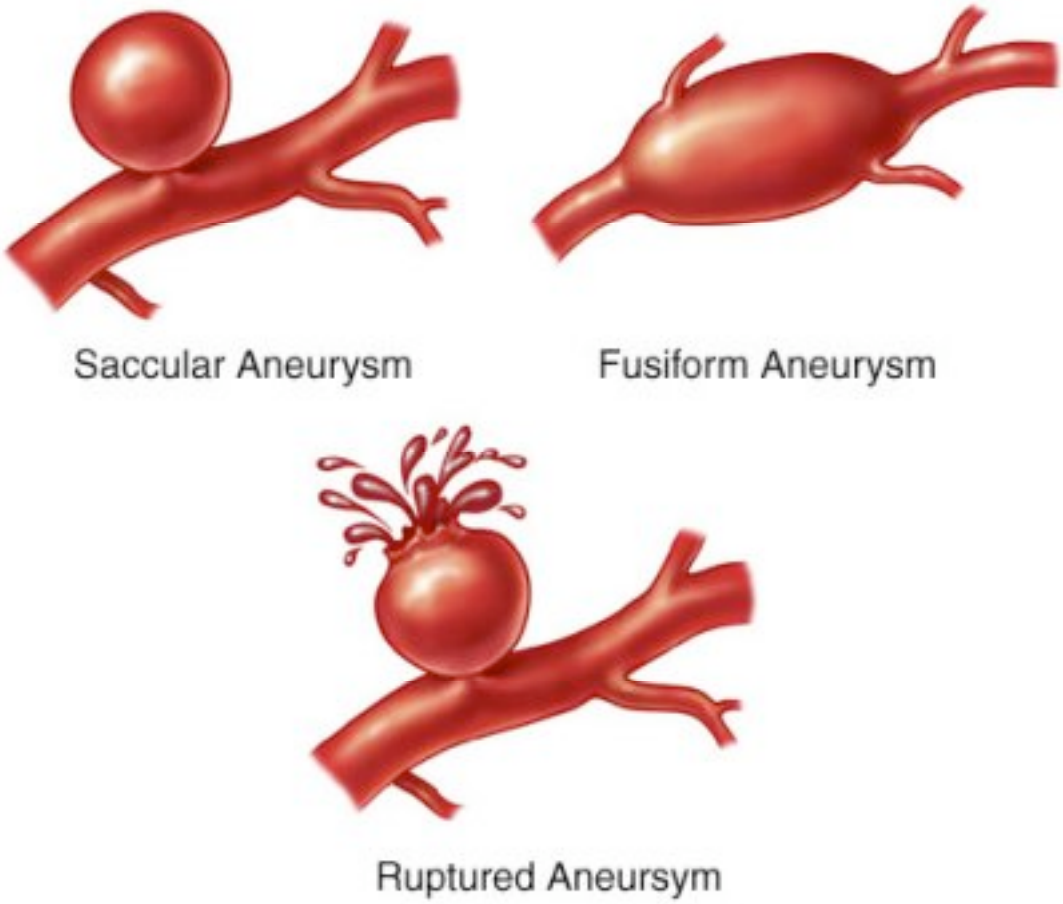
3D ROTATIONAL DSA

3D Rotational DSA is very similar to regular DSA, except that the fluoroscopy machine is rotated around the patient while scanning. The 3D Rotational DSA series of images are used to create a 3D model of blood vessels in the brain.

ANEURYSM

An aneurysm is a permanent ballooning in the wall of an artery. The pressure of blood passing through can force part of a weakened artery to bulge outward, forming a thin-skinned blister or sac. The gravest threat an aneurysm poses is that it will burst and cause a stroke or life-threatening hemorrhage. Even if it doesn't rupture, a large aneurysm can impede circulation and promote

unwanted blood-clot formation.

