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Grand Rounds: Spontaneous 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

Educator

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

Honors

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

Publications


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

Editorial

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

Community

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




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What is Our Purpose?

- **To Detect a Spontaneous Event.**
 - Difficult and at times impossible.
- **To Refer and Communicate with Emergency Medical Personnel ASAP.**

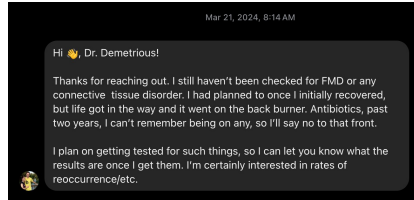


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An Unpredictable and Spontaneous Event...



- **Associated cause?**
- **Could anyone predict this event?**
- **What Standard of Care could predict this event?**
 - IC, Hx, Exam, Office Notes?
- **Detect, Emergent Referral and Communicate.**

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Spontaneous

spontaneous

adjective
US 🇺🇸 /sponˈteɪ.ni.əs/ UK 🇬🇧 /sponˈteɪ.ni.əs/

spontaneous adjective (NO OUTSIDE CAUSE)

BIOLOGY, MEDICAL - specialized

happening, especially in a living thing, without being caused by something outside, or without the organism's control:

- *Since spontaneous remissions are common in rheumatoid arthritis, it is impossible to attribute them to any particular therapy.*
- *Spontaneous maturation is when meiosis continues without hormonal stimulation.*

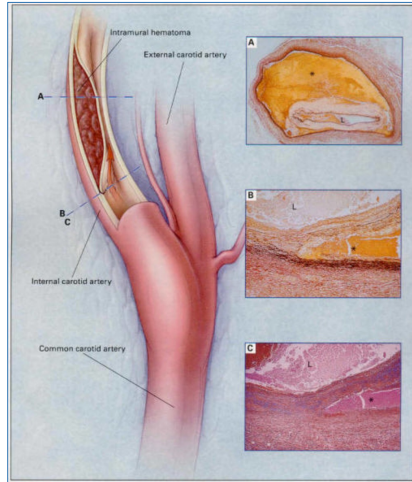
- Fewer examples

- *It is estimated that spontaneous tendon ruptures occur in about one in 100,000 people.*
- *Although about 15 percent of cases are inherited, the vast majority appear to be spontaneous genetic mutations.*
- *The bacterium is capable of spontaneous movement.*
- *The delivery was spontaneous, rather than an induced or Caesarean birth.*



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Spontaneous and Unpredictable Events



In the case of stenosis, sluggish blood flow distal to the dissection results in the formation of fibrin clot. The clot continues to enlarge and eventually breaks off to travel and dislodge downstream as an embolus.

Above Figure: Pathological Findings in a 37-Year-Old Woman with a Dissection of the Internal Carotid Artery. Photomicrographs of the right extracranial internal carotid artery (Panels A, B, and C) show a dissection within the outer layers of the tunica media, resulting in stenosis of the arterial lumen (L). The rectangles outlined in blue on the left indicate the sites of the photomicrographs. The intramural hemorrhage (asterisk) extends almost entirely around the artery (Panel A) (van Gieson's stain, x4). Higher-power views of the internal carotid artery at the point of dissection show fragmentation of elastic tissue (Panel B) (van Gieson's stain, x25), with the accumulation of pale ground-glass substance in the tunica media, indicated by the blue-staining mucopolysaccharides (Panel C) (Alcian blue, x25). These changes are consistent with a diagnosis of cystic medial necrosis. From Schievink et. al, Current Concepts: Spontaneous Dissection of the Carotid and Vertebral Arteries, NEJM, 344 (12): 898, Figure 1, March 22, 2001.



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Spontaneous



spontaneous [spon-tey-nee-uhs] [SHOW IPA](#)  

See synonyms for: [spontaneous](#) / [spontaneously](#) on Thesaurus.com

adjective

1. coming or resulting from a natural impulse or tendency; without effort or premeditation; natural and unconstrained; unplanned:

In a scientific context, *spontaneous* is used to describe effects that happen independently, without being acted on by outside forces. The most well-known example of its use in this sense is in the term [spontaneous combustion](#), in which something catches on fire due to an internal chemical reaction (as opposed to external [ignition](#)).

