## 205. "Snoring and scoring": subjective and objective measures of sleep-disordered breathing

**1660**

**The Epworth sleepiness score should not be used to screen out patients with suspected sleep-breathing disorders**

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The Epworth Sleepiness Score (ESS) is used to assess the level of daytime sleepiness as perceived by the patient. In some centres and in primary care, the ESS is used to reduce the number of referrals for suspected sleep-breathing disorders (SBD), where an ESS is within normal range (≤10).

**Aim:** To determine the limitations of using ESS to screen patients with suspected SBD.

**Methods:** 150 consecutively referred patients were given an ESS and had 2 nights of oximetry at home (Minolta 300i). The oximetry data was analysed using Download 2001 (Stowood Scientific,UK) for 4% dips/hr and an Δindex cut-off of >0.6. Data is given as median (range). The highest dips/hr and Δindex was used in the analysis from either night.

**Results:** 130 patients had usable data; 39F and 91M, aged 50 yrs (19-79), ESS - 11.5 (1–23), 4% dips/hr - 4.8 (0.3-119) and 6.2 (0.1-118), and Δindex - 0.57 (0.2-5.6) and 0.63 (0.2-10.9) on the 2 nights respectively. There was no correlation between ESS and oximetry indices.

Distribution of patients based on Epworth score

| | ≤10 | 11–15 | >15 |
|---|---|---|---|
| <5 4% dip/hr | 25 | 14 | 13 |
| 5–15 4% dip/hr | 13 | 14 | 15 |
| 15–30 4% dip/hr | 11 | 4 | 2 |
| >30 4% dip/hr | 5 | 6 | 6 |
| Δindex <0.6 | 20 | 15 | 16 |
| Δindex >0.6 | 34 | 23 | 20 |

25/130 (19%) had a normal 4% dips/hr and 20/130 (15%) had a normal Δindex in with a normal ESS of ≤10. 27/130 (21%) had a normal 4% dips/hr with an ESS>10.

**Conclusion:** The ESS, within limitations, is a guide as to whether daytime sleepiness is present. It should not be used to reduce referrals for assessment of suspected SBD, but as part of a screening assessment using oximetry and a good clinical history. The reasons why patients have a high ESS in the absence of a significant SBD requires further investigation.

**1661**

**Clinical audit of the Quebec Sleep Questionnaire in a routine sleep apnoea service**

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**Introduction:** We reviewed 2 years of our obstructive sleep apnoea & hypopnoea syndrome (OSAHS) service. The Quebec Sleep Questionnaire (QSQ) was used as a subjective measure of improvement[1] with CPAP. We aimed to see if QSQ reflected symptomatic improvement in treated patients.

**Methods:** Referrals undertook history & baseline overnight oximetry (Pulsox 300i, Minolta, Japan). If positive for OSAHS, they undertook an auto-titration and, if beneficial, a trial of CPAP. Of 783 patients, only 155 completed QSQ before & after the CPAP trial. QSQ includes 5 areas; Q1. hypersomnolence, Q2. diurnal symptoms, Q3. nocturnal symptoms, Q4. emotions, Q5. social interactions. An increased score indicated improved symptoms. We compared objective & subjective improvements with CPAP.

**Results:** Patients exhibited witnessed apnoeas (68%), snoring (90%), excessive daytime sleepiness (76%) with 56% showing all 3 symptoms. Differences in SpO2 dip rate, Epworth Score (ESS) & QSQ pre- & post-CPAP trial are shown in Table 1. Surprisingly, there was poor correlation between hypersomnolence (Q1) & ESS.

QSQ scores (Q1-5), Diprate and ESS pre- & post-two week CPAP trial

| | Q1 | Q2 | Q3 | Q4 | Q5 | Dips >4% SpO2/hr | EDS |
|---|---|---|---|---|---|---|---|
| Baseline | 23.9 (10.4) | 35.4 (15.1) | 24.8 (9.8) | 21.1 (7.5) | 16.8 (6.7) | 31.4 (27.5) | 13.1 (5.0) |
| End of Trial | 32.0 (9.2) | 49.2 (15.2) | 34.0 (9.8) | 25.9 (7.5) | 22.1 (5.8) | 5.8 (8.0) | 9.2 (5.1) |
| T-Test | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 |

Data is presented as mean (SD) with T-Test comparisons of Baseline to End of Trial.

