



SAPIENZA
UNIVERSITÀ DI ROMA



UMBERTO I
POLICLINICO DI ROMA

Master di II livello in Vestibologia Pratica
Direttore: Prof. Giovanni Ralli

Stimolazioni caloriche

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UOC di Otorinolaringoiatria
Fondazione IRCCS Policlinico San Matteo
Università di Pavia

Roma 13/07/18

Stimolazioni caloriche: storia



Robert Barany

Vienna 22 Aprile 1876

Uppsala 08 Aprile 1936

Stimolazioni caloriche

- ✧ Tecnica di Veits
- ✧ Tecnica di Mulch
- ✧ Prova termica calibrata secondo Freyss
- ✧ **Tecnica di Fitzgerald-Hallpike**

Fitzgerald G, Hallpike SC (1942) Studies in human vestibular function I: Observations on the directional preponderance of caloric nystagmus (nystagmus bereitschaft) resulting from cerebral lesions. Brain 65(2): 115-137.

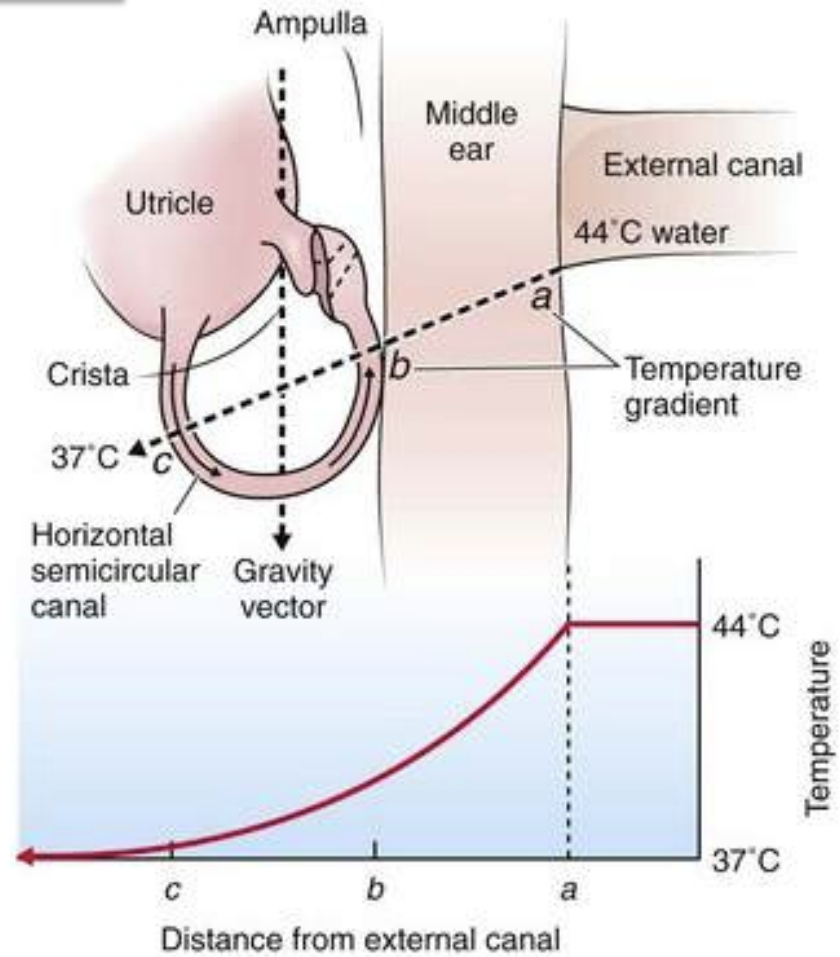
Stimolazioni caloriche: fisiopatologia

Stimolazione termica di Fitzgerald-Hallpike

Stimolazione termica calda 44 °

250 cc

40 secondi



Chapter 61

Special Neurologic Tests and Procedures

J. Stephen Hall

Published on 08/04/2015 by admin

Filed under Emergency Medicine

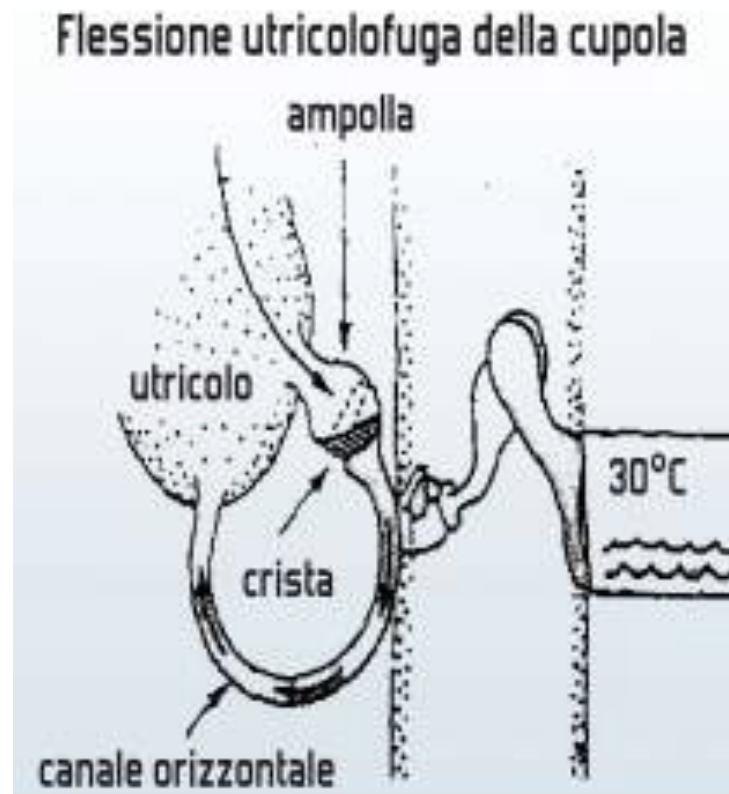
Last modified 08/04/2015

Stimolazioni caloriche: fisiopatologia

Stimolazione termica di Fitzgerald-Hallpike

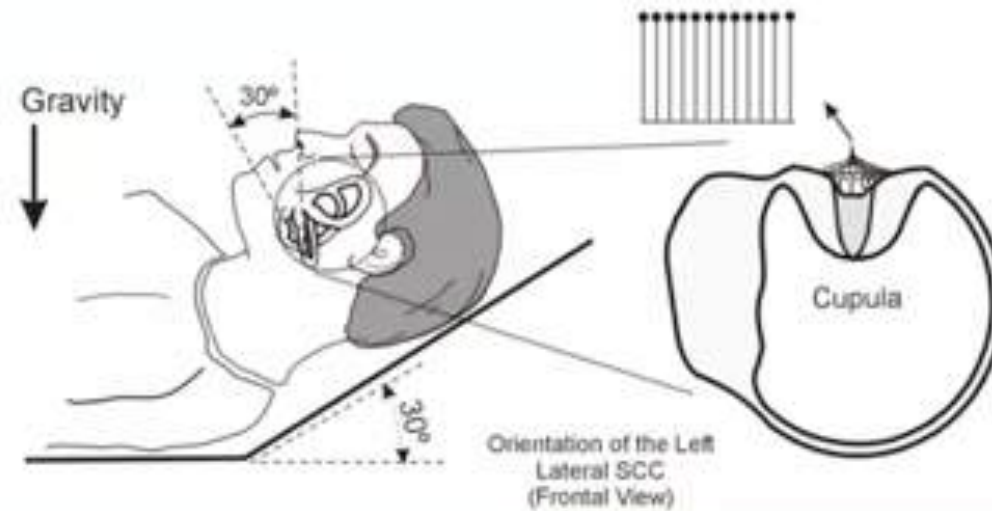
Stimolazione termica fredda 30 °

250 cc
40 sec



Stimolazioni caloriche

Posizione del paziente



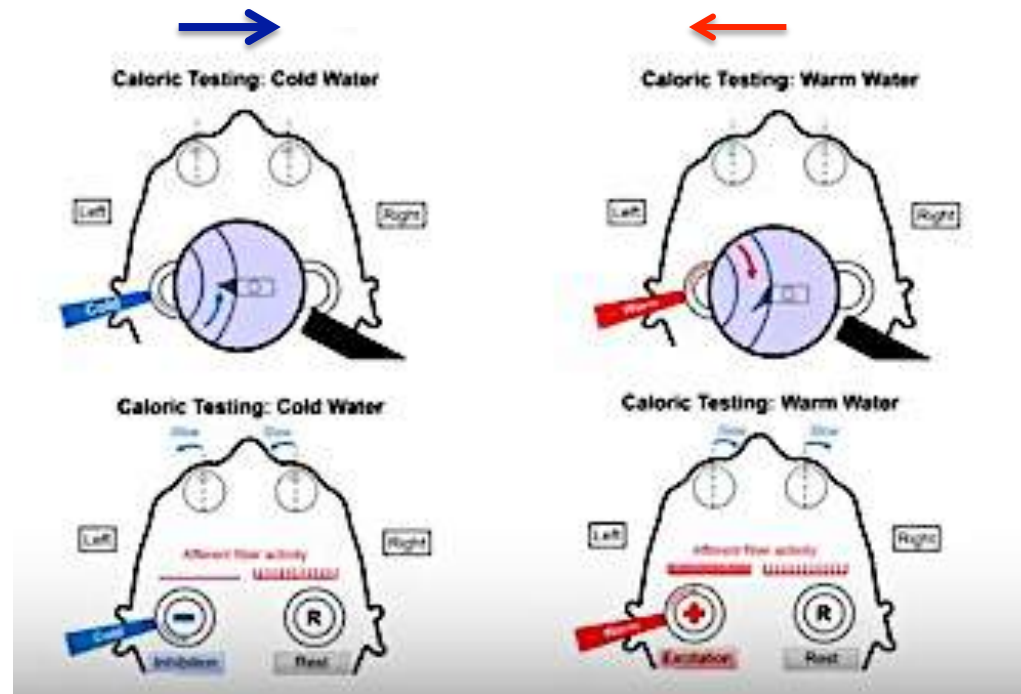
Stimolazioni caloriche: fisiopatologia

Stimolazione termica di Fitzgerald-Hallpike

“COWS”

