



SLEEP DISORDERED BREATHING

The Clinical Conditions

Robert G. Hooper, M.D.

In the previous portion of this paper, the definitions of the respiratory events that are the hallmarks of problems with breathing during sleep were reviewed. In this portion the clinical conditions that result from these events will be covered.

The Clinical Conditions

There are four major sleep disordered breathing conditions that physicians should understand. They are the Obstructive Sleep Apnea Syndrome, the Upper Airway Resistance Syndrome, the Central Sleep Apneas, and the problems of Complex Sleep Apnea. Each will be reviewed individually, but the conditions often overlap and patients are not always easily placed into one diagnosis.

Obstructive Sleep Apnea Syndrome

Obstructive sleep events are the most common events recorded. On a regular basis many adults have a few obstructive events during their sleep. Seeing obstructive events, while watching someone sleeping or on a polysomnography, is reason for concern, but does not mean that there is a problem with sleep quality nor does it establish a diagnosis of the sleep apnea syndrome. Clinical findings and a specified number of disordered breathing events on a polysomnogram are required to diagnose the syndrome. So how is the syndrome defined?

Clinical Features

The syndrome of obstructive sleep apnea has characteristic symptoms. They include poor quality and non-refreshing sleep, frequent nocturnal awakenings, and excessive daytime sleepiness. Table one is a list of many of the common symptoms. However, almost any symptom caused by poor quality sleep can result from obstructive breathing during sleep. Individuals and their sleeping partners may report snoring, restless sleep, frequent movements, and observe cessation of breathing during sleep.

A person with sleep apnea syndrome most commonly has a normal exam of the upper airway. Certainly abnormalities may be found. Tonsils, adenoids, congenital defects in the jaw or tumors may be present and significant enough to cause apnea. However in most patients, the exam does not reveal abnormal findings.

Despite the normal appearance of the throat, careful inspection of the anatomy does demonstrate certain characteristic appearances in many patients with obstructive sleep apnea. The throat may appear small and have a narrow anterior-posterior or right-left dimension between the palate and the posterior pharyngeal air space. The tongue may appear generous in size. The exam may demonstrate a Mallampati type number four

throat (an exam that shows only the tongue and palate). None of these findings are diagnostic of sleep apnea, but their presence should raise suspicion on the condition.

SYMPTOMS OF OBSTRUCTIVE SLEEP APNEA

NON-REFRESHING SLEEP
FREQUENT AWAKENINGS
FREQUENT MOVEMENTS (TOSSING AND TURNING)
FREQUENT NOCTURIA
AWAKING FROM CHOKING
AWAKING FROM SNORING
MORNING TIREDNESS
MORNING HEADACHES
SLEEPINESS ON AWAKENING
SLEEPINESS DURING THE DAY
EXCESSIVE STIMULANT USE

FREQUENT PATIENT COMMENTS

“I CAN DRINK A CUP OF COFFEE AT BEDTIME AND GO TO SLEEP”
“IF I AM NOT BUSY I’LL NOD OFF”
“I’M FINE AS LONG AS I’M ACTIVE”
“I CAN SLEEP 12 HOURS AND STILL NEED A NAP”
“I CAN SLEEP ANYWHERE AT ANY TIME.”

The more symptoms of disturbed sleep that are reported, the more striking the observations by the sleeping partner, and the more impressive the physical exam, the more suspicious a physician should be of the problem. However, a diagnosis cannot be made with these features alone. The diagnosis rests on the documentation of disordered breathing during sleep. Most practicing physicians will easily recognize sleep apnea when they observe a sleeping individual with the problem. In our world of “prove it doctor”, the demonstration of sleep disordered breathing requires polysomnography testing.

Polysomnogram Features (Figure 5)

The diagnosis of sleep apnea syndrome requires the measurement of the number of obstructive sleep events that occur during sleep. As we reviewed in the previous portion of this paper, there are three types of obstructive events – apneas, hypopneas, and flow reductions.

Government regulations (Medicare) dictate much of what is required for a clinical diagnosis of sleep apnea syndrome. Most insurance providers have adopted the Medicare requirements for coverage of sleep equipment, established over a decade ago. The diagnosis of sleep apnea requires measurements of the number of apneas and the number of hypopneas. The rate of events per hour is expressed as the Apnea-Hypopnea Index (AHI). It must exceed four per hour. No other features of the polysomnography are considered.

I will expand on the diagnosis and the criteria required in the next installment of this publication.

