CASE 1

A 74-year-old man with severe ischemic cardiomyopathy and atrial fibrillation

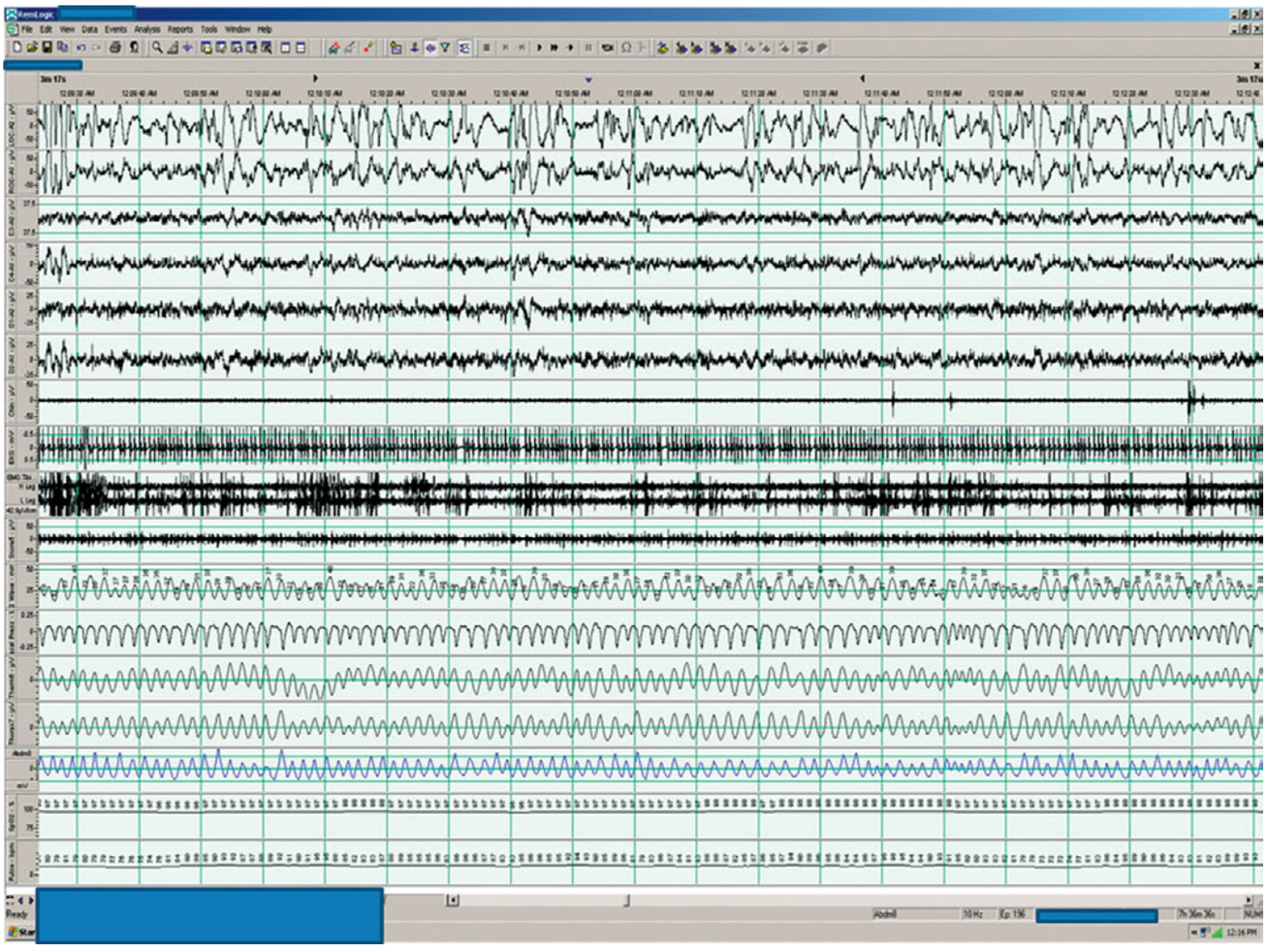
Robert C. Basner, with technical assistance from Ravi K. Persaud

The following 3 minute polysomnogram (PSG) tracing was recorded in a 74-year-old man with severe ischemic cardiomyopathy and atrial fibrillation. His awake arterial blood gases breathing room air at sea level are Pao_2 of 70 mmHg and $Paco_2$ of 38 mmHg. The tracing represents the patient breathing room air.

