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Ischemic Stroke

Brett Winner
winner1@otterbein.edu

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Brett Winner, BSN, RN, MS
Otterbein University, Westerville, Ohio

Introduction

- Cerebrovascular accident (CVA) or stroke as it is referred to is a serious medical condition that affects approximately 795,000 people in the United States each year (Mozzaffarian et al., 2016).
- Of those experiencing a stroke, approximately 87% are of the ischemic stroke etiology (Mozzaffarian et al., 2016).
- The risk of stroke doubles after the age of 55 (Kuriakose et al. 2020)
- When considered separate from other cardiovascular diseases, stroke is the 5th most common cause of death in the United States (Mozzaffarian et al., 2016).
- Stroke is the 2nd leading cause of death worldwide (Kuriakose et al. 2020)

Ischemic strokes are caused by a number of syndromes that lead to a lack of blood flow to different areas of the brain that can manifest into correlated physical exams. The area of the brain that is affected and size of the vessel that is occluded or narrowed can be related to the relative morbidity or risk of mortality for ischemic strokes and can be predictive of the level of disability for those suffering from strokes.

Further understanding of ischemic stroke is extremely important because of the severe health risk it poses to many Americans and the devastating disabilities and decreased quality of life many stroke victims are forced to live with for extended periods of their life. As a registered nurse in a comprehensive neurological ICU, one may see many levels of ischemic strokes ranging from very little to no disability to heartbreaking death and everything in between. However, due to the very recent emphasis and progress in stroke research, many RN's lack awareness on some of the pathophysiological causes, modifiable risk factors, diagnosis, and treatment options of ischemic stroke as well as the nursing implications for treating patients suffering from ischemic stroke.

Pathophysiology

The main cause of ischemic stroke is a reduction in blood flow through areas of the brain which leads to damage to the surrounding brain tissue. The area of the brain closest to the reduced perfusion can die in minutes while the area adjacent to the infarct, the penumbra, may incur damage and reduced function but is still salvageable if blood flow is restored in an appropriate time frame, usually within 3 hours. Tissue cell death secondary to a reduction in blood flow can be the result of a number of different events following a period of hypoxia, including: (McCane & Huether, 2019; Alotaibi et al. 2020)

- Reduction in ATP and increase in ADP causing lactic acidosis
- Increase in cellular glutamate, which causes increases in intracellular calcium that can lead to excessive enzyme production that damage the cell membrane. Glutamate also causes an influx in intracellular Na+ and water which lead to cellular edema
- Oxygen free radicals are increased which cause damage to the neuronal cells
- Endogenous protein function is altered by free nitrogenous species which can cause autophagy, apoptosis, and necrosis of neuronal cells
- Pro-inflammatory cytokines are released as an inflammatory response around the area of infarct which can cause more damage to the penumbra

There are three main types of ischemic stroke

Thrombotic Stroke

Thrombotic strokes often develop from thrombus formation that create arterial occlusions in the large vessels of the brain including the internal, middle, and anterior cerebral arteries as well as the vertebral or basilar arteries that affect posterior circulation. Atherosclerotic plaques can form over many years in cerebral vessels which promote the adherence of fibrin and platelets that aid in the clot formation. These clots eventually break off and travel upstream through cerebral circulation where they get stuck causing ischemia to the brain supplied by the corresponding vessel (McCance & Huether, 2019; Alotaibi et al., 2020).

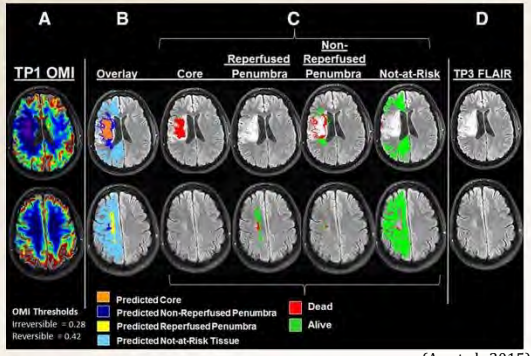
Embolic Stroke

Embolic strokes often occur as a result of a clot, or embolus, that breaks off from areas of the body outside of the brain and travels to bifurcated or narrowed vessels in the brain causing cerebral ischemia. Areas of the body most common for embolus formation include the heart, aorta, or common carotid artery, as the direction of blood flow from these areas have direct access to the smaller vessels in the cerebral circulation. Atrial fibrillation is a common cause of embolic strokes as emboli formation in the heart can often go undetected and untreated with anticoagulation. It is common for emboli to break into smaller fragments and remain in the circulation which increases the risk of a second ischemic stroke. Additional sources of emboli include fat, air, tumors, bacterial vegetation, and foreign bodies (McCance & Huether, 2019, Jaakkola et al., 2016).

