

## **Does the Result of the Caloric Test Change Patient Management?**

Noor Yousif Abdulkarim, MD, MSc (UCL)\*

**Background:** The caloric test has been regarded as the gold standard for vestibular function testing for over 40 years. The value of its role in the overall management of dizzy patient is variable and appears to be dependent on the clinician's expertise and training background. Many studies have reviewed this subject, but there are still no clear or consistent guidelines.

**Objective:** To review different professionals' experience with the caloric test and to have an insight on their opinion about its role and value in the overall management of dizzy patients.

**Setting:** University College of London (UCL). Ear Institute and the Royal National Throat, Nose, and Ear hospital, London - UK.

**Design:** Retrospective review and questionnaire.

**Method:** Retrospective review of the records of patients attending the neurotology clinic and questionnaire distributed to audiology professionals of different designations to review their opinion about the validity of the caloric test. The study was performed between May to October 2010.

**Result:** The caloric test was requested for all dizzy patients attending the neurotology clinic. There were no clear or consistent reasons for requesting the caloric test among different professionals. The management plan was often established prior to the test, and almost always remained unchanged post testing.

**Conclusion:** Fifty percent of the professionals enrolled in the study reported that the results of the caloric testing did not influence their line of management. Studies at wider scale would be advisable to allow a solid conclusion and to verify the real value of this gold standard tool.

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Caloric test assesses the function of the Vestibulo-Ocular Reflex (VOR) by physiological stimulation and the quantitative measurement of the eye movement. It also allows the assessment and recording of each labyrinth function separately, but it does not test the other component of the vestibular apparatus<sup>1,2</sup>.

The caloric response is linked to the central nervous system; therefore, it is an important

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\* MSc Student

University College of London ó Ear Institute  
The Royal National Throat, Nose, and Ear Hospital and UCL Ear Institute  
United Kingdom  
Email: noor\_bdf@hotmail.com

tool to differentiate between central and peripheral vestibular diseases.

Normal caloric test result does not exclude pathology of the VOR pathway because caloric test is a test of the lateral semicircular canals but not the other structures within the vestibular system.

Ahmed et al in a retrospective review of 200 dizzy patients have estimated the predictive value of caloric and rotational testing in distinguishing peripheral from non-peripheral vestibular causes in vertigo patients<sup>3</sup>. It is important to evaluate both tests and study the differences existing between them in order to understand their diagnostic yield<sup>4</sup>. This could help the clinician about the appropriate test for different patients<sup>5</sup>. However, these tests can provide conflicting results regarding the nature of the vestibular insult<sup>6</sup>.

The study demonstrated that caloric testing has the most promising marker (caloric weakness) for identifying a peripheral from non-peripheral vestibulopathic patients. The caloric test specificity was 84% and sensitivity was 55%. The moderate sensitivity of the caloric test is due to the fact that it only evaluates the lateral semicircular canals; hence, lesions of the vertical canals and the otolith organs may not be detected. Caloric test might not detect early and low level of dysfunction and it is highly dependent on different stages of the disease, which might reveal normal findings.

As the most sensitive test for detecting vestibular abnormality, its role in the overall management of the dizzy patient is still controversial.

The aim of this study is to gain an insight from different professionals' experience on the proper application and usefulness of the caloric test for different patients and its impact on the management plan.

## **METHOD**

The first part of the study was a retrospective review of dizzy patients. A simple questionnaire was distributed among the Neurotology clinic physicians of different designations. They are simply asked to review the records of any new or follow-up patients with balance problems and fill out the questionnaire. Any patient attending the clinic during the time of the study was to be included.

The second part of the study was distributing a carefully worded questionnaire to all professionals involved in the overall process of assessing, and managing patients with balance problems.

## **RESULT**

Sixteen patients attending a neurotology clinic were reviewed, 6 (37.5%) males and 10 (62.5%) females, the mean age was 51.4 years (range 28-79 years), see table 1.

