C31 The Importance of CT for Stroke Protocol

Objectives

- Identify different types of strokes

- Explain why CT is important for diagnosing strokes

- Explain the process and what images are taken for stroke protocol

- Understand what strokes look like on CT scans

- Compare CT and MRI for stroke protocol

What are the Different Types of Strokes?

There are 2 main classifications of strokes: Ischemic and Hemorrhagic

Ischemic:
- Caused by a blockage of an artery (loss of blood)
- Most common type of stroke (make up 87% of all strokes)
- Broken down into two types: Thrombotic and Embolic
  - **Thrombotic**: caused by a blood clot that develops in the blood vessels in the brain
  - **Embolic**: caused by a blood clot or plaque debris that develops elsewhere in the body and then travels to the brain

Hemorrhagic:
- Caused by bleeding in the brain
- Less common (make up about 13% of all strokes)
- Broken down into two types: Subarachnoid and Intracerebral
  - **Subarachnoid**: caused by bleeding in the subarachnoid space
  - **Intracerebral**: caused by bleedings from the blood vessels in the brain

Something to Note:
Recurrent Strokes: continuing strokes that occur within 5 years after the first stroke

Why is CT important for Diagnosing Strokes?

Time is of the essence!

- Every minute that passes by during a stroke, 1.9 million brain cells are lost. Getting treatment to a patient as quickly as possible is critical for stroke recovery. It is best practice for a stroke patient to get a CT scan within 1 hour of arriving at the hospital.

Imaging:

- CT scans are much faster than MRI scans. Because time is so important with stroke recovery, a CT scan is almost always the first scan done when a stroke is suspected. A CT brain scan is usually able to show whether there is bleeding in the brain allowing doctors to determine whether it was a ischemic or hemorrhagic stroke.

F.A.S.T.

| Face Drooping | Arm Weakness | Speech Difficulty | Time to Call 911 |

Process and Images Taken for Stroke Protocol

Stroke protocol usually includes 3 concatenated scans
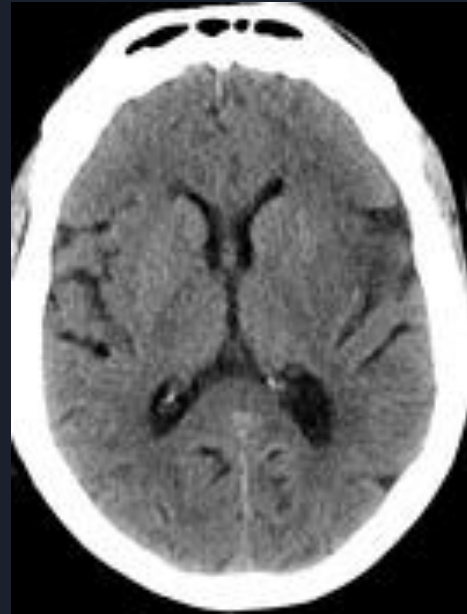
- Non-contrast CT
- CT perfusion
- CT angiography

Purpose of this protocol

- Asses brain for infarcts or alternative diagnoses
- Identify location and physiological effects of arterial blockage
- Assess vascular anatomy that may impact endovascular access

Process and Images Taken for Stroke Protocol cont.

Non-contrast CT

- First scan performed
- Rapid overview of the brain
- Allows for stroke-related features to be seen
    - Intracerebral hemorrhages
    - Hyperdense artery sign
    - Established acute cerebral infarction

https://radiopaedia.org/articles/stroke-protocol-ct?lang=us

Process and Images Taken for Stroke Protocol cont.

CT perfusion

- Contrast administered
- Various parameters of cerebral perfusion calculated
  - Cerebral blood volume
  - Cerebral blood flow
  - Mean transit time
  - Time-to-maximum or time to peak
    - These allow the diagnosis and quantification of areas of impaired perfusion
    - They also identify infarct core and penumbra

https://radiopaedia.org/articles/stroke-protocol-ct?lang=us
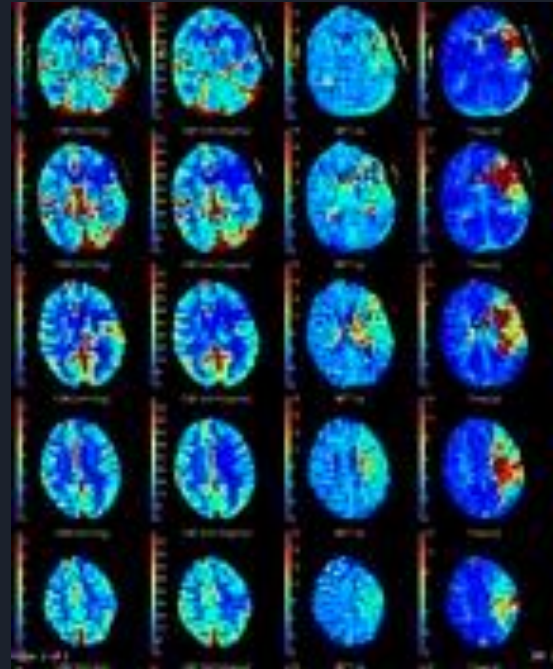
Process and Images Taken for Stroke Protocol cont.

