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Correlation Between Anxiety, Depression, and Patient Tolerance in Patients With no Prior History of Mental Disorders Undergoing Office-Based Laser Surgery: A Case Study

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ABSTRACT

Objective: To investigate tolerance to office-based laser surgery (OBLS) in patients with no prior history of mental illnesses, and to analyze the correlation between patient tolerance, anxiety, and depression using validated questionnaires.

Methods: Patients aged 18–65 with no prior history of mental disorders undergoing OBLS from May 2024 to September 2024 were included in this study. All patients completed the Generalized Anxiety Disorder scale-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). After surgery, tolerance was assessed using the IOWA satisfaction with anesthesia scale and a Visual Analog Scale for discomfort.

Results: A total of 25 patients were enrolled. Eighteen patients had moderate–severe anxiety and six patients had moderate–severe depression. The mean GAD-7 was 12.32 ± 4.09, and the PHQ-9 score was 6.60 ± 5.43. The mean IOWA score was 1.78 ± 1.07, and the mean VAS for discomfort was 4.60 ± 3.31. There was a moderate negative correlation between IOWA score and GAD-7 score ($r = -0.489$) and a mild positive correlation between the GAD-7 score and the VAS score for discomfort ($r = 0.372$). A mild negative correlation was found between IOWA scores and PHQ-9 scores ($r = -0.357$) and a weak positive correlation between the PHQ-9 score and the VAS score ($r = 0.204$). It is important to note that although this study group had a high risk for anxiety and depression, the results indicated that OBLS was a well-tolerated procedure. This could be ascribed to the non-invasiveness of OBLS and proper application of topical anesthesia.

Conclusion: The study revealed a high tolerance level despite a high risk for anxiety and depression in a large percentage of our study group. Moreover, there was a mild to moderate negative correlation between anxiety, depression, and patient tolerance.

Level of Evidence: 2

1 | Introduction

Office-based laser surgery (OBLS) has gained popularity as a safe treatment modality for patients with structural voice disorders [1]. It is considered by many as an alternative to traditional microlaryngeal surgery with a high success rate in selected cases [2–4]. In 2006, Zeitels and Burns [5] reported the successful use of potassium titanyl phosphate (KTP) laser in the treatment of laryngeal

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dysplasia and papilloma in 48 patients. The authors stressed the photoangiolytic properties of this laser and its enhanced performance compared to the old generation pulse dye laser (PDL). In 2007, Koufman et al. [6] reviewed their experience in 443 cases of office-based laser laryngeal surgery using three types of lasers: the PDL, thulium laser, and the carbon dioxide laser. The authors highlighted the efficacy and safety of these lasers in the management of benign and pre-malignant laryngeal lesions. In 2012, in a multi-institutional review of office-based laryngeal surgery, which included laser therapy among other procedures such as esophagoscopy and injection laryngoplasty, Young et al. [7] reported a completion rate of 92%. Moreover, 96% of the patients advocated awake in-office laser surgery. In 2023, Abi Zeid et al. [4] conducted a systematic review and meta-analysis on the efficacy of office-based laser therapy for vocal fold polyps and noted a significant improvement in subjective and objective voice measures following treatment. The review, which included 10 articles, showed a decrease in the Voice-handicap Index-10 score, GRB scores, and cycle-to-cycle variation in amplitude following therapy. Similarly, in another systematic review and meta-analysis on office-based laser therapy for Reinke's edema, Hamdan et al. [8] reported a significant improvement in the VHI-10 core and a significant decrease in the size of the lesion. The disease regression was associated with a significant increase in the fundamental frequency.

