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Grand Rounds: Neurologic Deficits Due to VAD

Presented by James Demetrious, DC, DABCO

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James Demetrious, DC, DABCO

Clinician
- Active Practice >38 years
- Diplomate, American Board of Chiropractic Orthopedists
- Diplomate, International Academy of Neuromusculoskeletal Medicine

Publications
- Over 31 Peer-Reviewed chiropractic journal articles.
- Many Contributions to NCMIC Examiner and Podcast

Educator
- Post-Grad. > 24 years
- NCMIC Speakers' Bureau for>10 years
- Northeast College of Health Sciences
- **PostGradDC**

Editorial
- Editorial Reviewer for journals *Spine*, *Annals of Internal Medicine*, and *Clinical Anatomy*
- Former Managing Editor of *Journal of Chiropractic Orthopedists*

Honors
- Academy of Chiropractic Orthopedists Distinguished Service and Fellow Awards
- American College of Chiropractic Orthopedists Outstanding Achievement Award

Community
- Lower Cape Fear Hospice, Board Member
- Founder, Past-President Wilmington Autism Society
- Optimists Club – Safety Officer

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CAD...An Extremely Difficult DDX

Cervical Artery Dissection: The Elusive Diagnosis

APR 14TH, 2020 JOHN RIGGINS JR CATEGORIES: PRACTICE UPDATES

Authors: John Riggins Jr, MD (EM Resident Physician, SUNY Downstate/Kings County Hospital) and Richard Sinert, DO (Professor of Emergency Medicine, SUNY Downstate/Kings County Hospital) // Reviewed by: Alex Koyfman, MD (@EMHighAK) and Brit Long, MD (@long_brit)

- **Pearls/Pitfalls:**
  - CAD is a disease process with multiple risk factors. Make sure to keep this diagnosis on your differential for any patient with severe neck pain, new-onset headache and/or neurological abnormalities on exam. Pain may be the only presenting symptom for a cervical artery dissection.

https://www.emdocs.net/cervical-artery-dissection-the-elusive-diagnosis/

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Asymptomatic CAD Presentations are Rare

Pain as the only symptom of cervical artery dissection

M Arnold, R Cumurciuc, C Stapf, P Favrole, K Berthet, M-G Bousser

J Neurol Neurosurg Psychiatry 2006;**77**:1021–1024. doi: 10.1136/jnnp.2006.094359

See end of article for authors' affiliations

Correspondence to: M Arnold, Department of Neurology, University Hospital of Berne, Inselspital, Freiburgstrasse 18, 3010 Bern, Switzerland; marcel.arnold@insel.ch

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Published Online First 4 July 2006

Background: Headache or neck pain is a frequent symptom of spontaneous cervical artery dissection (sCAD).
Patients and methods: Patients were drawn from an ongoing hospital-based registry of consecutive cases diagnosed with sCAD. Only patients with isolated pain were included in this series. Pain topography, dynamics, severity and quality, imaging findings and outcome were analysed.
Results: 20 of 245 (8%) patients with sCAD presented with pain as the only symptom (mean (SD) age 39 (8) years; 14 (70%) women). Of them, 12 had vertebral artery dissection, 3 had internal carotid dissection and 5 had multiple dissections. The median delay from symptom onset to diagnosis was 7 days (range 4 h to 29 days). 6 patients presented with headache, 2 with neck pain and 12 with both. Onset of headache was progressive in 6, acute in 8 and thunderclap-type in 4 patients; neck pain was progressive in 7 and acute in 7. Headache was throbbing in 13 and constrictive in 5 patients; neck pain was throbbing in 4 and constrictive in 10. Pain was unilateral in 11 and bilateral in 9. Pain was different from earlier episodes in all but one case. All patients were pain free at 3 months.
Conclusion: Pain may be the only symptom in sCAD, even when multiple arteries are dissected. Pain topography, dynamics, quality and intensity were heterogeneous. Data from this study lend support to recommendations favouring imaging studies of the cervical arteries in patients with new-onset unexplained headache or neck pain.

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Annals of Medicine
ISSN: 0785-3890 (Print) 1365-2060 (Online) Journal homepage: https://www.tandfonline.com/loi/iann20

A risk–benefit assessment strategy to exclude cervical artery dissection in spinal manual-therapy: a comprehensive review

Aleksander Chaibi & Michael Bjørn Russell

To cite this article: Aleksander Chaibi & Michael Bjørn Russell (2019) A risk–benefit assessment strategy to exclude cervical artery dissection in spinal manual-therapy: a comprehensive review, Annals of Medicine, 51:2, 118-127, DOI: 10.1080/07853890.2019.1590627

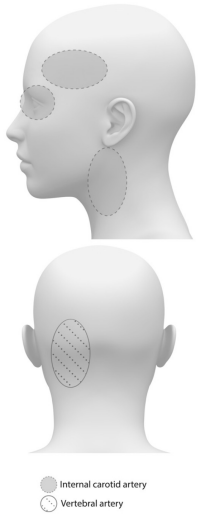

Figure 2. Typical pain distribution due to vertebral artery and internal carotid artery dissections.

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MAYO CLINIC

CONCISE REVIEW

Craniocervical Artery Dissections: A Concise Review for Clinicians

Zafer Keser, MD; James F. Meschia, MD; and Giuseppe Lanzino, MD

Mayo Clin Proc. ■ April 2022;97(4):777-783 ■ https://doi.org/10.1016/j.mayocp.2022.02.007
www.mayoclinicproceedings.org ■ © 2022 Mayo Foundation for Medical Education and Research

FIGURE 2. Dissection-related headache and neck pain (left). Miosis and ptosis of the left eye without anhidrosis, partial Horner syndrome. It is commonly seen in ipsilateral carotid dissections (right). (Used with permission of Mayo Foundation for Medical Education and Research, all rights reserved.)

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An Unpredictable and Spontaneous Event…

- **Listen to how he describes the onset, symptoms and neurologic compromise due to this acute CAD.**

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JoS JOURNAL OF STROKE

Journal of Stroke 2019;21(1):112-115
https://doi.org/10.5853/jos.2018.03055

Letter to the Editor

Local Signs and Symptoms in Spontaneous Cervical Artery Dissection: A Single Centre Cohort Study

- Spontaneous cervical artery dissection (sCAD) is one of the main causes of ischemic stroke in young adults.1
- Local symptoms (LSs) are common in sCAD and often predate ischemic events, yet little is known about their frequency and prognosis.2-9

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Journal of Stroke 2019;21(1):112-115
https://doi.org/10.5853/jos.2018.03055

- Local Symptoms (LSs) were evident in 212 of the 259 sCAD patients (81.9%) with:
  - Head/neck pain being the most frequent (n=205, 79.2%),
  - followed by Horner's syndrome (n=42, 16.2%),
  - tinnitus (n=19, 7.3%), and
  - lower cranial nerve palsy (n=13, 5.0%).
- Multiple LSs were seen in 61 of 259 patients (23.6%).
- Headache was the only LS that was present in all patients with multiple LSs and head/ neck pain combined with Horner's syndrome was the most common combination of symptoms (34 of 61, 55.7%).

