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Podcast of the *Journal of Clinical Sleep Medicine*

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Welcome to the regular podcast of the *Journal of Clinical Sleep Medicine*. I am Dr. Stuart Quan, editor of the *Journal*. These podcasts are a regular feature of each issue of the *Journal* and can be downloaded at the *Journal*'s website. Each podcast features summaries of important articles published in the current issue of the *Journal*, as well as occasional interviews with authors of these papers.

The first paper to be discussed is entitled, "Periodic Limb Movements during Sleep and Cardiac Arrhythmia in Older Men (MrOS SLEEP)," by Dr. Brian Koo and colleagues from the Department of Neurology, Department of Pulmonary, Critical Care & Sleep Medicine, Case Western Reserve University School of Medicine, Cleveland, OH, Research Institute, California Pacific Medical Center, San Francisco, CA, Department of Psychiatry, University of California, San Diego, La Jolla, CA, Department of Medicine, Brigham & Women's Hospital and Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA. Periodic limb movements of sleep are repetitive contractions of the muscles of the legs, occurring sometimes hundreds of times during the night. Although they frequently are observed on polysomnography, only infrequently are they attributed to daytime symptoms of sleep disruption, in which case they are thought to be the cause of periodic limb movement disorder. Periodic limb movements during sleep are also associated with increased sympathetic nervous system activity. Therefore, it is possible that they may increase susceptibility to cardiac arrhythmias. In this study, 2,793 older men who were enrolled in the MrOS study underwent polysomnography with recording of periodic limb movements and ECG. The average age of the participants was 76.2 years, with over 90% being Caucasian. Their average BMI was 27.2 and there was a mean apnea-hypopnea index of 17 per hour. Using logistic regression techniques, the associations of the periodic limb movement index and periodic limb movement arousal index with cardiac arrhythmias including atrial fibrillation and non-sustained ventricular tachycardia were ascertained. Analytic models were adjusted for age, race, cardiovascular risk factors and clinic sites. In secondary analyses, data were limited to men who were not using calcium channel or beta adrenergic blocking medications and also stratified for presence of congestive heart failure and history of myocardial infarction. Overall, the investigators found no relationship between either periodic limb movement index or the periodic limb movement arousal index and cardiac arrhythmias. However, when analyses were restricted to men who were not taking either calcium channel or beta blocking medications, there was an increased odds of having non-sustained ventricular tachycardia for both the periodic limb movement index and the periodic limb movement arousal index. In addition, in men who had congestive heart failure or who had a history of myocardial infarction, there was a trend toward the association of the periodic limb movement index or the periodic limb movement arousal index with atrial fibrillation. The authors conclude that, although there is no overall association between periodic limb movements of sleep and cardiac arrhythmias, in a subset of men who are not taking either calcium channel or beta adrenergic blockers, there may be an increased risk of non-sustained ventricular tachycardia and in those individuals who have either congestive heart failure or a history of myocardial infarction, there may be an increased risk of atrial fibrillation. These results are important because heretofore it has been difficult to show any significant association of periodic limb movements of sleep with daytime symptoms of sleep disruption or significant relationships with other clinical outcomes. It would suggest that if these results can be replicated, treatment of periodic limb movements of sleep may be important in certain subsets of individuals.

