

# Sleep Diagnostic Dilemmas and PSG Puzzlers

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# Conflict of Interest Disclosure

- Aneesa Das, MD
  - Uptodate Royalties
- David Schulman, MD
  - Uptodate Royalties

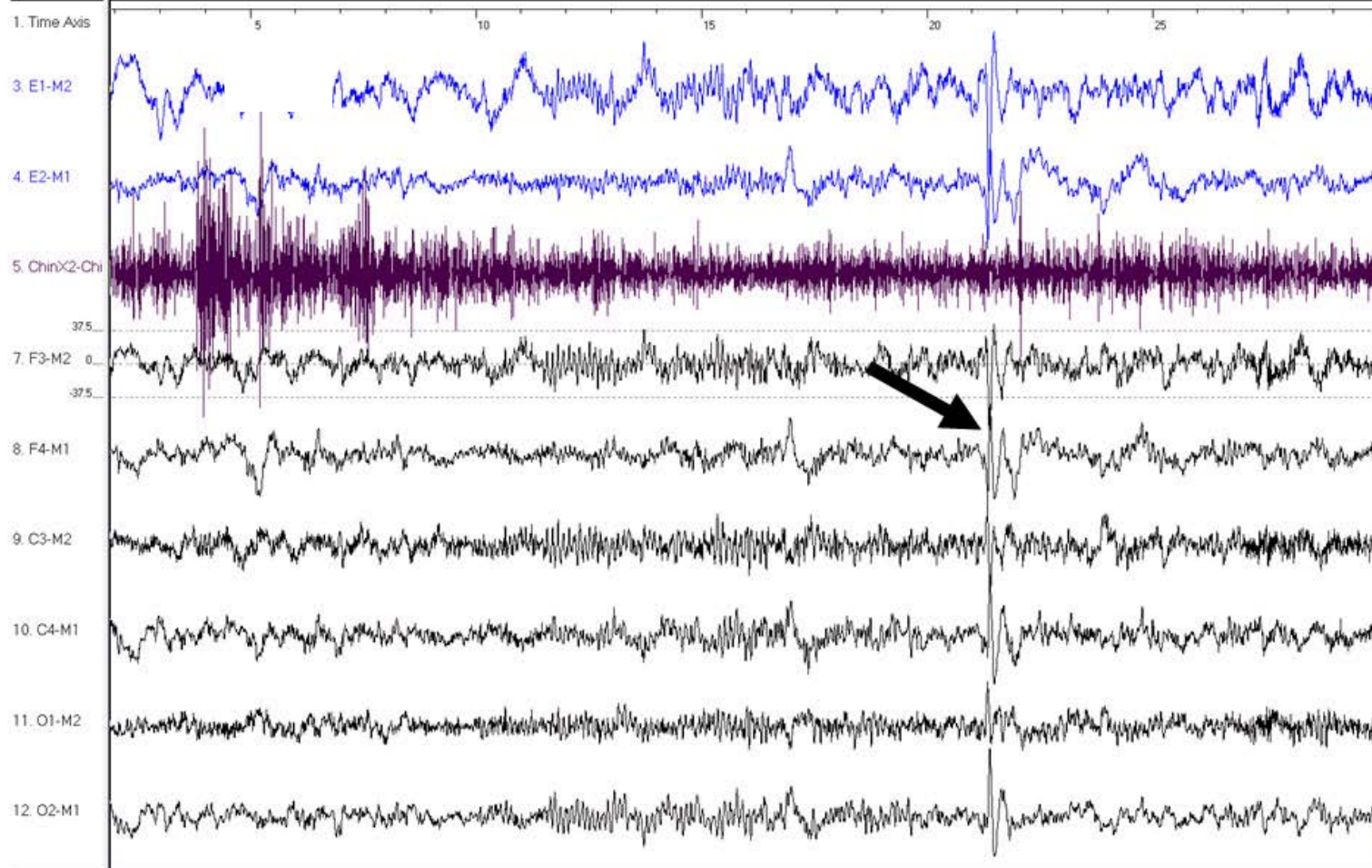
- An 86 year old woman is being evaluated by a neurologist for progressive cognitive and behavioral decline
- Her neuropsychiatric and extended mental status examination is consistent with Alzheimer's disease
- Recently started on memantine and galantamine

A Das, T Afaq. American Thoracic Society. Sleep Fragments.  
2011

- Subsequently referred to sleep clinic for evaluation of daytime sleepiness, snoring and witnessed apneas
- Goes to bed around midnight and gets up by 8 am
- Denies excessive movements or arousals during sleep
- Overall AHI is 21.1 with oxygen nadir 71%

# Thailand

Bangkok | 10-12 April

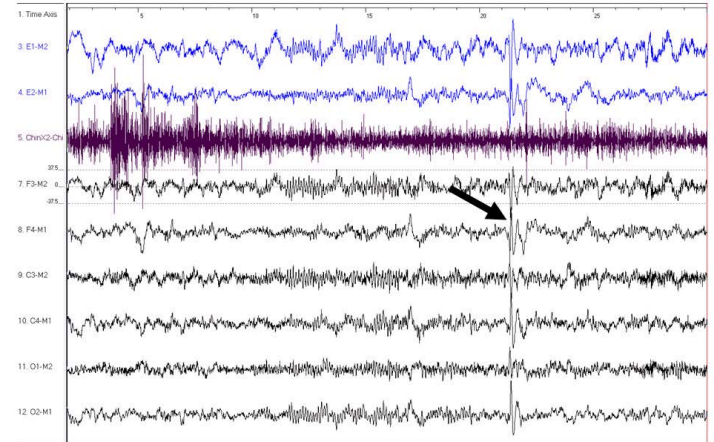


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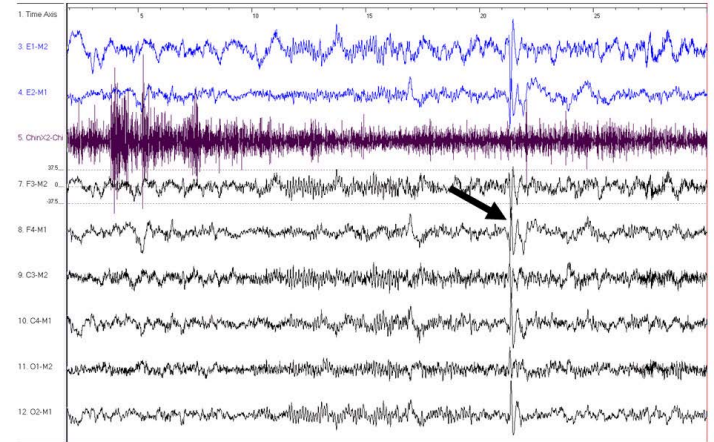
What is the waveform shown by the arrow?

- A. Interictal epileptiform discharge
- B. Vertex sharp wave
- C. Blink artifact
- D. Muscle twitch artifact