What is the best interpretation of the respiratory status of this patient displayed on this tracing?

A. Cheyne–Stokes breathing
B. Hypoventilation
C. Hypopneas
D. Respiratory effort-related arousals (RERAs)
E. Normal rapid eye movement (REM)-related breathing.

Answer on page 138.



A1, left mastoid (ear) referential electroencephalography (EEG); A2, right mastoid (ear) referential EEG; Abdm8, abdominal respiratory inductance plethysmography; ECG, electrocardiogram (precordial right-sided); C3, left central referential EEG; C4, right central referential EEG; Chin, submental electromyogram (EMG); EMG Tib, right and left leg EMG; LOC, left eye referential electro-oculogram (EOG); Nasal Press, nasal pressure transducer; O1, left occipital referential EEG; O2, right occipital referential EEG; Pulse, pulse rate from pulse oximeter; ROC, right eye referential EOG; Spo_2, O_2 saturation by oximetry (from ear pulse oximetry); Therm6, oronasal thermistor; Thorax7, thoracic respiratory inductance plethysmography; 2 Wave, end-tidal Pco_2 ($ETco_2$). Highest $ETco_2$ value displayed (11th channel from top) is 41 mmHg; Nadir Spo_2 displayed (2nd channel from bottom) is 96%.

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CASE 2 A 65-year-old man with amyotrophic lateral sclerosis

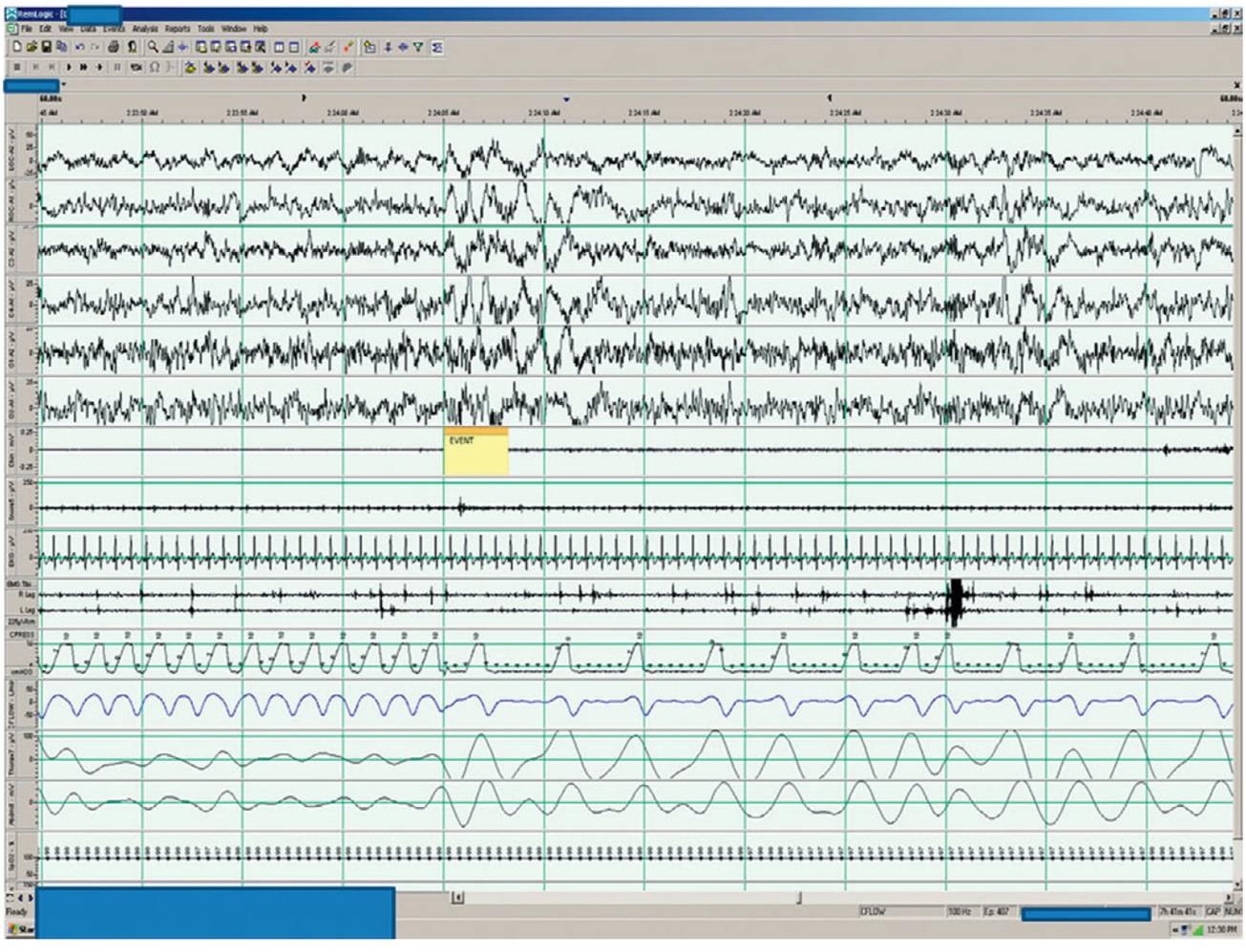
Robert C. Basner, with technical assistance from Ravi K. Persaud