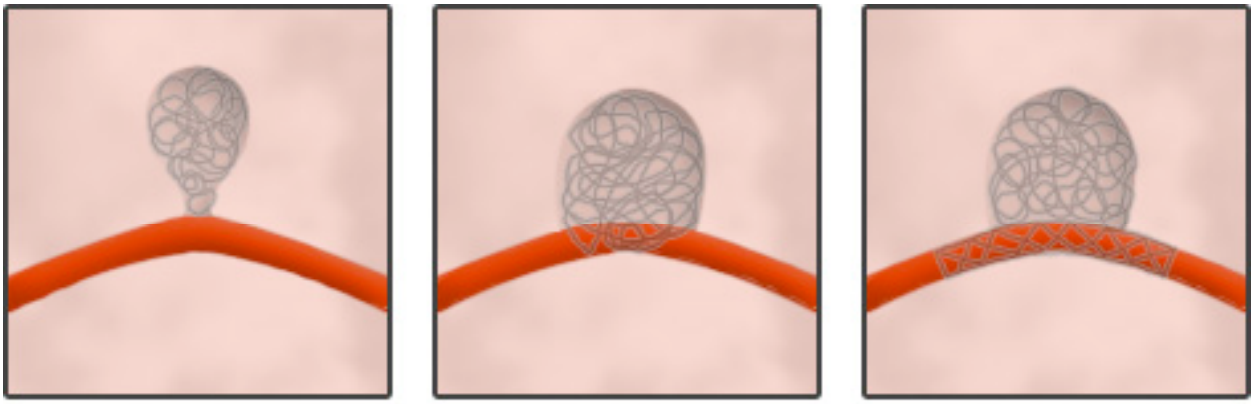


Types of Aneurysms

TYPES OF ANEURYSMS

Any condition that causes arterial walls to weaken or deteriorate can result in an aneurysm. The most common culprits are Atherosclerosis and high blood pressure. Penetrating wounds and infections can also lead to an aneurysm. Some types, such as Berry Aneurysms, are the result of congenital, or inherited, weakness in artery walls.

ANEURYSM NECK SIZE



Aneurysm Shapes

* A neck of greater than 4 mm will allow the coils to loop out of the aneurysm. This will cause blood clots to form within the brain blood vessel, resulting in a stroke.

* A narrow-neck aneurysm will prevent coils from looping out into the brain blood vessels.

* Wide neck aneurysms can be treated with coils if a balloon or stent is placed in the brain vessel.

ANEURYSM TREATMENT OPTIONS

Coiling

- Performed in a neuroendovascular suite by a neuroendovascular radiologist or surgeon.
- Minimally invasive procedure without surgical cutting through to the brain blood vessels.
- A catheter is navigated through a vessel in the groin region and advanced to the anuerysm using using fluoroscopy.
- Platinum coils attached to a delivery wire are deployed through catheter into the aneurysm. The wire is detached and removed, leaving the coil within the aneurysm. A number of coils are needed to occlude the aneurysm.

Clipping

- A craniotomy (surgical drilling and cutting to create a window through the skull) is performed. The brain is retracted to locate the aneurysm.
- A small clip is placed across the neck (or "opening") of the aneurysm to block normal blood flow from entering.
- The clip remains on the artery permanently.

Should an Aneurysm be Clipped or Coiled?

- Studies have shown that patients with ruptured and unruptured aneurysms have better clinical outcomes from coiling rather than clipping. There is less recovery time required and no manipulation of brain tissue.
- Surgical clipping is still used for younger patients with superficial, easy-to-access aneurysms.
- The size and morphology (or shape) of an aneurysm is extremely important when determining whether to coil or clip.
- The overall risk rate for both procedures is comparable.
- The advantage of surgical clipping is that it is almost always permanent.
- The disadvantage of coiling is that the coils may compact within the aneurysm and may require retreatments. This is mostly dependent on the size of the aneurysm.

COILING COMPLICATIONS

The aneurysm can rupture if the microcatheter or wire penetrates through the wall.

Coils can loop out of the aneurysm if not placed carefully. This can cause blockage of brain blood vessels, resulting in an ischemic stroke.

Clots may form on the devices used and may also cause ischemic strokes. This is why medication is given at the beginning of coiling to prevent blood clots.

CT SCAN

An X-ray beam is rotated around the head to create an image slice of the brain, called "computerized tomography". Sometimes iodinated contrast is administered through a vein in the arm. This dye flows throughout the body and is imaged once it reaches the brain. Iodinated contrast, like bone, absorbs energy and will appear on the scan results.