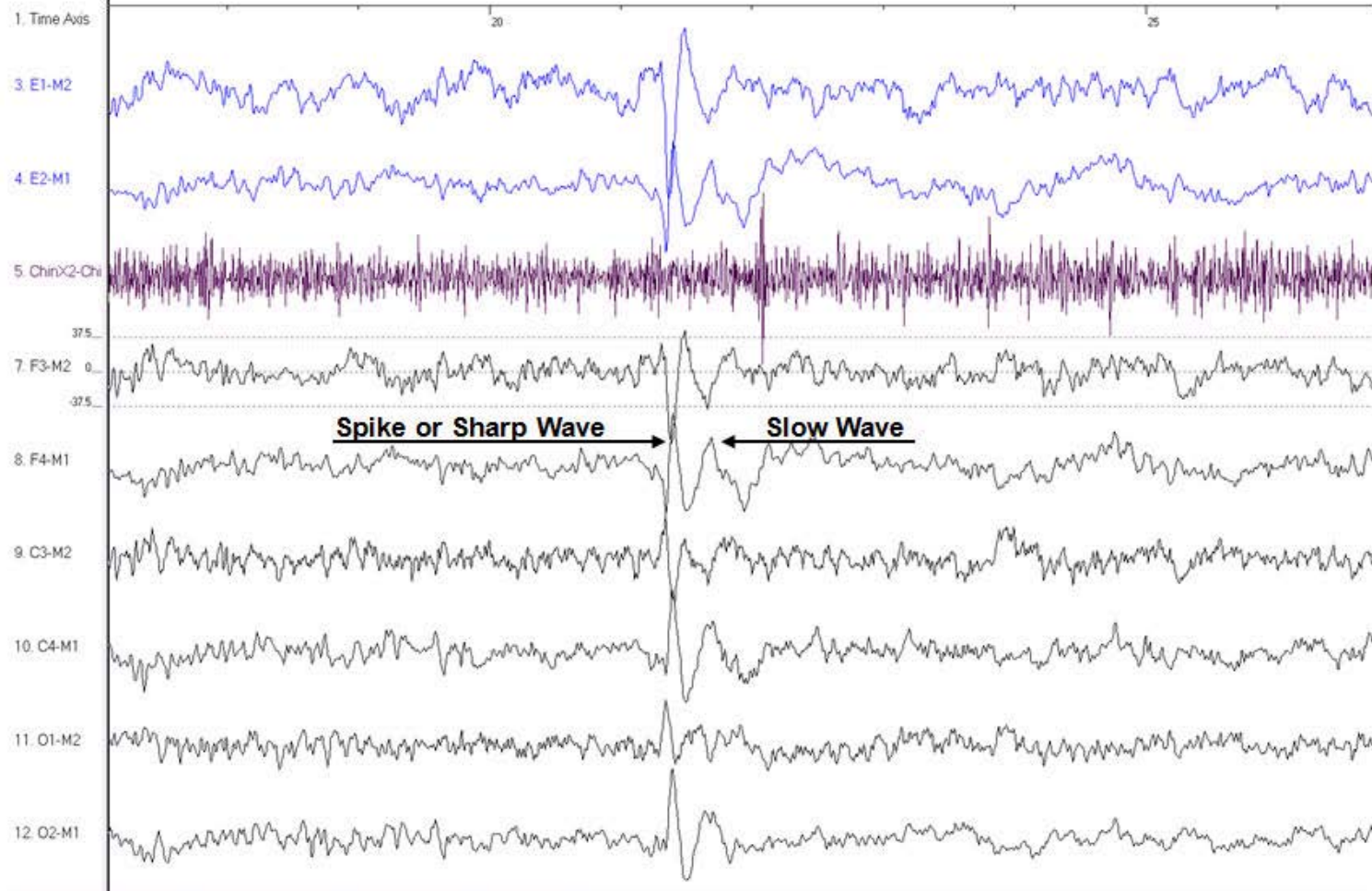


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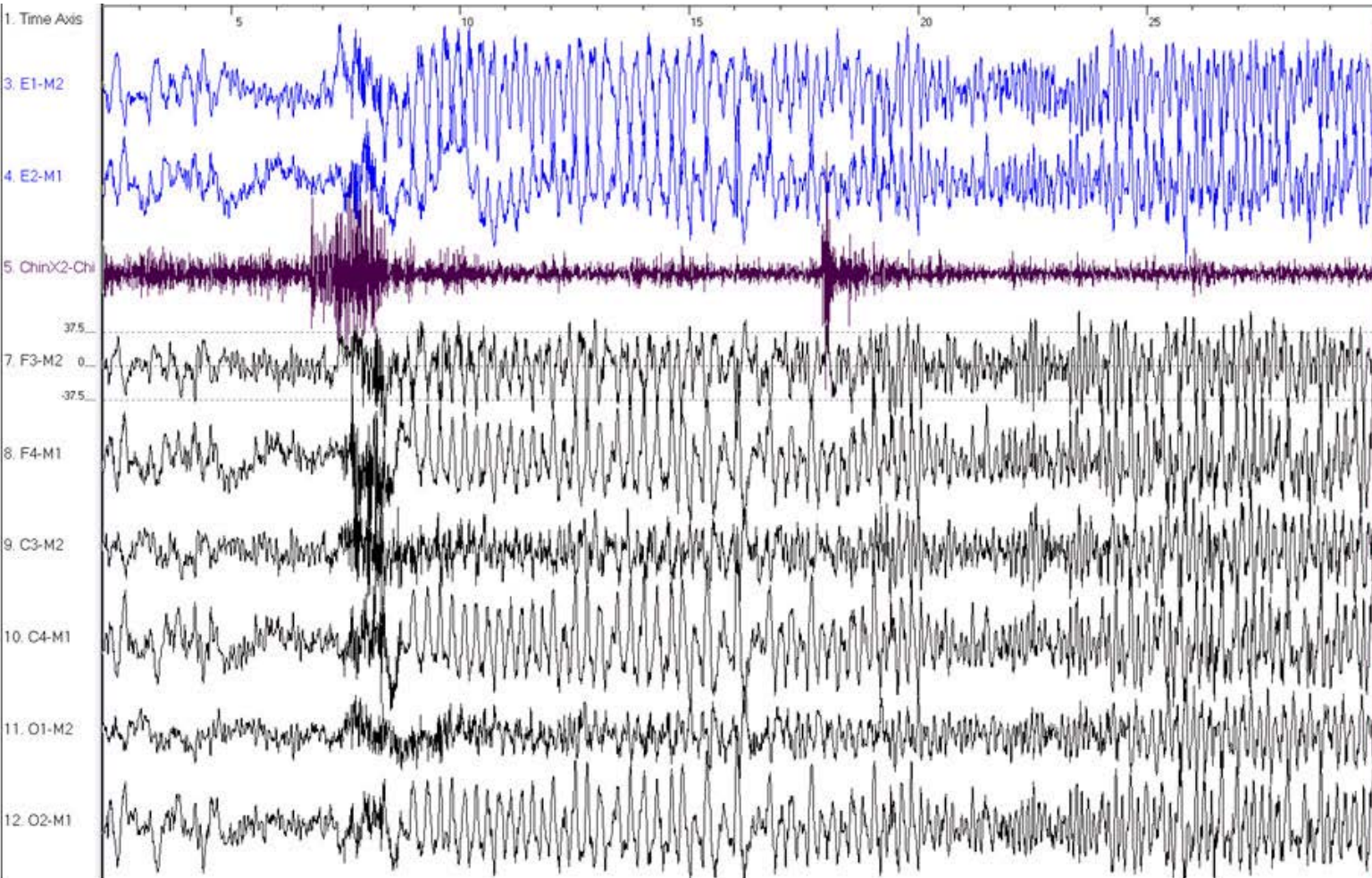




Later on in the study the following occurred...

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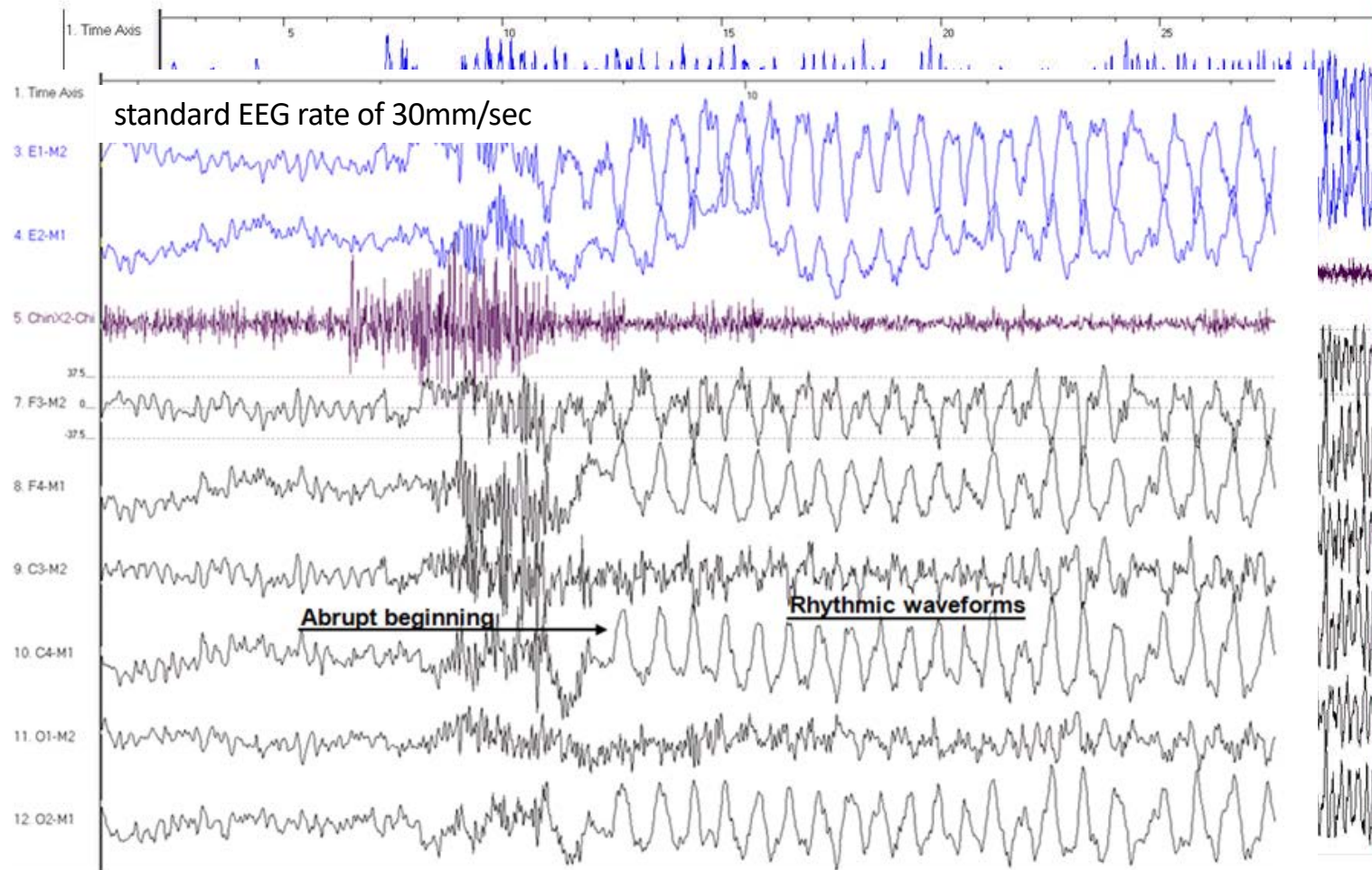


# What does this epoch show?

- A. Tremor
- B. Shivering
- C. Ictal epileptiform activity
- D. Confusional arousal

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# In what physiologic stage are seizures most likely to occur?

- A. REM sleep
- B. NREM sleep
- C. Wakefulness

Minecan B, et al. Relationship of epileptic seizures to sleep stage and sleep depth. *Sleep* 2002;25(8):899-904

In what physiologic stage are seizures most likely to occur?

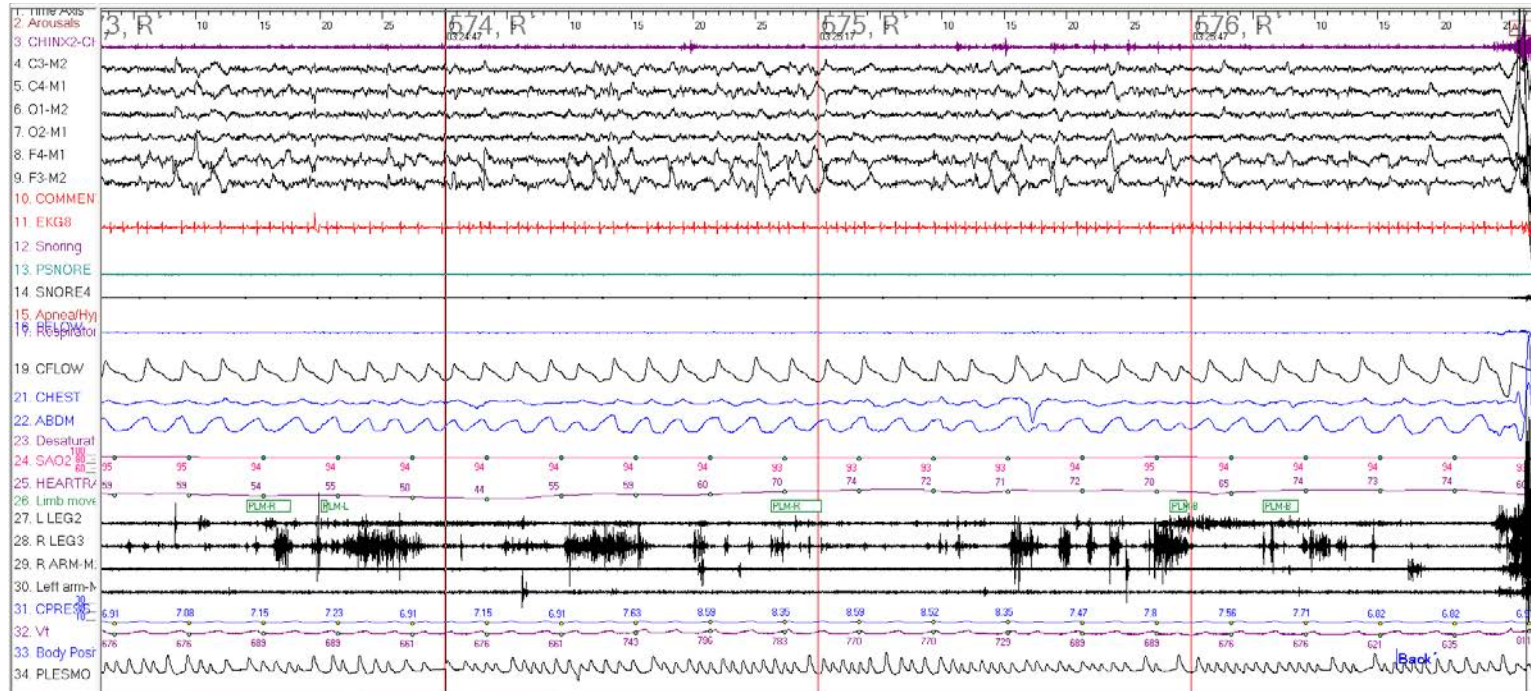
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- B. NREM sleep
- C. Wakefulness

Minecan B, et al. Relationship of epileptic seizures to sleep stage and sleep depth. Sleep 2002;25(8):899-904



A 71 year old patient complains of arms and legs flailing in his sleep. The following 120 second epoch is from his polysomnography and is scored as REM sleep.

