

Respiratory Scoring Rules for Adults

Apneas

Technical Specifications

- Must use an oronasal thermal sensor to detect apneas
 - If thermal sensor not functioning or signal unreliable, use one of the following:
 - Nasal pressure transducer (cannula)
 - RIPsum
 - RIPflow
 - PVDFsum (acceptable but not recommended)
- Must use nasal pressure transducer (cannula) to detect hypopneas
 - If nasal pressure transducer not functioning or signal unreliable, use one of the following:
 - Oronasal thermal sensor
 - RIPsum
 - RIPflow
 - Dual thoracoabdominal RIP belts
 - PVDFsum (acceptable but not recommended)

Technical Specifications

- During PAP titration, use PAP device flow signal to identify apneas or hypopneas
- For monitoring respiratory effort, use one of the following:
 - Esophageal manometry
 - Dual thoracoabdominal RIP belts
 - Dual thoracoabdominal polyvinylidene fluoride (PVDF) belts (Acceptable but not recommended)
- For monitoring O₂ saturation, use pulse oximetry with max acceptable signal averaging time of ≤ 3 seconds at HR of 80 bpm

Technical Specifications

- For monitoring snoring, use an acoustic sensor (microphone), piezoelectric sensor, or nasal pressure transducer
- For detection of hypoventilation during diagnostic study, use arterial PCO₂, transcutaneous PCO₂, or end-tidal PCO₂
- For detection of hypoventilation during PAP titration, use arterial PCO₂ or transcutaneous PCO₂

Technical Notes

- Thermal sensors include:
 - Thermistors
 - Thermocouples
 - PVDF airflow sensors
- RIP = Respiratory Inductance Plethysmography
- RIPsum = Sum of signals from thoracic and abdominal RIP sensors (belts) and excursions in signal are estimate of tidal volume
- RIPflow = Time derivative of RIPsum and excursions in signal are estimate of airflow
- PVDFsum = sum of signals from thoracic and abdominal PVDF sensors (belts)
- Using the nasal pressure signal without square root transformation for scoring hypopneas will result in a slightly higher hypopnea index than scoring using a square root transformation—this difference is not clinically significant for most patients

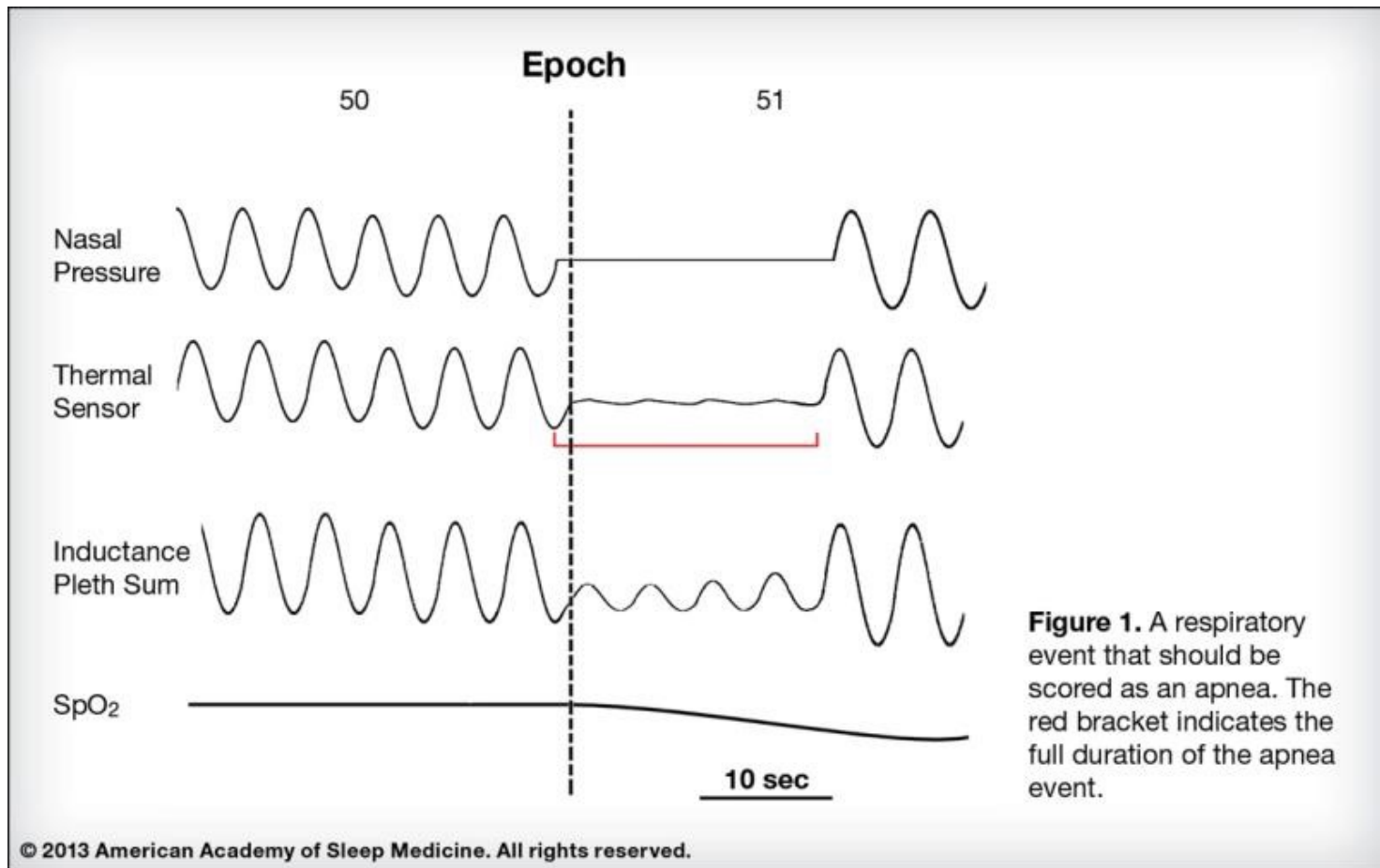
Technical Notes

- Diaphragmatic/intercostal EMG may be used for respiratory effort during apnea, hypopnea, or RERAs to complement effort belt signals when clear-cut EMG bursts are visible during normal breathing
- Monitoring snoring is optional
- Monitoring hypoventilation is optional
- Clinical judgment essential when assessing accuracy of end-tidal PCO₂ and transcutaneous PCO₂ readings
- Transcutaneous PCO₂ sensor should be calibrated with a reference gas when the accuracy of reading is doubtful
 - The value typically lags behind arterial PCO₂ changes by 2 min or more.
- End-tidal PCO₂ often malfunctions or provides falsely low values in patients who have marked nasal obstruction, profuse nasal secretions, are mouth breathers, or receiving supplemental O₂

