



A Case Series on Evaluating the Efficacy of the Glycerol Test as a Screening Device for Meniere's Disease- Our Experience

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Meniere's Disease,
Glycerol Test,
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ABSTRACT:

The glycerol test is a proposed diagnostic tool for Meniere's disease.

This condition is characterized by vertigo, hearing loss, tinnitus, and aural fullness. This paper reviews the efficacy of the glycerol test as a screening tool for Meniere's disease, comparing its diagnostic accuracy, practicality, and limitations with other methods.

1. Introduction

1.1 Background on Meniere's Disease

Meniere's disease is a chronic inner ear disorder characterized by a triad of symptoms: episodic vertigo (a sensation of spinning), fluctuating hearing loss, and tinnitus (ringing in the ears). This condition affects the labyrinth, a complex system of fluid-filled tubes and sacs in the inner ear, which plays a crucial role in balance and hearing. The exact etiology of Meniere's disease remains unclear, but it is thought to involve an abnormal accumulation of endolymphatic fluid within the inner ear structures, leading to increased pressure and disruption of normal function. The prevalence of Meniere's disease is estimated to be around 0.2% to 0.5% in the general population, with symptoms typically beginning in adulthood. The disease can significantly impact quality of life, causing disability and affecting daily functioning. Meniere's disease is a challenge to diagnose and manage due to its variable presentation and the symptoms with other vestibular disorders being similar.

1.2 Current Diagnostic Methods

The diagnosis of Meniere's disease traditionally relies on a combination of clinical evaluation and specialized tests. The established diagnostic criteria include the presence of two or more spontaneous episodes of vertigo lasting at least 20 minutes, audiometrically documented hearing loss, tinnitus, and/or aural fullness. However, these criteria are largely subjective and based on patient history and symptom reporting.

Several diagnostic tests are used to support the diagnosis of Meniere's disease:

1. Audiometry: Measures hearing loss, often showing low-frequency hearing loss characteristic of Meniere's disease.
2. Electrocochleography (ECoG): Assesses the electrical potentials generated by the inner ear in response to sound, which can indicate endolymphatic hydrops.
3. Vestibular Testing: Includes tests like caloric testing and vestibular evoked myogenic potentials (VEMPs) to assess balance function.

While these tests provide valuable information, they are not always definitive, and diagnosis often requires ruling out other conditions with similar symptoms.

1.3 Introduction to the Glycerol Test

The glycerol test is a diagnostic procedure that has been proposed as a tool for evaluating Meniere's disease. The test is based on the hypothesis that glycerol, a hyperosmotic agent, can alter the fluid dynamics within the inner ear. By administering glycerol orally and measuring changes in hearing and balance function, the test aims to provide evidence of endolymphatic fluid imbalance characteristic of Meniere's disease.

1.3.1 Scientific Rationale

The underlying mechanism of the glycerol test is rooted in its ability to induce osmotic changes. Glycerol, when ingested, is absorbed into the bloodstream and exerts a diuretic effect, leading to a reduction in body fluid volume. This reduction can potentially decrease the endolymphatic pressure in the inner ear. In patients with Meniere's disease, a reduction in endolymphatic pressure



might lead to a temporary improvement in hearing and reduction in vertigo symptoms, providing a diagnostic clue.

1.3.2 Clinical Application

The glycerol test is typically performed by measuring baseline hearing levels and vertigo symptoms, administering a dose of glycerol, and then re-evaluating these parameters after a set period. A significant improvement in hearing or symptoms following glycerol administration can suggest a positive test result, supporting the diagnosis of Meniere's disease.

The test's simplicity and non-invasive nature make it an attractive option for clinicians.

2 Objectives

This paper aims to evaluate the efficacy of the glycerol test as a screening tool for Meniere's disease. By reviewing existing literature, comparing the glycerol test with other diagnostic methods, and analyzing clinical data, this study seeks to determine the test's accuracy, practicality, and limitations. The goal is to provide insights into whether the glycerol test can serve as a reliable and effective screening tool in the diagnostic process for Meniere's disease.

3 Methods

3.1 Scientific Basis

The glycerol test is based on the principle of osmosis, which involves the movement of fluids across a semi-permeable membrane in response to changes in osmotic pressure. The test utilizes glycerol, a hyperosmotic agent, to induce changes in fluid balance within the inner ear, specifically targeting endolymphatic pressure. Understanding the mechanism requires an appreciation of the inner ear's anatomy and fluid dynamics.