The success of OBLS is contingent on patient tolerance and collaboration. Factors affecting patient tolerance have traditionally been stratified as procedure-related factors such as the approach used, type of surgery performed and its duration, patient-related factors such as age, gender, history of smoking, and the presence of comorbidities, and disease-related factors such as extent of the lesion, its location and ease of accessibility [9–13]. An equally important factor that affects tolerance and is often missed by otolaryngologists is the patient's mental well-being [14, 15]. Numerous studies indicate that mental disorders are more common in patients with dysphonia in comparison to normal subjects with no dysphonia. The estimated prevalence of anxiety in patients with voice disorders ranges from 29.5% to 55%, and that of depression from 19% to 45% [15–24]. These figures may increase with the worsening of the socio-economic status, further burdening the mental well-being of patients presenting with dysphonia. For instance, the socio-economic crisis in Lebanon has triggered a surge in mental health disorders, notably anxiety, depression, and post-traumatic stress disorders (PTSD), especially after the 2020 Beirut explosion. Nearly 60% of adults reported depression strongly tied to low socio-economic status and poor living conditions [25], while youth faced anxiety as a result of neglect and abuse [26]. In a study on the relationship between anxiety, depression, and self-perceived hoarseness in 100 Lebanese patients presenting with voice disorders, Hamdan et al. [27] reported moderate–severe anxiety and mild–moderate depression in 64% and 50% of the cases, respectively.

Despite the numerous reports on the high prevalence of anxiety and depression in patients with dysphonia, there are no studies on the correlation between these disorders and patient tolerance in OBLS. Based on a Pubmed, Scopus and Medline literature review using the words “anxiety,” “depression,” “mental disorders,” “office-based,” “laryngeal surgery,” “laser surgery,” “office-based laser surgery,” “office-based laser therapy,” “office-based laryngeal surgery,” and “tolerance,” no studies on the correlation between anxiety, depression and patient tolerance in OBLS could be found. The primary objective of this study is to investigate tolerance to OBLS in patients with no prior history of mental illnesses, and to analyze the correlation between tolerance level, anxiety, and depression in this cohort. The authors of this manuscript hypothesize that OBLS is a well-tolerated procedure and there is a negative correlation between anxiety, depression, and patient tolerance. Proper awareness and pre-operative treatment of these co-morbidities may help improve the success rate of OBLS.

2 | Methods

After having obtained the institutional review board approval (BIO-2023-0266), all patients undergoing OBLS during the period extending from May 2024 to September 2024 at the Voice and Swallowing Unit of a tertiary referral center were invited to participate in this prospective study. Written informed consent was obtained from all participants. All OBLS were performed using either the blue laser or the thulium laser via the transnasal approach using the flexible nasopharyngoscope with a working channel (HD Video Rhino-Laryngoscope 11,001 UD1 Karl Storz, Germany). Exclusion criteria included a positive history of psychological or mental disorders based on a review of the medical record, patients with severe cardiovascular disease and unstable hemodynamically. Patients with a previous history of psychological or mental disorders were excluded because the purpose of this study is to investigate the correlation between anxiety/depression and patient tolerance in patients not known to have a history of mental illnesses. Demographic data included age, gender, history of smoking, type of comorbidities, voice diagnosis, and the Voice Handicap Index-10 (VHI-10) score [28]. The duration of OBLS (including anesthesia time) and the number of joules delivered were also documented.

Prior to the procedure, patients were asked to complete the Generalized Anxiety Disorder scale-7 (GAD-7) [29] and the Patient Health Questionnaire-9 (PHQ-9) [27]. The GAD-7 is a validated questionnaire that measures the prevalence of core anxiety symptoms. Scores of 0–4 indicate minimal anxiety, 5–9 mild anxiety, 10–14 moderate anxiety, and 15–21 severe anxiety [29]. The Patient Health Questionnaire-9 (PHQ-9) is a nine-item tool that assesses depression severity. Scores of 0–4 indicate minimal depression, 5–9 mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression [30].

Immediately after surgery, patient tolerance to the procedure was assessed using the IOWA Satisfaction with Anesthesia Scale [31] and the Visual analog scale (VAS) for discomfort ranging from 0 to 10 with 0 indicating no discomfort and 10 indicating maximum discomfort. The IOWA questionnaire is a self-administered assessment tool composed of 11 items that is commonly used to assess aspects of comfort and perceived pain during surgical procedures [31]. The statements alternate between negative and positive with a total of six negative statements and five positive statements. The patient is provided with a set of response choices from “disagree very much,” scored as −3, to “agree very much,” scored as +3, to determine his or her level of agreement with the scale's statements. The score of positive statements remains the same while that of the negative statements is reversed. The sum of the scores is then

divided by 11 to determine the mean tolerance score for each patient that can range from −3 (totally unsatisfied patient) to +3 (totally satisfied patient).