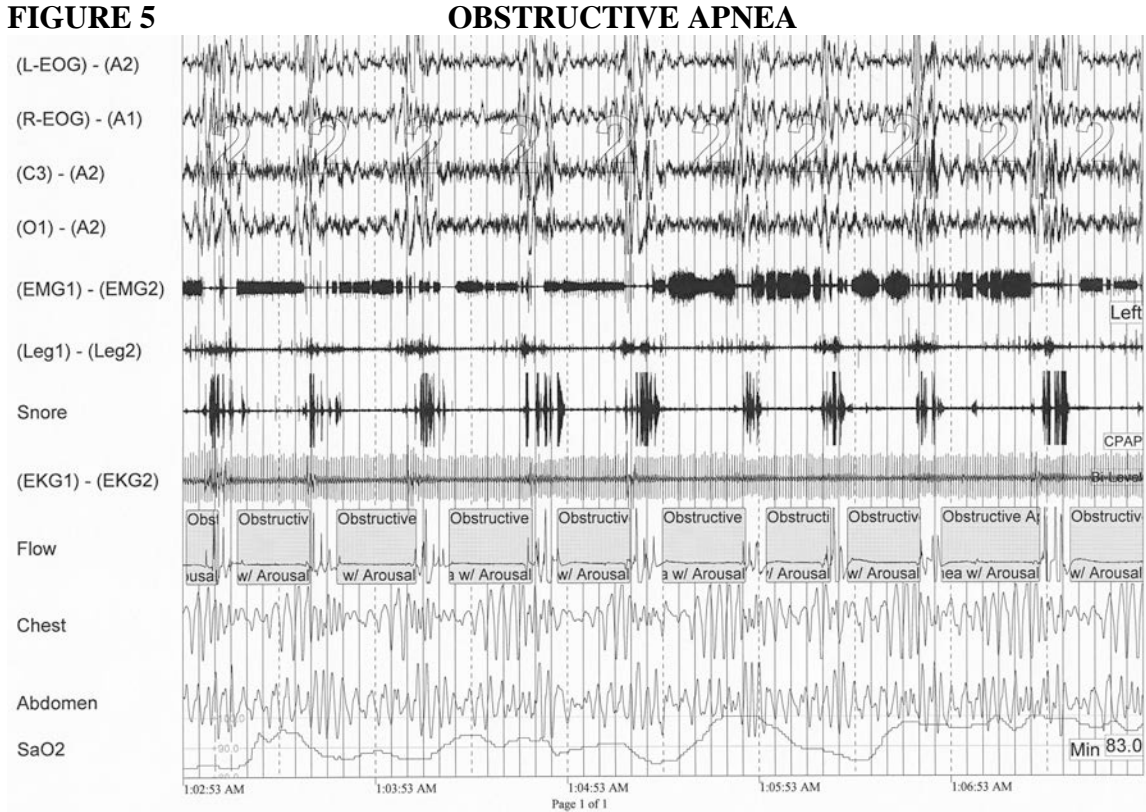


Figure 5: This is a five-minute recording of stage two sleep that demonstrates severe repetitive episodes of obstructive apnea. Note the strong snore signal when airflow is present and the disruption of the EEG. See figure 1 in the Events Section for definitions. The SaO2 channel shows the resulting desaturations. The polysomnogram of Obstructive Sleep Apnea Syndrome is characterized by an apnea-hypopnea index of 5 or greater.

Upper Airway Resistance Syndrome

This syndrome shares many features with the Obstructive Sleep Apnea Syndrome. In fact, it could be called “sleep apnea without apnea”. This diagnosis contains those individuals with obstructive breathing problems who do not have the Obstructive Sleep Apnea Syndrome.

Clinical Features

Individuals who have this problem have the same symptoms as patients with Obstructive Sleep Apnea Syndrome. The symptoms listed in table one and in fact, almost any symptom related to disturbed sleep, non-refreshing sleep or sleep maintenance can be the result of the events seen with this condition. There are no studies of the physical findings in these individuals. I suspect they are similar to those of the sleep apnea syndrome.

Polysomnogram Features (Figure #6)

The diagnosis of Upper Airway Resistance Syndrome includes only those individuals who have obstructive sleep disordered breathing and an AHI of less than five (four or less). This group of individuals usually has a significant number of airflow reductions (the events that are similar to hypopneas but do not result in a four percent drop in oxygen saturation).

