

DOES AN OBJECTIVE MEASUREMENT DURING A MÜELLER'S MANEUVER PREDICT OBSTRUCTIVE SLEEP APNEA?

by Herbert Patrick MD



For this issue of *Focus* we will discuss a Respiratory Care Practitioner Performance Improvement (PI) project selected by our practitioners who have an interest in sleep disorders.

Our Sleep Center had an Ears, Nose and Throat (ENT) Physician Consultant who shared an interest in the Müller's maneuver as an objective measure of upper airway narrowing. Normally, a Müller's maneuver is performed by exhaling completely, pinching off the nose, closing the mouth and trying to inhale. During the Müller's maneuver, in the absence of flow, negative pleural pressure will equilibrate with lung parenchymal pressure, which will equilibrate with thoracic airway pressure, which will equilibrate with upper airway pressure. However, if there is significant occlusion between the thoracic and upper airway, the upper airway pressure equilibration will be delayed or absent compared to the onset of the negative pleural pressure. Noting occlusion between the thoracic and upper airway could identify patients susceptible to obstructive sleep apnea.

Our RCPs and ENT physician had two ways to measure occlusion between the thoracic and upper airway. In both, a pediatric sized bronchoscope would be used via the nasal approach and positioned in the hypopharynx. In the first case, a pressure transducer was attached to the suction channel of the bronchoscope without suction applied. Upper airway pressure

before and during the Müller's maneuver would then be displayed and recorded by the pressure transducer system. In the second case, video freeze frames were made of the hypopharynx before and again during the Müller's maneuver. The reduction in the cross sectional area of the hypopharynx, expressed using area measurements from the video freeze frames, as "[before-during]/before," would correspond to the degree of occlusion. Both of these cases could be explored simultaneously during a single bronchoscopy session.

Although this project was designed for PI due to the pilot nature of the proposal, it could have been submitted for IRB approval as a research project for presentation. In fact, after the initial trials were performed on the Technical Director of Respiratory Care as a volunteer, an IRB application was submitted. Now let's review all steps of the project.

The Background (Introduction) section explains interest in the topic and why the topic is significant. Sleep apnea affects over 25 million people. A screening tool for disease in the upper airway could help triage patients to an ENT doctor. Such triage could allow more patients to be more easily identified and ultimately treated. Any screening step should be brief and easy to perform compared to a complete Nocturnal Polysomnogram.

The Question to be addressed is: Does upper airway change during a Müller's maneuver predict the severity of OSA?

The Hypothesis is the preconceived answer by researchers to the Question. For this project, the Hypothesis was "Yes, upper airway change during a Müller's maneuver will predict the severity of obstructive sleep apnea."

The Methods section explains the mechanism to gather, tabulate and analyze data to answer the Question. In this project, the Respiratory Care Practitioners and ENT collaborated to design an interdisciplinary data collection sheet. Each sheet was for data collected for one subject. Each patient scheduled for an NPSG was asked if they would agree to participate as a subject in this study. For each subject who agreed, an appointment was scheduled for the bronchoscopy with the two objective measurements during the Müller's maneuver. The data sheet provided spaces for the video freeze frame measurement of the cross sectional area of the hypopharynx before and during the Müller's maneuver. The pressure transducer tracing from the bronchoscope channel during the Müller's maneuver could also be attached to the sheet. Each subject performed Müller's maneuvers until three maneuvers were satisfactory. Each subject's data were the average of the three cross sectional area changes and the average of the three pressure delays. After the subject had the NPSG, the apnea-hyponea index (AHI) was added to the data sheet. For data analyses, two Graphs were constructed. The first displayed the change in cross sectional area of the hypopharynx on the y axis, from 0 (0% change) up to 1 (100% change with total occlusion) plotted against AHI on the x axis. The second graph displayed the pressure time delay (seconds) in the hypopharynx from the onset of the Müller's maneuver on the y axis plotted against AHI on



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Pessimism about salary and benefit negotiations

We hear, "I've been down that road before," from people who won't ask for a salary adjustment because last year the boss refused. The passage of time makes a difference. A boss who was unaware of a labor shortage last year may be experiencing rampaging turnover now and, therefore, acting on a whole different mindset. Why not give the boss a chance to act rationally even if he/she had rejected opportunities before?

Companies that said they'd never make concessions on flextime, vacation, unpaid leave, and other working conditions are making them now. Here's how quickly a company can react when it needs people: In early 1997, a hirer making an offer would say, "Our range is \$x to \$y and I think I can get you into the top of the range." In January 2006, that same manager is saying, "What salary will it take to get you here?" Don't rely on the negotiating ploys or the salary research you used even one year ago.

Here's another way you can shoot yourself in the foot with a negative attitude about money. We know a candidate who fought so hard for the absolute last dollar that the hirer withdrew the job offer. The candidate wasn't greedy, he was trying to get even with his former employer for underpaying him! Yes, he behaved irrationally. The goal is to overcome knee-jerk responses with more rational strategies.

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the x axis. A correlation coefficient (r value 0 to 1) was computed for each graph and judged to be significant if the p value was less than 0.05. A high correlation coefficient, (r value greater than 0.6) would indicate the Müller's maneuver predicted a high AHI, reflecting a diagnosis of sleep apnea. A p value less than 0.05 meant there was only one chance in 20 that the difference between the measures during the Müller's maneuver versus the AHI was due only to chance.

The Results section is a summary and analysis of data. For this project, ten subjects were studied prior to their NPSG. For the cross sectional area comparison with the AHI, the correlation coefficient was $r = 0.72$ with a p value = 0.037. For the pressure delay comparison with the AHI, the correlation coefficient was $r = 0.63$ with a p value = 0.048. Therefore, both correlation coefficients proved predictive for the AHI with statistical significance at p less than 0.05.

The Conclusion was: yes, upper airway change during a Müller's maneuver does predict the severity of OSA. Therefore, in this project, the Hypothesis was supported.

The Reflections section offers an opportunity to critique the project by suggesting possible modifications that could improve the quality of future research. For example, a lengthy time separation between performing the Müller's maneuver and performing the NPSG could reduce the correlation coefficient. Reflections can also include a comparison with other similar research projects. Clinical Implications represent the connection between the research world and the actual clinical world. For this project, the research provides a novel tool for screening patients for OSA and may help define patients who could benefit from an ENT evaluation.

The *Future Research* section follows the theme that completed research should lead to new research. For example, this project led to patients having rapid sequence CT scans of the neck. The CT images were sorted and labeled for inhalation and exhalation, facilitating another screening test for sleep apnea. The *Bibliography* section lists references from similar research. The *Acknowledgement* section lists financial support provided to the project and the *Conflicts of Interest* (COI) section lists any COI for each person involved in the project.



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