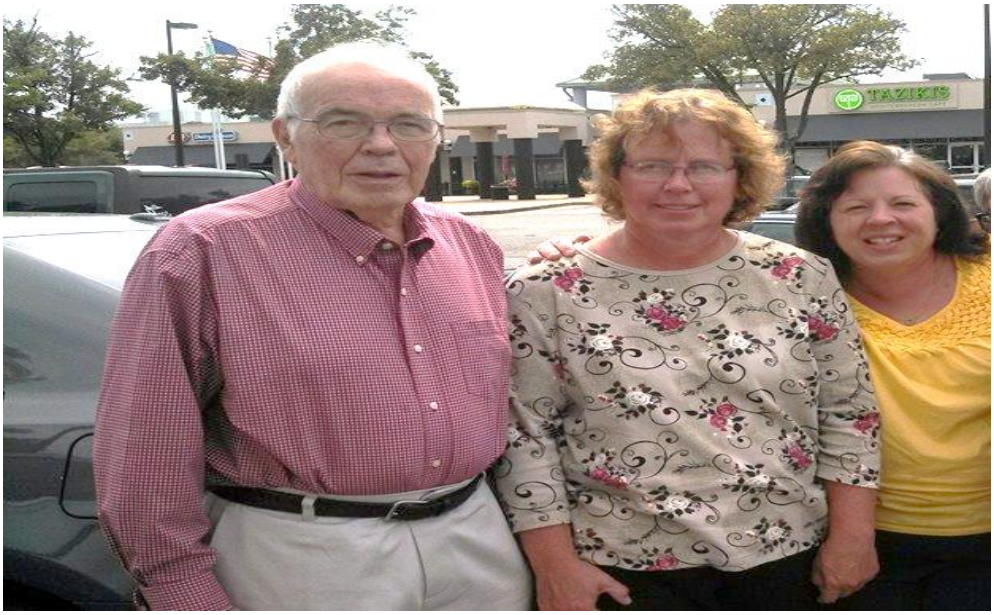
Obstructive Sleep Apnea Screening in Stroke Rehabilitation

Julia Castleberry MS PT, DPT, CLT, GCS, NCS



In the picture above are clients with history of stroke. Can you tell which client has a history of hypertension (HTN), atrial fibrillation, sleep apnea, myocardial infarction, and congestive heart failure? The answer is all. With each client, sleep apnea was diagnosed more than 10 years after their first cardiac event. Once treatment for sleep apnea began, all lost weight, demonstrated significant improvement in cardiac function and have remained hospital free. Currently the standard of medical care with cardiac disease and events (myocardial infarction, HTN, atrial fibrillation, cardiac bypass and stenting, and stroke) does not include sleep apnea screening.

Stroke

Stroke is strongly correlated with age and cardiovascular risk factors.

Ten percent of strokes are fatal, and stroke is the 4th leading cause of death in the U.S. (CDC 2010). The charts (*Charts 1 & 2*) below provide stroke facts and risk factors.

Stroke Facts
~55% patients will experience a new & often more severe stroke or die within the next 5 years ~30% of survivors becomes disabled and/or develops vascular dementia ~25% of patients with stroke are institutionalized After a stroke: 2 – 3x increased risk for myocardial infarction ~10% of patients with myocardial infarction, stroke will occur within the next 5 years
(CDC Statistics, 2010)

Chart I presents stroke facts obtained from the CDC Fact Sheet Statistics, 2010. Published U.S. Department of Health and Human Service: CDC Statistics, (2010). Framingham Heart Study, American Heart Association, Heart and Stroke Facts Statistical Updates, 61(4).