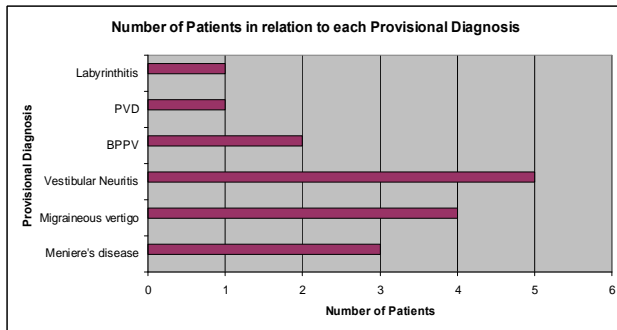
**Table 1: Summarizing the Retrospective Records Review**

Diagnosis	Age	Gender	Type of Visit	Line of Management	Caloric Test Req*	Reasons to CT**	Other Test	Caloric Test Result	Post Caloric Diagnosis	Management Post-caloric Test Result
Meniere's Disease	31	Male	Follow-up	Estd***	Yes	Establish diagnosis	No	Not confirm or refute the diagnosis	Meniere's disease	Same
Migrainous Vertigo	52	Female	Follow-up	Estd***	No	Establish diagnosis	Yes	Contradict the provisional diagnosis	Migrainous vertigo with Meniere's overlap	Completely changed
BPPV	63	Female	Follow-up	Estd***	Yes	Establish diagnosis	Yes	Confirm the diagnosis	BPPV and Migrainous vertigo	Same
Migrainous Vertigo	46	Female	Follow-up	Estd***	Yes	Confirm diagnosis	Yes	Confirm the diagnosis	Migrainous Vertigo	Same
Labyrinthitis	54	Male	First	Estd***	Yes	Confirm diagnosis	Yes	Awaiting results	Labyrinthitis	Same
Meniere's Disease	75	Female	Follow-up	Estd***	Yes	Confirm diagnosis	Yes	Confirm the diagnosis	Meniere's disease	Same
Vestibular Neuritis	61	Male	Follow-up	Estd***	No	NA	Yes	NA	NA	NA
Vestibular Neuritis	45	Female	Follow-up	Estd***	No	NA	Yes	NA	NA	NA
PVD	56	Male	Follow-up	Estd***	No (Mastoid cavity)	NA	Yes	NA	NA	NA
Meniere's Disease	55	Female	Follow-up	Estd***	Yes but patient refused	Establish diagnosis	Yes	NA	NA	NA
Migrainous Vertigo	31	Male	Follow-up	Estd***	Yes	Establish diagnosis	Yes	Confirm the diagnosis	Migrainous Vertigo	Same
Migrainous Vertigo	57	Female	Follow-up	Estd***	Yes but patient refused	Establish diagnosis	Yes	NA	NA	NA
Vestibular Neuritis	28	Female	First	Estd***	Yes	Establish diagnosis	Yes	Neither	Vestibular Neuritis	Same
Vestibular Neuritis	46	Male	Follow-up	Estd***	Yes	Establish diagnosis	Yes	Normal findings	Vestibular Neuritis	Same
Vestibular Neuritis and BPPV	44	Female	First	Estd***	Yes	Establish diagnosis	Yes	Awaiting results	NA	NA
BPPV	79	Female	First	Estd***	No	NA	Yes	NA	NA	NA

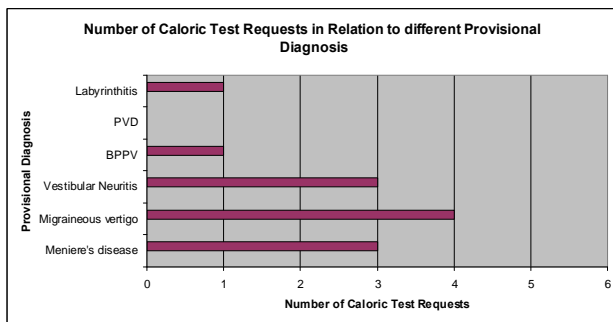
\*Request \*\*Caloric Test \*\*\*Established

Twelve (75%) patients attended the clinic for their follow-up visits and four (25%) for the first time; caloric test was requested for 12 patients.

Three patients were provisionally diagnosed with Meniere's disease, four with migrainous vertigo, five with vestibular neuritis, two patients with BPPV, one patient with labyrinthitis and one with PVD secondary to chronic middle ear disease and mastoidectomy, see figure 1. The line of management of these patients was established before requesting any vestibular function tests (VFT) including the caloric. The caloric test was requested in 12 of 16 patients. It was requested to establish a diagnosis in 9 (75%) and to confirm the diagnosis in 3 (25%). The frequency of requesting caloric test for different neurotology conditions is demonstrated in figure 2.



