



Stanford
MEDICINE

Otolaryngology
Head & Neck Surgery

 **Zaghi** MD

Otolaryngology- Sleep Medicine *OTE In-Service Exam Review*

Sleep Physiology & Intro to Polysomnography

Soroush Zaghi, MD

Snoring and Sleep Apnea Surgery

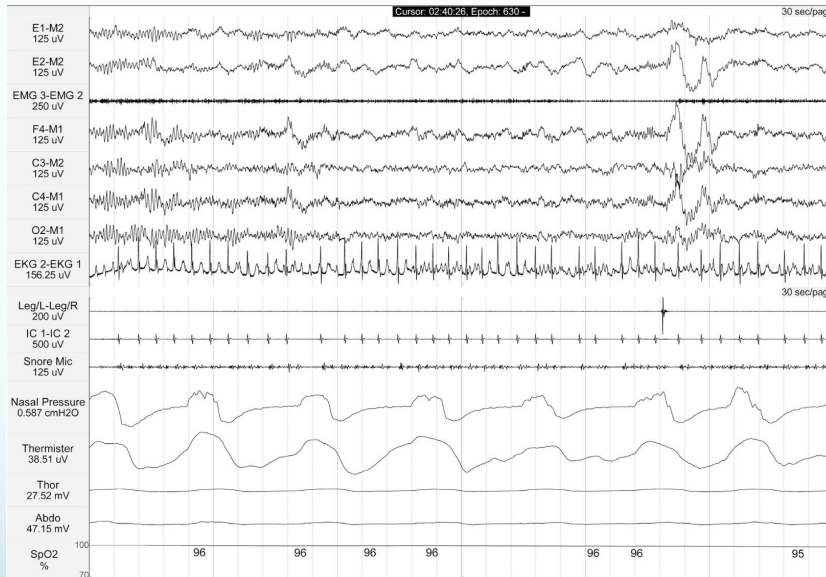
Maxillofacial and Airway Reconstruction Surgery

General Otolaryngology- Head and Neck Surgery



Sleep Medicine Topics

- Sleep Physiology and Evaluation

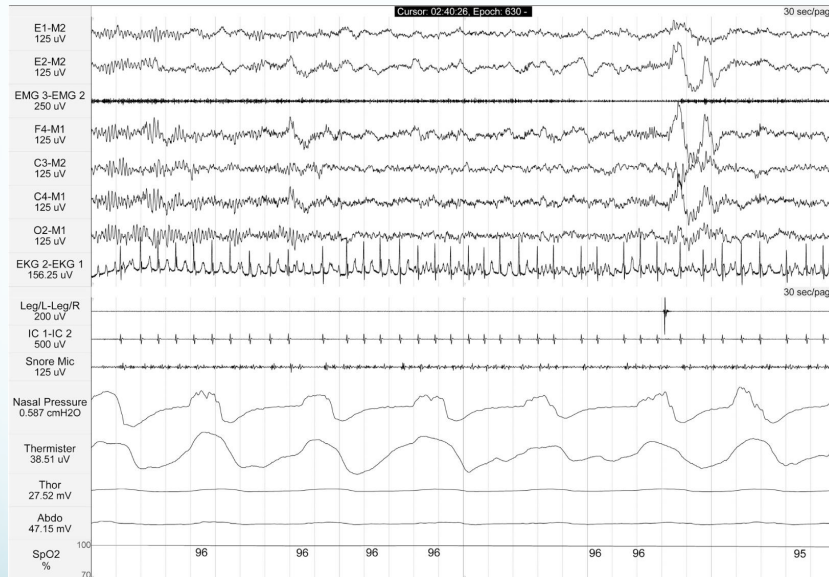


- Anatomy and Physical Exam
- Non-Surgical Treatment Options
- Surgical Treatment Options
- Circadian Rhythm Disorders
- Restless Leg Syndrome
- Insomnia
- Narcolepsy



Sleep Medicine Topics

- Sleep Physiology and Evaluation



- Stages of Sleep
- Interpreting Polysomnography Results
- Ordering a Sleep Study

Choose your response:



Respond at Pollev.com/soroushzaghi575



Text **SORUSHZAGHI575** to 22333 once to join, then **A, B, C, or D**





Question 1. Which stage of sleep constitutes 45-55% of total sleep time for adults?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM



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Question 1. Which stage of sleep constitutes 45-55% of total sleep time for adults?

- (A) Stage 1
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- (C) Stage 3
- (D) REM

Answer:

Stage 1: 2%-5%

Stage 2: 45%-55%

Stage 3: 5%-20%

REM: 20%-25%



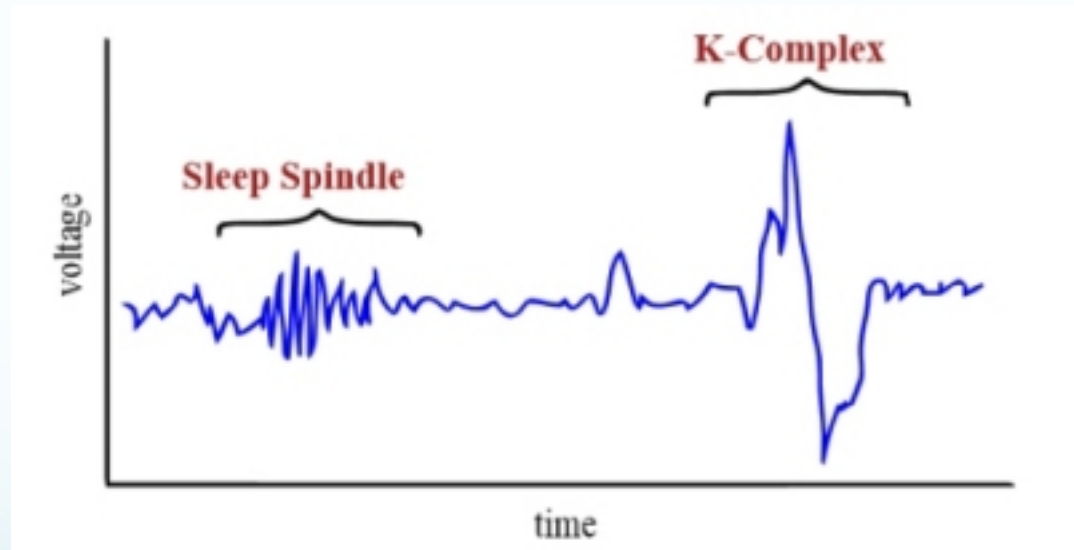
Sleep Physiology

- Sleep occurs in cycles of 90-120 minutes.
- **Stage 1** is the transition between wakefulness and sleep.
 - Short period of very light, easily disrupted sleep.
 - Usually lasting less than 10 minutes.
 - Sleeper may be aware of sounds and conversations, but feels unwilling, rather than unable, to respond to them.
 - A person awakened during this period will often believe they have never slept at all.
- **Stage 2**
 - First unequivocal stage of sleep
 - Muscle activity decreases still further and conscious awareness of the outside world begins to fade completely.
 - More time is spent in stage 2 sleep than in any other single stage
- **Stage 3** is deep sleep.
 - The sleeper is even less responsive to the outside environment
 - Essentially cut off from the world and unaware of any sounds or other stimuli.
 - Transition to **REM sleep**.



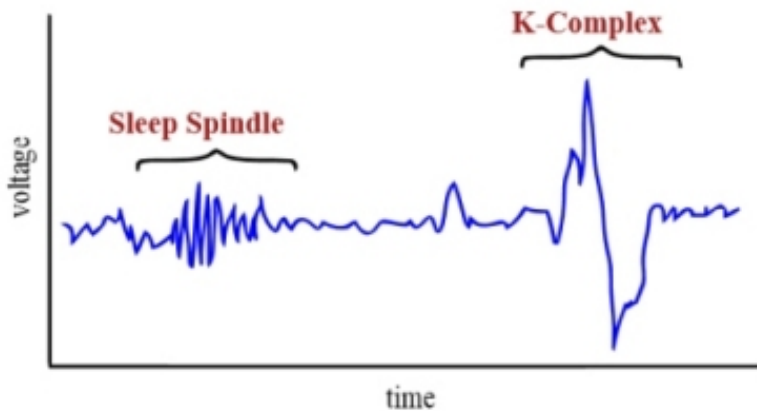
Question 2. Which stage of sleep is characterized by sleep spindles and K-complexes?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM





Stage 2 is noted by the presence of sleep spindles and K complexes.

