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Improvement of Obstructive Sleep Apnea Post Bariatric Surgery—Observation Study and Review of literature

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Abstract: Obesity is a risk factor for self-reported Obstructive Sleep Apnea (OSA) and makes respiratory management more difficult. The effects of bariatric surgery on OSA and Exercise Induced-bronchospasm (EIB) in obese or morbid obese subjects; both adulthood and childhood groups remain a virgin field of research worldwide.In this prospective study, 156 adult patients and 13 children with obesity were respectively evaluated before, 3 6 and 12 months after bariatric surgery, both Sleeve gastrectomy and bypass operations. Each had Sleep tests, measures of expiratory flows, measurements of EWL corresponding to improvement of both OSA and EIB.Mean body mass index decreased from 51.2 to 34.4 kg/m2 twelve months post-surgery. EWL was gained in almost all patients with a comparable improvement in all respiratory function tests, OSA and EIB. All children showed significant improvement in Exercise induced- bronchospasm at the BMI of 30 or less. ($P < 0.001$) and CI (0.65), overall Mikro was 97%.Airway responsiveness, OSA and EIB markedly improved with weight loss following bariatric surgery in both adults and children obese patients. Bariatric surgery would be a definitive clue for patients suffering respiratory disorders related-obesity.

Keywords: Obesity, Bariatric Surgery, Obstructive Sleep Apnea (OSA), Exercise-induced bronchospasm, Elbanna operation**.**

Abbreviations: AIH: Apnea hypopnea index; **BMI:** Body mass index; **CPAP:** Continuous Positive Airway Pressure; **NPV:** Negative Pressure Ventilation; **EWL:** Excessive weight loss; **OSA:** Obstructive sleep apnea.

1 Introduction

Obesity is responsible for a large morbidity and mortality worldwide. Obesity can contribute to the development of many chronic diseases and has been considered as a contributing factor to the development of OSA and EIB in both adults and Children [1-4]. There are many reports worldwide estimated that weight loss via behavioral modification improves overall health and decreases apnea hypopnea index and asthma. Nevertheless, weight loss achieved from bariatric operations also reduces AHI and appears to be similar to the efficacy of behavioral modification weight loss [5-7].This study was performed to investigate the impact of Bariatric surgery; Sleeve gastrectomy and Modified -Ilio-Jejunal bypass on the changes in airway responsiveness, OSA and EIB control inseverely obese patients at baseline, then 3, 6 and 12 months after surgery.

2 Patients and Methods

Since patients are referred to the sleep clinic for a suspicion of sleep related disorders prior to the bariatric surgery, the prevalence of OSA is high in this population with obesity.

The high sensitivity and Negative Pressure Ventilation (NPV) with a STOP-Bang score ≥3 as the cut-off can help sleep clinicians exclude patients with very little chance of moderate-to-severe OSA prior to surgery. On the other hand, a patient with a high score (≥5) on the STOP-Bang questionnaire has a high probability of severe OSA. These patients warrant expedited diagnosis and treatment. With the STOP-Bang questionnaire, sleep clinicians can prioritize their patients and efficiently allocate their limited resources.

We have experienced 240 patients have undergone Bariatric surgery, however among all patients presented with Obesity and have experienced bariatric surgical interventions, only 156 patients enrolled in the study who suffered obstructive Sleep Apnea (OSA) and Exercise induced-bronchospasm (EIB).

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Of all 156 patients; 122 females (78.2%) and 34 males (21.8%), aged 21 to 52 years old; (39.7 ± 9.2) mean age, with morbid obesity BMI ≥40 kg/m2 presented with OSA, with Exercise-induced bronchospasm or (Dyspnea of obese patients) , a condition significantly affected their quality of life , in the period from December 2010 to December 2012. [Table 1, Figure 1].

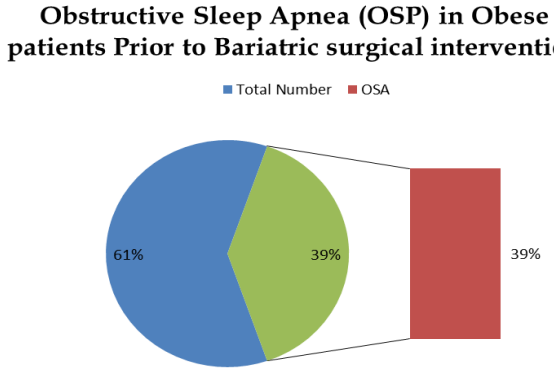

Figure 1:OSA is 39 % of all obese patients presented for Bariatric surgery; indicate the higher prevalence in obese or morbid obese individuals.