Small Vessel (Lacunar) Stroke

Lacunar strokes are strokes involving the small vessels in the brain that perfuse the deeper tissue in the brain and often include small perforating vessels that provide blood flow to the pons, basal ganglia, and internal capsule. The cause of lacunar strokes is attributed to edema surrounding the vessel, inflammation, and thickening of the vessel wall. Because of the size of the vessel affected and the corresponding small area of ischemia and infarction, these types of the strokes may be pure motor or pure sensory in nature (McCance & Huether, 2019, Alotaibi et al., 2020).

It is important to note that while thrombus or embolus formation can lead to abrupt cerebral ischemia, the main causes of most ischemic strokes is underlying endothelial damage resulting in atherosclerosis causing eventual plaque rupture or hypoperfusion as a result of stenosis of an artery supplying cerebral blood flow (McCance & Huether 2019)



(An et al., 2015)

Clinical Presentation

- Altered mental status and/or level of consciousness
- Contralateral weakness, sensory deficit, or both including limb ataxia or balance disturbance
- Impaired speech, aphasia, or contralateral facial drooping
- Ipsilateral visual disturbance, gaze preference, or dysconjugate eye movement
- Severe headache

(Darsie & Moheet, 2017)

NIH Stroke Scale

Item	Description	Score
1A	Level of Consciousness	0-2
1B	LOC Questions	0-2
1C	LOC Commands	0-3
2	Gaze	0-2
3	Visual	0-3
4	Facial Palsy	0-3
5A	Motor Arm (Right)	0-4
5B	Motor Arm (Left)	0-4
6A	Motor Leg (Right)	0-4
6B	Motor Leg (Left)	0-4
7	Limb Ataxia	0-2
8	Sensory	0-2
9	Language	0-3
10	Dysarthria	0-2
11	Extinction and Inattention	0-2
	Total	0-42

(National Institutes of Health, n.d.)

Risk Factors

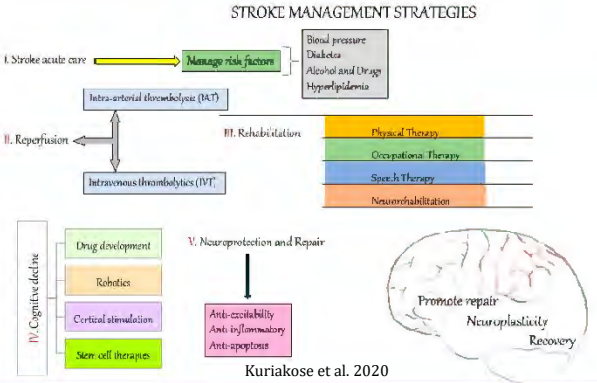
Non-Modifiable Risk Factors:

- Age
- Sex
- Race/Ethnicity
- Genetics

Modifiable Risk Factors:

- Hypertension (#1 Cause)
- Smoking/Alcohol/Drug use
- Physical Inactivity
- Hyperlipidemia
- Diet
- Diabetes Mellitus
- Atrial Fibrillation

(Kuriakose & Xiao, 2020)



Kuriakose et al. 2020

Diagnosis

- NIH Stroke Scale to determine severity of potential stroke
- Non-Contrast Computerize Tomography (CT) is the gold standard to rule out cerebral hemorrhage within 20 minutes
- CT Angiography and Perfusion study to determine large vessel occlusion for potential intervention
- Complete blood count (CBC) and coagulation study
- Conventional angiography can help visualize clot and also be used in treatment

(Alotaibi et al., 2020)

Nursing Implications

- Hourly neurological assessments to determine potential changes in neurological status
- Frequent (Q15min and Q30min) neurological checks post tPA or thrombectomy
- Permissive hypertension (SBP<180 if tPA given, SBP<220 otherwise)
- Head of Bed 30 degrees
- Bedside swallow evaluation to monitor for dysphagia

(Darsie & Moheet, 2017)

Treatment

- IV tissue plasminogen activator (tPA) once hemorrhage ruled out (~65% favorable outcome)
- Mechanical Thrombectomy for large vessel occlusion
- Permissive Hypertension (SBP<220mmhg unless given tPA)
- Decompressive hemicraniectomy for cerebral edema or hemorrhage
- Hypertonic saline or mannitol for cerebral edema
- Anticoagulation for AFib
- PT/OT/Speech Therapy
- Statin therapy for dyslipidemia, glucose control, and control of hypertension for secondary stroke prevention

(Schmitz et al., 2017; Singh et al. 2017; Darsie & Moheet, 2017)

Resources

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