2.1 | Statistical Analysis

Categorical and continuous variables were described using frequencies and means (±standard deviation), respectively. Spearman correlation was used to measure the strength of association between continuous variables. Analysis of Variance (ANOVA) was used to compare means across multiple groups. All analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 29 software package. A two-tailed p-value <0.05 was considered statistically significant.

3 | Results

3.1 | Demographic Data

A total of 25 patients were enrolled in this study. The mean age of the study group, which included 12 male and 13 female, was 48.52 ± 11.20 years. More than half the patients were smokers (56%) and 19 had comorbidities, including a history of reflux disease, hypertension, diabetes, and dyslipidemia. The most common laryngeal pathologies treated were vocal fold polyps (28%) followed by Reinke's edema (24%) and leukoplakia (24%). The mean VHI-10 score of the study group was 14.72 ± 6.50. The mean duration of surgery, including anesthesia, was 21.80 ± 6.8 min. The mean number of joules delivered was 70.8 ± 57.59 (Table 1).

TABLE 1 | Demographic characteristics of the study population.

Demographic data ($N=25$)	n (%)
Gender	
Male	12 (48)
Female	13 (52)
Age in years (mean years ± SD)	48.52 ± 11.20
History of smoking	14 (56)
Comorbidities	19 (76)
Voice diagnosis	
Polyp	7 (28)
Reinke's edema	6 (24)
Leukoplakia	6 (24)
Cyst	5 (20)
RRP	1 (4)
VHI-10 score (mean ± SD)	14.72 ± 6.50
Duration of the surgery in minutes (mean years ± SD)	21.80 ± 6.8
Number of joules (mean years ± SD)	70.8 ± 57.59

Abbreviations: SD, standard deviation; VHI-10, Voice Handicap Index-10.

3.2 | The IOWA Score and the VAS Score for Discomfort in the Study Group and Across the Subgroups With Different Laryngeal Pathology

The mean IOWA score of the study group was 1.78 ± 1.07. After excluding the only patient with recurrent respiratory papillomatosis, patients who underwent OBLS for vocal fold leukoplakia had the highest mean IOWA score (2.50 ± 0.63), whereas those who had OBLS for Reinke's edema had the lowest IOWA score (0.86 ± 1.01). With respect to the VAS score, the mean of the total group was 4.60 ± 3.31. Patients who underwent OBLS for Reinke's edema reported maximum discomfort with a mean VAS score of 6.80 ± 3.2, whereas those who underwent OBLS for vocal fold leukoplakia had a mean VAS score of 1.17 ± 1.16 (Table 2).

TABLE 2 | Mean IOWA and VAS scores across different subgroups of laryngeal pathologies.

Laryngeal pathology	IOWA score (mean years ± SD)	VAS score (mean years ± SD)
Polyps	1.88 ± 1.16	5.14 ± 3.43
Reinke's edema	0.86 ± 1.01	6.80 ± 3.27
Leukoplakia	2.50 ± 0.63	1.17 ± 1.16
Cyst	1.62 ± 0.81	6.17 ± 1.94
RRP	3.00 ± 0.00	1.00 ± 0.00

Abbreviations: RRP, recurrent respiratory papillomatosis; SD, standard deviation; VAS, visual analogue scale.

3.3 | The GAD-7 Score and Its Correlation With IOWA Score and VAS for Discomfort Score

Based on the GAD-7 questionnaire, seven patients had mild anxiety, 10 patients had moderate anxiety, and 8 patients had severe anxiety. Note that none of the patients had minimal anxiety. The mean GAD-7 score of the study group was 12.32 ± 4.09.

There was a negative moderate correlation between the GAD-7 score and IOWA score ($r=-0.489$). Patients with mild anxiety had the highest mean IOWA score, and patients with severe anxiety had the lowest mean IOWA score (2.54 ± 0.63 and 1.35 ± 1.16, respectively). Similarly, there was a mild positive correlation between the GAD-7 score and the VAS score for discomfort ($r=0.372$). Patients with mild anxiety had the lowest mean VAS discomfort score (2.29 ± 3.1) and patients with severe anxiety had the highest mean VAS discomfort score (6.00 ± 2.87) (Table 3).