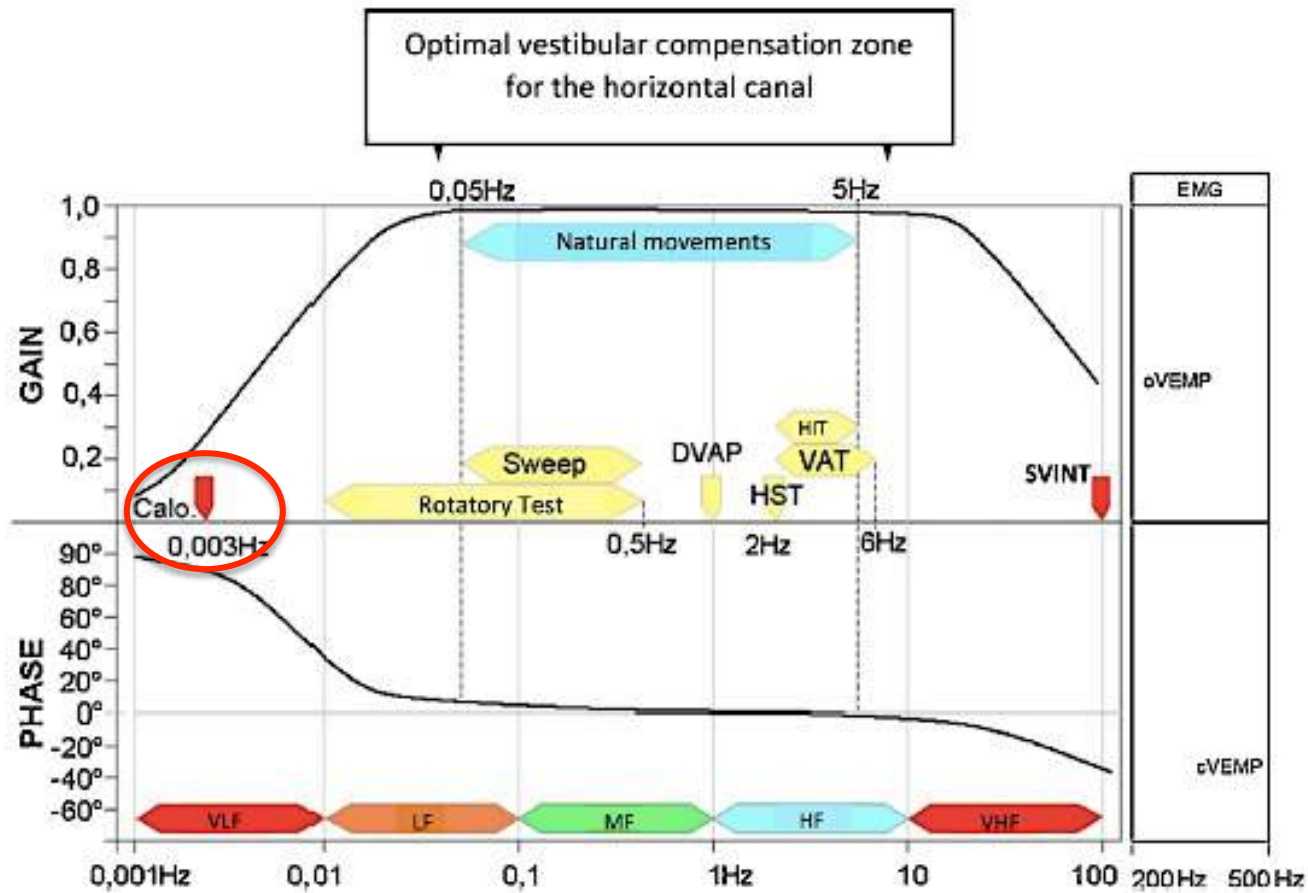
Stimolazione fredda → ny batte verso lato NON stimolato

Stimolazione calda → ny batte verso il lato stimolato



Da “Caloric Testing Explained” You Tube

Stimolazioni caloriche



Stimolazioni caloriche

Limiti

- . Stimolo non fisiologico
- . Stimolazione del canale orizzontale
- . Variabilità di risposta
- . Impossibile da eseguire in pazienti con patologie orecchio medio