The 60 second PSG epoch displayed below was recorded in a 65-year-old man with amyotrophic lateral sclerosis. The patient is supine and being ventilated with bilevel positive airway pressure (PAP) at 10 cmH_2O inspiratory PAP (IPAP) and 4 cmH_2O expiratory PAP (EPAP) using a hybrid (mouthpiece plus nasal prongs) interface.

Which of the following is the most likely maneuver performed by the technician at the notation "EVENT" (2:24:05 a.m.)?

A. The setting was changed from ST (spontaneous/timed) mode with back-up rate of 20/minute to S (spontaneous mode) without a back-up rate
B. Supplementary O_2 was added in-line to an adapter just below the interface at 4 L/min flow rate
C. The thoracic and abdominal respiratory inductance plethysmography belts were tightened to allow for a better signal
D. The trigger sensitivity was changed from high to low in ST mode, with a continued back-up rate of 12/minute
E. The bilevel PAP was changed to continuous PAP (CPAP) of 4 cmH_2O.

Answer on page 138.



C2, right central referential EEG; CFLOW, airflow derived from pressure signal; CPRESS, PAP signal, positive deflection upwards (5th channel from bottom).

CASE 3

An 80-year-old man with severe heart failure and witnessed apnea awake and during sleep

Robert C. Basner, with technical assistance from Ravi K. Persaud

The following 60 second PSG tracing was recorded in an 80-year-old man with severe heart failure and witnessed apneas awake and during sleep.

How is the respiratory event depicted in the middle of the epoch best interpreted?

A. Obstructive apnea during CPAP titration
B. Central apnea during servo bilevel PAP ventilation
C. Hypopnea during spontaneous breathing
D. Hypopnea during fixed bilevel PAP ventilation
E. None of the above.

Answer on page 139.

Abdomen, abdominal respiratory inductance plethysmography; E1, E2, left and right referential EOG; Thorax, thoracic respiratory inductance plethysmography; Spo_2 by ear pulse oximetry. PAP is 5th channel up from bottom.