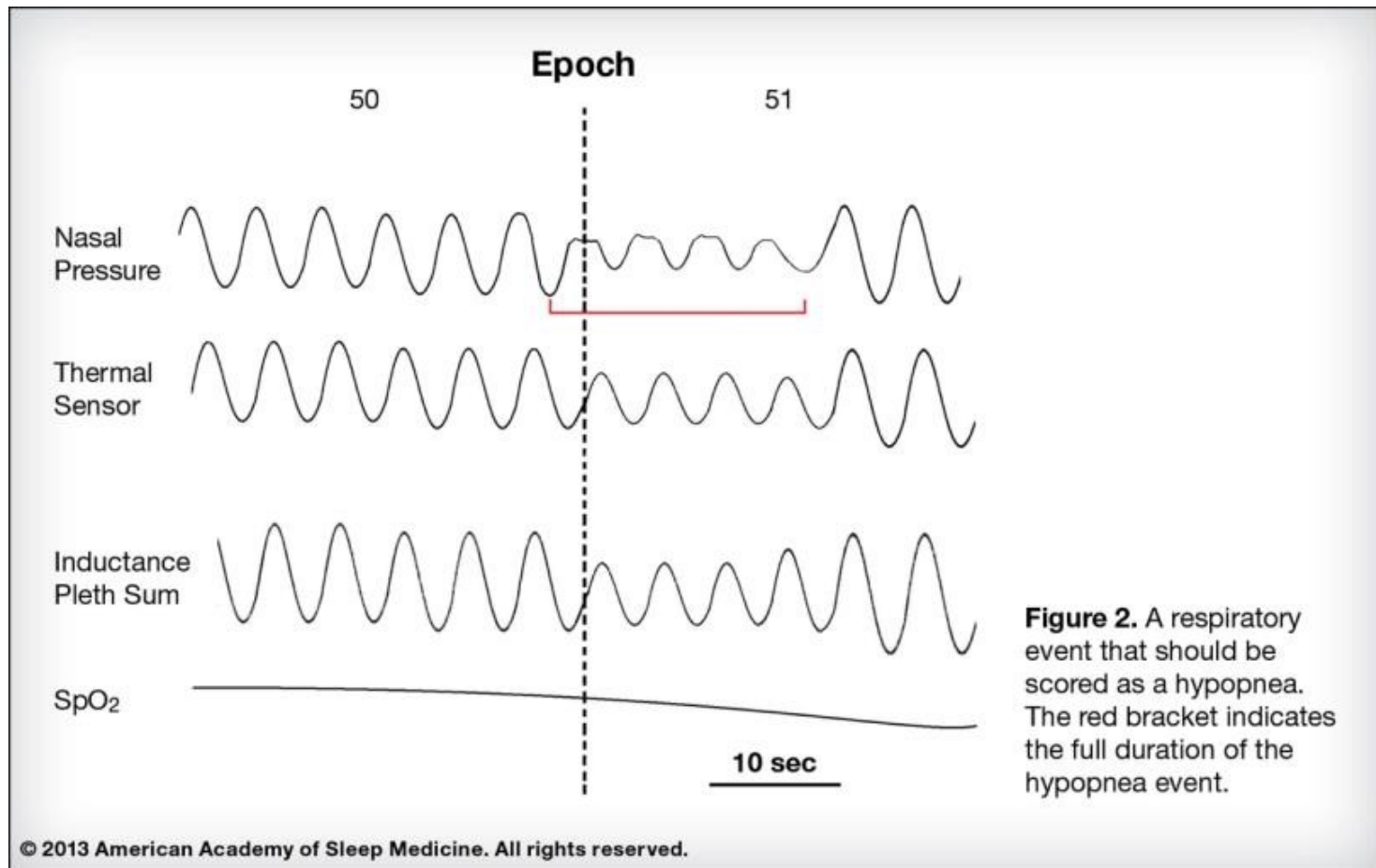
Measuring Event Duration

- For apneas, hypopneas, and RERAs: Event is measured from the nadir preceding the first breath that is clearly reduced to the beginning of the first breath that approximates the baseline breathing amplitude

Measuring Event Duration



Measuring Event Duration



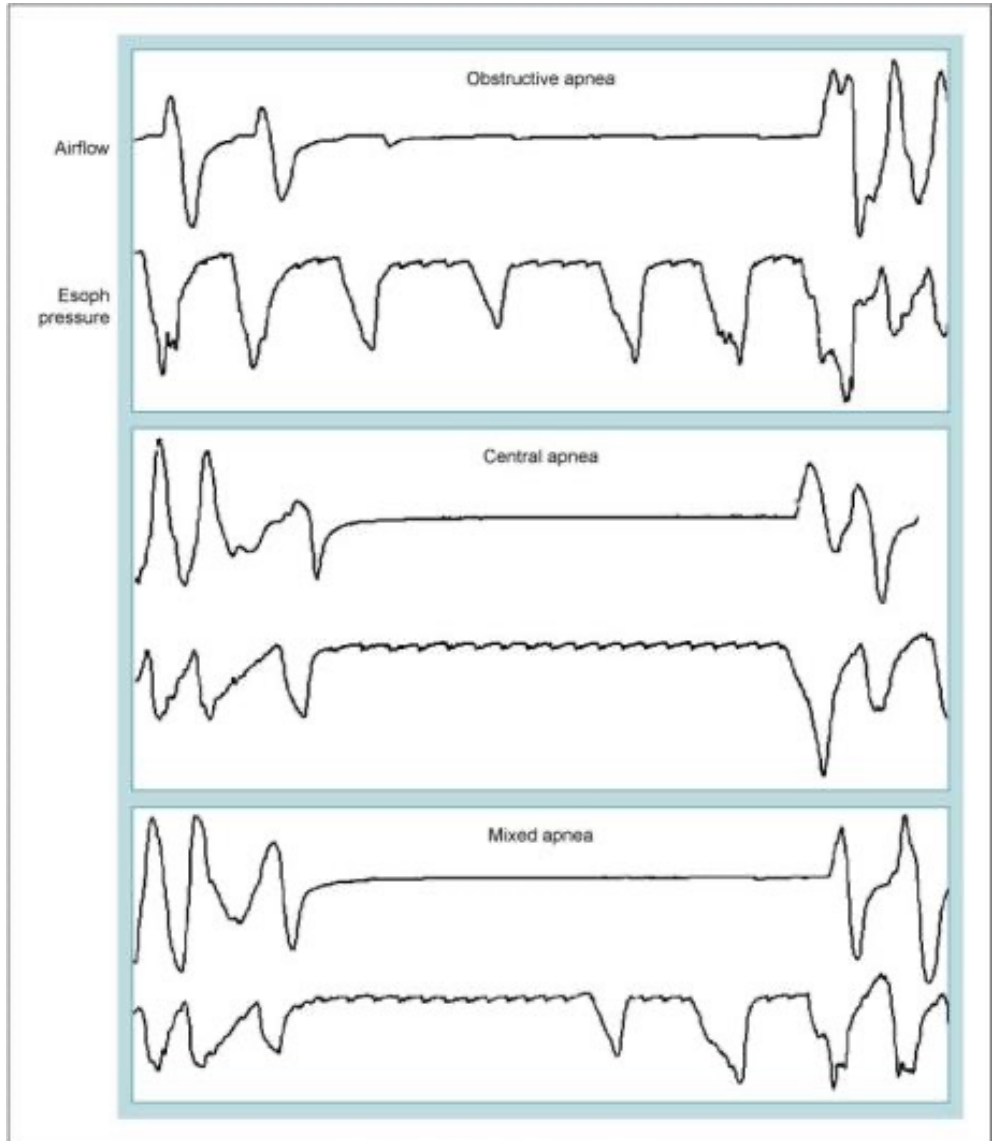
Measuring Event Duration

- For apnea duration: Use oronasal thermal sensor signal (diagnostic study) or PAP device flow signal for event duration
- For hypopnea duration: Use nasal pressure signal (diagnostic study) or PAP device flow signal for event duration
- Notes:
 - The baseline breathing amplitude should take into consideration the mean amplitude of stable breathing during the 2 minutes preceding the event start. If breathing instability present, consider the mean amplitude of the 3 largest breaths prior to the event start.
 - When baseline breathing amplitude cannot be easily determined, events can also be terminated when either there is a clear and sustained increase in breathing amplitude, or in the case where a desat occurred, there is event-associated resat of at least 2%.

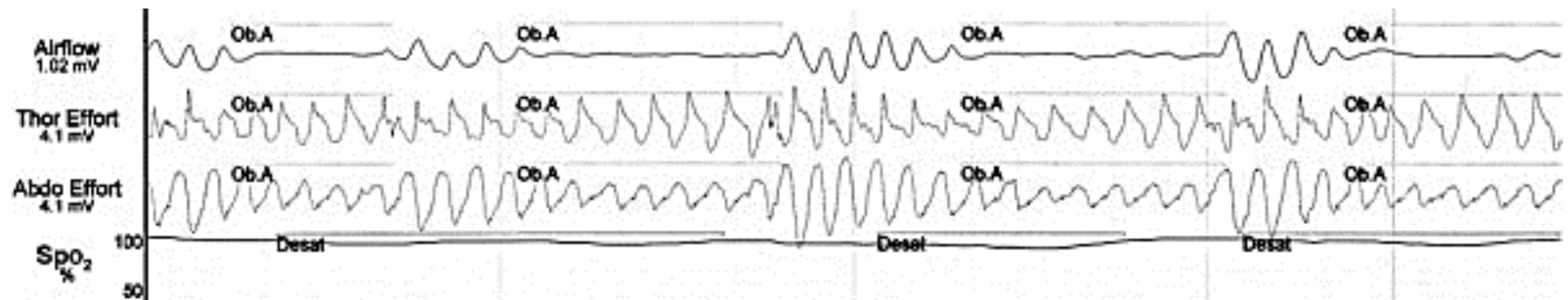
Scoring Apneas

- Score a respiratory event as apnea when BOTH are met:
 - Drop in peak signal by $\geq 90\%$ of pre-event baseline using oronasal thermal sensor (diagnostic study), PAP device flow, or an alternative apnea sensor
 - Duration of the $\geq 90\%$ drop in signal is ≥ 10 seconds
- Score an apnea as obstructive if it meets apnea criteria and is associated with continued or increased inspiratory effort throughout entire period of absent airflow

