

Background

- Acute vertigo or dizziness
 - 3.3 to 4.4% of all ED consultations \rightarrow ~4.3 million consultations per year in the US
 - Annual costs of about 4 billion USD
 - Broad differential diagnosis across many specialities. No single diagnosis makes up more than 5-10% of all cases.
 - Isolated vertigo/dizziness \rightarrow complicates DDx
 - Often imaging (CCT, CTA, MRI) with low diagnostic impact ordered.
 - → Systematic approach is essential!

Misdiagnosis of stroke on ED

- The ED is a high-risk site for preventable errors.¹
- Among adverse events in the ED deemed negligent, most are diagnostic failures.²
- Studies suggest that ED misdiagnoses may be unevenly distributed and disproportionate for neurologic conditions (deaths due to cerebrovascular events vs. myocardial infarction (45% vs. 1%, p<0.001).^{3,4}
- Among major diagnostic errors reported by physicians, stroke is the fourth most common.⁵

¹Vinen. Incident monitoring in emergency departments: an Australian model. Acad Emerg Med. 2000;7(11):1250-1297. Thomas et al. Incidence and types of adverse events and negligent care in Ubah and Colonado. Med Cure. 2000;38(3):261-271. Dubbian and Broch. Yeventable destricts: who fore dnn, and why? Am Intern Med. 3008;10(7):528-359. Tarnutzer et al. ED moldagenosis of cerebrovascular events in the era of modern neuroimaging. A males-analysis. Reurology. 2017;88(15):1468-1477 Solif et al. ED moldagenosis of cerebrovascular events in the era of modern neuroimaging. A males-analysis. Reurology. 2017;88(15):1468-1477 Solif et al. ED moldagenosis of cerebrovascular events in the era of modern neuroimaging. A males-analysis. Reurology. 2017;88(15):1468-1477



The dizzy patient – differential diagnosis on the ED

- Most frequent cases (based on several studies)
 - Neuro-otological diagnoses (peripheral and central)(13-34%)
 - Other neurological disorders (5-11%)
 - Cardiovascular disease including arrhythmia (4-21%)
 - Psychiatric disorders (2-14%)
 - Non-cardiovascular, internal-medicine related causes (8-28%)



Six categories of vestibular syndromes				
Timing	Obligate Triggers ^b Present	No Obligate Triggers ^b		
New, episodic	t-EVS (eg, BPPV)	s-EVS (eg, cardiac arrhythmia)		
New, continuous	t-AVS (eg, post gentamicin)	s-AVS (eg, posterior fossa stroke)		
Chronic, persistent	Context-specific chronic vestibular syndrome (eg, uncompensated unilateral vestibular loss, present only with head movement)	Spontaneous chronic vestibular syndrome (eg, chronic, persistent dizziness associated with cerebellar degeneration)		
Abbreviations: t-EVS, triggered episodic vestibular syndrome; s-EVS, spontaneous episodic vestib- ular syndrome; t-AVS, traumatic/toxic acute vestibular syndrome; s-AVS, spontaneous acute vestib- ular syndrome.				
	Newm	an-Toker and Edlow, Neurol Clin 33 (2015) 577–599		





Structured history taking

• Duration and frequency of the single attacks?

• Onset of the attacks (abrupt vs. slowly)?



hours

abbreviations: BPPV = benign paroxysmal positional vertigo; CPV = central positional vertigo; PFL = perilymph fistula; SSCDS = superior semicircular canal dehiscence syndrome; VP = vestibular paroxysmia.

day:

or longe

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minutes

Typical duration of a single episode

seconds

• Provocation factors?

Provocation factors

- Head inclination or reclination, turning over in bed, standing up / lying down
- → benign paroxysmal postional vertigo (BPPV)
 (fast) standing up
 - ightarrow orthostatic hypotension
- Valsalva maneuver, acoustic stimuli
- → superior canal dehiscence syndrome
 Busy places (shopping centers, railway stations...)
- → functional dizziness ("psychogenic dizziness")
 None

→ Menière's disease, cardiac arrhythmia, epileptogenic vertigo, (migraine)

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- head or neck trauma?

