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PHARMACY CONTINUING EDUCATION FROM WF PROFESSIONAL ASSOCIATES

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“Stroke Therapy”

February 2017

The medical term for stroke is cerebrovascular accident (CVA). It involves the sudden death of brain cells due to deprivation of oxygen and nutrients and is caused by obstruction of blood flow in an artery or rupture of an artery in the brain.

Pharmacists may not be actively involved with patient care regarding stroke; however, it IS an area where we can provide invaluable service by counseling patients and their families. This lesson provides 1.25 (0.125 CEUs) contact hours of credit, and is intended for pharmacists & technicians in all practice settings.

The program ID # for this lesson is 707-000-17-002-H01-P for pharmacists & 707-000-17-002-H01-T for technicians.

Participants completing this lesson by January 31, 2020 may receive full credit. Release date for this lesson is February 1, 2017.

To obtain continuing education credit for this lesson, you must answer the questions on the quiz (70% correct required), and return the quiz. Should you score less than 70%, you will be asked to repeat the quiz. Computerized records are maintained for each participant.

If you have any comments, suggestions or questions, contact us at the above address, or call 1-847-945-8050. **Please write your name, NABP eProfile (CPE Monitor®) ID Number & birthdate (MM/DD) in the indicated space on the quiz page.**

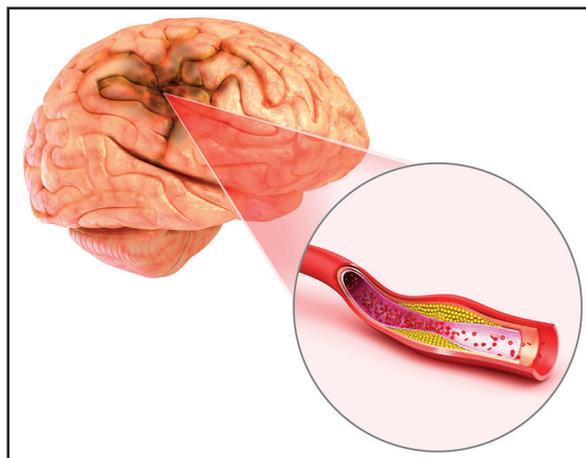
The objectives of this lesson are such that upon completion participants will be able to:

Pharmacists:

1. Differentiate between ischemic & hemorrhagic strokes.
2. Summarize the incidence & prevalence of stroke.
3. Comment upon the outcomes of stroke.
4. List the factors associated with occurrence of stroke.
5. Describe “TIA” and differentiate with stroke.
6. State how stroke is diagnosed as well as its potential for prevention.
7. Describe pharmacological & surgical measures that may be used in treating a stroke.

Technicians:

1. Summarize the incidence & prevalence of stroke.
2. List the factors associated with occurrence of stroke.
3. Describe pharmacological & surgical measures that may be used in treating a stroke.



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INTRODUCTION

The medical term for stroke is cerebrovascular accident (CVA). It involves the sudden death of brain cells due to deprivation of oxygen and nutrients and is caused by obstruction of blood flow in an artery or rupture of an artery in the brain. Within a short period of time brain cells begin to degrade. If emergency treatment is delayed, the patient may experience sudden speech and understanding problems; confusion; paralysis or numbness of the face, arms or legs on one side of the body; impaired vision in one or both eyes; severe headache; difficulty in walking and maintaining balance; lack of support of the arms; and, one side of the mouth may hang downward. Emergency and prompt treatment can reduce complications, the extent of disability, or death.

There are two types of strokes:

1. **Ischemic stroke**, which occurs when an artery in the brain becomes blocked, mostly from blood clots or due to narrowing of an artery by atherosclerotic plaque. It is the most commonly occurring type of stroke.
2. **Hemorrhagic stroke: (2 kinds):**
 - a. **Intracerebral hemorrhage** occurs when a blood vessel breaks in the brain and instantly causes bleeding, and
 - b. **Subarachnoid hemorrhage** occurs when the blood vessel at the brain surface bursts and blood collects in the space between the surface of the brain and skull.

