Latest PAT® Publications

**Diagnosis of Obstructive Sleep Apnea by Peripheral Arterial Tonometry: Meta-analysis.**

Yalamanchali S, Farajian V, Hamilton C, Pott TR, Samuelson CG, Friedman M.

Meta Analysis of the correlation between respiratory disturbance index (RDI), apnea-hypopnea index (AHI), and oxygen desaturation index (ODI), measured by WatchPAT and PSG in adults, based on 14 studies meeting inclusion criteria with data suitable for pooling, (total 909 patients). Of the 14 studies, 13 had blinded study designs, with WatchPAT and PSG conducted simultaneously in a home or laboratory setting, one study of which included both comparisons. Another study contained 2 different study groups based on age.

**RESULTS:** Watch PAT and PSG indices of RDI, AHI and ODI, were all significantly correlated and had respective r values of 0.879, 0.893, and 0.942 (all P<0.001). RDI and AHI were highly correlated (r=0.889, P<0.001). Analysis of publication bias revealed a non-significant Egger regression intercept.

**CONCLUSION:** Respiratory indices determined by WatchPAT positively correlated with those of PSG. Strengthened by the blinded design of 13/14 of the included studies, WatchPAT represents a viable alternative to PSG for confirmation of clinically suspected sleep apnea.


**Preeclampsia and Sleep-Disordered Breathing: A Case-Control Study.**

Facco FL, Lappen J, Lim C, Zee PC, Grobman WA.
Pregnancy Hypertens. 2013 Apr;3(2):133-139.

Determined whether sleep-disordered breathing (SDB) is more prevalent among women with preeclampsia than among normotensive controls, in 20 preeclamptic patients and 20 controls matched for gestational age, using Watch-PAT100 sleep studies to diagnose and quantify SDB.

**RESULTS:** Preeclamptic subjects had a higher mean BMI (32.6± 9.5 vs. 24.5 ± 3.5, P=0.001), higher mean respiratory disturbance indices (RDI, mean difference 4.9 events/hour of sleep), higher apnea hypopnea indices (AHI, mean difference 5.7 events/h) and higher oxygen desaturation indices (ODI, mean difference 4.5 events/h) indices; however, these differences did not reach statistical significance. Preeclamptic subjects were more likely to have more severe forms of SDB vs. controls (ODI S, 20% vs. 0%, p=0.047).

**CONCLUSION:** Compared to normotensive controls, preeclamptic subjects experience more SDB events and a greater degree of nocturnal hypoxemia. Further research is needed to determine if SDB, independent of BMI, is a significant contributing factor to the risk of developing preeclampsia.


**The efficacy of Watch PAT in obstructive sleep apnea syndrome diagnosis.**

Kürkayış E, Düzlü M, Karamert R, Tutar H, Yılmaz M, Ciftçi B, Güven SF.
Eur Arch Otorhinolaryngol. 2014 May 17. [Epub ahead of print]

Assessed the efficacy and reliability of WatchPAT-200 as an alternate option to standard polysomnography (PSG), in OSAS diagnosis in the sleep lab. The correlation in REM and Non-REM apnea/hypopnea (AHI) scores, sleep periods and mean O₂ saturation percentage between WatchPAT and PSG sleep studies were assessed.

**RESULTS:** There was a statistically significant very strong correlation between PSG and Watch PAT AHI scores (Spearman’s rho= 0.802 p < 0.001).

There was no significant difference between mean recording times, or in mean O₂ saturation percentage (p < 0.001), but average sleep time and REM sleep period were significantly different.

**CONCLUSION:** Watch PAT is an efficient device and is considered to be an adjunctive diagnostic method for PSG in diagnosis of OSAS.


**Clinical Usefulness of Watch-PAT for Assessing the Surgical Results of Obstructive Sleep Apnea Syndrome.**


Assessed the accuracy and clinical efficacy of Watch-PAT in evaluating the results of sleep surgeries such as septoplasty, tonsillectomy, or uvuloplasty in 35 obstructive sleep apnea syndrome, (OSA), patients. WatchPAT-derived respiratory disturbance index (RDI), apnea and hypopnea index (AHI), lowest oxygen saturation, and valid sleep time were measured before and after surgery.