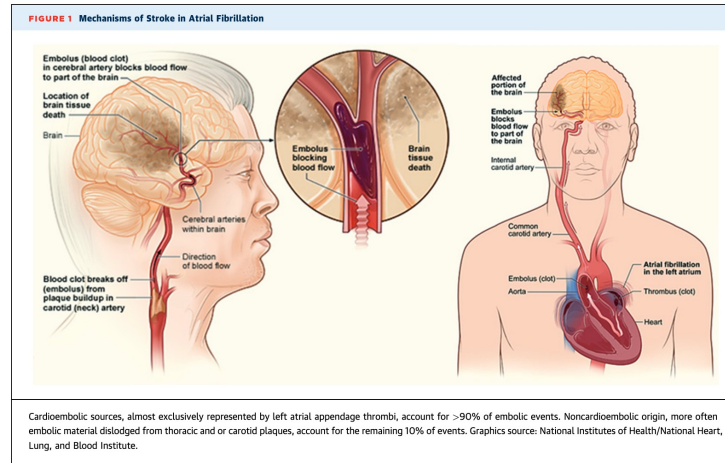


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Spontaneous and Unpredictable Events



J Am Coll Cardiol 2015; 65:281–94

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Spontaneous

BRITISH DICTIONARY DEFINITIONS FOR SPONTANEOUS

spontaneous / (spon'teinəs) /

adjective

1. occurring, produced, or performed through natural processes without external influence: *spontaneous movement*

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Spontaneous and Unpredictable Events

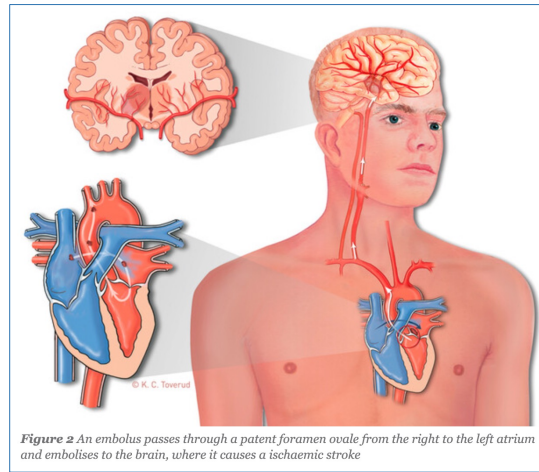


Figure 2 An embolus passes through a patent foramen ovale from the right to the left atrium and embolises to the brain, where it causes a ischaemic stroke

Tidsskr Nor Lægeforen 2014. 134: 180-4

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CAD...An Extremely Difficult DDX

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Acute hypoglycemia • Carbon monoxide toxicity • Cervical fracture • Cluster headache • Hemorrhagic stroke • Herpes simplex • Herpes zoster • Ischemic stroke | <ul style="list-style-type: none"> • Migraine headache • Neck Trauma • Retinal artery occlusion • Retinal vein occlusion • Subarachnoid hemorrhage • Tension headache • Transient ischemic attack • Vertebral artery dissection |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Carotid dissection is a rare disease, and it is an extremely difficult diagnosis to make.

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CAD...An Extremely Difficult Diagnosis

INTERNATIONAL STROKE CONFERENCE 2023 POSTER ABSTRACTS
SESSION TITLE: RISK FACTORS AND PREVENTION POSTERS II

Abstract TP165: Missed Diagnosis In Cervical Artery Dissection: A Single Center Cohort Study

Mary Penckofer, James Siegler, Nicholas Vigilante, Scott Kamen, Linda Zhang, Emma Frost, Manisha Koneru, Solomon Oak and Renato Oliveira

Originally published 2 Feb 2023 | https://doi.org/10.1161/str.54.suppl_1.TP165 | Stroke. 2023;54:ATP165

Conclusions: 27% of patients with nontraumatic CAD were misdiagnosed at first presentation. Misdiagnoses may be more common in younger persons with less pre-existing disability, and those with nonspecific symptoms such as dizziness and neck pain. Larger studies are needed to provide more precision in estimates of association.



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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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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

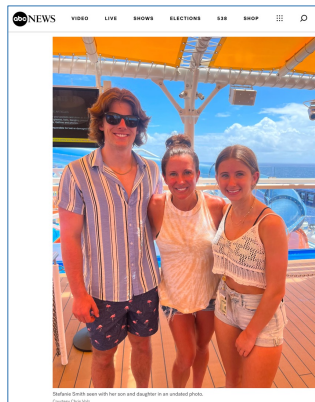


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Challenges to Avert Tragedy?



A forensic pathologist contacted Smith's family on Wednesday to tell them Smith died from a carotid artery dissection in her neck, Volz said.

- **Does a Reasonable Standard of Care Exist?**

- Lacking apparent cause;
- Common symptoms and conditions;
- Transient and variable symptoms and signs;
- Unknown, undiagnosed, and undisclosed pre-existing risk factors;
- Asymptomatic presentations;
- Unpredictable;
- Temporal delay and spontaneous thromboembolism that are unpredictable;
- Complex and unconfirmed causality;
- Patient non-compliance;
- Rare events - most DC's will never see it.



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Grand Rounds


Our Grand Rounds Format:

- Case Presentation
- Topical Considerations
- Supportive Research
- Lessons
- Interactive Discussion.