FIGURE 6 THE FINDINGS OF UPPER AIRWAY RESISTANCE SYNDROME HYPOPNEA AND AIRFLOW REDUCTIONS

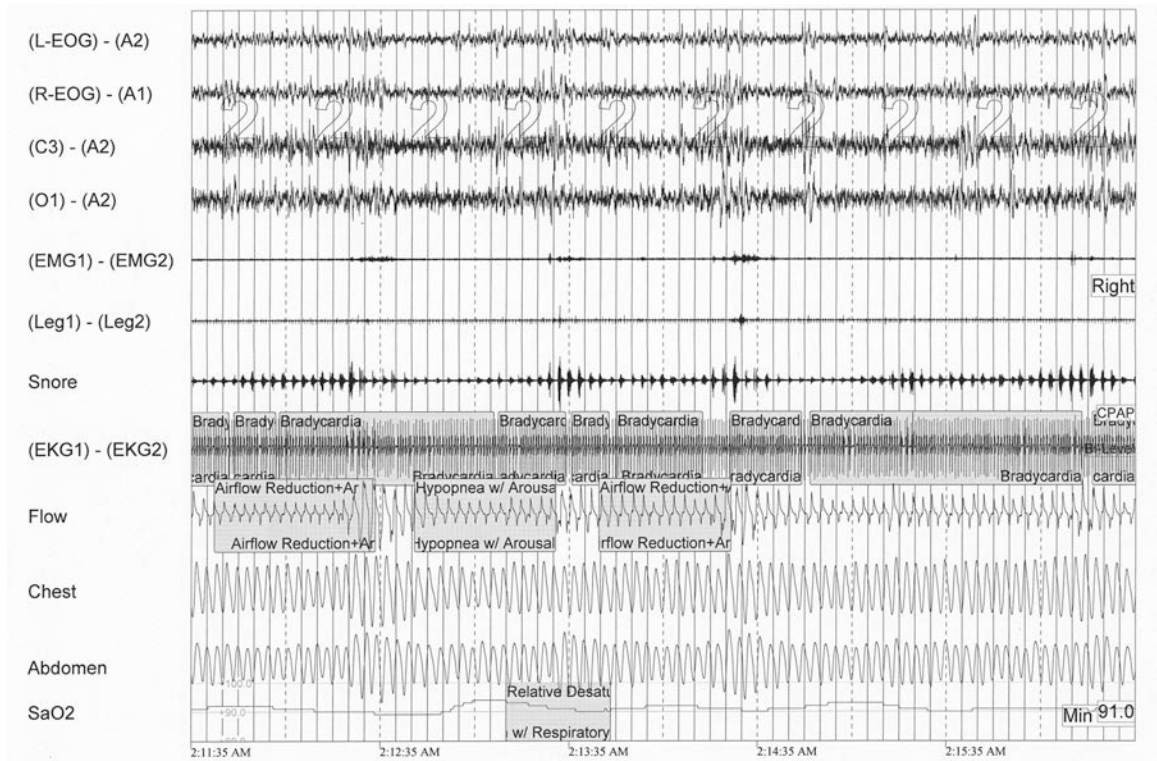


Figure 6: This is a five-minute recording of stage 2 sleep. Three respiratory events have been marked on the flow channel. The first and last are Airflow Reductions and the middle event is a Hypopnea. The only difference between them is the presence of a drop in oxygen saturation of 4% for the middle event that makes it a hypopnea. The polysomnogram of Upper Airway Resistance Syndrome is characterized by frequent airflow reductions and an apnea-hypopnea index of less than five per hour.

Studies of patients who have this syndrome have demonstrated that very significant breathing disturbances during sleep can occur with only minor abnormalities manifested on standard polysomnography. Esophageal pressure studies have shown evidence of severe upper airway obstruction during sleep that will be seen only as an “airflow reduction” on standard polysomnogram recordings. These obstructions are known to lead to disturbed sleep, which leads to symptoms similar to those of the Obstructive Sleep Apnea Syndrome. While the symptoms of the sleep apnea syndrome can be produced by these events, there have been no studies of the long-term effects of this level of sleep disordered breathing on the health of these individuals.