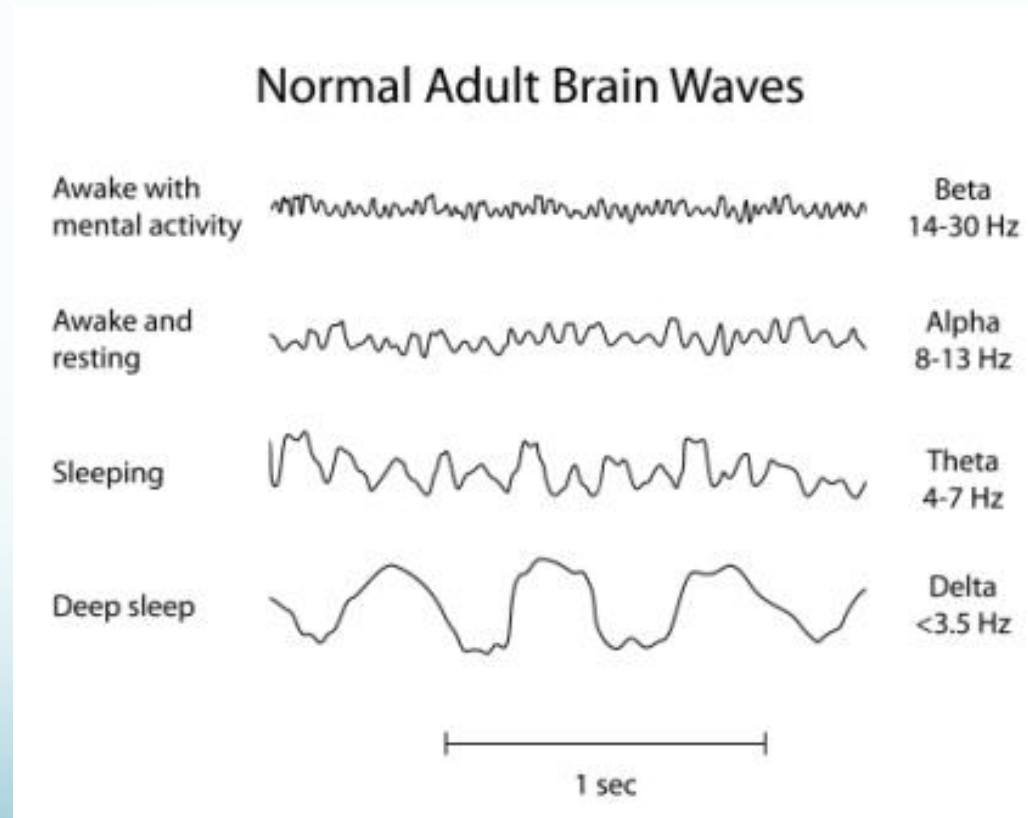


Sleep spindles (short bursts of brain activity in the region of 12-14 Hz, lasting maybe half a second each, also known as sigma waves)

K-complexes (short negative high voltage peaks, followed by a slower positive complex, and then a final negative peak, with each complex lasting 1-2 minutes).

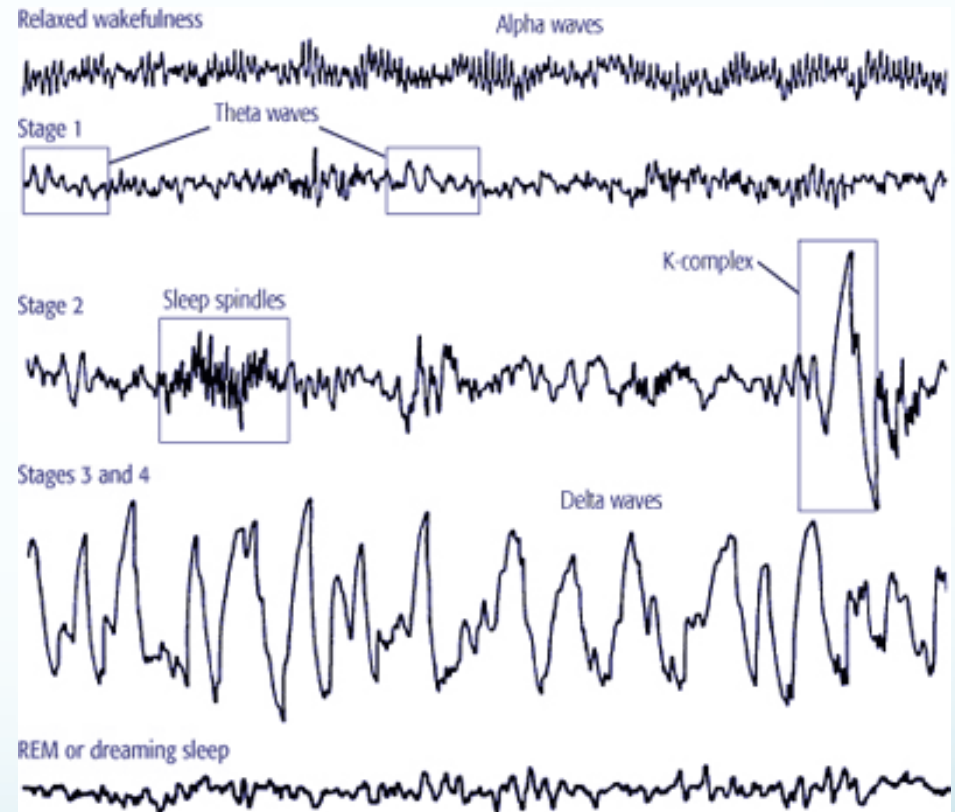
Question 3. Which stage of sleep is characterized as a transition from relatively unsynchronized beta waves (14-30 Hz) to more synchronized but slower alpha waves (8-13 Hz) and then theta waves (4-7 Hz).

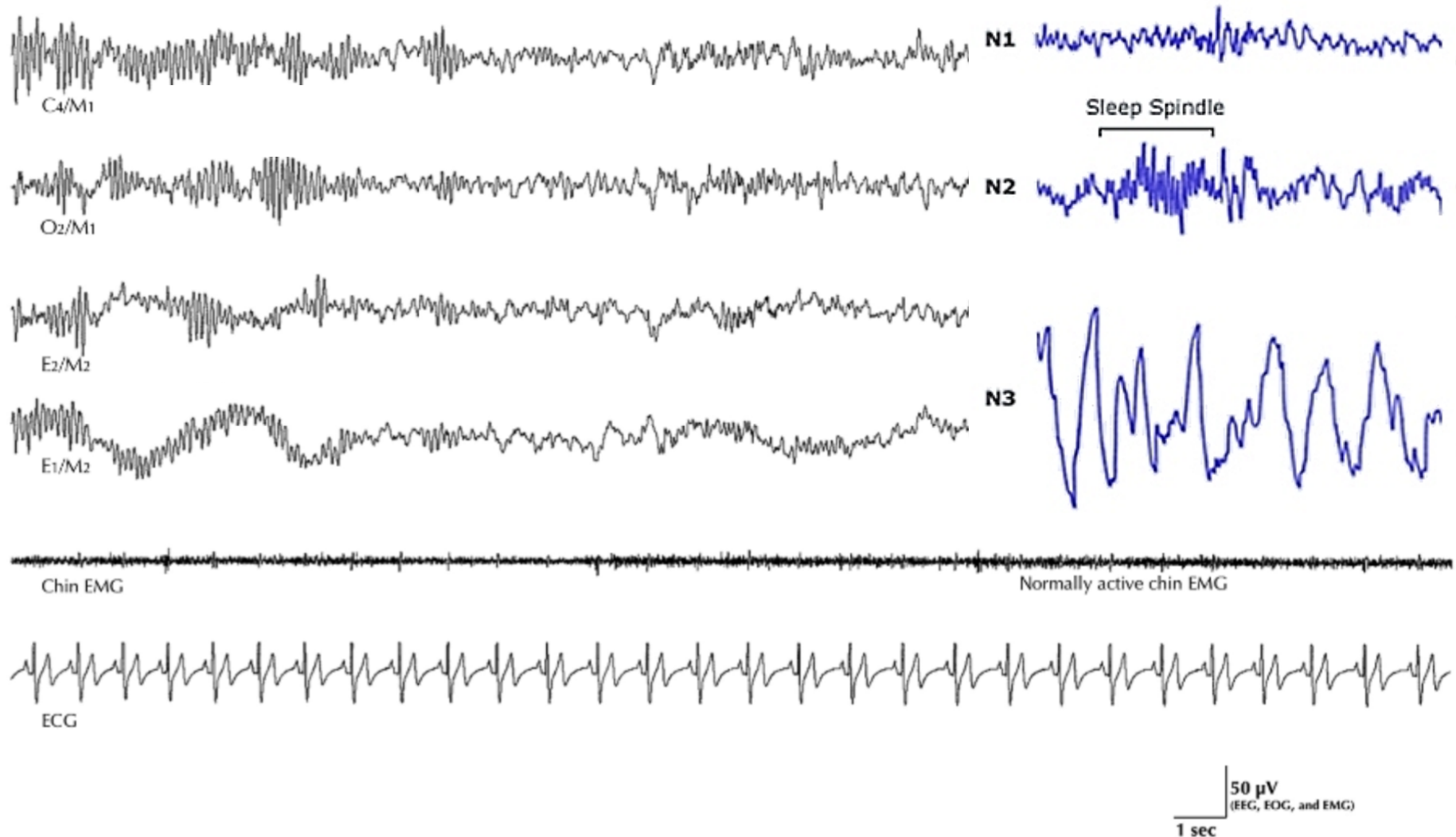
- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM