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Today's Case

Journal of Chiropractic Medicine (2015) 14, 183–190

 ELSEVIER

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Topics in Diagnostic Imaging

Chiropractic Response to a Spontaneous Vertebral Artery Dissection

Gary Tarola DC^a, Reed B. Phillips DC, PhD^{b,*}

^a Private Practice, Lehigh Valley Medical Network, Allentown, PA
^b Adjunct Faculty, Southern California University of Health Sciences, Whittier, CA

Received 28 March 2015; received in revised form 13 October 2015; accepted 13 October 2015






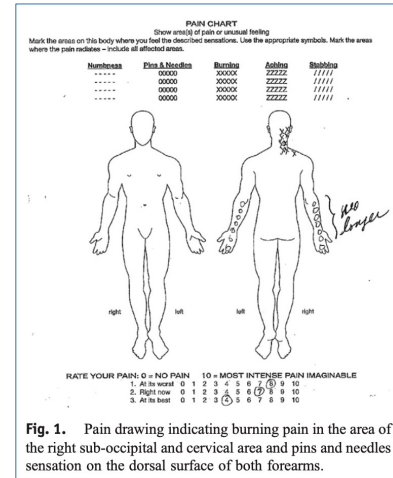
Fig. 3. MRA neck image. Fat suppressed axial T1 weighted imaging of the neck utilizing IDEAL technique (Iterative Decomposition of water and fat with Echo Asymmetry and Least squares estimation) reveals high signal within the wall of the V2 segment of the right vertebral artery compatible with intramural hematoma. (Color version of figure appears online.)

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Tarola and Phillips

• Chief Complaint:

- **Constant burning pain** in the right side of her neck and shoulder with a limited ability to turn her head from side to side.
- **Periods of blurred vision and muffled hearing** since the onset of symptoms, which began at 9:30 AM on the same day.
- Immediate onset of symptoms started after she lifted a patient's legs onto the operating table.
- At onset, there was **dizziness, spots in her field of vision, and a partial loss of balance that resulted in a walk that listed to the right.**
- **No** nausea or vomiting.
- **Dizziness, visual and auditory disturbances, and balance difficulty abated** within 1 hour of onset and were not present at the time of evaluation.
- The patient reported that she had "[taken] some **ibuprofen** and a little later some valium and left work early." The patient denied any prior symptoms of this nature.
- The Neck Disability Index score of 44 placed the patient's **pain in the most severe category.**



Journal of Chiropractic Medicine (2015) 14, 183–190

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Tarola and Phillips

• History:

- There was **no family history** of any significant disease or condition.
- She had no known allergies and **was taking ethinyl estradiol and levonorgestrel**, for birth control and diazepam for pain.
- The patient had **never been to a chiropractor** prior to this event.
- The patient reported **smoking 2** cigarettes per day, drinking 1 cup of coffee and tea per day and using alcohol "socially."
- The date of her last menstrual period was July 17 to July 21, 2013, and she stated that she was **not pregnant.**
- She had no history of cancer and no significant weight change over the last year.
- She presented with **mild scoliosis in the lumbar and thoracic regions.**

Journal of Chiropractic Medicine (2015) 14, 183–190

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Tarola and Phillips

- **Examination:**

- The patient was 5' 10" in height, weighed 145 lb, and had a body mass index of 21, a blood pressure of **118/78**, and a pulse rate of 70 beats per minute.
- Her walking was normal with no drifting or abnormal gait.
- Her **cervical range of motion exhibited limitations** in flexion (40/45), extension (10/30), right lateral flexion (20/40), left lateral flexion (30/40), right rotation (40/80), and left rotation (60/80).
- Her eyes, ears, nose, throat, and heart were normal.
- A cervical compression test was negative for aggravation of the symptoms, cervical distraction decreased the pain, and Spurling test reproduced the localized neck pain, particularly in the upper right cervical area, **but no dizziness occurred**.
- There was no nystagmus. The deep tendon reflexes, sensations, and muscle strengths of the upper extremities were normal. **Cranial nerves 2 to 12 were normal**. There were no long tract signs.
- **Palpable tenderness, tension**, and edema were noted in the upper right cervical region, and mild scoliosis was noted in the lumbar/thoracic region.

Journal of Chiropractic Medicine (2015) 14, 183–190



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Tarola and Phillips

- **DDX:**

- A working diagnosis of ICD-9 codecs 723.1 (cervicalgia) and 737.3 (scoliosis) were entered into the patient's record.
- Based on the patient's age, sudden nontraumatic onset of severe upper neck pain and headache and transient neurological symptoms that included visual and auditory disturbances, dizziness, and mild ataxia, the **index of suspicion was raised for the possibility of spontaneous vertebral or carotid artery dissection**.
- These symptoms may also be observed in some patients with migraine headaches and viral infections.

Journal of Chiropractic Medicine (2015) 14, 183–190



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Tarola and Phillips

● Management:

- The patient was not treated on the initial visit on the 22nd of July. The chiropractic physician advised her of the possibility that a vertebral artery or carotid artery dissection caused reduced blood flow to the brain.
- The patient was provided a recommendation that she attend the Emergency Department (ED) for immediate evaluation.
- The patient declined, and said she decided to go home and rest.
- She was urged to go to the ED immediately if any of her neurological symptoms returned, and she was taken home by her husband.
- She was given a follow-up appointment on the following day for reassessment.

