Challenges in Management of Symptomatic Carotid Artery Disease in Cancer Patients

Mini George, DNP, FNP-C, RNFA
Thoracic and Cardiovascular Surgery

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center
Making Cancer History®

Disclosures

- Mini George, DNP, FNP-C, RNFA has no financial relationships with commercial interests to disclose
- Silk Road medical (TCAR) Video used with permission.
- No discussion of off label devices or products or commercial endorsements.
- Opinions are from my own personal experiences and does not represent any official committee or societal endorsements.

Carotid Artery Disease Management

Objectives

- Describe the pathophysiology of carotid artery disease (CAD) and how to interpret common diagnostic studies to identify CAD.
- Differentiate treatment guidelines for symptomatic CAD and the optimal medical management of symptomatic CAD
- Recognize specific concerns of cancer patients with CAD

Worry About Carotid Artery Disease?

- Carotids - provide 80% blood flow to brain
- Carotid atherosclerosis - 10-20% of ischemic strokes
- Carotid atherosclerosis can start as early as 20 years
- Carotid screening is not recommended for asymptomatic patients

(USPTF, 2021)

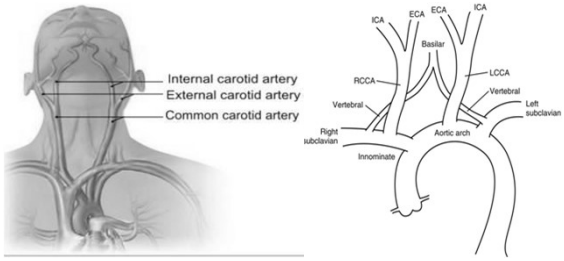
Current Statistics

- Aging population - increasing stroke risks
- Stroke genetic loci - share genetic association with BP
- Women consuming >2 artificially sweetened beverage daily - increased risk of stroke (AHA-2020)
- Globally in 30-79 years old, carotid artery thickening - 27.6%

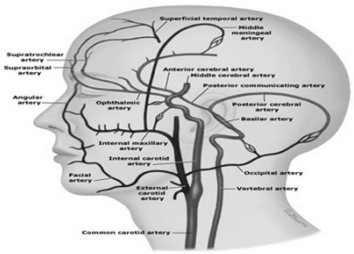
Cost of Carotid Atherosclerosis

- Direct cost of Stroke - $35 billion annually
- Alteplase 100 mg - $6400
- DRG 559 (Ischemic Stroke) CMS hospital reimbursement - $11578
- Carotid Stenting - $13539+/- 5590
- Carotid Endarterectomy - $16422+/-7414
- TCAR - $23278+/- 7303
- Carotid Duplex - $220-1500

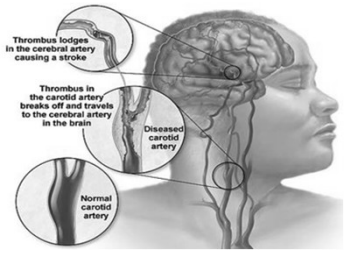
Carotid Anatomy - Brief Overview



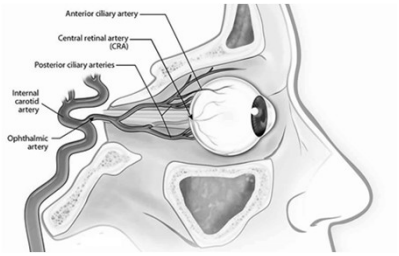
Carotid Artery Distribution



Carotid Circulation - On Cerebral Ischemia

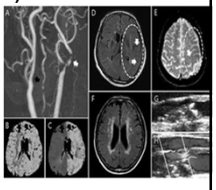


Carotid Anatomy in Amaurosis Fugax



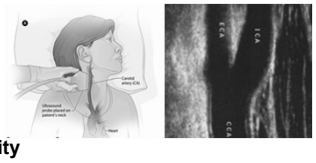
Carotid Artery Disease Evaluation

- Carotid Artery Ultrasound Duplex Study (CDUS)
- Computed Tomography Angiography (CTA)
- Magnetic Resonance Angiography (MRA)

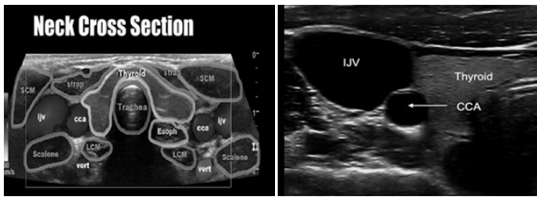


Carotid Artery Duplex Ultrasound

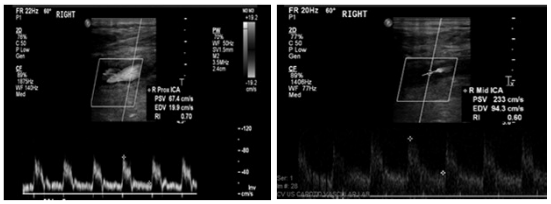
- Sound waves
- B - mode and Pulse wave
- Low cost, no risks
- High sensitivity and specificity
- Technician and interpreter related