Risk Factors for Stroke
Non-modifiable: Age, gender, race, heredity **Controllable risks factors with medical treatment and life style modifications** high blood pressure, Diabetes, cigarette smoking ,TIA (Aspirin),High blood cholesterol, obesity, heart disease, atrial fibrillation, oral contraceptive use ,physical inactivity, sickle cell disease, asymptomatic carotid stenosis, and hypercoagulability Hypertension (HTN) : 140/90 mmHg or higher; 2x lifetime risk for stroke Elevated Low-density lipoprotein (LDL) above 130 mg/dL Low levels of High-density lipoprotein (HDL) below 40 mg/dL Fasting triglyceride level of 150 mg/dL or greater Atrial fibrillation: 5x risk for stroke **Sleep Apnea**: independent risk factor of stoke Doubles the risk of stroke or death Early menopause before 42 y/o, 2 x risk of ischemic stroke TIA: Precursor to stroke and to myocardial infarction. 15% of all strokes are preceded by a TIA; greatest risk of occurrence within 90 days. Atherosclerosis: symptomatic with 80% flow restriction
(Goodman, 2009)

Chart 2 outlines the general risk factors for stroke as describe in Goodman C.C., & Fuller K.S. (2009). Pathology: Implications for the physical therapist (3rd ed.). Philadelphia, PA: Saunders.1449-1453.

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) screening can impact stroke rehabilitation outcomes. Consider a client with mild stroke diagnosis based on imaging, however, very slow to progress and presents with multiple cognitive deficits. Consider the client with moderate to severe stroke diagnosis with significant attention deficits. Could undiagnosed obstructive sleep apnea have an impact on their functional recovery? Have the clients been screened for OSA?

Obstructive sleep apnea or sleep-disordered breathing (SDB) refers to an abnormal breathing pattern during sleep that is often quantified as the apnea-hypopnea index (AHI). The clinical diagnosis of OSA requires the presence of both SDB and symptoms of sleep disruption (fatigue/sleepiness when awake). In the general population, SDB is estimated to occur in 9% of middle-aged women and 24% of middle-aged men. However, only 2% of women and 4% of men also complain of daytime sleepiness, and therefore meet strict criteria for OSA (Hiestand, 2006).

Any condition that reduces the diameter of any portion of the upper airway may contribute to SDB. OSA is caused by recurrent partial or complete obstruction of the airway during sleep. Resistance to airflow is increased at areas of anatomic narrowing in the nasopharynx and oropharynx. These areas may be further compromised by a sleep-related reduction in muscle tone and the effects of gravity related to being supine.

As a result, ventilation may be decreased (hypopnea) or absent (apnea) for several seconds until upper airway muscle tone increases, allowing the resumption of normal ventilation. This recovery is often associated with an arousal or shift to a lighter sleep

stage. As deeper sleep resumes and muscle tone diminishes, the cycle may repeat itself (Nieto, 2000). According to the American Sleep Association, more than 18 million Americans are affected by OSA. The prevalence of OSA is higher in older and more obese populations, and African-Americans have a 2.5 times greater risk of obstructive sleep apnea than Caucasians. It is estimated that up to 60% of community-residing elderly people have significant SDB (Nieto, 2000).

One recent study by Boyer estimated that 93% of women and 82% of men with moderate to severe OSA remain undiagnosed. Many studies have reported an increased frequency of occupational and motor vehicle accidents associated with OSA. People with OSA also have impaired psychological and cognitive functioning, as well as a reduced quality of life (Boyer, 2002).

As United States obesity rates rise, obstructive sleep apnea rates also rise. Thirty-five percent of U.S. Adults were considered obese in 2011-2012. The highest prevalence among adults ranged from 40-49 years old (Nwankwo, 2013). Men are more likely to have obstructive sleep apnea than women before the age of 50, and after age 50, the risk is considered the same in men and in women. Among obese patients, 70% have obstructive sleep apnea. Obstructive sleep apnea worsens in severity and prevalence with increasing obesity. Among patients with heart disease 30%-50% have obstructive sleep apnea; and among patients with strokes, 60% have obstructive sleep apnea (Tishler, 2003; Yaggi, 2005). In addition it is estimated that only 10% of people with obstructive sleep apnea are currently receiving treatment (Veasey, 2006).

