Respiratory-Related Dynamic Upper Airway Changes in Obese Apneics After Weight Loss

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Rationale: It has been shown that the percentage change in airway caliber during awake respiration is significantly greater in apneics as compared to normals due to increased airway collapsibility. We hypothesized that weight loss would decrease upper airway collapsibility in obese apneics as demonstrated by larger minimum and smaller maximum airway areas, as well as smaller differences between maximum and minimum airway areas (a measure of airway compliance).

Methods: Dynamic MRI and polysomnography data were collected on 25 obese (BMI≥30 kg/m3) apneics (AHI≥15 events/hour) before and after participation in a six month weight-loss program. For the dynamic imaging, three sets of 100 axial slices were taken at the mid-soft palate, mid-tongue, and mid-epiglottis. Maximum and minimum slice areas were determined by averaging the largest and smallest five slice areas at each position. After completing the program, 10 subjects lost ≥5% weight, and 15 were weight stable. Comparisons between pre- and post-weight loss were made using paired t-tests.

Results: Subjects who lost ≥5% weight had larger minimum airway areas at the mid-tongue and mid-soft palate, as well as smaller maximum airway areas at the mid-tongue and mid-epiglottis (Table 1). Post weight loss subjects also showed a decreased difference between maximum and minimum airway area at the mid-tongue and mid-epiglottis. Weight stable subjects showed little change in minimum airway areas at the mid-soft palate and mid-tongue and little change in maximum airway areas at all locations. In contrast to those who lost weight, weight stable subjects showed little change in maximum-minimum airway area differential at the mid-tongue and an increase in maximum-minimum area change at the mid-epiglottis. Moreover, after completing the weight loss program, subjects who lost ≥5% weight exhibited smaller differences in minimum-maximum airway areas at all positions as compared with weight stable subjects (mid-soft palate P=0.374, mid-tongue P = 0.140, mid-epiglottis P= 0.675). In all subjects, no changes were significant, possibly because of the small sample size.

Conclusions: These data suggest that a weight loss of ≥5% causes decreased airway collapsibility during wakefulness in obese apneics as shown by a smaller range of dynamic change in the upper airway post-weight loss. Improvements in AHI post-weight loss may be due in part to this decrease in airway compliance.

Table 1: Differences in Airway Areas in 5% Weight Loss and Weight Stable Obese Apneics

	Apneics Pre 5% Weight Loss (n=10)	Apneics Post 5% Weight Loss (n=10)	P-value	Weight Stable Apneic Pre Weight Loss Program (n=15)	Weight Stable Apneic Post Weight Loss Program (n=15)	P-value
Variable	Average ± SD	Average ± SD		Average ± SD	Average ± SD	
Mid Soft Palate Max Airway Area (mm^2)	126.9 ± 53.5	134.8 ± 55.5	0.6522	141.1 ± 73.9	138.6 ± 94.0	0.8962
Mid Soft Palate Minimum Airway Area (mm^2)	67.6 ± 41.2	74.3 ± 56.5	0.7163	41.2 ± 27.5	57.3 ± 50.7	0.2237
Mid Soft Palate Δ Max-Min Airway Area(mm^2)	59.3 ± 37.8	60.5 ± 35.4	0.9211	99.9 ± 76.5	81.3 ± 71.9	0.1711
Mid-Tongue Maximum Airway Area (mm^2)	233.8 ± 200.6	196.6 ± 108.7	0.3399	194.7 ± 98.8	190.7 ± 96.9	0.8704
Mid-Tongue Minimum Airway Area (mm^2)	108.6 ± 62.9	119.6 ± 70.3	0.5782	72.0 ± 62.0	68.5 ± 50.7	0.8537
Mid-Tongue Δ Max-Min Airway Area (mm^2)	125.2 ± 171.6	77.1 ± 59.5	0.2472	122.7 ± 68.7	122.2 ± 88.6	0.9777
Mid-Epiglottis Maximum Airway Area (mm^2)	285.0 ± 238.7	218.4 ± 131.8	0.2782	257.3 ± 109.9	232.2 ± 97.3	0.4179
Mid-Epiglottis Minimum Airway Area (mm^2)	123.8 ± 53.3	108.1 ± 72.7	0.4552	140.9 ± 98.7	105.9 ± 65.3	0.2056
Mid-Epiglottis Δ Max-Min Airway Area (mm^2)	161.2 ± 218.3	110.3 ± 107.7	0.3301	116.4 ± 61.0	126.3 ± 57.9	0.6262