Table 1: Demographic data of studied patients (n=156)

	No.	**%**
Age		
Range	21-52	
Mean±SD	**39.7 ± 9.2**	
Sex		
Male	34	21.8
Female	122	78.2

All subjects have referred to sleep center for such diagnosis of OSA and Exercise –induced bronchospasm, all of them have undergone laparoscopic operations of Sleeve gastrectomy or Bypass surgical operations. Subjects were followed up for 3 years after both procedures, as well as we evaluated nutritional supplements, eating disorders, vomiting, and other post-operative complications. Follow up included EWL and Evaluation of (ca++), albumin, Hg, iron, zinc, B12 and sleep apnea.

13 children selected for the study; 10 female and 3 male, with BMI > 40, aged between 12 and 15 years old, all of them had Exercise induced-bronchospasm only. 12 patients experienced sleeve gastrectomy and only one female patient aged 13 years old experienced, modified Ilio-Jejunal bypass; Elbanna operation.

We retrospectively reviewed all data, in the Gastroenterology-Bariatric Units of Al Azhar University Hospitals- faculty of Medicine, and other private centers-Arab Republic of Egypt.

2.1 Statistical analysis

Statistical differences in various parameters groups were analyzed by SPSS version 22, using both univariate and multivariate analysis.

2.2 Data Mining Analysis

Data mining analysis is a machine learning process of examining large amount of data by computer system to create an algorithm. Conventional statistics is used to examine a certain hypothesis. In this context, data mining is superior as it makes computerized algorithms using both Naive Baÿes and decision tree methods.

In the current study Tenfold cross-validation using naïve Baÿes applications are generally used to predict the performance of a model on a validation set using computation in place of mathematical analysis.

3 Results

Statistical analysis was used to determine the association between the Excessive Weight loss (EWL) and improvement of (OSA) and (EIB) in a case group of patients presented with morbid obesity. Qualitative data of Excessive weight loss were expressed as number and percentage. Data were statistically described in terms of mean ± standard deviation (M± SD). There was significant improvement of Exercise induced-Bronchospasm of all individuals reached normal BMI, however only 30 % of those reached normal BMI showed improvement of OSA. Figure 2.

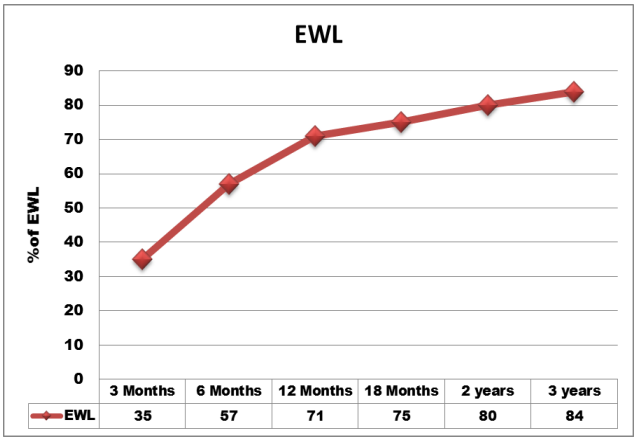

Figure 2: Excessive Weight Loss through 3 years post bariatric surgery.

In the multivariate model, the area under the curve (AUC) value of the receiver operating characteristic curve was 0.709 (95% CI=0.638-0.781).

Calibration of the model by the Hosmer-Lemeshow test showed no significance (*P*=0.783), indicates that the model was correctly calibrated statistically.

Using Rapid I, version 4.6, Berlin, Germany, the decision tree indicated that Laparoscopic modified ilio-Jejunal

bypass operation (El banna operation) was significantly correlated with maximum EWL and improvement of the all chest comorbidities of OSA and Exercise- induced bronchospasm.

All children experienced bariatric surgeries showed significant improvement in Exercise induced-bronchospasm at the BMI of 30 or less.

