Effect of Weight Loss on Voice After Bariatric Surgery

***Abdul-Latif Hamdan, †Bassem Safadi, ‡Ghassan Chamseddine, §Maher Kasty, ||Zaahir A. Turfe, and ¶Georges Ziade,** *†‡§¶*Beirut, Lebanon, and* ||*Grand Rapids, Michigan*

Summary: Objective. To investigate the effect of weight loss on voice.
Study Design. Prospective study.
Subjects. A total of 15 subjects undergoing bariatric surgery were investigated. Six subjects were lost to follow-up, and nine subjects were evaluated preoperatively and 3–6 months postoperatively. The evaluation included a questionnaire on voice quality filled by the patient, laryngeal examination, perceptual evaluation, and acoustic analysis. The questionnaire consisted of four questions: change in vocal pitch, change in vocal loudness, increase or decrease in phonatory effort, and the presence or absence of vocal fatigue. For the perceptual evaluation, a simplified version of the Grade, Roughness, Breathiness, Asthenia, Strain scale classification was used. These parameters were rated using a score ranging from zero to three where zero stands for none and three for severe. For the acoustic analysis, the following variables were measured: fundamental frequency, habitual pitch, jitter, shimmer, noise-to-harmonics ratio, voice turbulence index, and maximum phonation time.
Results. The mean age was 35.56 ± 9.93 years. The mean weight preoperatively and postoperatively was 112.17 and 83.61 kg, respectively. The body mass index dropped by eight points from 38.06 to 30.83. Only three of the nine patients have reported change in voice quality. The latter was described as an increase in vocal pitch in the three cases, reduced loudness and increased phonatory effort in two, and the presence of vocal fatigue in one. There was no significant difference in the mean score of any of the perceptual parameters in patients preoperatively versus postoperatively. There was also no significant difference in any of the acoustic parameters or in the laryngeal findings before and after surgery.
Conclusion. One-third of the patients with weight loss reported change in voice quality that was not documented acoustically. The laryngeal examination is nonrevealing.
Key Words: Bariatric surgery–Pitch–Roughness.

INTRODUCTION

Obesity is a worldwide health problem with significant comorbidities. It has been associated with numerous diseases, such as hypertension, cardiovascular illnesses, diabetes, stroke, and obstructive sleep apnea.[1–3] The high prevalence of the latter among obese subjects has been attributed to the mass loading of the upper airway, in addition to the volume of abdominal fat among other factors. A driving force for the development of apnea is the size and configuration of the pharynx, both of which are altered in obese subjects. A recent investigation by Busetto et al[4] using acoustic pharyngometry has documented the strong correlation between body mass index (BMI) and pharyngeal size in obese female subjects. Radiologic imaging has also indicated excessive deposition of peripharyngeal fat with subsequent narrowing of the pharyngeal lumen in obese subjects.[5–7]

Despite the strong interplay between upper airway size, morphology, and obesity, the link between obesity, weight loss, and voice is still underexplored. Based on a review of the literature, there are only two studies that have investigated the effects of obesity and/or weight loss on voice.[8,9] Da Cunha et al[8] in his investigation on 45 obese adults have reported a higher prevalence of vocal strangulation, hoarseness, and instability compared with nonobese subjects. These perceptual findings were substantiated by an increase in the perturbation parameters and noise and by a marked reduction in the maximum phonation time (MPT). More so, obese patients were twice as likely to have abnormal laryngoscopic findings compared with nonobese patients.[8] The second study was by Solomon et al[9] on eight obese and eight nonobese subjects who underwent endotracheal intubation for either bariatric surgery or other abdominal surgery. In the investigation by Solomon et al, vocal function using auditory-perceptual, acoustic, and aeromechanic indicators was reported over a 6-month period, during which obese participants had lost substantial weight. The results indicated no significant differences between the two groups preoperatively and no significant differences over time in acoustic parameters, MPT as well as laryngeal airflow and resistance. On the other hand, there were minor changes in the perceptual evaluation, namely strain, pitch, and loudness across sessions. Obese subjects were quieter than nonobese subjects, and pitch decreased with reduction in weight. It is worth noting that all the averaged data were within normal limits.[9]

The purpose of this investigation is to cast more light on the correlation between obesity and voice by examining the effect of weight loss on voice in a group of female obese subjects undergoing bariatric surgery. Findings on laryngeal examination, the presence of self-perceived change in voice quality, perceptual evaluation, and acoustic analysis are reported before and 6 months after surgery.