**Conclusion:** QSQ correlates with objective improvements in OSAHS & appears to be a reliable subjective measure of symptom improvement. However, there was poor correlation between ESS & hypersomnolence.

**Reference:**

[1] Lacasse, et al. Thorax 2004;59:494-499.

**1662**

**Sleep-breathing disorders (SBD) – Sleepiness, fatigue, quality of life (QoL) and depression**

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Patients with SBD may present with sleepiness, fatigue, and often cannot separate them. SBD affects QoL and depression may occur.

**Aim:** To determine sleepiness, fatigue, depression and QoL in relation to the severity of SBD.

**Methods:** 150 consecutively referred patients had 2 nights of home oximetry (Minolta 300i). Oximetry data was analysed by experienced Physiologists (Download 2001, Stowood Scientific,UK). Patients completed Epworth Sleepiness Score (ESS), SF-36, Multidimensional Fatigue Inventory (MFI-20) and Beck-II score. Data were stratified using 4% and 3% dips/hr, cumulative %time at $SpO_2$<90% ($CT_{90}$), Δindex and pulse rate change > 6 bpm ($PR_6$) from oximetry. Data are given as median(range).

**Results:** 130 patients had usable data, 91M, aged 50yrs (19-79). MFI-20 Reduced Motivation correlated (p<0.05) with 4% (r=0.19), 3% (r=0.22), Δindex (r=0.18) and $CT_{90}$ (r=0.17), whilst SF-36 General Health correlated with 3% (r=-0.17) and $CT_{90}$ (r=-0.21). No other correlations occurred.

Percent patients related to 4% Dips/hr

| | 0–5 | 5–15 | >15 |
|---|---|---|---|
| ESS | 23 | 33 | 25 |
| MFI-20 | | | |
| General Fatigue | 55 | 64 | 34 |
| Physical Fatigue | 36 | 49 | 53 |
| Reduced Activity | 28 | 53 | 31 |
| Reduced Motivation | 13 | 33 | 19 |
| Mental Fatigue | 30 | 38 | 22 |
| SF-36 | | | |
| General Health | 47 | 71 | 66 |
| Vitality | 74 | 82 | 60 |
| Mental Health | 23 | 42 | 25 |

Similar results were observed for 3% dips/hr, Δindex>0.6 and $CT_{90}$. BECK-II (n=72) had a distribution of 45%, 52% and 33% in relation 4% dips/hr.

**Conclusions:** We observed high levels of fatigue and sleepiness and poor QoL. Patients with mild SBD had high levels of fatigue, depression and sleepiness, whereas patients with moderate SBD had a lower percentage of patients. It is essential to account for fatigue and QoL and to investigate negative studies further.

**1663**

**Inter-device variation in dual oximetry for polysomnography**

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**Aims:** Some sleep laboratories use two SpO2 channels to better detect artefact. This study aimed to examine the agreement between two SpO2 monitors used concurrently on the same polysomnography (PSG).
**Methods:** 117 PSGs were audited for this study. The PSGs included channels from an integrated SpO2 monitor (Nonin) and an external device from another manufacturer (Masimo). The mean SpO2 and the desaturation index (DI) for both oximeters were compared. Comparisons were made using Bland Altman analysis, with limits of agreement (LOA) of 1.96 standard deviations, and confidence intervals (CI) of 95%.
**Results:** Bland Altman analysis indicated a bias of +1.7% (CI +1.4%, +2.0%), showing a systematic offset towards Masimo. The LOA were -1.2% (CI -1.7%, -0.7%) to 4.5% (CI 4.0%, 5.0%), indicating a variation of ±2.85%.
Bland Altman analysis of the DI indicates a -38.5% (CI: -28.0%, -49.1%) smaller DI for the integrated sensor as compared to the external sensor.
**Conclusions:** When used to assess mean SpO2 there is a variation of ±2.9%, this may not be clinically acceptable. Additionally the external sensors produced systematically higher readings than integrated sensor. Therefore the outcome of an assessment of hypoxia is device dependant, if only one of these devices is used.
There is poor agreement between devices with regards to the desaturation index. The integrated sensor detected 38.5% less desaturations compared with the external sensor. This systematic bias suggests that an assessment of sleep disordered breathing is device dependant.

