Australian Dizziness Clinic

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CLINICIAN CHEAT SHEET: Vestibular Function Testing (vHIT, Calorics, Rotational Chair)

1. DEFINITIONS & KEY CONCEPTS

- Vestibulo-Ocular Reflex (VOR): Mechanism stabilizing gaze during head movement; gain = eye velocity/head velocity (Normal ≈ 1.0).
- Functional Triad:
  - vHIT: High-frequency, physiologic (>1 Hz), canal-specific.
  - Caloric: Ultra-low frequency (~0.003 Hz), lateral canal only, ear specific.
  - Rotational Chair: Mid-frequency (0.01–1 Hz), global bilateral function, physiologic.
- Nystagmus: Diagnostic eye movement; fast phase directs definition (e.g., "right-beating"); COWS (Cold Opposite, Warm Same) for calorics.
- Saccades (vHIT):
  - Overt: Visible to naked eye, occur *after* head stop.
  - Covert: Occur *during* head movement, require vHIT to detect.
- Canal Paresis/Unilateral Weakness (UW): Significant asymmetry (>20–25%) in caloric response.
- Directional Preponderance (DP): Nystagmus consistently stronger in one direction.

2. RISK FACTORS & CONTRAINDICATIONS (Procedural)

Anatomical & Surgical

- Cervical Pathology: Severe spondylosis, instability (e.g., RA, Down syndrome), or recent surgery contraindicates vHIT (rapid rotation risk). Use Rotational Chair instead.
- Ear Pathology: Perforated tympanic membrane, acute otitis, or mastoid cavities contraindicate Water Calorics (infection/pain risk). Use Air Calorics or vHIT.

Neurologic & Systemic

- Seizure/Syncope: Photosensitive epilepsy or profound vaso-vagal history requires caution in Rotational Chair.
- Severe Anxiety/Fragility: Calorics poorly tolerated (vertigo/nausea); consider vHIT (better tolerated).

Medication & Intake

- Vestibular Suppressants: Benzos, antihistamines, alcohol.
  - *Action:* Discontinue 24–48h prior to testing to avoid false bilateral weakness.

3. CLINICAL ASSESSMENT PROTOCOL

A. Objective Assessment (The "Triad")

- **vHIT (Video Head Impulse Test)**
  - Protocol: Rapid, passive head thrusts (10–20°) in plane of canals. Fixation on target.
  - Normal: Gain ~1.0; eyes equal/opposite to head.
  - Abnormal: Gain <0.8 (lat) or <0.7 (vert) + Catch-up Saccades (Overt/Covert).
  - Clinical Pearl: First-line for acute vertigo (HINTS+); normal vHIT in acute vertigo = Stroke risk (99% sensitivity).
- **Caloric Testing**
  - Protocol: Bithermal irrigation (Warm 44°C/Cool 30°C) or Air. Supine, head elevated 30°.
  - Metrics:
    - Unilateral Weakness (UW): >20–25% difference = Peripheral lesion.
    - Directional Preponderance (DP): >30% = Bias (central or uncompensated peripheral).
    - Fixation Suppression: Failure to suppress nystagmus by >50% with vision = Central/Cerebellar.
- **Rotational Chair**
  - Protocol: Sinusoidal oscillation (0.01–0.64 Hz) and Step Velocity tests in dark.
  - Metrics:
    - Gain: Global strength of VOR. Low gain across freqs = Bilateral Loss.
    - Time Constant (TC): Decay of nystagmus. <5–6 sec = Bilateral Loss.
    - Phase Lead: Increased in peripheral lesions.

B. Diagnostic Workup Utility

Indication	Preferred Test	Rationale
Acute Vertigo (Stroke vs Neuritis)	**vHIT**	Differentiates central (normal vHIT) vs peripheral (abnormal).
Suspected Menière's (Unilateral)	**Calorics**	Detects low-freq hydrops (vHIT often normal in early disease).
Bilateral Loss / Ototoxicity	**Rotational Chair**	Gold standard; quantifies residual function across frequencies.
Paediatric Vestibular	**Rotational Chair**	Better tolerated than calorics; bypasses ear canal issues.