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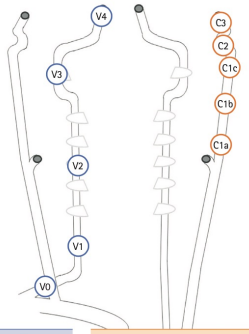

Vertebral artery	% V0-V4 (n=141)
Headache	84.4 (119)
Horner's	0.0
Cranial nerve palsy	0.0
Tinnitus	3.5 (5)

Internal carotid artery	% C1a-C3 (n=127)
Headache	74.8 (95)
Horner's	33.1 (42)
Cranial nerve palsy	10.2 (13)
Tinnitus	13.4 (17)

Vertebral artery	% V0-V2 (n=51)	% V3-V4 (n=119)
Headache	94.1 (48)	82.4 (98)
Horner's	0.0	0.0
Cranial nerve palsy	0.0	0.0
Tinnitus	3.9 (2)	2.5 (3)

Internal carotid artery	% C1a (n=23)	% C1b-C2 (n=118)	% C3 (n=5)
Headache	69.9 (16)	74.6 (88)	80.0 (4)
Horner's	30.4 (7)	33.9 (40)	20.0 (1)
Cranial nerve palsy	0.0	11.0 (13)	0.0
Tinnitus	21.7 (5)	11.9 (14)	40.0 (2)

Figure 2. Frequency of local symptoms according to vessel segment involvement in patients with spontaneous cervical artery dissection (sCAD). Patients with simultaneous anterior and posterior circulation sCAD (n=9) were excluded from this figure. In some patients, a singular dissection involved multiple vessel segments.

https://doi.org/10.5853/jos.2018.03055

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Clinical Characteristics of Symptomatic Vertebral Artery Dissection. A Systematic Review

Rebecca F. Gottesman, MD PhD[1], Priti Sharma, MBBS[1], Karen A. Robinson, PhD[2], Martinson Arnan, MD[1], Megan Tsui[1], Karim Ladha, BA[1], and David E. Newman-Toker, MD PhD[1,3]
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Neurologist. 2012 September ; 18(5): 245–254.

Table 2

Symptoms and signs associated with VAD.

	# Studies	Total sample size (N)	Number of subjects with symptom	Pooled proportion (pooled SE)	Range of proportions
Dizziness/ Vertigo	18 [8, 16, 19, 28, 30, 32, 44, 47, 52, 55-57, 60-62, 65, 73, 74]	467	273	0.58 (0.53)	5-100%
Headache	32 [2, 9, 11, 12, 15, 19, 21, 22, 24, 25, 27, 28, 30, 32, 33, 35, 38, 41-46, 52, 53, 57, 60, 64-66, 69, 73]	689	348	0.51 (0.7)	6-93%
Neck Pain	27 [11, 12, 14, 15, 21, 22, 24, 25, 30, 35, 37, 38, 41, 43-45, 52, 53, 56, 57, 60, 61, 64-66, 69, 73]	526	244	0.46 (0.69)	10-80%
Gait problems/ Ataxia	10 [1, 6, 8, 16, 52, 53, 56, 57, 61, 65]	150	57	0.38 (0.43)	7-71%
Visual symptoms	17 [1, 6, 8, 12, 16, 30, 32, 37, 47, 52, 53, 56, 57, 61, 65, 72, 73]	314	114	0.36 (0.53)	4-88%
Nausea/ Vomiting	13 [1, 8, 12, 30, 32, 44, 52, 56, 57, 60, 65, 73, 74]	306	108	0.35 (0.42)	5-79%
Nystagmus	7 [6, 8, 30, 37, 56, 61, 65]	150	44	0.29 (0.30)	4-55%
Horner's syndrome	11 [30, 41, 44, 47, 52, 55, 60, 61, 65, 72, 73]	265	58	0.22 (0.03)	6-36%
Sensory deficits	17 [1, 8, 16, 30, 32, 37, 47, 52, 53, 55-57, 60, 61, 65, 72, 73]	335	70	0.21 (0.43)	4-58%
Cranial nerve palsies	11 [8, 30, 37, 47, 52, 53, 55, 56, 65, 72, 73]	241	51	0.21 (0.32)	4-43%
Dysphagia	6 [16, 53, 57, 60, 65, 74]	102	13	0.13 (0.20)	5-29%
Tinnitus	4 [5, 32, 44, 65]	238	17	0.07 (0.09)	5-13%

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Stroke
Volume 52, Issue 3, March 2021; Pages 821-829
https://doi.org/10.1161/STROKEAHA.120.031579

CLINICAL AND POPULATION SCIENCES

Clinical Features of Patients With Cervical Artery Dissection and Fibromuscular Dysplasia

Table 2. Clinical Features, Triggering Factors, and Vascular Pathology of Index Cervical Artery Dissection by cFMD Status

Variable	cFMD+ (n=103)	cFMD− (n=1180)	*P* value
Clinical features			
Cervical pain	41 (39.8)	493 (41.8)	0.755
Headache	50 (48.5)	587 (49.7)	0.815
Tinnitus	6 (5.8)	57 (4.8)	0.633
Cranial nerve involvement	8 (7.8)	134 (11.4)	0.327
Horner syndrome	26 (25.2)	229 (19.4)	0.155
TIA	15 (14.6)	147 (12.5)	0.536
Cerebral infarct	73 (70.9)	864 (73.2)	0.607
Subarachnoid hemorrhage	0 (0.0)	18 (1.5)	0.390
Dissection site			0.547
Carotid	63 (61.2)	708 (60.0)	
Vertebral	19 (18.4)	277 (23.5)	
Intracranial arteries	2 (1.9)	25 (2.1)	
Multiple vessel	19 (18.4)	170 (14.4)	
Vascular pathology			≤0.001
Occlusion	33 (32.0)	520 (44.1)	
Stenosis	40 (38.8)	444 (37.6)	
Intimal flap	3 (2.9)	47 (4.0)	
Pseudoaneurysm	9 (8.7)	47 (4.0)	
Other	18 (17.5)	104 (9.0)	
Triggering factors			
Infections, past 30 d*	13 (12.6)	133 (11.3)	0.630
Antibiotics use	8 (61.5)	72 (54.1)	0.773
Trauma, minor	8 (7.8)	176 (14.9)	0.055
Strenuous physical activity	38 (36.9)	544 (46.1)	0.079
Acute-phase treatment			0.517
Antiplatelet therapy	51 (49.5)	538 (45.6)	
Anticoagulant treatment	40 (38.8)	457 (38.7)	
Any recanalization therapy	12 (11.7)	185 (15.7)	

cFMD indicates cerebrovascular fibromuscular dysplasia.

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Asymptomatic CAD Presentations are Rare

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November 28, 2006; 67 (10) ARTICLES

Incidence and outcome of cervical artery dissection
A population-based study

Vivien H. Lee, Robert D. Brown, Jayawant N. Mandrekar, Bahram Mokri
First published November 27, 2006, DOI: https://doi.org/10.1212/01.wnl.0000244486.30455.71

- Three patients were asymptomatic (6%), and neuroimaging was performed for unrelated reasons.
- Three patients (6%) had known disorders of connective tissue and an additional three patients had a family history of connective tissue disorder in first-degree relatives.

From the Departments of Neurology (V.H.L., R.D.B., B.M.), and Biostatistics (J.N.M.), Mayo Clinic College of Medicine, Rochester, MN. Dr. Lee is currently with the Department of Neurology, Rush University Medical Center, Chicago, IL.