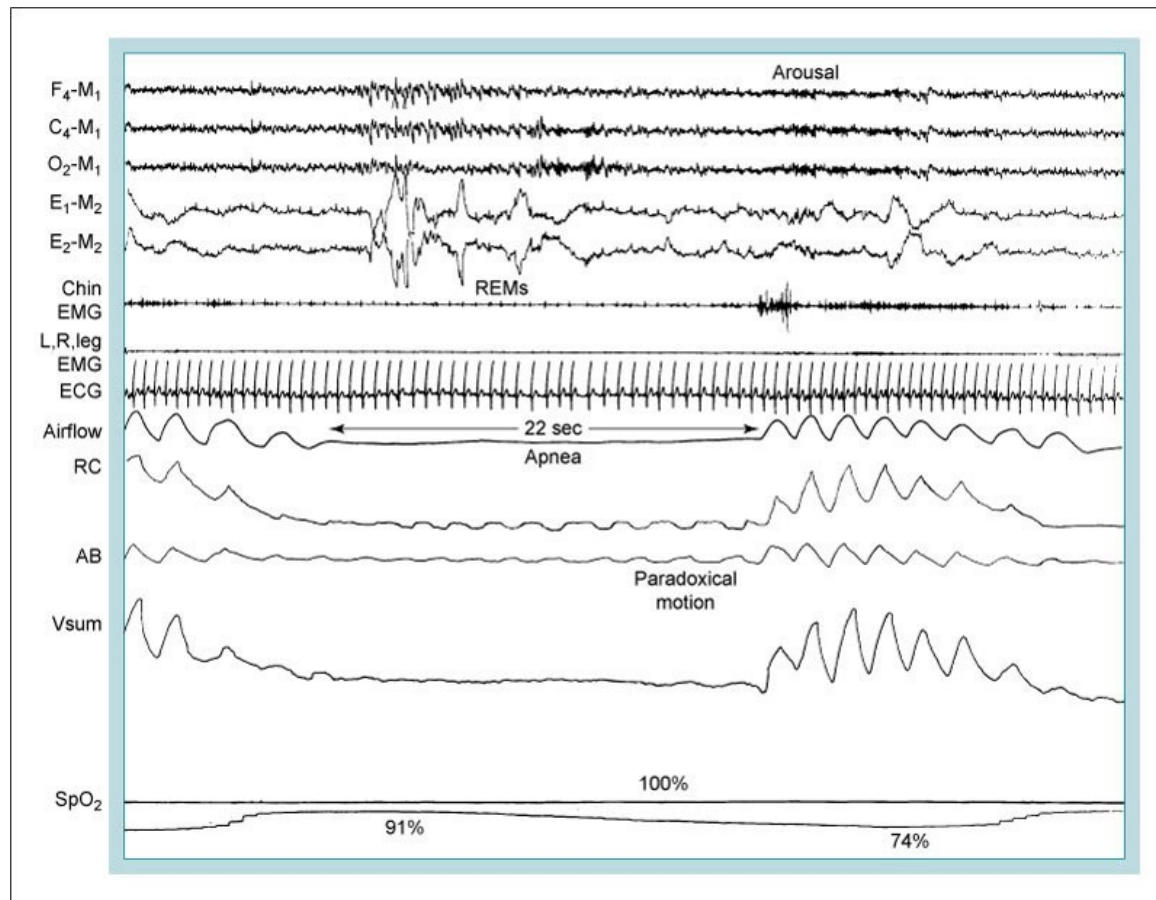
Apnea Examples



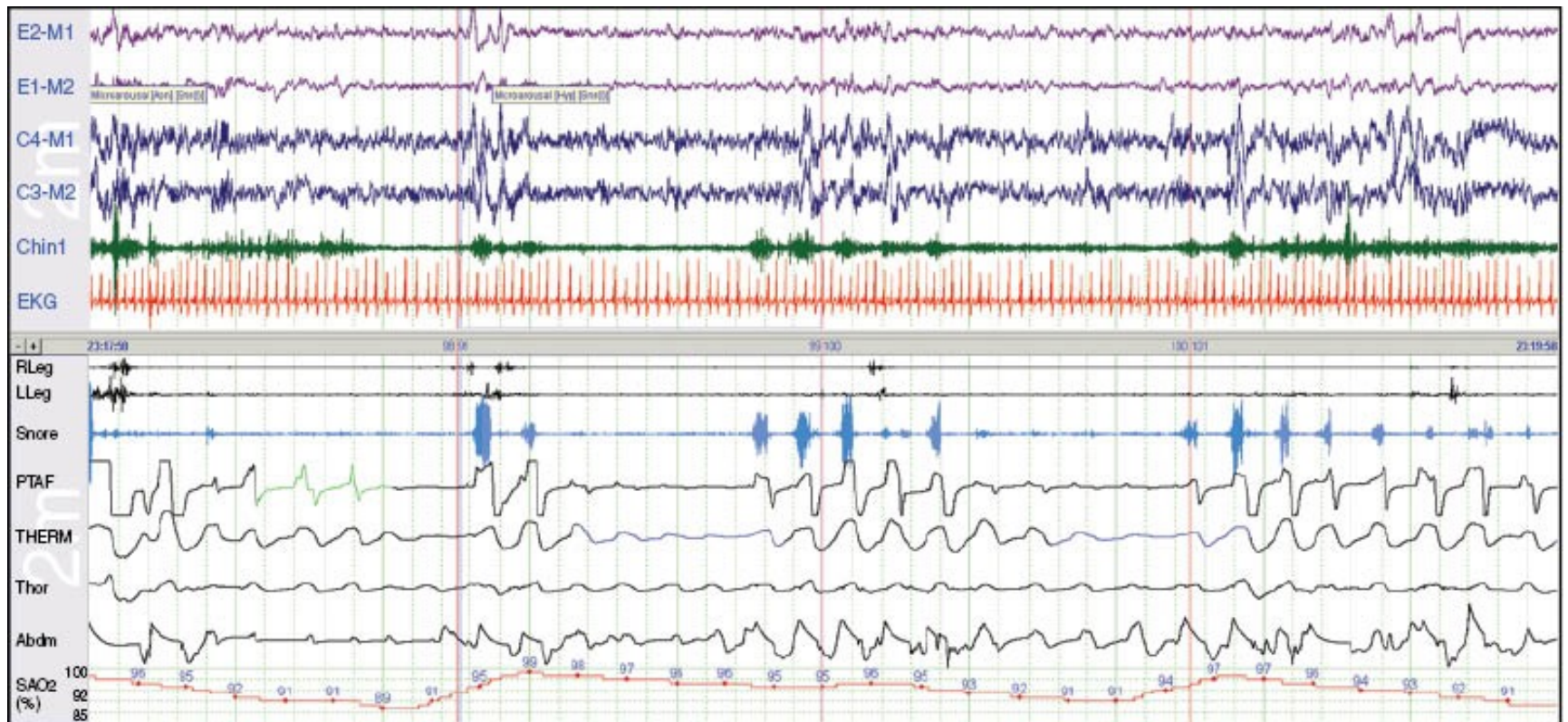
Obstructive Sleep Apnea



Obstructive Sleep Apnea

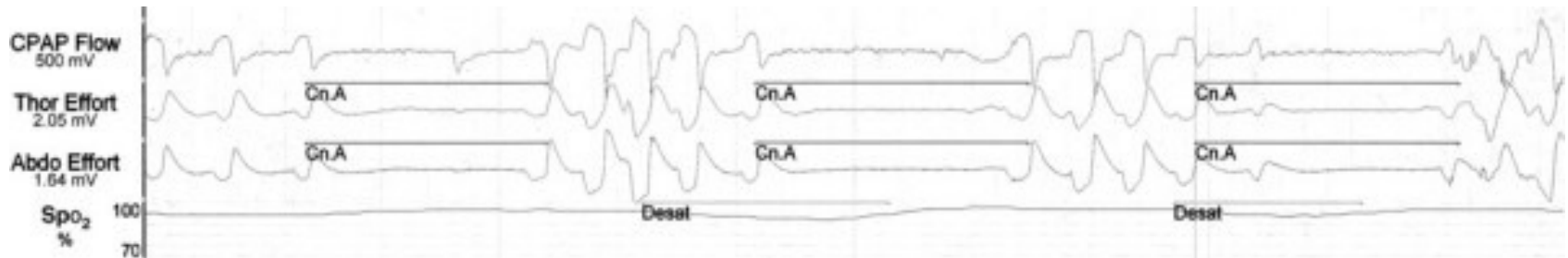


Obstructive Sleep Apnea

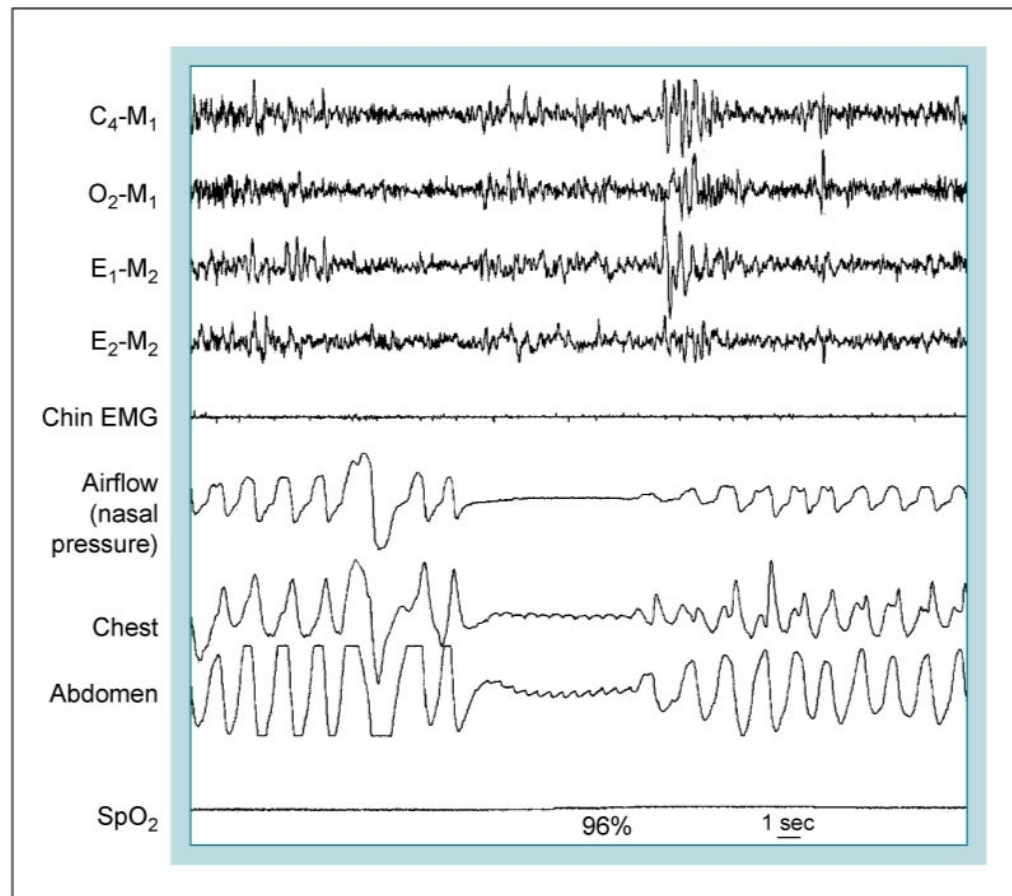


Scoring Apneas