**1664**

**Screening for obstructive sleep apnoea (OSA) in patients attending a hypertension clinic with features of the metabolic syndrome**

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**Aim:** To see if OSA is a common finding in patients with Metabolic Syndrome.
**Background:** Metabolic Syndrome has been described as a constellation of risk factors for cardiovascular disease (CVD). The WHO places the incidence at 21% of the population. OSA syndrome occurs in 2-4% of males and females. Both conditions represent a significant burden to the health service in terms of diagnosis, treatment and management. Volunteers agreed to undergo a home cardiopulmonary sleep study and interview with questionnaires including the Epworth score. Studies were manually scored to determine the Apnoea Hypopnoea Index.
**Results:** 35 volunteers were recruited. This yielded 32 studies (10 female) that were analysed. Mean age: 50yrs (Range 26 – 73), mean BMI: 37.5 (±5.8). Significant OSA (AHI>5) was found in 7 females (80%) and 20 male (88%) subjects, 86% overall.

Summary findings

| AHI | No. Subjects | Mean AHI (±sd) | Mean Epworth (±sd) | Mean BMI (±sd) |
|---|---|---|---|---|
| Normal (<5) | 6 | 2 (1) | 15 (6) | 40 (4) |
| Mild (5 to ≤15) | 13 | 10 (3) | 4 (3) | 35 (5) |
| Moderate (15 to ≤30) | 5 | 22 (6) | 7 (4) | 36 (7) |
| Severe (≥30) | 8 | 55 (27) | 15 (4) | 40 (6) |

**Conclusion:** OSA is prevalent in this group of patients and was not the primary reason for attendance. Epworth Score alone was a poor predictor of sleep breathing disorder in those with mild to moderate AHI. OSA is a risk factor for CVD and so we suggest that there should be routine screening for OSA in this particular patient group.

**1665**

**Pulse oximetry to assess sleep disordered breathing (SDB)**

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Pulse oximetry is a simple tool used to assess suspected SDB. Currently focus is mainly on using 4% hypoxic dips/hr, although other indices exist.
**Aim:** To determine the use of pulse oximetry in the assessment of SDB using 4 indices and the value of using 2 nights of assessment
**Methods:** 150 consecutively referred patients had 2 nights of oximetry at home (Minolta 300i). Data was analysed (Download 2001; Stowood Scientific, UK), by experienced Physiologists and artefact removed. The 4% and 3% dips/hr, cumulative %time at $SpO_2 < 90\%$ ($CT_{90}$; Olson et al, J Sleep Res 1999;8:51-55) and Δindex>0.6 (Levy et al, Chest 1996;109:395-99) were obtained for each night.
**Results:** 132 patients gave usable data, 39F and 93M, aged 50 yrs (19–79).

Number of patients with positive diagnosis on both and each night

| | Both Nights | Night 1 | Night 2 |
|---|---|---|---|
| 4%: 5–15/hr | 24 | 4 | 15 |
| 4%: >15/hr | 24 | 4 | 6 |
| 3%: 5–15/hr | 36 | 4 | 12 |
| 3%: >15/hr | 36 | 3 | 13 |
| CT90 | 54 | 10 | 20 |
| Δindex >0.6 | 56 | 5 | 18 |

The median(range) differences between the two nights (N1 - N2) for the group were: 4% dips/hr: -0.78 (-29.5 to 19.9), 3% dips/hr: -1.2 (-15.6 to 20.2), $CT_{90}$: -0.12 (-21.9 to 29.7) and Δindex: -0.04 (-10.4 to 1.2). Using a combination of these indices, 26/132 (20%) were negative for all 4, 66 (50%) positive for all 4, 10 for any 3, 12 for any 2 and 18 for any one.
**Conclusions:** To use pulse oximetry
1) requires analysis by experienced practitioners to ensure accuracy of data;
2) requires two nights, resulting in a > 23% increase in a positive diagnosis from the second night;
3) with a combination of the 4 indices, all of which have good sensitivity and specificity for SDB, gives an indication of the likelihood of SDB being present. Using a combination of any 3 or all 4 accounts for 77% of the patients assessed.

