



BREAKING THE PARADIGM

Sensorineural Hearing Loss in morbidly obese patients

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ABSTRACT

Introduction: The prevalence of obesity and its associated comorbidities has increased globally, and emerging evidence suggests a link between obesity and sensorineural hearing loss (SNHL). However, the relationship remains poorly understood.

This study investigated the potential association between morbid obesity and SNHL in a homogenous cohort of morbidly obese patients eligible for bariatric surgery.

Methods: A prospective cohort study was conducted involving comprehensive audiometric assessments and medical examinations of adult patients with morbid obesity. One hundred adult patients who met the criteria for bariatric surgery were enrolled in the study. Patients with known causes of hearing loss and otologic abnormalities were excluded. Medical history and anthropometric measurements were collected. All participants underwent detailed audiometric evaluations, including pure-tone and speech audiometry to assess their hearing status.

Main Outcomes: The primary outcome was the incidence of SNHL among the study participants.

Results: In this cohort of morbidly obese patients, 16% were found to have SNHL, primarily in high frequencies. There was no statistically significant association between morbid obesity, as measured by body mass index (BMI), weight, or obesity duration, and the risk of hearing loss. Older age and male gender were identified as significant risk factors for SNHL in this population. Notably, a significant discrepancy was found between patients' subjective complaints of hearing loss and objective audiometry results.

Conclusion: Contrary to previous conceptions, this study did not find a significant association between morbid obesity and hearing loss in a homogenous morbidly obese cohort. Further research is needed to explore the multifactorial nature of hearing loss in individuals with obesity and to understand its underlying mechanisms better.

References

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INTRODUCTION

Emerging evidence points to obesity and its associated comorbidities as potential risk factors for hearing loss. Previous studies reported a positive correlation between hearing loss and BMI, waist circumference, abdominal visceral adipose tissue, and other metabolic obesity complications. Large-scale population-based studies, while informative, are constrained by reliance on self-reported data, questionnaires, and data drawn from non-unified sources.

Our study aimed to meticulously evaluate pure tone audiograms within a homogenous group of morbidly obese patients eligible for bariatric surgery to ascertain the incidence of SNHL in this cohort.

METHODS AND MATERIALS

In this prospective cohort, we enrolled **100** adult patients with **morbid obesity** 1-2 days following their bariatric surgery.

Eligibility criteria: age greater than 18, BMI \geq 40 kg/m² or BMI \geq 35 kg/m² with comorbidities, absence of relevant otologic history. All patients had a normal otoscopy per otolaryngologist examination, a type A tympanometry, and within standard word recognition score (WRS).

All eligible participants underwent pure tone audiometry (frequencies ranging from 250 to 12000 Hz), and speech audiometry to determine speech reception threshold (SRT) and WRS alongside tympanometry assessments.

Hearing loss was defined if any average thresholds (low, mid, high) exceeded 25 dB or the SRT exceeded 25 dB.

Hearing loss incidence was compared to the prevalence of hearing loss in the general American population, as reported by the US National Health and Nutrition Examination Survey (8), as well as with the Israeli population (9).

RESULTS

Of the enrolled 100 patients, 75% were female, with a **mean age of 37.24 years**.

Sixteen patients were found to have hearing loss. They all exhibited losses in the **high frequencies** with an average of 35 \pm 9.9 dB.

Data regarding comorbidities associated with Metabolic Syndrome for all patients are presented in Table 1

A univariate analysis was conducted to determine the potential risk factors for hearing loss. **Older age, male sex, a history of diabetes, and hyperlipidemia were significantly correlated with a higher risk for hearing loss**, as evidenced in Table 1. However, BMI, patients' weight, and years of obesity were not found to be correlated, as evidenced in Table 2

Analyzing BMI as a continuous variable revealed an unexpectedly lower average BMI in patients with hearing loss. Additional analysis, categorizing BMI into three groups (below 40, between 40 and 45, and above 45), as presented in Table 2, did not yield a significant correlation.

A multivariate analysis was conducted for age, sex, diabetes, hyperlipidemia, and BMI. After adjusting for all these variables, **only older age and male sex remained statistically significant** with odds ratios of 1.1 (95% CI: 1.02 to 1.2, p = 0.0118) and 5.3 (95% CI: 1.3 to 21.2, p = 0.0178), respectively.