Duplex Evaluation - Anatomical View



Duplex Evaluation



Ultrasound Lab Report

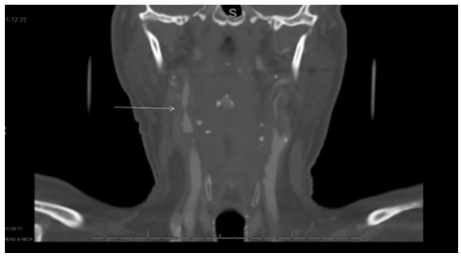
FINDINGS:

Left And Right Carotid Artery Velocities (cm/sec)

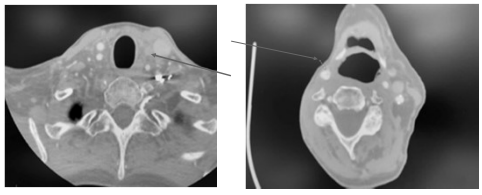
	PSV	EDV	PSV	EDV
CCA, proximal	107	13	114	27
CCA, mid 65	14	82	23	
CCA, distal 59	14	89	18	
ICA, proximal	55	16	94	22
ICA, mid **105**	30	**107**	32	
ICA, distal **248**	18	82	27	
ECA 95	37	90	18	
Vertebral artery	64	20	0	0
ICA/CCA ratio	**1.6**		**1.3**	

CCA - Common Carotid Artery, ICA - Internal Carotid Artery, ECA - External Carotid Artery, PSV - Peak Systolic Velocity, EDV - End Diastolic Velocity

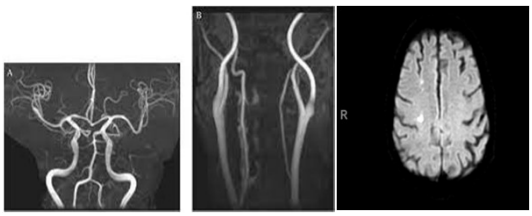
Computed Tomography Angiography (CTA)



Computed Tomography Angiography (CTA)



Magnetic Resonance Angiography (MRA)



Pop Quiz 1

67 y. o. male patient with colon cancer status post chemotherapy and surgery 3 years ago, now with no evidence of cancer came to your surveillance clinic.

While discussing about current health he said "when I was working in yard 3 days ago my left arm got weak for 2 minutes, but no issues now".

After enquiring a little more about history and his risk factors, which diagnostic test is appropriate to order first to rule out TIA?

a) CT Scan Head

b) MRI Neck and Brain

c) Carotid Duplex

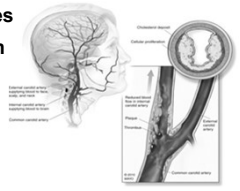
d) ECG

e) ECHO

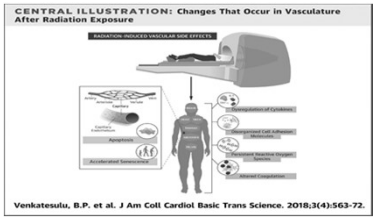
19

Atherosclerosis of Carotid Artery

- Hardening and thickening of arteries
- First step – endothelial dysfunction
- High level plasma LDL
- Inflammation at every step
- Interaction between genetics, risk factors, & coagulation disorders
- Concurrently seen in other arteries



Radiation-Induced Carotid Artery Disease



Atherosclerosis - Medical Management

- Antiplatelets - aspirin, clopidogrel
- HMG - CoA Reductase Inhibitor (Statins)
- Control Risk Factors
  - BP <140/90 mm Hg, keep diastolic <85, if diabetic
  - Smoking Cessation
  - Obesity Management
  - HbA1c < 7

Medicines And More!

- **Aspirin -** cyclooxygenase (COX) inhibitor
  prevent platelets from synthesizing thromboxane A_2
  potent vasoconstrictor, promoter of platelet aggregation.
- **Thienopyridines** (Clopidogrel, Prasugrel, Ticlopidine) - block ADP binding to platelet receptors and prevent platelet aggregation.
- **HMG-CoA Reductase Inhibitor** - cholesterol synthesis rate limiter, improve endothelial dysfunction, reduce inflammation and stabilize plaque.