**1666**

**Forensic oximetry: Is it possible to confirm that the same patient has worn an oximeter on 2 nights?**

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**Introduction:** We suspected a patient had performed home oximetry on their partner as they did not wish to receive treatment or be stopped from driving due to their obstructive sleep apnoea hypopnoea syndrome (OSAHS). We wanted to see if it was possible to recognise a pulse rate "fingerprint" in patients who had performed two consecutive sleep studies. We wanted to determine the normal variation in pulse rate (PR) on 2 nights in the same subject. The mean PR or the SD of the PR should be close enough to tell that the same patient is using the device.
**Method:** We reviewed mean and standard deviation (SD) of the pulse rates recorded during routine overnight oximetry and a multi-channel study in 37 patients [17F:20M Mean (SD); Age 50.8 (13.9) years;) with suspected OSAHS 16.4 (28.4) >4% dips per hour.] 37% of patients had confirmed OSAHS.
**Results:** The results (Table 1) show that mean difference in heart rate was 3.5 bpm (±7.1) and that statistically there was no little difference between the 2 nights. However, analysis by Bland & Altman (Fig 1) shows that the variation in pulse rate was 9-12%.

Table 1

| | Night 1 | Night 2 | Diff* |
|---|---|---|---|
| Mean PR | 63.9 | 67.4 | 3.5±7.1 |
| SD PR | 7.3 | 7.8 | 0.5±3.0 |
| COV % PR | 9.0±3.0 | 10.0±2.0 | 7.0±36.0 |

*Values shown as Mean (SD) No significant difference were found between Nights 1 & 2.

**Discussion:** The variation in pulse rate between any two oximetry studys is on average 10% or between ±7 bpm difference in the mean PR. However, 3 out of 37 patients had greater variation than this.
**Conclusion:** It is not possible on an individual basis to confirm if the same patient has performed an oximetry study. We have shown the expected normal range in PR for the same patient.

**1667**

**Chest wall mechanics during induction of anesthesia**

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**Background:** It has been reported that anesthesia may be associated to variation in chest wall (CW) mechanics. We have developed a CW scanning system (CWSS) based on self-mixing laser interferometers that allows the measure of relative displacement. If this approach is combined with Forced Oscillation Technique (FOT) it allows to infer CW mechanics.
**Methods:** Five patients were studied during anesthesia induction at different stages, while they were submitted to a sinusoidal pressure forcing at the mouth with components at 5, 11 and 19 Hz. At each step FRC (GE; Engstrom CareStation) and CW mechanics (phase displacement among these points and the pressure stimulus) were estimated by spectral technique.
**Results:** Figure 1 shows results at 11 Hz. At all steps rib cage and abdomen the pressure stimulus travels faster in the rib cage than in the abdomen, likely because of the high inertia of the latter. FRC presents a minimum during sedation, then it increased during pressure support and it reaches physiological values after the

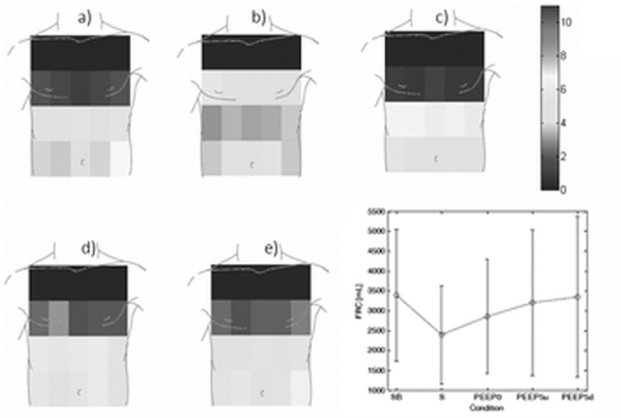


Figure: CW phase shift and FRC at different steps. Panel a) spontaneous breathing (SB), b) sedation in spontaneous breathing (S), c) ZEEP (PEEP0), d) PEEP= 5 cmH2O before the recruitment maneuver (PEEP5u), e) PEEP= 5 cmH2O after the recruitment maneuver (PEEP5d). FRC at the same steps (mean±std).

recruitment maneuver. The marked variation in ϕ induced by sedation on the lower rib cage may be related to the reduction in FRC.