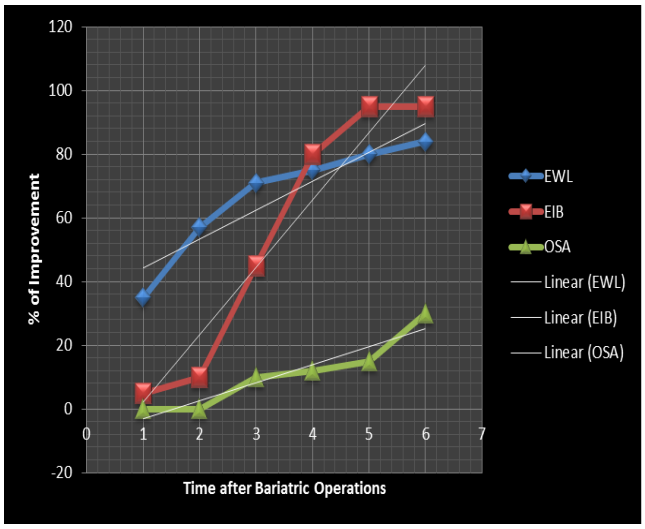

Figure 3: Correlation between EWL (Excessive Weight Loss) after Bariatric Surgery and (EIB; Exercise-induced bronchospasm and OSA; Obstructive Sleep Apnea). Time in months; 1=6 months, 2=12 months, 3=18 months, 4=24 months, 5=30 months and 6= 36 months; 3 years after bariatric surgery. P value is statistically significant; < 0.0001.

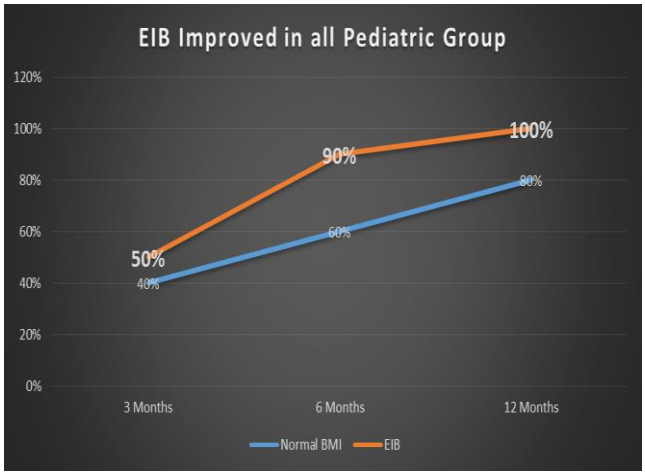

Figure 4: All Pediatric group experienced Bariatric surgical interventions of Both Sleeve gastrectomy and Elbanna operation, significantly showed improvement of Exercise-induced bronchospasm (EIB).

4 Discussion

Obesity- related comorbidities is very common dilemma worldwide, it is very clear that obese and morbid obese individuals may suffer pulmonary disorders than those with normal body mass index, accordingly an increased prevalence of obstructive sleep apnea in the obese population is well established . Weight loss via behavioral modification improves overall health and decreases apnea hypopnea index (AHI, the number of apneas and hypopneas per hour of sleep). In addition, weight loss achieved from bariatric operations also reduces AHI and appears to be similar to the efficacy of behavioral modification weight loss [8]. Losing weight means overcoming pulmonary illness at the present, complications in future and alleviating the economic burden of chest diseases in the present and future. However to evaluate the condition pre and post bariatric surgery, the STOP-Bang questionnaire should be applied individually, STOP-questionnaire was first developed in 2008. It is a simple, easy to remember, and self-reportable screening tool, which includes four subjective (STOP: Snoring, Tiredness, Observed apnea and high blood Pressure) and four demographics items (Bang: BMI, age, neck circumference, gender).The STOP-Bang questionnaire was originally validated to screen for OSA in the surgical population. The sensitivity for the STOP-Bang score ≥3 as the cut-off to predict any OSA (apnea hypopnea index (AHI) >5), moderate-to-severe OSA (AHI >15) and severe OSA (AHI >30) was 83.9%, 92.9% and 100% respectively, nevertheless these results are similar to our evaluation parameters in the current study [9-11].

However, after general anesthesia high risk of obstructive sleep apnea patients had an increased incidence of postoperative respiratory complications, early observational studies showed conflicting results on the benefits of bariatric surgery on OSA, in part because of varying selection criteria and lack of formal polysomnography outcome data in many of the studies. Furthermore, the improvement in AHI following a bariatric operation is illustrated in many of Laparoscopic adjustable gastric banding (LAGB) worldwide [12-15]. A meta-analysis of 69 studies performed in 2013 identified a high rate of resolution or improvement in OSA following bariatric procedures. The meta-analysis included 3 randomized control trials, 11 prospective studies, and 55 case series containing 13,900 obese patients and found a comparable rate of resolution or improvement of OSA for patients undergoing either RYGB (n = 5340), AGB (n = 4095), or SG (n = 543) (79 versus 77 versus 86 percent, respectively) . Patients undergoing either RYGB or AGB had a higher mean excess weight loss compared with patients undergoing a SG (75 versus 67 versus 46 percent, respectively). Resolution of OSA should be documented by a repeat sleep study prior to discontinuing CPAP in this patient population [16-19].

