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Abstract

Objective. Halitosis secondary to pathology of the palatine tonsils is considered airway (type 2) halitosis in the etiologic classification. Reports differ as to the proportion of objective halitosis complaints that have tonsillar etiology, with some giving this figure as 3%. Due to their immunologic role, even healthy tonsils usually possess some subclinical inflammation. The tonsil crypt system is also the most ideal environment for anaerobic bacterial activity in the upper respiratory tract. Tonsillar halitosis is thought to occur mainly because of chronic caseous tonsillitis and tonsillolithiasis (tonsil stones). Tonsillectomy and various cryptolysis techniques are reported to improve halitosis in such cases. In this article, diagnostic methods and evidence for interventions are reviewed.

Review Methods. Studies reporting the efficacy of any intervention (medical or surgical) on tonsillar halitosis were included, whether halitosis was the focus or one of several measures.

Conclusions. There are insufficient high-quality studies on this topic. Improved methodology, for example, use of control groups and utilization of more accurate halitosis detection/ quantification techniques, are required.

Implications for Practice. Lack of evidence currently prevents firm conclusions, but the following is recommended: (1) Use reliable methods for halitosis diagnosis and confirmation of tonsillar etiology. Initial treatment such as tongue scraping is useful to rule out oral halitosis. (2) Tonsillar procedures are contraindicated in: subjective halitosis, non-tonsillar etiology, or if medical management resolves halitosis. (3) Where indicated and where facilities permit, less invasive techniques such as laser cryptolysis may be preferable to tonsillectomy in adults, potentially avoiding general anesthetic and the higher risk associated with tonsillectomy in this group.

Keywords tonsil, halitosis, cryptolysis, tonsillectomy, caseous tonsillitis, tonsil stone.

Introduction

Halitosis can be objective (clinically detectable odor) or subjective (complaints without detectable odor). It may come from the mouth, nose, and/or alveolar air and often represents benign processes, yet it is taboo, causing social anxiety.¹ Five percent to 72% of halitosis complaints may represent subjective complaints with no detectable odor.² The potential contributing etiologic factors are heterogeneous and variously located. Ten percent of objective halitosis has extra-oral etiology. According to some, 3% are attributed to the tonsils³ and overall 4% to 10% to upper respiratory tract (URT) pathology.³⁻⁵ Others suggest the tonsils are the most common cause of extra-oral halitosis,^{6,7} and the majority of idiopathic halitosis is actually chronic tonsillitis.⁸ Halitosis secondary to pathology of the respiratory tract is termed type 2 halitosis in the etiologic classification (Table 1).⁹

Table 1. Etiologic Classification of Halitosis.

Type	Description
Type 0: physiologic	The physiologic odor present in all healthy individuals. It is formed by the physiologic contributions from the following types. The levels of physiologic halitosis fluctuate but stay under halitometric limits and do not disturb the patient's social environment. No treatment needed beyond reassurance.
Type 1: oral	Odor in association with an oral pathology, for example, tongue coating, periodontitis, xerostomia, plaque stagnation.
Type 2: airway	Odor in association with pathologies of the respiratory tract, from nasal cavity to alveoli, for example, rhinosinusitis, laryngitis, bronchiectasis, carcinomas.
Type 3: gastro-esophageal	Odor in association with gastroesophageal pathology, for example, erosive gastro-esophageal reflux disorder, gastritis with H. pylori infection, Zenker diverticulum, gastrocolic fistula.
Type 4: blood-borne	Odorant volatiles from the systemic circulation transferred to the exhaled breath during gas exchange. Hepatic, renal, digestive, endocrine system disease, including trimethylaminuria.
Type 5: subjective	Patient believes there is halitosis, but no odor is detectable clinically, for example, retronasal olfaction, psychologic (olfactory reference syndrome), and neurologic conditions (eg, chemosensory dysfunction).

