

## The Brain and Stroke

Imagine sitting in your backyard on a beautiful spring day with all your closest friends and family. The sun is shining, a light breeze is blowing, the birds are chirping, and the kids are having a blast in the pool. You cannot help but think that this moment in time, life could not get any better. Suddenly, as you look across the pool where your mother and father are sitting and you see your father stand up for a few seconds and start to walk with an unsteady gait. As he takes a few more steps your mother jumps up to help him and she visibly starts to panic. A few more assisted unsteady steps later and your father is supine on the grass unable to speak, one eye closed, drool coming out of his mouth, and he cannot move one side of his body. The perfect backyard day comes to a screeching halt and chaos ensues.

Unfortunately, this is a scenario that unfolds in many households across the nation. Fortunately, there are many ways to prevent these devastating instances from occurring. This paper will discuss the different arteries that lead to the control centers and how they present differently when affected. In addition, this paper will discuss the different types of strokes, highlighting the different quadrants, hemispheres, and control centers of the brain.

### *Types of Stroke*

There are two different types of stroke, Ischemic (TIA's) and hemorrhagic. Eighty percent of strokes are ischemic. Ischemic strokes are most commonly caused by a thrombus or embolus that blocks the blood flow to a particular area of the brain. TIA's occur suddenly, most often in the morning when a person wakes up or in the evening when they are going to bed. However, they can occur at any time and can last only a few minutes or up to 24 hours. TIA's have very similar symptoms to stroke but are often transient and milder in nature. TIA's are a

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warning sign to a full stroke.

The second type of stroke is a Hemorrhagic stroke, which occurs when a blood vessel in the brain ruptures. When the blood vessel ruptures, wherever the blood travels it creates pressure not allowing oxygen and nutrients to reach that specific area of the brain.

There are two different kinds of hemorrhages that can cause a stroke. An intracerebral hemorrhage is usually caused by high blood pressure and occurs within the blood vessels of the brain. This type of hemorrhage often leads to a severe coma or death. A subarachnoid hemorrhage occurs when there is bleeding between the brain and meninges, the covering around the brain. Hemorrhages in the subarachnoid space are often caused by high blood pressure and can also be congenital, developing later in life.

### ***Arteries of the Brain***

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The major arteries of the brain are the anterior communicating artery, middle cerebral artery, posterior inferior cerebellar artery, posterior cerebral artery, and the vertebral arteries.

The anterior communicating artery is the most common intracranial artery to rupture. It is located very close to the optic nerve in the vision center of the brain. Due to its close proximity to the optic nerve, when a rupture of the anterior communicating artery occurs, the primary symptoms are vision disturbance and headache.

The Middle Cerebral Artery (MCA) is the largest cerebral artery and is located in the middle of the brain and is where most other arteries branch. The MCA is affected mainly by hemorrhage and occurs predominately in males over the age of seventy. The symptomatic findings depend on which side of the MCA is affected. ~~If the trunk of the right side for example is occluded symptoms will be seen on the opposing side.~~ In general, if the right MCA is occluded then symptoms will be seen on the left side, such as weakness or paralysis. Moreover,

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the telling symptom when there is a MCA rupture is the eyes gaze towards the effected side and in some instances the entire head will turn with a blank gaze towards the effected side.

The Posterior Inferior Cerebral Artery (PICA) is the main artery responsible for feeding the cerebellum. Blockage of the PICA is very uncommon but can happen and lead to lateral medullary syndrome. Lateral medullary syndrome symptoms when the PICA is blocked include: loss of pain or temperature sensation below the chin on the same side of the face. Below the neck neurological deficits affect the ~~trunk~~ thorax and extremities on the opposing side of the blockage. This is a significant finding and can differentiate the PICA blockage from others.

The Posterior Cerebral Artery (PCA) supplies oxygenated blood to the occipital region of the brain. Signs and symptoms of PCA occlusion include acute vision loss, confusion, posterior headache, limb weakness, speech dysfunction, nausea, and dizziness. Often times the early onset of a PCA blockage presents with a slight headache and blurry vision in one eye. Due to these symptoms, there are several cases where patients have been discharged from urgent care centers with the diagnosis of a migraine headache. When the blockage of the PCA gets worse and more infarcted brain material occurs, the symptoms get increasingly worse and are more easily identified as a stroke.

The vertebral arteries parallel each other, with one on each side of the body. They follow similar pathways of the carotid arteries. Once they meet up inside the skull they form the basilar artery which feeds the brain stem and connects to the circle of Willis (arrangement of arteries used as redundancy so if one artery is compromised others take over so ischemia does not occur), which supplies blood to the brain if for some reason one of the carotid arteries becomes compromised. Atherosclerosis is the most common disease affecting the vertebral arteries. In order for ischemia to occur both vertebral arteries must be occluded. The symptoms of a stroke

in these arteries include vertigo, which is very common and may be the only symptom, nausea, vomiting, sudden loss of consciousness, headache, pupillary changes, blurred vision, speech disturbance, sensory changes in the face and scalp, ataxia, and motor weakness opposite of the affected side.