INCIDENCE OF STROKE

Stroke is a major healthcare problem and is fatal in 25% of cases. For the last 3-4 decades, stroke cases and mortality from cardiovascular diseases have declined significantly due to public awareness as well as discovery of better drugs, improved methods of diagnosis and changes in lifestyle. Between 1996 and 2006, morbidity rate from stroke decreased by 33.5%. In spite of this progress, the number of annually reported cases is relatively high and the morbidity and mortality rates are significant. About 795,000 persons in the U.S. suffer strokes annually, 61,000 are first timers and 185,000 are recurring cases. Approximately 160,000 Americans die annually as a result of stroke and 3 million are currently disabled due to stroke, which is the third leading cause of death after coronary heart disease and cancer. It is the leader in causing disability. Even though it can occur at any age, 66% of patients are 65 years or older. More males have strokes, but the death rate is higher in women. In 2005, 66.6% of deaths as a result of stroke occurred in females. Age-adjusted mortality rates were 44 per 100,000 in white females, and 60.7 per 100,000 among African American females. The mortality rate among African Americans and whites were 44.7 and 70.5 per 100,000 respectively. Stroke rate of African-Americans is double that in whites. The risk in Hispanics is more than in whites but less than African Americans. The vast majority (87%) of strokes occur as a result of occlusion of an artery in the brain.

The economic cost is enormous. About \$34.3 billion are spent for care services and medications for stroke survivors as well as loss of productivity and premature mortality. After effects can be permanent and survivors can be prone to pneumonia, falls, and other symptoms such as urinary incontinence.

OUTCOMES OF STROKE

Dissolution of a clot and treating the area where the hemorrhage took place in the brain may take a while. In addition, recovery from the consequence of the stroke such as disability, may take months, or years, if ever, as some results are permanent. Physical disabilities include weakness to move on one side of the body, numbness, difficulty walking, muscular pain especially in the hands, feet, legs and neck. Other outcomes include reduced intelligence, thinking, awareness of surroundings, speech ability, depression, presence of anxiety, anger, frustration, and lack of concentration. These outcomes may be transient or may become permanent. To alleviate these symptoms and assist in restoring some or all natural functions, patients often undergo rehabilitation or therapies such as **physical, occupational, speech and psychological**.

Physical Therapy

This is the process of treating certain conditions or disabilities that limit the patient to move or walk, thereby improving gait and balance and restoring the ability to perform daily functional activities. Patients of all ages can utilize physical therapy through the application of massages, heat treatment and exercise to improve mobility. Usually a physical therapist makes decisions regarding methods. These techniques can assist the patient in moving and walking correctly, reduce pain, restore part or complete normal functioning and enhance the well-being and quality of life.

Occupational Therapy

This is the use of evaluation methods that reflect and assess the value of the problem at hand. Such evaluation and estimation are used in assisting patients with physical, mental or cognitive disabilities to develop, restore or retain daily living and work skills. Occupational therapy does not deal with vocational counseling, rather, it deals with promotion of skills development in every daily activity.

Speech Therapy

This is directed toward assessing, diagnosing and treating speech and cognitive communication. Stroke patients may experience difficulty in producing speech sounds correctly. Cognitive communication involves difficulty in organizing thoughts, concentration, thinking, remembering and planning. The speech therapist evaluates speech pronunciation and communication as well as providing training and education to family members.

Psychological Therapy

Finally, this option deals with behavioral and cognition problems as well as self-development. The psychotherapist plans and goes through methods to understand the patient and finds solutions that fit the circumstances.

RISK FACTORS

Strokes can be associated with **non-modifiable** or **modifiable** considerations.

Non-Modifiable

These risks cannot be corrected or changed. **They include age, gender, race/ethnicity and genetic predisposition.**

Age

There is a misconception that stroke is limited to older people. Pediatric patients are at risk for developing a stroke, but the rate is low. Young adults (25-45 years of age) are at greater risk than pediatric patients, but they are at a lower risk than the elderly. Aging increases the risk for stroke. It has been pointed out that the risk factors for ischemic and intracerebral hemorrhagic strokes increase by 100% for each 10 years after reaching the age of 55.