The palatine tonsils are part of Waldeyer's ring surrounding the oropharyngeal and nasopharyngeal inlets to the aerodigestive tract, sampling antigens from inhaled air, foods/drinks, and the microbiota. The branching and interconnecting crypt system makes the most ideal URT anaerobic bacterial site.^{8,10} Continuing immunologic processes transpire within the tonsillar parenchyma, and minimal inflammation, potentially undetectable clinically, is usually present due to constant antigenic/microbial exposure. This level of tonsil inflammation may generate odor via a similar mechanism to the dorsoposterior tongue.

Chronic Caseous Tonsillitis and Tonsillolithiasis

Chronic caseous tonsillitis (CCT) is characterized by retention and/or discharge of cheese-like, semi-solid whitish crypt material. Mineralization of this debris leads to tonsillolith formation. CCT is commonly seen on ear, nose, and throat (ENT) clinics,¹⁰ occurring in both sexes at any age,^{11,12} unilaterally or bilaterally.¹⁰ CCT is painless and may present

monosymptomatically as halitosis, but throat irritation, foreign body sensation, and periodic tonsillolith shedding are possible.¹¹ This condition may be present without any clinically obvious inflammation. Approximately 77% of patients have intermittent halitosis,^{10,13} possibly because of tonsillolith exfoliation.¹⁴ Tonsilloliths are 10 times more likely to give elevated breath volatile sulfur compounds (VSC).¹¹ Up to 10% of the general population have tonsilloliths,¹⁵ with even gender distribution but higher occurrence in adults.¹⁶ Usually asymptomatic, incidental findings on routine radiography or examination,¹⁷ tonsilloliths possess a dynamic biofilm similar to dental biofilms.¹⁵ Anaerobic bacteria detected in tonsilloliths include Eubacterium, Fusobacterium, Porphyromonas, Prevotella, Selenomonas, and Tannerella spp., all VSC-forming.¹⁸ The tonsil microbiota resembles the dorsal tongue microbiota, containing D and A group streptococci, Neisseria, pneumococci, Actinomyces, Bacteroides, and yeasts.¹⁹

Each tonsil is bi-lobed due to embryologic derivation from the second and third branchial arches, divided by the second pharyngeal pouch in utero. This is represented in the adult as the intratonsillar cleft. It is barely visible in childhood due to physiologic tonsillar hypertrophy. Thereafter, atrophy starts to widen the cleft. A stagnation site may develop, accumulating debris (“intratonsillar cleft stasis”). It has been suggested that more tonsilloliths form in this cleft than the crypt system.²⁰

Others

Peritonsillar abscess can cause acute, transient halitosis. Pus can be malodorous, particularly in anaerobic infections,²¹ as well as tasting offensive to the patient. Gustation and olfaction are intimately linked, and bad taste can cause subjective halitosis complaints. Airway impingement, dysphagia, and odynophagia may also cause mouth breathing, fasting, xerostomia, oral stagnation, increased bacterial activity, and odor production. Fungating oropharyngeal malignancies can be malodorous due to anaerobic colonization of ulcerated surfaces in the oropharynx, as well as suppuration and necrosis.²²⁻²⁵ Actinomycosis involving the tonsils may cause halitosis.²⁶⁻²⁸ Malodorous “sulfur granules” (Actinomyces colonies) may be mistaken for tonsilloliths as the clinical picture is similar. Rare, nonmalignant conditions with associated halitosis include chondroid chorisotoma²⁹ and inflammatory myofibroblastic tumor.³⁰

Halitosis Detection and Differentiation between Oral and Tonsillar Halitosis

Since there is no ideal halitosis diagnostic test, all available evidence sources should be utilized, building a clinical picture that allows more confident diagnosis. Lack of an ideal test similarly causes problems quantifying symptom improvement. Evidence includes: reliable reports from

the patient’s social environment, such as family/close friends; patient selfreport; and techniques described in the following, ideally on more than one occasion as halitosis is fluctuant.

Halitometry is measurement of odorant breath volatiles. This is usually semi-objective quantification of key VSC (eg, H₂S, CH₃SH) by portable devices of varying accuracy. The level of VSC on the breath is fluctuant, and non-VSC gases can contribute to halitosis (eg, trimethylamine). Gas chromatography is more accurate at quantifying volatiles and detects non-VSC odorants but is unlikely to be available in most settings.