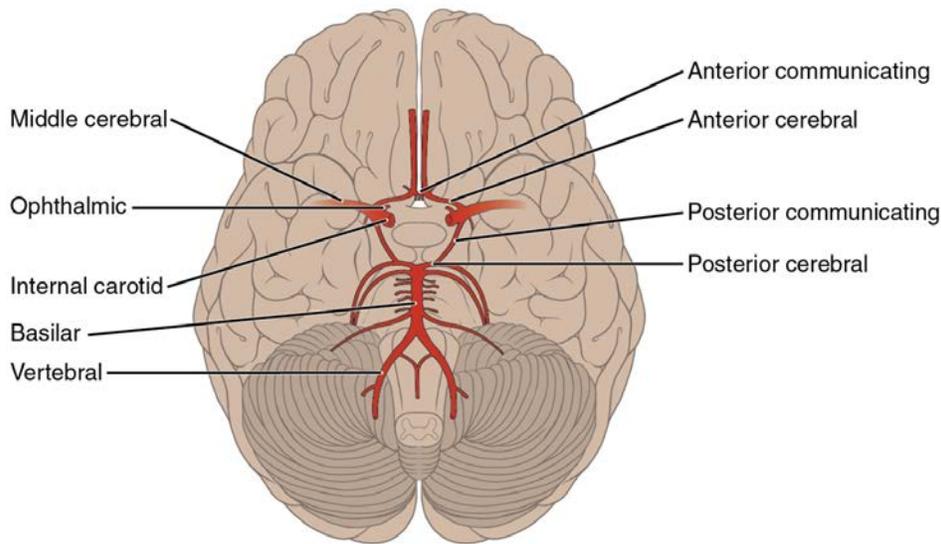


Figure 6: Arteries of the Brain from ncx.org

### ***Centers of the Brain***

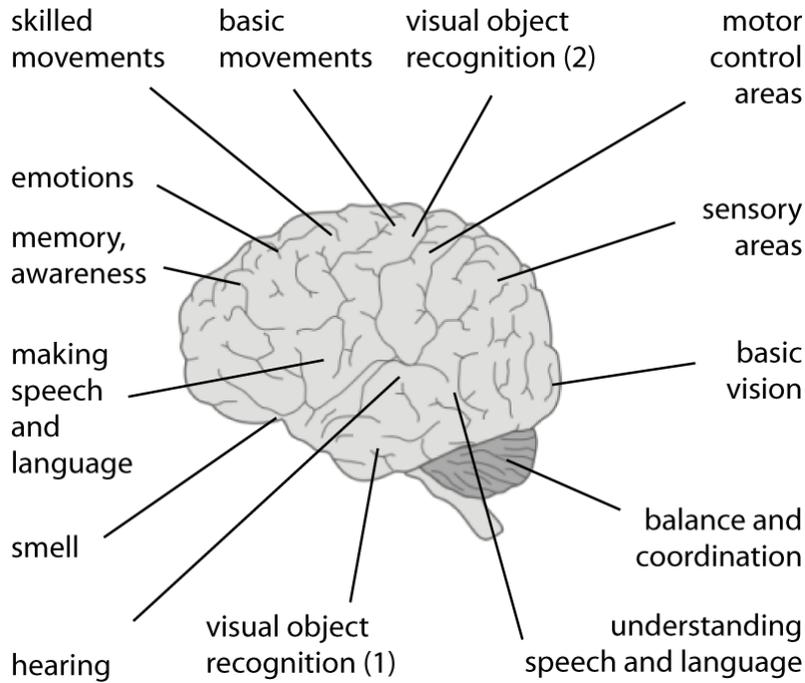
Broca's area of the brain is a region in the frontal lobe of the left hemisphere, which is responsible for speech production and comprehension. Post injury to this region with speech disturbances has become known as Broca's aphasia or expressive aphasia. This is when a person knows what they want to say but cannot seem to find the right words to say. Moreover, they are also able to understand what someone is telling them but cannot express themselves clearly. Commonly the analogy of being stuck in your own brain is the best way to describe how this

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may feel to your patients. Receptive aphasia originates in Wernicke's area in the posterior region of the left hemisphere. Thoughts are formed in Wernicke's area and translated in Broca's area, therefore people with receptive aphasia tend to have clear speech but leave out key words in a sentence or use words that do not make sense. They may also not understand what someone is telling them or understand what they are reading, in contrast to expressive aphasia.

Conduction aphasia is rare but occurs when a person understands what they are being told, but cannot express their thoughts in a manner that make sense. Often these patients show disgust because they are thinking one thing but something else is coming out when they speak. Often this type of aphasia occurs when the Wernicke's and Broca's area of conduction is disrupted during stroke. Transcortical motor aphasia is a result of injury to the anterior superior frontal lobe that surrounds Broca's area. These individuals have good comprehension due to Wernicke's area not being affected, but usually can only repeat one or two words that do not make sense. These patients typically have impaired writing ability as well. Transcortical sensory aphasia affects the temporal regions of the brain. This type of aphasia is similar to receptive aphasia but is different in the fact that patients they compulsively repeat words. They also have difficulty maintaining a clear thought process.

Global aphasia is also known as a 'complete left side blowout.' It affects Broca's area, Wernicke's area, and Arcuate fasciculus or frontal, parietal and temporal areas of the brain. This reduces all speech and writing functions. It can also be seen in the left middle cerebral artery ruptures. Patients with global aphasia have severe expressive and receptive aphasia. These patients are often mute.



### **Stroke Risk Factors**

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There are several reasons patients can be impacted by strokes, some are controllable and others are due to uncontrollable predispositions.

Controllable Risk Factors Include:

- High Blood Pressure
- Atrial Fibrillation
- High Cholesterol
- Diabetes
- Atherosclerosis
- Circulation Problems
- Tobacco Use and Smoking
- Alcohol Use
- Physical Inactivity
- Obesity

Uncontrollable Risk Factors Include:

- Age
- Gender
- Race
- Family History
- Previous Stroke or TIA

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