- Score an apnea as central if it meets apnea criteria and is associated with absent inspiratory effort throughout entire period of absent airflow

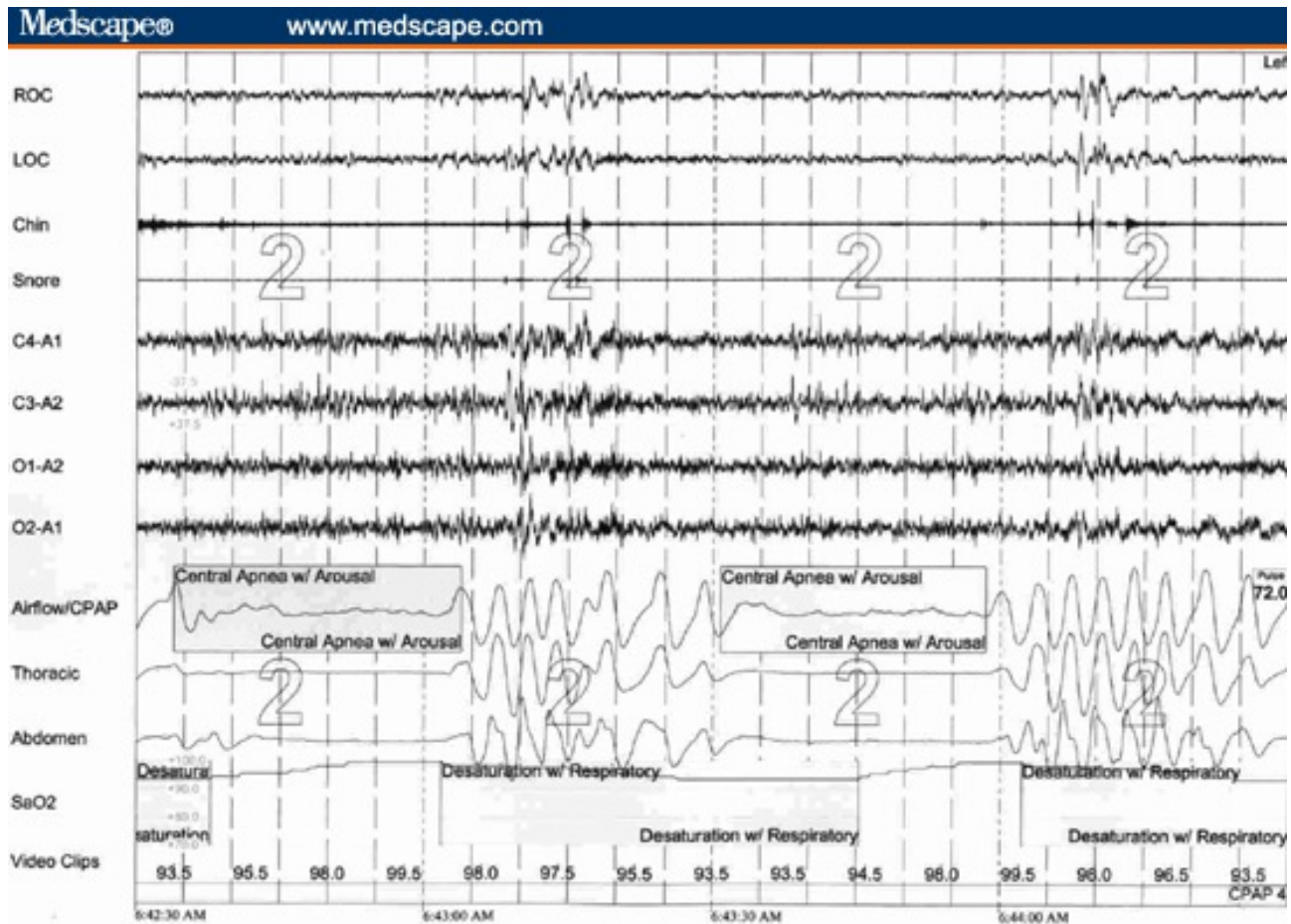


Central Apnea

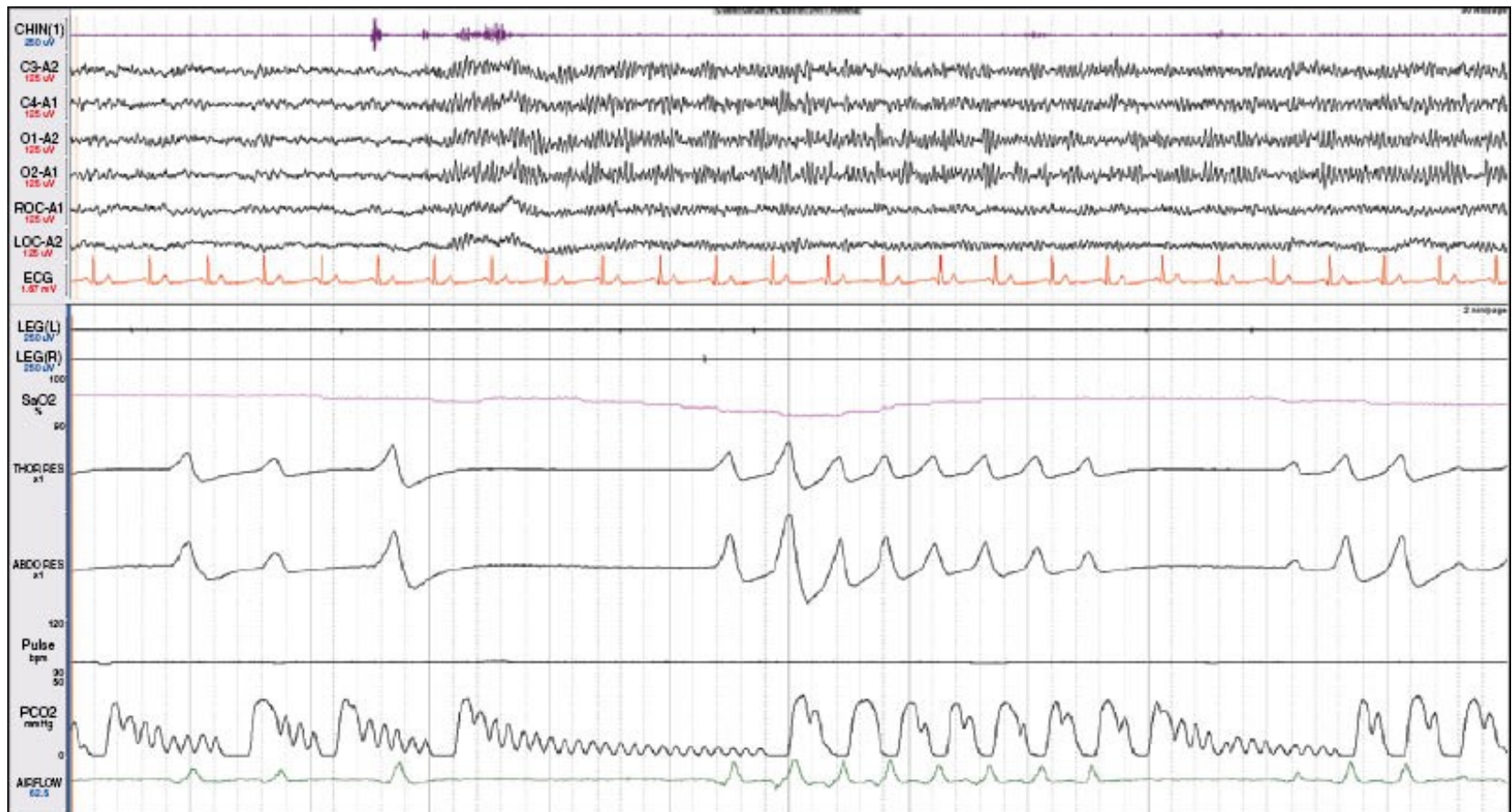


Adapted from Berry RB. Sleep Medicine Pearls, 2nd ed. Philadelphia: Hanley & Belfus, 2003, p. 237.