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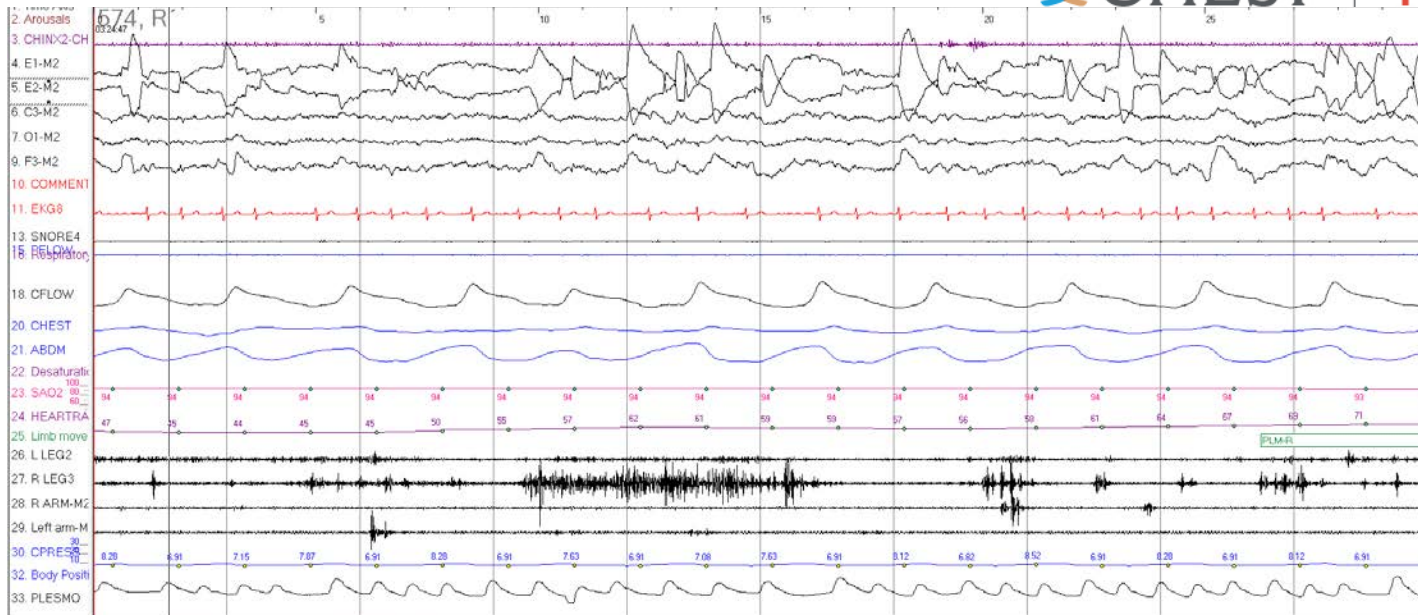


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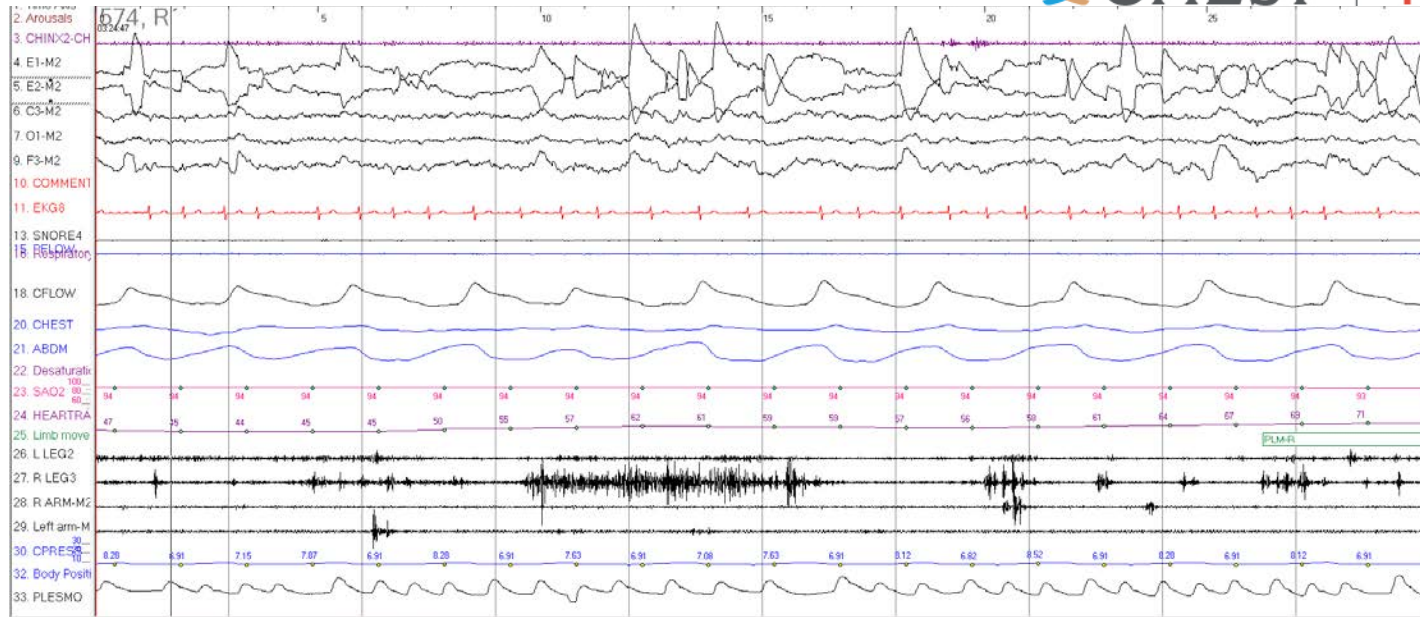
30 seconds



Does the following PSG fragment meet criteria for REM Behavior Disorder?

- A. Yes
- B. No

30 seconds



Does the following PSG fragment meet criteria for REM Behavior Disorder?

A. Yes

B. No

## Sustained muscle activity in REM sleep in the chin EMG

- An epoch of REM sleep with at least 50% of the duration of the epoch having a chin EMG amplitude greater than the minimum amplitude demonstrated in NREM sleep.

## Excessive transient muscle activity during REM in the chin or limb EMG

- In a 30-second epoch of REM sleep divided into 10 sequential 3-second mini-epochs, at least 5 (50%) of the mini-epochs contain bursts of transient muscle activity
- Excessive transient muscle activity bursts are 0.1-5.0 seconds in duration and at least 4 times as high in amplitude as the background EMG activity.

Which medication is most likely to cause an increased muscle tone in REM sleep (disrupted REM atonia)?

- A. bupropion
- B. clonazepam
- C. donepezil
- D. fluoxetine

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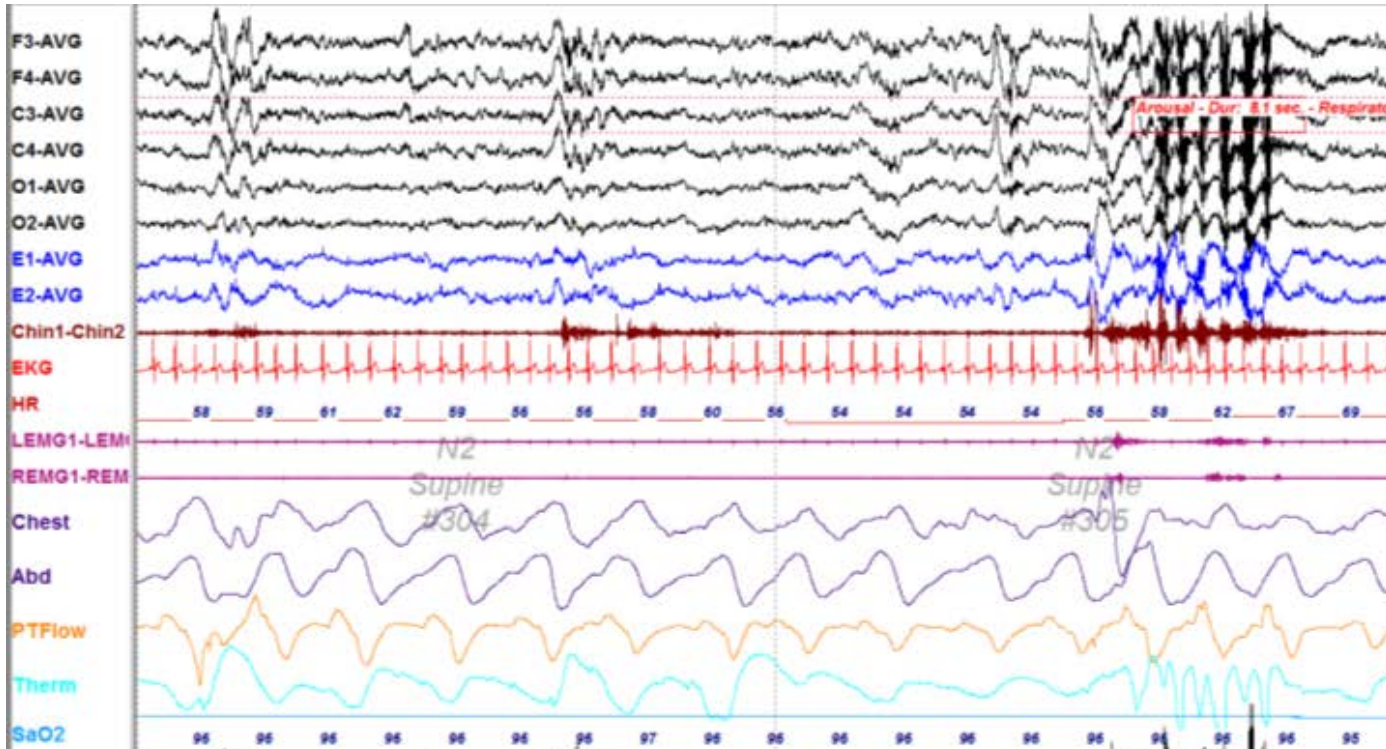
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# Disrupt REM Atonia

- serotonin-selective receptor inhibitor (SSRI's) → fluoxetine
- tricyclic antidepressants (TCA's)
- monoamine oxidase inhibitors (MAOI's)



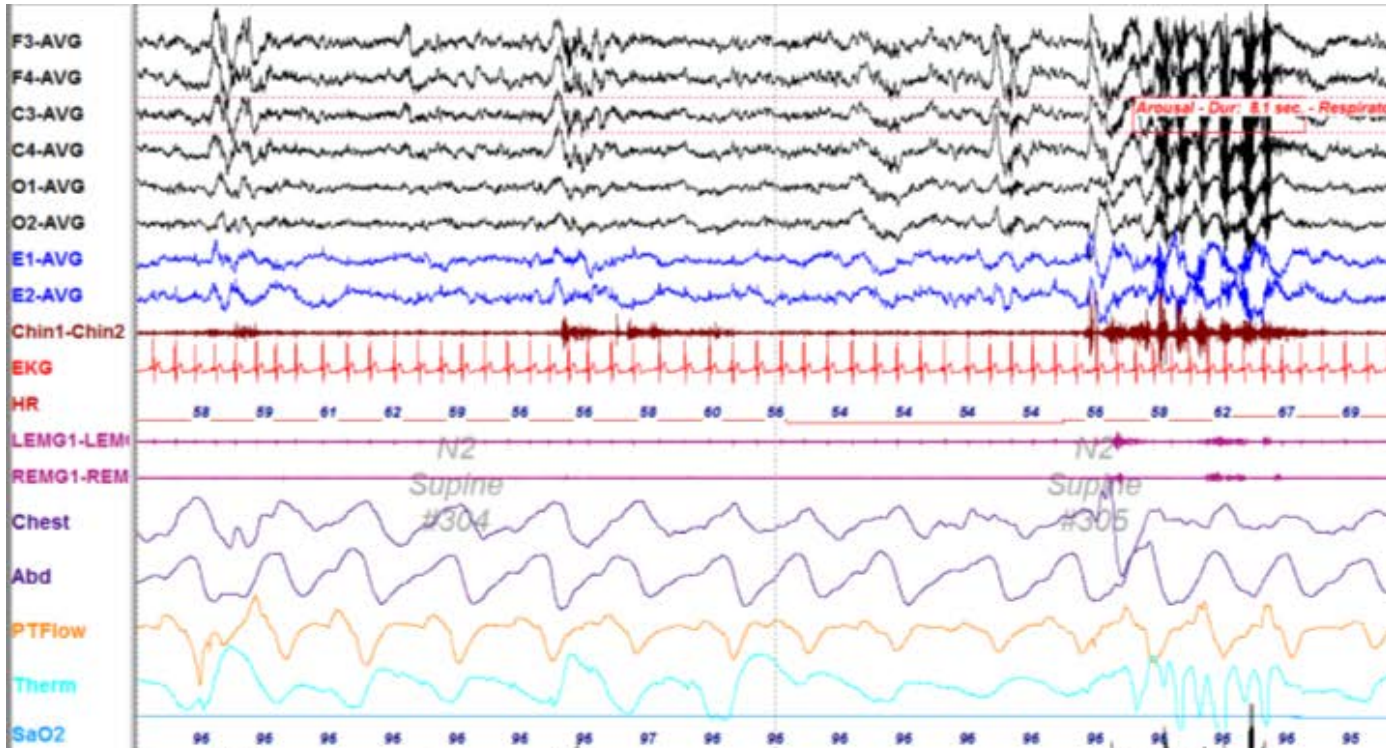
# What is the best description of the following polysomnogram finding in a 49 year old male?