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Asymptomatic CAD Presentations are Rare

Table 2 *ICAD and VAD patients in Olmsted County, MN (1987–2003)*

	ICAD	VAD	CAD
Demographics			
Total patients	32 (67)	18 (38)	48
Mean age, y	47.0	43.4	45.8
Male	12 (38)	12 (67)	24 (50)
Female	20 (63)	6 (33)	24 (50)
Medical history			
Connective tissue disorder	3 (9)	0	3 (6)
Migraine	13 (41)	4 (22)	16 (33)
Hypertension	6 (19)	3 (17)	9 (19)
Smoker	11 (34)	4 (22)	14 (29)
Clinical symptoms			
Asymptomatic	1 (3)	2 (11)	3 (6)
Pain	25 (78)	15 (83)	38 (80)
Neck pain	6 (19)	7 (39)	13 (27)
HA	23 (72)	12 (67)	33 (69)
Horner syndrome	8 (25)	4 (22)	12 (25)
Cerebral ischemia (stroke or TIA)	19 (59)	14 (78)	32 (67)
TIA	9 (29)	2 (11)	11 (23)
Stroke	13 (41)	15 (83)	27 (56)

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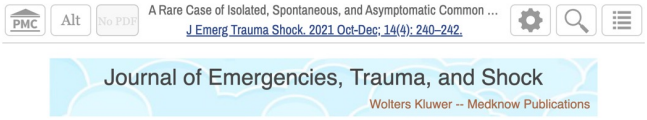
Asymptomatic CAD Presentations are Rare



A Rare Case of Isolated, Spontaneous, and Asymptomatic Common Carotid Artery Dissection

Iyad Farouji, Hossam Abed, [...], and Addi Suleiman

- Herein, we report a very unique case of isolated, spontaneous, and asymptomatic common carotid artery dissection.

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Epidemiology of sCeAD

- **Clinical manifestations of the 123 patients:**
  - Most patients presented with **headache** (49.6%) and **neck pain** (29.3%).
  - Ischemic stroke occurred at presentation in 45 patients (36.6%), with **infarction** confirmed on imaging in 44, and diagnosed based on clinical findings alone in 1.
  - **15.5% were asymptomatic** from a neurological standpoint or presented with nonspecific symptoms considered to likely not be related to the CeAD.

Table 1. Demographics and Clinical Presentation of Patients With Cervical Artery Dissection

	ICAD (63)	VAD (54)	Total CeAD (123)
Female sex	28 (44.4)	33 (61.1)	63 (51.2)
White race	57 (90.5)	48 (88.9)	111 (90.2)
Hispanic ethnicity	1 (1.6)	0 (0)	1 (0.8)
Presentation			
Found Incidentally	12 (19.1)	4 (7.4)	19 (15.5)
Neck pain	15 (23.8)	19 (35.2)	36 (29.3)
Headache	31 (49.2)	28 (51.9)	61 (49.6)
Horner syndrome	18 (28.6)	0 (0)	18 (14.6)
Pulsatile tinnitus	7 (11.1)	4 (7.4)	11 (8.9)
Cerebral infarction (clinical or imaging)	20 (31.8)	24 (44.4)	45 (36.6)
Transient ischemic attack	7 (11.1)	10 (18.5)	18 (14.6)
Comorbidities			
Hypertension	24 (38.1)	14 (25.9)	44 (35.8)
Hyperlipidemia	19 (30.2)	20 (37.0)	45 (36.6)
Diabetes	5 (7.9)	4 (7.4)	11 (8.9)
Migraine	22 (34.9)	20 (37.0)	46 (37.4)
Former smoking	12 (19.1)	13 (24.1)	30 (24.4)
Active smoking	9 (14.3)	8 (14.8)	19 (15.5)
Family history of dissection	3 (4.8)	0 (0)	3 (2.4)

Values are expressed as n (%). Total CeAD includes patients with ICAD, VAD, and common carotid artery dissection, as well as the 2 patients who presented with both ICAD and VAD. CeAD indicates cervical artery dissection; ICAD, internal carotid artery dissection; and VAD, vertebral artery dissection.

Stroke. 2024;55:670–677. DOI: 10.1161/STROKEAHA.123.043647

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CAD...An Extremely Difficult DDX

Stroke

CLINICAL AND POPULATION SCIENCES

Epidemiology of Spontaneous Cervical Artery Dissection: Population-Based Study

Kim J. Griffin, MD; William S. Harmsen, MS; Jay Mandrekar, PhD; Robert D. Brown Jr, MD; Zafer Keser, MD

- **Clinical manifestations of the 123 patients:**
  - **15.5% were asymptomatic** from a neurological standpoint or presented with nonspecific symptoms considered to likely not be related to the CeAD.

Stroke. 2024;55:670–677. DOI: 10.1161/STROKEAHA.123.043647

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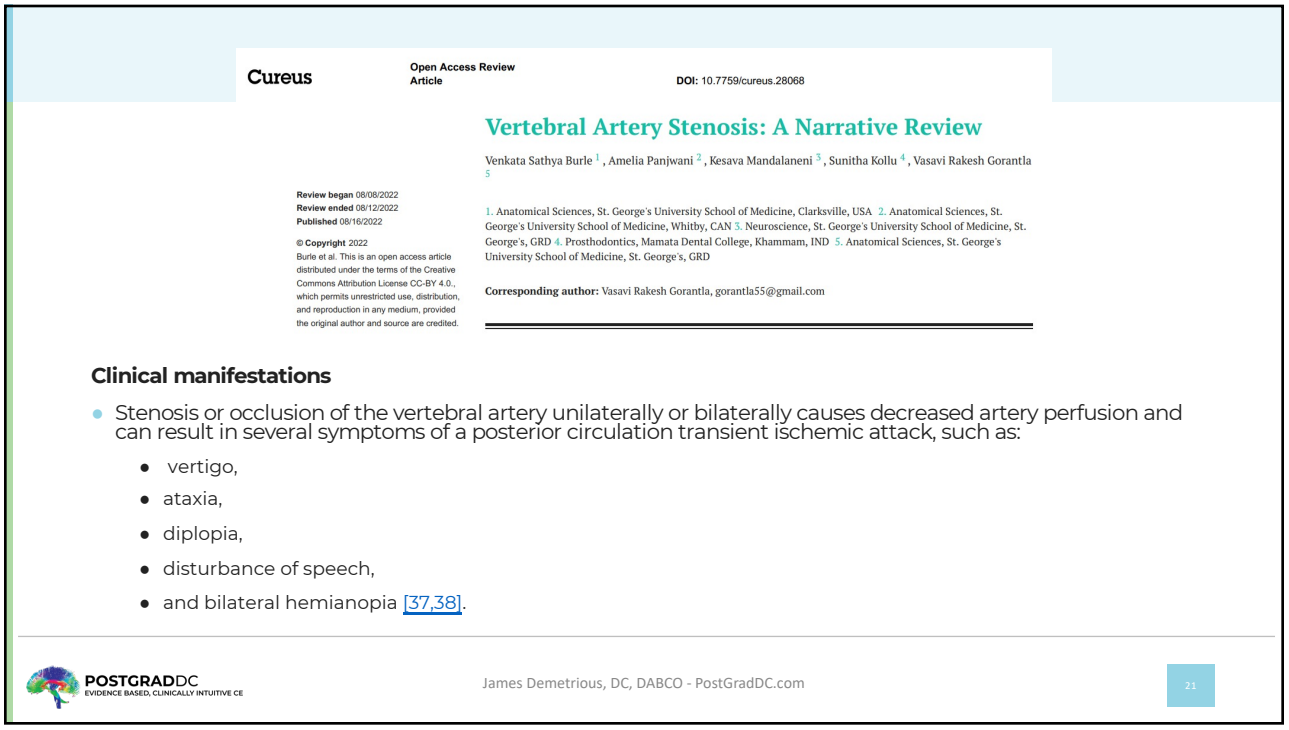

Cureus

Open Access Review Article

DOI: 10.7759/cureus.28068

Vertebral Artery Stenosis: A Narrative Review

Venkata Sathya Burle [1], Amelia Panjwani [2], Kesava Mandalaneni [3], Sunitha Kollu [4], Vasavi Rakesh Gorantla [5]

1. Anatomical Sciences, St. George's University School of Medicine, Clarksville, USA 2. Anatomical Sciences, St. George's University School of Medicine, Whitby, CAN 3. Neuroscience, St. George's University School of Medicine, St. George's, GRD 4. Prosthodontics, Mamata Dental College, Khammam, IND 5. Anatomical Sciences, St. George's University School of Medicine, St. George's, GRD

Corresponding author: Vasavi Rakesh Gorantla, gorantla55@gmail.com

Review began 08/08/2022
Review ended 08/12/2022
Published 08/16/2022

Clinical manifestations

- Stenosis or occlusion of the vertebral artery unilaterally or bilaterally causes decreased artery perfusion and can result in several symptoms of a posterior circulation transient ischemic attack, such as:
  - vertigo,
  - ataxia,
  - diplopia,
  - disturbance of speech,
  - and bilateral hemianopia [37,38].

