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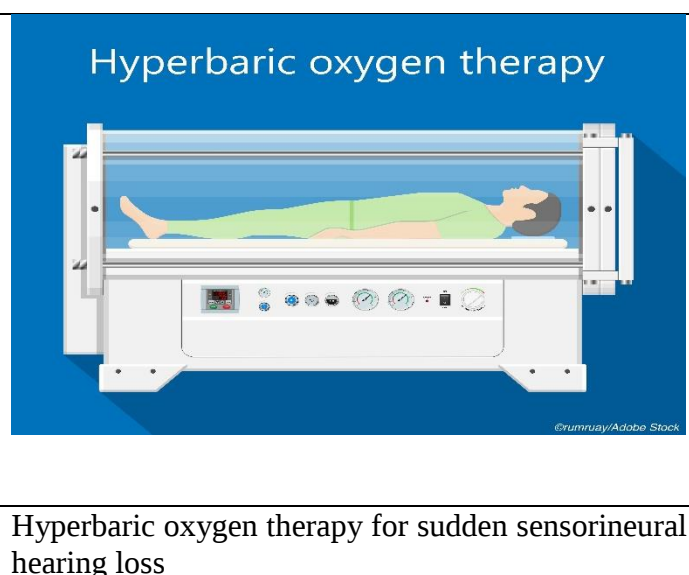
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Medical Team, Micro Labs

## Evaluation of the efficacy of various hyperbaric oxygen therapy approaches in patients suffering from sudden sensorineural hearing loss

**Introduction:** Sudden Sensorineural Hearing Loss (SSNHL) refers to the abrupt onset (less than 3 days) of perceptive hearing loss with a deficit exceeding 30 dB in three contiguous frequencies. The prevalence of SSNHL was higher in the 43–53 age group (77 per 100,000) than in the <18 age group (11 per 100,000). Although a complex origin has been proposed, the pathogenesis of SSNHL remains unclear. Several diseases, including autoimmune inner ear diseases, vascular problems, acoustic tumors, viral infections, medication toxicity, and psychological disorders, can cause SSNHL.<sup>1</sup> Hyperbaric oxygen therapy (HBO) was used as an essential or salvage therapeutic option in addition to systemic or intratympanic steroid therapy. Studies have shown that the perilymphatic fluid's oxygen tension increases dramatically in hyperbaric settings. HBO therapy may lessen damage to the cochlea, which was vulnerable to ischemia, by assisting in the delivery of oxygen into the inner ear tissues.<sup>2</sup> As per the latest scientific data, HBOT ought to be initiated no later than two weeks following the onset of symptoms. However, there were no clear recommendations for HBOT.<sup>3</sup> Thus, the purpose of this study was to assess how various HBOT profiles affected the improvement of hearing in SSNHL patients.



**Methods:** This retrospective analysis comprised 218 individuals who were receiving HBOT for SSNHL. The completeness of medical records, including information on whether the patient had pure-tone audiometry (PTA) prior to and during HBOT, and a diagnosis of SSNHL were the research's eligibility requirements. As per the AAO-HNS recommendations, a rise in the hearing threshold stimulus to >30 dB HL over three audiometric frequencies, evolving over

a maximum of 72 hours, was one of the diagnostic criteria for SSNHL. The primary factors taken into account for the SSNHL diagnosis were the PTA results. An Interacoustics AC40 audiometer was used to measure the air conduction (AC) and bone conduction (BC) frequencies in the tests. An analysis was done on the connection between the length of treatment and the postponement of hyperbaric therapy. Examining the importance of variations in PTA's mean hearing threshold between the pre- and post-treatment periods for each subgroup was the initial step. The final step in the statistical analysis was to evaluate the statistical significance of hearing improvement with the number of hyperbaric chamber cycles.