- A. Seizure activity
- B. Head banging
- C. Bruxism
- D. Hypnic jerk



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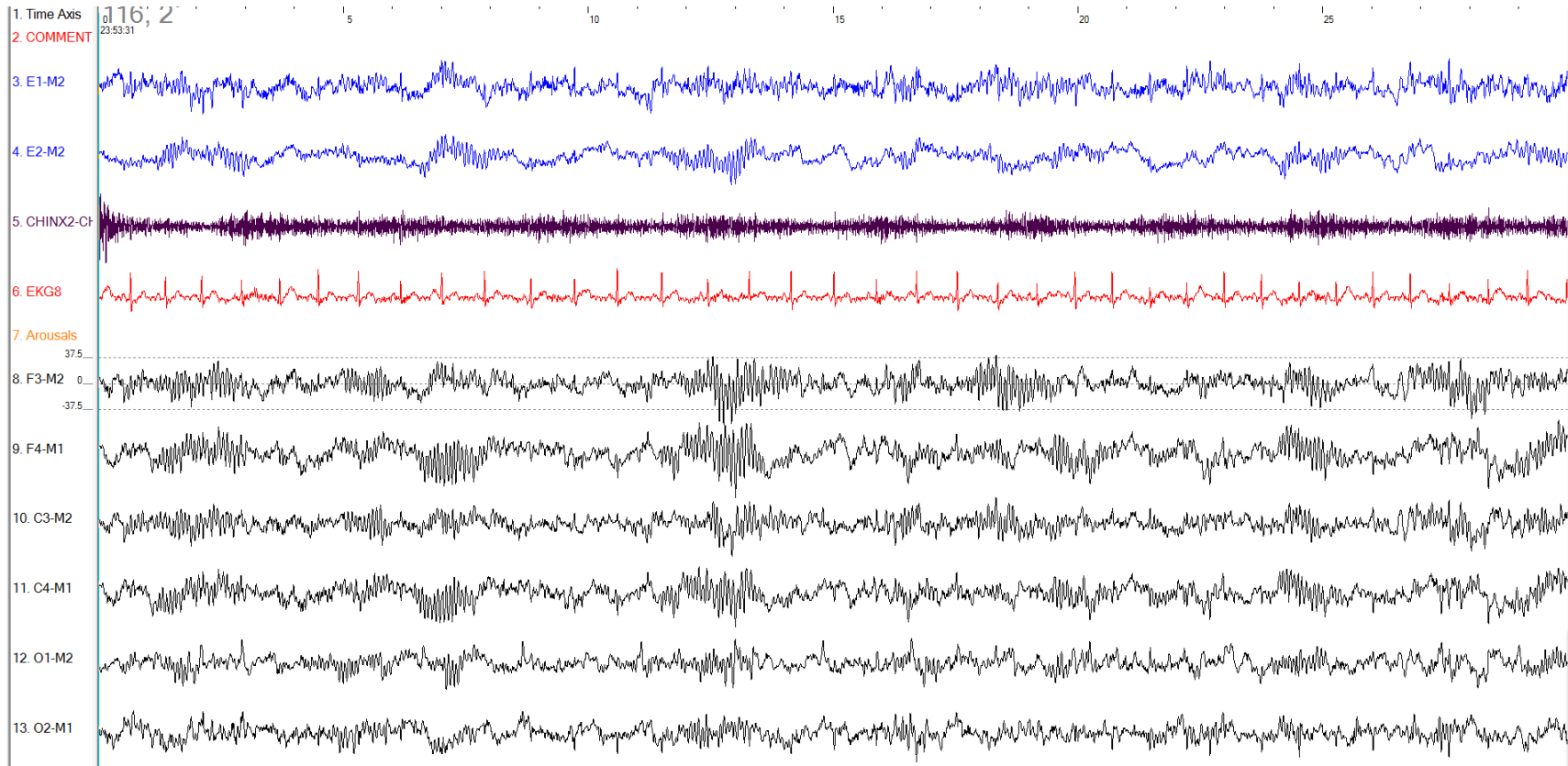
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# Bruxism:

Bruxism may consist of brief (phasic) or sustained (tonic) elevations of chin EMG activity that are at least twice that of the background EMG

- **Phasic:** brief elevations of 0.25-2 seconds in duration and a minimum of 3 in sequence
- **Tonic:** sustained elevations in chin EMG for greater than 2 seconds

A 43 yo female referred for evaluation of chronic insomnia. She undergoes complete evaluation and therapy is initiated. Due to snoring and continued arousals from sleep a PSG is ultimately done.

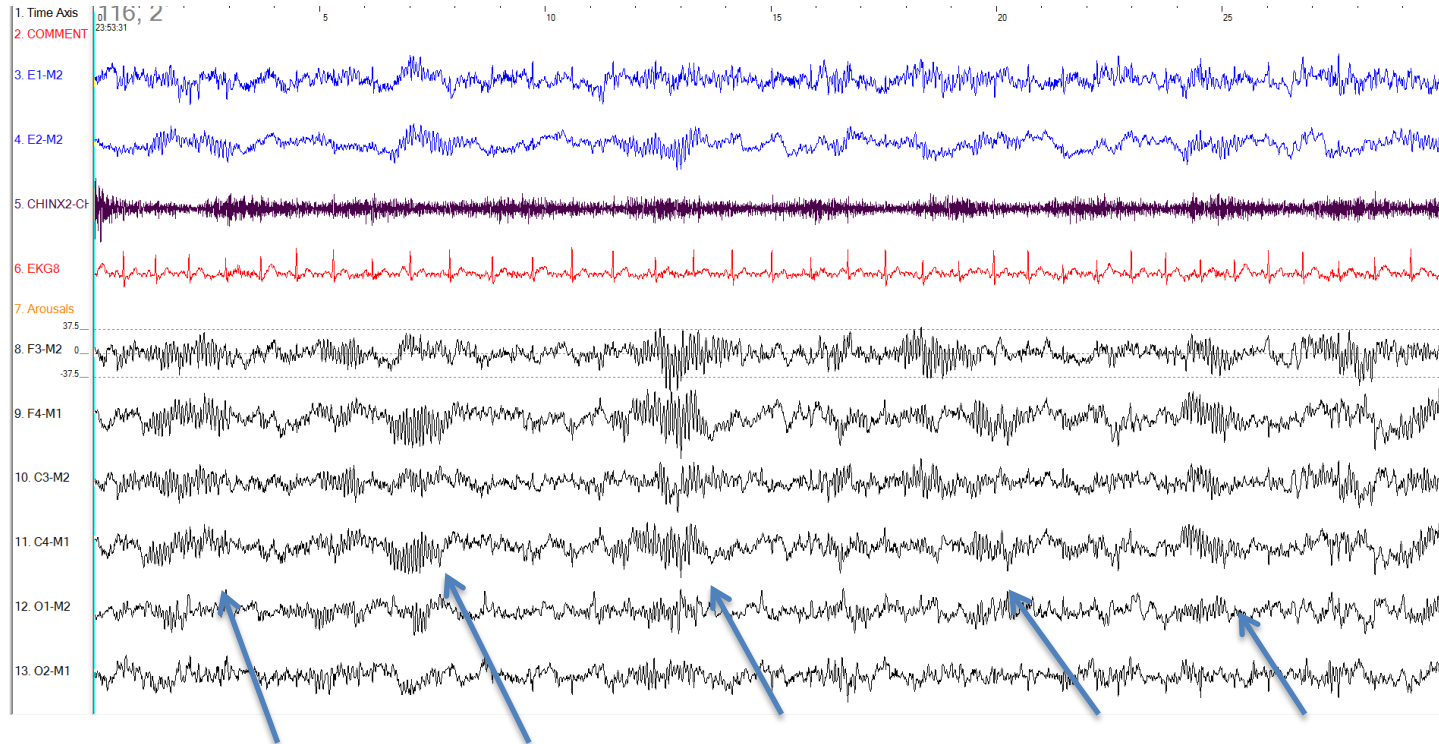


Based on the previous PSG fragment which of the following treatments was most likely initiated?

- A. stimulus control therapy
- B. mirtazapine
- C. temazepam
- D. diphenhydramine

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# Benzodiazepines have the following effects:

- ↑ increased stage N2
- ↑ increased sleep spindles
- ↓ sleep latency
- ↓ stage changes
- ↓ stage N1 sleep
- ↓ stage N3 sleep
- ↓ stage R (REM) sleep

Qureshi, A., 2004 *Medical Clinics of North America* 88, 751-766



A patient undergoes a multiple sleep latency test using standard AASM protocol with the following results. What is this patient's mean sleep latency?

Nap	1	2	3	4	5
Sleep Latency	3minutes	5 minutes	2 minutes	No sleep	No sleep
SOREM	No	Yes	No	n/a	n/a

- A. 2 minutes
- B. 10 minutes
- C. 3.3 minutes
- D. 7.5 minutes

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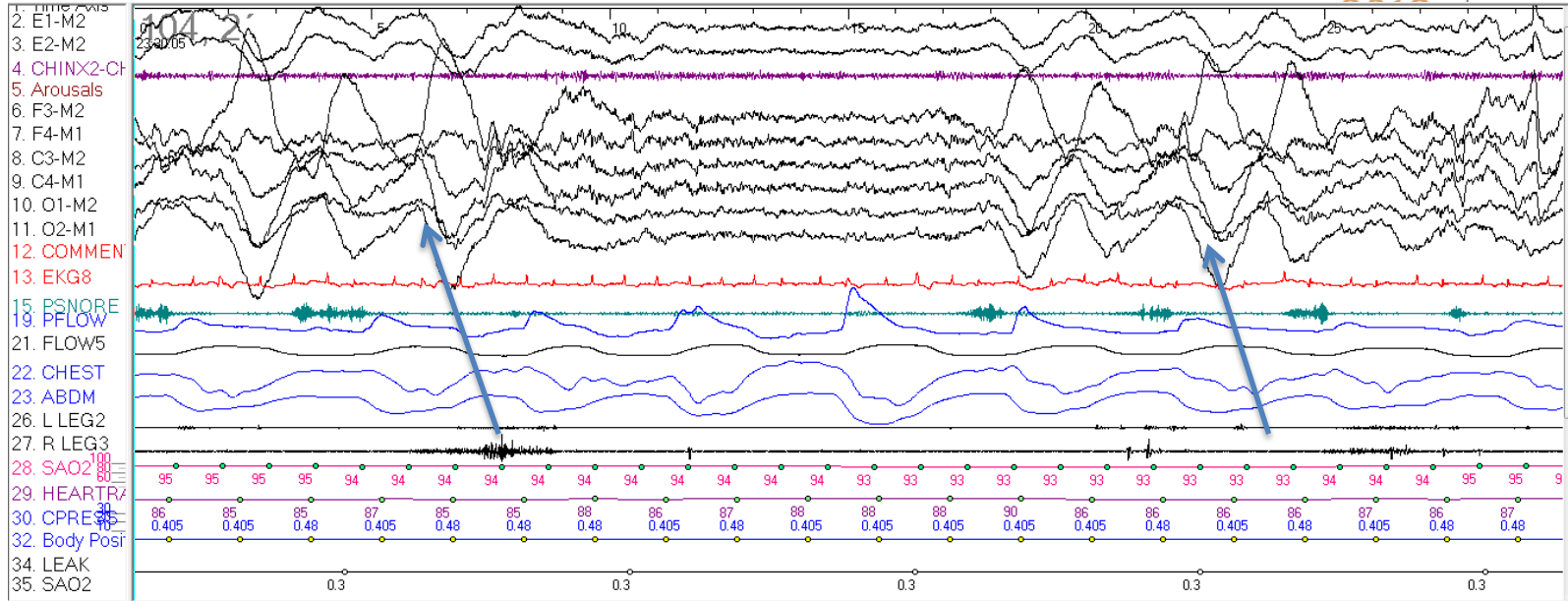
Nap	1	2	3	4	5
Sleep Latency	3minutes	5 minutes	2 minutes	No sleep	No sleep
SOREM	No	Yes	No	n/a	n/a