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From the *Department of Otolaryngology – Head and Neck Surgery, American University of Beirut Medical Center, Beirut, Lebanon; †Department of General Surgery, American University of Beirut Medical Center, Beirut, Lebanon; ‡Department of Surgery, American University of Beirut Medical Center, Beirut, Lebanon; §Department of Otolaryngology, Head and Neck Surgery, Rafik Hariri University Hospital, Beirut, Lebanon; ||Michigan State University College of Human Medicine, Grand Rapids, Michigan; and the ¶Department of Otolaryngology, American University of Beirut Medical Center, Beirut, Lebanon.
Address correspondence and reprint requests to Abdul-Latif Hamdan, Department of Otolaryngology – Head and Neck Surgery, American University of Beirut Medical Center, P.O. Box: 11-0236, Beirut, Lebanon. E-mail: ah77@aub.edu.lb
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TABLE 1.
Demographic Data

Subject	Age (y)	Weight (kg) (Before Surgery)	BMI (Before Surgery)	Weight (kg) (After Surgery)	BMI (After Surgery)	Smoking	Allergy	Reflux
1	25	117	40.48	92	31.83	N	N	N
2	30	93	34.16	73	26.81	Y	Y	N
3	29	120	43.03	100	35.86	N	Y	N
4	50	123.5	41.26	97	33.17	N	N	N
5	53	91	36.46	64	25.97	Y	N	Y
6	37	100	37.64	84	31.34	Y	N	N
7	27	93	37.25	74.5	29.84	Y	N	Y
8	32	169	34.00	68	24.98	N	Y	N
9	37	103	38.30	73	27.14	Y	N	N
Mean ± standard deviation	35.56 ± 9.93	112.17 ± 24.64	38.06 ± 3.08	80.61 ± 13.11	29.66 ± 3.68	55.6%	33.3%	22.2%

MATERIALS AND METHODS

All female patients presenting to the bariatric division of surgery at a tertiary referral center between January 2012 and March 2013 were invited to participate in this study. Subjects included in this study were patients with morbid obesity (BMI greater than 30 kg/m^2) deemed eligible for surgical intervention after failure of multiple diet therapy. All patients have read and signed the informed consent approved by the institutional review board. Subjects with a history of dysphonia at the time of presentation, recent history of upper respiratory tract infection, and/or laryngeal manipulation were excluded from this study. Subjects with abnormal laryngeal findings were also excluded.

A total of 17 subjects were recruited for this study. Two patients were excluded because they had vocal fold pathologies on laryngeal examination. Of the remaining 15 patients, six were lost to follow-up (patients were of different nationalities and failed to show up postoperatively) and only nine were evaluated preoperatively and 3–6 months postoperatively. The evaluation consisted of demographic data, questionnaire on change in voice quality, laryngeal endoscopic examination, perceptual evaluation, and acoustic analysis.

Demographic data included age, weight of the subjects before and after surgery, BMI before and after surgery, type of surgery, comorbid diseases, such as diabetes, hypertension, dyslipidemia, sleep apnea, depression, malnutrition status, history of smoking, history of allergy, and history of gastroesophageal reflux. The latter was defined as the presence of history of heartburn and or regurgitation. The occurrence of intraoperative and/or postoperative complications was also reported.

The questionnaire on voice quality consisted of four questions: (1) change in pitch (none, higher, or lower), (2) change in loudness (none increased or decreased), (3) change in phonatory effort (none, increased, or decreased), and (4) vocal fatigue (present or absent). Phonatory effort was defined as the effort needed to talk. Vocal fatigue was defined as vocal tiring after a prolonged phonatory task (see Appendix).

Laryngeal endoscopy was performed using 70° scope linked to the RLS 9100B Rhino-Laryngeal stroboscope (KayPentax, Lincoln Park, NJ). Abnormal mobility of the vocal folds and/or the presence of any laryngeal pathology were reported.

For the perceptual evaluation, the simplified version of the Grade, Roughness, Breathiness, Asthenia, Strain (namely, the GRB where G stands for grading, R for roughness, and B for breathiness) classification was used. These parameters were rated using a score ranging from zero to three where zero stands for none and three for severe.

Subjects also underwent acoustic analysis using the *VisiPitch IV* software (KayPentax, Lincoln Park, NJ).[10] Patients were seated in a quiet room with a microphone placed 10 cm away from the mouth. Patients were asked to sustain the vowel /a/ at a comfortable pitch and loudness. The following acoustic parameters were examined: fundamental frequency (*F*0), shimmer, jitter, noise-to-harmonics ratio, and voice turbulence index. Patients were then asked to take a deep breath and phonate for as long as they can, and the MPT was recorded. Then, they were asked to count up to 10 at their comfortable pitch and loudness, and the habitual pitch was recorded.

Frequencies and means (±standard deviation) were used to describe the sample, for categorical and continuous variables, respectively. For each subject, the parameters were collected before and after surgery, and the appropriate statistical analysis for small-size samples (Wilcoxon nonparametric paired test) was conducted. The analysis took into consideration the design (before and after) and modality of data collection (paired data). Differences were considered significant for $P < 0.05$. All analyses were conducted using *SPSS* software (SPSS, Inc, Chicago, IL).

RESULTS

Demographic data

The mean age of the patients was 35.56 ± 9.93 years, with a range of 25.0–53.0. The mean weight preoperatively and postoperatively was 112.17 and 83.61 kg, respectively. The BMI dropped by eight points from 38.06 to 30.83 (Table 1).

In terms of comorbid diseases, three patients (33.33%) had diabetes, one had hypertension (11.11%), four had