CASE 4

A 33-year-old man with a history of interstitial pulmonary fibrosis and obesity

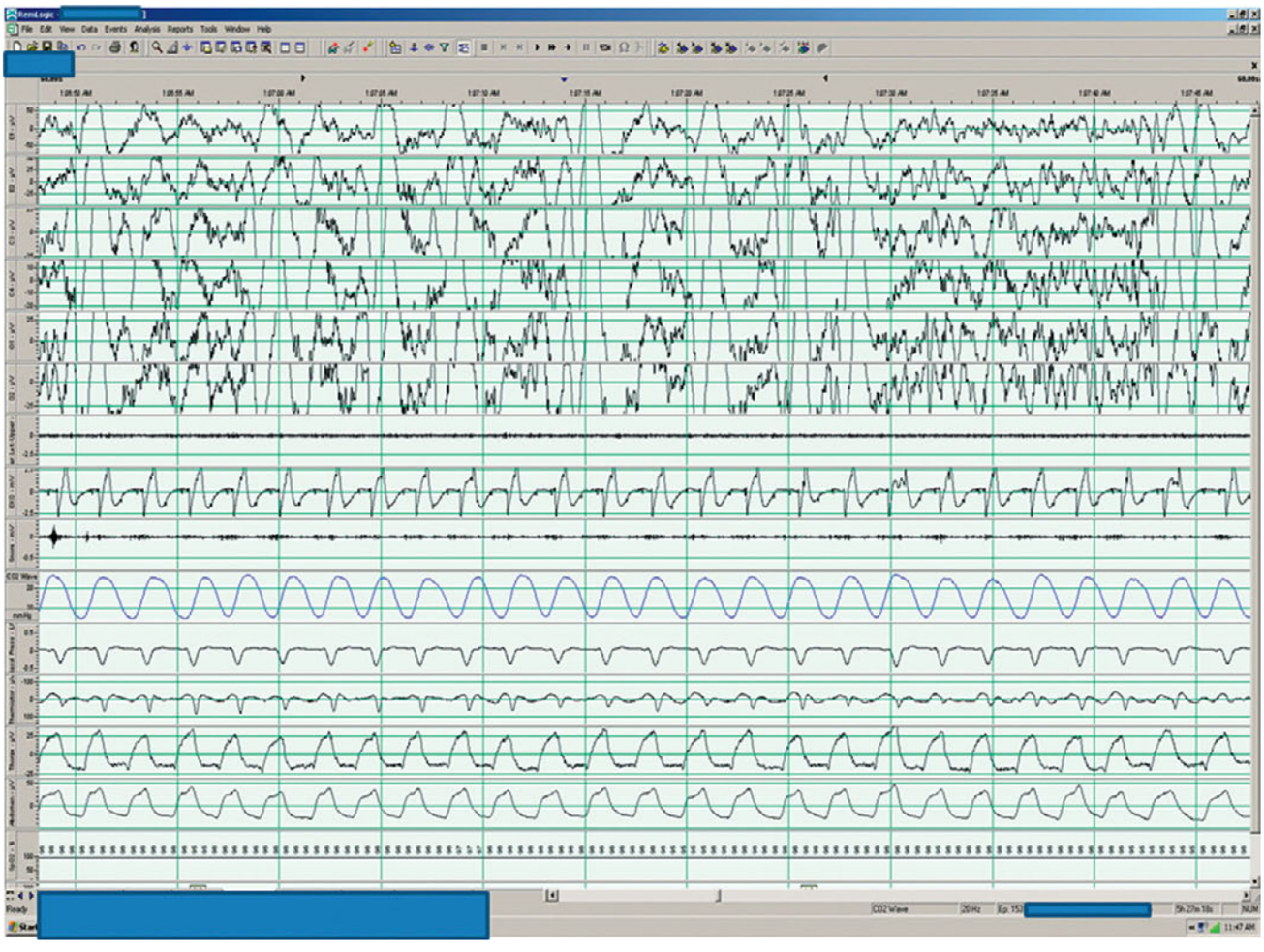
Robert C. Basner, with technical assistance from Ravi K. Persaud

The following 60 second epoch is from a PSG recorded in a 33-year-old man with a history of interstitial pulmonary fibrosis and obesity, who was studied to assess for a sleep-related breathing disorder and the need for PAP therapy. The patient is receiving supplemental O_2 at 4 L/min via nasal cannulae.

What is the best interpretation of the right-sided precordial ECG (8th channel from the top) displayed here?

A. Sinus rhythm with right bundle branch block
B. Ventricular tachycardia
C. Atrial flutter with 2:1 conduction
D. Hyperkalemia effect
E. Artifact.

Answer on page 140.



Abdomen, abdominal respiratory inductance plethysmography; Er, Left-upper, submental EMG; Thorax, thoracic respiratory inductance plethysmography; Spo_2 by ear pulse oximetry. ECG tracing is 8th channel from the top.