Gender

Men are more prone to both ischemic and hemorrhagic stroke, except for women whose age ranges between 35 and 40 years old and those over 85. The risk of the group of younger women is due to the use of oral contraceptives as well as to pregnancy. Menopause may increase the risk of stroke in older females. More women die from strokes than males.

Racial/Ethnicity

African and Hispanic Americans have a higher stroke incidence and mortality rate than whites. This may be attributed to the higher prevalence of hypertension, obesity, and diabetes among these groups. Native Americans have an incidence of stroke higher than both African Americans and whites.

Genetic Factors

A cross-sectional study of prevalence showed that an affirmative family history of stroke increases the risk of experiencing stroke by 80%. The risk of identical twins experiencing stroke is 1.65 times more than those of twins originating from two different eggs. Moreover, it has been reported that females are more prone to stroke than males if parents have stroke history.

Modifiable Risk Factors

These are risk factors that potentially can be treated, controlled or changed.

Hypertension

This is a risk factor for both types of stroke but mostly hemorrhagic. There is a strong and predictive relationship between hypertension and stroke. The higher the blood pressure, the more predictable the risk of a stroke. The prevalence of hypertension in the U.S. is 65 million and is on the increase, due in part to aging, obesity, diabetes and living a sedentary life. In the U.S., it is estimated that more than 66% of individuals over 65 years of age are hypertensive. Pharmacological treatment of hypertension has significantly reduced the risk of stroke.

Cigarette Smoking

There is a substantial relationship between cigarette smoking and stroke, especially among younger people. The number of deaths caused by stroke associated with smoking ranges between 21,400 (without adjusting comorbidity) and 17,800 (if comorbid conditions are excluded). About 12% - 14% of deaths from stroke are associated with smoking. Second hand smoke is a significant risk factor in heart disease and stroke. This modifiable risk factor can be reduced drastically through sustained smoking cessation and treatment of nicotine dependence.

Diabetes

Diabetics are prone to atherosclerosis as well as disorders that result from the presence of atherosclerotic plaques in the arteries, including hypertension and hyperlipidemia. In 2007 there were 17.9 million Americans with diabetes and 5.7 million who were undiagnosed. There is a considerable relationship between diabetes and the increased risk of stroke, especially the ischemic variety. A study conducted by the CDC between 1997-2003 indicated that age-adjusted prevalence of self-reported stroke was 9% among diabetics 35 years of age and older, though diabetes incidence of stroke increases with all ages. It was found that the risk of stroke is more pronounced before the age of 55 for African Americans and before 65 for whites.

Hyperlipidemia

It has been shown that the higher the level of HDL cholesterol (good cholesterol) the lower the risk of ischemic stroke. The use of statins can reduce the level of LDL by 30%-50%. Reduction in the level of stroke risk in patients with atherosclerosis or at risk of developing atherosclerosis is evident.

Atrial Fibrillation (A Fib)

A Fib is a quivering, rapid, irregular heartbeat that can interfere with blood flow and leads to increased risk of blood clots and heart failure. It occurs as a result of disorganized electrical discharge. A Fib increases the risk of ischemic stroke 4-5 fold. A Fib is a common cardiac

condition affecting about 2.7 million patients in the U.S. About 15%-20% of patients who suffer from stroke have A Fib. A Fib can lead to the formation of a blood clot in the heart which can travel to other organs including the brain, causing ischemic stroke. A Fib is treatable.

Postmenopausal Hormone Therapy

There is evidence to indicate that the use of raloxifene and tamoxifen do not provide protection against stroke and in reality raloxifene may increase the risk to fatal stroke. Replacement hormone therapy such as conjugated estrogens together with hydroxyprogesterone acetate may also increase the risk of stroke.

Oral Contraceptives

Early studies indicated that the use of oral contraceptives increase the risk of stroke, especially the ischemic type. More recent studies show that there is a slight increase in the risk of hemorrhagic stroke, especially in developing countries. Older women who smoke and are hypertensive, suffer migraine headaches, are obese, have diabetes and hyperlipidemia may have increased risk of arterial thrombosis when using oral contraceptives.