<u>Acute</u> and <u>persistent</u> vertigo or dizziness























Lacunar strokes – H.I.N.T.S. vs. MRI					
	Small strokes (≤10 mm), % (n of 15)	Large strokes (>10 mm), % (n of 90)	p Value		
False-negative initial MRI*	53.3 (8)	7.8 (7)	<0.001		
False-negative HINTS examination	6.7 (1)	3.3 (3)	0.46		
False-negative HINTS "plus" hearing examination ⁹	0 (0)	1.1 (1)	1		
Abbreviations: AVS – acute vestibular syndrome; HINTS – head impulse, nystagmus, test of skew. *All strokes were confirmed by MRI/diffusion-weighted imaging neuroimaging. For false-negative initial MRis, confirmatory scans were obtained several days after the initial false-negative scan.					
	27	BI			
	:	Saber Tehrani et al. (2014) Neuro	logy; 83:169-173		











Summary AVS predictors for central origin

- Normal head-impulse test (HIT) → central (ischemic) origin (PICA, less often AICA)
- → CAVE: HIT "false" positive in AICA / lateral pontine stroke • Testing for gaze-evoked nystagmus and skew deviation \rightarrow
- increases sensitivity of the HIT to 98%.
- H.I.N.T.S. have higher sensitivity to exclude stroke than early (first 24-48h) MRI with diffusion weighted imaging (DWI)
- MRI (including DWI) may be negative in first 24-48h in up to 20% and up to 50% for small (lacunar) strokes.

AVS cases

Interaction appreciated!

44-year-old male patient

Current medical history:

Acute vertigo accompanied by nausea, vomiting, gait imbalance and intense sweating since this morning.

Relevant findings from clinical examination:

Neurologic examination: No obvious focal neurologic deficits (no eye muscle palsies, no limb palsies, no sensory loss, no aphasia)

<u>Targeted neuro-otolotic examination</u>:

- Torsional-horizontal spontaneous systagmus to the left (Alexander grade II) without increase during fixation suppression Bedside head impulse test to the right with very few catch-up
- saccades, normal on repetition.
- No skew deviation, no gaze-evoked nystagmus, no hearing loss
- Examination of stance and gait not possible due to his overall medical • condition.



→ Acute ischemic stroke in the right PICA territory





Brain MRI 24h after symptom onset

Case 3

- 81-year old female patient with vertigo, gait imbalance, headache and nausea since three days.
- On exam: periphal facial palsy on the right side and adnormal head-impulse test to the right.
- Diagnostic work-up: brain MRI "normal" → diagnosed and treated as acute peripheral vestibulopathy
- Disease course: Increase in headache, drop in GCS from 15 to 7.



Case 3 – dangerous peripheral AVS

A: head CT → SAH prepontine right side B: DSA → AICA aneurysm (arrow) with accompanying AVM (arrow) with accompanying Avia (arrow with star) C/D: brain MRI before rupture → aneurysm (arrow) detectable E: head CT → after coiling of the aneurysm. Arrow points to

the coils.

→ Distal AICA aneurysm!

Willms et al. (2016) J Stroke Cerebrovasc Di

Case 3 – dangerous peripheral AVS

- Additional cranial nerve deficits besides the vestibulocochlear never is a red flag!
- Without clear signs for zoster oticus (VZV \rightarrow Ramsey Hunt syndrome \rightarrow Vesicles in the external auditory canal/at the ear) \rightarrow incompatible with the diagnosis vestibular neuropathy
- Imaging (focus on the cerebello-pontine angle) and • joint evaluation with neuroradiology
- Up to 50% of all AICA aneurysms become symptomatic BEFORE rupture!