Organoleptic test (OLT) is the clinician smelling the patient’s breath and grading the odor level. Odor fluctuation and reliance on the clinician’s subjective opinion make OLT unreliable, but it is widely used clinically. It is practical (no equipment needed) but far from perfect. The patient refrains from performing any oral hygiene measures on the day of the test. He or she closes their mouth for 1 minute, exhales slowly from their mouth into the clinician’s face from 10 cm, who scores the odor as follows: 0 = none, 1 = barely noticeable, 2 = slight but clearly noticeable, 3 = moderate, 4 = strong offensive, and 5 = extremely foul.³¹

The tonsil smelling test is essentially a modified OLT, subjectively assessing odor of tonsil exudate. It was first described by Finkelstein et al⁸ and later modified by Al-Abbasi³² (inclusion of patient’s family/partner in assessment of exudate at 5-10 cm) and Talebian et al³³ (insertion of a dental burnisher into a crypt). Correlation of the findings with other halitosis detection methods is not available. This technique may also induce severe gagging and pushing bacterial products and tonsilloliths deeper into the crypts.³⁴ Elevated blood TNF α , IL1B, IL6 occurred in psoriasis patients 3 hours after touching the tonsils with a hard object.³⁵

Standard oropharyngeal examination hides much of the tonsils from

view. Instead, 2 wooden spatulas/tongue depressors are gently used, 1 on the posterolateral tongue, with downwards retraction, and 1 vertically against palatoglossus with posterior pressure, displacing the tonsil from its fossa into the oropharyngeal lumen and exuding tonsilloliths/ caseum.³⁴

Differentiation between oral and extra-oral halitosis may be possible. The first assessment is made with the patient's nares occluded while exhaling through their mouth and the second exhaling through the nose with the mouth closed. Oral halitosis may be more detectable on mouth breath, while halitosis from the sinonasal apparatus may be more detectable on nose breath. Other extra-oral halitosis causes may be equally objectionable on both nose and mouth breath.

In practice, confirmation of tonsillar origin in halitosis is difficult. The

nose and mouth breath carries volatiles from the tonsils, being located at a nasal-oral airflow junction. Neither OLT nor halitometry can separate tonsillar odors from oral odors, but they may help to distinguish subjective and objective complaints.

Methods

A literature search was performed by 2 of the authors, utilizing MEDLINE and the Cochrane database. The majority of the included papers were obtained with MeSH terms "Tonsil" AND "Halitosis." Supplementary searches were performed with keywords such as tonsillitis, tonsillectomy, tonsil stone, cryptolysis, and so on. Studies reporting the efficacy of any intervention (medical or surgical) on tonsillar halitosis were included, whether halitosis was the primary focus or one of several measures (Table 2).

Table 2. Summary of Studies about Surgical Procedures for Tonsillar Halitosis.

Intervention	Study (first author, year)	Results	Comment
Temperature-controlled radio frequency tonsil ablation	Tanyeri 2011 (n = 58)	Complete resolution of halitosis in 1 session in 84.4% and 2 sessions in 6.9%	Unreliable method of halitosis diagnosis and quantification of improvement. Insufficient follow-up in some cases.
Coblation cryptolysis	Chang 2012 (n = 7)	Mean 79.3% subjective improvement in tonsil stone symptoms	Unclear if halitosis was included as a measured outcome, and if so, unclear number of halitosis complaints at baseline, and what method of diagnosis and quantification of improvement was used
Laser cryptolysis (coagulation)	Dal Rio 2006 (n = 38)	At baseline, 78.9% had abnormal breath sulfide levels. Levels	Use of Halimeter for breath sulfide analysis unreliable, only semiobjective