Diet

A relationship exists between diet and hypertension, a major risk factor for strokes. Excessive intake of salt as well as a diet low in potassium, high in consumption of alcoholic beverages and intake of low quality or a poorly balanced diet may increase the risk of stroke. Studies have shown that the lower the consumption of vegetables and fruits, the higher the risk of stroke. The 2005 report of Dieting Guidelines in Americans stated that daily consumption of fruits and vegetables in the U.S. is low, since it was less than 5 servings per day. The effectiveness of reduction in salt and normal or increased intake of potassium chloride on stroke is mediated through effects on blood pressure. DASH diet is an example of a balanced diet that may lead to lowering of blood pressure. DASH is an acronym for Dieting Approach to Stop Hypertension. This diet is rich in fruits, vegetables, low-fat or nonfat dairy products, whole grain, lean meat, mainly fish and poultry, nuts, beans, and seeds. There appears to be other dietary factors that reduce the risk of stroke. For example, Asian dietary consumption, which is low in animal protein, saturated fat and cholesterol has been linked to decreased risk of stroke.

Sedentary Lifestyle

Sedentary lifestyle is one where physical activity is lacking or pursued irregularly. This includes sitting, excessive reading, socializing, watching TV, or remaining on the computer. Sedentary lifestyle can lead to preventable negative health results such as obesity, hypertension, increased risk of developing chronic diseases, higher mortality and morbidity. The 2008 Physical Activity Guideline for Americans states that physically active people have about 25%-30% lower risk of stroke or death than the least active individual. Walking and jogging regularly, swimming, cycling, tennis and yard work are good examples.

Obesity and Fat Distribution

Weight status is usually expressed in terms of BMI (Body Mass Index) which is based on height and weight that applies to both males and females or weight in Kg divided by the square of height in meters. A person whose BMI is from 25-29.9 Kg/Meter square is considered overweight. Those with BMI of equal to or more than 30Kg/meter square is classified as obese. Abdominal obesity, which is the most common form, is a waist that measures more than 102 cm or 40

inches in men and 88 cm or 35 inches in women. Obesity in the U.S. is becoming a major public health problem. About 66.3% of the population is either overweight or obese. It has been found that among those with BMI between 25%-50%, each 5kg/meter square increase can raise the risk of stroke mortality by 40%. It has been speculated that abdominal body fat, determined by waist circumference, may be a far more significant prediction for stroke risk than BMI.

Metabolic Syndrome

Metabolic syndrome is defined as the presence of 3 or more of the following conditions: abdominal obesity, triglyceride blood level of equal or more than 40 mg/dl for men and 50 mg/dl for women, hypertension of equal to or more than 130/85, and fasting glucose of equal to or more than 110/dl. The higher the frequency of metabolic syndrome, the higher the risk of stroke.

Alcohol Consumption

Excessive alcohol consumption is associated with a variety of diseases including stroke. Overindulgence with alcoholic beverages increases the incidence of stroke. However, moderate to light drinking can provide protection from ischemic stroke. Light to moderate drinking may increase HDL cholesterol (good cholesterol) blood level, cause reduced aggregation of blood platelets, lower fibrinogen level and increase insulin sensitivity and glucose metabolism. Excessive drinking may lead to hypertension, increased tendency to blood coagulation (clot formation), diminished cerebral blood flow, and increased risk of causing A Fib.

MAJOR ARTERIES IN THE BRAIN

The brain, more than any other organ, requires abundant supplies of blood and nutrients. The brain cells consume about 20% of oxygen and nutrients supplied to the body. Approximately 20%-25% of the blood supplied to the body goes to the brain. The blood vessel network in the brain includes small blood vessels, arteries and veins. The brain is divided into two parts, left and right brains. The left portion controls body movement on the right side of the body, and the right part of the brain controls the left side of the body. Brain blood supplies are provided through the right and left carotid arteries and the right and left vertebral arteries. These arteries originate in the neck and extend to the skull (cranium). The arteries connect and form the Circle of Willis. This provides the branches that bring blood to the cerebrum. Small arteries from the vertebral arteries supply blood to the spinal cord. They originate from the subclavian arteries and they enter the cranial cavity via the foramen magnum (the opening in the base of the skull). The subclavian arteries are located below the clavicle or collarbone. The anterior, middle, and posterior cerebral arteries supply blood to three different areas of the cerebrum. The anterior artery provides the anteromedial part of the cerebrum; the middle is responsible for supplying the lateral part of the brain; while the posterior supply the posterior part of the cerebrum.