Central sleep apnea Syndromes

Central sleep apnea events are seen in many clinical situations during polysomnograms. Central apnea events are seen in many individuals when returning to sleep after arousals. Chaotic breathing – Biot’s breathing – seen in degenerative brain disease and with major central nervous system injuries is one form of central apnea that is recognized, but rarely encountered as a diagnostic problem because of the obvious neurological condition. The most common form of central apnea identified in an ambulatory medical population is Cheyne-Stokes breathing, seen primarily in congestive heart failure. Central apnea resulting from the use of narcotic drugs for pain control represents another form of ambulatory diagnostic problem. Central apnea is uncommon as a presenting breathing problem during sleep and probably represents less than 1% of patients evaluated for an initial diagnosis in a clinical sleep practice.

Clinical Features

The clinical presentations of patients with central sleep apnea are primarily those of disturbed sleep and the disease causing the apnea. The disturbed sleep can take the form of many sleep complaints. Symptoms expressing difficulty with sleep onset, sleep maintenance, poor quality sleep, and excessive daytime sleepiness are all commonly reported. Often the symptoms are difficult to separate from the symptoms of the disorder that produced the apnea. The two most common causes of central apnea problems are congestive heart failure and the use of narcotics for pain control.

Patients may present because of sleep complaints or they may have been encouraged, forced or dragged into the physician’s office by spouses, family or friends. The symptoms of disturbed sleep or excessive sleepiness may be readily reported, but sometimes they can be found only with pointed questions. Often, patients brought by other individuals for evaluation have had the breathing problems recognized although the patients may have no awareness or will deny awareness of the problem.

Cheyne-Stokes breathing can represent a diagnostic problem when the cardiac decompensation has been slow in developing or the cardiac problem is not recognized. Conditions such as mitral valve disease and myocardial muscle disease may present in this manner. Cheyne-Stokes breathing is also seen in patients with recognized advanced cardiac disease. These individuals have significant cardiac dysfunction despite their medical programs.

Polysomnogram Features (Figure 7 & 8)

The two common conditions producing central sleep apnea have a slightly different event appearance on polysomnography. The identification of a large number of central apnea events is the hallmark of central apnea syndromes. Figure seven demonstrates polysomnogram features of Cheyne-Stokes breathing from congestive heart failure. It demonstrates the gradually increasing and decreasing respiratory efforts that are matched by changes in airflow.