CASE 5

A 52-year-old man being treated for sleep-related hypoventilation

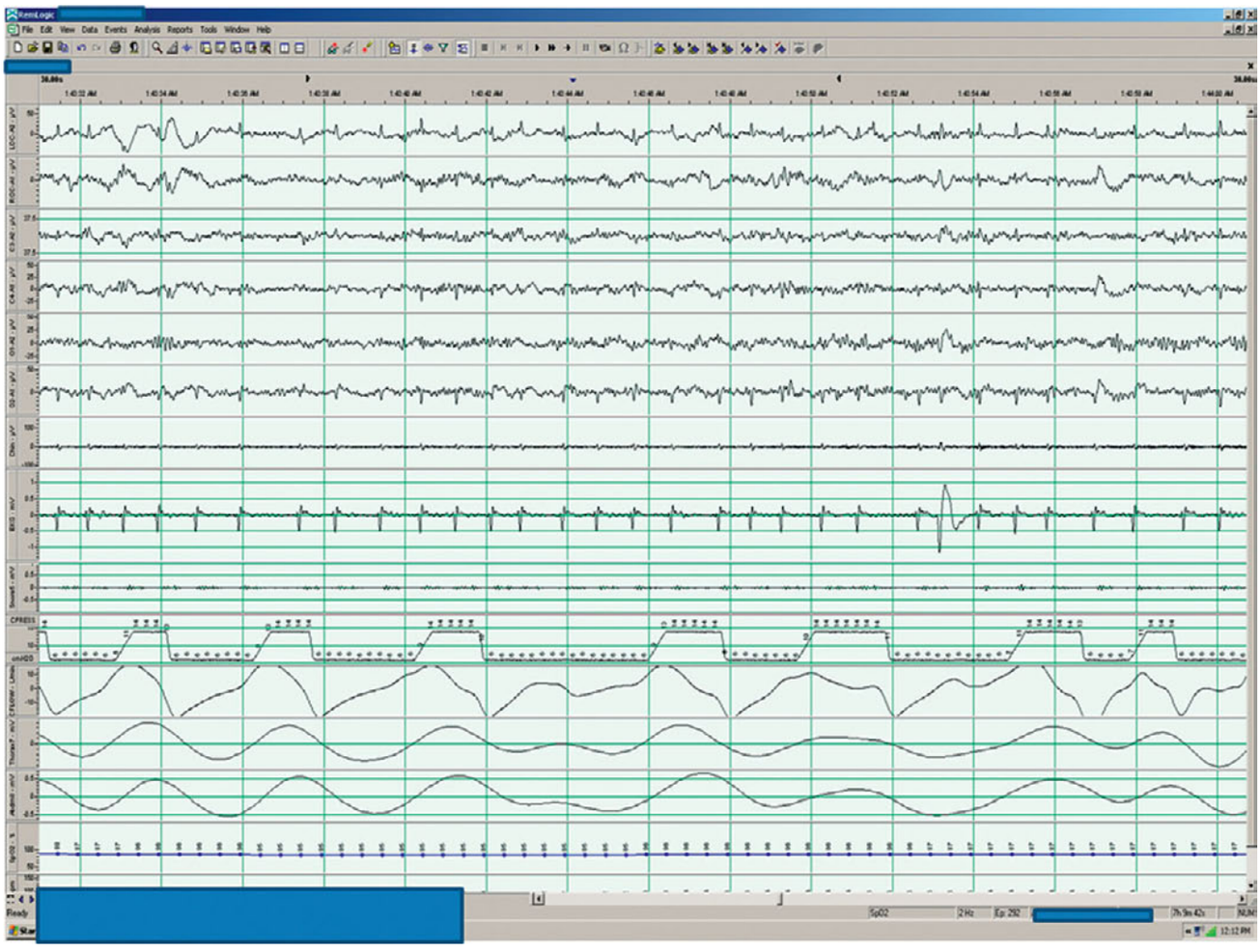
Robert C. Basner, with technical assistance from Ravi K. Persaud

A 30 second PSG epoch is shown that was recorded in a 52-year-old man being treated for sleep-related hypoventilation with bilevel nasal PAP of 14 cmH_2O IPAP and 6 cmH_2O EPAP.

Which of the following best describes the ECG displayed?