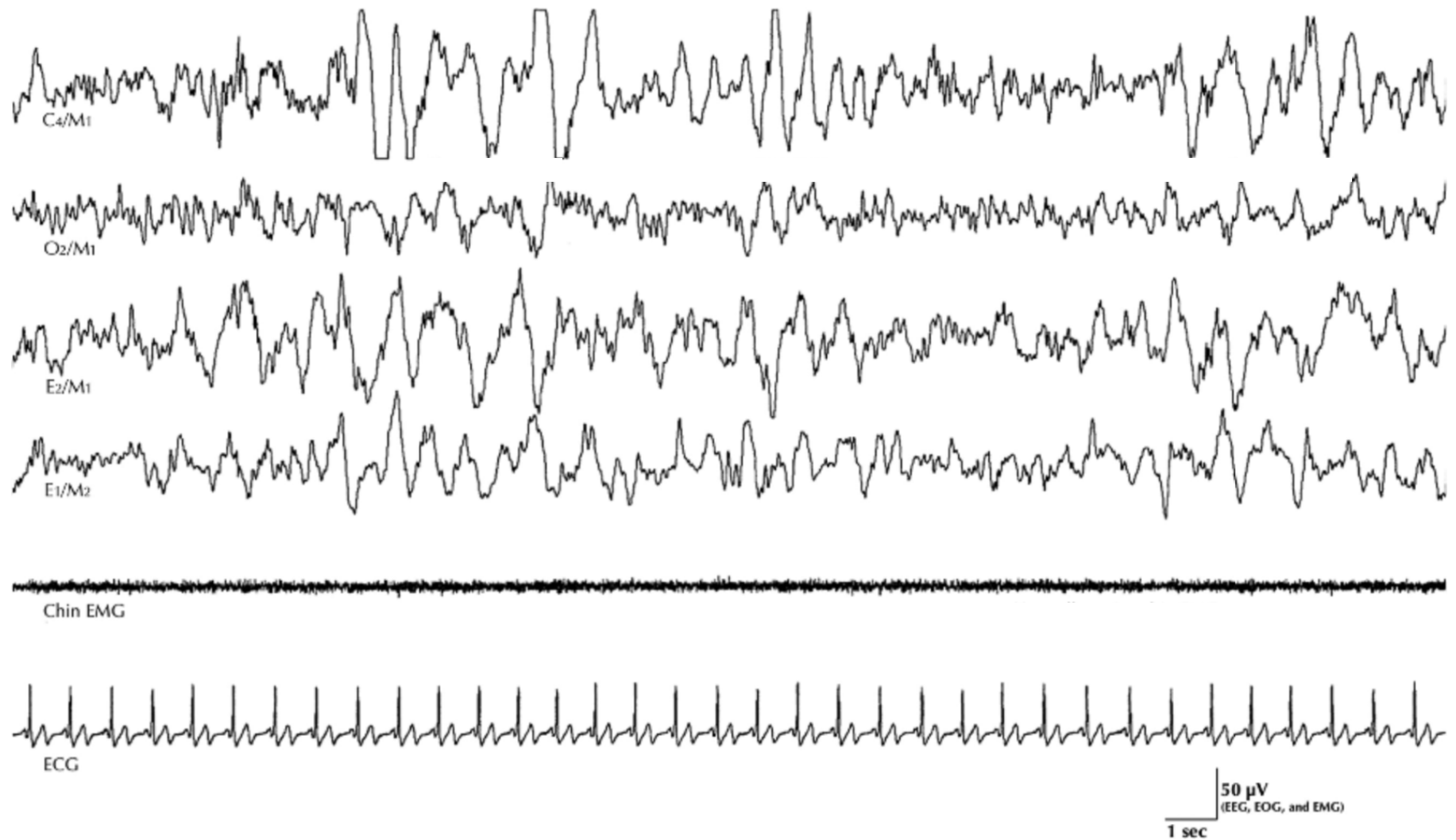
- Stage 1 is characterized by vertex sharp waves and slow eye movements.
- Stage 2 is noted by the presence of sleep spindles and K complexes.
- Stage 3 is characterized by slow-wave (delta) sleep.
- REM sleep is characterized by low EMG tone and rapid eye movement.





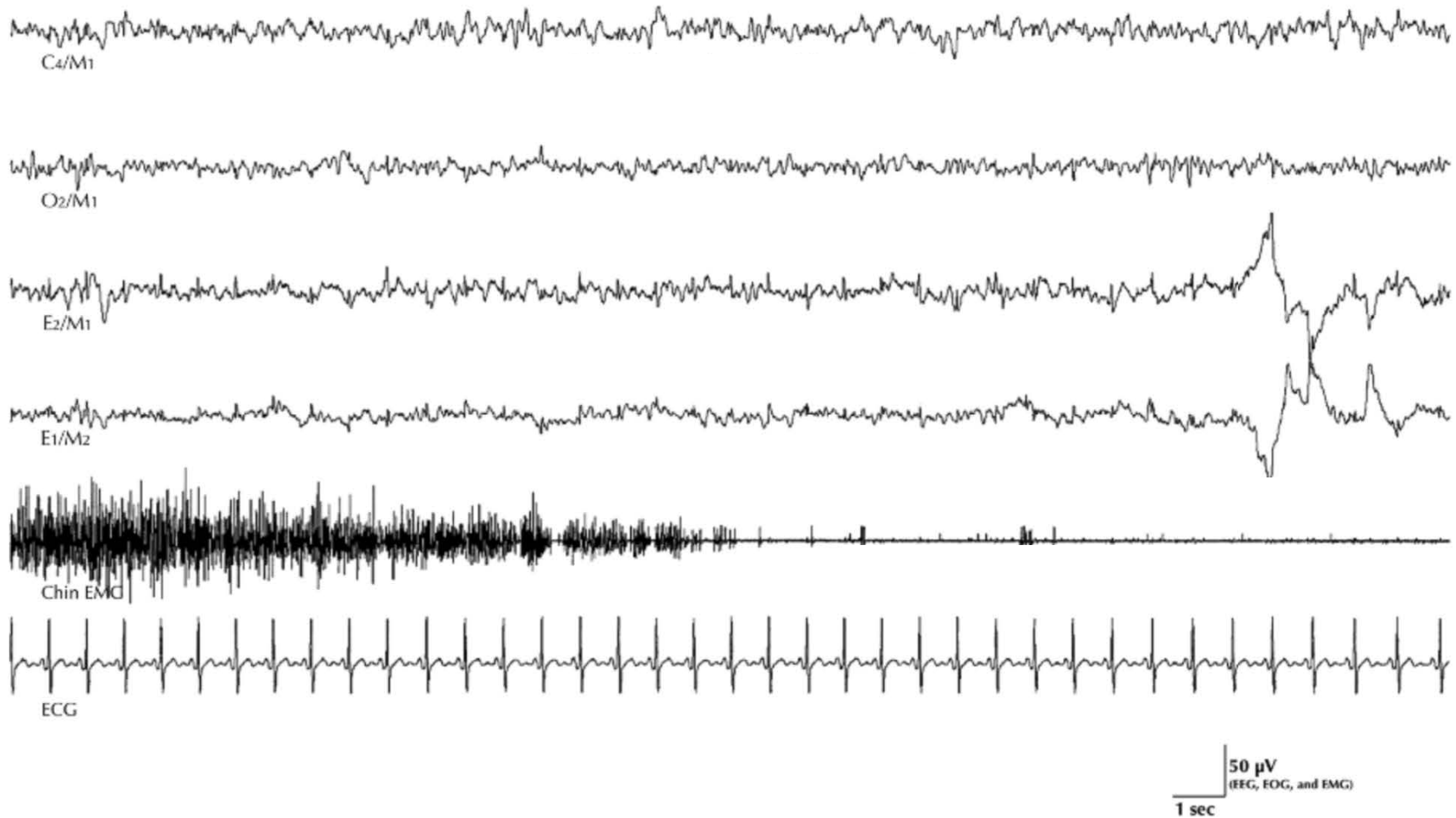
Question 4. Which stage of sleep is characterized by this pattern?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM



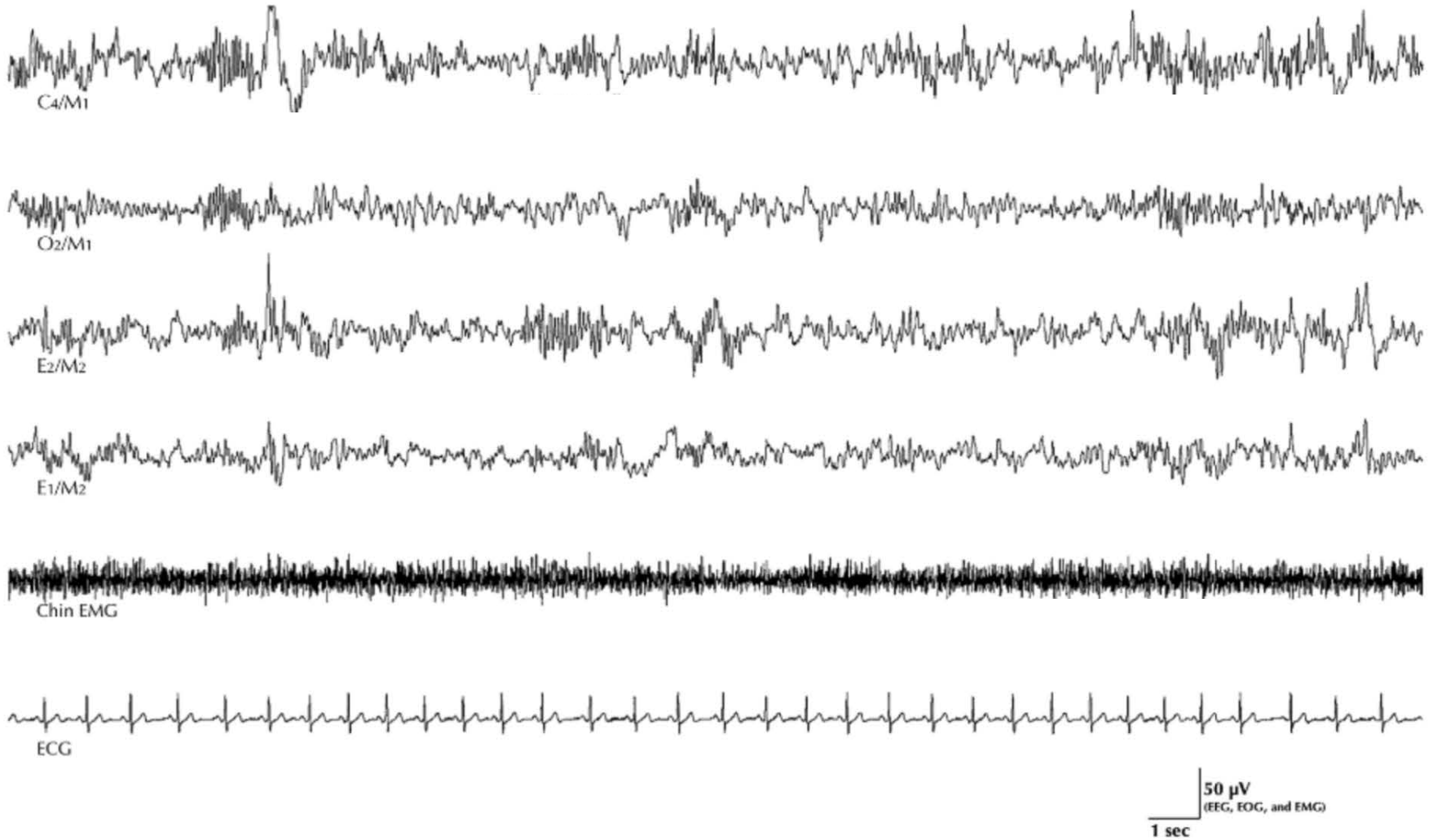
Question 5. Which stage of sleep is characterized by this pattern?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM



