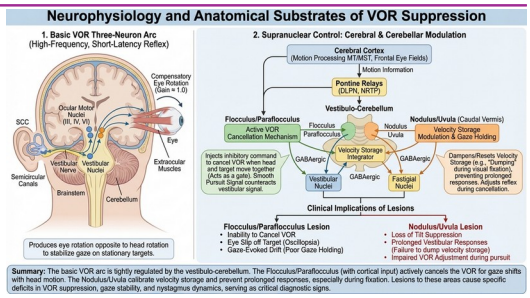
VOR Suppression — Clinical Cheat Sheet

OVERVIEW & CEREBELLAR CONTROL



Definition: VOR suppression (VORS) is the ability to cancel or reduce the vestibulo-ocular reflex during combined head-eye tracking of a moving target. This requires active cerebellar modulation of the VOR gain.

Purpose: Assess cerebellar flocculus and oculomotor cortex function. VORS testing is one of the most sensitive clinical tests for cerebellar dysfunction, often abnormal before pursuit deficits appear.

Clinical Value: Highly specific for cerebellar dysfunction. Even subtle floccular disease impairs VOR suppression. Normal pursuit with abnormal VORS = floccular-specific lesion.

Mechanism: During head rotation while tracking a head-fixed target, the VOR must be cancelled. The flocculus receives an error signal (retinal slip) and modulates Purkinje cell output to reduce VOR gain.

VOR SUPPRESSION NEURAL PATHWAY

Component	Structure	Function	Role in VORS
Vestibular Signal	Semicircular canals → CN VIII	Detect head rotation velocity	Provides VOR drive that must be cancelled
Fixation Input	FEF + oculomotor cortex	Generate visual tracking command	Decreases VOR velocity output signal
Floccular Modulation	Cerebellar flocculus Purkinje cells	Receive retinal slip error signal	Reduce VOR gain during active fixation
Learning Loop	Climbing fiber from inferior olive	Encode prediction error	Purkinje cells learn suppression pattern
Output Pathway	Flocculus → vestibular nucleus	Inhibit VOR relay neurons	Final common pathway for VOR cancellation

CLINICAL ASSESSMENT PROTOCOL

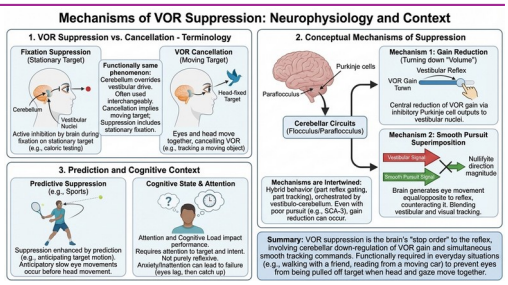
A. Baseline VOR: Patient rotates head ±20° at 0.5-1.0 Hz (60°/sec) WITHOUT fixation target (eyes open in darkness or Frenzel goggles). Record eye velocity as baseline VOR gain.

B. Suppression Task: Repeat same head rotation WITH patient fixating an earth-fixed target at 1 metre distance. Measure residual eye velocity during fixation.

C. Gain Calculation: VORS gain = (residual eye velocity with fixation) / (pure VOR eye velocity without fixation). Normal VORS gain <0.50. Lower = better suppression.

D. Frequency Testing: Test at multiple frequencies: 0.2 Hz, 0.5 Hz, 1.0 Hz. Cerebellar lesions typically impair high-frequency suppression first. 2.0 Hz is maximally challenging.

VOR SUPPRESSION INTERPRETATION GUIDE



VORS Gain	Classification	Suspected Pathology	Clinical Action
<0.30	Excellent suppression	Intact cerebellar-cortical integration	Normal — no further testing needed
0.30-0.50	Normal suppression	Intact or minimally impaired	Monitor if clinical suspicion exists
0.50-0.70	Mild impairment	Early cerebellar dysfunction or medication	Repeat off medications; cerebellar MRI
0.70-0.85	Moderate impairment	Significant cerebellar or cortical lesion	Neuroimaging; neurology referral
>0.85	Absent suppression	Advanced cerebellar disease, MSA	Urgent cerebellar assessment; genetic testing

DIFFERENTIAL DIAGNOSIS: VOR SUPPRESSION PATTERNS

Pattern	VORS Gain	Pursuit Gain	Localisation
Floccular cerebellar	Impaired (>0.70)	Normal or mild decrease	Cerebellar flocculus specific
Diffuse cerebellar	Impaired (>0.70)	Significantly reduced	Widespread cerebellar disease (SCA, MSA)
Cortical	Mildly impaired (0.50-0.70)	Reduced	Frontal eye fields or parietal cortex
Medication effect	Mildly impaired (0.50-0.70)	Mildly reduced	Reversible; dose-dependent
Peripheral vestibular	Normal (<0.50)	Normal	Peripheral lesion; central pathways intact

CEREBELLAR DISEASE STAGING & CLINICAL INTERPRETATION

Stage 1 (Subclinical): VORS mildly impaired (0.50-0.60) while pursuit remains normal. This is the earliest detectable sign of floccular disease. May precede ataxia by months to years.

Stage 2 (Early): VORS clearly abnormal (0.60-0.80), pursuit begins to decline, mild gaze-evoked nystagmus appears. Subtle limb ataxia may be present on finger-nose testing.

Stage 3 (Established): VORS absent (>0.85), pursuit gain <0.60, prominent GEN, rebound nystagmus. Clear clinical ataxia with dysarthria and dysmetria.

VORS vs Pursuit: VORS abnormalities appear before pursuit deficits in floccular disease. If pursuit is abnormal but VORS is normal, consider cortical rather than cerebellar pathology.

Medication Checklist: Phenytoin, carbamazepine, alcohol, and benzodiazepines impair VORS. Always test drug-free or document medication status. Repeat testing after washout if results are borderline.