Vantaggi

- . Facilità di esecuzione
- . ***Stimolazione separata dei due labirinti***

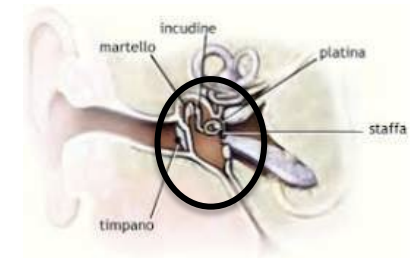
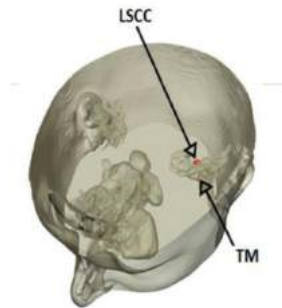
Stimolazioni caloriche



The Caloric Test:
Using the newest technology to better understand our oldest vestibular test

ERIN G. PIKER, AUD, PHD
RUTH SYMPOSIUM 2016

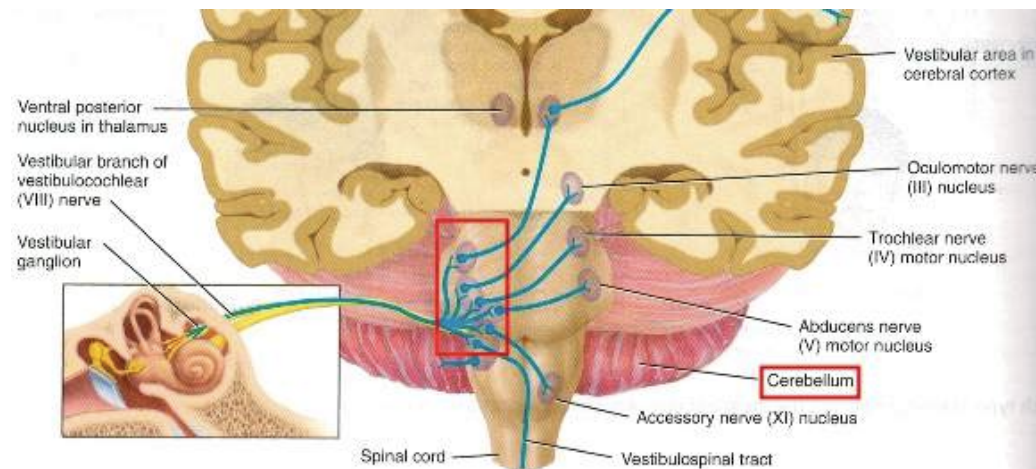
- . Conduttività dell'osso temporale
- . Pneumatizzazione della mastoide
- . Diametro e orientamento del CSO
- . Perforazioni timpaniche
- . Volume della cavità timpanica



Stimolazioni caloriche

Scopo

- . Valutare l'asimmetria del VOR generato dal canale semicircolare laterale
- . Valutare il controllo del VOR da parte delle strutture cerebellari (flocculo)



Stimolazioni caloriche

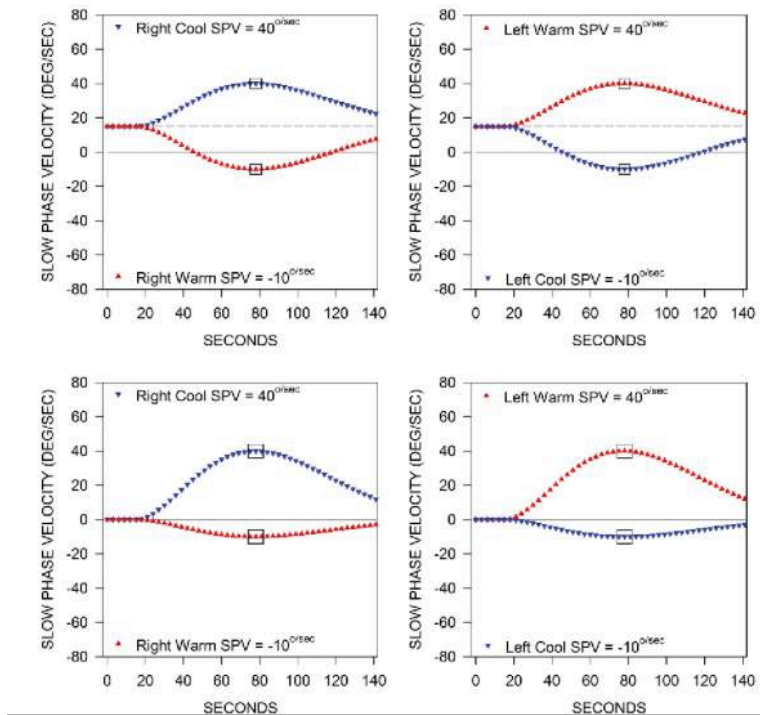
Parametri

. Velocità angolare della fase lenta (VAFL)

**Culmination
Stifness**

60 -90 sec dopo la stimolazione

. Frequenza del ny (numero di scosse)