3.4 | The PHQ-9 Score and Its Correlation With IOWA Score and VAS Tolerance Score

Based on the PHQ-9 score, nine patients had minimal depression, 10 patients had mild depression, five patients had moderate depression, and one patient had severe depression. The mean PHQ-9 score of the study group was 6.60 ± 5.43.

TABLE 3 | Mean IOWA and VAS scores across different anxiety levels.

Anxiety levels	IOWA score (mean years ± SD)	VAS (mean years ± SD)
Minimal	—	—
Mild	2.54 ± 0.63	2.29 ± 3.14
Moderate	1.59 ± 1.04	5.10 ± 3.17
Severe	1.35 ± 1.16	6.00 ± 2.87

Abbreviations: SD, standard deviation; VAS, visual analogue scale.

TABLE 4 | Mean IOWA and VAS scores across different depression levels.

Depression levels	IOWA score (mean years ± SD)	VAS (mean years ± SD)
Minimal	2.22 ± 0.84	4.22 ± 3.63
Mild	1.66 ± 1.01	4.40 ± 3.53
Moderate	1.64 ± 1.26	5.00 ± 2.82
Severe	−0.3 ± 0.00	8.00 ± 0.00

Abbreviations: SD, standard deviation; VAS, visual analogue scale.

There was a mild negative correlation between IOWA scores and PHQ-9 scores ($r = -0.357$). Patients with minimal depression had the highest mean IOWA score, and patients with moderate depression had the lowest mean IOWA score (2.22 ± 0.84 and 1.64 ± 1.26, respectively). Similarly, there was a weak positive correlation between the PHQ-9 score and the VAS score for discomfort ($r = 0.204$). Patients with minimal depression had the lowest mean VAS score, and patients with moderate depression had the highest mean VAS score (4.22 ± 3.63 and 5.00 ± 2.82, respectively) (Table 4).

4 | Discussion

Mental disorders represent a leading cause of disability and premature mortality among adults. An estimated 4.4% of the world's population suffers from either a major depressive disorder or generalized anxiety disorder, which often coexist in the same individual [32]. Mental disorders carry adverse effects on quality of life in all its dimensions: emotional, physical, and functional [33, 34]. Based on the World Health Organization Global Burden of Disease Survey, the burden of anxiety and depression is overwhelming and often perceived as a handicap [32]. In a study by Jain et al. [35], which included 1051 participants diagnosed with depression, the authors reported a decrease in work productivity and an increase in absenteeism in the study group.

What is alarming is that anxiety and depression remain underdiagnosed in many cases due to the social stigma and/or lack of diagnostic resources. To that end, many patients with voice disorders scheduled for OBLS may be suffering from a mental illness that had not been previously diagnosed. Indeed, the results of this investigation showed a relatively high prevalence of anxiety and depression in patients with dysphonia and no prior history of mental disorders undergoing OBLS. Eighteen of the 25 participants had moderate to severe anxiety, and 16 had mild to severe depression. These figures may be inflated given the biased selection of participants from one institution in a limited geographic area. This is particularly true in the context of the socioeconomic and challenging geopolitical status where the study was conducted. Another possible confounding factor is the stress of undergoing surgery, although the screening questionnaires were filled out before the procedure. The study also showed the presence of a moderate negative correlation between the degree of anxiety and patient tolerance, and a mild negative correlation between the degree of depression and patient tolerance.