No nap counts as the full 20 minutes  
 $(3+5+2+20+20)/5 = 10$

# What the best description of the findings in this epoch?

Thailand

Bangkok | 10-12 April



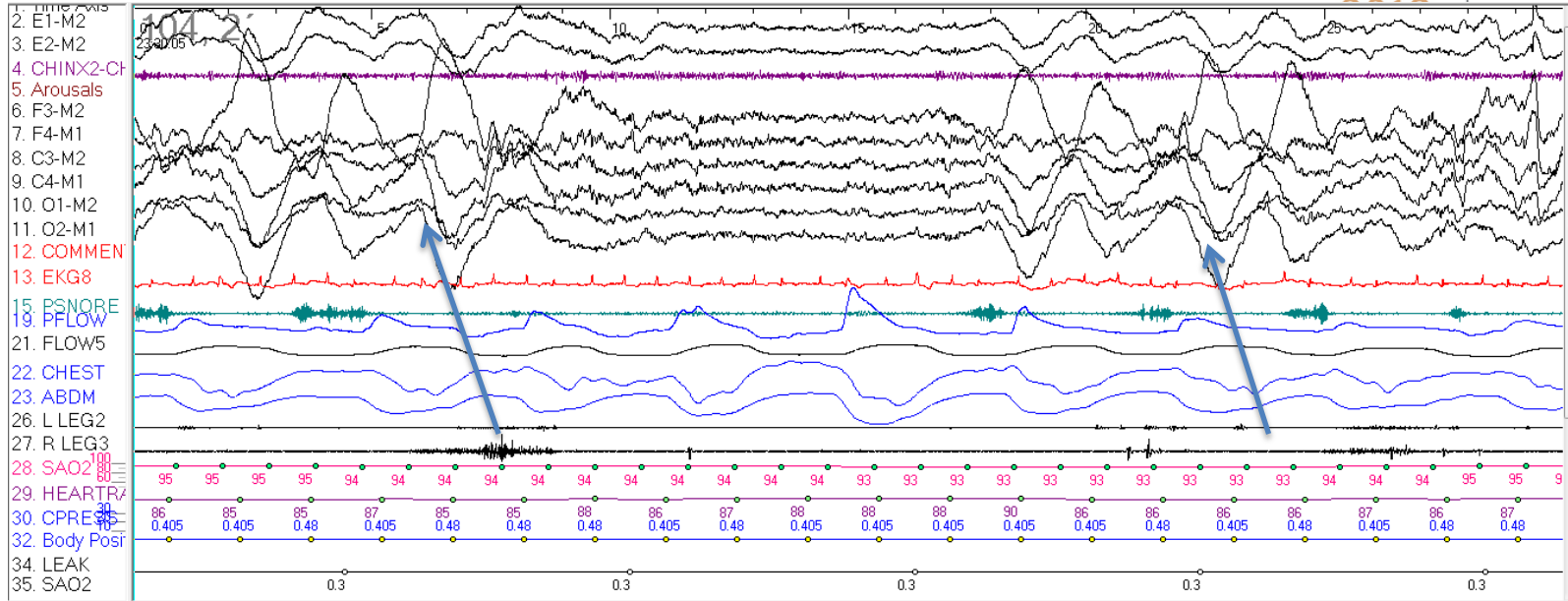
- A. Sweat artifact
- B. Delta waves
- C. Muscle artifact
- D. Electrode popping

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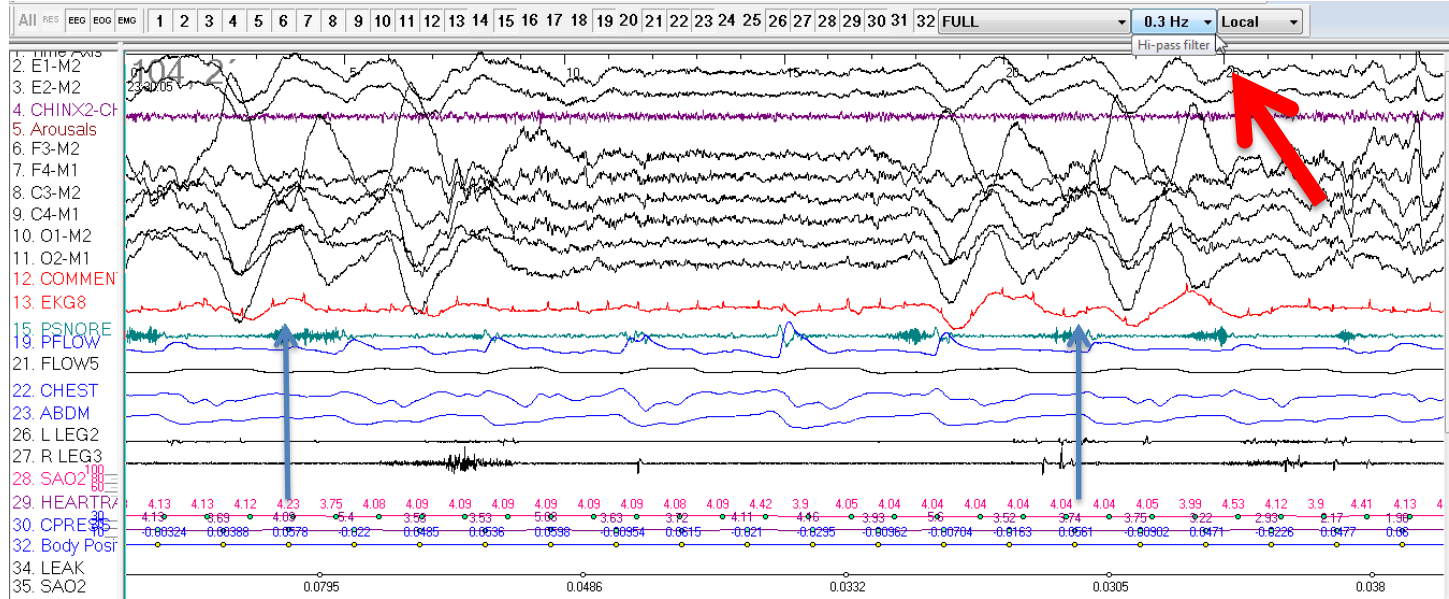


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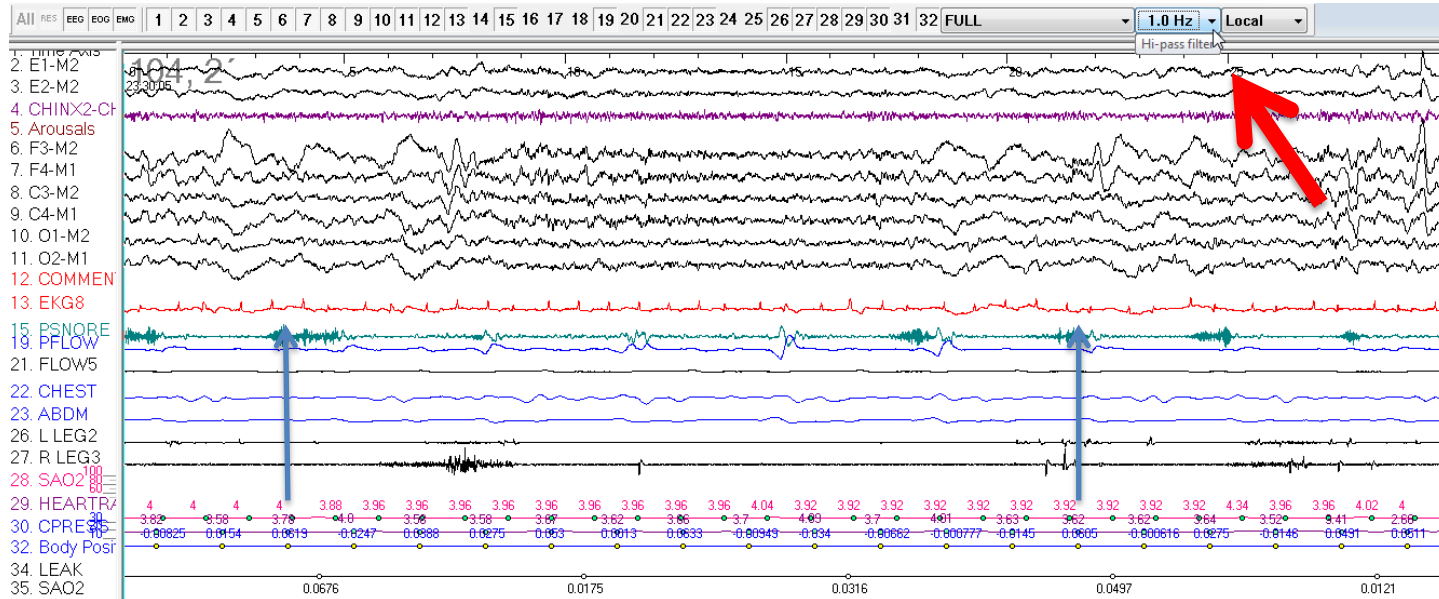
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# Sweat Artifact



- Typically seen in EEG (Occipital leads- pt on back)
- Slow (<2Hz)
- Disappears in REM (no thermoregulation)
- Trouble shooting sweat artifact:
  - Lower room temp or change patient position
  - Adjust low frequency filter (increase from 0.3Hz to 0.5 or 1.0 Hz)