**RESULTS:** RDI, AHI, lowest oxygen saturation, and valid sleep time recovered to within normal range after surgery in 28 subjects. Good agreement was found between WatchPAT-derived factors and visual analogue scales for changes in subjective symptoms, (snoring, apnea, and daytime somnolence).

In 7/35 subjects, who showed no improvement for their subjective symptoms after surgery, RDI and AHI were not reduced, and lowest oxygen saturation and valid sleep time were not elevated.

**CONCLUSION:** WatchPAT is a highly sensitive portable device for estimating treatment results and symptomatic changes in OSA patients after sleep surgery for correction of airway collapse.

A prospective study of 180 acute myocardial infarction (AMI) patients, investigating whether metabolic perturbations associated with sleep disordered breathing (SDB - based on Watch PAT-100 sleep studies), are present in AMI, and if they affect clinical outcomes. Blood levels of high-sensitivity C-reactive protein (hs-CRP) and markers of oxidative stress (lipid peroxides [PD] and serum paraoxonase-1 [PON-1]), and echocardiography to evaluate cardiac dimensions and pulmonary artery systolic pressure, was performed.

RESULTS: SDB was present in 64% of patients. Hs-CRP levels, PD and PON-1 were similar in patients with and without SDB. Echocardiography revealed higher left atrial dimension (P=0.003) and a significant positive correlation between ODI and pulmonary artery systolic pressure (r=0.41, P<0.0001). After median follow up of 68 months, no significant differences were observed between SDB and nonSDB groups with regard to death, heart failure, myocardial infarction and unstable angina.

CONCLUSION: Undiagnosed SDB was highly prevalent among patients with AMI. SDB in the setting of AMI is associated with higher pulmonary artery systolic pressure, but not with adverse clinical outcomes.


Examined the relationship between adverse pregnancy outcomes and the presence and severity of sleep-disordered breathing (SDB - determined by WatchPAT-100), between weeks 6 and 20 and again in the third trimester, in a prospective high risk cohort, (i.e. BMI 30 kg/m2, chronic hypertension, pregestational diabetes, prior preeclampsia, and/or a twin gestation, n=188), to estimate the prevalence and trends of SDB in high-risk pregnant women. Pregnancy outcome determinations (preeclampsia, gestational diabetes, prior preeclampsia, and/or a twin gestation, and echocardiography to evaluate cardiac dimensions and pulmonary artery systolic pressure, was performed.

RESULTS: Mild to moderate sleep apnea was found in 29% of subjects. Those with higher self-reported posttraumatic stress scores also reported a higher degree of both somatic and cognitive factors interfering with sleep initiation. Those with high posttraumatic stress scores, had a mean 38 minute lower total sleep time and higher apnea/hypopnea, respiratory disturbance, and oxygen saturation indices.

CONCLUSION: Enhanced sleep assessments that include traditional self-report tests and a home sleep study can help identify previously undiscovered behavioral and respiratory problems among service members, particularly those with higher posttraumatic stress scores.


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CONCLUSION: Undiagnosed SDB was highly prevalent among patients with AMI. SDB in the setting of AMI is associated with higher pulmonary artery systolic pressure, but not with adverse clinical outcomes.


Investigated whether snoring sounds, recorded using WatchPAT-200 or polysomnography, could be distinguished from breath sounds by 25 subjects exposed to 55 sound sequences, and asked to determine the nature of the sounds and their degree of certainty, and to evaluate whether the sound pressure level in common use and psychoacoustic parameters are suitable for making the distinction.

RESULTS: Sixteen percent of the sound sequences could not be classified unequivocally, by raters, although they stated that they were moderately certain about their decision. The sound pressure level and psychoacoustic parameters were capable of distinguishing between breath sounds and snoring sounds at an optimal sensitivity and specificity of 76.9% and 78.8%, respectively.

CONCLUSIONS: Although snoring appears to be a subjective impression and a generally valid acoustic definition seems to be impossible, sound pressure level and psychoacoustic parameters are suitable for distinguishing between breath sounds and snoring sounds with moderate validity.


**Impaired endothelial function after aneurysmal subarachnoid haemorrhage correlates with arginine:asymmetric dimethylarginine ratio.**


Prospective observational study of 48 aneurysmal subarachnoid haemorrhage (SAH) subjects, and 23 controls examining associations between EndoPAT-RHI and plasma concentrations of S-100B protein, nitrite/nitrate, arginine, and asymmetric dimethyl arginine (ADMA), middle cerebral artery flow velocity (VMCA), angiographic vasospasm, delayed neurological deficit, and 30 day survival. Measurements were obtained at days 0-2, 3-5, 6-8, 9-11, and 12-15.