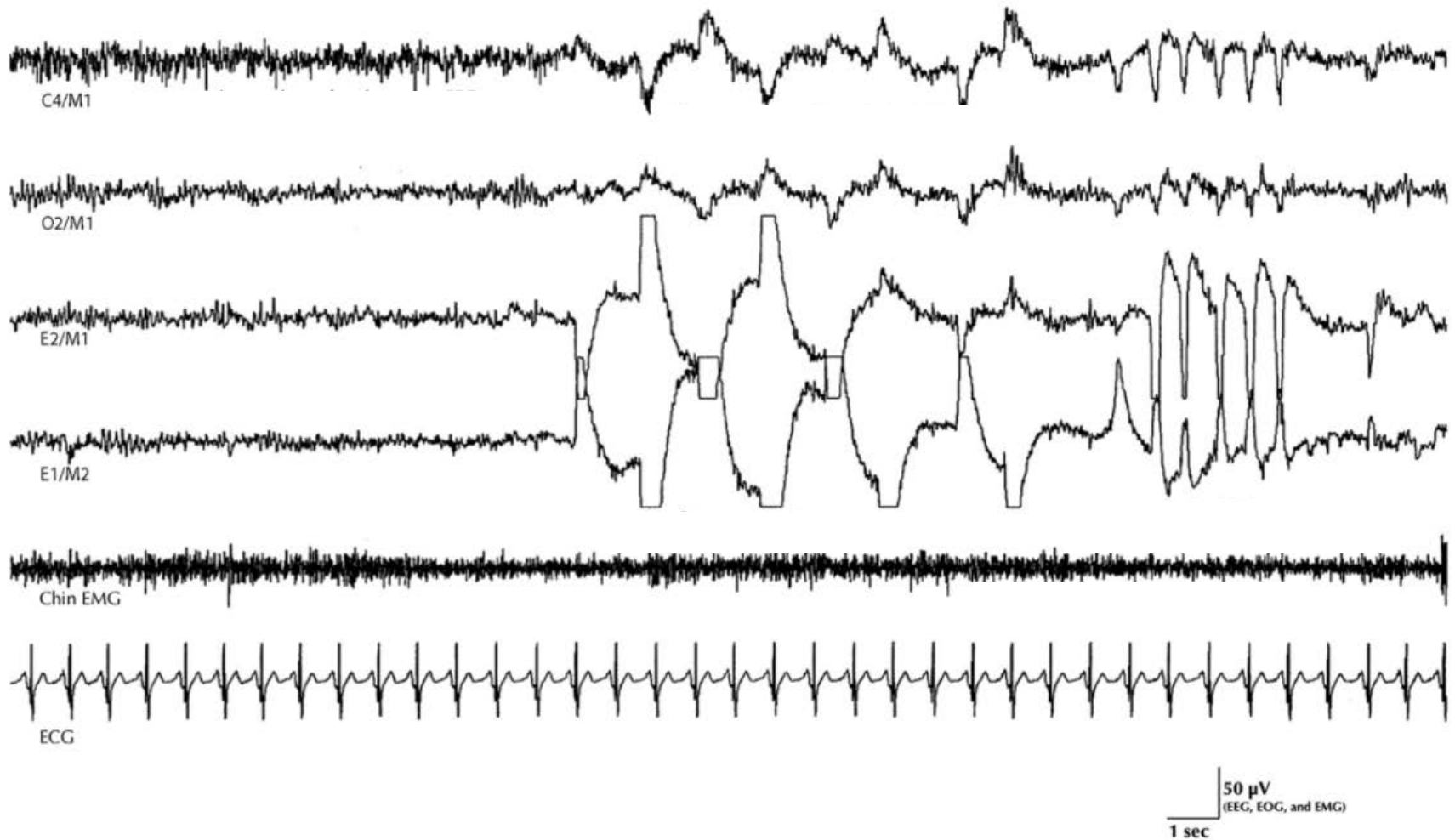
Question 6. Which stage of sleep is characterized by this pattern?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM



Question 7. Which stage of sleep is characterized by this pattern?

- (A) Stage 1
- (B) Stage 2
- (C) Stage 3
- (D) REM



Question 8. Which stage of sleep is characterized by this pattern?

- (A) Awake
- (B) Non-REM
- (C) REM
- (D) All of the above.



Question 9. Which of the following apnea-hypopnea indices are diagnostic of moderate obstructive sleep apnea in an adult?

- (A) 5 to < 15 event/hr
- (B) 15 to < 30 events/hr
- (C) 30 to < 45 events/hr
- (D) 45 to < 60 events/hr

Normal:

Less than 5 events/hr.

Mild Sleep Apnea:

5 to less than 15 events/hr.

Moderate Sleep Apnea:

15 to less than 30 events/hr.

Severe Sleep Apnea:

More than 30 events/hr.



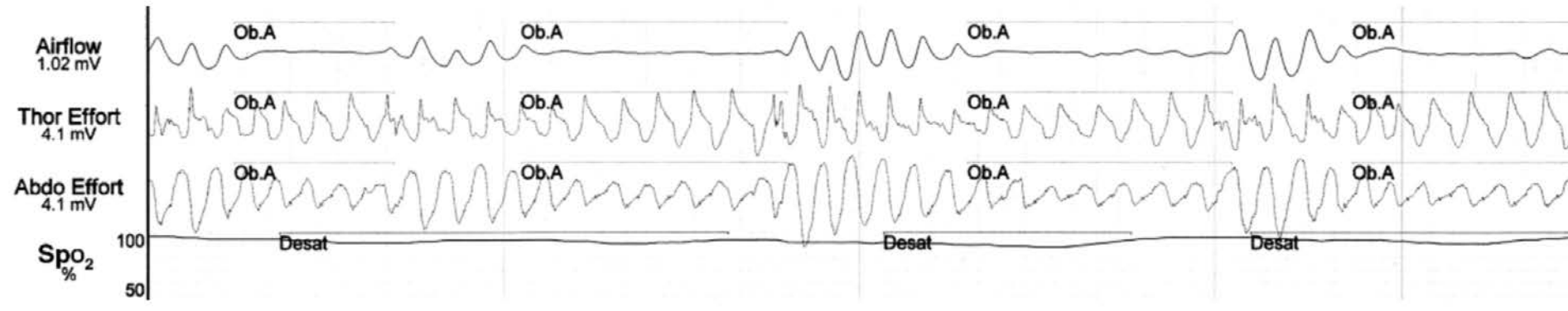
Question 10. In terms of respiratory scoring data, apnea is defined as a >90% cessation of airflow (pause in breathing) that must last for at least:

- (A) 5 seconds
- (B) 10 seconds
- (C) 15 seconds
- (D) 20 seconds

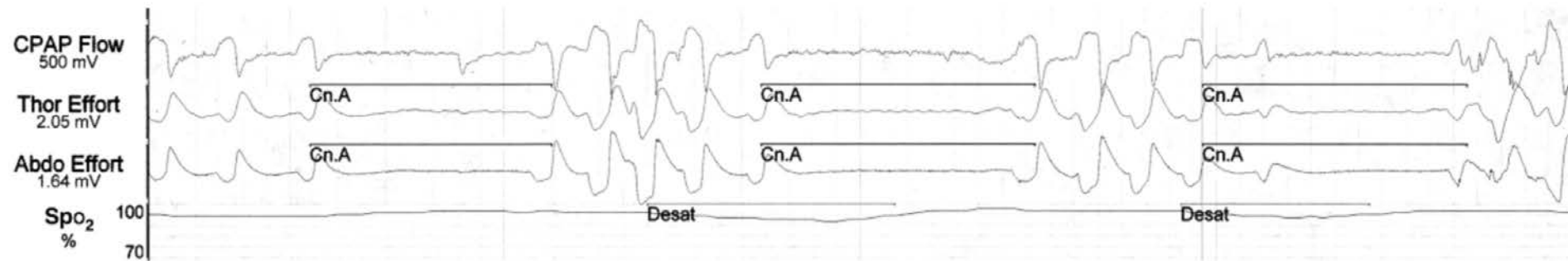
Apnea is defined as a >90% cessation of airflow (pause in breathing) that must last for at least 10 seconds.

Apnea is defined as a >90% cessation of airflow (pause in breathing) that must last for at least 10 seconds.