Obstructive sleep apnea is often found in patients with obesity, diabetes, and cardiovascular disease, and there is growing evidence that sleep apnea is

independently associated with increased cardiovascular morbidity (hypertension, myocardial infarction, and inflammation /atherosclerosis). There is a strong link between Sleep Disordered Breathing (SDB) and the development of hypertension independent of age, sex, and obesity (Young, 2002; Nieto, 2000; Peppard, 2000).

A Mayo Clinic web publication by Lipford describes the link between obstructive sleep apnea and cardio-embolic stroke risk. Moderate to severe obstructive sleep apnea (OSA) has been shown to increase the risk of ischemic stroke. There is a threefold increase risk of ischemic stroke in men. Although sleep apnea frequently goes undiagnosed and is not routinely screened for in the cardiac population, population studies indicate that as many as 1 in 15 adults have moderate to severe OSA.

A recent study by Lipford found that cardio-embolic stroke is more common in patients with OSA than in patients without OSA. The retrospective case-control study examined 53 records of patients who had undergone a polysomnography study at the Mayo Clinic between 2000 and 2011, and who had suffered an ischemic stroke within one year after the sleep study. Thirty-two of the patients met the criteria for OSA and were classified as cases; 21 did not meet criteria for OSA and were classified as controls.

Among the OSA cases, 71.9 percent had cardio-embolic strokes as compared to 33.3 percent in the control group. Cardio-embolic stroke frequency rose in conjunction with increased severity of OSA. Eighty-four percent of the OSA patients had at least one cardio-embolic risk factor, such as cardiomyopathy, compared with 52 percent of the control group.

OSA leads to structural and physiologic changes in the heart that can predispose patients to cardio-embolic stroke as described by Melissa C. Lipford, M.D., lead researcher of the study and a neurologist at the Center for Sleep Medicine at Mayo Clinic in Minnesota.

An important aspect of the study to consider is that all patients were diagnosed with OSA prior to experiencing a stroke. This provides strong support for the link between obstructive sleep apnea and stroke. If OSA was diagnosed after the stroke, it would be unclear whether OSA was a risk factor leading to the stroke or if the stroke itself caused the OSA or other factors. This study's results suggest that cardio-embolism is highly likely when a patient with OSA suffers a stroke (Lipford, 2013).

Diabetes and obstructive sleep apnea (OSA) are common disorders that often coexist. Obesity and possible underlying metabolic disorder predisposes clients or the metabolic and autonomic abnormalities associated with one disorder may influence the development of the other. Both diabetes and OSA are associated with increased cardiovascular morbidity and mortality (Peker, 2002). A common OSA client presentation associated with an increased risk for OSA may include a medical history of HTN, habitual snoring, witnessed apneas, nocturnal gasping/choking, neck circumference 19 inches, BMI >25 kg/m2, and age >40 years. *Chart 3* depicts the clinical characteristics of a client with obstructive sleep apnea. *Figure 1* demonstrates the cycle of decline including co-morbidities often seen with cardiac and stroke clients.

Clinical Presentation of Obstructive Sleep Apnea	
1.	**Loud snoring and daytime sleepiness** In severe cases, a person may fall asleep while driving, during meals or conversations. Falling asleep during passive activities, such as watching TV or reading is common. Some clients may deny sleepiness but complain about daytime fatigue or lack of energy.
2.	**Restless or unrefreshing sleep is described by clients with OSA. Bed partner and clients may report episodes of nocturnal gasping, and clients complain of dry mouth or headaches when first awake. There may be frequent nighttime esophageal reflux, and nocturia.**
3.	**Bed-partners may report breathing irregularities**, such as apnea, or complain of nocturnal kicking.
4.	**Neck circumference** > 17 inches in men and >16 inches in women has been found to be predictive of SDB.
5.	**Hypertension: 140/90 mmHg** (Kushida,1997)

Chart 3 presents a general clinical picture of a client with obstructive sleep apnea. Chart created by author. Clinical presentation described by Kushida, C.A., Efron, B., & Guilleminault, C.A. (1997). Predictive morphometric model for the obstructive sleep apnea syndrome. *Annals of Internal Medicine*, 127, 581-587.