**Figure 1: Provisional Diagnosis of Patients**



**Figure 2: Caloric Test and Provisional Diagnosis**

The management plan post caloric test was changed in one (6.3%) patient, and was the same for eight (50%) patients. The remaining 44% physicians gave no clear answer.

The patients were seen by three audio vestibular physicians of different grades (Consultant, Registrar and SHO).

### Questionnaire Result

Seventeen responses were received via e-mail, 4 of which were from professionals dealing with pediatric population and the caloric test was not usually performed in their units.

Thirteen different professionals have completed the questionnaire. It was easier to categorize them according to profession and compare the responses within each group and in different groups.

The respondents were classified into ENT surgeons, audio vestibular physicians and audiological scientists; the third group included chief audiologists and vestibular scientists.

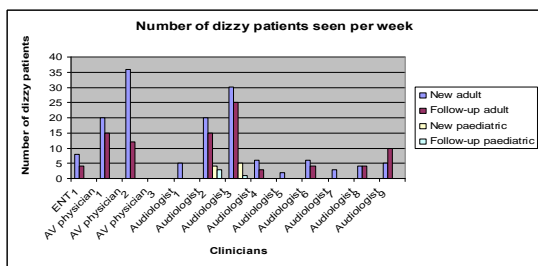
In the ENT group, the test was requested to check for a response before repeating Gentamicin injection and for very atypical patients with unclear diagnosis.

Three audio vestibular physicians participated in the study; the reasons for requesting the caloric test were to establish significance of borderline signs, confirm the diagnosis,

establish the severity of the vestibular impairment, distinguish Meniere’s from migraine and guide surgical decision in Meniere’s disease, superior semicircular canal dehiscence or vestibular Schwannoma.

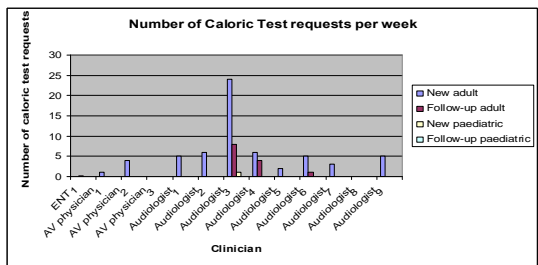
The main reasons to perform the caloric test in the audiological scientist group were suspicion of Meniere’s disease, ototoxic drugs, before vestibular surgery, to determine vestibular hypofunction, pre and post-intratympanic Gentamicin treatment, monitor changes in function, pre cochlear implantation, repeatable positive head thrust test, repeatable positive unterberger test, suspected labyrinthitis and part of routine diagnostic work-up in neurotology unit.

Overall, the number of dizzy patients seen per week varied between different clinicians, with more patients in the audio vestibular physicians group as compared with the others, see figure 3.



**Figure 3: The Total Number of Dizzy Patients Seen per Week among Different Clinicians**

The total number of caloric test requests per week also varied among different groups. Clinicians, who are seeing more patients per week are those with lower number of caloric test requests in relation to the total number of patients, see figures 3 and 4.



**Figure 4: Caloric Test Requests per Week among Different Clinicians**

Four (30.8%) clinicians often request the caloric test to confirm a clinical diagnosis, 3 (23%) sometimes, one (7.7%) rarely, 3 (23%) almost always, one (7.7%) always and one (7.7%) never request the test.

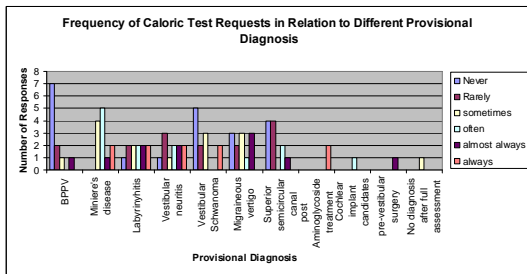
Seven (53.8%) clinicians believed that the history and clinical tests often predict the loss of vestibular function, 4 (30.8%) almost always, and 2 (15.4%) sometimes predict the loss.

Six (46.2%) clinicians think that the history and clinical tests rarely contradict the expected loss of function as measured by the caloric test, 5 (38.5%) sometimes, and one (7.7%) never.

Seven (53.9%) clinicians believed that the history and clinical tests correctly predict the normal vestibular function, 3 (23%) almost always, 2 (15.4%) sometimes, and one (7.7%) always correctly predict the normal function.