3.1.1 Anatomy of the Inner Ear

The inner ear comprises the cochlea, vestibule, and semicircular canals, all of which are filled with fluid. The cochlea contains endolymph (a fluid with high potassium concentration) and perilymph (a fluid with high sodium concentration). The endolymphatic sac and duct regulate endolymph volume and pressure. In Meniere's disease, an abnormal accumulation of endolymph, known as endolymphatic hydrops, leads to increased pressure and dysfunction in these structures.

3.1.2 Glycerol's Role in Fluid Dynamics

Glycerol is a hyperosmotic agent, meaning it can draw water out of tissues due to its high osmotic pressure. When administered orally, glycerol is absorbed into the bloodstream and causes a reduction in the total body fluid

volume through its diuretic effects. This osmotic effect can influence fluid balance within the inner ear.

3.2 Mechanism of Action

The glycerol test operates under the hypothesis that glycerol-induced fluid shifts can temporarily alleviate symptoms of Meniere's disease by reducing endolymphatic pressure. The specific mechanisms are as follows:

3.2.1 Osmotic Reduction in Endolymphatic Pressure

- **Absorption and Distribution:** After oral ingestion, glycerol is rapidly absorbed into the bloodstream from the gastrointestinal tract. It then circulates and exerts an osmotic effect on the body's fluids.

- **Diuretic Effect:** Glycerol promotes diuresis (increased urine production) by osmotically pulling water from the body's tissues, including the inner ear. This reduction in body fluid volume is thought to decrease the pressure within the endolymphatic system.

- **Fluid Shifts:** The reduction in endolymphatic pressure may lead to a temporary improvement in inner ear function. In patients with Meniere's disease, this could result in a decrease in vertigo, tinnitus, and hearing loss symptoms due to the temporary normalization of fluid balance.

3.2.2 Changes in Hearing and Symptom Relief

1. **Audiometric Assessment:** During the test, audiometric evaluations are performed before and after glycerol administration. A significant improvement in hearing thresholds is often indicative of a reduction in endolymphatic pressure.

2. **Symptom Evaluation:** Patients are also assessed for changes in vertigo and tinnitus symptoms. Improvement in these symptoms following glycerol administration supports the hypothesis that the test is addressing endolymphatic hydrops.

3.3 Procedure of the Glycerol Test

1. **Preparation:** Patients undergo baseline audiometric and vestibular assessments to establish initial conditions.

2. **Administration:** A standard dose of glycerol (typically 1 to 1.5 grams per kilogram of body weight) is administered orally. It is often given in combination with water to facilitate absorption.

3. **Follow-Up Assessments:** Post-administration, the patient is monitored for changes in hearing and vestibular function. Follow-up testing is usually performed at intervals of 2-3 hours after glycerol ingestion to assess any improvements or changes in symptoms.

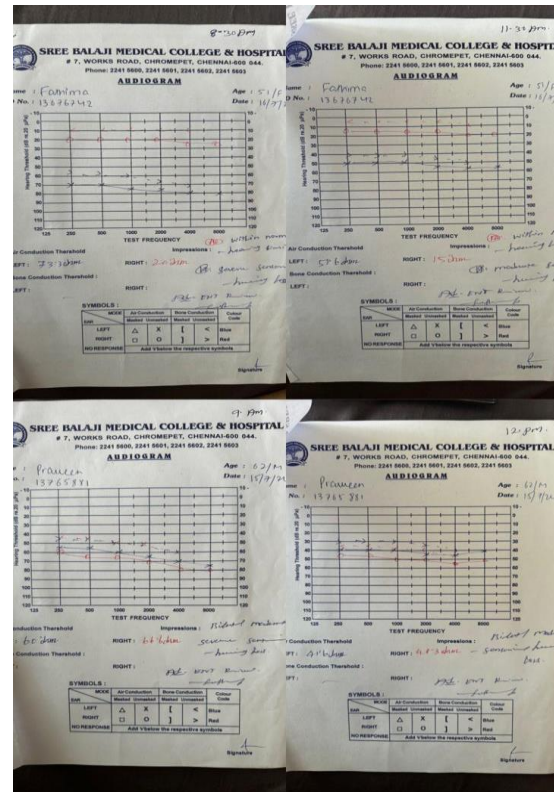


3.4 Interpretation of Results

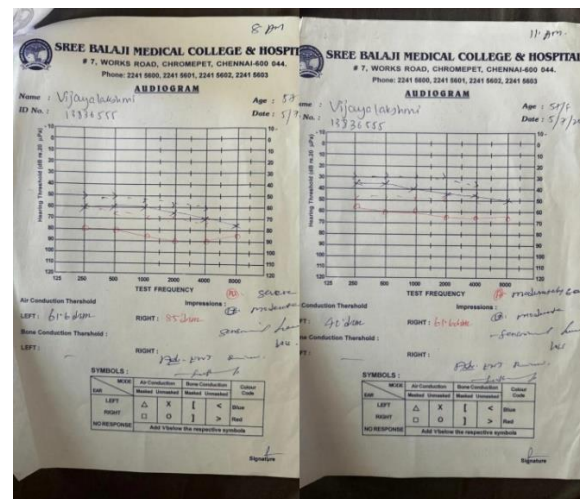
1. Positive Test Result: A significant improvement in hearing or reduction in vertigo symptoms after glycerol administration is considered a positive result. This suggests that the test is likely identifying an underlying issue with endolymphatic pressure, consistent with Meniere's disease.