		decreased after each treatment, performed 4 times, until normalized.	measure of true volatile sulfur compounds level
	Passos 2002 (n = 31)	77% complained of halitosis at baseline; symptom resolution in 87% after mean 7 sessions, rest required more extensive use of laser.	Method of halitosis quantification unreported.
	Passos 2004 (n = 20)	Symptom resolution in 75% after 6 sessions.	Method of halitosis quantification unreported; how many complained of halitosis at baseline unreported.
Laser cryptolysis (vaporization)	Finkelstein 2004 (n = 53)	Complete elimination of halitosis in 1 session in 53%, 2 sessions in 34%, and 3 sessions in 9%. 2 returned after 2 to 3 years with recurrent halitosis.	Unreliable method of halitosis diagnosis and quantification of improvement.
	Krespi 2013 (n = 500)	84% required 1 session; overall symptom resolution in 96.4%	Number of halitosis complaints at baseline unreported; method of halitosis diagnosis and quantification of improvement unreported.
	Krespi 1994 (n =120) ^a	After 4 sessions, 79% reported total elimination of symptoms.	Number of halitosis complaints at baseline unreported. Unreliable method of halitosis diagnosis and quantification of improvement. Unclear if symptoms referred to halitosis, or to sore throat, etc.
Tonsillectomy	Al-Abbasi 2009 (n = 44) ^b	At 8 weeks, patients reported complete	Unreliable method of halitosis diagnosis and

		disappearance (79.5%, 35) or incomplete disappearance (20.4%, 9) of halitosis, but smelling test negative in all subjects	quantification of improvement.
	Krespi 1994 (n = 86) ^c	60% required 1 session and 37% required 2. After 4 weeks 98% reported symptom relief.	Number of halitosis complaints at baseline unreported. Method of halitosis diagnosis and quantification of improvement unreported.
^a Gross ablation of tonsils to level of tonsillar pillars, ie more accurately termed tonsillotomy rather than cryptolysis. ^b Tonsillectomy technique unreported. ^c Laser-assisted serial tonsillectomy.			

Discussion

All identified studies reported the impact of interventions on halitosis secondary to chronic tonsillitis, apart from 1 case report, which stated that tonsillectomy resolved halitosis caused by actinomyces.²⁶

Medical Management

If CCT/tonsillolithiasis is asymptomatic or the patient is unconcerned, then no treatment is indicated. In 48 halitosis patients, baseline OLT for mouth air was 4.2 and 3.7 for tonsil odor. After 1 month using zinc-containing mouthwash, mean OLT for oral and tonsil odor scores were 3.0 and 2.2, respectively.³³ Therefore, therapy for reducing oral halitosis appears ineffective for reducing odor associated with tonsillar pathology. Oral halitosis therapy is nevertheless useful in ruling out oral halitosis.

Nonsurgical management for CT/tonsillolithiasis includes irrigation, saline gargling, manual tonsillar massage, or gentle curettage.³⁶ Pharmacologic resolution may involve topical antiseptic (eg, chlorhexidine spray), anti-

inflammatories, and systemic antibiotics (metronidazole, amoxicillin or clindamycin).^{8,10,32,37} There are no data available concerning the efficacy of medical measures for CCT/tonsillolithiasis in reducing halitosis. Two authors observed that antibiotic therapy yields temporary halitosis improvement, which returns once the course is complete; however, no formal evidence was cited.^{8,32}

Temperature-controlled Radiofrequency Ablation

This is high-frequency alternating current (300-3000 kHz) producing controlled tissue heating, protein denaturation, desiccation, and tissue destruction.³⁸ Complications include hemorrhage and edema. Tanyeri and Polat³⁷ present a retrospective case series (n = 58) of patients with chronic halitosis complaints and a diagnosis of CCT. Other causes of halitosis were excluded clinically. Tonsil smelling test was performed at baseline, including the opinion of the patients' relatives/partners. Patients were re-examined 4 to 6 weeks after surgery and

followed up for an average of 20 months. Of them, 84.4% reported complete disappearance of halitosis after 1 treatment, with negative tonsil smelling test and no visible caseum. In addition, 8.6% reported insufficient improvement and 6.9% patients reported no change. These 9 patients also had positive tonsil smelling test and caseum still present. Overall, complete elimination of halitosis was reported with 1 session in 84.4% and 2 sessions in 6.9%, making a total of 91.3%. The authors concluded that the intervention was efficacious and carried less risk of complications than other surgical interventions.³⁷