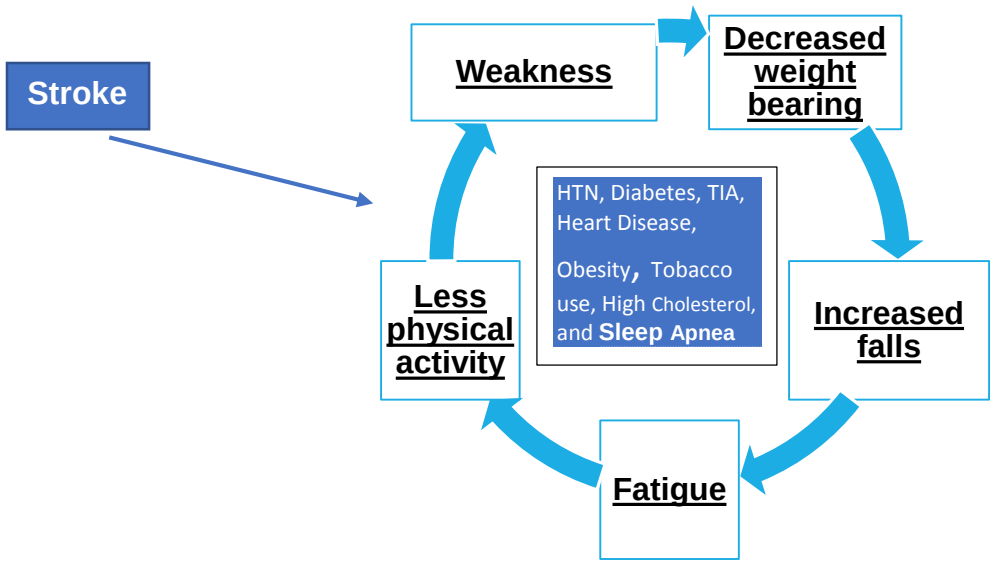


Figure 1 presents the cycle of decline seen with cardiac and stroke co-morbidities.

Author created *Figure 1.*

The gold standard for OSA diagnosis is the overnight polysomnography (sleep study) in a sleep laboratory. This study typically includes monitoring of snoring, pulse oximetry, electrocardiogram (EKG), muscle tone, eye movement activity (to detect REM sleep), electroencephalogram (EEG) to detect sleep stage and presence of cortical arousals, nasal/oral airflow, and chest and abdominal wall movement (to detect respiratory effort).

Obstructive hypopneas and apneas are seen as reduction or absence of airflow with persistent respiratory effort, as seen by chest or abdominal wall movement. One measure of severity of OSA is the frequency of these respiratory hypopneas and apnea events occurring per hour of sleep, which is usually reported AHI or as the respiratory disturbance index (RDI) (Marin, 2005). Although we do not utilize polysomnography or sleep studies within our scope of practice, physical therapists can screen clients for the risk of sleep apnea. These hypoxic/anoxic events have the potential to steal your client's potential to recover.

Screening for the RISK of Sleep Apnea

Although questionnaires are subjective, they do provide information regarding symptoms and behaviors. As individual screening methods, the Berlin and Epworth Sleepiness questionnaires may have limited predictability as their reliability (sensitivity and specificity) within a rehabilitative client setting is unknown. The Berlin and Epworth Sleepiness questionnaires combined with body mass index and neck circumference measurements may provide therapists with the tools to screen for sleep apnea in a variety of settings and with a variety of diagnoses. Questionnaires can provide information on sleep behaviors and symptoms, which can be verified by family and/or

significant others participation in answering the questions to provide a realistic and accurate assessment of risk for sleep apnea. More research is needed to investigate sleep apnea screening. *Chart 4 & 5* provide details on the Berlin and Epworth questionnaires.