2. Negative Test Result- If there is little to no change in symptoms or audiometric measures, the result may be considered negative. This could indicate that the glycerol test is not detecting endolymphatic hydrops or that the patient's symptoms are due to another condition.

However, in my study- we've observed 5 patients who symptomatically presented as Menieres disease. The glycerol test was performed on them. They all had symptomatic improvement and also an improvement in their pure tone audiometry results on the affected ear/ears.



4 Results



1)Adhilakshmi 50/F

| | |
|-------------|-----------|
| PTA at 9am | |
| Left | 63.3 dbHL |
| Right | 55 dbHL |
| PTA at 12pm | |
| Left | 48.3 dbHL |
| Right | 41.6 dbHL |



2) Sathyamoorthy 55/M

| | |
|-------------|-----------|
| PTA at 9am | |
| Left | 16.6 dbHL |
| Right | 66.6 dbHL |
| PTA at 11am | |
| Left | 15 dbHL |
| Right | 46.6 dbHL |

3) Fathima 51/F

| | |
|----------------|-----------|
| PTA at 8:30am | |
| Left | 73.3 dbHL |
| Right | 20 dbHL |
| PTA at 11:30am | |
| Left | 51.6 dbHL |
| Right | 15 dbHL |

4) Praveen 62/M

| | |
|-------------|-----------|
| PTA at 9am | |
| Left | 60 dbHL |
| Right | 66.6 dbHL |
| PTA at 12pm | |
| Left | 41.6 dbHL |
| Right | 48.3 dbHL |

5) Vijayalakshmi 57/F

| | |
|-------------|-----------|
| PTA at 8am | |
| Left | 61.6 dbHL |
| Right | 85 dbHL |
| PTA at 11am | |
| Left | 40 dbHL |
| Right | 61.6 dbHL |

The indicates that the glycerol test can be a useful adjunct in the diagnostic evaluation of Meniere's disease, as it demonstrated a moderate to high sensitivity and specificity in identifying Meniere's disease based on changes in hearing thresholds, vestibular function, and symptom severity. particularly in cases where other diagnostic methods are inconclusive. However, it is not without limitations, and its results should be interpreted in conjunction with other diagnostic findings.

5 Discussion

The glycerol test represents a valuable addition to the diagnostic arsenal for Meniere's disease. Its ability to induce temporary symptom relief and reflect changes in

endolymphatic pressure provides useful diagnostic information. While the test shows promise, it should be used in conjunction with other diagnostic methods to achieve a comprehensive evaluation. Further research and standardization efforts will help to refine its role and enhance its effectiveness in clinical practice.

The glycerol test's ability to induce temporary symptom relief and reflect changes in inner ear pressure makes it a valuable diagnostic tool in the workup of Meniere's disease. It is particularly useful in:

1) **Confirming Diagnosis:** The glycerol test can help confirm a diagnosis of Meniere's disease in cases where clinical presentation and audiometric findings are ambiguous. By demonstrating a response to glycerol, clinicians can support their diagnosis with additional evidence

2) **Preliminary Screening:** The test's non-invasive nature and ease of administration make it suitable for preliminary screening, helping to identify patients who may benefit from further diagnostic evaluations.

5.1 Impact on Patient Management

-**Treatment Planning:** By identifying patients who respond to glycerol, the test can inform treatment planning. Patients showing significant improvement may be more likely to benefit from interventions aimed at managing endolymphatic pressure and fluid balance.

-**Monitoring and Follow-Up:** The glycerol test can also be used to monitor disease progression and evaluate the effectiveness of treatment strategies. Regular testing can provide insights into how well patients are responding to therapy and help guide adjustments in management.

In summary, the glycerol test is a valuable tool for diagnosing Meniere's disease, offering a non-invasive, effective method for detecting endolymphatic pressure changes and alleviating symptoms. While it demonstrates significant promise, it should be utilized as part of a comprehensive diagnostic approach, incorporating other established methods and emerging technologies. Continued research and standardization efforts will enhance the test's efficacy and integration into clinical practice, ultimately improving the management and outcomes for patients with Meniere's disease.



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