Coblation Cryptolysis

This technique utilizes radiofrequency energy to excite electrolytes in a medium (eg, saline gel), creating localized plasma, which causes dissolution of tissue at relatively low temperatures (40 °C -70 °C), while preserving surrounding tissues.³⁶ Chang and Thrasher³⁶ describe coblation cryptolysis as safer compared to laser cryptolysis. In a retrospective case series (n = 7), coblation cryptolysis was carried out on patients with clinically confirmed tonsilloliths and longterm daily tonsil stone extrusion, halitosis, and disrupted quality of life (QOL). Follow-up was at 2 weeks and 3 months postoperatively. The outcome was assessed by patient-reported reduction in tonsil stone symptoms (it is not clear if halitosis was included). On average, patients reported 79.3% improvement in symptoms following this procedure.³⁶

Laser Cryptolysis

This technique is also termed laser resurfacing and laser assisted intracapsular tonsillectomy. Carbon dioxide (CO₂) laser was utilized in all the studies identified. Laser cryptolysis is less invasive than traditional tonsillectomy, carries less risk of complications and reduced healing time, and can be carried out under local anesthesia provided adequate compliance

and lack of oversensitive gag reflex.³⁴ Two types of laser cryptolysis are distinguished: vaporization (LCV) and coagulation (LCC). The goal in both is to selectively widen crypt orifi and reduce crypt depth, decreasing the tendency for caseum and tonsillolith retention.¹⁰ In LCV, significant fibrous replacement of lymphoid tissue occurs.⁸ In LCC, the laser settings are altered such that only epithelial coagulation and protein denaturation occurs and the laser is focused mainly on the borders of the crypts. LCC preserves the tonsil parenchyma and is described as virtually painless in comparison.^{10,39,40} Complications of laser cryptolysis include tightening of the lateral pharyngeal walls⁸ and a small potential for airway fire, retinal damage from reflected scatter and orofacial burns. The smoke generated from tissue ablation also requires aspiration. Generally the cost of laser equipment is also high.³⁶

Dal Rio et al¹⁰ present a case series (n = 38) of patients with halitosis secondary to CCT who underwent LCC. Other causes of halitosis were excluded by a multidisciplinary team (internist, dentist, and ENT). Four CO₂ LCC sessions with 4 weeks between each session were carried out. Halitometry and symptom reassessment was performed on each occasion. The authors divided the patients into 2 groups based on their baseline halitometry readings. Although all patients complained of halitosis, 78.9% had abnormal halitometry readings at baseline (.150 parts per billion VSC), and the remaining 21.1% had normal halitometry readings. The authors attributed the lack of abnormal halitometry to non- VSC odorants and symptom transience due to intermittent presence of caseum. However, the latter group had normal halitometry readings throughout the study, so it is possible that these individuals had subjective complaints. After each session, those who started with abnormal halitometry showed a decreased reading, resulting in normalization of halitometry by the last review and

resolution of patient-reported halitosis and caseum formation.¹⁰ Although the use of semi-objective breath analysis strengthens the results of this study, the Halimeter has been criticized for being imprecise and causing misdiagnosis. It has unequal sensitivity for some VSC and not others and furthermore appears to give phantom VSC readings when exposed to non-VSC odorants.⁴¹

Passos et al³⁹ report a case series (n = 31) of patients who underwent LCC. The included subjects had a diagnosis of symptomatic CCT, and an average of 7 sessions were performed per patient. At baseline, 77% complained of halitosis. They report symptom resolution in 87%, and the remaining 13% required treatment of the areas adjacent to the crypts in addition. It is not clear what method was used to confirm halitosis or to quantify symptom resolution.³⁹

Passos et al⁴⁰ reported a case series (n = 20) of patients who underwent sessions of LCC. These subjects had CCT .1 year and lack of response to medical management. Biopsies were taken before the first session and 1 month after the last session. Follow-up was at least 6 months. They report symptom resolution in 75% of subjects after 6 sessions. However, it is not clear how many of the patients complained of halitosis at baseline and what method was used to quantify symptom improvement.⁴⁰