Table 1: Demographics and Comorbidities

	Total	Hearing Loss		P value
		No	Yes	
Gender				0.0016
Male n(%)	25	16(64%)	9(36%)	
Female n(%)	75	68(91%)	7(9%)	
Age (Mean \pm SD)	100	35.28 \pm 10.34	47.52 \pm 9.8	<0.0001
Smoking				0.1583
No n(%)	68	60(88%)	8(12%)	
Yes n(%)	14	12(86%)	2(14%)	
Shisha n(%)	13	9(69%)	4(31%)	
Past smoker n(%)	5	3(60%)	2(40%)	
OSA				0.0978
No n(%)	83	72(87%)	11(13%)	
Yes n(%)	17	12(71%)	5(29%)	
Fatty liver				0.9441
No n(%)	32	27(84%)	5(16%)	
Yes n(%)	68	57(84%)	11(16%)	
Diabetes				0.0124
No n(%)	73	66(90%)	7(10%)	
Yes n(%)	16	10(62%)	6(38%)	
Prediabetic n(%)	11	8(73%)	3(27%)	
HTN				0.0771
No n(%)	79	69(87%)	10(13%)	
Yes n(%)	21	15(71%)	6(29%)	
GERD				0.0922
No n(%)	68	60(88%)	8(12%)	
Yes n(%)	32	24(75%)	8(25%)	
Hyperlipidemia				0.0314
No n(%)	77	68(88%)	9(12%)	
Yes n(%)	23	16(70%)	7(30%)	
Orthopedic complications				0.3558
No n(%)	72	62(86%)	10(14%)	
Yes n(%)	28	22(79%)	6(21%)	

Table 2: Anthropometric Measurements

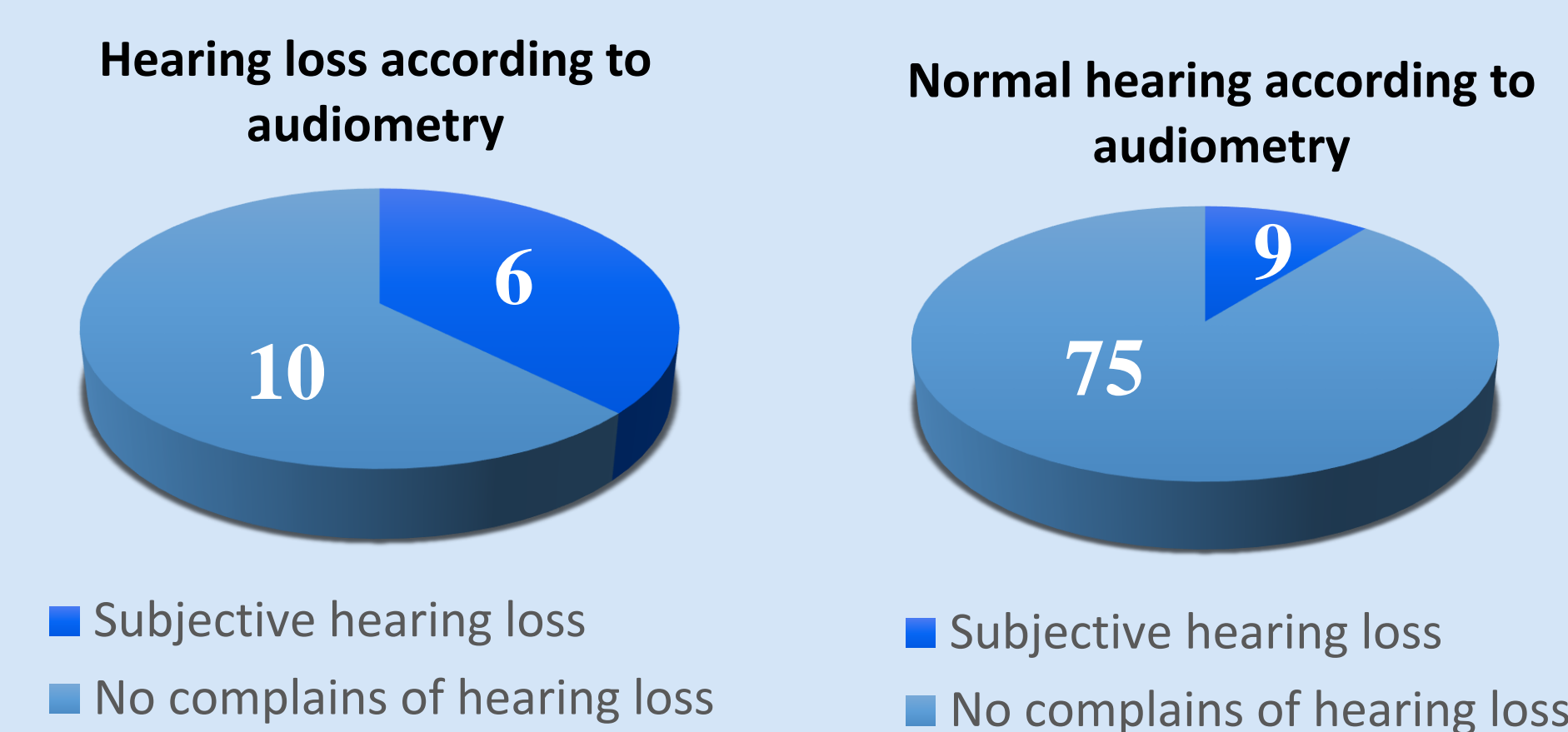
	Total	Hearing Loss		P value
		No	Yes	
Weight (Mean \pm SD)	114.16 \pm 20.37	114.6 \pm 20.84	111.91 \pm 18.18	0.6309
Height (Mean \pm SD)	164.76 \pm 8.79	164.09 \pm 8.34	168.25 \pm 10.44	0.0826
BMI (Mean \pm SD)	41.87 \pm 5.28	42.34 \pm 5.31	39.42 \pm 4.47	0.0421
BMI				0.283
< 40 n(%)	40	31(78%)	9(22%)	
40-45 n(%)	35	30(86%)	5(14%)	
> 45 n(%)	25	23(92%)	2(8%)	
Mean years of obesity (Mean \pm SD)	16.43 \pm 9.81	15.94 \pm 9.62	19.0 \pm 10.73	0.2551