Central Apnea



Central Apnea



Central Apnea

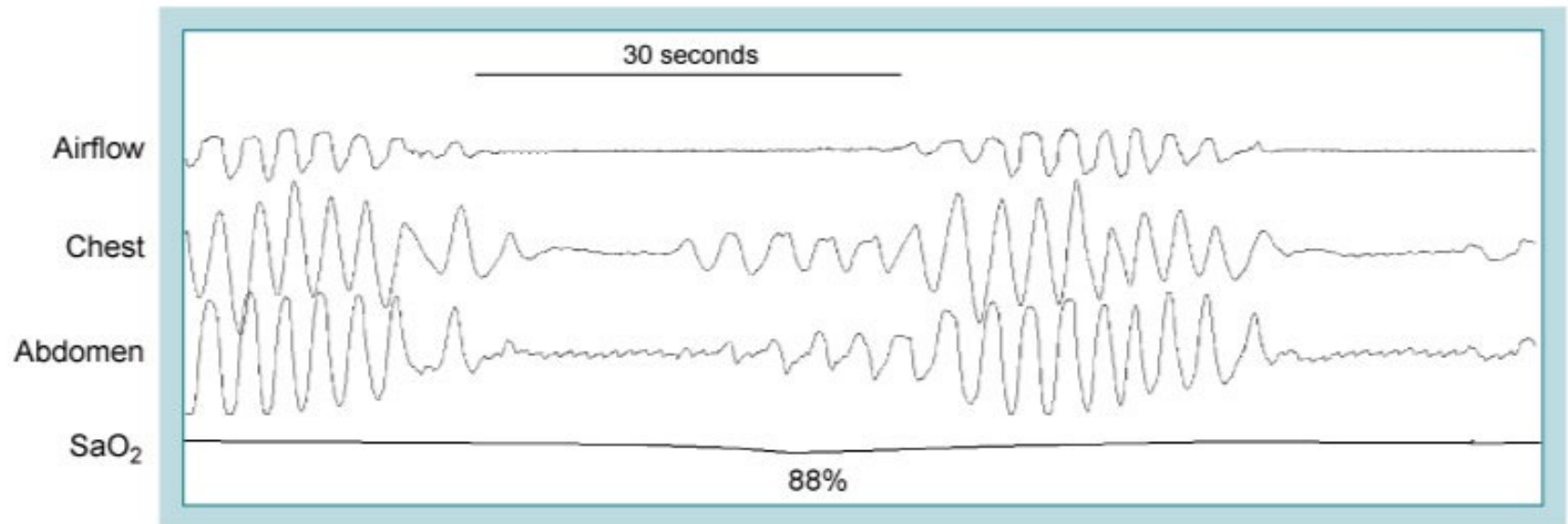


Central Apnea

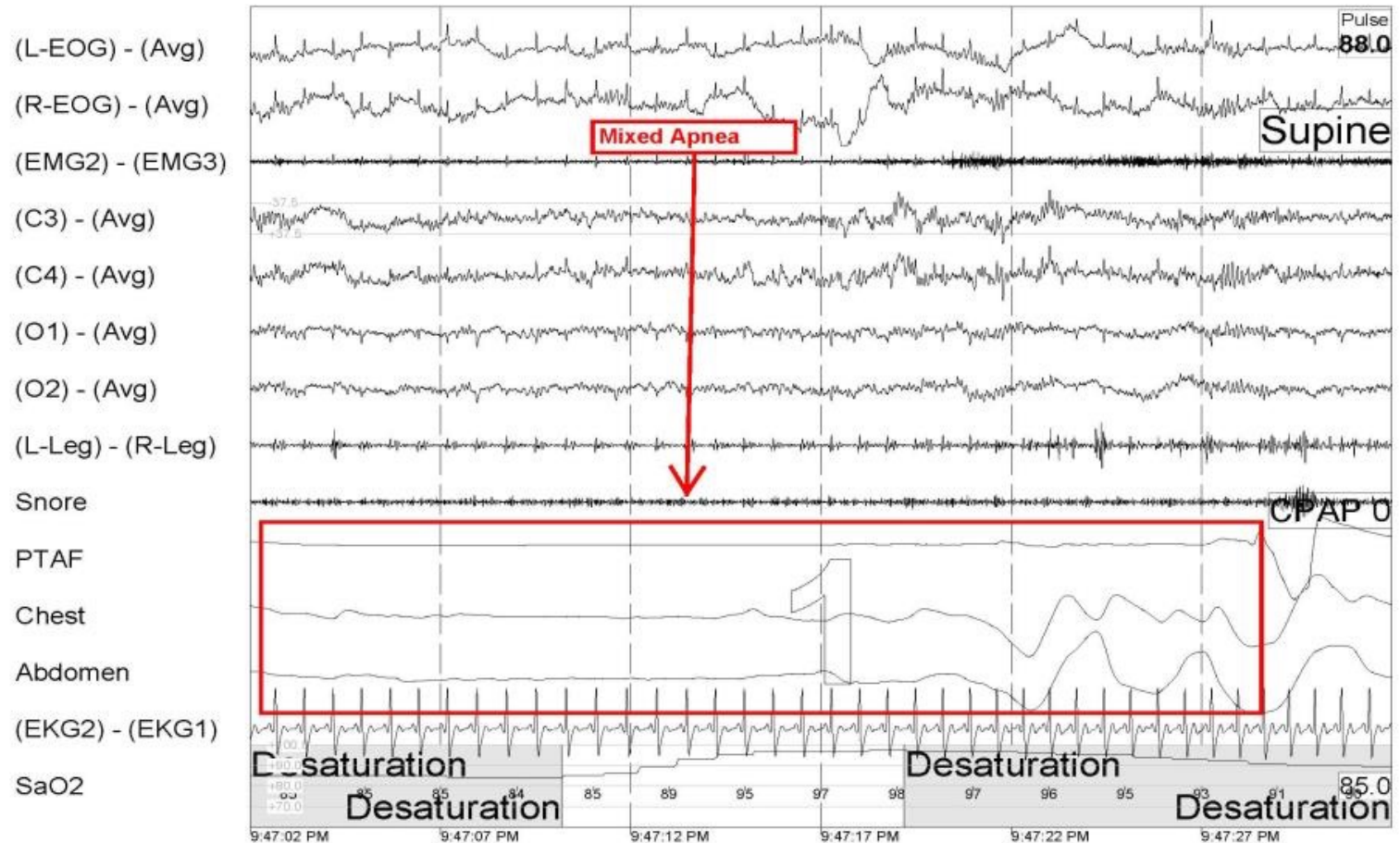


Scoring Apneas

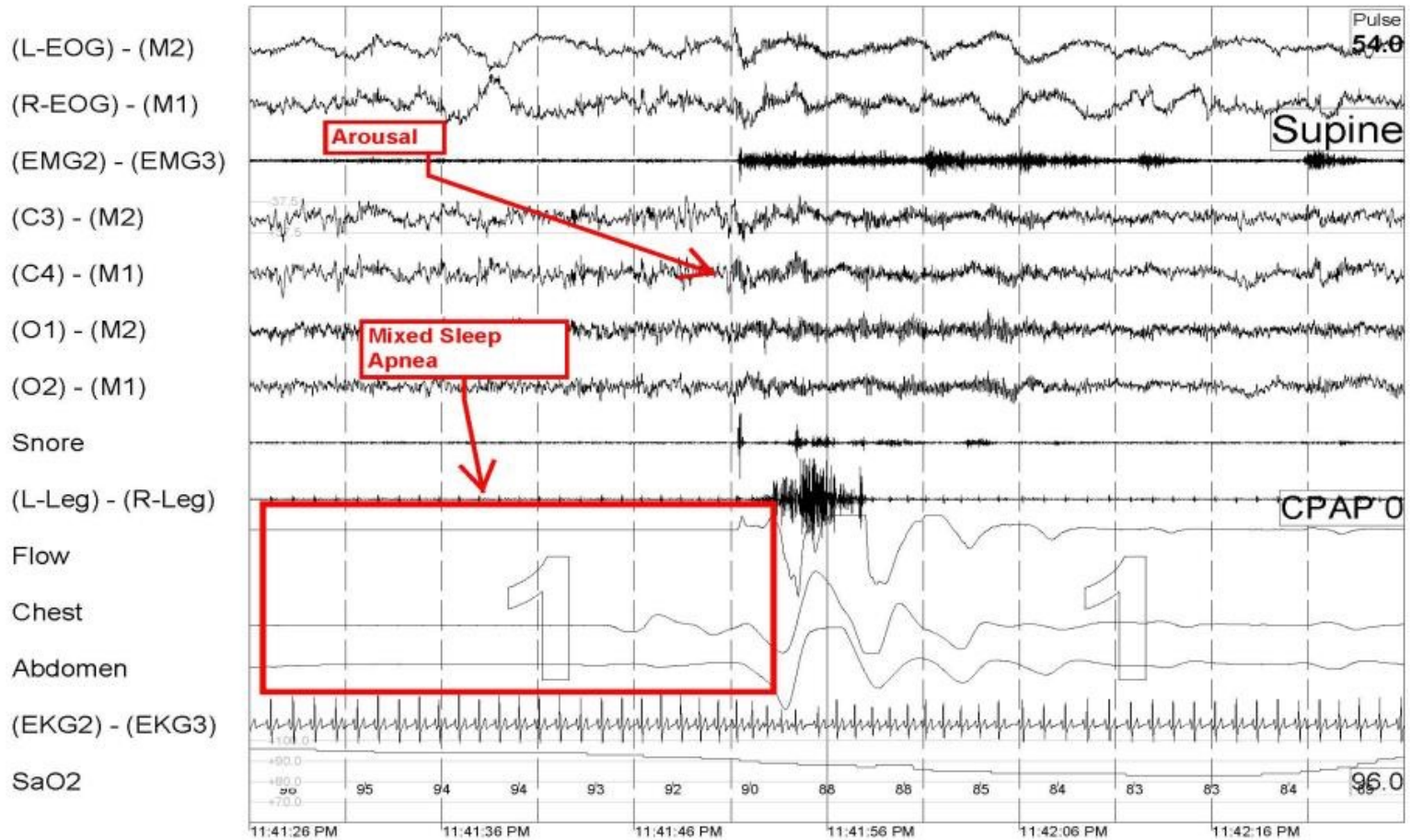
Score an apnea as mixed if it meets apnea criteria and is associated with absent inspiratory effort in the initial portion of the event, followed by resumption of inspiratory effort in second portion of event