Stimolazioni caloriche

Parametri

- ✧ **Latenza** : tempo che intercorre tra inizio della stimolazione e comparsa della risposta
- ✧ **Durata della risposta**: 100-160 sec
- ✧ **Direzione e piano del nistagmo**: orizzontale/rotatorio – “**perverted ny**”
- ✧ **Ritmo**: omogeneità di frequenza e ampiezza
 - .ny ritmico: scosse di stessa frequenza / ampiezza/ VAFL
 - .ny aritmico: i parametri della scossa variano
- ✧ **Indice di fissazione oculare (IFO)**: valuta integrità dell’arco retino-cerebello-vestibolo-oculomotore → inibizione del ny del 50 %

Stimolazioni caloriche

L'errore retinico che si verifica in presenza di un ny spontaneo attiva l'arco riflesso retino-cerebello-vestibolo-oculomotore (arco di ITO)

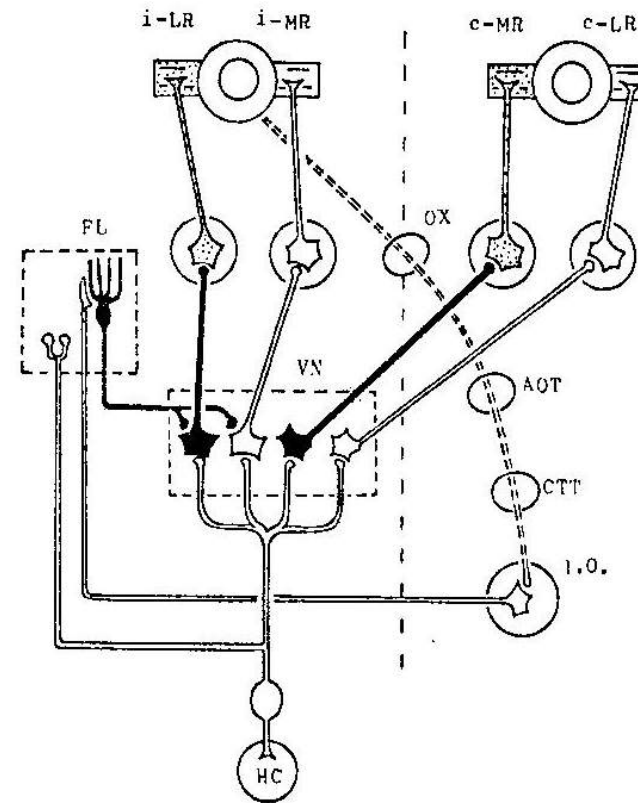
Integrità del RCVO



Inibizione o riduzione del ny sotto fissazione



Lesione periferica



Stimolazioni caloriche

Formule di Jongkees

. Preponderanza Labirintica > 25 % → *paresi canalare*

$$\frac{(\text{Right}44^{\circ}\text{C} + \text{Right}30^{\circ}\text{C}) - (\text{Left}44^{\circ}\text{C} + \text{Left}30^{\circ}\text{C})}{\text{Right}44^{\circ}\text{C} + \text{Right}30^{\circ}\text{C} + \text{Left}44^{\circ}\text{C} + \text{Left}30^{\circ}\text{C}} \times 100$$

. Preponderanza Direzionale > 30 % → *squilibrio tra i due emisistemi vestibolari*

$$\frac{(\text{Right}44^{\circ}\text{C} + \text{Left}30^{\circ}\text{C}) - (\text{Left}44^{\circ}\text{C} + \text{Right}30^{\circ}\text{C})}{\text{Right}44^{\circ}\text{C} + \text{Right}30^{\circ}\text{C} + \text{Left}44^{\circ}\text{C} + \text{Left}30^{\circ}\text{C}} \times 100$$

Stimolazioni caloriche

Vestibular Neuritis and Bilateral Vestibulopathy

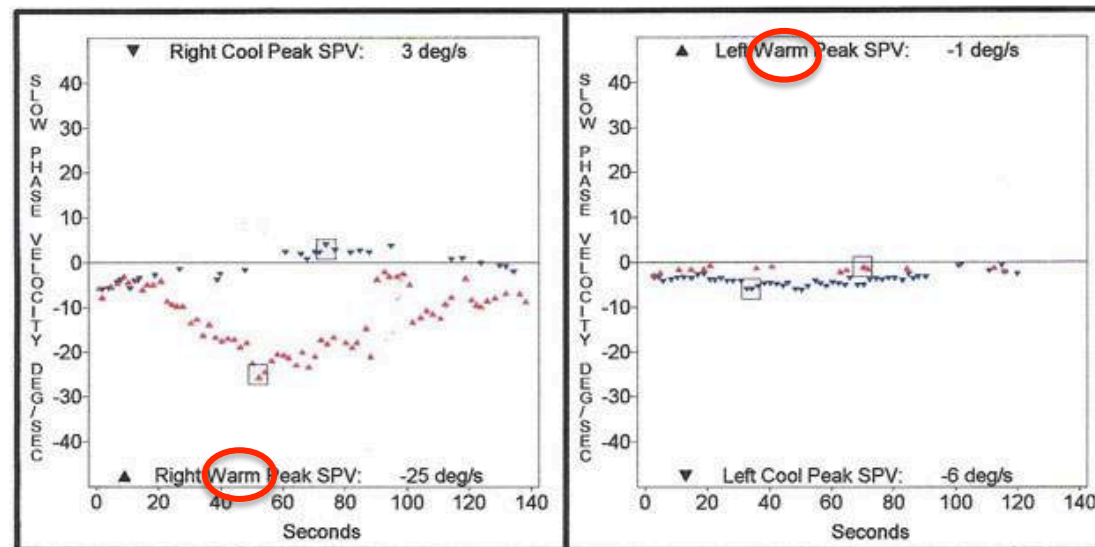
Risultati

Article in Journal of the Korean Medical Association · November 2008
DOI: 10.5124/jkma.2008.51.11.992