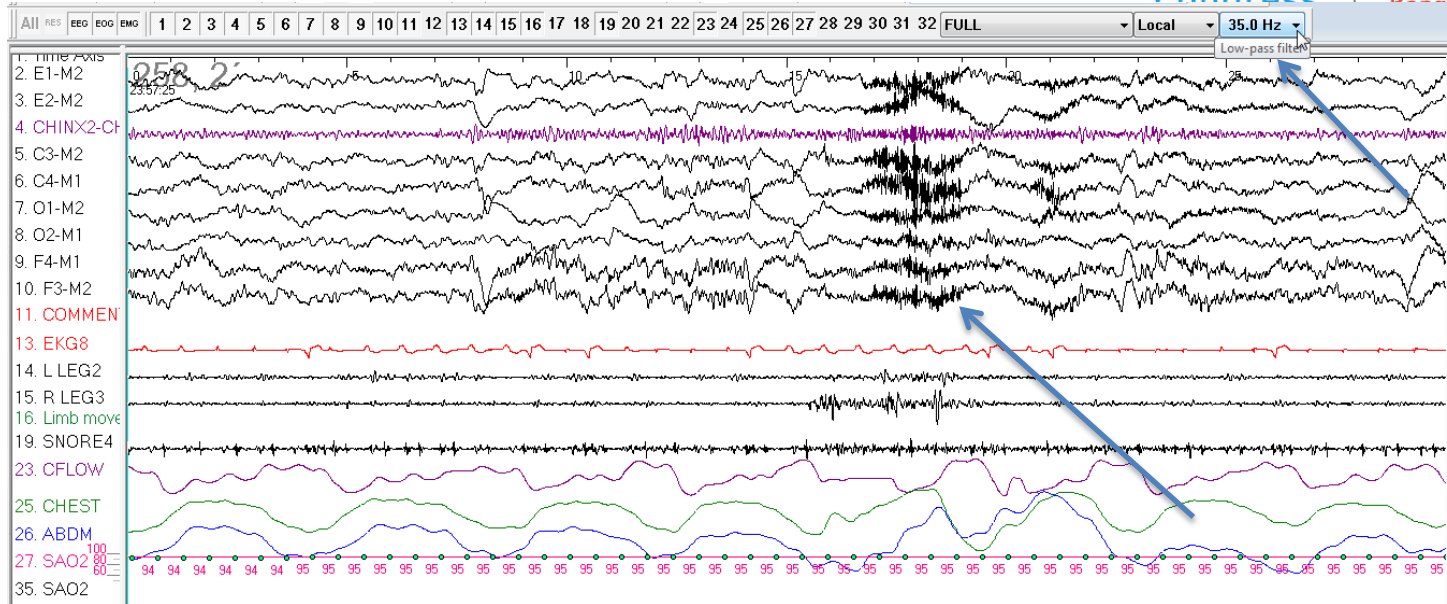
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- Trouble shooting sweat artifact:
  - Lower room temp or change patient position
  - Adjust low frequency filter (increase from 0.3Hz to 0.5 or 1.0 Hz)
  - Caution when scoring! delta wave amplitude may be attenuated if you increase low frequency filter

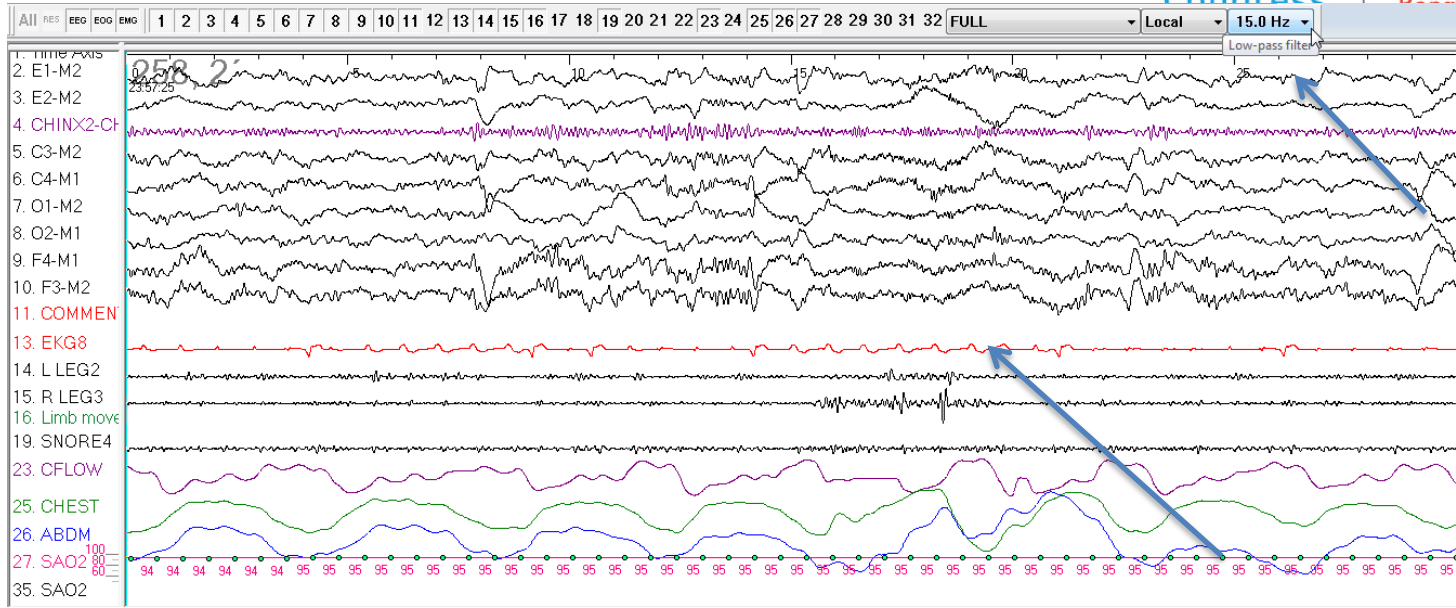


# Muscle Artifact



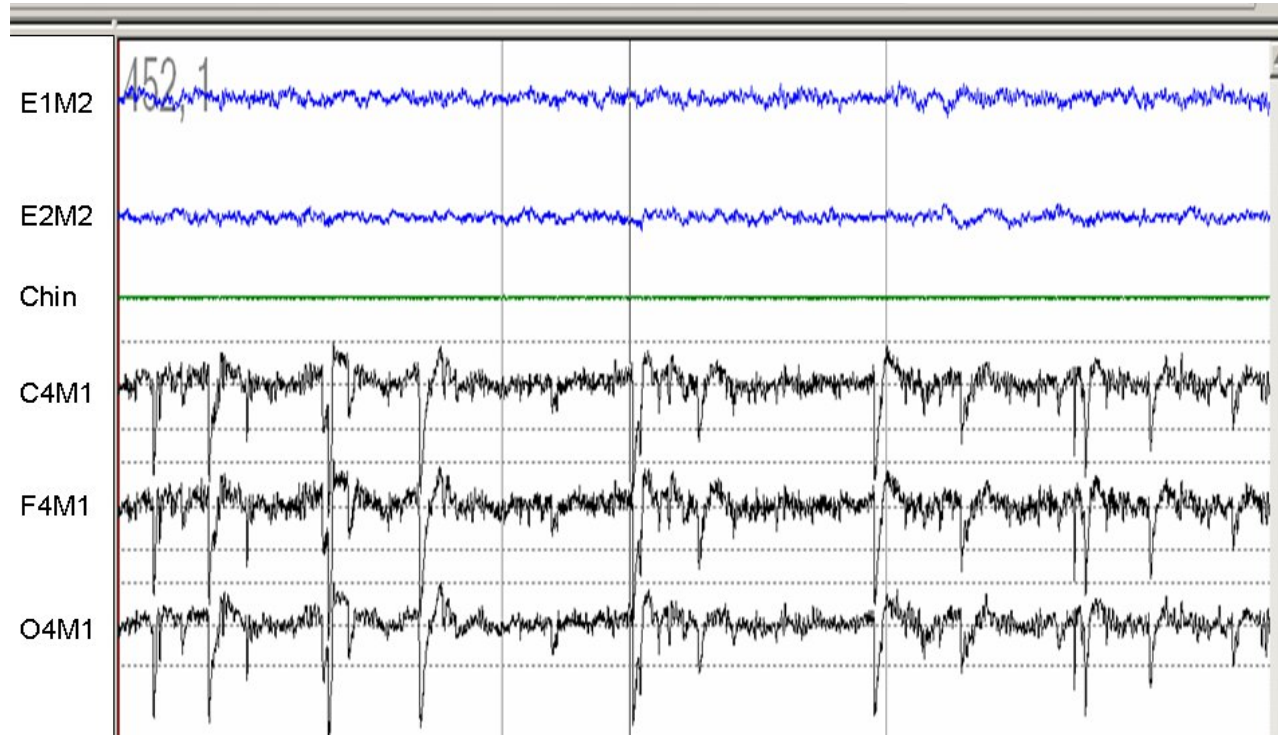
- Fast (10-70Hz)
- Do not misinterpret as arousals or spindles

# Muscle Artifact



- Fast (10-70Hz)
- Do not misinterpret as arousals or spindles
- Troubleshooting if persistent:
  - Reduce high frequency filter (reduce from 35Hz to 15Hz)
  - Caution scoring as you may miss arousals and spindles due to attenuation of higher frequency waves

# Electrode Popping

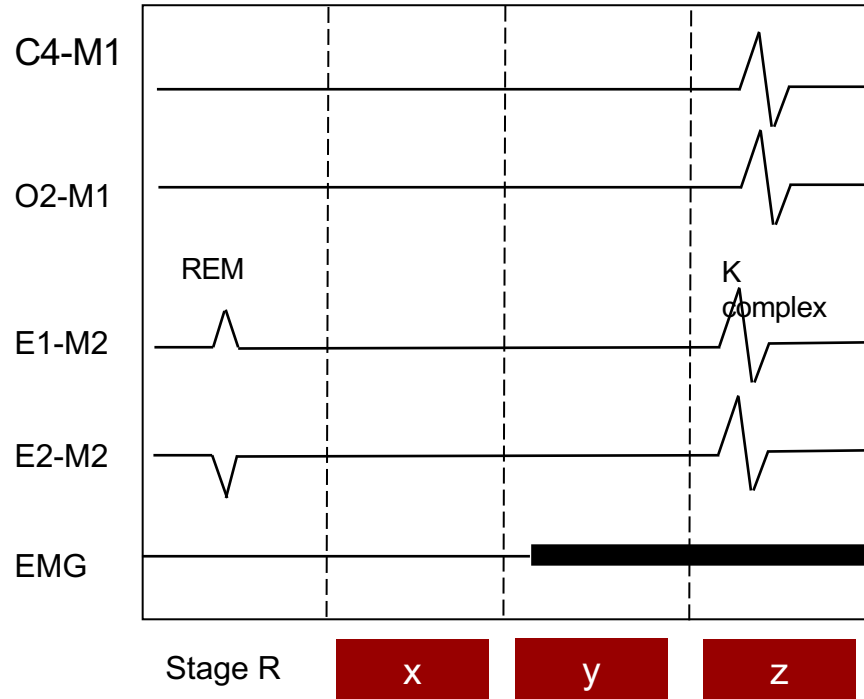


# REM RULES

# Name that Stage!

Which of the following represents x,y,z?