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Cureus

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Corresponding author: Vasavi Rakesh Gorantla, gorantla55@gmail.com

Review began 08/08/2022
Review ended 08/12/2022
Published 08/16/2022

- Vertebral artery stenosis can also result in:
  - recurring
  - syncope,
  - headaches,
  - recurrent stroke,
  - palsy of cranial nerves,
  - change in consciousness,
  - altered function of the sensory and pyramidal tracts,
  - cerebellar infarcts,
  - and tinnitus [8,24,27,34].

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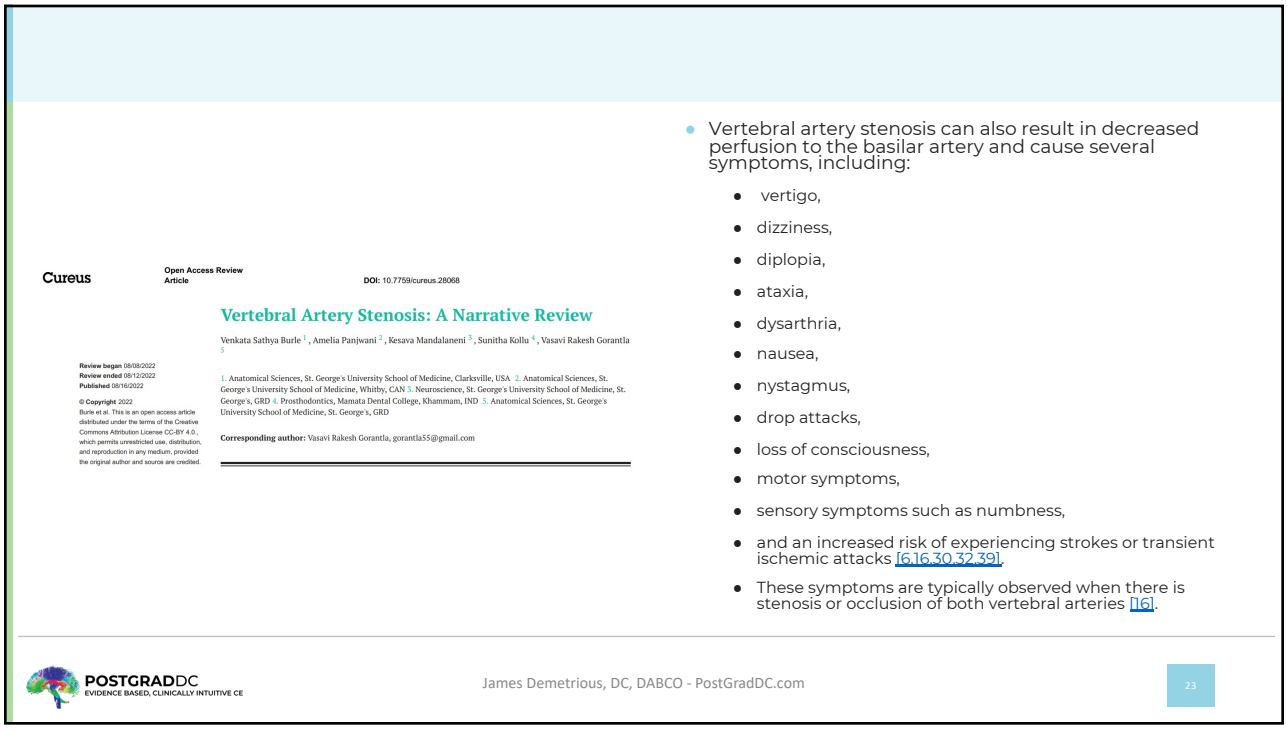

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Review began 08/08/2022
Review ended 08/12/2022
Published 08/16/2022

- Vertebral artery stenosis can also result in decreased perfusion to the basilar artery and cause several symptoms, including:
  - vertigo,
  - dizziness,
  - diplopia,
  - ataxia,
  - dysarthria,
  - nausea,
  - nystagmus,
  - drop attacks,
  - loss of consciousness,
  - motor symptoms,
  - sensory symptoms such as numbness,
  - and an increased risk of experiencing strokes or transient ischemic attacks [6,16,30,32,39].
  - These symptoms are typically observed when there is stenosis or occlusion of both vertebral arteries [16].

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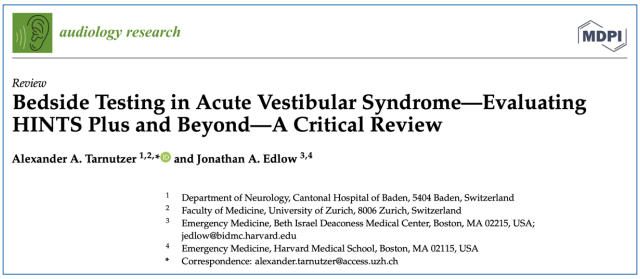
CAD...An Extremely Difficult DDX



audiology research MDPI

Review

Bedside Testing in Acute Vestibular Syndrome—Evaluating HINTS Plus and Beyond—A Critical Review

Alexander A. Tarnutzer [1,2,*] and Jonathan A. Edlow [3,4]

1 Department of Neurology, Cantonal Hospital of Baden, 5404 Baden, Switzerland
2 Faculty of Medicine, University of Zurich, 8006 Zurich, Switzerland
3 Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA 02215, USA; jedlow@bidmc.harvard.edu
4 Emergency Medicine, Harvard Medical School, Boston, MA 02115, USA
* Correspondence: alexander.tarnutzer@access.uzh.ch

- The three-component bedside **HINTS** (**H**ead-**I**mpulse, **N**ystagmus, and **T**est of **S**kew) can accurately identify central causes (mostly ischemic stroke) in AVS patients [19].
- In the hands of a trained oto-neurologist, HINTS was associated with a 100% sensitivity and 96% specificity for detecting a stroke [19].
- Importantly, the presence of one out of these three signs was sufficient to suspect a central cause.

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CAD…An Extremely Difficult DDX

audiology research

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3 Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA 02215, USA; jedlow@bidmc.harvard.edu
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Table 2. H.I.N.T.S. plus bedside testing battery * (modified after [36]).