✧ Ipo/areflessia monolaterale

Espressione di una patologia vestibolare periferica monolaterale

Asimmetria significativa se la differenza tra i due labirinti > 30 % (stimolazioni calde)



Caloric Weakness: 70% in the left ear
Directional Preponderance: 88% to the right

Stimolazioni caloriche

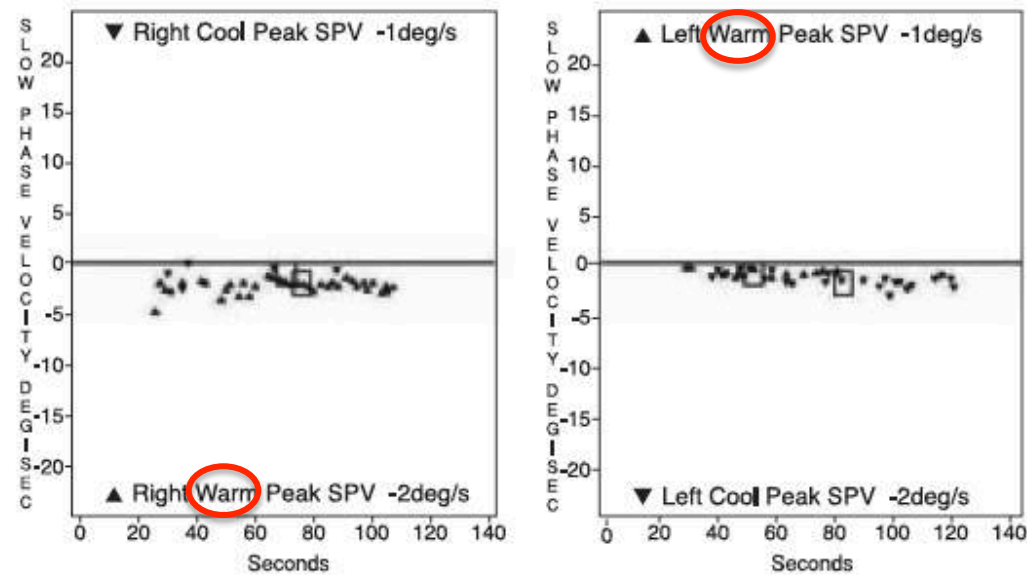
Vestibular Neuritis and Bilateral Vestibulopathy

Risultati

Article in Journal of the Korean Medical Association · November 2008
DOI: 10.5124/jkma.2008.51.11.992

✧ Ipo/areflessia bilaterale

- . farmaci ototossici
- . idrope endolinfatica bilaterale
- . meningite



Caloric Weakness: None
Directional Preponderance: 200% to the right

Case Report

Iranian Journal of Otorhinolaryngology, Vol. 27(1), Serial No.78, Jan 2015

Risultati

Subjective Visual Vertical and Horizontal Abnormalities in a Patient with Lateral Medullary Syndrome-A Case Report

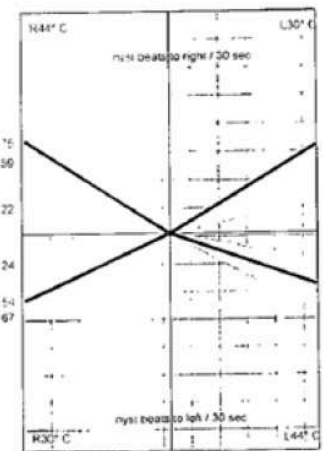
Amit Kumar Tyagi¹, Gaurav Ashish¹, Anjali Lepcha¹, Achamma Balraj¹

✧ *Iperreflessia bilaterale*

. Frequenza > 85 scosse ny in 30 secondi

. VAFL > 50 – 80 ° /sec

- Lesioni cerebellari con perdita della attività inibitoria sui nuclei vestibolari
- Emicrania



| Stim | Freq [n/30s] | Cut [s] | SPV Mean [deg/s] |
|--------|--------------|---------|------------------|
| R44° C | 75 ↑ | 4 - 34 | 12.08 |
| R30° C | 54 • | 1 - 31 | 11.63 |
| L44° C | 42 • | 6 - 36 | 8.886 |
| L30° C | 70 ↑ | 6 - 36 | 13.28 |