**RESULTS:** RHI was 1.67 (±0.46) at days 0-2 after SAH but increased at days 3-15 to the same levels as in controls (P<0.05 vs. days 0-2), and both arginine and ADMA increased after SAH compared with days 0-2 controls (P<0.05). RHI was lower in subjects who died before day 30 (P=0.07), but no trends were observed in relation to angiographic vasospasm or delayed neurological deficit. S-100B was highest in non-survivors (P<0.01) and in subjects with neurological deficit (P<0.01). RHI was positively correlated with arginine:ADMA ratio (r=0.43, P<0.005), but not with nitrite/nitrate, VMCA, or S-100B.

**CONCLUSION:** EndoPAT-RHI is attenuated in the first days after SAH indicating acute systemic endothelial dysfunction, and correlates with imbalance of the arginine/ADMA pathway.


**Altered vascular structure and wave reflection in hypertensive women with low magnesium levels.**


Investigated the relationships of low concentrations of serum magnesium (sMg) and intracellular Mg (iMg) with clinical and vascular parameters, in thiazide-treated hypertensive women who were separated into two groups according to lower (<2.0 mg/dL) or normal (2.0 mg/dL) sMg concentrations, and then according to lower (<3.75 mg/dL erythrocytes) and normal (3.75 mg/dL erythrocytes) iMg concentrations. Carotid ultrasound, radial applanation, and EndoPAT-AI were performed in all patients.

**RESULTS:** Low sMg levels were associated with significantly increased Framingham Risk Score (P=0.024), higher systolic and diastolic blood pressures (P<0.05), and carotid intima-media thickness (P=0.023). Low concentrations of iMg were related to increased augmentation pressure (P=0.032) and augmentation index (P=0.004).

**CONCLUSION:** In diuretic-treated hypertensive women, low sMg was associated with higher blood pressure values, and more intense wave reflection were closely linked to iMg depletion, processes that might contribute to hypertension and other cardiovascular risk factors.


**Neither Cyclosporine nor Tacrolimus Deteriorate Endothelial Function in Renal Transplant Recipients Assessed With Reactive Hyperemia Index.**


Determined EndoPAT-RHI and EndoPAT-AI in 40 renal transplant recipients (RTR), at 48.9 ± 36 months post transplantation, in relation to immunosuppressive drugs tacrolimus (n=22, group 1), or cyclosporine (n=18, group 2), vs. 18 healthy controls.

**RESULTS:** Median RHI in group 1 was 2.00, not different from 2.11 in controls. Multivariate analysis revealed age to be the independent factor influencing RHI in all groups but treatment with calcium channel blockers appeared to be the only independent factor influencing RHI among RTR. AI% values were not significantly different between the 2 RTR groups, but it was significantly higher among controls than among RTR treated with tacrolimus.

**CONCLUSION:** RHI in RTR was not worse than in controls, and was not different between cyclosporine or tacrolimus. Arterial stiffness was dependent on age but not the calcineurin inhibitor, which showed little effect.


**Impact of Atorvastatin Treatment in First-Degree Relatives of Patients With Premature Coronary Artery Disease With Endothelial Dysfunction: A Double-Blind, Randomized, Placebo-Controlled Crossover Trial.**


Tested whether Atorvastatin could improve endothelial dysfunction (ED) as assessed by EndoPAT-RHI, in 35 first-degree relatives (FDRs) of patients with premature coronary artery disease (CAD) and ED (median age, 52 years, 21 male) in a prospective double-blind trial with a crossover 6 weeks of treatment with atorvastatin 40 mg/day followed by placebo, or vice versa. The primary outcome was the difference of RHI between atorvastatin vs. placebo, both in subjects with or without indications for statin treatment.

**RESULTS:** LDL cholesterol was lower after atorvastatin vs. placebo (124 [102-145] mg/dL vs 67 [50-73] mg/dL, P < 0.001), but neither RHI, nor the augmentation index were different after atorvastatin vs. placebo, both in subjects with or without indications for statin treatment.

**CONCLUSION:** Despite improvement in the lipid profile, atorvastatin failed to improve ED in the FDRs of patients with premature CAD with ED.
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