Stroke

Treating This Equal Opportunity Killer in the 21st Century

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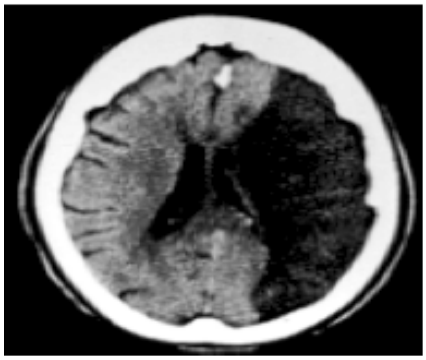
Stroke remains the third leading cause of death in the United States and the leading cause of adult disability. We spend in excess of $50 billion dollars annually to treat this killer. It is estimated that there are 800,000 new stroke cases every year, (ASA, 2008).

Of the four million stroke survivors in the United States, 10% will recover almost completely, 25% will recover will minor impairments, 40% will experience moderate to severe impairments requiring specialized care, 10% require care in a nursing home and 15% will die shortly after the stroke, (AHA, 2007).

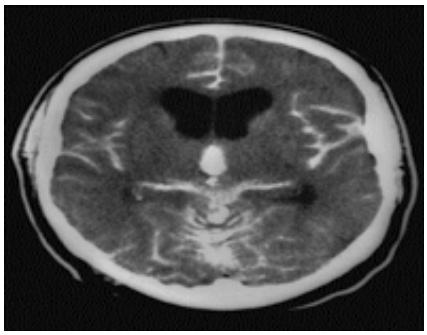
The medical morbidities associated with stroke are staggering. Pneumonia carries the highest medical morbidity at 30%. The risk of recurrent stroke is around 10% and there is a 10% death from post-stroke pulmonary embolism. Other morbidities from stroke include multi-infarct dementias, depression and even depression among caregivers (40%), (ASA, 2008).

The definition of stroke is when a blood vessel in the brain ruptures or becomes occluded. This interrupts blood flow and deprives the neurons of oxygen and glucose resulting in cellular death. The brain relies on its moment to moment needs by its extensive collateral circulation, and is not capable of storing glucose. Brain cells start to become ischemic within 45 seconds of no blood flow.

Stroke is usually acute, can occur at any time and is accompanied by one or more neurological deficits. There are two kinds of strokes, ischemic and hemorrhagic. Transient ischemic attacks are a type of ischemic stroke that resolve completely with 24 hours and usually last minutes to a couple of hours. Most strokes are ischemic in nature and include Lacunar, thrombotic small vessel and thrombotic large vessel. Hemorrhagic strokes account for 15%-20% of all strokes and include subarachnoid hemorrhage and intracranical hemorrhage.



Acute ischemic stroke (AIS)



Subarachnoid Hemorrhage (SAH)

Subarachnoid hemorrhage usually results from a rupture of an aneurysm or an arteriovenous malformation in the brain bursts, causing sudden bleeding into the space between the arachnoids membrane and the brain itself. More than twenty seven thousand Americans suffer ruptured intracranial aneurysms each year. The mortality rate reaches as high as 40% within the first week and about 50% of patients will die in the first six months. Of interest is that aneurismal subarachnoid hemorrhage is higher in women than in men. The reason is unclear (ASA, 2008).

Symptoms of subarachnoid hemorrhage include the classic sudden onset of a severe headache. Most patients have described it as the worst headache they

have ever had. Nausea and projectile vomiting, loss of consciousness, neck stiffness and visual changes often occur.

Treatment of a subarachnoid hemorrhage can be broken down into two care areas. If the patient or family called the emergency response system at 911, the paramedics will address the ABC's, triage and transport the patient to the closest medical center with a CT scan and neurosurgical backup (ASA 2008). If the patient presented directly to the Emergency Department, ABC's are addressed and in patients with a suspected grade I or II, the ED care is essentially limited to diagnosis and supportive therapy. If the patient has a grade III, IV or V, the Emergency Department care is more extensive.

DESCRIPTION	GRADE
Asymptomatic, mild headache, slight nuchal rigidity	1
Moderate to severe headache, nuchal rigidity , no neurologic deficit other than cranial nerve palsy	2
Drowsiness / confusion, mild focal neurologic deficit	3
Stupor, moderate-severe hemiparesis	4
Coma, decerebrate posturing	5

Ischemic strokes often occur from a thrombosis in the internal carotid artery where the common carotid divides into the internal and external. But a clot can be launched by mural thrombi formed in atrial fibrillation or from a heart valve.

There are two zones of injury that occur with a stroke, the ischemic core and the penumbra. The ischemic core is most severe and is likely to result in permanent cell damage. The neurons in this area will not regenerate. The penumbra is a zone of stunned cells that surround the ischemic core. The tissue is not infarcted and may remain viable if collateral circulation is intact and/or tissue reperfusion is quickly addressed. When fibrinolytic treatment is given, the penumbral area is what is targeted.