**Results:** The study group had an average hearing threshold stimulus of 54.6 ( $\pm 31.3$ ) dB HL before therapy, which decreased to 39.6 ( $\pm 32.2$ ) dB HL after treatment. In BC, there was a noticeable reduction in hearing threshold, which was clear evidence that SSNHL has improved (Table 1). For individuals treated with 15 cycles or fewer, a statistically significant improvement in hearing was shown across all frequencies examined. With the exception of 1500 Hz, every frequency showed statistically significant improvement in hearing in patients receiving more than 15 cycles of treatment. The improvement in hearing at frequencies of 1500, 3000, and 4000 Hz was statistically not significant in the group receiving treatment after a delay of more than 10 days.

| Frequency [Hz] | Before [dB] | After [dB] | Difference | <i>p</i> |
|----------------|-------------|------------|------------|----------|
| 250            | 41.22       | 26.03      | 15.19      | <0.001   |
| 500            | 48.05       | 28.68      | 19.37      | <0.001   |
| 1000           | 49.05       | 30.52      | 18.52      | <0.001   |
| 1500           | 69.40       | 32.72      | 36.68      | <0.001   |
| 2000           | 52.49       | 34.86      | 17.63      | <0.001   |
| 3000           | 56.76       | 38.11      | 18.65      | <0.001   |
| 4000           | 54.03       | 38.67      | 15.35      | <0.001   |

Table 1. BC before and after receiving combined ST and HBOT treatment

**Discussion:** For both early and late therapy of SSNHL, the combination of HBOT with oral steroids (OS) was a beneficial option. When starting treatment more than 14 days after the onset of symptoms, the combination of HBOT and OS proved to be the most effective option.<sup>1</sup> A safe and well-tolerated treatment option for individuals suffering from idiopathic sudden sensorineural hearing loss (ISSNHL) was HBO therapy. This method has been shown to significantly enhance audiologic function in people with profound hearing loss, and as such, it was a promising therapeutic alternative for this patient population.<sup>2</sup>

**Conclusion:** The current study concluded that individuals who got HBOT after 10 days showed no significant improvement in their high-frequency PTA hearing threshold. Therefore, it appeared advantageous to begin HBOT for SSNHL within the first ten days of the condition. The patients who received more than 15 cycles of HBOT saw a decrease in the statistical significance of hearing improvements.

**The rapid initiation of hyperbaric oxygen therapy (HBOT) may be a key component in the treatment of sudden sensorineural hearing loss (SSNHL).**

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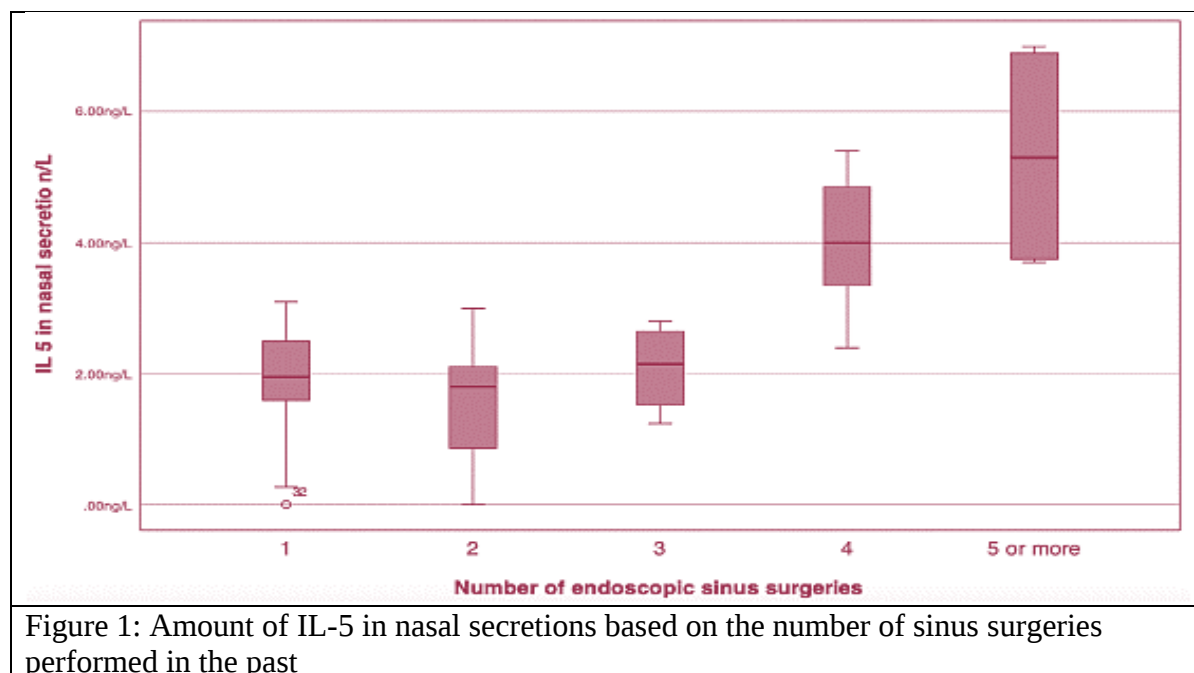
## **Determination of Interleukin-5 and calprotectin in defining severity of disease and identifying uncontrolled patients**