CP = 3.37 % (NORMAL)

DP = 10.56 % (NORMAL)

This report is not to be used for Medical-Legal purposes. The contents of this report require clinical correlation before all

Stimolazioni caloriche

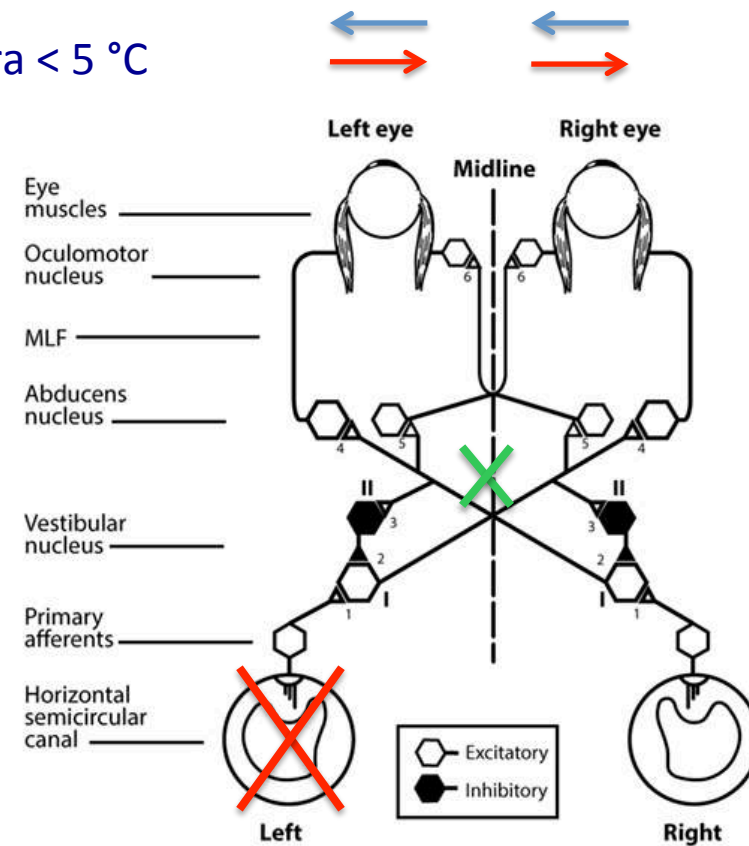
Ny spontaneo ??

Simultanea fredda (Ice Water Test)

Irrigazione del CUE con 10 cc acqua temperatura < 5 °C

In presenza di ny spontaneo:

- Inibizione/inversione del ny
- Non modificazioni del ny



H₂O ghiacciata



Sensitivity of caloric test and video head impulse as screening test for chronic vestibular complaints

Raquel Mezzalana,^{1,III,*} Roseli Saraiva Moreira Bittar,¹ Marcia Maria do Carmo Bilécki-Stipsky,^{1,II} Cibele Brugnera,¹ Signe Schuster Grasel¹

mal vHIT results, indicating 3 abnormal CT results for every abnormal vHIT result. Thus, the probability of diagnosing a vestibular dysfunction via CT was 72%, whereas that via vHIT was 26%. In our sample, the CT was ultimately more sensitive for diagnosing vestibular diseases.

(17), these alterations suggest that this structure is involved. The vHIT findings did not indicate the presence of rhythm abnormalities ($p=0.1458$). This result was not surprising



✧ “..the caloric stimulus is a perfect example of storage velocity ..”

Table 1 - CT and vHIT test results.

| | Normal CT results | Abnormal CT results | |
|---------------|-------------------|---------------------|-----|
| Normal vHIT | 39 | 77 | 116 |
| Abnormal vHIT | 5 | 36 | 41 |
| | 44 | 113 | |

Stimolazioni caloriche

Applicazioni cliniche

HNO. 2013 Sep;61(9):781-5.

[Video head impulse test or caloric irrigation?. Contemporary diagnostic tests for vestibular schwannoma].

[Article in German]

Blödow A¹, Helbig R, Wichmann N, Wenzel A, Walther LE, Bloching MB.

The video head impulse test (vHIT) is a new method for investigating vestibular function that is currently poorly studied in terms of its value for clinical diagnosis in otolaryngology. Both the caloric irrigation and vHIT serve to evaluate the horizontal vestibulo-ocular reflex. In the present study, caloric irrigation and vHIT were compared in 46 patients with vestibular schwannoma. Caloric irrigation exhibits a higher sensitivity than vHIT (72% versus 41%) and both tests show only a moderate correlation. Tumor size and hearing level was significantly correlated with caloric abnormalities but not with vHIT findings. Since caloric irrigation and vHIT measure the hVOR in low and high frequency ranges, respectively, these tests have to be considered complementary and are valuable in both diagnostics and therapeutic decisions.