A. Ashman phenomenon
B. Sinus arrhythmia
C. Junctional rhythm
D. Sinus rhythm with first-degree atrioventricular (AV) block
E. Sinus rhythm with frequent premature supraventricular beats.

Answer on page 141.



Spo_2 by ear pulse oximetry; ECG is 8th channel from top.

CASE 6

An 81-year-old obese woman with a history of snoring

Robert C. Basner, with technical assistance from Ravi K. Persaud

Displayed below is a 60 second PSG epoch of supine sleep recorded in an 81-year-old woman with a body mass index (BMI) of 31 and a history of snoring, who is being assessed for a sleep-related breathing disorder. She is breathing room air. Her awake arterial blood gas when breathing room air prior to the study was Pao_2 of 77 mmHg and $Paco_2$ of 40 mmHg.

What is the best interpretation of the respiratory status as depicted here as consistent with the AASM Manual?

A. Snoring alone
B. Hypoventilation
C. Respiratory effort-related arousals
D. REM-related hypoxemia
E. Complex sleep apnea.

Answer on page 141.

2 Wave, $ETco_2$; Spo_2 by ear pulse oximetry. $ETco_2$ values vary from 47 to 54 mmHg, and are generally 75 mmHg as displayed. Spo_2 values are in the 93–94% range.

CASE 7

A 33-year-old obese man with idiopathic pulmonary fibrosis and snoring

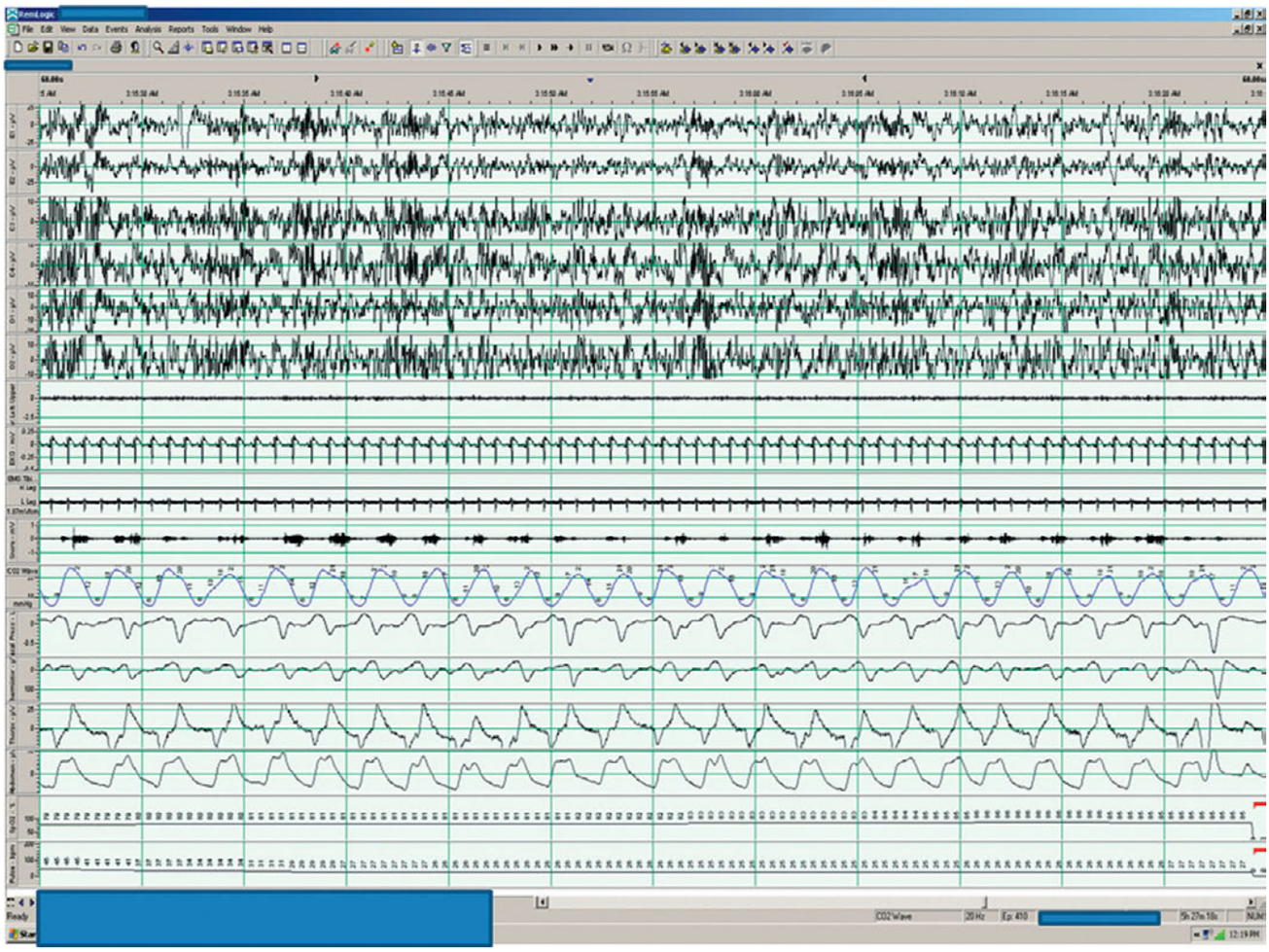
Robert C. Basner, with technical assistance from Ravi K. Persaud