**Introduction:** Chronic rhino sinusitis with nasal polyps (CRSwNP) is a complicated disorder with multiple phenotypes and endotypes. The pathophysiologic core of the disease was chronic sinonasal mucosal inflammation, which was induced by a variety of pathogenic processes. Granulocytic airway infiltration composition can be influenced by three types of cell-mediated immune responses (type 1, type 2, and type 3), which could account for the heterogeneity of CRSwNP. Numerous inflammatory states were linked to the intricate pathophysiology, which can cause a range of severities.<sup>1</sup> Functional endoscopic sinus surgery (FESS), which improves symptoms and quality of life, was usually considered a safe and successful treatment for CRSwNP. Research has helped to better understand the pathophysiological pathways underlying chronic rhinosinusitis. Depending on the precise imbalance in the immune cell response, many endotypes have been identified. Interleukins (IL) such as IL-5, IL-4, and IL-13 are examples of inflammatory mediators involved in the Th2 response that were highly expressed in type 2 CRSwNP and have been linked to pathognomonic eosinophilia. However, unusual neutrophilia has been linked to a higher concentration of TH1 cytokines (TNF-G, TNF-alpha, IL-17, etc.) in types 1 and 3 CRSwNP. Finding biomarkers that can more accurately describe the severity spectrum of CRSwNP was the current area of research attention. In fact, biomarkers might be useful in defining the degree of the illness and the likelihood that treatment outcomes won't be satisfactory.<sup>2</sup> The current study's main goal was to investigate if IL-5 and calprotectin in nasal secretions and nasal polyps might be used as clinical biomarkers to identify CRSwNP patients who were difficult to treat and to evaluate the severity of the disease.

**Methods:** In this case-control study, 81 individuals with diffuse CRSwNP who had received intranasal steroids as treatment for at least one prior operation were included. Patients were split into two groups: Group A consisted of 39 uncontrolled patients (SNOT-22  $\geq 40$  and two or more cycles of systemic corticosteroids in the previous year), and Group B consisted of 42 controlled patients (SNOT-22  $< 40$  and less than two cycles of systemic corticosteroids in the previous year). Patients were assessed both during the screening visit (V0) and one month later (V1). Every patient had a baseline interview at V0 in order to gather all clinical history and

data from further workup, including blood eosinophilia, asthma, smoking, allergy, NSAID-exacerbated respiratory disease (NSAID-ERD), Lund-Mackay score (LMS), past surgeries, and treatments. At V1, IL-5 and calprotectin levels in nasal secretions and nasal polyp tissue were examined for each patient.

**Results:** In Group A, there was a significant increase in calprotectin and IL-5 levels in both secretions and tissue. The amounts of these substances were shown to be greater in nasal secretions in correlation with the number of prior surgeries. The progressive rise in IL-5 levels according to the number of procedures was shown in Figure 1. IL-5 levels were less than 3 ng/L up until three FESS, and in patients who have undergone more than three operations, they rise to more than 3 ng/L. These findings validated the concept that IL-5 and calprotectin were suggestive indicators of the severity of the disease. Smoking, asthma, blood eosinophilia, NSAID-exacerbated respiratory disease (NSAID-ERD), neutrophils, and eosinophils at nasal cytology were all substantially linked to uncontrolled disease at univariate analyses. Multivariate studies revealed a strong relationship between the likelihood of uncontrolled disease and nasal secretion/polyp tissue IL-5, NSAID-ERD, and asthma.