Figure 7 CENTRAL APNEA - CHEYNE-STOKES

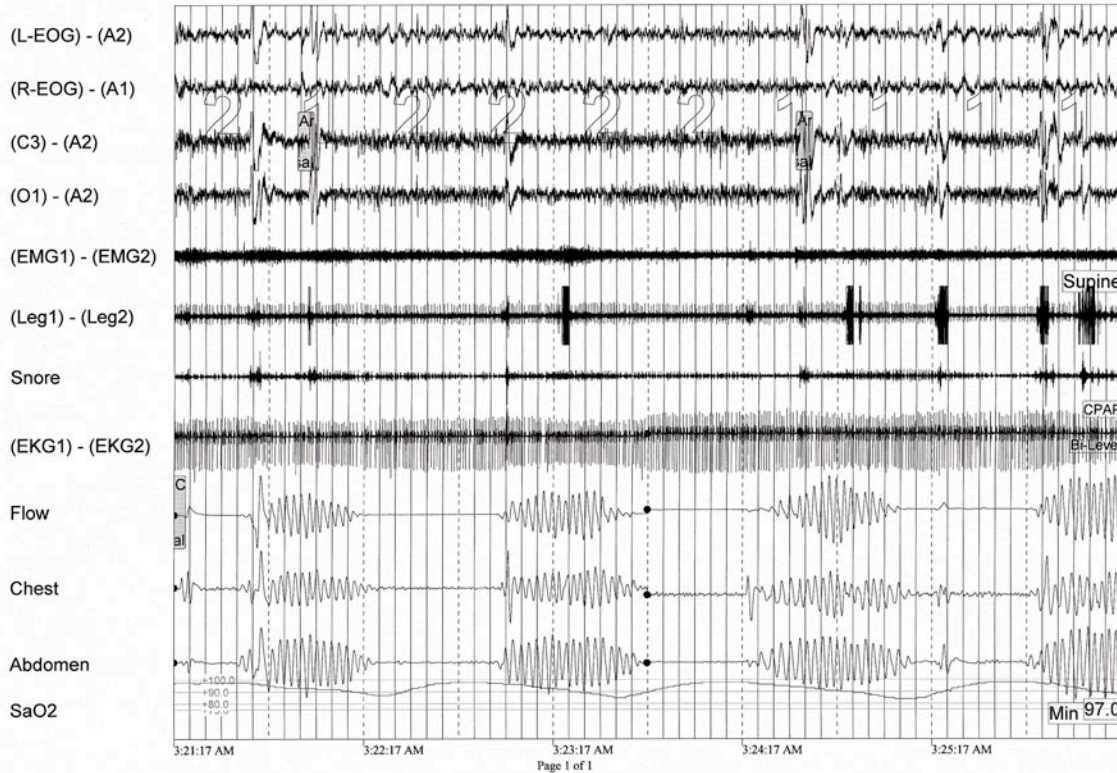


Figure 7: A five-minute recording of stage II and stage I sleep showing typical central apneas. Note the total absence of respiratory efforts in the abdominal and chest channels. Note the gradually increasing respiratory efforts that are exactly matched to the changes in airflow. See figure 1 for definitions. The EKG channel shows atrial fibrillation. The patient was newly diagnosed with mitral stenosis and insufficiency producing congestive heart failure.

Figure eight shows the features of someone with narcotic induced central apnea. The central apneas in these individuals usually have a more abrupt onset and termination than those secondary to central sleep apnea.

FIGURE 8 CENTRAL APNEA – SECONDARY TO NARCOTIC MEDICATIONS

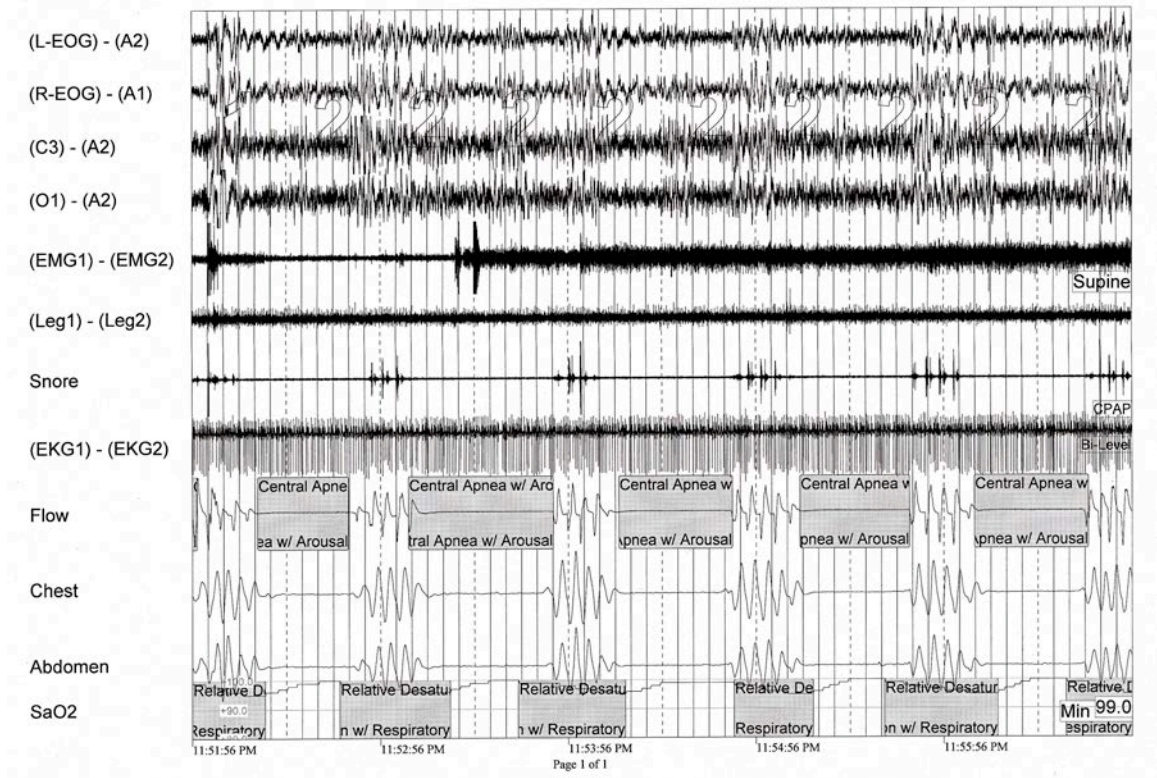


Figure 8: A five-minute recording of stage II sleep showing typical central apneas. Note the total absence of respiratory efforts in the abdominal and chest channels. Note the respiratory efforts are exactly matched to the changes in airflow. The differences between this example and the Cheyne-Stokes central apneas are minor and consist of the more abrupt onset and termination of respirations. See figure 1 for definitions. The EKG channel shows atrial fibrillation. The patient had a chronic pain syndrome and was receiving scheduled narcotics.

