Title : IMPROVEMENT IN OXYGENATION WITH MASSIVE WEIGHT LOSS

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Introduction. Poor preoperative oxygenation as measured by PaO_2 and $P(A\text{-}a)O_2$ is documented in morbidly obese patients. Weight loss has been shown to improve the circulatory effects of obesity toward more normal values.[1] However, improvement in oxygenation with weight loss has not yet been demonstrated. The purpose of this study is to determine if oxygenation improves and correlates with massive weight loss following jejunoilial bypass operation.

Methods. Eleven consenting morbidly obese patients (9 women, 2 men, 21-39 years old) scheduled for elective jejunoileal small bowel bypass were studied 24 hours preoperatively and again postoperatively at time intervals ranging from 5 to 17 months (mean, 9.5 mo.), corresponding to weight loss ranging from 41-86 kg (mean, 60 kg). All patients were free of primary cardiorespiratory disease and denied a present or past history of smoking. Each was without respiratory symptoms such as regular morning cough or sputum, wheezing, or history of asthma. All demonstrated a forced expiratory volume in one second (FEV_1) within two standard deviations of the predicted value. Data collected included age, height, weight, girth, length of time since surgery, and supine arterial blood gas samples. Arterial blood was sampled and measured using standard techniques. Alveolar-arterial oxygen difference was calculated as:

$$P(A\text{-}a)O_2 = 0.2\,(P_B - P_{H2O}) - 1.25(PaCO_2) - PaO_2$$

where P_B is barometric pressure, and P_{H2O} is water vapor tension at 37°C. Data were analyzed using both paired t-test and linear regression analysis.

Results. Significant differences (preoperative to after weight loss, ($p < 0.001$) were observed in weight, girth, body mass index (BMI) and body surface area (BSA). No significant differences were found in PaO_2, $P(A\text{-}a)O_2$, $PaCO_2$, pH, or HCO_3^- over the period of weight loss. However, linear regression revealed important correlations between oxygenation [PaO_2, $P(A\text{-}a)O_2$] and measured morphologic variables. Improvement in $P(A\text{-}a)O_2$ correlated with duration of weight loss ($r = 0.73$, $p = 0.005$) and amount of weight loss, as described by change in weight ($r = 0.77$, $p = 0.003$), change in BMI ($r = 0.82$, $p < 0.001$), change in weight expressed as percent of the ideal weight ($r = 0.82$, $p = 0.001$), and change in BSA ($r = 0.73$, $p = 0.005$). The best correlates were weight loss expressed as a change in BMI and expressed as percent of ideal weight. Improvement in $P(A\text{-}a)O_2$ also correlated with girth difference ($r = 0.59$, $p = 0.027$), but did not correlate significantly with age. Improvement in PaO_2 also correlated with duration of weight loss ($r = 0.59$, $p = 0.028$). Again, the best correlates were with weight loss expressed as a change in BMI ($r = 0.75$, $p = 0.004$) and weight loss expressed as percent of ideal weight ($r = 0.77$, $p = 0.003$). Neither girth difference nor age correlated with improvement in PaO_2. Figure 1 demonstrates the change in PaO_2 as a function of weight loss expressed as change in BMI (ΔBMI) for each patient. An implied threshold exists for improvement in oxygenation. A change in BMI of less than 20 results in no significant change in PaO_2 ($p = 0.43$) or $P(A\text{-}a)O_2$ ($p = 0.165$) while a ΔBMI greater than 20 results in a significant improvement in PaO_2 ($p = 0.002$) and $P(A\text{-}a)O_2$ ($p = 0.014$). A similar relationship exists for weight loss expressed as a percent of ideal weight. A weight loss of less than 100% of ideal weight results in no significant change in PaO_2 ($p = 0.799$) or $P(A\text{-}a)O_2$ ($p = 0.522$), while a weight loss of more than 100% of ideal weight results in a significant improvement in PaO_2 ($p = 0.004$) and $P(A\text{-}a)O_2$ ($p = 0.033$). There was no significant correlation noted between improvement in oxygenation [PaO_2 or $P(A\text{-}a)O_2$] and final weight as expressed by any of the morphological indices used (weight, BMI, percent of ideal weight, BSA, girth).

Conclusion. Long-term massive weight loss after jejunoileal bypass is associated with improvement in oxygenation as expressed by either $P(A\text{-}a)O_2$ or PaO_2.

References.

1. Alexander JK and Peterson KL: Cardiovascular effects of weight reduction. Circulation 65:310-318, 1972.