TIA's (TRANSIENT ISCHEMIC ATTACKS)

TIA's are transient stroke-like attacks that occur as a result of a temporary, partial or complete occlusion of an artery in the brain. It may happen as a consequence to temporary lack of blood flow in an area in the brain which could be from an acute thromboembolic event. The blockage occurs rapidly and is temporary, lasting a relatively short time ranging from

minutes to a few hours. An episode that lasts as long as 24 hours is not considered a typical TIA, rather it represents a minor stroke that resolves quickly. While duration of the attack serves as a part of the definition of TIA, the American Stroke Association (ASA) and the American Heart Association (AHA) base their definition on anatomical description. Thus, it is an episode of focal ischemia rather than infarction. At the end of the attack, the blood flows again in the arteries leaving no symptoms, permanent damage or disability. Unlike TIA, the occlusion caused by a stroke may remain in an artery for weeks or longer unless it is removed or dissolved pharmacologically. Moreover, a stroke may cause permanent damage to brain cells leading to disability. Physiologically, all formed clots in the arteries will eventually dissolve on their own as the body has a naturally occurring clot dissolving agent. That said, the speed at which the dissolution of the clot takes place and extent of damage depends on duration of the occlusion. TIAs are considered a yellow light warning to the patient that a stroke may be forthcoming. Thus, a TIA may be a precursor to a stroke. The incidence of having a stroke in an individual who suffered TIA is 4% after 2 days, 8% after 30 days, 9% after 90 days and 24-29% after 5 years. The signs and symptoms encountered in TIAs resemble those that occur early in a stroke such as confusion, vision impairment, slurred or difficult speech, muscular weakness, numbness, tingling, paralysis in the face, arms or legs on one side of the body, dizziness and loss of balance.

The exact number of Americans who suffer TIAs annually is unknown, but it has been estimated that 200,000 to 500,000 individuals experience TIAs. About 1.1 per 1000 people in the U.S. visit emergency rooms due to this condition. About 15% of the patients who have stroke usually begin with TIA. Like stroke, the incidence of TIAs increase with aging. It has been estimated that about 1-3 TIA cases in 100,000 occur among people 35 year of age and younger; whereas, in people older than 85 the rate is 1500 per 100,000. Children are not immune from TIAs as about 3% of cerebral infarctions occur in children. In general, patients who have TIAs or a stroke are most likely to suffer from coronary heart disease.

Diagnosis: Due to the relatively short duration of TIAs, an urgent physical examination is needed to make a positive diagnosis based on medical history of the patient, in particular cardiovascular and cerebrovascular diagnoses as well as the sequence of events that led to the symptoms. A quick diagnosis may be achieved through a new generation of imaging tools. Contrast-enhanced computer tomography (CT) scanning is widely used for brain imaging in the acute evaluation of patients who may be admitted to an emergency room complaining of stroke-like or TIA symptoms. For fast evaluation, CT angiography of the head and CT perfusion scanning, MRI of the head, carotid duplex scanning, ultrasound of the neck, echocardiogram of the heart, and digital subtraction angiography, may be employed. If imaging tests give negative results, further clinical measures should be taken to rule out meningitis and subarachnoid hemorrhage. Laboratory tests such as complete blood count (CBC) may reveal thrombocytosis.

PREVENTION OF STROKES AND TIAs CONSISTS OF TWO MEASURES

Primary prevention must be associated with treating individuals with no history of stroke or TIA. Primary prevention is aimed at preventing or avoiding the onset of stroke through reducing the risks by changing lifestyle and complying to proper treatment to certain conditions that increase the risk of stroke and TIA. Examples: smoking cessation, avoidance of excessive drinking, consuming balanced diet and hyperlipidemia.