Test Performed	Property Evaluated	How to Perform This Test	Pointing to a Peripheral Cause	Pointing to a Central Cause	Comments
Horizontal Head-Impulse test (HIT)	Vestibulo-ocular reflex (VOR)	Fast, low amplitude (10–15°) head rotations to the left/right while the patient is looking at a fixed target in space (e.g., the examiner's nose)	Delayed to one side, pathological catch-up saccade	Normal HIT.	Note that central lesions involving the VOR (e.g., lesions in the root-entry zone or of the vestibular nuclei) may show a "pseudo-peripheral pattern"
Testing for Nystagmus	Eccentric gaze-holding on lateral gaze	Fixation of an object (e.g., the tip of a pen) during lateral (eccentric) gaze (~20 to 30°) for at least 5 s.	Stable eccentric gaze-holding	Deficient eccentric gaze-holding with centripetal drift and centrifugal nystagmus (i.e., left-beating on left-gaze and right-beating on right-gaze).	Spontaneous, predominantly horizontal nystagmus (i.e., primary gaze nystagmus) can be found in both peripheral and central causes and thus allows no differentiation.
Alternating cover test ("Test of Skew")	Vertical alignment of the eyes	Rapid covering then uncovering one eye after the other while the patient is looking at a fixed target in space (e.g., the examiner's nose). The examiner should focus on only one eye.	No vertical deviation of the eyes	Vertical realignment of the uncovered eye (one eye goes up while the other eye goes down). This is why it does not matter which eye the examiner focuses on.	Note that rarely a vertical skew can also be observed in peripheral-vestibular deficits, but is usually of smaller amplitude and short-lived.
New-onset unilateral hearing loss (fourth sign—"plus sign")	Hearing	Finger rub on each side	Normal hearing	Hearing loss on the side with the abnormal head-impulse test	Hearing may also be compromised in inner ear disorders such as labyrinthitis or complicated otitis media, emphasizing the need for a dedicated examination of the ear.

* Teaching videos can be found under: http://novel.utah.edu/Newman-Toker/collection.php (accessed on 15 August 2023).

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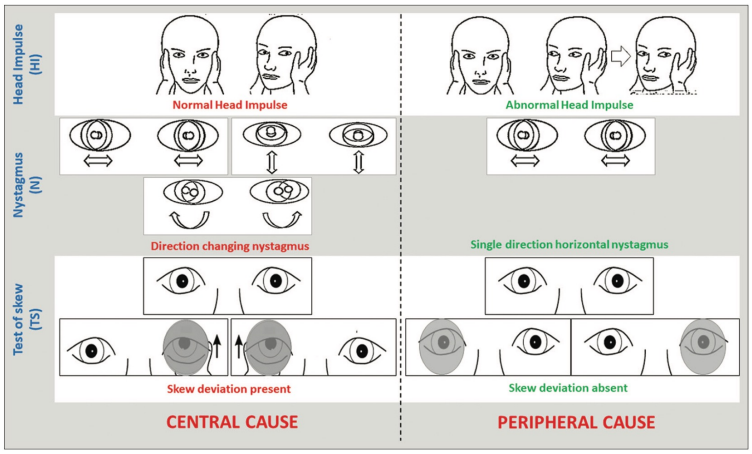
CAD…An Extremely Difficult DDX

Sahu, *et al.*: Beside examination of vertigo



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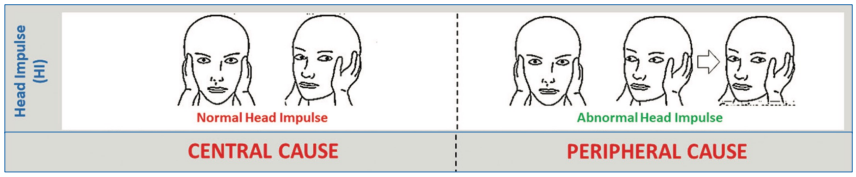
CAD...An Extremely Difficult DDX



Contraindicated in developing CADs or patients at risk for thromboembolism?

- **HI-**
  - During the head impulse test (HI), the patient sits opposite the examiner and fixes their gaze on the examiner's nose.
  - The examiner then moves the head in one direction, followed by a move to the center and another move in the opposite direction. The head turn should be rapid from an eccentric (lateral) position back to the center (midline) with an excursion angle of 10°.
  - The examiner looks for any quick eye movement sign, a so-called corrective saccade.
  - The absence of saccadic corrections points towards a central cause, whereas, on the contrary, the presence of saccades is suggestive of a peripheral cause.

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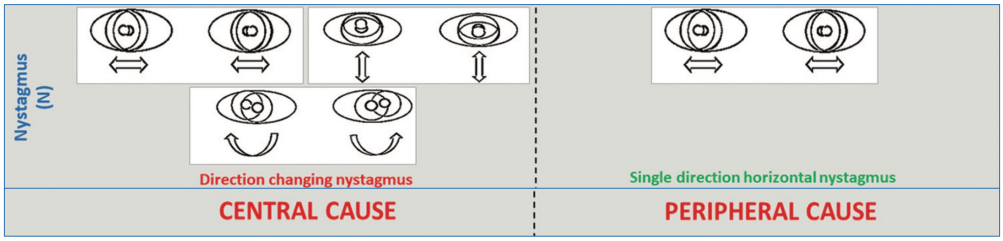
CAD...An Extremely Difficult DDX



- **N -**
  - For testing nystagmus (N), the patient is asked to look to the left, right, and center position.
  - The direction-changing nystagmus or vertical nystagmus is suggestive of central causes of vertigo, whereas, on the contrary, single directional horizontal nystagmus is suggestive of a peripheral cause.

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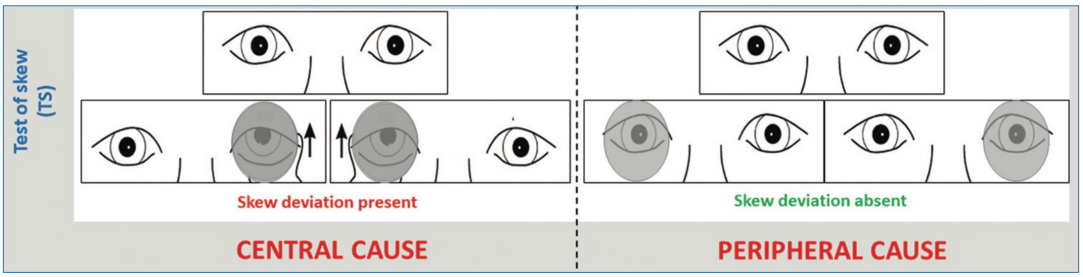
CAD...An Extremely Difficult DDX



- **TS -**
  - In the test of skew (TS), the eyes of the patient are fixed on a distant target. The eyes of the patient are covered and uncovered in a slow alternating manner.
  - A vertical skew deviation is seen in central causes of vertigo, whereas the absence of any skew deviation suggests a peripheral cause.

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CAD...An Extremely Difficult DDX

Quimby et al. Journal of Otolaryngology - Head and Neck Surgery (2018) 47:54
https://doi.org/10.1186/s40463-018-0305-8
Journal of Otolaryngology - Head & Neck Surgery
ORIGINAL RESEARCH ARTICLE Open Access

Usage of the HINTS exam and neuroimaging in the assessment of peripheral vertigo in the emergency department

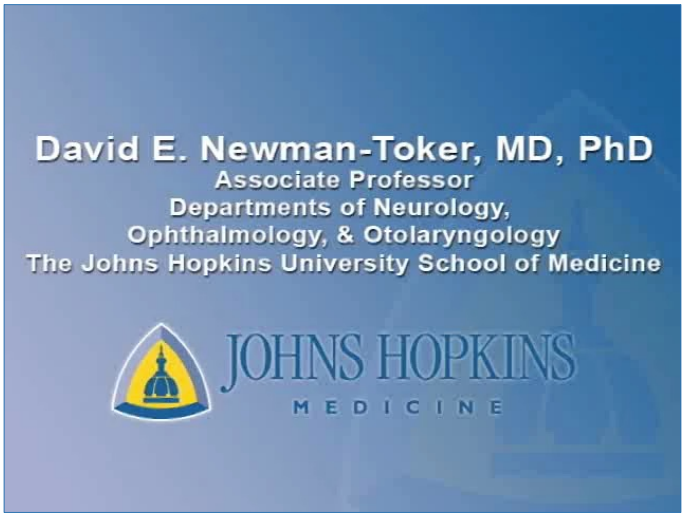
Alexandra E. Quimby[1*], Edmund S. H. Kwok[2], Daniel Lelli[3], Peter Johns[4] and Darren Tse[5]

?

cranial ionizing radiation to which patients were exposed.