However, it is well established that Exercise-induced bronchospasm in obese patients significantly improved post bariatric surgeries, but still a debate of conflict whether bariatric intervention should be encouraged therapy for

those with OSA. Nevertheless our current retrospective-observation analysis in 156 obese patients in Egypt indicated the beneficial outcome of those with OSA experienced bariatric surgeries. According to our protocol guidelines for all patients with OSA undergoing a bariatric operation, were admitted to the post-anesthesia care unit (PACU) immediately at the conclusion of the operation. Oxygen is administered by nasal cannula and weaned thereafter. The likelihood that, early specific complication, will arise for a given patient is determined by the nature of the procedure, open versus laparoscopic, the anesthetic techniques used, and the patient's preoperative diseases. Respiratory problems are common complication in the early postoperative period following bariatric surgery. Patients with significant comorbidities, particularly neuromuscular, pulmonary, or cardiac problems are at a higher risk for respiratory compromise, but any patient can develop hypoxemia following bariatric surgery. For prophylaxis against Deep Venous Thrombosis (DVT) following bariatric surgeries either sleeve Gastrectomy or bypass, early ultrasound evaluation is recommended for all patients, D-dimer test should be applied for suspected patients with DVT, especially after long operative time, repeat ultrasound or venography may be required for those with suspected calf vein DVT and a negative initial ultrasound investigation.

The overall improvement of Exercise-induced bronchospasm was 95 %, however EWL was only 84 %, explained that even patients have not gained maximum weight loss, bariatric surgery may change the overall comorbidities related-obesity such as hypertension, metabolic syndrome and diabetes , furthermore help partially in overall improvement of Exercise-induced bronchospasm, ultimately we encourage overall management of weight loss including bariatric surgeries, however only 30 % of patients with OSA improved, likely there are other factors induced-OSA , other than obesity itself.

Nevertheless, patients have gained maximum EWL, who had experienced bypass surgery that explained improvement of overall pulmonary functions, OSA and EIB in bypass group. Children obesity has become one of the most important public health problems in many countries worldwide. Although the awareness of childhood obesity as a modifiable health risk is high, but many societies do not prioritize this issue as a health care problem, which may lead to comorbidities and even premature death [20-25]. Recently a modified intestinal bypass bariatric procedure (Elbanna operation), reported a novel surgical technique designed to maintain good digestion, better satiety, and selective absorption with less medical and surgical complications especially for those with OSA and other respiratory disorders related-obesity in both adulthood and childhood groups [26]. This procedure preserves the proximal duodenum duodenum and the terminal ileum and thus preserving the anatomical biliary drainage and enterohepatic circulation in both adulthood and childhood morbid obesity [10,11,26]. All children experienced the bariatric operations, showed significant improvement of Exercise-induced bronchospasm, additionally they developed better psychogenic outcome.

In conclusion, resolution of OSA, EIB and other respiratory disorders-related obesity may be cured by bariatric surgical intervention for adults and children, however as the plateau of bariatric surgeries increased in Egypt, we need further studies to establish such beneficial effects of bariatric surgical intervention for those with OSA and EIB for both adults and children groups.

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References

[1] www.allcountries.org/ranks/global_prevalence_of_adult_obesity.html (Accessed on October 21, 2013).

[2] Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and prevention of respiratory diseases with high quality index. www.cdc.gov/obesity/data/trends.html(Accessed on January 28, 2010).

[3] Peeters A, Barendregt JJ, Willekens F, et al. Obesity in adulthood and its consequences for life expectancy: a life-table analysis. Ann Intern Med 2003; 138:24.

[4] Vlad I. Obesity costs UK economy 2bn pounds sterling a year. BMJ 2003; 327:1308.

[5] Duda RB, Darko R, Adanu RMK, et al. Prevalence of Obesity in an Urban West African Population: Results of the Women's Health Study of Accra. African J Health Sciences 2007; 14:154.

[6] McGuire S. Shields M., Carroll M.D., Ogden C.L. adult obesity prevalence in Canada and the United States. NCHS data brief no. 56, Hyattsville, MD: National Center for Health Statistics, 2011. Adv Nutr 2011; 2:368.