Journal of Chiropractic Medicine (2015) 14, 183–190

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Tarola and Phillips

● Management:

- On the July 23, 2013, the patient returned feeling better with only minor right-side upper neck pain without recurrence of the neurologic symptoms.
- On examination, she exhibited mild tenderness of the right upper cervical area, and Spurling's test reproduced the mild right upper cervical pain.
- With both subjective and objective improvements, the initial symptoms were thought to have been due to vasovagal effect, and the continuing neck pain was likely mechanical/myofascial in nature.
- Treatment consisted of myofascial release and mild distraction and mobilization techniques, which provided some relief.
- Again, she was advised to go directly to the ED if any of her previous symptoms reoccurred.
- She was scheduled for another follow-up 2 days later.

Journal of Chiropractic Medicine (2015) 14, 183–190

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Tarola and Phillips

● Management:

- On July 24, 2013, the chiropractic physician sent a report to the referring cardiothoracic surgeon and a copy to her primary care physician (PCP) that outlined his findings, diagnostic suspicions, and patient management plan.
- The patient returned to the chiropractic physician on July 25, 2013. She continued to complain of pain of varying intensity in the right upper cervical area.
- She denied the return of dizziness, sensory problems, visual/auditory disturbances, or coordination difficulties but stated that she simply did not feel right.
- On renewed suspicion of vertebral or carotid artery dissection, the chiropractic physician ordered an MRI and magnetic resonance angiography (MRA) of the brain and MRA of the vertebral and carotid arteries at the hospital's Imaging Center, due to the acute onset of the right neck and head pain with transient dizziness and visual, auditory, and balance disturbances to rule out arterial dissection.

Journal of Chiropractic Medicine (2015) 14, 183–190



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Tarola and Phillips

● Management:

- On July 25, 2013, at 8 PM, the patient reported to the LVHN Imaging Center.
- An MRA of the neck and carotid arteries was obtained using 3D time-of-flight and gadolinium-enhanced imaging.
- The common carotid and cervical internal carotid arteries were normal.
- The left vertebral artery was hypoplastic and appeared to terminate at the left posterior inferior cerebellar artery. There was an abrupt moderately long segment of narrowing involving the right vertebral artery beginning near the junction of the V1 and V2 segments.
- The radiologist noted a concern regarding right vertebral artery dissection.

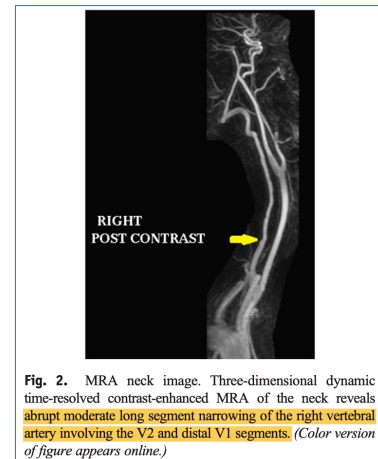


Fig. 2. MRA neck image. Three-dimensional dynamic time-resolved contrast-enhanced MRA of the neck reveals abrupt moderate long segment narrowing of the right vertebral artery involving the V2 and distal V1 segments. (Color version of figure appears online.)

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Tarola and Phillips

● Management:

- The radiologist called the chiropractic physician at approximately 11 PM to inform him of these findings.
- The patient was put on the phone, and the chiropractic physician instructed her to go immediately to the ED.
- The chiropractic physician phoned the ED in advance to advise the attending physician of her arrival.

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Tarola and Phillips

● Management:

- At 11:26 PM on July 25, the patient went directly from the hospital imaging center to the emergency department and was admitted.
- The ED record noted the following: "Patient presented to the chiropractor with upper neck pain and some neurological symptoms... 3 days ago.
- The chiropractor advised her to go to the ED that day, but the patient declined (because she felt her symptoms were improving)."
- The record also noted that "on Monday afternoon, saw chiropractor, but did no manipulations."
- At 12:12 AM on July 26, she spoke with the neurologist on call who recommended a computed tomographic (CT) angiogram to confirm the vertebral artery dissection (VAD) and gave low-dose aspirin for blood thinning.

Journal of Chiropractic Medicine (2015) 14, 183–190



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New Research from the Mayo Clinic

Stroke

 Check for updates

CLINICAL AND POPULATION SCIENCES

Epidemiology of Spontaneous Cervical Artery Dissection: Population-Based Study

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

BACKGROUND: Cervical artery dissection (CeAD) represents up to 15% to 25% of ischemic strokes in people under the age of 50 years. Noninvasive vessel imaging is increasingly used in clinical practice, but the impact on the frequency of detection of CeAD is unknown. In 2006, the yearly incidence rate of CeAD was estimated at 2.6 per 100 000 person-years, but the current incidence is unknown.