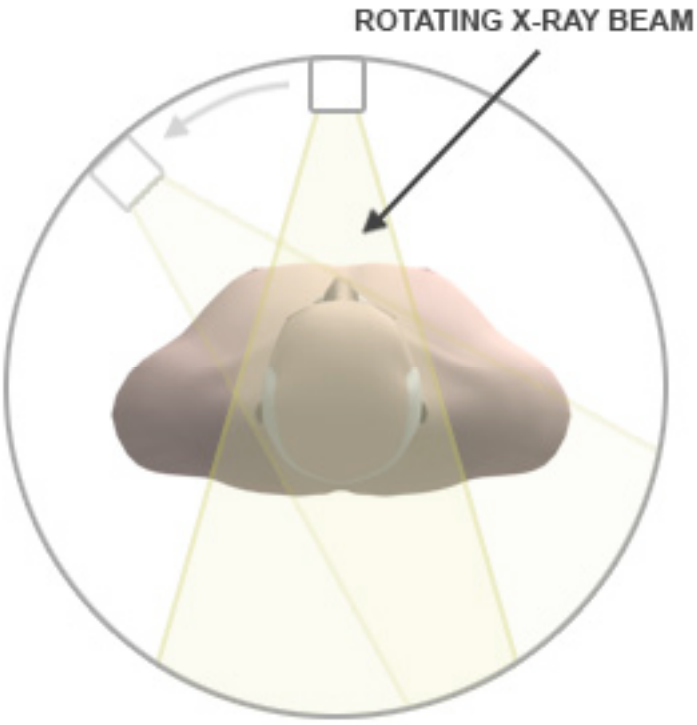
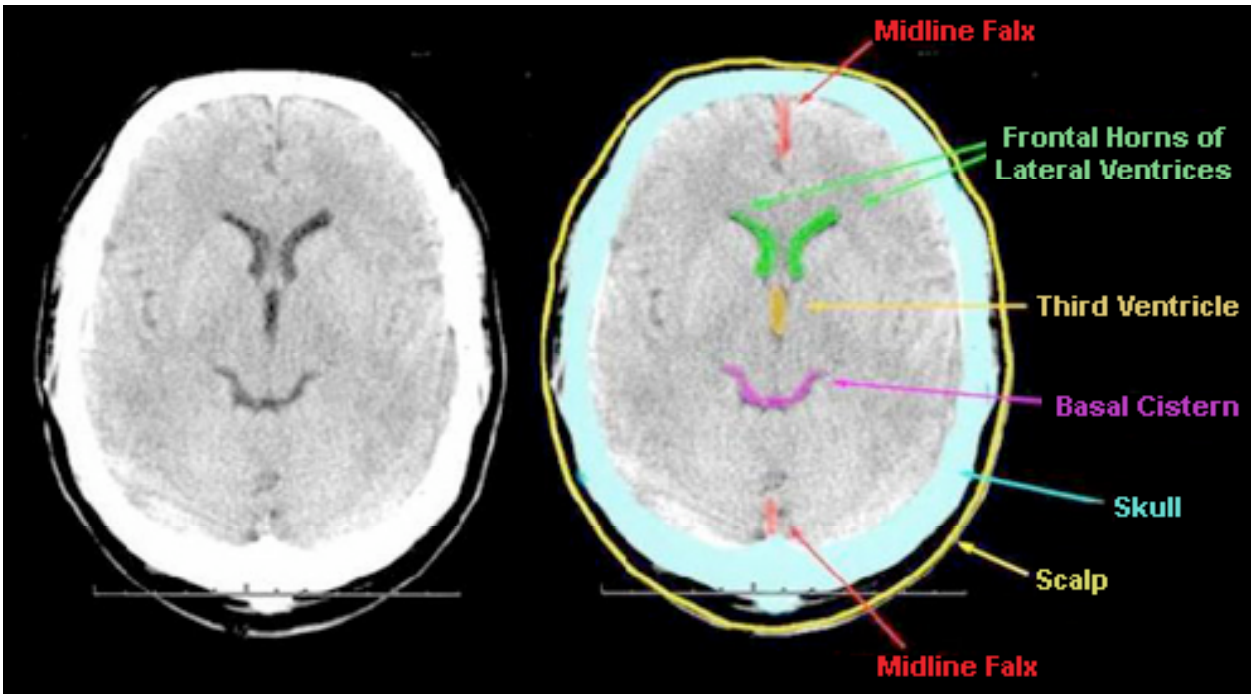


ILLUSTRATION OF X-RAY BEAM ROTATING AROUND PATIENT

CT SCANS (INTERPRETING)

Reading a CT Scan can be tricky and involves an immense amount of training. CT Scans are black and white and the coloration is very dependent upon density. More dense areas appear lighter while less dense areas appear darker. So, dark spaces on a CT Scan indicate empty space while white spaces often indicate dense objects. In the brain, most tissue will normally appear gray, with empty spots (such as the ventricles), appearing black. The skull and other bones will appear white. Such an example can be seen below:



CT SCAN W/ LABELS ILLUSTRATING THE EFFECTS OF MATERIAL DENSITY

Radiologists reading CT Scans normally look for abnormalities in tissue to give them diagnostic clues. In the CT Scan below on the left, you can see a large white mass in the normally gray brain tissue. This is an indication of bleeding the brain, caused in this case by an arteriovenous malformation (AVM).