Secondary prevention is associated with treating patients who HAVE experienced stroke or TIA. Secondary prevention focuses on methods that diagnose pre-clinical pathological changes. It concerns mainly persons who have risk factors and who have been stricken by stroke or TIA and currently are asymptomatic. The goal is to prevent the occurrence of cerebrovascular accident and treating of underlying disease such as A Fib. Maintaining an acceptable blood pressure and glucose level in diabetics as well as pursuing a healthy lifestyle and intake of medications to treat any comorbidity, are all essential. Use of medications that prevent coagulation of blood platelets, assessment of the presence of carotid disease and atherosclerotic plaques are advisable.

TREATMENT

Immediately after the occurrence of a stroke, brain cells begin to die within as little as a few seconds. Recovery depends, among other things, on how immediate treatment is provided, area of the brain involved and knowing whether the stroke is ischemic or hemorrhagic. The slower emergency therapy is made available, the likelihood of occurrence of permanent damage to the brain, partial or permanent disability or even death. It is of paramount importance to urgently seek medical attention if a stroke is suspected. Disappearance of the symptoms within 24 hours is not reassuring as the event may be due to TIA which must be investigated to treat the abnormality behind the TIA. Medical advances in stroke therapy, whether it is pharmacological or surgical, have significantly improved survival rate and minimized the risk for long-term disability. About 87% of strokes can be prevented by managing the risk factors (discussed earlier), especially A Fib, hypertension, diabetes, smoking and diet. Patients who experienced TIAs, survived a stroke, or are at high risk should undergo preventive treatment.

PREVENTIVE MEASURES

Anticoagulants and antiplatelet agents are capable of reducing the risk factors for ischemic stroke. Aspirin, clopidogrel and prasugrel are examples of antiplatelet agents that reduce platelet aggregation. Warfarin is an older anticoagulant that inhibits Vit K synthesis and whose use has largely been replaced by more recently approved oral anticoagulants.

Active Treatment

Ischemic stroke may be treated pharmacologically or surgically. In 2000 the FDA approved a tissue plasminogen activator (tPA) as a thrombolytic agent (clot buster) for the treatment of acute myocardial infarction (AMI). This drug is a serine protease enzyme which is found in the cells that line the blood vessels. It tends to enhance the production of the enzyme plasmin which dissolves blood clots via fibrinolysis. Plasmin is produced due to the conversion of plasminogen catalyzed by tissue plasminogen activator (tPA). In addition to treating AMI, it is used in acute, emergency treatment of stroke. The drug is given intravenously and should be administered within 3-4 hours from the time of appearance of symptoms. The sooner the start of therapy, the better the results. Administration within the time window of 3-4 hours can often prevent further damage and improves the chances for partial or complete recovery. The intravenous injection can be completed in 5 seconds. Aspirin may be given once the patient is admitted into a hospital to minimize the occurrence of a second stroke. Side effects of tPA include potential bleeding in the brain, bleeding from the gums, coughing up blood, dizziness, difficulty in breathing, headache, nosebleed, and tarry stool. It is contraindicated in hemorrhagic stroke. In case of toxicity or overdose, aminocaproic acid, a derivative of the amino acid lysine, should be used as an antidote because it inhibits the proteolytic enzyme plasmin.

Emergency Surgical Procedures: Surgical procedures can be performed to remove or destroy a blood clot formed in ischemic stroke. **Intra-arterial thrombolysis** may be performed as an emergency procedure, which involves delivering tPA directly to the clot by means of a thin catheter inserted in an artery in the groin until it reaches the target. Another procedure called **mechanical thrombectomy** is aimed at introducing a tiny device attached to a catheter through an artery in the groin. Once it reaches the clot the device either pulls it out of the brain or physically breaks it up. The values of these procedures may not be beneficial in certain cases. **Endovascular** procedures are less invasive and involve depositing a stent in the clot area thereby allowing blood flow. **Carotid endarterectomy** is performed to remove atheromatous plaque in the carotid artery to reduce the risk of ischemic stroke.

Hemorrhagic stroke: The goals of treatment are to stop the bleeding, and to reduce or eliminate the pressure in the brain caused by swelling and blood that spilled from the ruptured artery. An important step is discontinuation of the intake of anticoagulants. Furthermore, Vit K may be given as an antidote to counter the effect of warfarin in a speedy manner. Blood transfusion may be performed in the absence of a specific antidote for a blood thinner.