METHODS: In this population-based retrospective observational cohort study, we utilized the resources of the Rochester Epidemiology Project to ascertain all adult residents of Olmsted County, MN, diagnosed with internal carotid artery dissection and common carotid artery dissection or vertebral artery dissection from 2002 to 2020. Patients with only intracranial involvement or CeAD following major trauma were excluded. Age-adjusted sex-specific and age- and sex-adjusted incidence rates were estimated using the US White 2010 decennial census, with rates expressed per 100 000 person-years. We assessed longitudinal trends by dividing the data into 5-year time intervals, with the last being a 4-year interval.

RESULTS: We identified 123 patients with a diagnosis of CeAD. There were 63 patients with internal carotid artery dissection, 54 with vertebral artery dissection, 2 with concurrent internal carotid artery dissection and vertebral artery dissection, and 4 with common carotid artery dissection. There were 63 (51.2%) female patients and 60 (48.8%) male patients. The average age at diagnosis was 50.2 years (SD, 15.1 [95% CI, 20.1–30.5] years). The incidence rate of spontaneous CeAD encompassing all locations was 4.69 per 100 000 person-years (2.43 for internal carotid artery dissection and 2.01 for vertebral artery dissection). The incidence rate increased from 2.30 per 100 000 person-years from 2002 to 2006 to 8.93 per 100 000 person-years from 2017 to 2020 (P<0.0001). The incidence rate for female patients rose from 0.81 per 100 000 person-years from 2002 to 2006 to 10.17 per 100 000 person-years from 2017 to 2020.

CONCLUSIONS: The incidence rate of spontaneous CeAD increased nearly 4-fold over a 19-year period from 2002 to 2020. The incidence rate in women rose over 12-fold. The increase in incidence rates likely reflects the increased use of noninvasive vascular imaging.

GRAPHIC ABSTRACT: A graphic abstract is available for this article.

Key Words: adult ■ arteries ■ dissection ■ epidemiologic studies ■ incidence ■ neck pain ■ stroke

Affiliations

Department of Neurology (K.J.G., R.D.B., Z.K.) and Department of Quantitative Health Sciences (W.S.H., J.M.), Mayo Clinic, Rochester, MN.

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



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Epidemiology of sCeAD

- Cervical artery dissection (CeAD) is an **uncommon cause of ischemic stroke**.
- However, in adults **under the age of 50 years**, CeADs represent up to **15% to 25% of ischemic strokes**.
- In a **19-year** period from 2002 to 2020, 262 records were manually screened...and **123 residents with a diagnosis of CeAD** were identified in Olmsted County.

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



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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.

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Epidemiology of sCeAD

• Pre-Existing Co-Morbidities:

- 39.8% were current or former smokers;
- hypertension (35.8%),
- hyperlipidemia (36.6%), and
- migraine headaches (37.4%);
- family history of dissection was noted in 3 patients. 7 patients had either a previous diagnosis of fibromuscular dysplasia or received a diagnosis during the evaluation for CeAD.
- 1 patient carried the diagnosis of Ehlers-Danlos type IV at the time of diagnosis.

Of note, medical providers did not consistently document examination for stigmata of connective tissue disease such as hyper-extensibility, previous joint dislocations, or congenital abnormalities, so we are unable to report these.

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Imaging Characteristics

- **Imaging Modalities:**
 - 22.8% of patients had **arterial occlusion** at presentation,
 - 78.0% had at least **some degree of stenosis**. This includes 30.1% of patients who presented with the classic constant **tapering stenosis** characteristic of dissections.
 - 23.6% of patients had **dissecting pseudoaneurysm** at the time of diagnosis.

Table 2. Imaging Modality Used in Diagnosis and Imaging Features at Presentation

	ICAD	VAD	Total CeAD
Modality used in diagnosis			
Angiogram	8 (12.7)	2 (3.7)	10 (8.1)
MRA	37 (58.7)	28 (51.9)	66 (53.7)
MRI	19 (30.2)	22 (40.7)	42 (34.2)
CTA	32 (50.8)	34 (63.0)	71 (57.7)
Carotid ultrasound	0 (0)	1 (1.85)	2 (1.6)
Dissection characteristics			
Intramural hematoma on T1 fat-saturated MRI	17 (27.0)	13 (24.1)	31 (25.2)
Tapering stenosis	39 (61.9)	33 (61.1)	76 (61.8)
Dissecting pseudoaneurysm	21 (33.3)	5 (9.3)	29 (23.6)
Intraluminal thrombus	5 (7.9)	2 (3.7)	7 (5.7)
Degree of stenosis			
none	16 (25.4)	10 (18.5)	27 (22.0)
<50%	15 (23.8)	10 (18.5)	26 (21.1)
50%–70%	8 (12.7)	5 (9.3)	14 (11.4)
>70%	12 (19.0)	13 (24.1)	28 (22.8)
Occlusion	12 (19.0)	16 (29.6)	28 (22.8)

CeAD indicates cervical artery dissection; CTA, computed tomography angiography; ICAD, internal carotid artery dissection; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; and VAD, vertebral artery dissection.