The HINTS exam was developed as a means of assessing patients with the acute vestibular syndrome (AVS), defined as acute onset and persistent vertigo, gait instability, nausea/vomiting, nystagmus, and head motion intolerance [9]. This battery of bedside clinical tests consists of three examinations: the head impulse test (HI-), characterization of spontaneous nystagmus (-N-), and test of skew (-TS) [10]. Each of the three components of the HINTS exam is analyzed

10. Newman-Toker, David E. 3-Step HINTS Battery Video 200-4. Neuro-Ophthalmology Virtual Education Library: NOVEL Web Site [online]. Available at: http://www.kaltura.com/index.php/extwidget/preview/partner_id/797802/uiconf_id/27472092/entry_id/0_b9t6s0wh/embed/auto. Accessed 22 Nov 2017.



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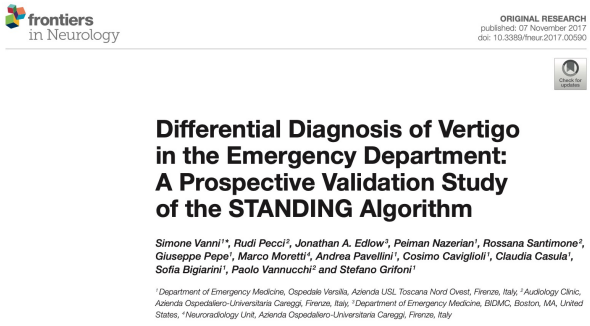
CAD…An Extremely Difficult DDX



frontiers in Neurology

ORIGINAL RESEARCH
published: 07 November 2017
doi: 10.3389/fneur.2017.00590

Differential Diagnosis of Vertigo in the Emergency Department: A Prospective Validation Study of the STANDING Algorithm

Simone Vanni[1], Rudi Pecci[2], Jonathan A. Edlow[3], Peiman Nazerian[1], Rossana Santimone[2], Giuseppe Pepe[1], Marco Moretti[4], Andrea Pavellini[1], Cosimo Cavigliol[1], Claudia Casula[1], Sofia Bigiarini[1], Paolo Vannucchi[2] and Stefano Grifoni[1]*

[1] Department of Emergency Medicine, Ospedale Versilia, Azienda USL Toscana Nord Ovest, Firenze, Italy, [2] Audiology Clinic, Azienda Ospedaliero-Universitaria Careggi, Firenze, Italy, [3] Department of Emergency Medicine, BIDMC, Boston, MA, United States, [4] Neuroradiology Unit, Azienda Ospedaliero-Universitaria Careggi, Firenze, Italy

- **Conclusion:** Using the STANDING algorithm, non-sub-specialists achieved good reliability and high accuracy in excluding stroke and other threatening causes of vertigo/unsteadiness.

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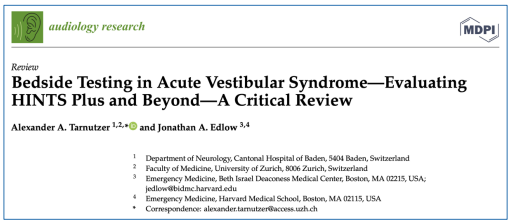

audiology research

MDPI

Review

Bedside Testing in Acute Vestibular Syndrome—Evaluating HINTS Plus and Beyond—A Critical Review

Alexander A. Tarnutzer [1,2,*] and Jonathan A. Edlow [3,4]

[1] Department of Neurology, Cantonal Hospital of Baden, 5404 Baden, Switzerland
[2] Faculty of Medicine, University of Zurich, 8006 Zurich, Switzerland
[3] Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA 02215, USA; jedlow@bidmc.harvard.edu
[4] Emergency Medicine, Harvard Medical School, Boston, MA 02115, USA
* Correspondence: alexander.tarnutzer@access.uzh.ch

- The **STANDING** algorithm (i.e., a four-step algorithm including
  - 1) the discrimination between **S**pon**TA**neous and positional nystagmus,
  - (2) the evaluation of the **N**ystagmus **D**irection,
  - (3) the head **I**mpulse test, and
  - (4) the evaluation of equilibrium (sta**N**din**G**))

  was designed to be more inclusive to include the diagnosis of benign paroxysmal positional vertigo (BPPV) as well.

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CAD…An Extremely Difficult DDX

Vanni et al. STANDING for Vertigo in ED

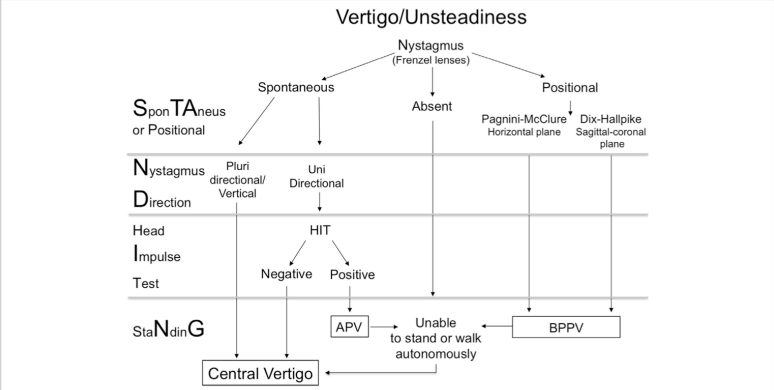

FIGURE 1 | Diagram of STANDING approach. APV, acute peripheral vestibulopathy; BPPV, benign paroxysmal positional vertigo. Central vertigo was diagnosed when an acute brain process (ischemic, hemorrhagic, neoplastic, and inflammatory) congruent with symptoms was detected by neuroimaging or by autopsy (see Materials and Methods).

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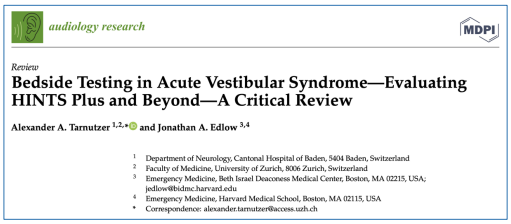
CAD…An Extremely Difficult DDX



audiology research MDPI

Review

Bedside Testing in Acute Vestibular Syndrome—Evaluating HINTS Plus and Beyond—A Critical Review

Alexander A. Tarnutzer [1,2,*] and Jonathan A. Edlow [3,4]

1 Department of Neurology, Cantonal Hospital of Baden, 5404 Baden, Switzerland
2 Faculty of Medicine, University of Zurich, 8006 Zurich, Switzerland
3 Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA 02215, USA; jedlow@bidmc.harvard.edu
4 Emergency Medicine, Harvard Medical School, Boston, MA 02115, USA
* Correspondence: alexander.tarnutzer@access.uzh.ch

- Missed or delayed diagnosis of posterior circulation stroke is an important and, unfortunately, a common problem.
- For the bedside clinical assessment of acutely dizzy patients meeting the diagnostic criteria of an acute vestibular syndrome, looking for subtle oculomotor signs is key to increasing diagnostic accuracy.
- Both the HINTS(+) exam and the STANDING algorithm are very good exclusion tests in the hands of ***trained*** emergency physicians, non-sub-specialists, and neuro-otology/ neuro-ophthalmology subspecialists [15].
- Thus, in the right circumstances, both HINTS and the STANDING algorithm can distinguish peripheral from central diagnoses, limiting the use of further diagnostic testing to cases where bedside testing points to a central (or equivocal) cause of AVS.

