

## CardioSleep Update: Central Validation Summary

The manuscript entitled “Detecting central sleep apnea in adult patients using WatchPAT- a multicenter validation study” by Pillar et al was published in July 2019 in the Sleep and Breathing Journal. What’s new is validation of detection of central sleep apnea among patients with heart failure. Why this is important is that of the 14-49% of the population who suffers from sleep disordered breathing, 75% goes undetected. The use of home sleep apnea testing provides alternative to in lab polysomnography (PSG) increasing access to diagnosis. It is reported that among patients with heart failure half will have sleep disordered breathing, what is special about this population is that up to 2/3 will have central apnea events. It is necessary that sleep testing in heart failure patients include assessment of central versus obstructive events, historically this necessitated in lab PSG. Today we will review data demonstrating the ability of WatchPAT to discern central from obstructive sleep apnea.

This multi-center study was conducted in 11 sites worldwide including Israel and North America. Patients had simultaneous WatchPAT and PSG studies. Among 84 patients the demographics presented in Table 1 show they have co-morbidities representative of a typical sleep apnea population. Among these patients 50 patients with heart failure, atrial fibrillation or both were selected for this analysis.

WatchPAT utilizes peripheral arterial tonometry and has been validated in multiple studies to reliably apnea hypopnea index (AHI). The peripheral arterial tonometry (PAT) signal measures blood flow in the distal finger, which is regulated by  $\alpha$ -adrenergic receptors of vascular smooth muscle. These are affected by sympathetic nervous system activity where apnea events are characterized by transient vasoconstrictive events.

Detection of central sleep apnea by the WatchPAT utilizes two methods. First in Figure 1 movement of the chest wall is detected by the snoring body position sensor which is placed below the sternal notch. You can see in this figure the periods of time during central events when breathing ceases. Second the PAT signal is affected by the negative intrathoracic pressure generated during obstructed apnea event. Figure 2 demonstrates the smooth PAT signal occurring during central episode as compared to non-central apnea in the bottom of the figure. When comparing these methods to PSG you can see in Figure 3 the similarity of the WatchPAT signals in white to the air flow and body position sensors of PSG in blue.

An advantage of WatchPAT over other home sleep apnea testing systems is its ability to detect REM sleep therefore accurately report total sleep time, this is demonstrated in Table 2. Also in Table 2 is reported there was no statistical difference in determination of total AHI when comparing WatchPAT to PSG. Analysis of central events as a continuous variable showed a difference with a p value of 0.34. Examining the quality of correlation you can see in Figure 4 scatterplot representation of total AHI with R2 Linear 0.763 in Figure 4a and AHIC with R2 Linear 0.638 in Figure 4b.

To determine clinical utility, analysis was conducted with clinically relevant thresholds of 10 and 15 events per hour. The ROC curves were significant and are shown in Figure 5. As seen in Table 3 utilizing a cut off of AHIC >10 events/h the sensitivity was 71.4%, specificity 98.6%, PPV 90.9% and NPV 94.5%. The area under ROC curve was 0.827 ( $p < 0.001$ ).

In summary the WatchPAT offers satisfactory discernment of central from obstructive apnea events among patients with heart failure.