**Discussion:** In this study, multivariate logistic regression revealed that asthma, NSAID intolerance, and IL-5 in nasal secretion/polyp tissue were separately and significantly associated with an elevated likelihood of uncontrolled illness.<sup>2</sup> According to Rosati D et al., there was a positive correlation between a greater likelihood of long-term recurrence and high eosinophilic infiltration and high IL-5 expression in chronic rhinosinusitis with nasal polyps (CRSwNP) and no correlation between IL-8 expression and neutrophilic and lymphocytic

infiltration. The best predictor of results in CRSwNP still has to be investigated; however, these findings offer a chance to enhance the ability to forecast the prognosis of surgical intervention.<sup>3</sup>

**Conclusion:** The current study concluded that asthma, IL-5 in nasal secretions and tissues, and NSAID-ERD may be useful in identifying more severe patients because they were associated with an increased risk of uncontrolled disease. However, uncontrolled patients also exhibited significant levels of neutrophilia and calprotectin, particularly following repeated procedures.

**A multivariate logistic regression analysis revealed that asthma, NSAID intolerance, and IL-5 in nasal secretion/polyp tissue were all separately and strongly associated with a greater probability of uncontrolled disease.**

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## **Assessment of the validity of High-Frequency Audiometry tool Using Bayesian active (BA) learning algorithm**

**Introduction:** Audiometry is the first test used to examine a patient for hearing loss or abnormalities. Standard audiometry (SA) is typically performed in the range of 125 to 8000 Hz in 1 or 0.5 octave steps. But the range of frequencies that humans can hear was between 20 and 20,000 Hz.<sup>1</sup> However, traditional audiometry has been reported to be unreliable in diagnosing auditory impairment due to the inability to identify responses at extended high frequencies (EHF) above 8 kHz. Monitoring EHF responses, on the other hand, may be very valuable in the early detection of hearing loss in some groups. Because changes in EHF hearing occurred before changes in conventional tests at frequencies below 8 kHz, research has shown that evaluating the hearing sensitivity at EHF could be useful for monitoring the auditory function of patients using ototoxic drugs.<sup>2</sup> In addition, high-frequency audiometry (HFA) can be helpful in conjunction with sound acoustics (SA) in detecting severe acoustic injuries and, consequently, early detection of noise-induced hearing loss. Moreover, a link was discovered indicating a causal relationship between the phenomena of the strength and laterality of tinnitus and high-frequency hearing loss. The test was not currently performed in clinics, despite the stated advantages that the HFA-added information would provide. The reason could be a time factor, which relates to the increased cost of spending more time on a single patient. Audiologists or clinicians actually conduct the audiometry test; they present the sound through the audiometer and wait for the patient's response, telling them to press a button only if they hear the sound. However, there were increasing evidence that determining sensitivity at high frequencies may serve as an alternative for identifying covert hearing loss and, possibly more precisely, inner ear synaptic damage.<sup>1</sup> So, this study aimed to evaluate the validity of a high-frequency audiometry instrument that uses Bayesian learning to provide a fast, automatic, repeatable, and predictable assessment.

**Methods:** Three tests were used in the study to determine the high-frequency thresholds in 85 participants (138 ears): conventional audiometry (SA), an algorithm based on alternative forced choice (AFC), and an algorithm based on Bayesian active learning (BA). In order to evaluate the test-retest reliability, each test was conducted twice. Participants were selected from a pre-existing database as well as from new sources. To reduce the possibility of higher thresholds

above 8 kHz, the only recruitment requirement for participants already in the database was a maximum threshold of 60 dB hearing level (dBHL) at 8 kHz. Prior to the testing, otoscopy was used to inspect the participants' ears, and a series of generic questions regarding tinnitus, hyperacusis, and hearing in noisy environments were utilized to determine whether the participants subjectively perceived their own hearing.