Mixed Apneas



Mixed Apneas



Mixed Apneas



Apnea Notes

Does not require a minimum desaturation criteria to be scored

If portion of event that would meet criteria for hypopnea meets criteria for apnea, then entire event should be scored as apnea

If an apnea or hypopnea begins or ends in an epoch scored as sleep, then it can be marked

Should not be scored if it occurs entirely in an epoch scored as Wake

No specific duration for central and obstructive components of a mixed apnea

Respiratory Scoring Rules for Adults

Scoring Hypopneas

Rules for Hypopneas

- Should be scored if ALL the following are present (Recommended Rule):
 - $\geq 30\%$ drop from baseline in peak airflow signal using nasal pressure (diagnostic study), PAP device flow (titration), or an alternative hypopnea sensor (diagnostic study)
 - Duration of $\geq 30\%$ drop in signal is ≥ 10 seconds
 - $\geq 3\%$ O₂ desaturation from pre-event baseline or event is associated with an arousal

Rules for Hypopneas

- Should be scored if ALL the following are present (Optional Rule):
 - $\geq 30\%$ drop from baseline in peak airflow signal using nasal pressure (diagnostic study), PAP device flow (titration), or an alternative hypopnea sensor (diagnostic study)
 - Duration of $\geq 30\%$ drop in signal is ≥ 10 seconds
 - $\geq 4\%$ O₂ desaturation from pre-event baseline
- Scoring hypopneas as central or obstructive is optional

Obstructive Hypopneas

- Score a hypopnea as obstructive if ANY of the following occur:
 - Snoring during the event
 - Increased inspiratory flattening of nasal pressure or PAP device flow compared to baseline breathing
 - Associated thoracoabdominal paradox occurs during event but not pre-event

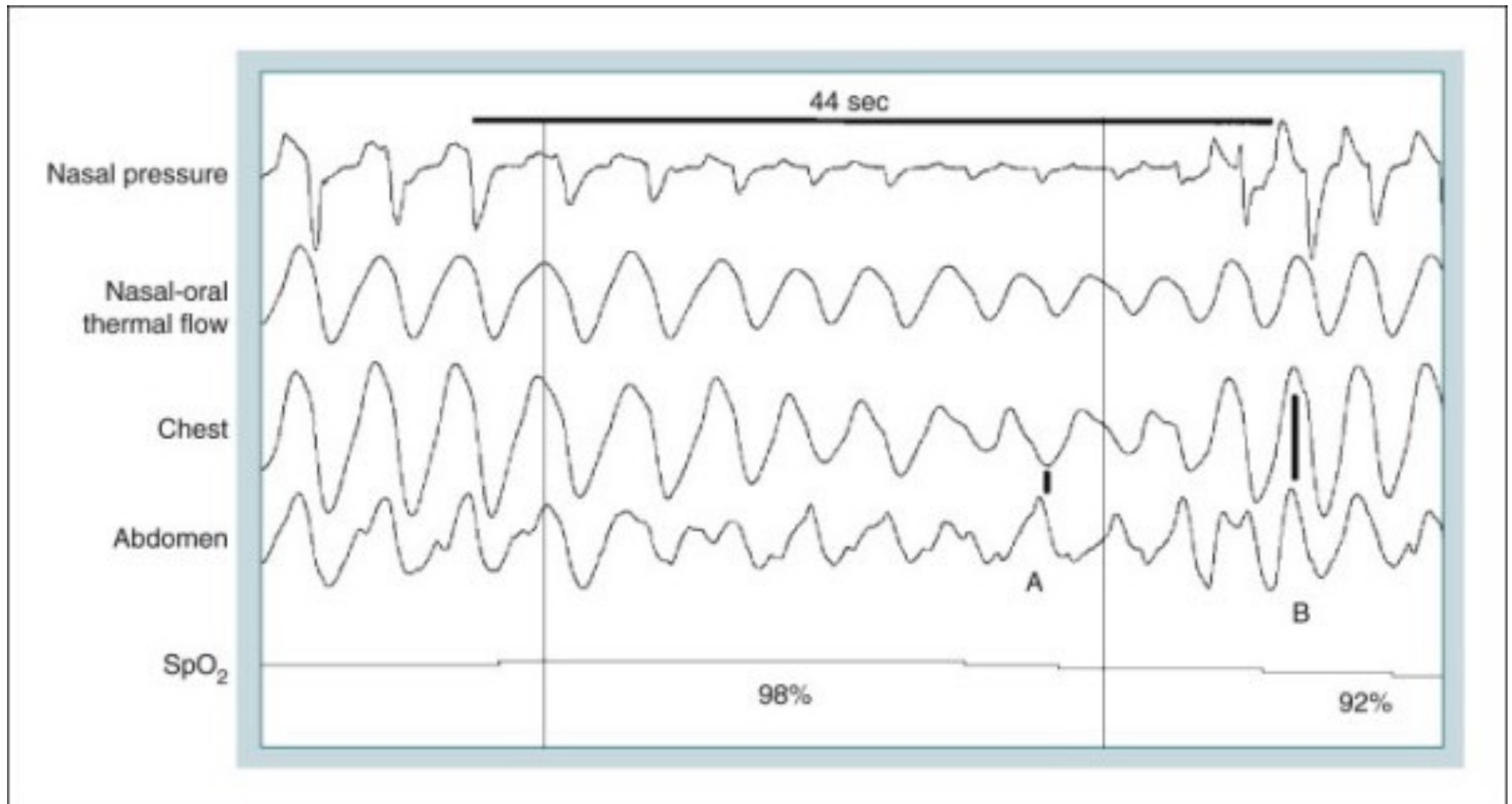
Central Hypopneas

- Score if NONE of the following occur:
 - Snoring during the event
 - Increased inspiratory flattening of nasal pressure or PAP device flow compared to baseline breathing
 - Associated thoracoabdominal paradox occurs during event but not pre-event