Obstructive: With respiratory effort



Central: No respiratory effort



Question 11. In terms of respiratory scoring data, ***hypopnea*** is characterized as:

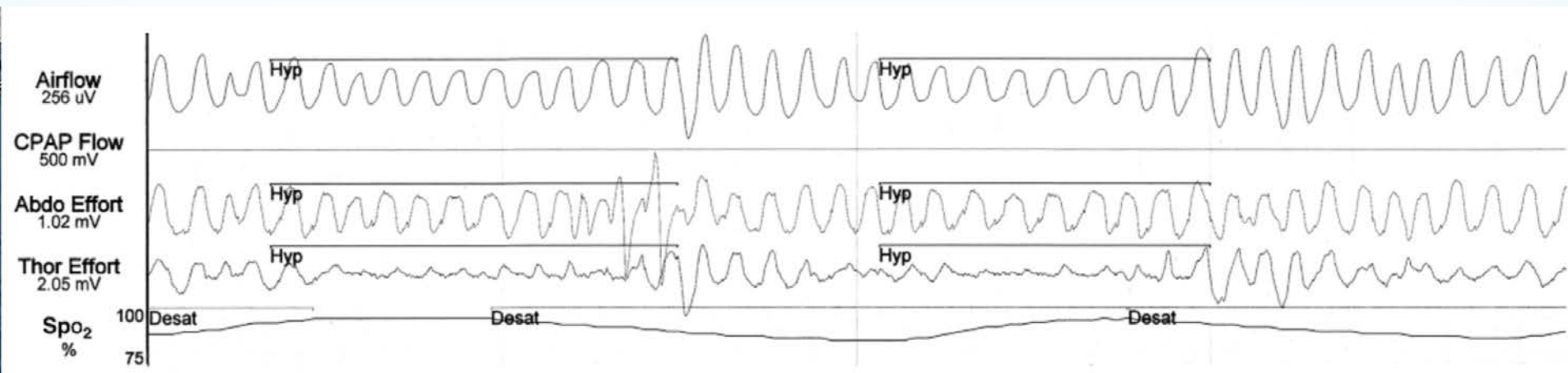
- (A) Reduction of airflow by at least 30%, lasting at least 10 seconds, that is associated with >4% desaturation
- (B) Reduction of airflow by at least 50%, lasting at least 10 seconds, that is associated with >3% desaturation or arousal
- (C) A reduction of airflow of >30%, lasting at least 10 seconds, that is associated with a >3% decrease in blood oxygenation or arousal
- (D) All of the above.

Hypopnea is characterized as:

Reduction of airflow by at least 30%, lasting at least 10 seconds, that is associated with 3% desaturation or arousal (AASM 2012)

OR Medicare Rules: → Follow AASM 2007 Guideline

Reduction of airflow of >50%, lasting at least 10 seconds, that is associated with a >3% decrease in blood oxygenation or arousal (AASM 2007)



Hypopnea is characterized as:

Reduction of airflow by at least 30%, lasting at least 10 seconds, that is associated with 3% desaturation or arousal (AASM 2012)

Medicare Rules: ➔ Follow AASM 2007 Guideline

(Recommended) Reduction of airflow by at least 30%, lasting at least 10 seconds, that is associated with >4% desaturation

(Alternative) Reduction of airflow by at least 50%, lasting at least 10 seconds, that is associated with >3% desaturation or arousal

Question 11. In terms of respiratory scoring data, ***hypopnea*** is characterized as:

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MEDICARE: AASM 2007
Recommended

(B) Reduction of airflow by at least 50%, lasting at least 10 seconds, that is associated with >3% desaturation or arousal

MEDICARE: AASM 2007
Alternative

(C) A reduction of airflow of >30%, lasting at least 10 seconds, that is associated with a >3% decrease in blood oxygenation or arousal

AASM 2012

(D) All of the above.

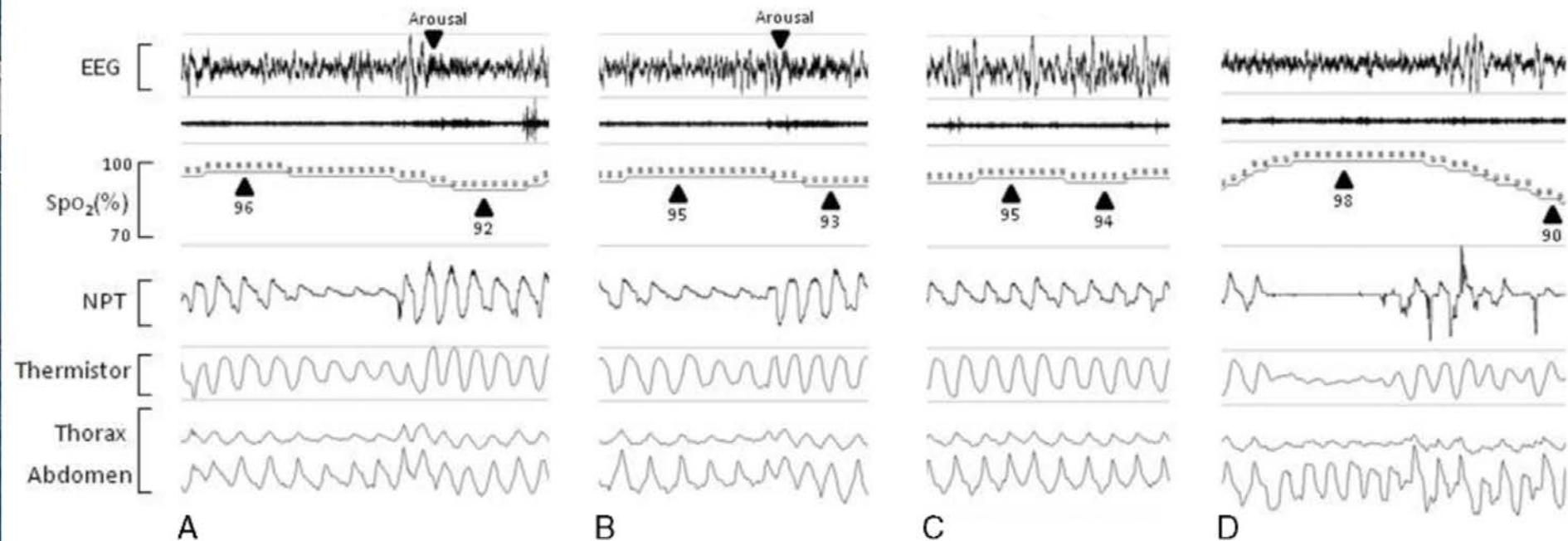
Hypopnea is characterized as:

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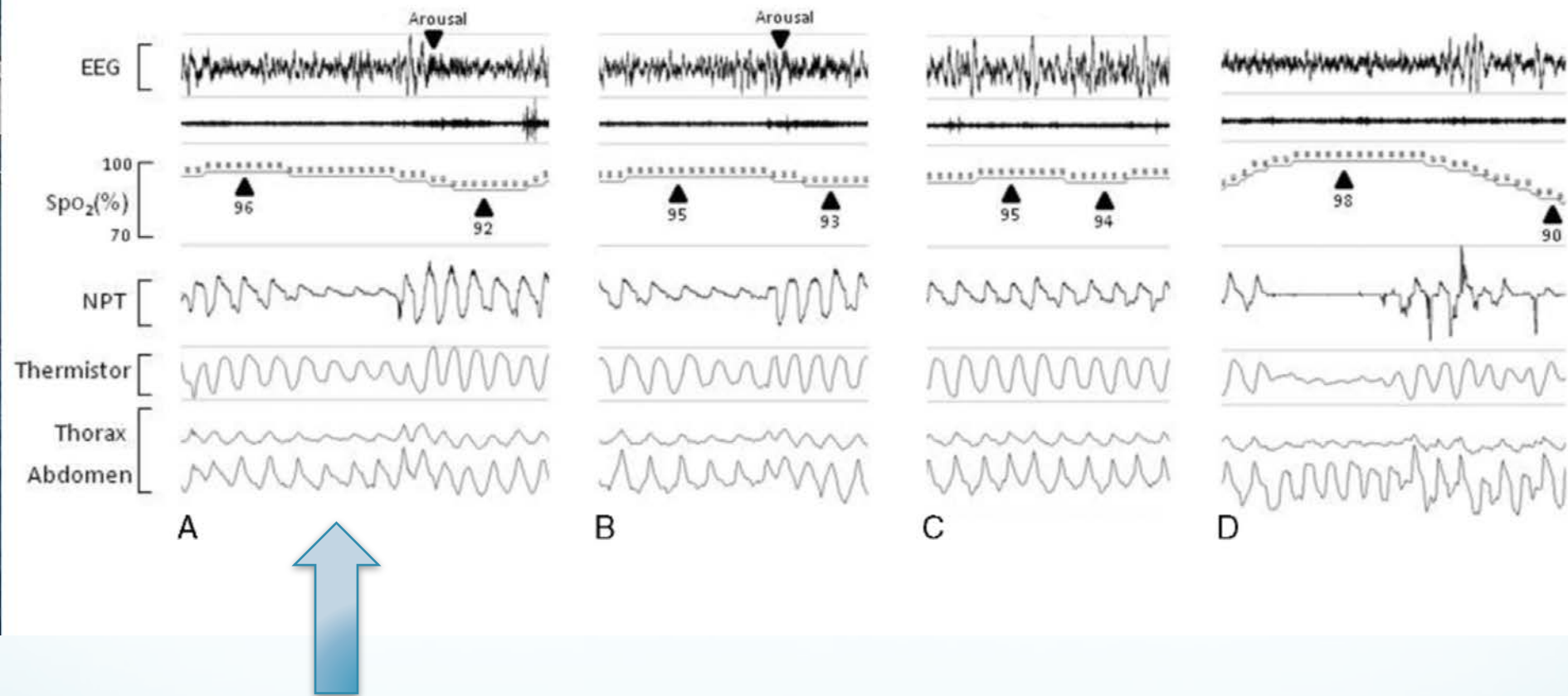
Respiratory-effort related arousals (RERAs) is characterized as:

Increasing respiratory effort for 10 seconds or more leading to an arousal from sleep, but one that does not technically fulfill the criteria for a hypopnea or apnea.