The symptoms of ischemic stroke can be identical to hemorrhagic stroke. Both types of strokes can also present with facial weakness, incoordination, weakness, sensory loss, ataxia or a change in speech. Visual changes can include a visual loss that is monocular or binocular. The patient may also report intense vertigo, double vision or unilateral hearing loss.

The differential diagnosis is critical for patients as treatment will be based on the cause. Following is a list of potential diagnosis that also exhibit the same signs and symptoms of a stroke.

- Hypoglycemia
- Hyperglycemia
- Seizure
- Migraine headache
- Hypertensive crisis
- Tumor
- Meningitis
- Encephalitis
- Abscess (AHA, 2006)

There are several scales that are used for the assessment of strokes.

Bathel Index: records indicators of independence in terms of the disability

- Modified Rankin Scale: a functional outcome measure
- Glasglow Coma Scale: Measures level of consciousness
- National Institutes of Health Stroke Scale (NIHSS): quantifies neurological functions and measures neurological deficit, (NIHSS, 2008).

All of these assist in the evaluation and determination of the patient's stroke and outcome.

In 1997, the American Heart Association included a new algorithm of the evaluation and treatment of the acute ischemic stroke patient. This algorithm for remains largely unchanged in 2008. We still work within a three hour window of opportunity in treating the patient with systemic IV fibrinolytic therapy. There may be therapies available beyond the three hour window. This however, depends if the hospital has the ability to perform intracerebral catheterizations (AHA, 2006).

There have been new mechanical techniques developed to treat stroke. The Penumbra System was approved by the FDA in March, 2008. This is a clot retrieval system. It uses multiple aspiration devices that are size matched to the specific neurovascular anatomy allowing clots to be gently aspirated out of the intracranial vessels.

The Merci Clot Retriever is also FDA approved to restore blood flow in the neurovasculature by removing the thrombus directly in the cerebral artery. This device can be used in patients with up to eight hours of symptoms.

With the development of microcatheter delivery systems, the use of fibrinolytics intra arterial became a reality. With the use of a tiny catheter that is threaded down to the clot, a fibrinolytic agent can be directly injected into the thrombus. This extends the time frame from the stroke onset. The disadvantage is that it can only be performed at highly qualified centers.

From the pharmaceutical area, there have been several drugs that have been studied. Desmoteplase is derived from the saliva of the vampire bat. It is a thrombolytic agent that allows treatment up to nine hours. Hacke et al (2005). Results and use are pending. Viprinex is derived from the venom of the Malayan pit viper. It is a thrombin like enzyme that is specific for fibrinogen. Again, this is still being studied and evaluated.

Several advanced surgical techniques have emerged. Sterotactic microsurgery for arterial venous malformations and aneurysms uses computer technology and geometric principles to pinpoint the precise location of the AVM. This allows location of the AVM within 1-2mm. It does not affect normal brain tissue.

Sterotactic Radiosurgery for AVM's is a minimally invasive, low risk procedure. It uses the same basic techniques as sterotactic mircrosurgery. But a beam of radiation is used to cause it to clot and then disappear. Again, normal brain tissue is not affected.

There are several agencies with recommendations and algorithms for the diagnosis and treatment of stroke. The Brain Attack Coalition has the following recommendations:

1. Hospitals have written protocols.
2. ED staff are integrated in the treatment and are well trained/educated.
3. There is a designated Stroke Team on call 24/7.
4. There is a Stroke Unit for monitoring the stroke patient.
5. Proven rapid access for CT (Brain Attack, Coalition 2007).

The future of the treatment of the stroke patient is multi-tiered. There still remains a huge need to educate the public on the signs and symptoms of stroke and the need to immediately call their local EMS for rapid transport to the appropriate facility. Paramedics need to be educated on the importance of the "quick screen" method to determine if the patient might be having a stroke.

We need to continue the pursuit of new diagnostic tools, surgical techniques, hypothermia and most importantly neuro/cerebral protection.

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As owner and Director of The Center of Excellence in Education, Barbara Furry empowers students with her passion for education and advances in cardiac care every day. With twenty years of critical care nursing experience, Barbara lectures nationally and specializes in development of courses or lectures for the specific needs of each healthcare audience. She holds a Masters of Science degree in Health, and provides critical care education with focus to serving rural and suburban healthcare practitioners. Additional experience includes hospital Education Director, Critical Care Educator and Critical Care Charge Nurse.

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Barbara actively participates and serves the AHA at the National Education Committee; an ACLS, ACLS-EP, PALS instructor; AHA Past-Chair, ECC and Board member with a variety of volunteer AHA leadership roles since

1986. She is past-President and Fellow of the American College of Cardiovascular Nurses.

Barbara lives in Chico, CA, where she enjoys antiquing & archeology. She is married with two children and delights in an array of family pets and travels.