The next paper to be discussed in this podcast is entitled, "Sleep Disordered Breathing in Chronic Spinal Cord Injury," by Dr. Abdulghani Sankari and colleagues from the Sleep Research Laboratory, John D. Dingell Veteran's Affairs Medical Center, Wayne State University, Detroit, MI. It is estimated that there are over 250,000 people in the United States with spinal cord injury with approximately 11,000 new cases every year. Previous studies assessing sleep disordered breathing have found a high prevalence, ranging from 27%-67%. The purpose of this study was to better characterize the nature of sleep disturbances in the spinal cord injury population, using standard questionnaires, polysomnography and pulmonary function testing. The authors studied 26 consecutive patients with spinal cord injury, of whom eight were females with an average age of 42.5 years and a mean BMI of 25.9. Fifteen had cervical and 11 had thoracic injury. After testing using the Pittsburgh Sleep Quality Index, 92% of the study population reported poor sleep quality and their mean Epworth Sleepiness Scale was 10.4. Complaints of daytime sleepiness were present in 59% of the subjects and daytime fatigability was reported in 96%. As expected, there was significant restriction on pulmonary function testing. 93% of cervical injury patients and 55% of thoracic injury patients had an apnea-hypopnea index of greater than five events per hour. Central sleep apnea and periodic breathing were observed in most of these individuals. However, some obstructive apnea was noted, as well. The authors conclude that the vast majority

of spinal cord injury survivors have symptomatic sleep disordered breathing, as well as poor sleep quality. It appears that those with cervical injury are more likely to have sleep disordered breathing than those with thoracic injuries. The authors propose that all spinal cord injury patients should undergo sleep assessment and full polysomnography.

The last paper to be discussed in this podcast is entitled, "Monitoring Sound To Quantify Snoring and Sleep Apnea Severity Using a Smart Phone: Proof of Concept," by Dr. Hiroshi Nakano and colleagues from the Sleep Disorders Center, Fukuoka National Hospital, Fukuoka, Japan, the Department of Public Health, Ehime University, and the Graduate School of Medicine, Shitsukawa, Toon, Ehime, Japan. Cell phones, particularly smart phones, are increasingly used by the general population of the world. These devices can do more than just receive and send telephone calls. They are, in reality, mini computers. For these smart phones, there are thousands of applications (or "Apps") that will allow the phone to perform a multitude of tasks, including being a flashlight, being a voice recorder, playing games, and surfing the internet. Not surprisingly then, there are now a number of applications that purport to measure some aspect of sleep. In this study, an android cell phone was used with a custom built program to monitor snoring and determine the presence of sleep apnea. Fifty consecutive individuals underwent polysomnography for sleep apnea and simultaneously had their sound recorded using a smart phone with the aforementioned custom app. Of the 50 participants, there were 42 males with a mean age of 47.9 years and a mean BMI of 26.4. After polysomnography, the mean apnea-hypopnea index was 27.3. Eleven subjects were found to not have sleep apnea, 10 had mild sleep apnea, 12 had moderate sleep apnea and 17 had severe sleep apnea. The authors found that snoring assessed by the smart phone was highly correlated with snoring time as recorded by the polysomnogram with a correlation coefficient of 0.93. In addition, the respiratory disturbance index estimated by the smart phone was also highly correlated with the apnea-hypopnea index measured by the polysomnogram with a correlation coefficient of 0.94. The sensitivity and specificity of the smart phone in diagnosing sleep apnea, with an apnea-hypopnea index greater than or equal to 15, was 0.70 and 0.94, respectively. The authors conclude that a smart phone can be used effectively for monitoring snoring and sleep apnea in a laboratory setting. However, whether this can be used in an ambulatory setting remains a subject of further investigation.

In an accompanying editorial, Dr. Scott Sands and Dr. Robert Owens suggest that this smart phone technology may have a number of uses. For example, they could be used for screening purposes before any formal testing and also to diagnose individuals with sleep apnea where portable monitoring and sleep laboratories are not available. Furthermore, they open the possibility of longitudinal or continuous monitoring of obstructive sleep apnea. Dr. Sands and Dr. Owens also emphasize the need for more research before adoption of such technology. They opine that advances in both understanding obstructive sleep apnea pathophysiology and monitoring technology may allow us to use smart phones not only to diagnose and monitor obstructive sleep apnea, but to make smart treatment plans.

This concludes the regular podcast of the *Journal of Clinical Sleep Medicine*. The listener is encouraged to read the contents of the *Journal* for additional information regarding each of the articles summarized in this podcast, as well as other papers published in this issue of the *Journal*.