The following 60 second epoch of non-REM (NREM) sleep is from a PSG recording in a 33-year-old man with a BMI of 35, snoring, and idiopathic pulmonary fibrosis awaiting lung transplant.

What is the best PSG interpretation of the cause of the hypoxemia depicted on this tracing?

A. Hypoventilation
B. Obstructive sleep apnea (OSA)
C. Snoring alone
D. Artifact
E. Complex sleep apnea.

Answer on page 142.



Abdomen, abdominal respiratory inductance plethysmography; CO2 wave, $ETco_2$; Left-upper, submental EMG; Thorax, thoracic respiratory inductance plethysmography; Spo_2 by ear pulse oximetry. Spo_2 values are in the high 70 to mid 80% range (2nd channel from bottom). $ETco_2$ (7th channel from bottom) is < 30 mmHg throughout tracing. Pulse is displayed as the bottommost channel and shows values of $\leqslant 45$ bpm throughout the tracing.

CASE 8

A 57-year-old woman with moderate obstructive sleep apnea

Robert C. Basner, with technical assistance from Ravi K. Persaud

The following is a 30 second epoch from a nocturnal PSG performed in a 57-year-old woman with moderate OSA undergoing titration with CPAP.

Which one of the following parameters present in this tracing is both necessary and sufficient to score this epoch as stage R (REM) sleep?

A. Low-amplitude, mixed frequency EEG
B. REMs
C. Low chin EMG tone
D. Sawtooth waves
E. Irregular shallow airflow and breathing efforts
F. None of the above.

Answer on page 142.

R leg, L leg, pretibial EMG, right and left respectively; Spo_2 by ear pulse oximetry.

CASE 9

A 57-year-old woman with potential obstructive sleep apnea

Robert C. Basner, with technical assistance from Ravi K. Persaud

The following is a 60 second PSG tracing from a 57-year-old woman being studied to assess for OSA. Her awake baseline $ETco_2$ was 38 mmHg. The tracing occurs with the patient supine in REM sleep.

What is the best interpretation of the respiratory event which occurs between 1:38:40 a.m. and 1:39:00 a.m.?

A. Obstructive apnea only
B. Hypopnea only
C. Hypoventilation only
D. Respiratory effort-related arousal only
E. Mixed apnea only
F. Any of A, B or C can be scored by current scoring rules.

Answer on page 143.

Spo_2 from ear pulse oximetry (2nd channel from bottom). Spo_2 nadir is 92% (decreased from 97%) for the event in question.

