Introduction to Sleep lab

Dr. Tripat Deep Singh
MBBS, MD, RPSGT, RST
International Sleep Specialist
(World Sleep Federation Program)
• The term polysomnography was given by Holland, Dement and Raynall in 1974

• It is the technique of recording, analysing and interpreting multiple simultaneous physiologic parameters during sleep
TYPES OF SLEEP STUDY
1. Full night diagnostic sleep study
2. Continuous Positive Airway Pressure (CPAP) titration study
3. Split night study (Diagnostic+Titration on the same night)
4. Multiple Sleep Latency test (MSLT)
5. Maintenance of wakefulness test (MWT)
6. REM behavior disorder study
7. Nocturnal seizure study
8. Ambulatory sleep studies
<table>
<thead>
<tr>
<th>Level of study</th>
<th>Characteristics</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Attended in-laboratory full polysomnography (typically consists of EEG, EOG, chin EMG, airflow, respiratory effort, SaO₂, EKG, leg EMG, and body position)</td>
<td>Gold standard for the diagnosis of OSA</td>
</tr>
<tr>
<td>Level 2</td>
<td>Unattended full polysomnography (monitors same parameters as Level 1 study including EEG, EOG, chin EMG, airflow, respiratory effort, SaO₂, EKG, leg EMG, and body position)</td>
<td>Validity of results may be limited by insufficient sleep time, absence of REM sleep, or absence of sleep in the supine position.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Cardiopulmonary studies consisting of 4 or more parameters (eg, airflow, SaO₂, respiratory effort, EKG, or body position)</td>
<td>Useful when there is a high pretest likelihood of OSA, Levels 1 or 2 studies are not readily available, and delay in testing is unacceptable. Might be useful for follow-up evaluation following therapy of patients previously diagnosed with OSA</td>
</tr>
<tr>
<td>Level 4</td>
<td>Monitoring using only one or two parameters (eg, SaO₂, airflow or snoring)</td>
<td>Poor specificity, and sensitivity Not recommended for diagnosis of OSA</td>
</tr>
<tr>
<td>(continuous single or dual bioparameter recording)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sleep Diagnostic Product Line

Outcomes

- referral
- screening
- RU Sleeping

Berlin Questionnaire

Technology

- Portable Diag
- Alice PDx
- Alice 5
- Lab Diagnostic
The Alice 6 family
Alice 6 Family

**LD$_E$ Base**
- Essentials for customers focused on OSA diagnosis

**LD$_{xS}$**
- Full-feature model for most sleep customers

**LD$_{xN}$**
- Advanced model with “Power” for research interests
FULL NIGHT DIAGNOSTIC
SLEEP STUDY – LEVEL 1
Essential components of a PSG Recording

1. Good quality amplifiers
2. Appropriate filter design
3. Independent filter selection for each channel
4. 50-60 Hz off/on selection for each channel
5. Adequate sampling rates and bit resolution for each parameter
6. Input signal re-referencing capability
7. Standard calibration procedures and signal verification
8. Appropriate signal display, sleep stage scoring capability of storing all changes to recording made by attending technicians
9. Full disclosure of all options and features that may potentially affect accuracy or signal resolution
• EEG
• EOG
• EMG (Chin&Leg)
• ECG
• SpO$_2$
• Respiratory effort
• Nasal flow
• Snore
NREM sleep

(N1) Relaxed wakefulness
Stage 1
Theta waves

(N2) Stage 2
Sleep spindles

(K-complex)

(N3) Stages 3 and 4
Delta waves

REM or dreaming sleep
The recommended EOG derivations and electrode positions are: (see Figure 2A) RECOMMENDED

a. Derivations: E1-M2 and E2-M2

b. Electrode Positions: E1 is placed 1 cm below the left outer canthus and E2 is placed 1 cm above the right outer canthus

Acceptable EOG derivations and electrode positions are:*NM (see Figure 2B) ACCEPTABLE

a. Derivations: E1-Fpz and E2-Fpz

b. Electrode positions: E1 is placed 1 cm below and 1 cm lateral to the outer canthus of the left eye and E2 is placed 1 cm below and 1 cm lateral to the outer canthus of the right eye
Three electrodes should be placed to record chin EMG:

a. One in the midline 1 cm above the inferior edge of the mandible (see a in Figure 3)
b. One 2 cm below the inferior edge of the mandible and 2 cm to the right of the midline (see b in Figure 3)
c. One 2 cm below the inferior edge of the mandible and 2 cm to the left of the midline (see c in Figure 3)
• During inspiration airway pressure is negative relative to atmospheric pressure and during expiration it is relatively positive.

• The resulting alteration in nasal airway pressure can provide a surrogate estimate of airflow.

• It is used to define hypopneas.
• Exhaled air is warmer than ambient temperature

• Measuring temperature fluctuation in front of nares or mouth provides a simple measure of airflow

• Thermistors are thermally sensitive variable resistors that produce voltage alterations when connected in a low current circuit
  
  – Advantage- Maximize sensing area while minimizing sensor size and mass
  – Used for defining apneas
Several factors limit the application of PtcO_2 monitoring during adult sleep studies:

- The variable relationship between PaO_2 and PtcO_2
- Slow response time that fails to mirror rapid changes in PaO_2
- And the need for periodic site changes
Biocalibration

- Close the eyes
- Open the eyes
- Move the eyes left and right
- Move the eyes up and down
- Cough
- Move the feet
- Hold breath
- Respiratory effort
• Time of Sleep study
• Biocalibration
• Technical difficulties and methods of correction
• Patient concerns or complaints
• Anything noteworthy that the patient said during hookup
• CPAP or BI-PAP pressure changes
• Supplemental oxygen flow
• Time and purpose for entering the patient room after the start of the study
• Level of snoring (mild, moderate, severe)
• Leg movements, respiratory events, EEG arousals and other significant events
• Periods of nocturia
• Any other unusual event or observation
• At the end of the study “lights on is marked on the tracing and the patient is awakened and unhooked from the electrodes. The paste off the electrode sites is cleaned after the wires are removed
• Post-test questionnaire- This is given in the morning after the study. Questions that are included in this are-

• How long did it take for you to fall asleep last night?

• How many times do you remember waking up last night?

• How did your sleep during the study compare with your normal night’s sleep?

• How many hours do you feel you slept last night?

• The patient is now discharged after the study
Post study Procedures

• Ensure that the study is saved properly

• Save the audio-visual sequence taking care that it is synchronized along with the polysomnographic tracing

• Ensure that the system is shut down properly

• The electrodes and various sensors are cleaned and sterilized
THANK YOU