The CT Scan on the right shows a small mass in the lower right hand quadrant. While still gray, it is lighter than the surrounding tissues, indicating a denser area. In this case, this is a brain tumor:

CT Scan w/ Bleeding

THE WHITE PATCH IN THIS

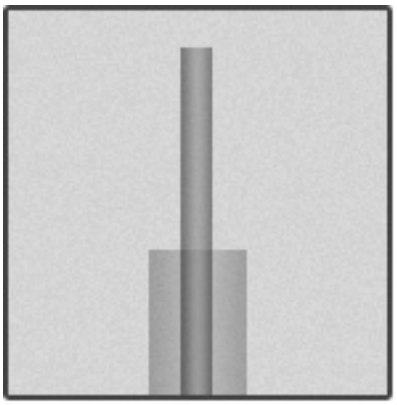
CT SCAN INDICATES BLEEDING

THE GRAY SPOT IN THIS

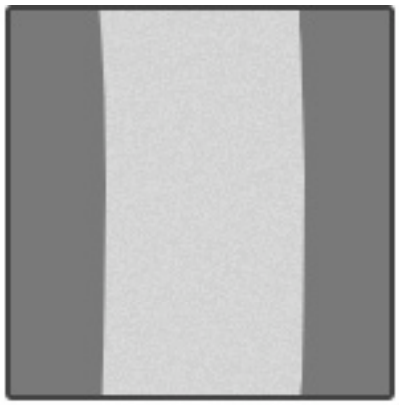
CT SCAN INDICATES A TUMOR

DIGITAL ROAD MAPPING

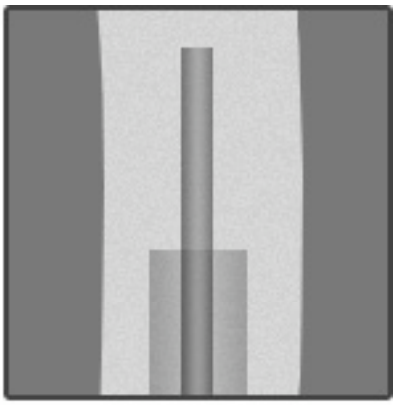
A digital road map is a process by with wires and catheters are navigated through blood vessels of the brain. The DSA image depicting the artery is superimposed on a live flouroscopic x-ray image.



LIVE FLUOROSCOPIC VIDEO ONLY SHOWS HARD-BODIED OBJECTS, SUCH AS THE CATHETER AND COIL SEEN HERE.



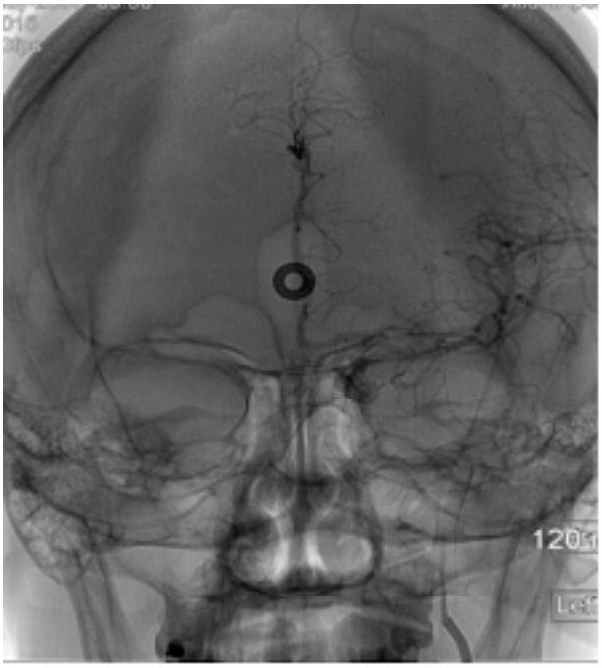
BY SCANNING THE ARTERIES WHILE THEY ARE FILLED WITH CONTRAST DYE, THEIR SHAPE CAN THEN BE VISUALIZED.



THE ARTERY IMAGES CAN THEN BE PLACED OVER THE LIVE VIEW AND USED AS A MAP.