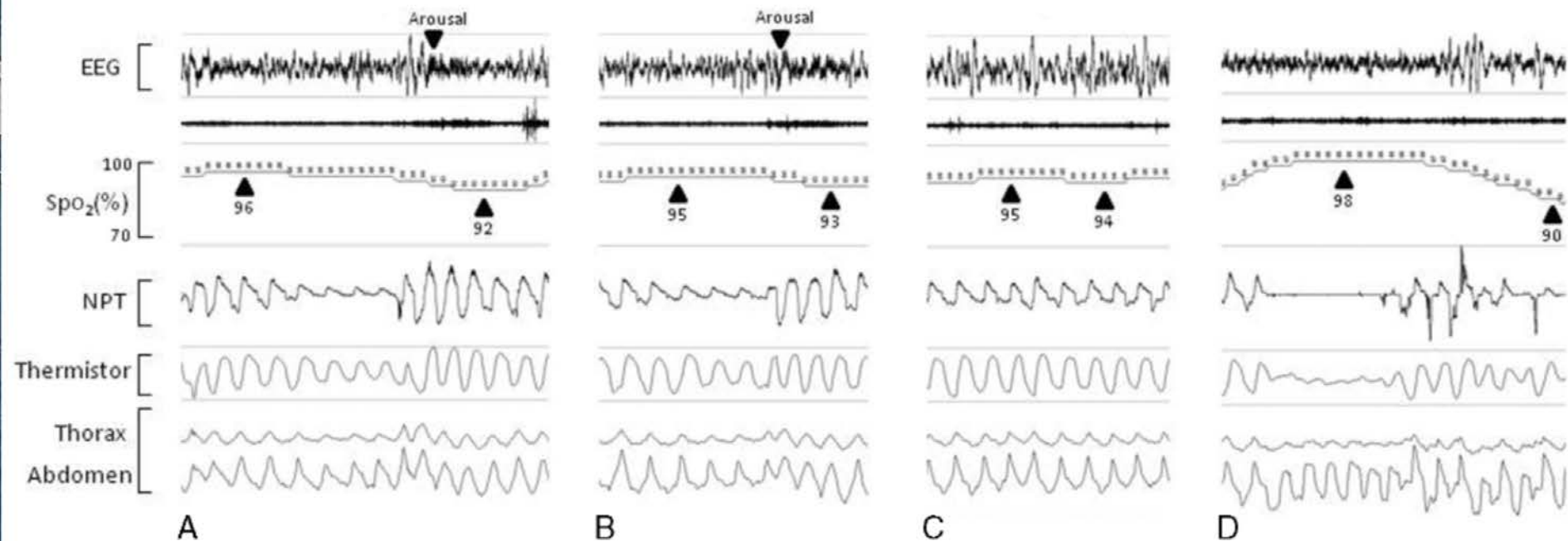
Respiratory disturbance index (RDI): Includes apnea, hypopnea, as well as respiratory-effort related arousals (RERAs).



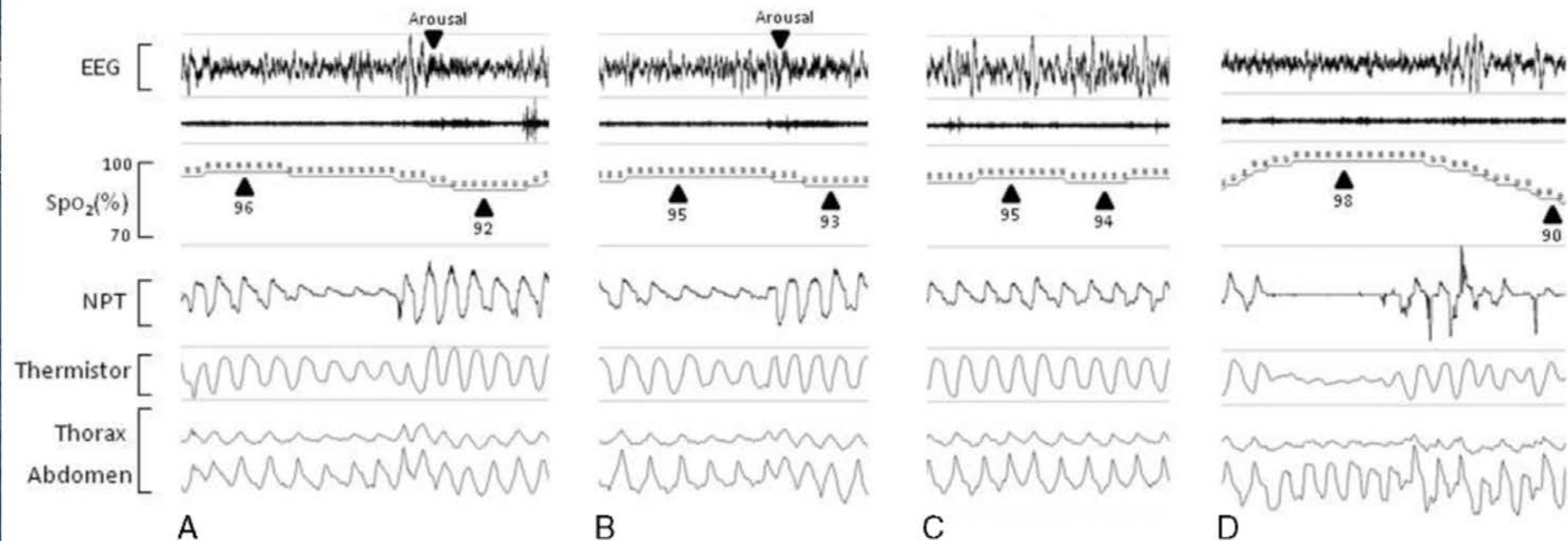
Question 12. Which polysomnogram fragment demonstrates an obstructive apnea?



Question 13. Which polysomnogram fragment demonstrates a hypopnea?

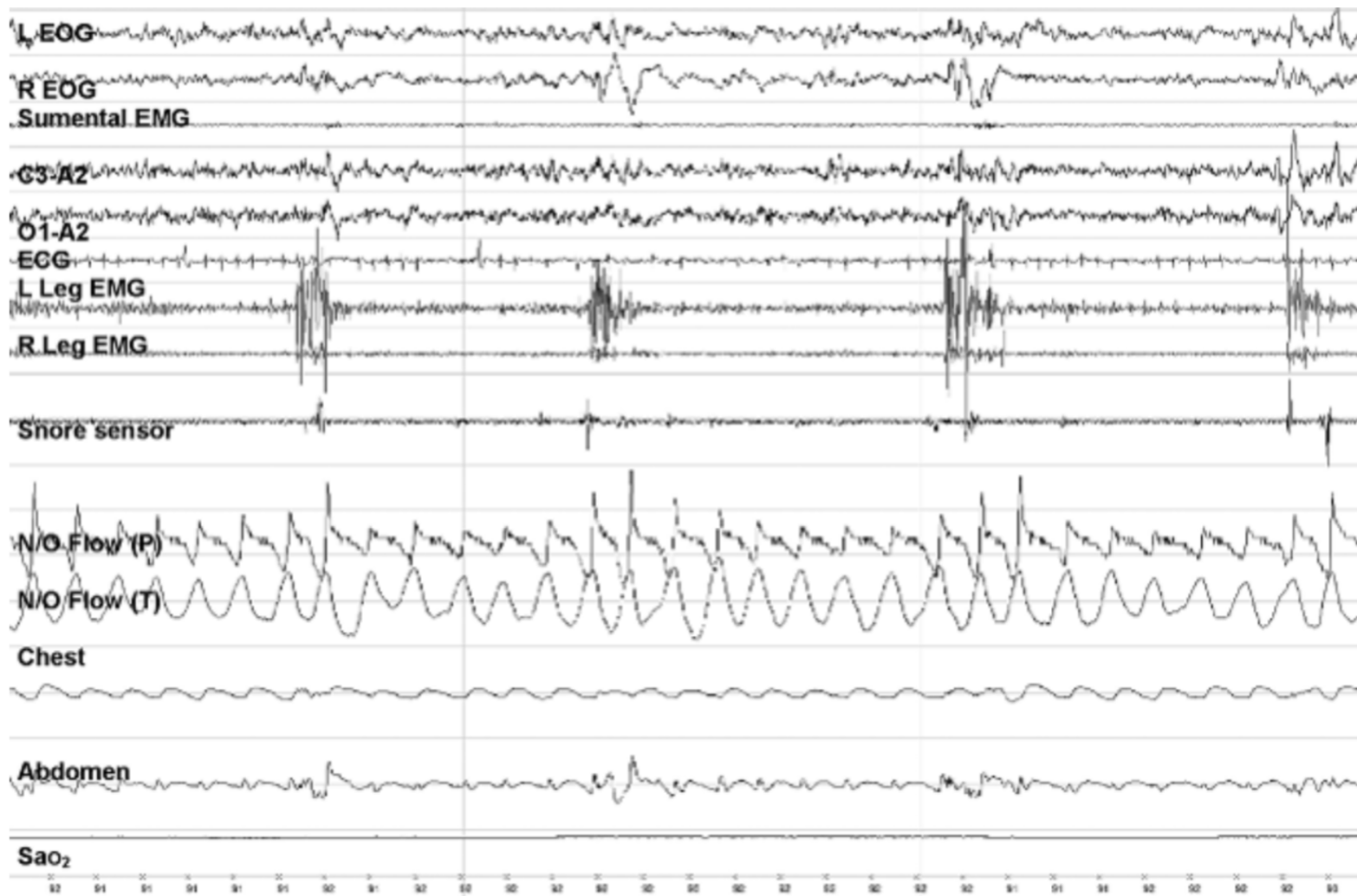


Question 14. Which polysomnogram fragment demonstrates a respiratory effort related arousal?