[7] Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. JAMA 2002; 288:1723.

[8] Balsiger BM, Murr MM, Poggio JL, Sarr MG. Bariatric surgery. Surgery for weight control in patients with morbid obesity. Med Clin North Am 2000; 84:477.

[9] Mahesh Nagappa, Pu Liao, Jean Wong et al, Validation of the STOP-Bang Questionnaire as a Screening Tool for Obstructive Sleep Apnea among Different Populations: A Systematic Review and Meta-Analysis PLoS One. 2015; 10(12): e0143697.Published online 2015 Dec 14. doi: 10.1371/journal.pone.0143697

[10] Abd Elrazek AE, Elnanna A, Bilasy S. Medical Management of patients after bariatric surgery. Principles and Guidelines. WJGS; 2014; Nov 27;6(11):220-8

[11] Elbanna A, Taweela NH, Gaber MB, Tag El-Din MM, Labib MF, Emam MA, Khalil OO, Abdel Meguid MM, Abd Elrazek MAA. Medical Management of Patients with Modified Intestinal Bypass: A New Promising Procedure for Morbid Obesity. *GJMR* 2014; 14: 8-19

[12] Lopes WA, Radominski RB, Rosario N, Leite N. Exercise-induced bronchospasm in obese adolescents. Allergologia et Immunopathologia 2009 10.1016/j.aller.2009.03.001.

[13] Glazebrook C, McPherson AC, Macdonald IA, Swift JA, Ramsay C, Newbould R, et al. Asthma as a barrier to children's physical activity: implications for body mass index and mental health. Pediatrics. 2006; 118:2443–9.

[14] Sin DD, Jones RL, Man SF. Obesity is a risk factor for dyspnea but not for airflow obstruction. Arch Intern Med. 2002; 162:1477–81.

[15] Brolin RE, Kenler HA, Wilson AC, et al. Serum lipids after gastric bypass surgery for morbid obesity. Int J Obes 1990; 14:939.

[16] Tishler PV, Larkin EK, Schluchter MD, Redline S. Incidence of sleep-disordered breathing in an urban adult population: the relative importance of risk factors in the development of sleep-disordered breathing. JAMA 2003; 289:2230.

[17] Redline S, Budhiraja R, Kapur V, et al. The scoring of respiratory events in sleep: reliability and validity. J Clin Sleep Med 2007; 3:169.

[18] Greenburg DL, Lettieri CJ, Eliasson AH. Effects of surgical weight loss on measures of obstructive sleep apnea: a meta-analysis. Am J Med 2009; 122:535.

[19] Dixon JB, Schachter LM, O'Brien PE, et al. Surgical vs conventional therapy for weight loss treatment of obstructive sleep apnea: a randomized controlled trial. JAMA 2012; 308:1142.

[20] Newman AB, Foster G, Givelber R, et al. Progression and regression of sleep-disordered breathing with changes in weight: the Sleep Heart Health Study. Arch Intern Med 2005; 165:2408.

[21] Sarkhosh K, Switzer NJ, El-Hadi M, et al. The impact of bariatric surgery on obstructive sleep apnea: a systematic review. Obes Surg 2013; 23:414.

[22] Herbella FA, Sweet MP, Tedesco P, et al. Gastroesophageal reflux disease and obesity. Pathophysiology and implications for treatment. J Gastrointest Surg 2007; 11:286.

[23] Williams B, Powell A, Hoskins G, Neville R. Exploring and explaining low participation in physical activity among children and young people with asthma: a review. BMC Family Practice. 2008; 9:40.

[24] Strauss RS, Rodzilsky D, Burack G, Colin M. Psychosocial correlates of physical activity in healthy children. Arch Pediatr Adolesc Med. 2001; 155:897–902.

[25] Van Gent R, van der Ent CK, Rovers MM, Kimpen JL, van EssenZandvlietLE, de Meer G. Excessive body weight is associated with additional loss of quality of life in children with asthma. J Allergy Clin Immunol. 2007; 119:591–6

[26] Elbanna A1, Eldin MT, Fathy M, Osman O, Abdelfattah M, Safwat A, Elkader MS, Bilasy SE, Salama K, Elnour AA, Shehab A, Baghdady S, Amer M, Alboraie M, Ragb A,Abd Elrazek M Ali Hussein. Bariatric Bypass Surgery to Resolve Complicated Childhood Morbid Obesity: Case Report Study Medicine (Baltimore). 2015 Dec; 94(49):e2221.