Complex Sleep Apnea Syndrome

Complex Sleep Apnea is a form of central sleep apnea. It has recently been recognized as a distinct form of apnea. The findings that constitute the syndrome are just being defined. The symptoms seem to be very similar to those reported for sleep apnea and consist of the results of disturbed sleep. No physical findings are known that are specific for the problem.

Complex apnea occurs when central apneas develop on positive air pressure treatment (CPAP) for obstructive sleep apnea.

Clinical Features

There are no specific symptoms for complex sleep apnea and the diagnosis will be made from the polysomnogram features. Many patients will present to the physician with a prior diagnosis of obstructive sleep apnea and a history of problems with constant

positive airway pressure treatment. When positive airway pressure is started on these patients for their obstructive sleep apnea, they frequently do not respond well. They are often CPAP treatment failures or individuals who continue to use positive airway pressure with poor symptom and apnea control.

Polysomnogram Features (Figure 9)

On initial polysomnography study, a patient with Complex Sleep Apnea Syndrome will be found to have obstructive sleep apnea. Frequently, a significant number of central apneas and hypopneas will be present on the initial study, but the vast majority of the events are obstructive in character. When placed on positive airway pressure, the obstructive events will disappear, but an increased number of central events occur.

FIGURE 9 COMPLEX APNEA – DIAGNOSTIC TEST BEFORE CPAP

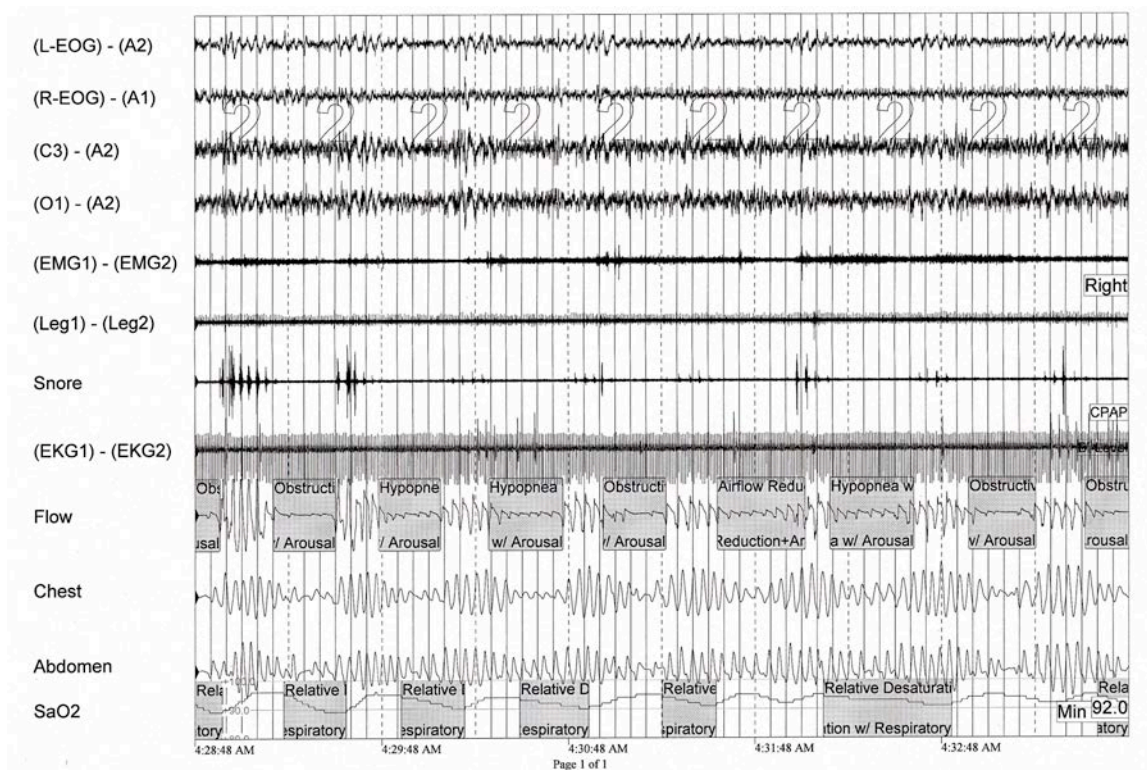


Figure 9: A five-minute recording of stage II sleep showing obstructive apneas and hypopneas. Note the second event from the left and the right. These two events show minimal effort and are suggestive of a central type event. However, the tracing is overall that of obstructive apnea.