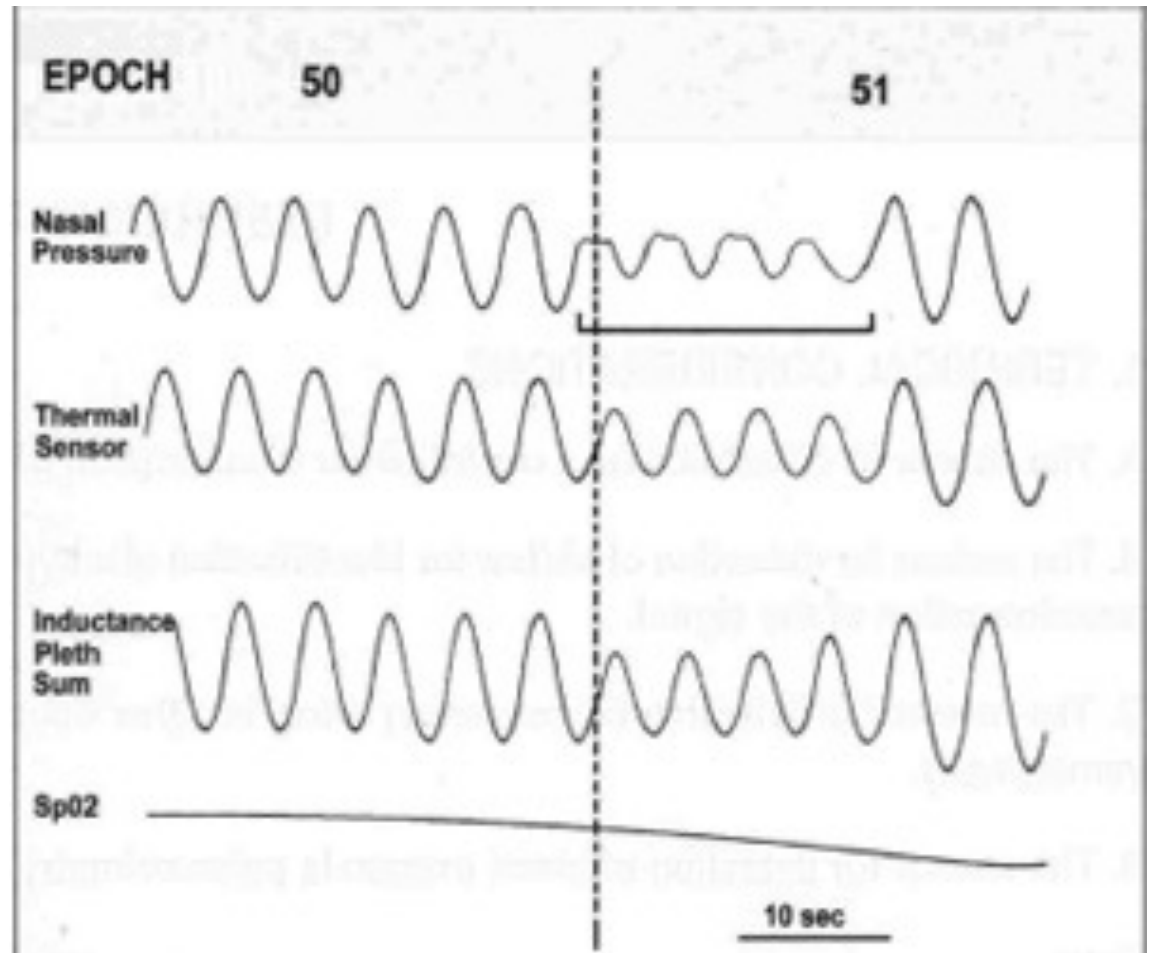
Hypopnea Notes

- Which hypopnea scoring rule was used (Recommended or Acceptable) should be documented in the PSG report
 - Individual practitioner is responsible to confirm and follow the patient's payer guidelines in order to receive reimbursement and qualify the patient for therapy
- Supplemental O2 may blunt desaturation
 - No scoring guidelines for supplemental O2
 - Presence of supplemental O2 should be mentioned in narrative summary of study