Case Scenario

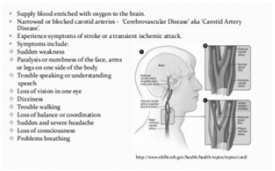
Mrs. Garza is 62 y/o female thin built Hispanic female who passed out two weeks ago, after her regular morning walk and regained full consciousness in 2 minutes. She went to the nearest hospital after the incident, found 85% blocked right internal carotid artery, and the cardiovascular surgeon recommended carotid surgery next week.

- **She is in the clinic asking a request for a second opinion to another doctor recommended by her friend, who does only stents and no surgery for carotid problems**
- **Her blood pressure is controlled with metoprolol 25 mg once daily. On atorvastatin 20 mg at bedtime for hyperlipidemia, and levothyroxine 75 mcg once daily for hyperthyroidism.**
- **Other relevant histories include right breast lumpectomy and chemotherapy for right breast cancer and exposure to second-hand smoking**

Mrs. Garza is very active, works as a school teacher, and does visit your clinic regularly for annual and required screening visits.

Case Study in Nutshell

- Symptomatic high grade carotid artery stenosis on one side.
- 10 year ASCD Risk Score - 5.3% (borderline)
- Need for Optimal medical management - start Aspirin
- Clinical decision making guidance



Pop Quiz- 2

Which of these symptoms is specific to carotid artery disease related ischemic stroke or TIA?

1. Confusion
2. Memory loss
3. Dizziness
4. Seeing floaters
5. Vision loss in one eye

26

Symptomatic CAD – Current Guidelines

AHA 50-99% Carotid Artery Stenosis
- **CEA or CAS** – If complications higher

SVS 50-99% Carotid Artery Stenosis
- **CEA or CAS or both**

ESC 70-99% or 50-69% Carotid Artery Stenosis
- **CEA or CAS** – If complications higher

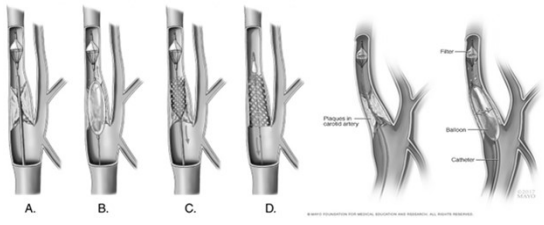
Grey Areas of Management

- **CAS vs CEA choice- Unclear boundaries, Provider dependent**
- **Reimbursement variations based on procedure and setting**
- **Multiple societies and different range of guidelines**
- **Many medical specialties can do same procedures**

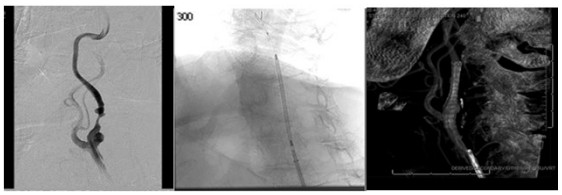
Grey Areas of Management

- **CAS vs CEA choice- Unclear boundaries, Provider dependent**
- **Reimbursement variations based on procedure and setting**
- **Multiple societies and different range of guidelines**
- **Many medical specialties can do procedures**

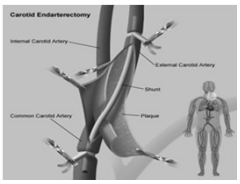
Carotid Artery Stenting

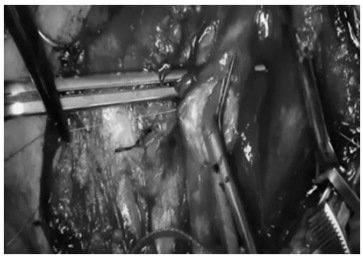


Carotid Artery Stenting



Carotid Endarterectomy





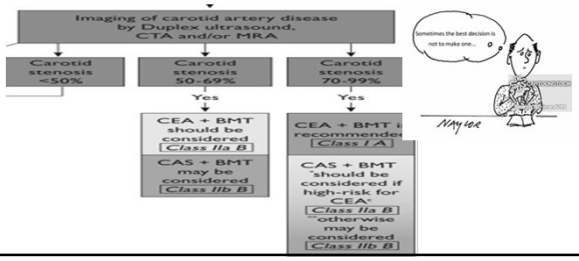
Trans Carotid Artery Revascularization

- Newer technique
- Select centers and surgeons

Case Study - Review

- Clinical decision making guidance

- Will you refer Mrs. Garza for stenting?



Conclusion

- Symptomatic carotid arterial disease with high-grade stenosis of more than 70% needs aggressive medical management with surgical interventions.
- Choice of intervention is based on individual patient and operators average risk rate.