Choice C demonstrates stable, flow-limited breathing.



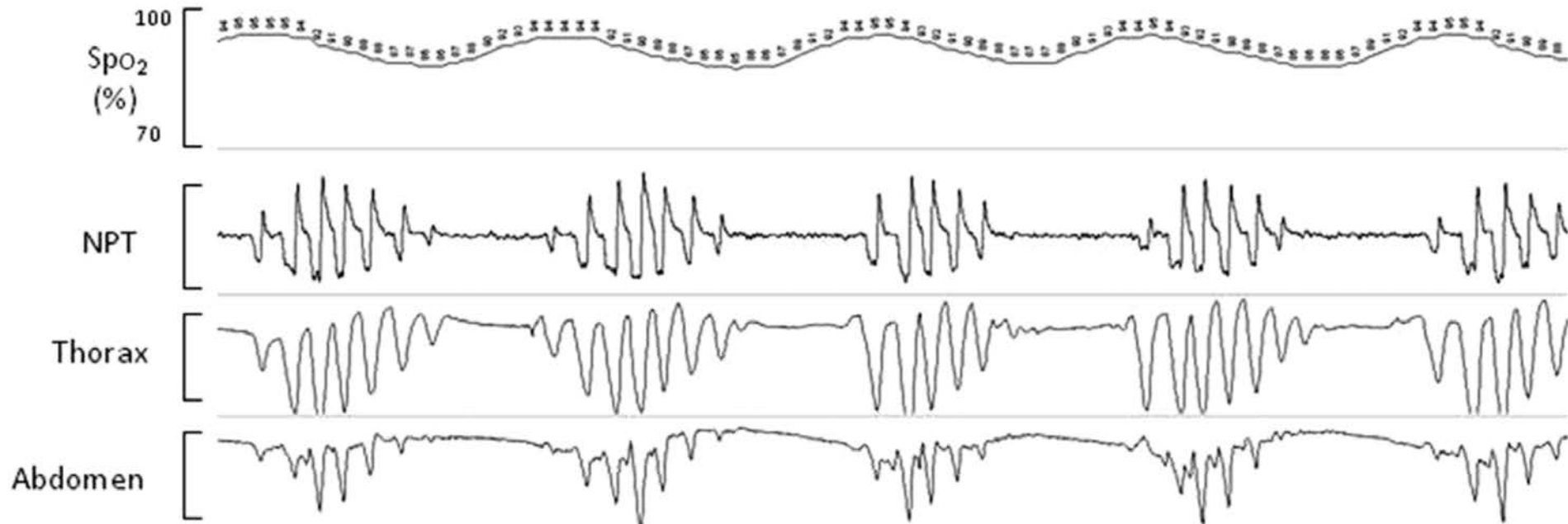


Question 15. 71-year-old man with difficulty initiating and maintaining sleep, hypertension, and dyslipidemia. His ESS score is 5.

What is the most likely diagnosis?

- (A) Upper airway resistance syndrome
- (B) Cheyne-Stokes respiration
- (C) Periodic limb movement disorder
- (D) Obstructive hypopnea syndrome

This patient has evidence of central sleep apnea with Cheyne-Stokes respiration (CSA-CSR), a respiratory pattern characterized by a crescendo-decrescendo pattern of ventilation.



Question 16. A 68-year-old gentleman with CHF has symptoms of intermittent awakening during sleep and excessive daytime sleepiness. A sleep study was performed to evaluate the patient for sleep-disordered breathing.

- (A) Upper airway resistance syndrome
- (B) Cheyne-Stokes respiration
- (C) Periodic limb movement disorder
- (D) Obstructive hypopnea syndrome

What is the most likely diagnosis?

TABLE 23-2 Sleep Study Results

Total recording time (minutes)	487.7
Total sleep time (minutes)	456.5
Supine (minutes)	426.5
Lateral (minutes)	30.0
Sleep efficiency	93.6%
Sleep-onset latency (minutes)	26.6
REM-onset latency (minutes)	97.5
Arousal index (events/hr)	8
Periodic limb movement index (events/hr)	0
Total apnea-hypopnea index (AHI) (events/hr)	13
Supine AHI (events/hr)	27
Lateral AHI (events/hr)	9
REM AHI (events/hr)	37
Oxyhemoglobin desaturation nadir	82.0%
Mean oxyhemoglobin saturation	94.8%

AHI, apnea-hypopnea index; REM, rapid eye movement.

Question 17. 32-year-old man is evaluated for excessive daytime sleepiness and snoring. He had an Epworth Sleepiness Scale score of 12 with no medical problems other than seasonal allergies/allergic rhinitis.

On physical examination he has a BMI of 28.3 kg/m², blood pressure of 128/87 mm Hg, pulse of 75 beats/minute, and SpO₂ of 98% on room air. A modified Mallampati class II airway, macroglossia, and retrognathia are noted. The remainder of his examination is within normal limits.

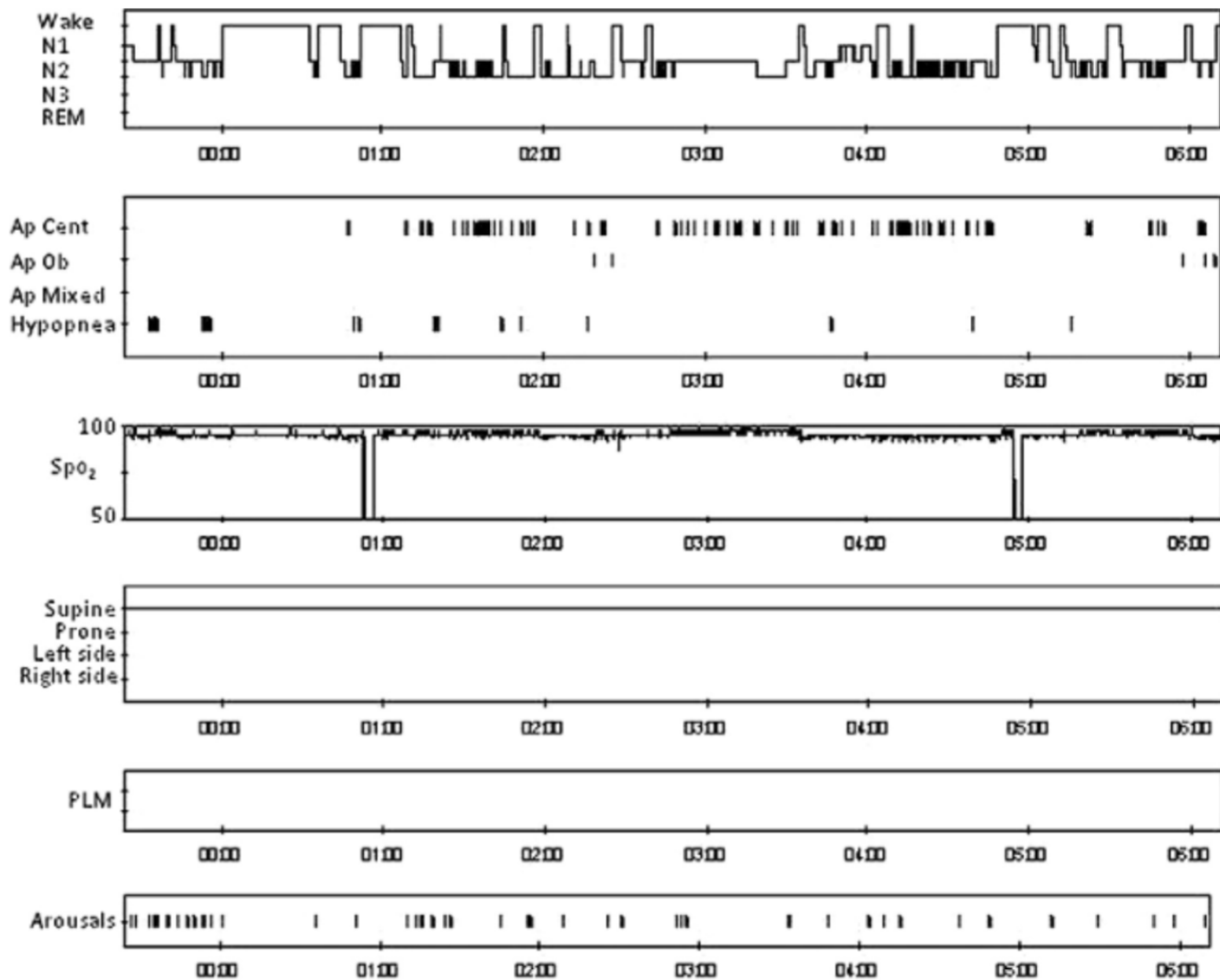
Which of the following would be the most appropriate next step?

- (A) Order a CPAP titration study.
- (B) Counsel the patient regarding weight loss strategies.
- (C) Prescribe positional therapy.
- (D) Assess whether the patient would prefer an oral appliance.