RESULTS cont.

The incidence of hearing loss in our morbidly obese cohort **was not found to be increased** compared to previously reported hearing loss rates in the American and Israeli populations.

During interviews, **15 patients reported experiencing** subjective hearing loss. Figure 1 illustrates that **60% had utterly normal hearing in their audiometry**. Notably, the average age of these nine patients was significantly higher (42 \pm 11 vs 34.5 \pm 10, p=0.0412). Conversely, 62.5% of patients found to have hearing loss in their audiometry did not report experiencing subjective loss.

Figure 1:



DISCUSSION

In our cohort of 100 morbidly obese participants, **16% had hearing loss** in high frequencies, which did not statistically differ from the general American and Israeli populations.

BMI, weight, or obesity duration were **not significant** as a risk factor for hearing loss, which aligns with previous studies. Zhang et al. even concluded that being overweight and obese were significantly associated with a decreased risk of hearing loss (1). In contrast, there are several publications that identify obesity as a risk factor for hearing loss. H. Hu et al. (2), in their vast population-based study that included 48,584 employees, showed a significant increase in the risk of unilateral hearing loss among metabolically unhealthy obese individuals. However, **only 3.8% had a BMI exceeding 30**, hearing loss was found only in 13% of this group, and only 1 and 4 kHz frequencies were measured. Curhan et al. (4) found a significant relationship in 68,421 women between BMI and waist circumference and **self-reporting hearing loss**. Nevertheless, in most studies, the majority of participants had within normal BMI levels.

The mechanism by which obesity affects hearing loss remains unclear. Several authors have suggested that obesity is merely a risk factor for age-related hearing loss. (3) In that case, **the relatively young age of our study group may explain the lack of a positive association between BMI and hearing loss**.

An alternative explanation may be the influence of other synergistic or mediating factors. **The development of hearing loss may be influenced by multiple factors operating in tandem, rather than overweight being a sole determining factor**.

Our analysis did reveal statistically significant associations with age, male gender, hyperlipidemia, and diabetes, but **after adjusting for all factors, only older age and male sex remained significant**.

Several previously reported studies relied on patients' self-reported hearing loss(6). We found a **significant discrepancy between reported hearing complaints and hearing levels according to pure-tone audiogram** (Figure 1). While 15 participants complained of hearing loss, only 40% of this group demonstrated corresponding audiogram findings. Interestingly, we noticed that this group had a higher mean age.

Previous studies investigating participants with audiologic symptoms and normal conventional audiograms reported them to be of greater age. They found hearing loss in the extended high-frequency range, up to 20 kHz (7,8), whereas in our study, we limited our measurements to 12 kHz. **These individuals experiencing "hidden" hearing loss may display indications of premature auditory aging**.

Our findings are subject to several limitations. First, Our study was conducted at a single institution with a relatively small sample size. Secondly, our study's absence of a control group restricts our ability to make direct comparisons.

CONCLUSION

Contrary to previous conceptions, our study of a unique, homogenous, morbidly obese cohort did not find a significant association between morbid obesity and hearing loss. Further studies are needed to explore this potential effect in greater depth.