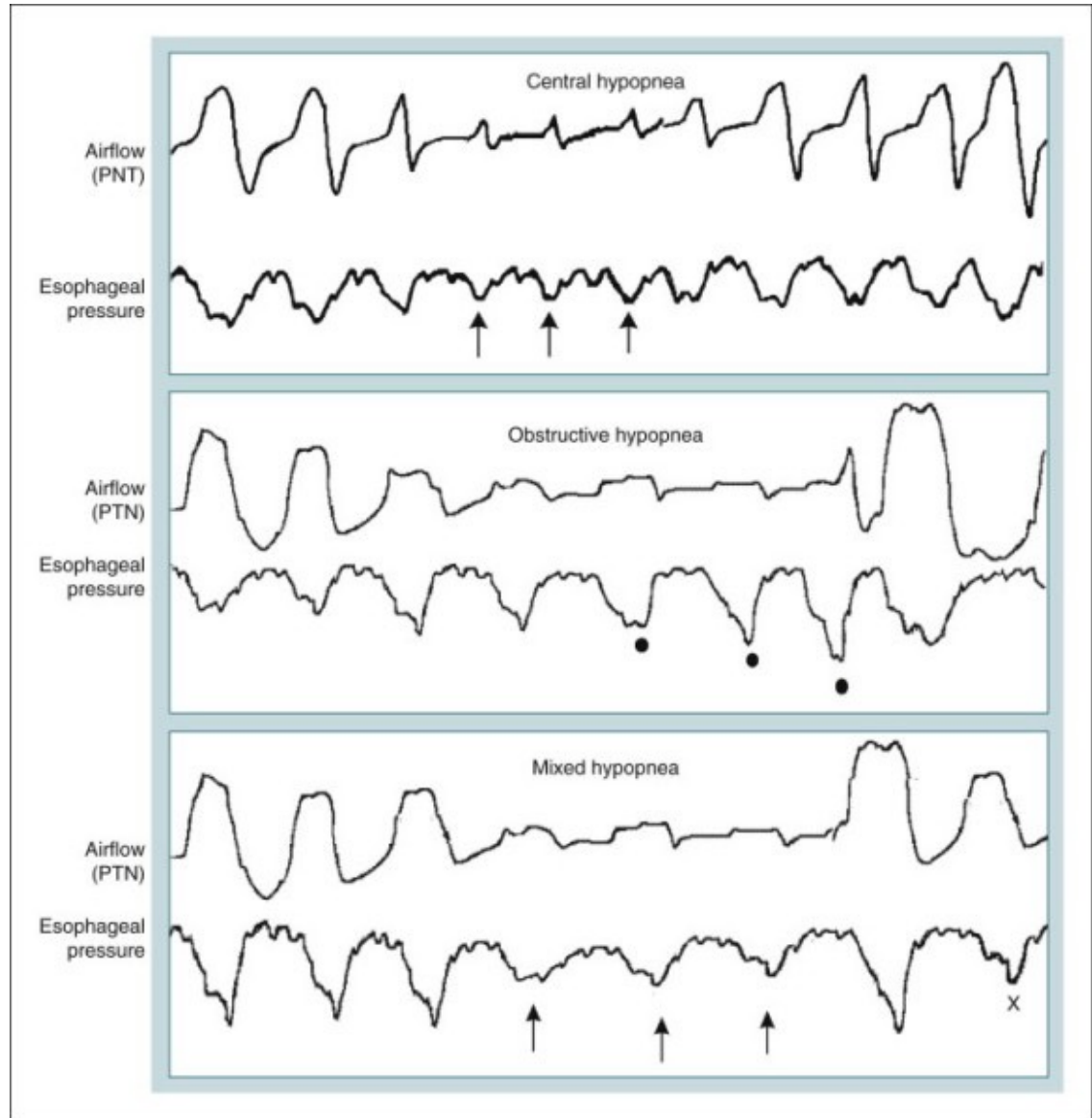
Hypopneas



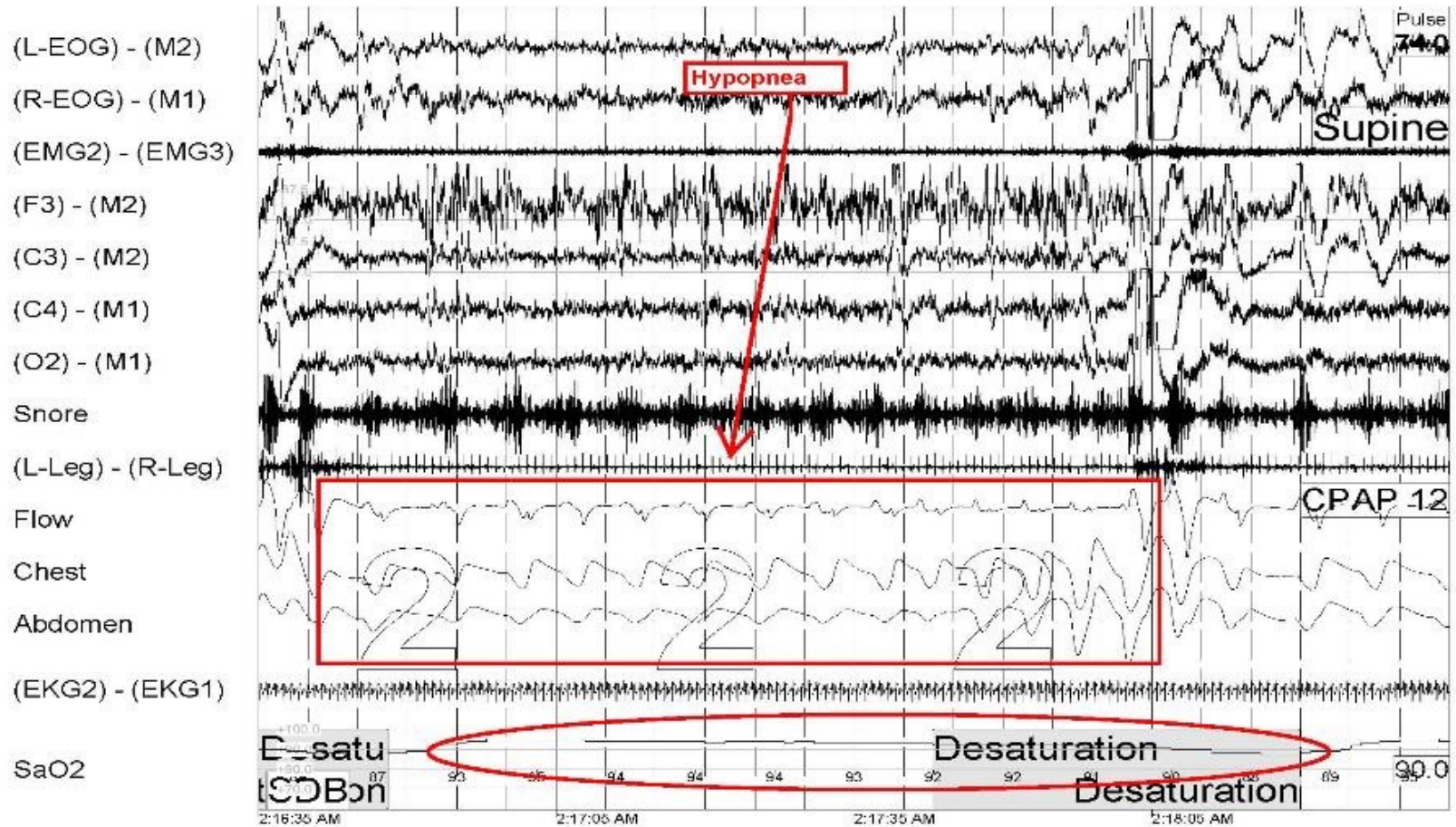
Hypopneas



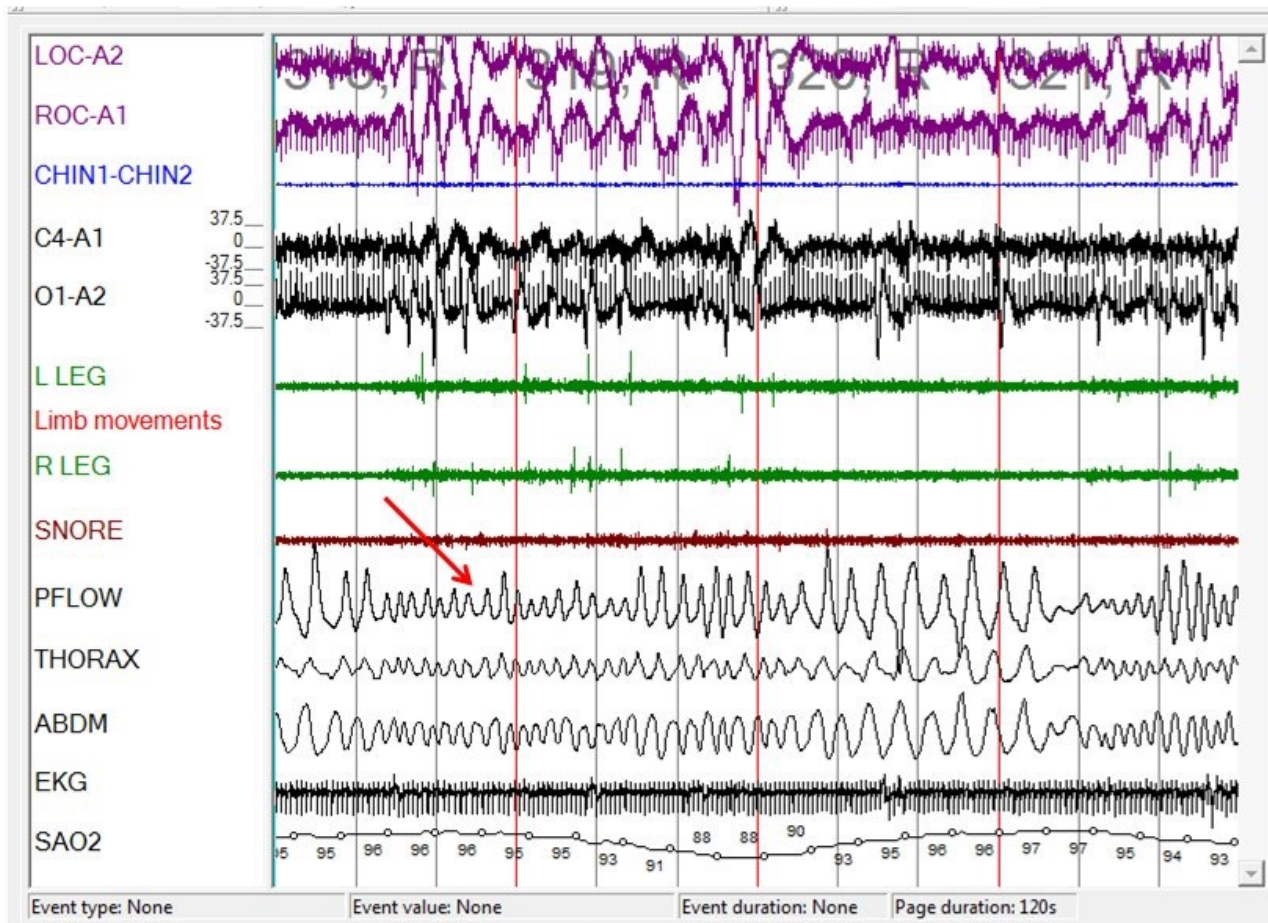
Hypopneas



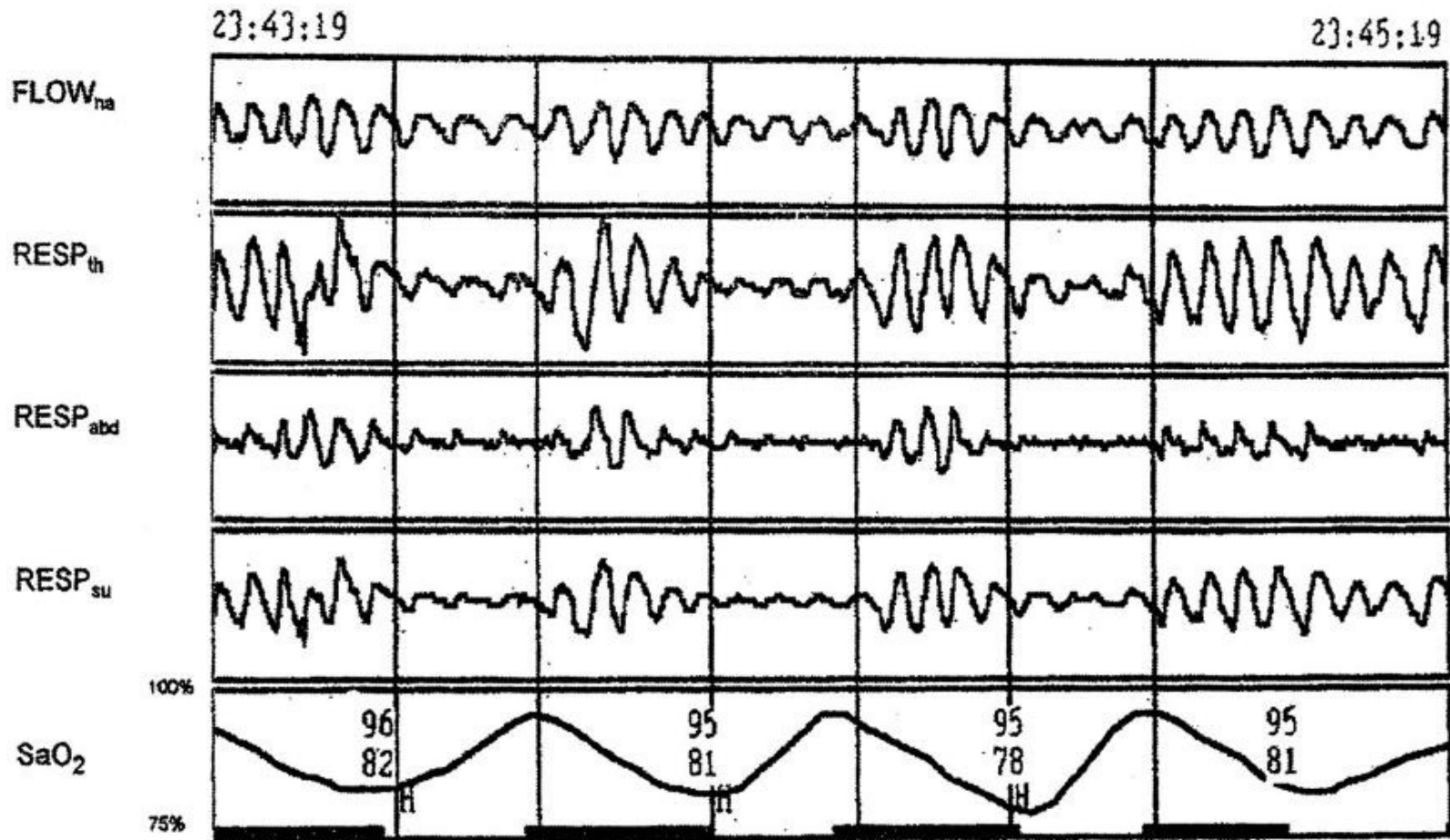
Hypopneas



Hypopneas



Hypopneas



Hypopneas