DIGITAL SUBTRACTION ANGIOGRAPHY (DSA)

Digital Subtraction Angiography (DSA) is a process by which the live video flouroscopy images are used to create a permanent set of images that can be reviewed. Iodinated x-ray dye is injected through a thin long tube called a catheter that is inserted into the body's blood vessels. A rapid series of flouroscopic images is obtained as the x-ray dye flows through the blood vessels. A computer then subtracts out all the bony structures. The resultant series of images represent only the vascular structures of the brain.



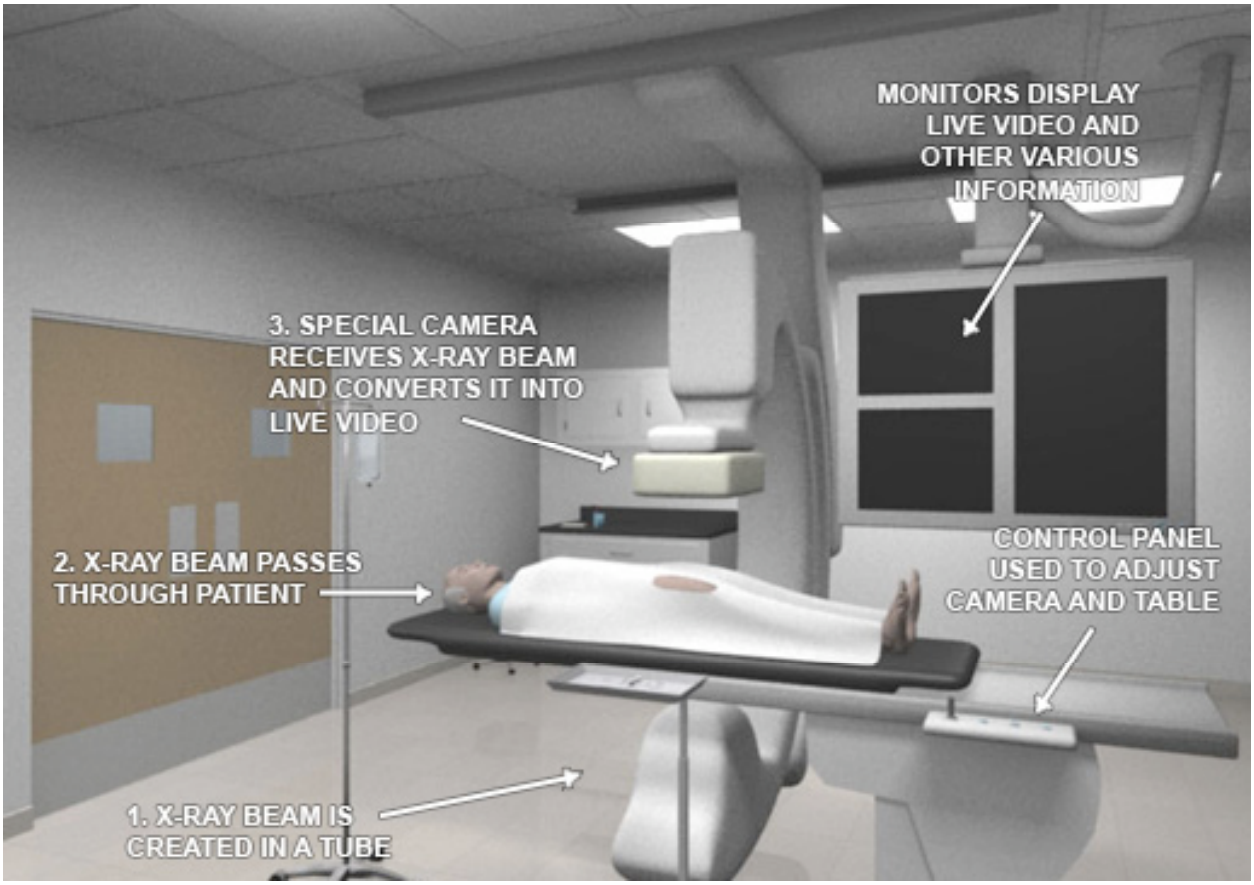
DIGITAL STILL IMAGE WITHOUT SUBTRACTION

DIGITAL SUBTRACTION STILL IMAGE WITH BONE SUBTRACTION SHOWING ONLY THE BLOOD VESSELS OF THE BRAIN

FLUOROSCOPY

Flouroscopy is live x-ray imaging that allows visualization of bony structures. This is created as a continuous beam of x-rays is allowed to penetrate the body. An x-ray camera than receives the attentuated beams to create a live video image. Metallic objects such as coils and an x-ray dye containing iodine can also be visualized in real time. Soft tissues such as blood vessels of the body cannot be visualized with fluoroscopy.