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



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Imaging Characteristics

#	Age	Sex	Dissection Location	Reason for imaging
1	47	Female	left ICAD	episodes of bilateral cheek paresthesias accompanied by a feeling of anxiety
2	73	Female	right ICAD	dizziness without room-spinning
3	56	Male	right ICAD	stroke in the posterior circulation
4	48	Male	left ICAD	spell of unresponsiveness with a history of psychogenic non-epileptic events
5	70	Female	left VAD	surveillance of transverse sigmoid dural AV fistula
6	89	Male	left ICAD	right frontal strokes after a hypoperfusion event after carotid massage
7	72	Male	right CCAD	generalized weakness and gait abnormalities in a patient with myasthenia gravis
8	62	Male	left ICAD	right-sided amaurosis fugax with symptomatic contralateral ICA
9	37	Female	right ICAD	brain fog with a history of menstrual migraines
10	71	Female	left VAD	unspecified encephalopathy that resolved within a few hours
11	90	Male	left ICAD	stertor and abnormal upper airway sounds
12	70	Female	both VAD and ICAD	lip laceration with history of ground-level falls in the setting of progressive supranuclear palsy
13	67	Male	right ICAD	episodic nausea
14	56	Male	left CCAD	dysarthria with a history of tonsillar squamous cell carcinoma status post remote radical tonsillectomy and radiation
15	81	Male	right ICAD	toxic-metabolic encephalopathy in the setting of dialysis and opioids; CTA obtained as part of a triple rule out
16	65	Male	left VAD	vertigo and tinnitus with formal diagnosis of Meniere's disease following previous episodes
17	47	Female	left ICAD	lightheadedness in the setting of viral illness and hyponatremia
18	67	Female	right VAD	post-op agitation
19	77	Female	bilateral ICAD	part of a research study

Supplemental Table 1. Summary of patients with CeAD considered to be found incidentally.

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Outcomes

- **Favorable Outcomes:**

- A good clinical outcome was achieved in 88.7% of patients.

- **Recurrence:**

- Recurrent strokes or TIAs occurred in 10 (8.1%) patients.
- Recurrent dissection occurred in 10 patients (8.1%),
 - 1 involving the same site of the original dissection (8 symptomatic and 2 asymptomatic).
 - Out of the 10 patients with recurrent dissection,
- 2 carried the diagnosis of fibromuscular dysplasia and 1 carried the diagnosis of Ehlers-Danlos type IV.
- 1 had a recurrent dissection 5 years after the initial presentation.

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Discussion

- **Incidence rate:**

- Our study shows an increase in the incidence rate of detection of CeAD from **2.30 per 100 000 person-years** to **8.93 per 100 000 person-years** over a 19-year period from 2002 to 2020, an increase of over 3-fold.
- This **trend likely reflects the increased use of non-invasive vascular imaging** in recent years, specifically computed tomography angiography.
- A recent study using Optum de-identified database of claims for beneficiaries of commercial and Medicare Advantage health plans reported an **increase in the use of neck CTA in the emergency department setting by 1300%** between the years 2007 and 2017.

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Imaging Characteristics

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Cervical Artery Dissection Epidemiology

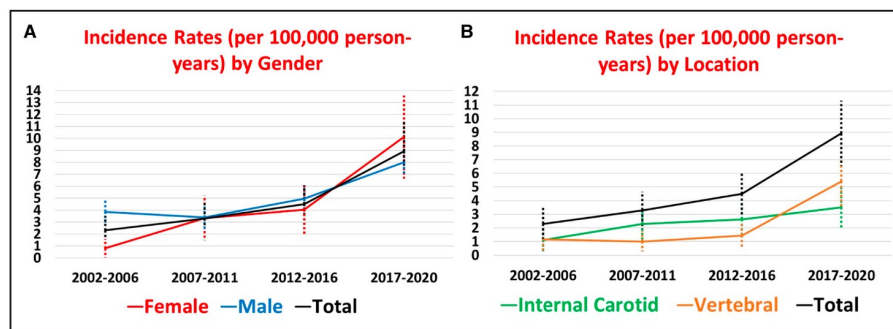


Figure 2. Incidence rates.

Incidence of cervical artery dissection over time (95% CI bands) by (A) sex and (B) dissection location relative to overall incidence rate.

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Discussion

● Important incidental findings:

- 15.5% of the patients in this study had acute or age-indeterminate dissections found incidentally on imaging that was obtained for indications as wide as altered mental status and generalized weakness.
- We are likely detecting more asymptomatic dissections.
- 31.8% of patients with ICAD and 44.4% of patients with VAD presented with ischemic stroke.