CASE 10 An 80-year-old man with heart failure and previously documented Cheyne–Stokes breathing

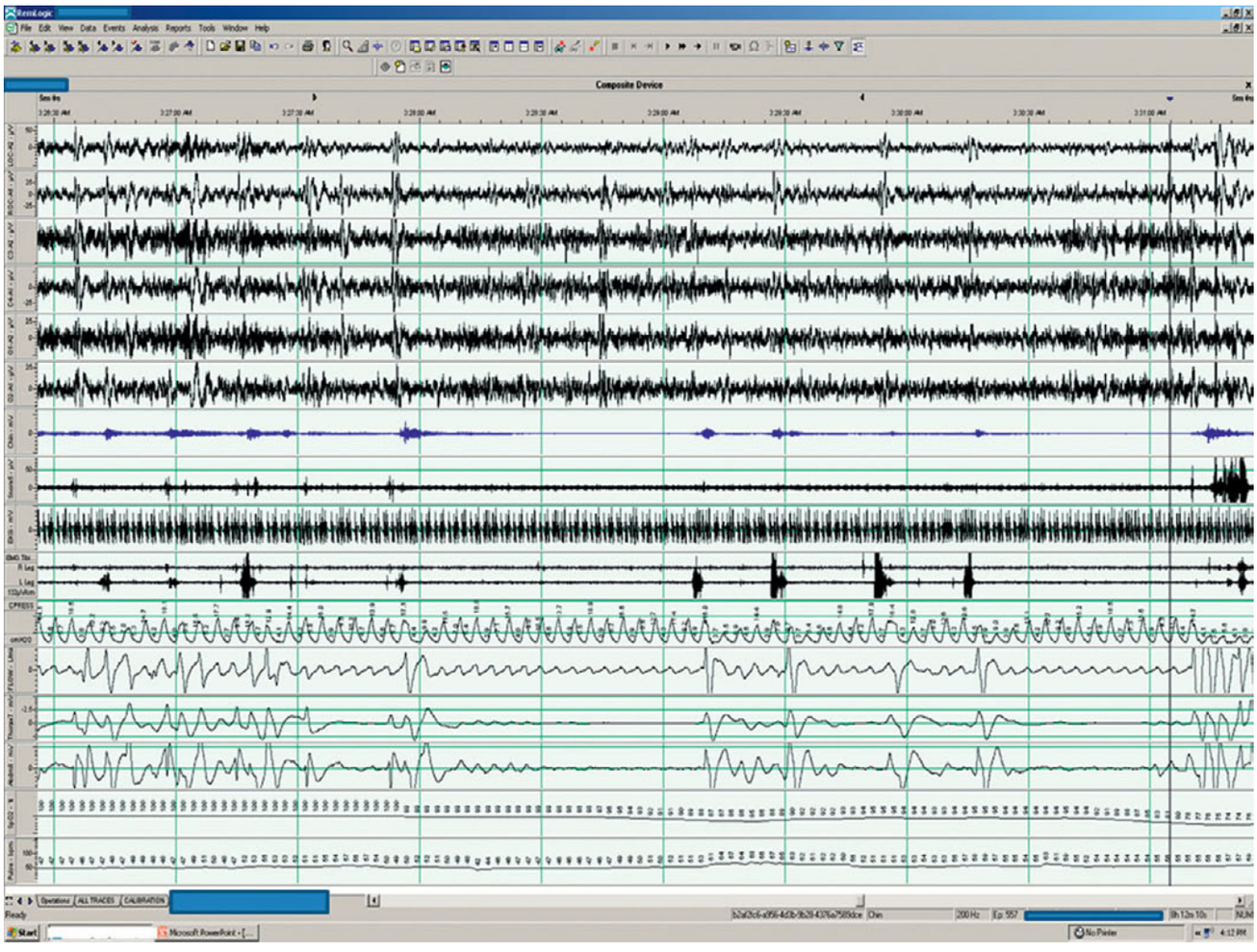
Robert C. Basner, with technical assistance from Ravi K. Persaud

The following 5 minute PSG tracing was recorded during NREM sleep with the application of servo PAP ventilation in an 80-year-old man with heart failure and previously documented Cheyne–Stokes breathing. The patient is supine using a hybrid (oral mask with nasal prongs) interface. The technician notes a large air leak at the time of this tracing. The back-up rate for the ventilation is 15 breaths/min.

What is the best interpretation of the respiratory status of this patient based on the displayed tracing?

A. Cheyne–Stokes breathing
B. Patient–ventilator asynchrony
C. Mixed apneas
D. Expected response to servo ventilation in NREM sleep
E. None of the above.

Answer on page 144.



Spo_2 by ear pulse oximetry. Nadir Spo_2 (2nd channel from bottom) is 85% for the middle respiratory event, and 74% for the last respiratory event shown.