4. DIFFERENTIAL DIAGNOSIS (Test Patterns)

Feature	Vestibular Neuritis (Acute Unilateral)	Menière's Disease (Early/Interictal)	Bilateral Vestibulopathy (Ototoxicity/Age)	Central/Cerebellar (Stroke/Degenerative)

vHIT	Abnormal (ipsilateral gain <0.8 + saccades)	Normal (spared high freq) or transiently abnormal	Abnormal Bilaterally (Low gain + saccades both sides)	Normal (usually) or Hyperactive (>1.0)
Calorics	Unilateral Weakness (>25% on lesion side)	Unilateral Weakness (Low freq sensitivity)	Bilateral Weakness (<20°/s total) or Areflexia	Normal or Failure of Fixation Suppression
Rotational	Asymmetry (Low freq) + Phase Lead	Dissociation (Low freq gain loss > High freq)	Low Gain (all freqs) + Short Time Constant (<5s)	No VOR Suppression (Visual-Vestibular mismatch)
Key Pearl	vHIT + Caloric both abnormal (concordant)	"Dissociation": Normal vHIT + Abnormal Caloric	Chair is gold standard for confirmation	Vertical nystagmus or Directional Preponderance w/o UW

5. MANAGEMENT IMPLICATIONS

Risk Stratification & Rehabilitation Algorithm

- **Acute Vestibular Syndrome (Continuous Vertigo):**
  - Test: HINTS+ (Head Impulse, Nystagmus, Test of Skew).
  - Result: Normal Head Impulse = High Risk (Stroke). Immediate MRI.
  - Result: Abnormal Head Impulse (Unilateral) = Peripheral (Neuritis). Vestibular Rehab.
- **Bilateral Vestibular Loss (Oscillopsia/Imbalance):**
  - Criteria: vHIT gain <0.5 bilaterally, Rotational TC <5s.
  - Management: Intensive safety counselling (falls risk, night driving), gaze stability exercises.
  - Refractory: Potential candidate for vestibular implants (experimental).
- **Chronic Unilateral (Compensation Monitoring):**
  - Assessment: Serial vHIT or Rotational Chair.
  - Compensation Signs: Disappearance of overt saccades (replaced by covert), normalization of symmetry.
  - Action: If overt saccades persist > months -> Aggressive Rehab.

Pharmacologic & Procedure Considerations

Category	Agent/Intervention	Clinical Note/Action
Vestibular Suppressants	Benzos, Antihistamines	Stop 48h pre-test. Can mask deficits (false negatives).
Ototoxins	Gentamicin, Chemotherapy	Monitor with Rotational Chair. Detects early gain drop before total loss.
Ablative Therapy	Gentamicin (Intratympanic)	Used for Menière's. Goal: Induce unilateral weakness (confirm w/ Caloric/vHIT) to stop attacks.
Alerting Tasks	Mental Arithmetic	Mandatory during Calorics/Rotation to prevent central suppression of nystagmus.

6. FOLLOW-UP & RED FLAGS

Follow-Up Criteria

- **Menière's Disease:** Monitor for progression to bilateral involvement or "burn out" (caloric weakness correlates with permanent loss).
- **Vestibular Neuritis:** Repeat vHIT/Caloric at 6–12 months.
  - Normalizing vHIT + Persistent Caloric Weakness = Good central compensation.
  - Persistent Overt Saccades = Poor compensation.

Red Flags

- Vertical Nystagmus: On vHIT or Caloric ("Perversion") -> Brainstem/Cerebellar Lesion.
- Normal vHIT + Acute Vertigo: Stroke until proven otherwise.
- Hyperactive Caloric/vHIT: Gain >1.0 or failure to suppress -> Central Pathology (Migraine/Cerebellum).
- Dissociated Eye Movements: Internuclear Ophthalmoplegia signs during nystagmus -> MS/Brainstem Stroke.