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CAD…An Extremely Difficult DDX

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Review

Bedside Testing in Acute Vestibular Syndrome—Evaluating HINTS Plus and Beyond—A Critical Review

Alexander A. Tarnutzer [1,2,*] and Jonathan A. Edlow [3,4]

1 Department of Neurology, Cantonal Hospital of Baden, 5404 Baden, Switzerland
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- Importantly, both HINTS(+) [15] and STANDING outperformed early (i.e., within the first 24–48 h) MRI-DWI, which has a sensitivity of 81.1 and a specificity of 99.9 based on a systematic review.

GRACE-3 – Acute Dizziness and Vertigo

AEM Academic Emergency Medicine

Academic Emergency Medicine
A GLOBAL JOURNAL OF EMERGENCY CARE

GRACE CLINICAL PRACTICE GUIDELINE

Guidelines for reasonable and appropriate care in the emergency department 3 (GRACE-3): Acute dizziness and vertigo in the emergency department

Jonathan A. Edlow MD, Christopher Carpenter MD, MSC, Murtaza Akhter MD, Danya Khoujah MD, Evie Marcolini MD, William J. Meurer MD ... See all authors

First published: 11 May 2023 | https://doi.org/10.1111/acem.14728 | Citations: 8

- This **3**rd **G**uideline for **R**easonable and **A**ppropriate **C**are in the **E**mergency Department (GRACE-3) from the Society for Academic Emergency Medicine is on the topic adult patients with acute dizziness and vertigo in the emergency department (ED).

Instructive Case

- **60-year-old patient seeks care for lower back pain:**
  - HX and risk factors:
    - Hypertensive
  - Symptoms:
    - Transient dizziness, following massage therapy earlier during the day. Recurrence following lumbar spine SMT. NO cervical spine SMT performed.
  - PE:
    - A&O x 3, BP: 140/90, 74BPM Afebrile
    - - CN
    - + Romberg with drift on walking
    - +Dix-Hallpike
    - - Otoscope
    - - Ortho, remaining - neuro

Consider everything!

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A Medical Intragenic Cause of CAD

ELSEVIER
Archives of Cardiovascular Diseases Supplements
Volume 15, Issue 1, January 2023, Pages 112-113

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Fluoroquinolone use preceding medium-size artery dissection: A case series

L. Wang [1], B. Oehmichen [1], B. Pariente [1], N. Mohamedi [1], C. Cheng [1], G. Détriché [1], A. Galloula [1], L. Khider [1], A. Lillo Le Louet [2], E. Messas [1], L. Amar [3], G. Goudot [1], T. Mirault [1]

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Fluoroquinolone adverse effects

- To our knowledge, it is the first case series reporting visceral artery dissections following a treatment by FQ.
- All the previous studies establishing a link between arterial dissection and FQ were related to aortic syndrome or carotid arteries.
- Although this class of antibiotics is effective to treat many infectious diseases, their prescription must be earmarked for weighed medical indications and avoided in patients with a previous history of dissection or underlying condition of arterial fragility.
- In addition, the search for a fluoroquinolone intake must be carried out precisely in the event of the discovery of a medium-sized arterial dissection.

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Intern Med 60: 2863-2865, 2021

Case 1

- A 45-year-old man presented to the emergency department with sudden-onset left posterior neck pain and left hemiparesis.
- His medical history included hypertension, dyslipidemia, and diabetes mellitus, and he had taken levofloxacin orally for a sore throat and cough for 8 days.
- He had no history of connective tissue disease or head and neck trauma.
- His vital signs were normal, except for high blood pressure (152/95 mmHg).
- A neurological examination revealed nystagmus, left hemifacial hypoalgesia, left-sided deficit of cranial nerves VII, IX, and X and paralysis of the left upper limb.
- Magnetic resonance imaging (MRI)/magnetic resonance angiography (MRA) of the brain revealed left vertebral artery dissection and infarction of the left me-dulla (Fig. 1, 2).
- A diagnosis of Wallenberg syndrome associated with vertebral artery dissection was made.
- He received conservative therapy and was subsequently tranferred to a rehabilitation hospital on day 30. He had a Modified Rankin Scale score of 3.

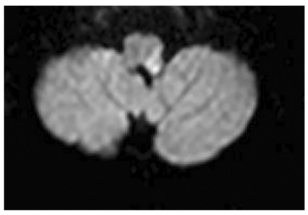

Figure 1. On diffusion-weighted magnetic resonance imaging, the left lateral medulla showed a high signal intensity.

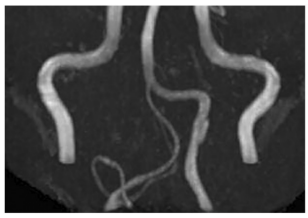

Figure 2. Magnetic resonance angiography showed dilation of the left vertebral artery with irregularity.

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James Demetrious, DC, DABCO

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National Institute of Neurological Disorders and Stroke

- **Wallenberg's syndrome or Lateral Medullary Syndrome** is a neurological condition caused by a stroke in the:
  - vertebral or
  - posterior inferior cerebellar artery of the brain stem.
- Symptoms include:
  - difficulties with swallowing,
  - hoarseness, dizziness,
  - nausea and vomiting,
  - rapid involuntary movements of the eyes (nystagmus),
  - and problems with balance and gait coordination.
  - Some individuals will experience a lack of pain and temperature sensation on only one side of the face, or a pattern of symptoms on opposite sides of the body – such as paralysis or numbness in the right side of the face, with weak or numb limbs on the left side.
  - Uncontrollable hiccups may also occur, and some individuals will lose their sense of taste on one side of the tongue, while preserving taste sensations on the other side.
  - Some people with Wallenberg's syndrome report that the world seems to be tilted in an unsettling way, which makes it difficult to keep their balance when they walk.

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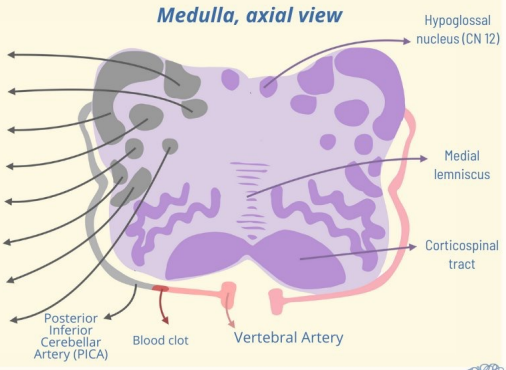
@Neudrawlogy

LATERAL MEDULLARY SYNDROME
- WALLENBERG'S SYNDROME

What? *Acute continuous vertigo* due to *Posterior Circulation Stroke (usually Posterior Inferior Cerebellar Artery occlusion)*

CLINICAL FINDINGS:

Nausea/vomiting/vertigo /nystagmus	Vestibular nucleus (CN 8)
Ageusia	Solitary nucleus/tract
Ipsilateral ataxia	Inferior cerebellar peduncle
Ipsilateral facial numbness	Trigeminal nucleus (CN 5) /tract
Ipsilateral Horner's Syndrome	Sympathetic pathway
Contralateral loss of pain/ temperature	Spinothalamic tract
Palatal myoclonus	Central tegmental tract
Hoarseness/dysphagia	Nucleus ambiguus - CN 9, 10)



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Sudden onset of Headache/Neck/Face Pain that's Different than the Patient has Experienced Before?