Iodinated contrast is injected through a catheter into the blood vessel for them to be visualized. The contrast is visualized in real time as it flows from through the brain.



A TYPICAL FLUOROSCOPY SETUP

IODINATED CONTRAST

An X-ray beam is rotated around the head to create an image slice of the brain, called "computerized tomography". Sometimes iodinated contrast is administered through a vein in the arm. This dye flows throughout the body and is imaged once it reaches the brain. Iodinated contrast, like bone, absorbs energy and will appear on the scan results. Iodine absorbs x-ray energy and, in a liquid form, can be safely introduced into the blood vessels of the body. It appears white on CT and is therefore not given in the initial diagnosis of stroke, as it may prevent detection of blood (since blood also appears white on CT scans).

Iodinated contrast is also used for CT Angiography (CTA) and Digital Subtraction Angiography (DSA). In CTA, the contrast is given through a small vein access site, usually in the arm. Imaging by a CT scanner is not in real time. Sliced images of blood vessels in the brain are used ot created a 3 dimensional model by a computer.

In DSA, the contrast is injected through a tube called a catheter that is guided into the arterial blood vessel of the neck from the groin region. There is subsequent real time imaging of the contrast as it flows through the blood vessels, using what is referred to as flouroscopy. This will be discussed in greater detail further on.

STROKE

- A stroke is a generic term that describes an acute onset of a neurologic deficit.
- Hemorrhagic and Ischemic are the two main categories of stroke types, each requiring different types of treatment.
- If left untreated, strokes can lead to severe and irreparable neuroligcal damage. In many cases, even death.

STROKE DIAGNOSTIC IMAGING TESTS

- Computerized Tomography (CT) of the Brain w/o Iodinated Contrast - especially useful for differentiating between ischemic and hemorrhagic strokes.
- Magnetic Resonance Imaging (MRI) of the brain
- Computerized Tomographic Angiography (CTA) of the Brain w/ Iodinated Contrast
- Magnetic Resonance Angiography (MRA)
- Computerized Brain Perfusion Imaging (CTP)
- Conventional Catheter Brain Angiography w/ Digital Subtraction (DSA)

STROKE RISK FACTORS

Ischemic Stroke

- High blood pressure
- Smoking
- High cholesterol levels, obesity, and physical inactivity
- Irregular heartbeat (called "atrial fibrillation")
- Diabetes
- Prior stroke
- African-American men and women have a significantly increased risk of stroke compared to Caucasians and Hispanics

Hemorrhagic Stroke

- Head trauma
- Smoking
- Blood-thinning medication
- Hypertension
- Brain blood vessel abnormalities such as aneurysms
- Family history of aneurysms or other brain vascular anomalies

STROKE SYMPTOMS

- Sudden numbness or weakness of face, leg or arm, especially on one side of the body
- Sudden confusion or trouble speaking and/or understanding speech
- Sudden dimness or loss of vision in one or both eyes
- Sudden severe headache with no known cause, often described as the "worst headache of your life". This is typical of a type of hemorrhagic stroke called a Subarachnoid Hemorrhage (SAH).
- Sudden dizziness, loss of balance or unsteadiness

Again, these are just possible warning signs of a stroke. An individual exhibiting any one of these conditions does not necessarily indicate that he or she is having a stroke. However, these symptoms do indicate a possible medical emergency, stroke-related or not. It is best to seek professional medical help immediately to avoid any further (and potentially, life-threatening) complications.

STROKE GRADING SYSTEMS

When a patient is suspected of having a stroke, there are a number of clinical "grading systems" used to indicate the severity of the stroke. Most of these systems involve the doctor performing various tests that assess comprehension, speech, motor skills, etc. The most commonly used grading systems are the Glasgow Outcome Scale, Hunt & Hess Scale, and the NIH (National Institute of Health) Stroke Scale.

In this simulation, we will be using the Hunt and Hess Scale:

- Grade 0: Asymptomatic
- Grade 1: Mildly symptomatic with headache. Patient Alert.
- Grade 2: Severe headache associated with neck stiffness. Patient alert.
- Grade 3: Severe headache. Patient drowsy/sleepy or confused. May have mild weakness of limbs.
- Grade 4: Patient stuporous. Moderate to severe weakness of limbs on one side.
- Grade 5: Comatose. Unresponsive.

TYPES OF STROKE

Ischemic Stroke

An ischemic stroke refers to an event where blood supply to portions of the brain is reduced or restricted, often by a blood clot, called a thrombus.