**Results:** Comparing the BA with the other two tests revealed median differences within  $\pm 5$  dB up to 10 kHz and median differences within  $\pm 10$  dB at higher frequencies. Variability increases from lower to higher frequencies. A boxplot showing the difference between the thresholds determined by frequency by the BA and SA was presented in Figure 1. The BA had lower thresholds than the SA at the majority of frequencies. Age, hearing impairment, and tinnitus test findings were all similar among the groups. High test-retest reliability ( $>90\%$ ) was observed in the BA data.

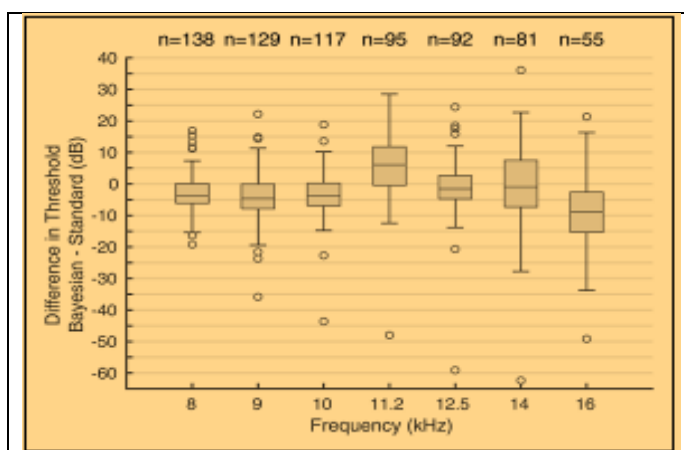


Figure 1: Boxplot showing the frequency-based difference between the thresholds determined by the BA and SA.

Compared to the AFC, the BA required less time (4 min vs. 13 min).

**Discussion:** Wang M et al. found that there was a definite age dependence in the hearing thresholds at EHF from 9 to 20 kHz for the prediction of hearing loss compared to frequencies below 8 kHz.<sup>2</sup> Schlittenlacher et al. employed pulsed tones in their investigation because they were easier to notice than pure tones for tinnitus listeners. One may anticipate comparable outcomes for pure tones or warble tones if the same was true for the broader frequency range taken into consideration in the current investigation. Additionally, they compared a manually operated audiometer using continuous tones with their Bayesian method using pulsed tones.<sup>3</sup>

**Conclusion:** The current study concluded that the Bayesian learning-based audiometry test demonstrated satisfactory tool performance at high frequencies. Test-retest reliability was consistently excellent, and the variation from the standard procedure matched the HFA error range. Given the test's short execution time—on average, around 4 minutes—it could be an effective way to include the HFA in clinical screening processes.

**The Bayesian learning test for high-frequency audiometry may be a suitable option for clinical screening. It would provide reliable and significant information without taking up too much time during the visit.**

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## Case report of endoscopic sinus surgery for chronic rhinosinusitis with Good's syndrome

**Introduction:** The association between persistent chronic rhinosinusitis (CRS) and immunoglobulin deficiencies (ID) was well recognized, with some studies revealing that up to 54% of individuals with refractory CRS had an underlying ID. Considering the uncommon occurrence of this illness, it was not surprising that multiple clinical guidelines have repeatedly stated that more study was needed in the area of treating CRS in individuals with ID.<sup>1</sup> In 1954, Good published the first description of Good's syndrome (GS), a rare condition linked to immunodeficiency and thymoma. The main immunological characteristics of GS include reduced T cell mitogenic response, aberrant CD4:CD8 T cell ratio, hypogammaglobulinemia, few or no B cells, and CD4 T cell lymphopenia. Decreased generation of antibodies leads to recurrent sinopulmonary infections and compromises the prognosis of the patient. Among patients with thymomas (1.4–11.0%) and primary hypogammaglobulinemia (2.9–7.0%), GS has been reported.<sup>2</sup> This case report described a patient with GS who did not improve with thymectomy, regular intravenous gamma globulin (IVIG), or macrolide treatment. As a result, ESS under general anesthesia was carried out, and following surgery, the persistent cough and postnasal drip improved.