These are also known as the 5 D's and the 3 N's:

- **Diplopia** → Double vision or other vision problems
- **Dizziness** → Vertigo, light-headedness
- **Drop Attacks** → Sudden numbness/weakness of face/arm/leg
- **Disarthria** → Difficulty speaking
- **Dysphagia** → Difficulty swallowing
- **Ataxia of Gait** → Difficulty walking
- **Nausea** → Vomiting or queasiness
- **Numbness** → Loss of sensation on one side
- **Nystagmus** → Involuntary rapid eye movements

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James Demetrious, DC, DABCO - PostGradDC.com

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American Journal of Case Reports

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Accepted: 2022.09.01
Available online: 2022.09.14
Published: 2022.10.19

Chiropractic Management of Neck Pain Complicated by Symptomatic Vertebral Artery Stenosis and Dizziness

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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- The present and previous cases provide limited evidence that some carefully considered chiropractic manual therapies can afford patients with VBI relief from concurrent neck pain and possibly dizziness.
- Given the paucity of research, cervical SMT cannot be recommended in such patients. These findings do not apply to vertebral artery dissection, for which SMT is an absolute contraindication.
- **Limitations**
  - **First, as a single case, the demonstrated results are not generalizable.**

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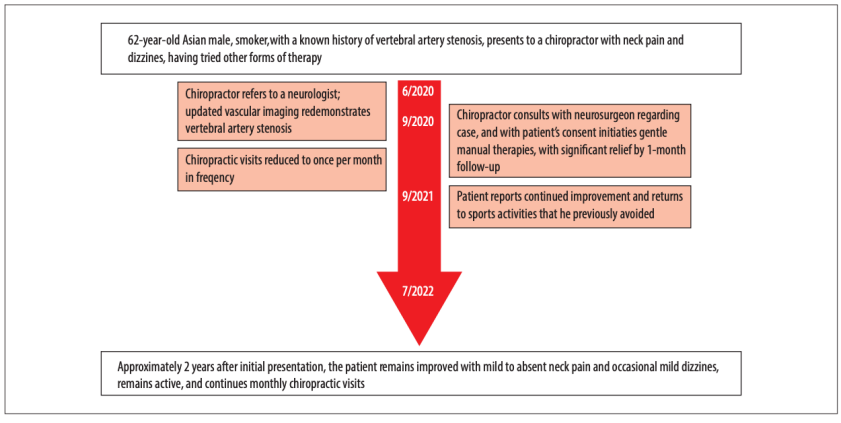

Figure 1. Timeline of care.

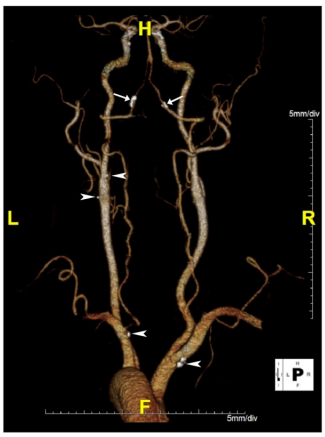

Figure 3. Computed tomography angiogram of neck, 3D volume-rendered image. Orientation: left (L), right (R), head (H), feet (F). Calcified plaques of the vertebral arteries are evident bilaterally (arrows), more prominently on the left than right. From superior to inferior, additional smaller calcified plaques are easily visible at the left carotid bulb (×2), left subclavian artery, and right brachiocephalic trunk (arrowheads).

Chu et al. Am J Case Rep, 2022; 23: e937991.

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Table 1. Patients with vertebrobasilar insufficiency treated by a chiropractor.

Author	Year	Patient age	Sex	Symptoms	VBI diagnosis and testing	Treatment
Current case	2022	62	M	Neck pain, headaches, dizziness	Calcified plaques in VA, MRA, CTA	Thoracic SMT, no cervical rotation, IASTM
Jensen [54]	2003	40	F	Neck and interscapular pain, lightheadedness, tremor	Decreased VA blood flow via Doppler	Cervical SMT with <45° rotation
Jensen [54]	2003	42	M	Neck pain, tremor, left hand numbness	Decreased VA flow via Doppler	Cervical SMT with <45° rotation
Rectenwald [53]	2018	39	F	Neck pain, upper extremity numbness	Bow hunter's syndrome, C1-2 stenosis via dynamic angiography	Instrument-assisted cervical SMT (cervical spine in neutral position)
Terenzi [41]	2002	28	F	Neck and arm pain, headaches, dizziness	Perfusion deficit on transcranial Doppler, VA compression and anomaly	Cervical SMT with flexion and no rotation

CTA – computed tomography angiography; F – female; IASTM – instrument assisted soft tissue manipulation; MRA – magnetic resonance angiography; M – male; NR – not reported; SMT – spinal manipulative therapy; VA – vertebral artery; VBI – vertebrobasilar insufficiency.

Chu et al. Am J Case Rep, 2022; 23: e937991.

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To DX the Developing CAD, We Must Consider…

- Risk Factors
- Symptoms
- Signs

Extraordinarily difficult. CADs are rare. Most doctors will never see this problem. Patients often do not provide detailed histories despite our best efforts.

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Questions?

- Which neurologic deficits are truly **Red Flags**?
- How to differentiate migraine from CAD?
- Is it possible to diagnose an asymptomatic CAD?

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CAD: Diagnosis (2 CE Hours)
CAD: Risk Factors (1 CE Hour)
CAD due to Fluoroquinolones (2 CE Hours)
Differential Diagnosis (1 CE Hour)
Clinical Risk Management: Informed Consent (1 CE Hour)

LIVE ZOOM Classes

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May 7, 2024 – Neurologic Deficits Due to VAD (1 CE Hour)
June 4, 2024 – Medically Caused CAD: Fluoroquinolones (1 CE Hour)
November – TBA – Cervical Artery Dissection (5 CE Hours)
December – TBA – Cervical Artery Dissection 5 CE Hours)

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The associated injury, herniation, and management of the intervertebral disc requires advanced chiropractic training to manage, improve outcomes and reduce clinical risk.

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Chiropractors' Guide to MRI Interpretation (1 CE Hour)
Injury and the IVD (1 CE Hour)
Disc Herniation and Spinal Stenosis (3 CE Hours)
The Facet Syndrome (3 CE Hours)
Clinical Risk Management: Informed Consent (1 CE Hour)

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Choose 3 CE Hours from the following:

July 2, 2024 – Modic Changes (1 CE Hour)
August 6, 2024 – IVD Trauma and Annular Tears (1 CE Hour)
September 3, 2024 – IVD Protrusions and Extrusions (1 CE Hour)
October 1, 2024 – The Post-Surgical IVD (1 CE Hour)
November – TBA – The IVD (5 CE Hours)
December – TBA – The IVD (5 CE Hours)

Once you have completed the required 10 CE Hours, click on the tab below, download, complete, and email the IVD Certification Application to:
info@postgraddc.com

Click Here for More Information and the IVD Certification Application

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The PostGradDC Certifications

The PostGradDC Certifications

- We are building a series of **PostGradDC Certifications**
- Our coursework is approved by the **American College of Chiropractic Orthopedists**, and the **International Academy of Neuromusculoskeletal Medicine** and **PACE**.
- Each certification will entail **10 CE hours** of designated coursework.
  - 7 CE Hours of Recorded ONLINE coursework;
  - 3 CE Hours of LIVE Grand Rounds Webinars.

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Upcoming Grand Rounds Schedule

The First Tuesday of the Month at 8PM EST

Upcoming Rounds

- **June 4, 2024** – Medically Caused CAD: Fluoroquinolones
- **Additional live qualifying CAD classes will be available at the end of the year.**

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Thank you!

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Credit and Certification

- **You must complete the Class Survey** to receive your Certificate of Completion and license renewal credit (for those doctors practicing in PACE approved states).
  - Go to PostGradDC.com, log onto your account, go to **My Account** and click on the class.
  - **Complete the survey.** Your Certificate of Completion will be generated and accessible in a PDF format.
- **To achieve PostGradDC CAD Certification**, complete the requisite classes listed on our Certification page and submit your form for processing.

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