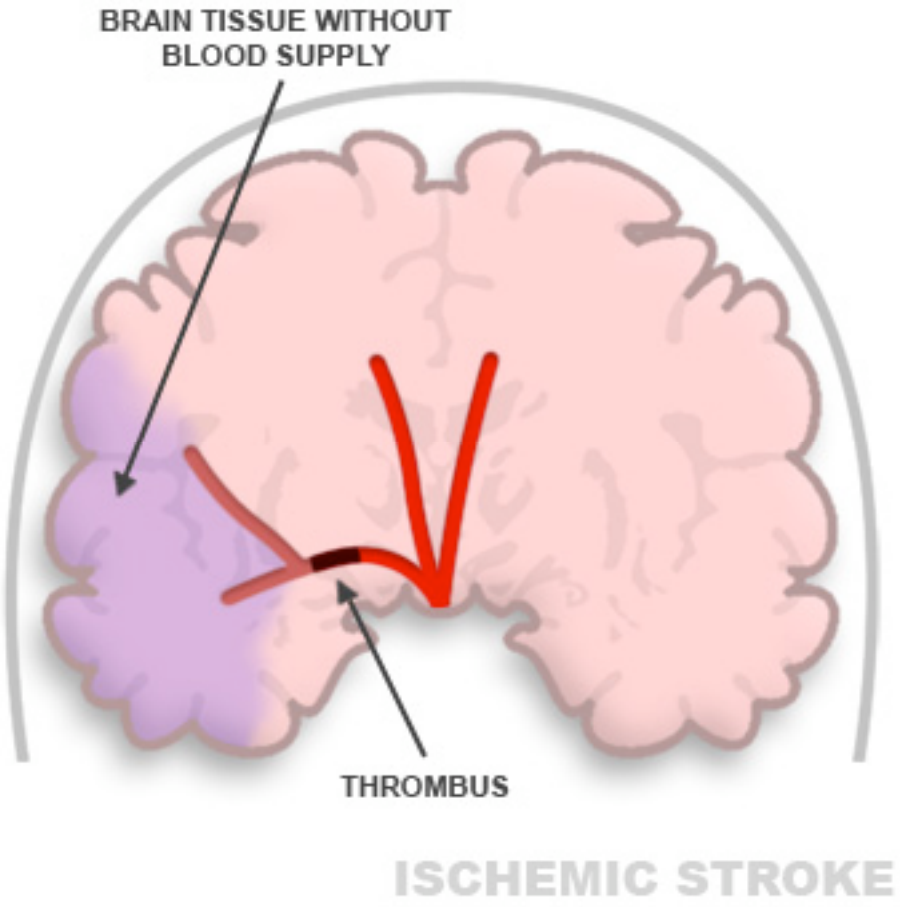


ILLUSTRATION OF AN ISCHEMIC STROKE

Hemorrhagic Stroke

A hemorrhagic stroke is a bleed within the brain. This can occur within membranes that line the surface of the brain, called a s**ubarachnoid hemorrage**. It can occur within the brain substance, called an **intra-cerebral hemorrrhage**. It can also occur between the spaces of the skull and the brain, called a **subdural** or **epidural hematoma.**