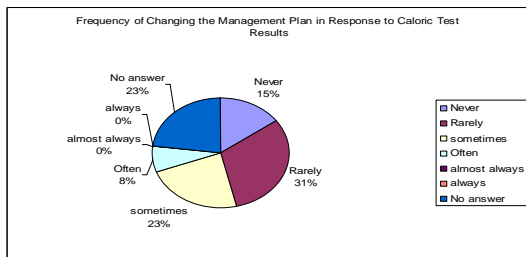
Six (46.2%) clinicians believed that the history and caloric tests rarely contradict the expected normal vestibular function, 5 (38.5%) sometimes, one (7.7%) often, and one (7.7%) never contradict.

The frequency of requesting the caloric test for different vestibular disorders also varied among different clinicians with exception of BPPV where most clinicians said they would never perform the test on a suspected case of BPPV. Another exception was Meniere's disease where most clinicians will often perform the test for a suspected case of Meniere's disease, see figure 5.



**Figure 5: The Frequency of Caloric Test Requests for Different Provisional Diagnosis**

Four (30.8%) believed that caloric test rarely change the established line of management, 2 (15.4%) never, 3 (23%) sometimes, one (7.7%) often, and 3 (23%) gave no answer, see figure 6.



**Figure 6: Changing the Management Plan in Response to Caloric Test Results**

## DISCUSSION

There were no clear criteria to request caloric test, it was mainly dependent on clinicians' experience and judgment and this was different among clinicians of different grades and level of training. The reason to request the caloric test was to establish diagnosis in 75%

of cases, and to confirm the diagnosis in 25%. Unfortunately, there were no similar data in the published literature to compare these findings; there was no study found with similar objective and findings.

The post caloric diagnosis remained the same except for one case of migrainous vertigo where Meniere's overlap was added. Some variants of migraine could be indistinguishable from Meniere's disease. In a retrospective study by Ibekwe et al, 25 patients attending ENT clinic met the diagnostic criteria for Meniere's disease; eight of them (32%) met the International Headache Society criteria for migraine<sup>7</sup>. Caloric test could be of a significant value to identify a vestibular pathology in such cases.

Teggi et al, in a study of 30 patients with a clinical diagnosis of migrainous vertigo found that 3 subjects had significant CP, 2 had significant DP and one had both significant CP and DP<sup>8</sup>. In our study, caloric test was requested for all suspected migrainous vertigo.

There was no justification for high rate of caloric test requests in the neurotology unit if it has no impact on the management plan in more than 50% of cases. No similar data could be retrieved from published literature. One reason may be that the unit is providing a tertiary care and most patients have been seen by other professionals before being referred for a second opinion and the patient must be worked-up thoroughly before a final decision is made to whether discharge or follow-up.

In our study, BPPV is diagnosed clinically by the Dix-Hallpike maneuver and the test is seldom requested for cases of PVD overlap. Domínguez-Durán et al concluded that Video-nystagmography and caloric tests are not necessary in most patients with BPPV and they should be carried out only when the diagnosis is in doubt<sup>9</sup>.

For a suspected case of Meniere's disease, clinician needs a confirmation before proceeding to more invasive treatments (Intratympanic gentamicin injection). Palomer et al, in a prospective study, studied the caloric and rotational test in 100 patients who had unilateral Meniere's disease<sup>10</sup>. They reported that the caloric test was fairly specific for patients with unilateral peripheral vestibulopathy; on the other hand, the rotatory chair test was more sensitive. In our study, physicians requested the caloric test in all cases provisionally diagnosed with Meniere's disease.

Zapala et al, found that the caloric test yield a sensitivity of 82% and specificity of 84% in differentiating between normal and abnormal<sup>11</sup>. These findings are consistent with our finding in both the retrospective review and the questionnaire. In the retrospective review, the post caloric diagnosis remains unchanged in all cases except one. In the questionnaire, there was a general agreement among all responses that the clinical diagnosis was often consistent with the results of the caloric test.

Our findings are very limited due to the small number of participants in general and among audio vestibular physicians and ENT groups specifically.

Limitations for the retrospective review were the small number of records reviewed. Moreover, the records were obtained from one unit that is led by one consultant.

## CONCLUSION

**The study showed lack of guidelines for the use of caloric test. Training and educating all professionals in this field about the proper use of caloric test and other vestibular function tests warrant a serious consideration in order to deliver better health care service.**

**Conducting a prospective study of large number of patients with balance disorders or a survey involving all audiology professions will provide more insight about the current practice.**

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**Author contribution:** All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes

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