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Discussion

● Asymptomatic dissections:

- The percentage of asymptomatic CeAD may even be underestimated, as there were cases in which clinicians noted that the dissection was possibly unrelated to the headache or neck pain at presentation.
- It is possible that more patients with asymptomatic and potentially chronic CeAD are diagnosed more commonly with the increased use of CTA leading to a somewhat older cohort.

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Discussion

● Resolution:

- Most patients achieved favorable imaging outcomes, with 89.1% having near-complete or complete resolution of the initial stenosis or stability of imaging findings.
- 10 patients (8.1%) had recurrent dissection with a median time to reimaging of 90 days, including 1 in the same artery and location.

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What is the Reasonable Standard of Care...

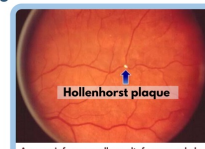
...for a spontaneous, transient event that may not be perceived, recognized or reported by the patient or their MD?

Amaurosis Fugax

refers to a transient ischemic attack of the retina.

Interruption of blood flow to the retina for more than a few seconds results in transient monocular blindness, a term used interchangeably with amaurosis fugax.

Patients describe a rapid fading of vision like a curtain descending, sometimes affecting only a portion of the visual field.



Amaurosis fugax usually results from an embolus that becomes stuck within a retinal arteriole.

Complete occlusion of the central retinal artery produces arrest of blood flow and a milky retina with a cherry-red fovea.

Emboli are composed of cholesterol (Hollenhorst plaque), calcium, or platelet-fibrin debris.

The most common source is an atherosclerotic plaque in the carotid artery or aorta, although emboli also can arise from the heart, especially in patients with diseased valves, atrial fibrillation, or wall motion abnormalities.

Source: Harrison 20th Ed



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Lessons...The Process of Informed Consent

James Demetrious, DC, DABCO

Diplomate, American Board of Chiropractic Orthopedics
4837 Carolina Beach Road, Suite 205 • Wilmington, NC 28412 • Telephone: 910-790-8020

Informed Consent Document

Patient's Name:

It is our goal to help you to the best of our ability. Please read this entire document before signing it. It is important that you understand the information contained in this document. Please ask questions before you sign if there is anything unclear.

What to Expect

With your permission, Dr. Demetrious will carefully assess your health. He will talk with you about your health history, examine you, and consider and order necessary tests based on standards of practice and his clinical experience. He will develop a differential diagnosis and make care recommendations. With your consent, he will provide you care to the best of his ability.

Chiropractic Care

The primary treatment offered by Dr. Demetrious is chiropractic adjustments. He may use his hands or a mechanical instrument upon your body in such a way as to move your joints. That may cause a "pop" or "crack" sensation. You may feel a sense of movement. If you feel discomfort with any adjustment, please inform Dr. Demetrious.

The most common side effect of chiropractic care is soreness and stiffness following the first few days of treatment. Sometimes patients experience headaches. This is usually short term discomfort that is followed by relief.

Risks Inherent to Chiropractic Care

Disc herniations, pinched nerves, arthritic change, and spinal biomechanical issues are very common in many people. Many patients without symptoms have these problems and they aggravate their

conditions through their activities of daily living causing them to seek chiropractic care.

Rarely complications from chiropractic care include but are not limited to fractures, disc injuries, dislocations, muscle strain, spinal cord injury, rib, and joint pain. Arterial dissections and strokes are rare and can lead to death and paralysis. The most current research reveals that chiropractic care does not cause arterial dissections or strokes and further research is necessary. It has been reported that patients with arterial dissections experience neck pain, headache, and neurologic symptoms that cause them to seek chiropractic care. We do our best to ensure that you do not have a developing dissection or stroke.

Please inform us of any risk factors or health issues before and during your care:

- Connective tissue disorder, loose joints, Ehlers-Danlos, or Marfan syndrome?
- Recent head or neck trauma?
- Worst headaches of your life?
- Elevated homocysteine?
- Recent infections?
- Pharmacologic medication in the past (Cipro, Levofloxacin, Levofloxacin, Nitrofurantoin, Augmentin, etc.)?
- Double hearing or blurred vision?
- Osteoporosis?
- Difficulty walking, difficulty swallowing?
- Nausea?
- Numbness or loss of sensation?
- Change in bladder or bowel function?
- Weakness of face, arm, or leg?
- Difficulty walking?
- Atrial fibrillation or atrial septal defect?
- Coagulation disorder or medicine?
- Past history of rib or chest injury or pain?
- Osteoporosis or osteomyelitis?
- Have you been diagnosed with cancer?

Please inform us of all medical procedures and medications you have taken in the past year:

I will instruct my medical providers to send this office my medical records and inform Dr. Demetrious of my health history.

Medical Referral

Dr. Demetrious strongly suggests that you advise your primary medical practitioners that you are seeking chiropractic care for your complaint. He may refer you to your medical doctor or other practitioners who may offer alternative care. Please advise Dr. Demetrious of any hospitalizations, changes in treatment, medication, or surgeries.