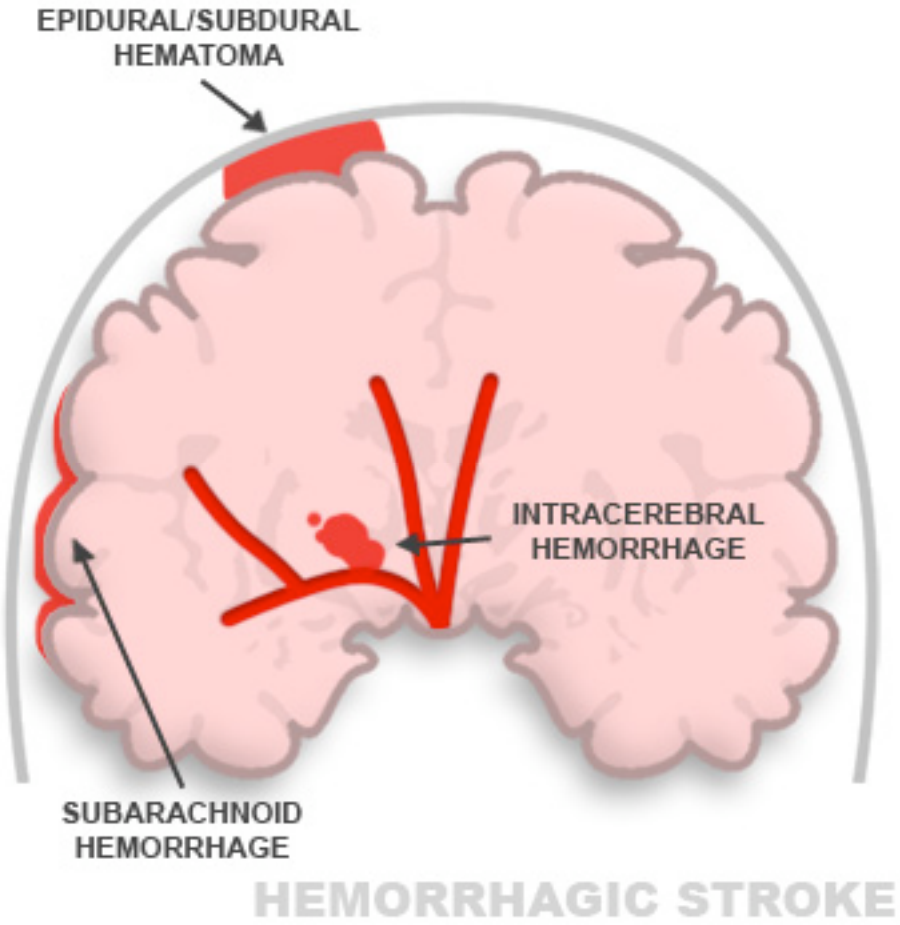
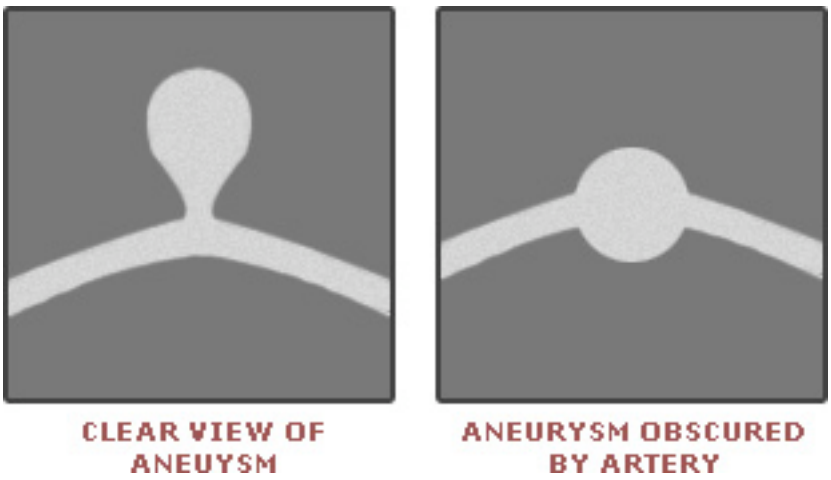


ILLUSTRATION OF A HEMORRHAGIC STROKE

WORKING PROJECTION

The fluoroscopy machine is positioned so that the aneruysm neck is clearly visualized. That way, coils are delivered in the aneurysm cavity and not within the blood vessel of the brain. 3D images help in identifying the correct working projection.

Example of a Working Projection



X-RAYS

X-rays are created as excess energy is released from an atom after it is penetrated by an electron beam. The penetrating electron beam displaces orbiting electrons, creating an excited atom that relaxes once the energy is released. This energy is passed through a patient and is deposited on a film to create an image, much like a camera does.

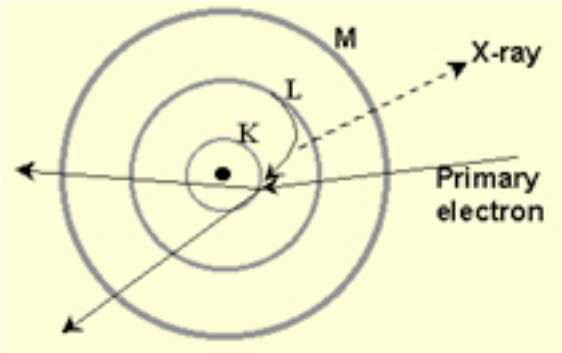


DIAGRAM OF X-RAY

Certain tissues, such as bone, absorb more energy than others. The unabsorbed beam of x-ray energy emerging from the body darkens the

receptive film. The contrast of white (absorbed energy) and black (transmitted energy) creates the x-ray image. X-rays are use in compturized tomography (CT) and computerized tomographic angiography (CTA) as well as in digital subtraction angiography (DSA). DSA will be discussed in later sections.

SKULL X-RAY RESULTS