Finkelstein et al⁸ present a case series (n = 53) of patients with “chronic fetid tonsillitis” who underwent LCV. Causes of oral halitosis were excluded by examination and treatment (eg, tongue scraping) and nontonsillar ENT causes by flexible nasopharyngoscopy. Patients, partners, and/or family members were asked to rate halitosis severity and patients asked to smell their own mouth/nose breath and debris scraped from their tongue. The tonsil smelling test was performed by 2 examiners. Baseline parameters included 15.1% reporting intermittent expulsion of tonsilloliths and

positive tonsil smelling test in 94% (over 2 consultations). Mean follow-up interval was 8.5 months. Complete elimination of halitosis (based on patient self-reports and repeat tonsil smelling test) was achieved in a single session in 53%, 2 sessions in 34%, and 3 sessions in 9%, overall giving halitosis resolution in 92% of cases. Two patients returned at 2 to 3 years with recurrent tonsillitis and mild halitosis and underwent tonsillectomy.⁸

Krespi and Kizhner³⁴ present the largest case series available on this topic (n = 500); however, the methods by which tonsillar etiology of halitosis was confirmed and symptom improvement was quantified were unreported. They report 16% required second procedure due to persistent symptoms and tonsilloliths and overall symptom resolution in 96.4%. Finally, 3.6% required tonsillectomy under general anesthesia. The follow-up period was 1 to 8 years.³⁴

Krespi and Ling⁴² 1994 reported a retrospective case series (n = 120) of patients who underwent laser cryptolysis, although since they describe ablation of the tonsils to the level of the tonsillar pillars, this procedure would be better termed tonsillotomy rather than cryptolysis, which all other publications define as localized to the tissue immediately surrounding the crypt orifice rather than gross ablation of tonsil tissue. Ninety-six percent experienced complete relief from recurrent tonsillitis, and 79% reported total elimination of symptoms. However, the proportion of patients who began the study with objective halitosis was unreported, and it appears that self-reported symptom improvement was used as a measure of quantifying the impact of the treatment. Furthermore, it is not clear if symptoms referred to halitosis, or to sore throat, and so on.⁴²

Tonsillectomy

Tonsillectomy is normally carried out in a single session under general anesthesia. Risks include those associated with

anesthesia and immediate or delayed hemorrhage and infection. Postoperative pain is especially a feature of adult tonsillectomy. Halitosis is generally considered a relative indication if (1) all other causes of halitosis are managed properly, (2) halitosis still persists despite these measures, and (3) crypts in tonsils are found to contain malodorous substrates.^{33,43-45}

Al-Abbasi³² reported the impact of tonsillectomy (technique unknown) on halitosis secondary to chronic tonsillitis in a case series (n = 44). Other causes of halitosis were excluded by an internist, a dentist, and with ENT examination. Halitosis was quantified by clinician, patients, partners, and/or family to rate the severity of the halitosis, including use of the tonsil smelling test. At 4 and 8 weeks postoperatively, these parameters were repeated. Baseline parameters were positive tonsil smelling test in 86.3%, increasing to 100% with repeat smelling test on another occasion; 95.5% complained of halitosis to some degree, and 40.9% reported intermittent caseum expulsion. At 8 weeks postoperatively, 79.5% reported complete disappearance of halitosis, 20.4% reported incomplete disappearance, and the tonsil smelling test was negative in all subjects. Incomplete halitosis resolution despite negative tonsil smelling test in these 9 subjects were attributed to psychologic factors.³²

Krespi⁴⁶ and Ling performed LAST in 86 adults with chronic recurrent tonsillitis, chronic sore throat, severe halitosis, or airway obstruction. Sixty percent required 1 session and 37% required 2. At 1 and 4 weeks postoperatively, 98% reported symptom relief. However, neither the proportion of subjects who had halitosis nor the method of diagnosing or quantifying halitosis improvement are detailed.⁴⁶

Comparison of Interventions

Heterogenous study methodology makes comparison difficult. However, Finkelstein

et al⁸ and Al-Abbasi³² used similar methods, so it could be concluded that LCV has comparable impact on halitosis to traditional tonsillectomy according to these.