CT angiography

- Performed from the arch of the aorta, to the vertex of the skull
- Performed using arterial phase of intravascular contrast
- Allows for visualization of numerous intracranial features relevant to stroke setting and anatomy that may be relevant to the endovascular intervention
  - Occlusive thromboembolism
  - Arterial dissection
  - Aneurysms
 - Spot sign in cerebral hemorrhage

https://radiopaedia.org/articles/stroke-protocol-ct?lang=us

What Does a Stroke Look Like On a CT Scan?

Findings on Brain CT that Support Diagnosis of Acute Infarction:

1. Dense middle cerebral artery (MCA) sign
   - Thrombus in the MCA
   - appears white
2. Dot sign
   - indicates a thrombus in distal middle cerebral artery branch
3. Insular ribbon sign
   - Subtle
   - absent of thin, high attenuation zone of normal cortex is an early sign
4. Basal ganglia asymmetry
5. Loss of gray-white boundary
   - Loss of normal borderline between gray and white matter
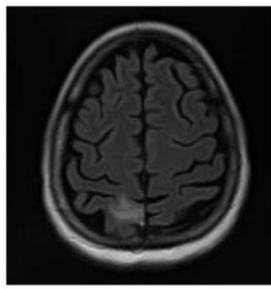6. Low attenuation of the cortex
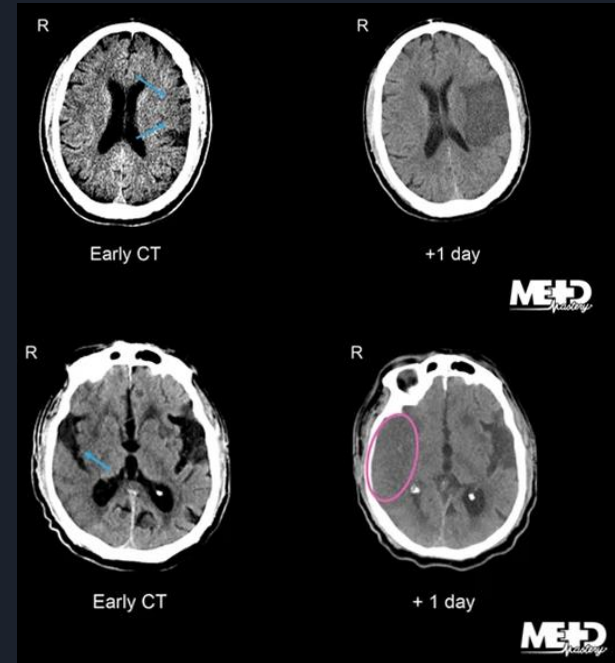
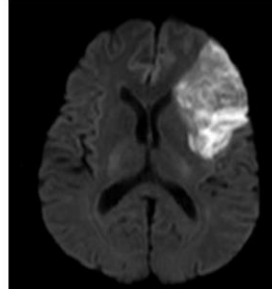-It is important to understand the patient's symptoms, to know the area of the brain to look at

Comparison of CT and MRI Per Stroke Protocol:
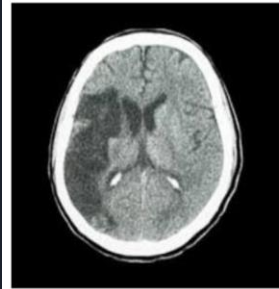
Computed tomography   MRI FLAIR sequence   Diffusion-weighted MRI

https://www.mdpi.com/2075-4418/12/10/2535

CT:

- A CT scan, specifically of the brain usually only takes a few minutes. This is important for stroke protocol as time is crucial.
- Additionally, MRI scanners are not always available at all locations, while CT scanners are much more common.

MRI:

- MRI scans take much longer to complete than CT scans. Therefore, if an MRI is ordered, it is often after a CT scan.
- A MRI scan is often ordered after a CT scan because the extent of a stroke can take a long time to show up as well as to ensure nothing was missed. Certain anatomy can be blocked in the CT scan such as if a stroke occurred in the brainstem or cerebellum.

Conclusion

There are two different types of strokes, ischemic and hemorrhagic. Ischemic strokes are the most common and they are caused by a blockage of an artery, which ends up causing a loss of blood. Hemorrhagic strokes are caused by bleeding in the brain.

Advances in radiologic imaging has allowed doctors to better diagnose and detect a stroke. Time is very important for diagnosing strokes and this is why CT is the chosen modality, over MRI. Depending on the facility, stroke protocols usually include a non-contrast scan, a CT perfusion, and a CT angiography. Strokes may be diagnosed by a variety of different findings on a CT scan. It is important to understand the patients symptoms and move in an urgent manner.

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