Fall 7-29-2019

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Aneurysmal Subarachnoid Hemorrhage

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Introduction

"Aneurysmal subarachnoid hemorrhage (SAH) is the most devastating type of stroke" (Yu, et al., 2018). It affects up to 16 to 100,000 adults per year worldwide with up to 14,100,000 of those adults being from the United States (Danse & Mohet, 2017).

- 80% of spontaneous, non-traumatic SAH results from aneurysm rupture
- 20% of SAH patients do not survive
- 60-80% of those who do survive are at risk for lifelong neurological deficits
- Patients with a SAH diagnosis are at high risk for many complications during their treatment (Danse & Mohet, 2017)

For many nurses, the neurological system serves as a weakness in their knowledge base. It is a specialized field requiring a specialized care. As a registered nurse working in a comprehensive stroke center, it is easy to identify the importance of education related to treating neurological patients and the close monitoring involved in their treatment. Continued education is a key part in reducing morbidity and mortality in these patients. By giving both nurses and providers a better background in treatment options, they can feel more comfortable and confident in the care they are providing to their neurological patients.

Pathophysiology

When an aneurysm forms at a vessel bifurcation, it weakens the walls of the vessel. This in combination with high intravascular pressure can cause a rupture of the aneurysm, which discharges blood into the subarachnoid space in the brain (McCance & Huether, 2018).

Intracranial Aneurysms
- Weak bulging areas of an arterial vessel wall
- Aneurysm development involves hypertension causing wall shear stress at sites of inflammation and remodeling
- Aneurysm development leads to a thin endothelial layer, absence of fragmented internal elastic lamina, and muscular layer of the media ending at the aneurysm
- Usually located within the bifurcations of the circle of Willis
- Due to a combination of genetic, congenital, and acquired defects
- Size: 2mm – 3cm
- Classified based on shape and size (McCance & Huether, 2018)

Aneurysmal Subarachnoid Hemorrhage
- Caused by rupture of intracranial aneurysms
- Ruptured aneurysm leaks blood into subarachnoid space
- As rupture progresses and blood is forced into subarachnoid space, it irritates the neural tissues and produces an inflammatory response
- Blood clots arachnoid granulations and impairs CSF reabsorption and circulation
- Increase in blood volume and CSF volume in the brain can cause increases in intracranial pressure (ICP)
- Increased intracranial pressure can lead to hypoxia in parts of the brain causing infarction and, if not treated, brain death and hemorrhage (McCance & Huether, 2018)

Clinical Presentation
- Thunderclap headache typically known as the “worst headache of my life”
- Nausea, vomiting, nuchal rigidity, photophobia
- Other neurological deficits seen in stroke patients such as paresthesia, cranial nerve deficits, coma, etc.
- Seizures
- Severity of bleed graded with presenting symptoms using Hunt Hess Scale – the larger the grade, the increased risk of mortality (Drs. & Mohet, 2017; Laxson & Gates, 2016)

Risk Factors
- Family History
- Hypertension
- Anti-coagulation use
- Substance abuse
- Oral contraceptive use
- Cerebral AVMs
- Ehlers-Danlos Syndrome type IV
- Marfan Syndrome
- Polycystic kidney disease
- Fibromuscular dysplasia
- Women 2:1
- < 55 years old
- Higher incidence in African Americans and Hispanics (McCance & Huether, 2018; Danse & Mohet, 2017)

Hunt Hess Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aeryspasmatic, or mild headache, slight nuchal rigidity</td>
</tr>
<tr>
<td>2</td>
<td>Moderate to severe headache, nuchal rigidity, cranial nerve palsies may appear</td>
</tr>
<tr>
<td>3</td>
<td>Drowsiness and/or confusion, appearance of other focal neurologic deficits</td>
</tr>
<tr>
<td>4</td>
<td>Seizure, moderate to severe hemiparesis</td>
</tr>
<tr>
<td>5</td>
<td>Coma, decerebrate posturing</td>
</tr>
</tbody>
</table>

Diagnostic Evaluation

- Initial diagnostic: non-contrast head computed axial tomography (CT scan)
- Head computed tomography angiography (CTA): Gold standard for confirming diagnosis, hemorrhage source, and aneurysm size and location
- Lumbar puncture: performed <12 hours after onset of symptoms. The presence of xanthochromia and an elevated opening pressure is indicative of a SAH
- Magnetic Resonance Imaging (MRI)

Complications
- Hydrocephalus: Obstruction of CSF flow or reabsorption causing its buildup within the ventricles of the brain (Drs. & Mohet, 2017)
- Delayed Cerebral Ischemia (DCI): Impairment of cerebral blood flow or hyperperfusion due to inadequate cerebral perfusion pressure (CPP), cerebral vasospasm, or microthrombi that typically occurs 3 to 15 days post-injury (Yu et al., 2019)
- Seizure (Drs. & Mohet, 2017)
- Re-Bleeding: occurs in 4% of patients within the first 24 hours post-injury (Drs. & Mohet, 2017)
- Hyponatremia & Hypovolemia: most likely related to excess atrial natriuretic factor release and/or excess anti-diuretic hormone excretion (Drs. & Mohet, 2017)
- Intracranial pressure (ICP) monitoring
- Ventriculoperitoneal shunt if CSF diversion is needed long term (Drs. & Mohet, 2017)

Procedural

- Clipping
- Coil insertion (Yu et al., 2018)

ICD prevention/Management

- Risk measured using modified fisher scale
- Daily transcranial doppler (TCD) velocities
- Nimodipine 60 mg every 4 hours
- Cerebral angiography for diagnosis of DCI
- Intra-arterial vasodilator or balloon angioplasty for refractory cases

Post-Treatment

- Hydrocephalus
- External ventricular device (EVD) insertion to drain CSF and avoid increased ICP

Nursing Implications

- Cerebral revascularization
- Increased intracranial pressure
- Neurovascular abnormality
- Ongoing hypertension
- Intracranial mass lesion
- Increased intracranial pressure
- Increased intracranial pressure

Conclusions

The occurrence of an aneurysmal SAH could cause detrimental changes in an individual’s life. The promotion of signs and symptoms will raise awareness of the condition and, in turn, will decrease the time between injury and treatment in those experiencing early signs. Within the hospital, knowledge of the most recent evidenced-based treatment modalities ensures adequate patient care and safety. “Early aggressive resuscitation and critical care management have been shown to improve outcomes” (McLeod & Salmons, 2014). By promoting quick and adequate care along with education to providers we can give patients diagnosed with a SAH a greater chance at a positive outcome and quality of life.