Only 1 source appeared to compare the efficacy of tonsillar procedures with non-tonsillar halitosis treatments. When validating the halitosis-associated life quality test (HALT, a 20-item QOL tool), Kizhner et al⁴⁷ report the effect of 2 interventions on patients with halitosis (defined by OLT 6 tonsil smelling test), namely, laser cryptolysis and calcium phosphate oral rinse for xerostomia. Although each treatment arm had only 8 subjects, this appears to be the only study that compares laser cryptolysis with another intervention. OLT (by 2 examiners) 6 tonsil smelling test and HALT measures were taken at baseline and at 2 months follow-up. Improved HALT scores and decreased OLT scores for both groups occurred (calcium phosphate rinse P = .001, cryptolysis P = .002), and the mean OLT decrease was greater for the cryptolysis group, although this was marginally statistically significant (23.8 vs 12.9, P = .05). However, the primary intention was not to compare different interventions but rather to assess the ability of the HALT to chart symptom improvement.⁴⁷

Implications for Practice

In every patient complaining of halitosis, it is important to reliably distinguish objective halitosis from subjective complaints. Simply questioning patients if they think they suffer from halitosis is unreliable.⁴⁸ Patients with subjective halitosis will not benefit from treatments that aim to eliminate odor, and performing unnecessary surgery raises ethical issues. Reliable confirmation of tonsillar etiology of halitosis should also be made. Standard therapy, such as tongue scraping, is useful to rule out oral halitosis.

Medical resolution should be attempted before approaching surgical

options. It would appear that the surgical interventions described have comparable efficacy, although robust evidence is currently lacking. Complete removal of the crypt system is theoretically favorable over cryptolysis, which might cause stenosis of crypt orifices, further predisposing to impaired secretion drainage and crypt stagnation. Rarely, lymphatic tissue has been reported to regenerate if it is not completely removed,⁴⁰ and a small percentage of patients are reported to return after 1 to 2 years. However, from the evidence available, cryptolysis appears efficacious.

Cryptolysis is less invasive compared to tonsillectomy, and it is suggested by some that preservation of tonsillar function is desirable,¹⁰ although the tonsils' immunologic role is generally considered limited. Also, the degree to which the tonsils function following cryptolysis is unclear. Histopathologic examination of tonsils from patients who had undergone LCV after 2 to 3 years showed extensive replacement of lymphoid tissue with scar tissue.⁸ LCC appears to preserve the parenchyma to a greater extent than LCV.⁴⁰ It has also been suggested that tonsillectomy risks alteration of the palatal position, vocal tract configuration, and voice timbre and resonance changes, whereas cryptolysis does not.⁴² Another consideration is the total cost of the treatment, including lost productivity due to recovery time.

The number of sessions and overall length of the treatment course is significant. Some patients may prefer to undergo single-occasion tonsillectomy instead of several sessions of cryptolysis. Most tonsillar surgical procedures for halitosis are carried out in adults rather than children. The tonsils become less biologically important after childhood, and the risks of tonsillectomy are relatively greater in adults. Surgical interventions are likely to cause halitosis to worsen before any improvement due to post-tonsillectomy eschar.⁴⁹ Posttonsillectomy

halitosis is said to last about 2 weeks,⁵⁰ but Al- Albassi³² reports changing halitosis parameters 4 weeks postoperatively. Tongue scraping and oral antibiotics are reported to have an impact on halitosis during this period.^{51,52}

Research Perspectives

An independent, well-designed randomized control trial is needed comparing medical management with the various surgical procedures. Inclusion of patients with subjective halitosis introduces bias. Similarly, more reliable methods of quantifying halitosis improvement need to be used. Follow-up time needs to be several months. A combination of short follow-up time and unreliable methods of halitosis quantification such as patient self-reports in uncontrolled studies may mean that the findings are strongly influenced by placebo effect.

Author Contributions

Matthew Ferguson, conception, literature search, analysis, conclusions; Murat Aydin, literature search, analysis, conclusions; Joseph Mickel, analysis, conclusions.

Disclosures

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