Underlying medical issues may not be initially apparent or may seem to be a rheumatological problem that does not. Heart problems, kidneys, infections, fractures, cancer, etc., can cause spinal pain. Sometimes, these problems are very difficult to diagnose early on. Symptoms may be very slight and may not be severe enough to warrant testing or referral.

I will honestly and regularly inform the doctor of new symptoms, and worsening symptoms, and let him know if you are not progressively improving. If you have an underlying condition and discontinue care without consulting Dr. Demetrious, he may not be able to provide you with proper medical referrals.

Discontinuing Care

If you decide to discontinue care in our office, please advise Dr. Demetrious. You may have a more severe condition that is not responding and may require further medical care and he will make medical referrals specific to help you.

Reporting New Problems

If you experience any new injury, illness, medical care, medication, surgery, or any other changes in your medical history, please inform Dr. Demetrious.

Home Care

Dr. Demetrious may make recommendations for activities of daily living, and home exercises. If any

recommendation produces discomfort during or after activities, please stop immediately and discuss your concerns with Dr. Demetrious.

Consent to Treat Minor

I hereby request and authorize Dr. James Demetrious to perform diagnostic tests and render chiropractic adjustments and other treatments to my minor son/daughter.

Consent

I have read the above explanation of chiropractic care and related treatment. I have discussed it with Dr. Demetrious and have had my questions answered to my satisfaction. By signing below, I state that I have weighed the risks involved in undergoing treatment and have decided that it is in my best interest to undergo the treatment recommended. Having been informed of the risks, I hereby give my consent to examinations and treatment:

Date: _____

Patient's Signature: _____

Doctor's Signature: _____

Signature of Parent or Guardian: _____

Frankly convey:

- ~9 young people of 100,000 may have CADs due to complex pre-existing risk factors.
- ~25% may have a stroke
- These spontaneous events are unpredictable and occur with or without identifiable cause.

This Document is a work in progress. Improvements are necessary.



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Discussion

- CADs represent a global public health issue.
- Chiropractors are uniquely qualified to identify burgeoning CADs and related strokes.
- Education and Communication are vital to save lives.
- Standard of care is a legal term that is based on practices that are taught and employed based on research that is continually evolving.
- Inappropriate association of CAD to chiropractic by plaintiffs and in poorly written publications pose an existential threat to the chiropractic profession.



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Advanced Certification

Protecting patients.

Protecting your family, practice, and profession.

Professional development.

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Elevate yourself. Protect your patients, practice and family. PostGradDC CE is approved by the ACCO, the IANM (MOC), NCMIC, and PACE. Complete 10 CE Requisite Hours (7 ONLINE + 3 LIVE) to Achieve PostGradDC Certifications.

The CAD-DDX Certification®

Cervical Artery Dissections are rare events that can have tragic outcomes. CAD can be nearly impossible to identify. To protect the public interest, we offer this advanced certification.

ONLINE RECORDED CLASSES
Choose **2 CE Hours** from the following:
 Clinical Risk Management: CAD (0 CE Hour)
 CAD: Diagnosis (2 CE Hour)
 CAD: Risk Factors (0 CE Hour)
 CAD: Due to Fluoroablations (2 CE Hour)
 Differential Diagnosis (0 CE Hour)
 Clinical Risk Management: Informed Consent (0 CE Hour)

LIVE ZOOM Classes
Choose **3 CE Hours** from the following:
 April 2, 2024 - Spontaneous VAD (0 CE Hour)
 May 3, 2024 - Neurologic Cervical Due to VAD (0 CE Hour)
 June 4, 2024 - Medically Caused CAD: Fluoroablations (0 CE Hour)
 November - TBA - Cervical Artery Dissection (5 CE Hour)
 December - TBA - Cervical Artery Dissection (5 CE Hour)

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

[Click Here for More Information and the CAD Certification Application](#)

The IVD Certification®

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

ONLINE RECORDED CLASSES
Choose **2 CE Hours** from the following:
 MRI of Herniated Disc, Stenosis and Radiculopathy (0 CE Hour)
 Chiropractic: Guide to MRI Interpretation (0 CE Hour)
 Injury and the IVD (0 CE Hour)
 Disc Herniation (and Spinal Stenosis) (0 CE Hour)
 The Facet Syndrome (0 CE Hour)
 Clinical Risk Management: Informed Consent (0 CE Hour)

LIVE ZOOM Classes
Choose **3 CE Hours** from the following:
 July 2, 2024 - Medic Changes (0 CE Hour)
 August 6, 2024 - IVD Trauma and Annular Tears (0 CE Hour)
 September 3, 2024 - IVD Protrusions and Extrusions (0 CE Hour)
 October 3, 2024 - The Post-Surgical IVD (0 CE Hour)
 November - TBA - The IVD (0 CE Hour)
 December - TBA - The IVD (0 CE Hour)

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

- **May 7, 2024** - Neurologic Deficits Due to VAD
- **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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Let's Study Harder to Protect Our Patients...



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Thank you!



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- **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.