Stimolazioni caloriche

Applicazioni cliniche

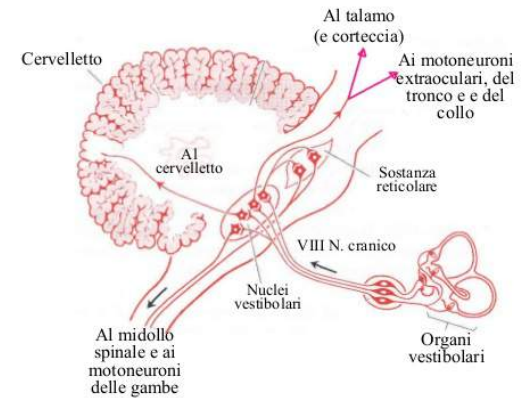
 **HHS Public Access**
Author manuscript
Psychiatry Res. Author manuscript; available in PMC 2018 May 01.

Published in final edited form as:
Psychiatry Res. 2017 May ; 251: 333–341. doi:10.1016/j.psychres.2017.02.020.

Vestibular stimulation improves insight into illness in schizophrenia spectrum disorders

Philip Gerretsen^{a,b,c,e,*}, David D Pothier^{g,h}, Carolyn Falls^h, Maxine Armstrong^h, Thushanthi Balakumar^a, Hiroyuki Uchida^{b,i}, David C Mamo^{a,c,f}, Bruce G Pollock^{a,b,c,d,e}, and Ariel Graff-Guerrero^{a,b,c,d,e}

1991; Cappa, 1987; Vallar, 1990). Functional imaging studies demonstrate that cold CVS of the left ear activates a number of areas in the right hemisphere, including the temporoparietal junction, posterior insula, putamen, anterior cingulate, and primary somatosensory cortex



Stimolazione dell'emisfero destro tramite proiezioni vestibolo-corticali dal talamo e dai nuclei vestibolari

Applicazioni cliniche



PERGAMON

Neuropsychologia 40 (2002) 1104–1106

NEUROPSYCHOLOGIA

www.elsevier.com/locate/neuropsychologia

Note

Bilateral vestibular stimulation does not improve visual hemineglect

G. Rode^{a,c,d,*}, C. Tilikete^{b,c,d}, J. Luaute^{a,c,d}, Y. Rossetti^{a,c,d}, A. Vighetto^{b,c,d}, D. Boisson^{a,c,d}

^a Service de Rééducation Neurologique, Hôpital Henry Gabrielle, Hospices Civils de Lyon, Route de Voirles, BP 57, F-69565 Saint-Genis Laval, France

^b Service de Neurologie, Hôpital Neurologique, Hospices Civils de Lyon, Lyon, France

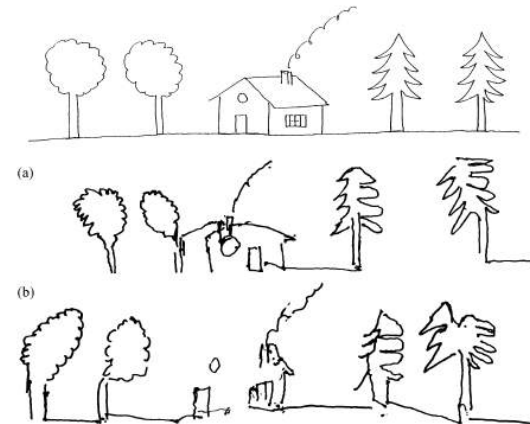
^c Inserm U534 Espace et Action, Bron, France

^d Institut Fédératif des Neurosciences de Lyon, Lyon, France

Received 16 March 2001; accepted 5 September 2001

of vestibular stimulation in hemineglect syndrome results from specific activation of subcortical and cortical structures integrating vestibular information. At subcortical level, the

Neglect was improved following left caloric vestibular stimulation, worsened following right vestibular stimulation.



Applicazioni cliniche



Caloric vestibular stimulation in aphasic syndrome

David Wilkinson^{1*}, Rachael Morris¹, William Milberg² and Mohamed Sake³

¹ School of Psychology, University of Kent, Canterbury, Kent, UK

² Department of Psychiatry, Harvard Medical School, Boston, MA, USA

³ East Kent Neuro-Rehabilitation Service, East Kent Hospitals University NHS Foundation Trust, Kent, UK

How might CVS have contributed to the observed recovery? As mentioned above, right-sided stimulation has been shown to increase metabolic activity in left hemisphere language networks (Baker et al., 2010; Hamilton et al., 2010; Fiori et al., 2011; Szaflarski et al., 2011) and also modulates the distal release of acetylcholine and monoamines relevant to language recovery (Horii et al., 1994; Nishiike et al., 2001; Klein and Albert,

Stimolazioni caloriche

Quando fare le stimolazioni caloriche ?

- . Follow-up del deficit vestibolare acuto
- . HST positivo
- . Anamnesi positiva per traumi cranici
- . Utilizzo di farmaci ototossici
- . Malattia di Meniere per bilancio funzionalità vestibolare
- . Malattia di Meniere dopo terapia IT

Ny spontaneo → simultanea fredda

L'acqua parla senza sosta ma non si ripete mai