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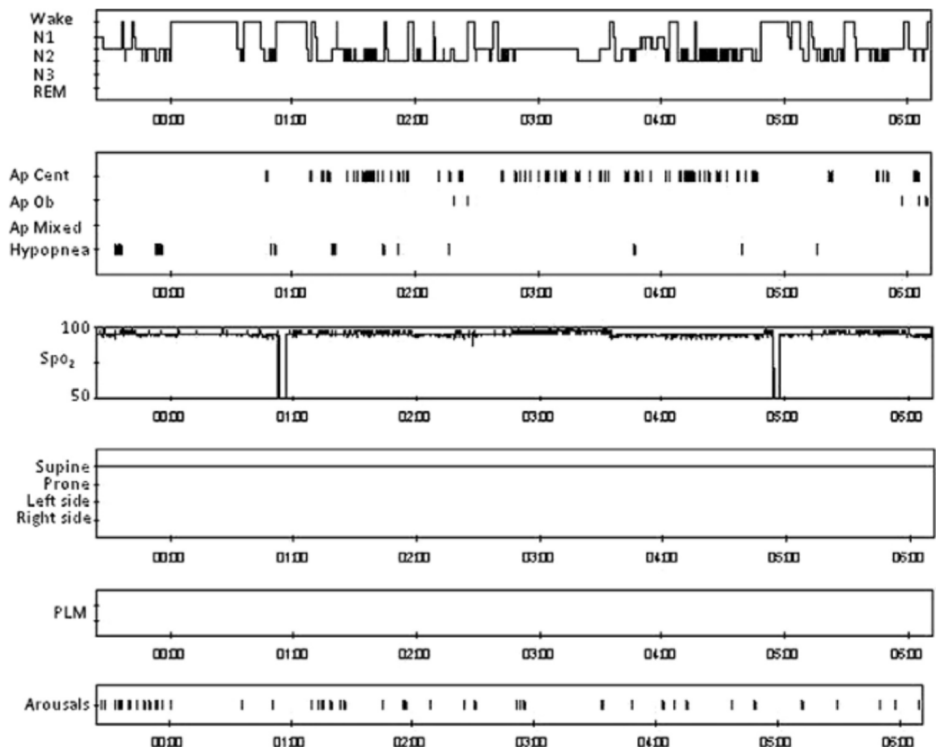
AHI, apnea-hypopnea index; REM, rapid eye movement.



Question 18. 57-year-old woman with hypertension, fibromyalgia, and interstitial cystitis complains of daytime sleepiness. She reports a history of awakening multiple times per night with pelvic pain and dysuria. Recently, her boyfriend has been complaining about her loud snoring. On examination she has a BMI of 30.1 kg/m², neck circumference of 16 inches, blood pressure of 126/80, Spo₂ of 95%, and modified Mallampati class IV airway. The remainder of her examination is within normal limit.

Which of the following medications is most likely to be associated with her sleep-disordered breathing?

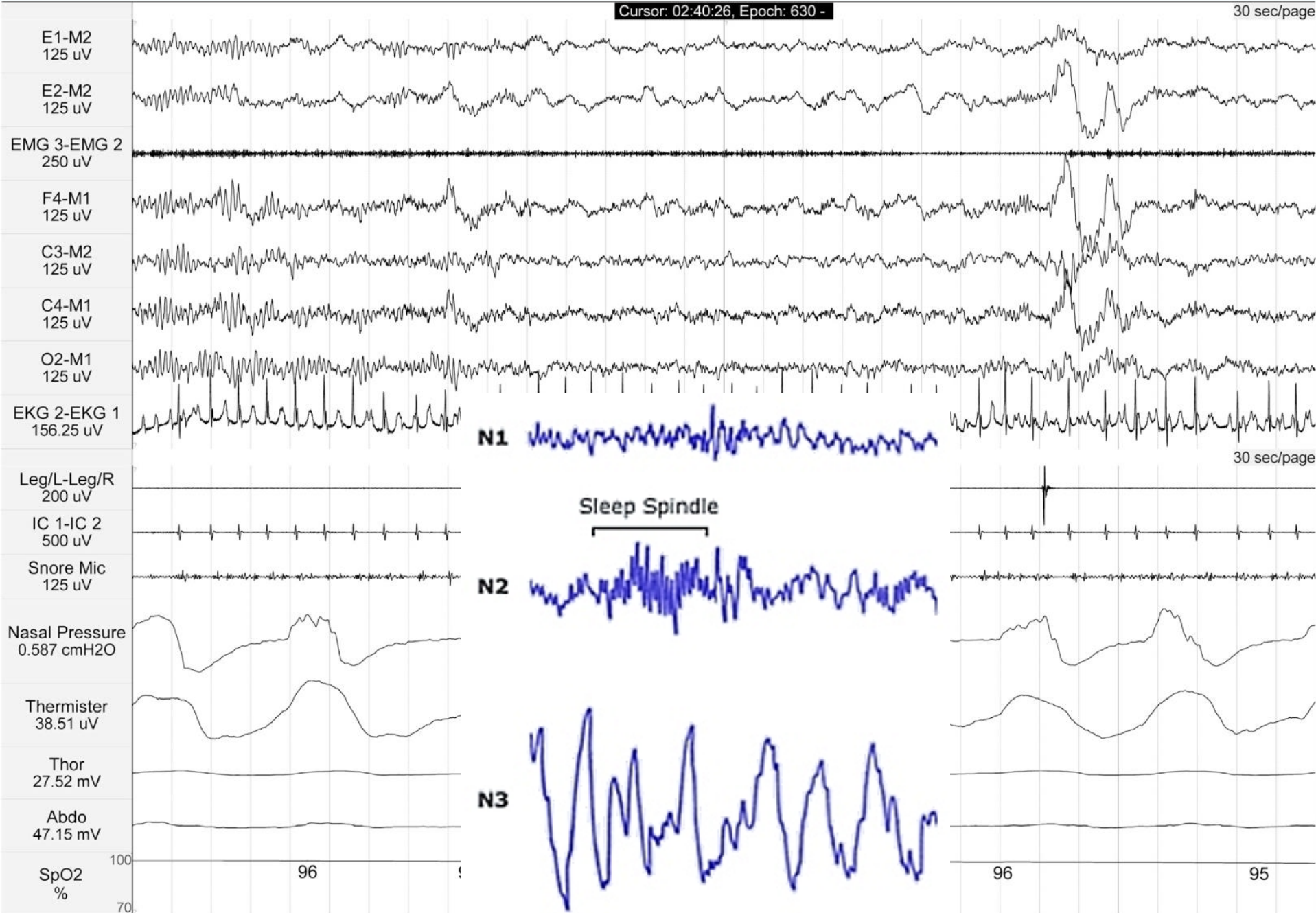
- (A) Metoprolol
- (B) Duloxetine
- (C) Caffeine-containing herbal remedy
- (D) Methadone



The sleep study yields the following results: AHI of 26.1 events per hour with 67% central apneas, 5% obstructive apneas, and 28% hypopneas. She has a periodic limb movement index of 13.6 events per hour.

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Question 19: Level 1 and Level 2 polysomnography studies are attended studies (i.e, monitored in a lab with a sleep technician present).

A. True

B. False

- A level I PSG represents the gold standard in which a minimum of seven different variables are measured:
 - Electroencephalogram (EEG), electrooculogram (EOG), chin or leg electromyogram (EMG), electrocardiogram (ECG), ventilation, respiratory effort, and oxygen saturation.
- Level II PSG measures all of the above-mentioned minimum seven variables but is performed with a portable system setup at the patient's home. Level II PSGs are unattended and therefore do not allow for technician interventions.

Question 20: 43 year-old male presents to you with concerns over persistent daytime fatigue and sleepiness, as well as nighttime snoring and witnessed apneas reported by his wife.

You suspect the presence of obstructive sleep apnea-hypopnea and arrange for an unattended portable home polysomnogram wherein his oxygen saturation, ventilation, heart rate and body position are the measured variables.

Which level of polysomnogram (PSG) does this study represent?

- A. Level I.
- B. Level II.
- C. Level III.
- D. Level IV.

- A level III PSG is a portable study that records a minimum of only three variables (ventilation, heart rate or ECG, and oxygen saturation) and are typically unattended.
- A level IV PSG is a portable unattended study that measures typically only one or two variables (including oxygen saturation and heart rate). Airflow and respiratory effort are not measured.

Question 21: In which of the following patient scenarios would a portable monitoring sleep study be a reasonable approach to diagnosis?

A) 57-year-old obese woman with complaints of snoring, witnessed apneic episodes, and non-refreshing sleep

B) 52-year-old woman with moderate chronic obstructive pulmonary disease (COPD) who complains of snoring and sleep disruption

C) A 37-year-old woman with snoring, frequent leg twitches, difficulty maintaining sleep, witnessed apneic episodes, and daytime hypersomnolence.

D) A 65-year-old woman with congestive heart failure (CHF) who complains of choking and awakenings because of shortness of breath

- Home Sleep Study **can be** used as an alternative to in-laboratory polysomnography in:

Patients with a high pretest probability of moderate to severe OSA.

- Groups in which HST **was not** recommended for the diagnosis of OSA included patients with
 - (1) significant co-morbid medical conditions that may limit the accuracy of the HST (e.g., COPD, CHF),
 - (2) other suspected sleep disorders (e.g., central sleep apnea, insomnia, periodic limb movement disorder, circadian rhythm disorders)
 - (3) no symptoms of OSA (i.e., asymptomatic screening of groups).



Sleep Medicine

OTE In-Service Exam Review

Avidan, Alon Y., and Teri J. Barkoukis. Review of Sleep Medicine. Elsevier Health Sciences, 2011. Third Edition: Chapters 5, 23, 36.

GOOD LUCK!!

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