Berlin Questionnaire	
1. Do you snore?	Yes *** No I don't know
2. How loud is your snoring?	As loud as breathing As loud as talking Louder than talking*** Very loud***
3. How frequently do you snore?	Almost every day*** 3-4 times per week*** 1-2 times per week 1-2 times per month Never or almost never
4. Does your snoring bother other people?	Yes*** No
5. How often have our breathing pauses been observed?	Almost every day*** 3-4 times a week*** 1-2 times per week 1-2 times per month Never or almost never
6. Are you tired after sleeping?	Almost every day*** 3-4 times per week*** 1-2 times per week 1-2 times per month Never or almost never
7. Are you tired during wake time?	Almost every day*** 3-4 times per week*** 1-2 times per week 1-2 times per month Never or almost never
8. How often do you nod off or fall asleep while driving?	Almost every day*** 3-4 times per week*** 1-2 times per week 1-2 times per month Never or almost never
9. Do you have high blood pressure?	Yes*** No I do not know
10. BMI (body mass index) Weight/height x height x 703	BMI >30***

Any answer followed by triple asterisks (***) is a positive response.
Category 1 is positive with 2 or more positive responses to questions 2 through 6
Category 2 is positive with 2 or more positive responses to questions 7 through 9
Category 3 is positive with 1 or more positive responses and/or a BMI>30
2 or more positive categories indicates a high likelihood of sleep apnea/ High Risk for Sleep Apnea (Netzer,1999)

Chart 4 describes the Berlin Questionnaire and how to calculate risk categories for sleep apnea. Chart 4 was created by author. Copy of the Berlin Questionnaire can be obtained from the American College of Physicians.

Epworth Sleepiness Scale

Used to determine the level of daytime sleepiness.

A score of 10 or more is considered sleepy.
Use the following scale to choose the most appropriate number for each situation:
0 = would never doze or sleep
1 = slight chance of dozing or sleeping
2 = moderate chance of dozing or sleeping
3 = high chance of dozing or sleeping

Epworth Sleepiness Scale	
Situation	**Chance of Dozing or Sleeping**
Sitting and reading	
Watching television	
Sitting inactive in a public place	
Being a passenger in a car/motor vehicle for an hour or more	
Lying down in the afternoon	
Sitting quietly after a lunch; no alcohol	
Stopped for a few minutes in traffic while driving	
Total Score: add scores from each situation to obtain the total score	
More Information: http://www.umm.edu/sleep/epworth_sleep.htm#ixzz26fHAciZJ.	

Chart 5 describes the Epworth Sleepiness Scale Questionnaire. Chart 5 was created by the author. Original publication by Johns, M. W. (1991). A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep, 50-55.

Consider incorporating sleep apnea screens with your clients. If you suspect your client has sleep apnea or the questionnaire scores indicate high risk for sleep apnea and sleepiness, refer your clients for additional testing and provide the physician with the client's Berlin and Epworth Sleepiness questionnaire scores as well as other supportive documentation (BMI, cognitive assessments, and vitals). Remember, clients have the right to decline further medical testing and may decline obstructive sleep apnea treatment. Positive airway pressure therapy is commonly used to facilitate oxygenation during sleep. A mask is worn over the nose and/or mouth and compliance is often an issue with clients.

We can screen, not diagnosis sleep apnea. Screening serves as a possible means of preventing systemic hypoxic/anoxic events which hinder the micro-vascular and nervous system recovery, thus neuroplasticity and stroke rehabilitation.

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Website Resources

American Thoracic Society

http://thoracic.org

American Sleep Association

http://www.sleepapnea.org

APTA Neurology Section

http://www.neuropt.org/docs/neurologic-specialist-certification/ncs-resource-list-2011.

National Health Statistics (Department of Health and Human Services and CDC)

http://www.cdc.gov/nchs/

Rehabilitation Measures Database: www.rehabmeasures.org/

StrokEngine: http://strokengine.ca/

Author Information

Julia Castleberry MS PT, DPT, CLT, GCS, NCS
Chair of the APTA's Neurology Section Stroke SIG
Assistant Professor
Radford University's Department of Physical Therapy
Address correspondence to joxenreid@radford.edu