The initial diagnostic polysomnography for complex sleep apnea will, like Figure 9, have the characteristics of obstructive sleep apnea. Or, as the example demonstrates, a small percent of the events recorded may be central or suggestive of central apnea. When the patient breathes positive pressure the obstructive events disappear and central events appear (Figure 10)

FIGURE 10 COMPLEX APNEA – TREATMENT WITH POSITIVE AIRWAY PRESSURE

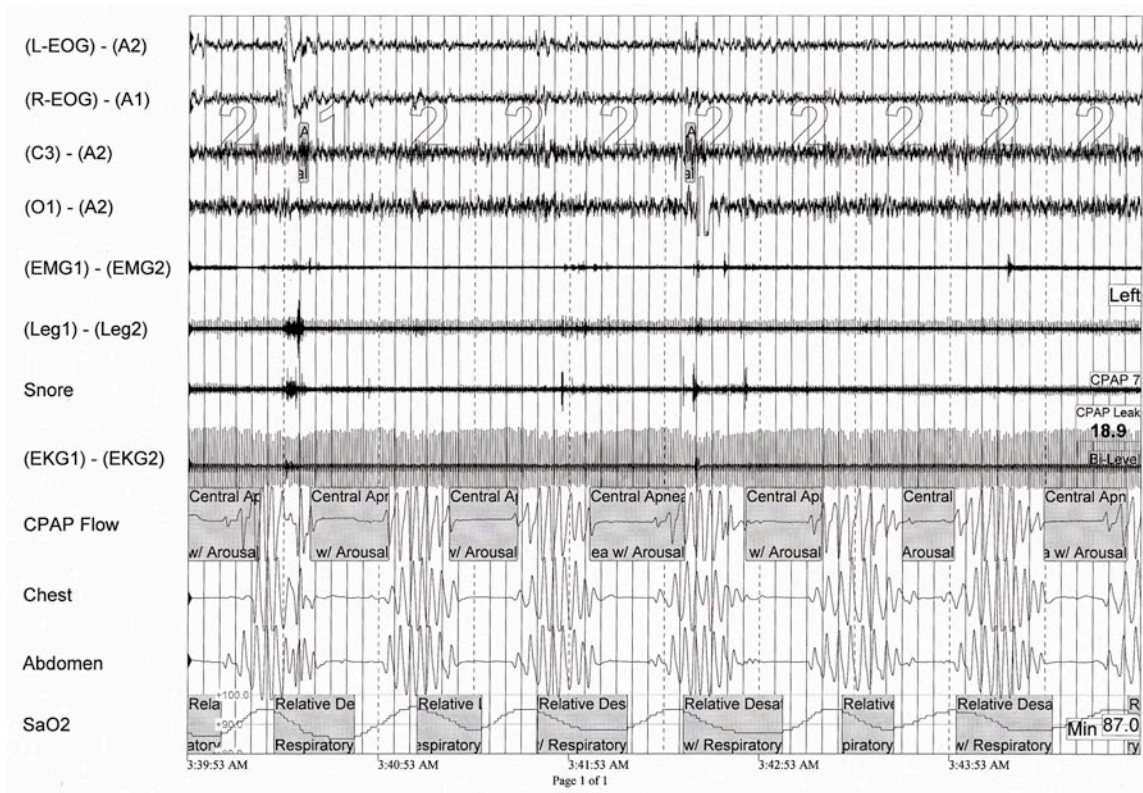


Figure 10: A five-minute recording of stage II sleep performed on the same patient as in figure 9 while breathing positive airway pressure at 7 cm H₂O. It shows central apneas similar to the prior examples that were secondary to heart failure and narcotic use.

Sleep Disordered Breathing - The Clinical Conditions

We have reviewed the four major sleep disordered breathing situations that physicians should understand. They are the Obstructive Sleep Apnea Syndrome, the Upper Airway Resistance Syndrome, the Central Sleep Apneas, and the problems of Complex Sleep Apnea. Each condition can be defined, but the conditions often overlap and patients are not always easily placed into one diagnosis. The next installment of this paper will review the diagnosis of each of these conditions.