Title: Validation of respiratory inductive plethysmography in people with obesity hypoventilation syndrome

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Body: The excessive chest and abdominal adiposity present in obesity hypoventilation syndrome (OHS) may reduce the accuracy of respiratory inductive plethysmography (RIP). The aim of the study was to validate RIP measures of ventilation in OHS against a clinical standard (spirometry). Measures of tidal volume ($V_T$), minute ventilation ($V_E$) and respiratory rate (RR) were obtained simultaneously from RIP (LifeShirt™) and a spirometer during two 40-minute air-supplemental $O_2$ breathing tests. 16 paired samples were obtained per subject. Using the Bland Altman method, bias was expressed as spirometer–RIP mean difference (MD), and as a percentage. Error was expressed as limits of agreement (LOA) and as a percentage. Differences between groups were assessed with independent samples t-tests. 162 viable paired samples were obtained from 13 subjects with OHS and 197 paired samples were obtained from 13 age- and gender-matched controls. Error of RIP measures was larger in subjects with OHS: $V_T$ MD=3mL (1%), LOA=-216 to 222mL (±36%) compared with controls, MD=5mL (1%), LOA=-160 to 169mL (±20%); $V_E$: MD=0.2L/min (2%), LOA=-4.1 to 4.4L/min (±36%) in subjects with OHS compared with MD=0.1L/min (1%), LOA=-1.4 to 1.5L/min (±20%) for controls; and RR: MD=0.2br/min (2%), LOA=-5 to 5br/min (±27%) in subjects with OHS compared with MD=-0.1 br/min (1%), LOA=-1 to 1br/min (±12%) for controls. Between group differences were only statistically significant for RR ($p<0.05$). $V_T$ %error correlated strongly with body mass index ($r_s=0.53$, $p<0.01$) and waist circumference ($r_s=0.61$, $p<0.01$). In conclusion, the accuracy of RIP is reduced in people with OHS, limiting its capacity for detecting small changes in ventilation.