Cancer and CAD

- CAD incidence is high after head and neck radiotherapy
- No clear dose-response effect between carotid disease and radiation
- Carotid artery screening and preventative strategies recommended for high-risk patient populations

Chemotherapy and Atherosclerosis

VEGF Inhibitors

- Endothelial dysfunction - ↓ vasodilator factors.
- ↑ vasoconstrictor and microcirculation
- Hypertension &Thrombosis

(Muki, M, 2018)

CAD - Cancer Specific

- **Aggressive risk factor control decrease progression of carotid disease in cancer patients**
- **No guidelines specific for surveillance and management of carotid artery disease in cancer survivors**
- **No specific treatment advised for significant radiation-induced carotid artery disease**
- **Radiation patients are at increased risk for restenosis and should undergo routine surveillance even after revascularization**

Questions?

- **Foods For Thoughts on Decision Making**
  - **Cost effective**
  - **Tailored to individual patient**
  - **Evidence - based**

Enquiries/concerns:mgeorge7@mdanderson.org

References

1. Bonati, L. H., Kakkos, S., Berkefeld, J., de Borst, G. J., Bulbulia, R., Halliday, A., van Herzeele, I., Koncar, I., McCabe, D. J., Lal, A., Ricco, J.-B., Ringleb, P., Taylor-Rowan, M., & Eckstein, H.-H. (2021). European Stroke Organisation guideline on endarterectomy and stenting for carotid artery stenosis. *European Stroke Journal*, *6*(2), I–XLVII. https://doi.org/10.1177/23969873211012121

2. Carpenter, D. J., Mowery, Y. M., Broadwater, G., Rodrigues, A., Wisdom, A. J., Dorth, J. A., Patel, P. R., Shortell, C. K., Clough, R., & Brizel, D. M. (2018). The risk of carotid stenosis in head and neck cancer patients after radiation therapy. *Oral oncology*, *80*, 9–15. https://doi.org/10.1016/j.oraloncology.2018.02

3. Chen, S., Kabutey, N., Kuo, I., & Fujitani, R. (2016). Comparative Outcomes of Carotid Endarterectomy (CEA) and Carotid Artery Stenting (CAS): Analysis of the ACS-NSQIP Targeted Vascular Database. *Journal of the American College of Surgeons*, *223*(4), e212–e213. https://doi.org/10.1016/j.jamcollsurg.2016.08.532

4. Dorth, J. A., Patel, P. R., Broadwater, G., & Brizel, D. M. (2014). Incidence and risk factors of significant carotid artery stenosis in asymptomatic survivors of head and neck cancer after radiotherapy. *Head & neck*, *36*(2), 215–219. https://doi.org/10.1002/hed.23280

5. Jonnalagadda, A., Texakalidis, P., Giannopoulos, S., Kokkinidis, D., Armstrong, E., Machinis, T., & Pascal, J. (2018). Carotid Artery Endarterectomy Versus Carotid Artery Stenting For Restenosis After Carotid Endarterectomy: A systematic Review And Meta-analysis *Journal of the American College of Cardiology*, *71*(11), A1097–A1097. https://doi.org/10.1016/S0735-1097(18)31638-3

References

6. Lokuge, K., de Waard, D., Halliday, A., Gray, A., Bulbulia, R., & Mihaylova, B. (2018). Meta-analysis Of The Procedural Risks Of Carotid Endarterectomy And Carotid Artery Stenting Over time. *British Journal of Surgery*, *105*(1),26 36-https://doi.org/10.1002/bjs.10717

7. Leal, I., Peinado, J., Lamarca, M., Montoya, R., Flores, A., Orgaz, A., Doblas, M., & Criado, E. (2016). FT01. 1-Year Follow-up After Transcarotid Artery Revascularization (TCAR) With Enroute Transcarotid Neuroprotection System. *Journal of Vascular Surgery*, *63*(6), 14S–14S. https://doi.org/10.1016/j.jvs.2016.03.181

8. Mukai, M., Komori, K., & Oka, T. (2018). Mechanism and Management of Cancer Chemotherapy-Induced Atherosclerosis. *Journal of Atherosclerosis and Thrombosis*, *25*(10), 994–1002. https://doi.org/10.5551/jat.RV17027

9. Min, S., & Wierzbicki, A. (2017). Radiotherapy, chemotherapy and atherosclerosis. *Current Opinion in Cardiology*, *32*(4), 441–447. https://doi.org/10.1097/HCO.0000000000000404

10. Venkatesulu, B., Mahadevan, L., Aliru, M., Yang, X., Bodd, M., Singh, P., Yusuf, S., Abe, J., & Krishnan, S. (2018). Radiation-Induced Endothelial Vascular Injury: A Review of Possible Mechanisms. *JACC. Basic to Translational Science*, *3*(4), 563–572. https://doi.org/10.1016/j.jacbts.2018.01.014