### Case presentation:

The patient was initially admitted to another hospital for pneumonia and sepsis about two years ago, when chest computed tomography revealed a drop in immunoglobulin and anterior mediastinal malignancies. After being diagnosed with GS, he underwent treatment. Hypogammaglobulinemia was found in the laboratory (IgG 175 mg/dL, IgA 20 mg/dL, IgM 1 mg/dL, and IgE 0.1 mg/dL). IVIG (20g) was used every 4 weeks to keep IgG levels at or above 600 mg/dL. After thymectomy, immunoglobulin levels did not rise, despite pathological examination revealing a type-AB thymoma. The patient's quality of life has been significantly impacted by a persistent cough that was initially linked to postnasal drip. There was purulent nasal drainage from the middle nasal meatus and a nasal septal rupture in the fiber

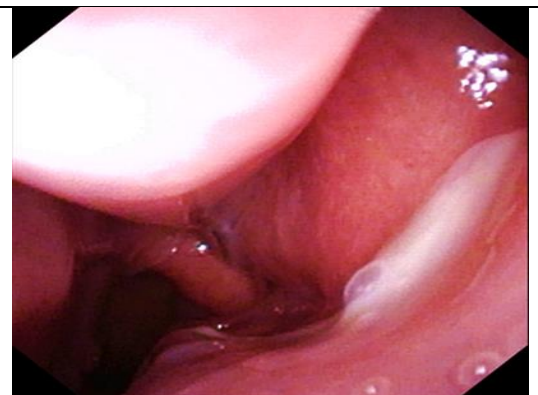


Figure 1. Nasal fibers with mucous nasal discharge from the middle nasal meatus.

(Fig. 1). Sinus CT revealed a soft tissue shadow in the pan-paranasal sinuses, with the maxillary sinus exhibiting the most. Bronchiectasis and a ground-glass shadow were seen on the chest CT scan (Fig. 2). Long-term macrolides and routine IVIG were used; however, there was no improvement in postnasal drip. As a result, they performed endoscopic sinus surgery (ESS) using general anesthesia, which involved accessing the maxillary, ethmoid, and frontal sinuses. On a sinus CT scan performed after the procedure, a little amount of nasal mucus thickness persisted, but lung views showed less inflammation (Fig. 3). Using the visual analog scale, symptoms of persistent cough, postnasal drip, and nasal discharge decreased by about 85% after surgery. The patient's quality of life and upper respiratory tract inflammation subsequently improved.



Figure 2: Bronchiectasis in the lungs and a ground glass shadow are shown on the chest CT scan.



Figure 3: Following ESS of chest CT: Chronic inflammation and bronchiectasis are improved.

**Discussion:** Good syndrome (GS) is an uncommon illness that appears in the fifth decade of life and was characterized by the presence of both thymoma and hypogammaglobulinemia. Recurrent sinopulmonary infections were a prevalent problem for GS patients, as other mainly antibody deficiencies (PAD) such as agammaglobulinemia and common variable immunodeficiency (CVID).<sup>3</sup> Patients requiring additional revision procedures were those with immunodeficiency and granulomatosis with polyangiitis. While several studies have revealed diverse immunodeficiencies, few have specifically addressed GS. Even though patients with GS in CRS may need more revision operations, ESS can enhance their quality of life.<sup>4</sup>

**Conclusion:** Good syndrome (GS) was linked to a significant death rate. Hematologic problems, autoimmune illnesses, and infections were the main causes of death for people with GS. Intravenous gamma globulin (IVIG) should be used in cases of humoral immunodeficiency, as it can lower the risk of infections, overuse of antibiotics, and hospital

stays. ESS may reduce sinopulmonary infections and enhance quality of life in cases where IVIG and macrolides were not successful in treating CRS.

**Endoscopic sinus surgery (ESS) may be used to treat chronic rhinosinusitis with Good's syndrome when conservative conventional treatment fails.**

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