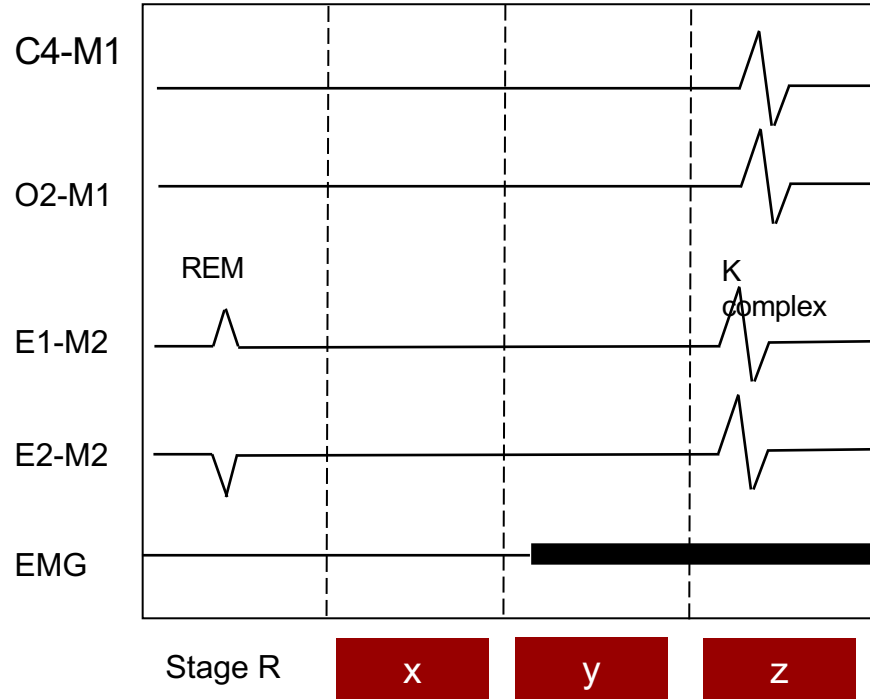
- A. N1,N1,N2
- B. R,N2,N2
- C. R,R,N2
- D. R,N1,N2



# Name that Stage!

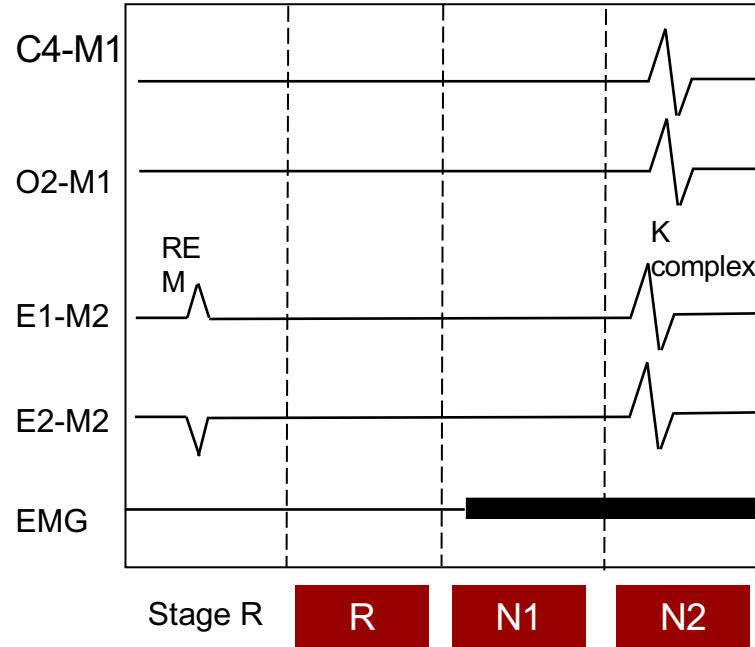
Which of the following represents x,y,z?

- A. N1,N1,N2
- B. R,N2,N2
- C. R,R,N2
- D. R,N1,N2**



# Scoring Rule

Continue to score stage R even in the absence of rapid eye movements, if the EMG tone remains low and without K complexes or sleep spindles

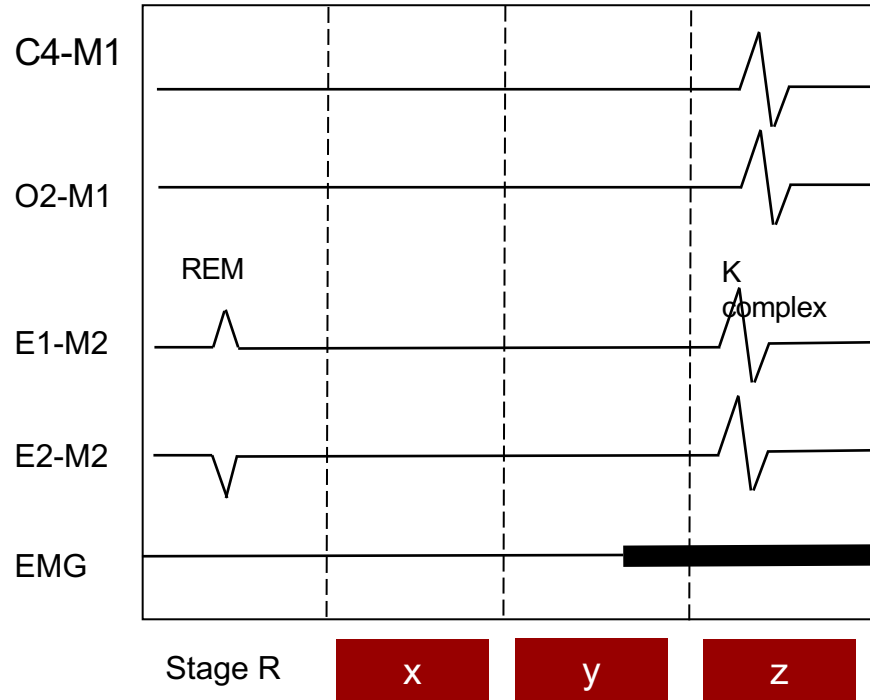




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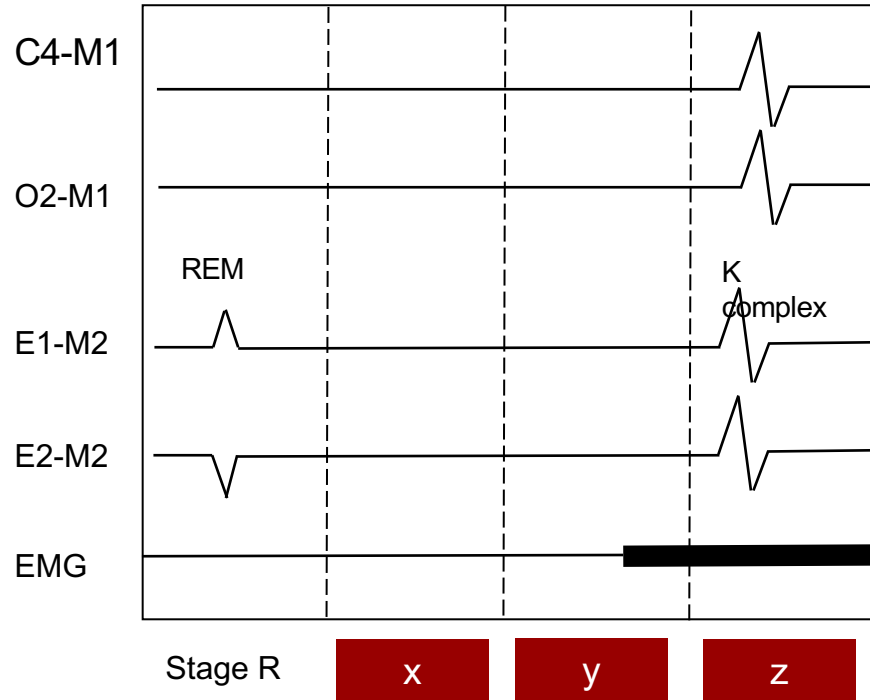
- A. N1,N1,N2
- B. R,N2,N2
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- D. R,N1,N2



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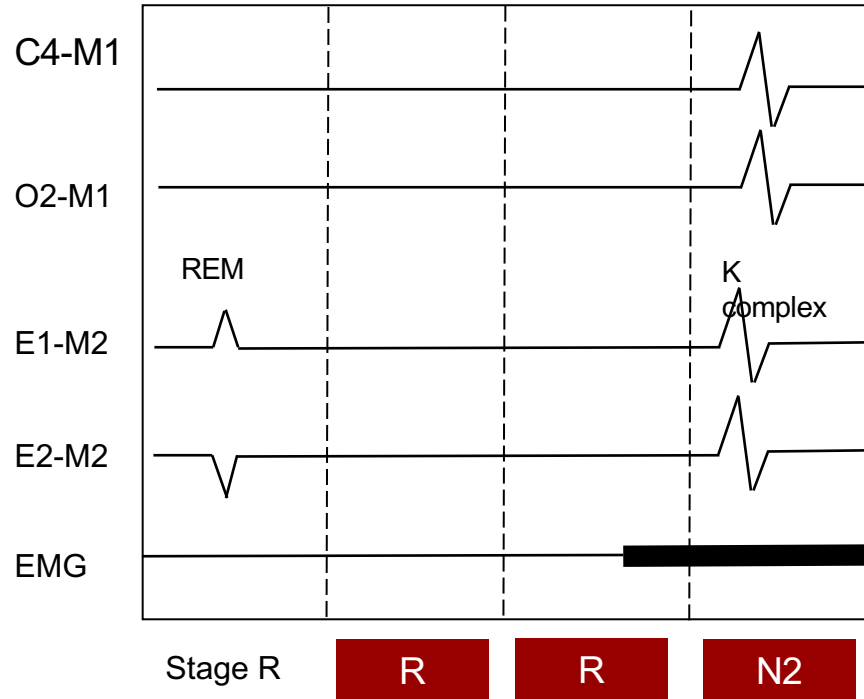
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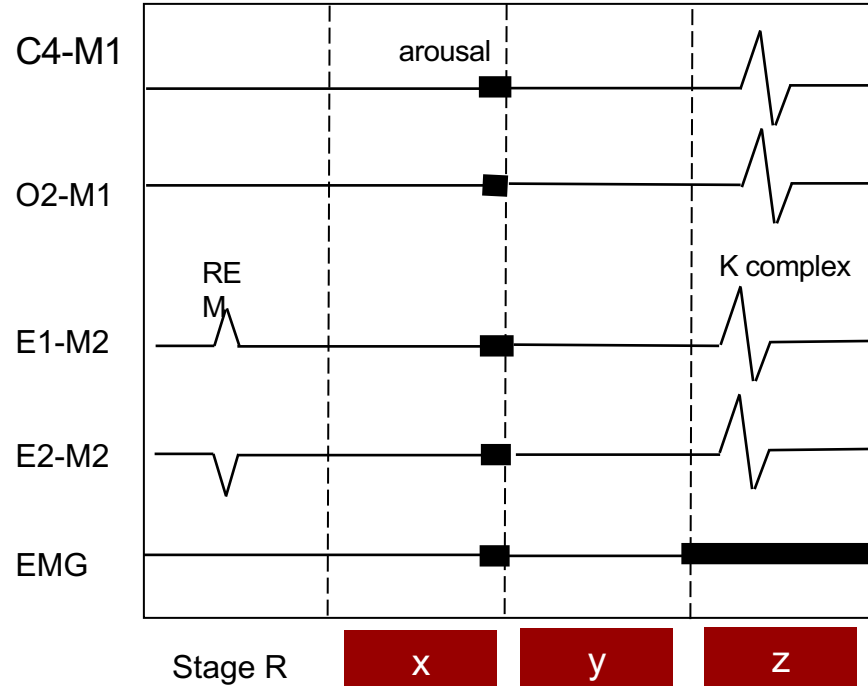
Continue to score stage R if the EMG tone remains low throughout **the first half** of epoch and without K complexes or sleep spindles



# Name that Stage!

Which of the following represents x,y,z?