SUMMARY

Stroke occurs as a result of sudden death of brain cells due to deprivation of oxygen and nutrients caused by occlusion of blood flow in an artery or rupture or vasospasm of an artery in the brain. There are two types of stroke: ischemic and hemorrhagic. Strokes occur in about 795,000 people annually in the U.S. Medical advances have resulted in decreasing the number of strokes by about 33.5%. There are numerous risk factors for strokes, some of which are modifiable and others are non-modifiable. TIA is a temporary stroke-like condition that may last from a few minutes to hours after which the symptoms may disappear completely. Ischemic stroke can be prevented by reducing the risk factors and intake of anticoagulants. In addition to reducing risk factors, stroke may be treated pharmacologically and surgically.

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LESSON EVALUATION

Please fill out this section as a means of evaluating this lesson. The information will aid us in improving future efforts. Either circle the appropriate evaluation answer, or rate the item from 1 to 7 (1 is the lowest rating; 7 is the highest).

1. Does the program meet the learning objectives?
- Differentiate between ischemic & hemorrhagic strokes YES NO
 - Summarize incidence & prevalence of stroke YES NO
 - Comment upon outcomes of stroke YES NO
 - List factors associated with occurrence of stroke YES NO
 - Describe "TIA" & differentiate with stroke YES NO
 - State how strokes can be diagnosed and prevented YES NO
 - Describe drug & surgical options for stroke YES NO

2. Was the program independent & non-commercial? YES NO

3. Relevance of topic

Low Relevance	1	2	3	4	5	6	7	Very Relevant
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4. What did you like most about this lesson? _____

5. What did you like least about this lesson? _____

Please Mark the Correct Answer(s)

1. **Ischemic stroke occurs as a result of:**
 - A. Leakage from a blood vessel in the brain
 - B. Occlusion of blood in artery in the brain
 - C. Irregular heartbeat
 - D. Low blood pressure
2. **The number of annual cases of stroke in the U.S. is:**
 - A. 100,000
 - B. 150,000
 - C. 300,000
 - D. 795,000
3. **Which of the following is considered a non-modifiable risk factor?**
 - A. Hypertension
 - B. Atrial fibrillation
 - C. Age
 - D. Cigarette smoking
4. **TIA's are characterized by:**
 - A. Temporary lack of blood flow in the brain
 - B. A minor hemorrhage in the brain
 - C. Complete occlusion of an artery in the brain for at least one week
 - D. Symptoms more severe than a stroke
5. **Which of these statements is true?**
 - A. Disability caused by a stroke is always transient
 - B. Atrial fibrillation is a quivering, rapid, irregular heartbeat, but does not interfere with normal blood flow
 - C. The less consumption of vegetables, fruits & potassium, the higher the risk for stroke
 - D. The presence of abdominal obesity is known as metabolic syndrome
6. **A pharmacological measure used to reduce stroke risk may include:**
 - A. Use of antiplatelet agents
 - B. Intake of Vitamin C
 - C. Once a week intake of ibuprofen 200 mg
 - D. Intake of mega doses of Vitamin K
7. **Which of the following is false?**
 - A. Light to moderate consumption of alcohol may increase HDL cholesterol level
 - B. The brain cells consume about 20% of oxygen & nutrients supplied by the body
 - C. The Circle of Willis is a reconnection of blood vessels found in the brain
 - D. A TIA is usually followed by a major stroke within a few days
8. **Which of the following statements is false?**
 - A. tPA enhances the production of plasmin
 - B. tPA is given orally immediately after a stroke
 - C. A potential adverse effect of tPA is bleeding in the brain
 - D. tPA was approved by the FDA in 2000
9. **Which of the following is an antidote for tPA?**
 - A. Vitamin K
 - B. Aminocaproic acid
 - C. Universal antidote
 - D. Ascorbic acid
10. **The surgical procedure of removing atheromatous deposits from an artery is known as:**
 - A. Endarterectomy
 - B. Thrombectomy
 - C. Phlebectomy
 - D. Thrombolysis

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