The results of this investigation are in accord with numerous studies highlighting the significant role of mental disorders such as anxiety and depression in modulating pain perception and tolerance in patients undergoing awake office-based procedures. In 2002, Trevisani et al. [36] reported an inverse association between patient tolerance, trait anxiety ($p < 0.05$) and state anxiety ($p < 0.01$) in 163 patients who underwent endoscopy (75 gastroscopy, 51 colonoscopy, and 37 bronchoscopy). Those with high levels of anxiety were less compliant and tolerant than those with low level of anxiety. In 2020, Sorrentino et al. [37] investigated pain perception in 104 women undergoing office hysterectomy and reported a positive correlation between the state of anxiety and pain intensity, indicating that higher levels of state anxiety are associated with increased pain perception. Anxiety was measured using the State–Trait Anxiety Inventory (STAI-Y1), and perceived stress using the Perceived Stress Scale (PSS). Similarly, in 2021, Whited et al. [38] examined the relationship between psychiatric disorders, intake of psychiatric medications, and pain tolerance during awake office upper airway procedures and noted a significant association between these three factors. The maximum pain change (PΔmax) increased significantly with the increased number of psychiatric disorders ($p < 0.001$), substantiating the significant impact of this latter on pain experience and tolerance.

Another interesting finding in this study is the overall high tolerance score to OBLS despite the high risk for anxiety and depression, and the mild to moderate negative correlation between anxiety, depression, and tolerance. The mean IOWA score of the study group was 1.78 ± 1.07, and the mean VAS score was 4.60 ± 3.31. These findings suggest that OBLS is a well-tolerated procedure, although a large percentage of the study group screened positive for anxiety and depression using validated questionnaires. The high tolerance to OBLS can be ascribed to the adequate application of topical anesthesia to the laryngopharyngeal complex, to the non-invasiveness of this procedure, and last to surgical dexterity when the surgery is performed by an experienced surgeon.

Our results are in agreement with the literature which supports the consensus that OBLS is well tolerated by most patients. Rees et al. [39] investigated patient tolerance for Pulse Dye Laser (PDL) therapy for diseases of the upper aerodigestive system and noted a tolerance score of 7.4 on a scale of 1–10, with 1 indicating most

discomfort. The data was collected using a phone survey in 89 patients, the majority of whom preferred in-office therapy to surgery in the operating room. Young et al. [7] reviewed 153 cases of awake laryngeal procedures and reported a tolerance score of 37 on a scale of 1–100, with 1 indicating the least discomfort. Zheng et al. [40] investigated patient tolerance to office-based KTP laser therapy and reported a negative correlation between the extent of disease and tolerance. Patients with multiple laryngeal lesions and with lesions of the posterior larynx had less tolerance than patients with a single lesion and/or with lesions limited to the vocal folds. In another study which included 48 patients, Hamdan et al. [12] reported a mean tolerance score of 1.51 ± 1.1 using the IOWA Satisfaction with Anesthesia Scale. The authors also noted that young patients and smokers had less tolerance than older patients and non-smokers. Furthermore, those with lesions involving more than half the vocal folds had poorer tolerance than those with lesions limited to less than half the vocal folds. The type of disease and duration of surgery also had an impact on tolerance score.

This study is the first to investigate the correlation between anxiety, depression, and tolerance to OBLS, and to underscore the high tolerance to OBLS despite the high risk for anxiety and depression in our cohort. It is important to note that the questionnaires used are not diagnostic but are screening questionnaires for mental illnesses. The relevance of patient psychological well-being in procedural tolerance and the impact of therapy warrant future investigation.

This study has its limitations; one is the small sample size, and the second is the fact that both the GAD-7 and PHQ-9 are screening questionnaires for anxiety and depression, respectively, and not diagnostic tools. Another limitation of this study is that our study group was solicited from one tertiary referral center and is not multi-institutional. Our cohort is also biased by the nationality and ethnicity of our participants.

5 | Conclusion

Based on two screening questionnaires, the GAD-7 and PHQ-9, this prospective investigation showed that OBLS is a well-tolerated procedure despite the high risk for anxiety and depression in a large percentage of our study group. Moreover, there was a negative correlation between tolerance, anxiety, and depression.

Acknowledgments

The authors have nothing to report.

Ethics Statement

This study was approved by the Institutional Review Board of the American University of Beirut Medical Center, Lebanon. IRB ID: BIO-2023-0266. Informed consent was obtained from patients to participate in this study. The study also conforms to the regulations and standards established by the Declaration of Helsinki of the World Medical Association.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available upon request. Abdul-Latif Hamdan confirms that he has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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