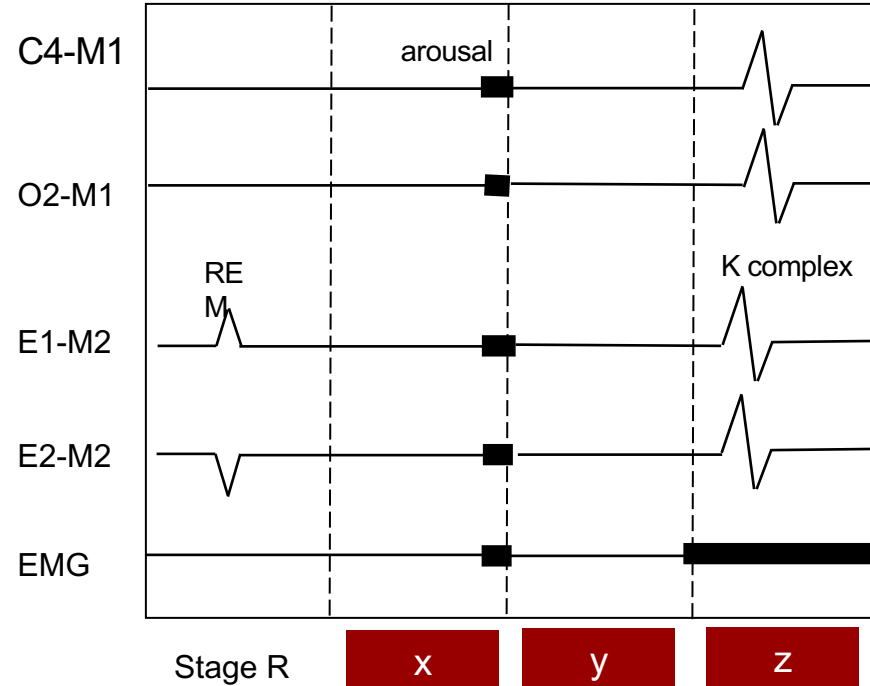
- A. R,R,N2
- B. R,W,N2
- C. R,N2,N2
- D. R,N1,N2



# Name that Stage!

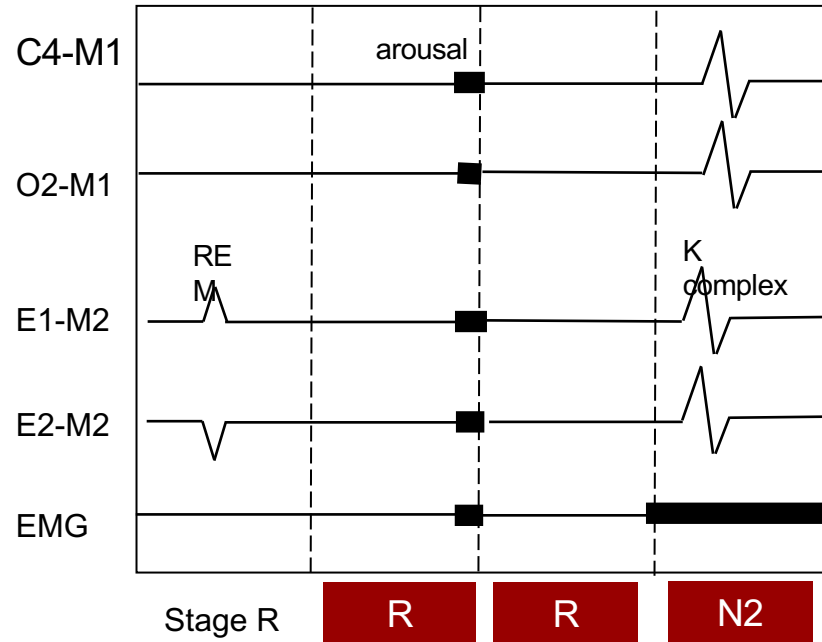
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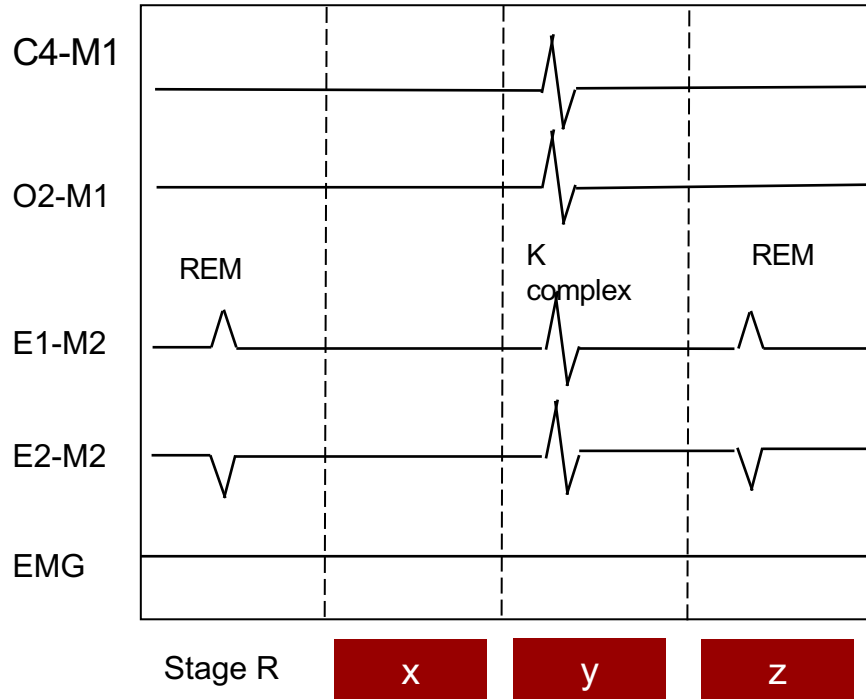
If an arousal occurs followed by low amplitude mixed frequency EEG and the chin EMG remains low, and there are no slow eye movements score as stage R



# Name that Stage!

Which of the following represents x,y,z?

- A. R,R,R
- B. R,N2,R
- C. R,N2,N2
- D. N2,N2,N2

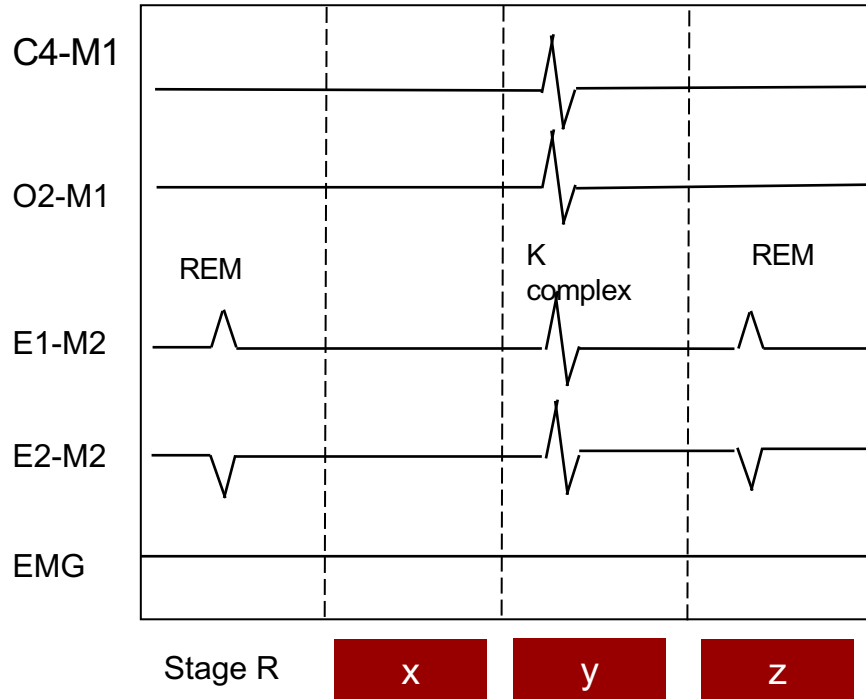




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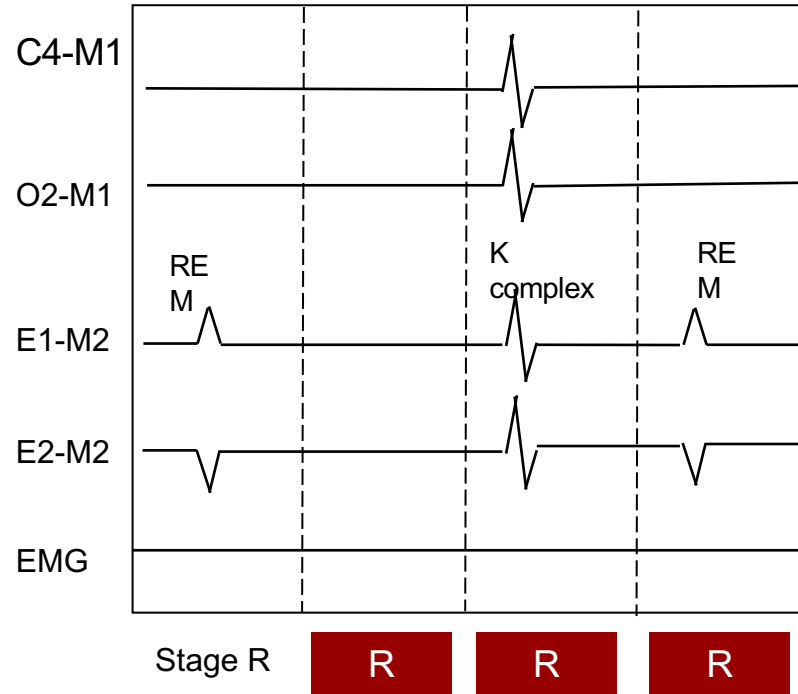
Which of the following represents x,y,z?

- A. R,R,R
- B. R,N2,R
- C. R,N2,N2
- D. N2,N2,N2



# Scoring Rule!

If the majority of an epoch contains a segment of the recording meeting criteria for stage R, the epoch is scored as stage R. Stage R rules take precedence over stage N2 rules.



(Scoring stage R , see figure 11A for rule) American Academy of Sleep Medicine. The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications, Version 2.3

In a patient with excessive daytime sleepiness, which of the following diagnostic testing results are consistent with narcolepsy type 2 according to the ICSD3?

	PSG REM Latency	Mean Sleep Latency on MSLT	# SOREM's on MSLT	CSF Hypocretin-1 Concentration	Cataplexy
A.	12 minutes	6 minutes	1	not obtained	no
B.	62 minutes	7.5 minutes	3	112 pg/mL	yes
C.	27 minutes	2 minutes	2	100 pg/mL	no
D.	17 minutes	9minutes	2	not obtained	no

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At least 3 months of excessive daytime sleepiness not otherwise explained

## Narcolepsy Type 1

- Cataplexy *and* a MSL of  $\leq 8$  minutes *and*  $\geq 2$  SOREM on an MSLT. (A SOREM (within 15 minutes of sleep onset) on the preceding PSG may replace one of the SOREMs on the MSLT.)

OR

- CSF hypocretin-1 concentration, is either  $\leq 110$  pg/mL or  $<1/3$  of mean normal values with the same standardized assay.

# Narcolepsy Diagnostic Criteria

At least 3 months of excessive daytime sleepiness not otherwise explained

## Narcolepsy Type 2

- A MSL of  $\leq 8$  minutes *and*  $\geq 2$  SOREM on an MSLT. (A SOREM (within 15 minutes of sleep onset) on the preceding PSG may replace one of the SOREMs on the MSLT.)
- Cataplexy is absent.
- *Either* CSF hypocretin-1 concentration has not been measured *or* CSF hypocretin-1 concentration, is either  $> 110$  pg/mL or  $>1/3$  of mean normal values with the same standardized assay.

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**Choice A** has no cataplexy and normal hypocretin-1 in the setting of an MSL  $\leq 8$  and 2 SOREM's (one is in the PSG) consistent with narcolepsy type 2

**Choice B** has cataplexy making it consistent with narcolepsy type 1

**Choice C** has CSF hypocretin  $\leq 110$  making it consistent with narcolepsy type 1

**Choice D** has an MSL  $> 8$  making it inconsistent with narcolepsy



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