Cross-sectional Area and Duplex Ultrasound for Calculation of Symptomatic Carotid Stenosis

Strandness Vascular Forum

March 20, 2022

Baylor Scott & White HEALTH

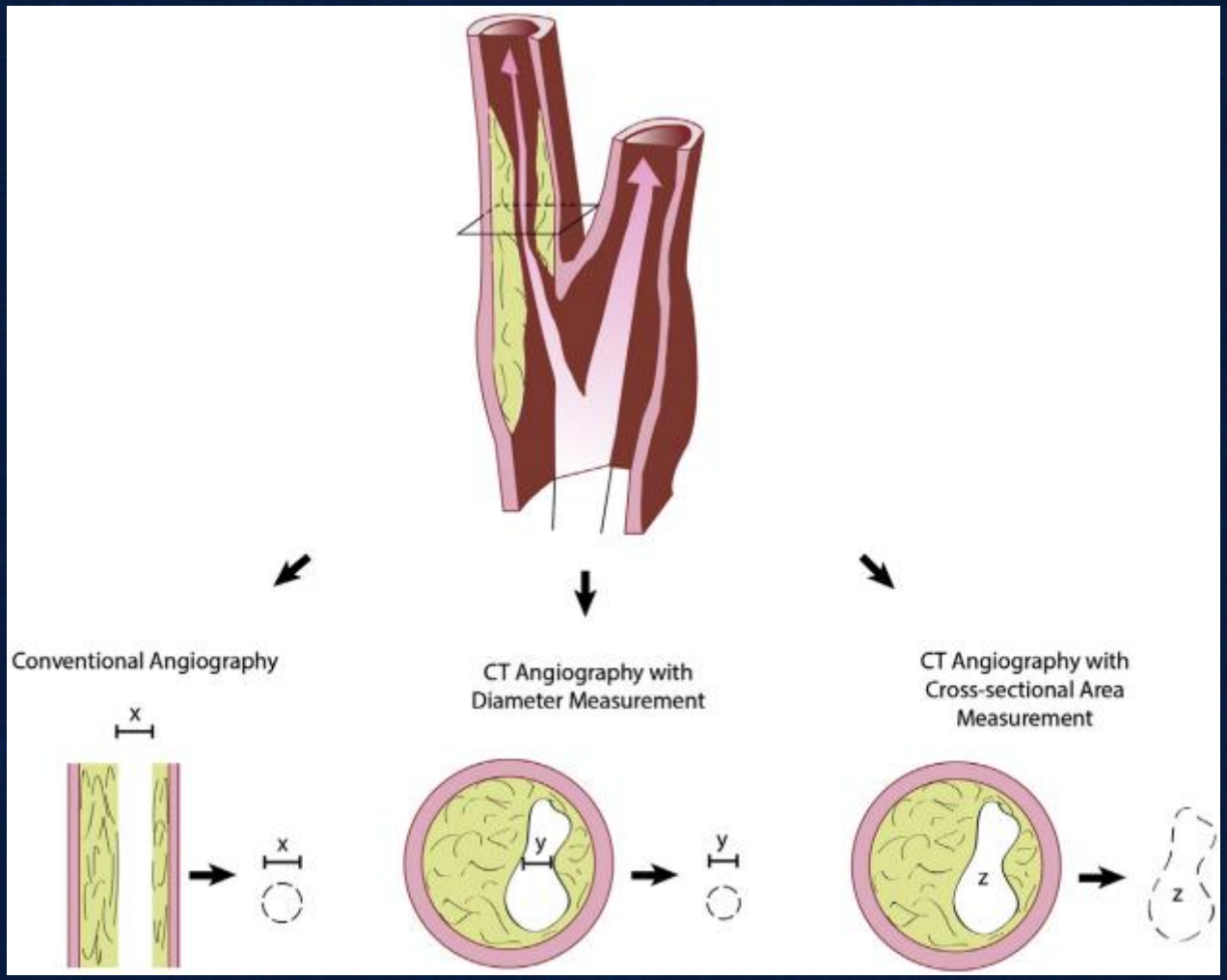
Introduction

- Catheter angiography was reference standard
- Carotid duplex ultrasound (DUS) recommended as “best” imaging test for screening
- Computed tomography angiography (CTA) not recommended for screening but can be used to rapidly and accurately evaluate the neck

Introduction

- Both imaging modalities with possible impaired or inaccurate measurements due to plaque morphology
- Different imaging protocols for evaluation of carotid stenosis may aid in clinical decisions for stroke evaluation

Introduction



Carnicelli AP, Stone JJ, Doyle A, et al. Cross-sectional area for the calculation of carotid artery stenosis on computed tomographic angiography. J Vasc Surg 2013 Sep;58(3):659-65.

Baylor Scott & White HEALTH

Hypothesis

- Semi-automated CTA-derived cross sectional area (CSA) measurements can predict carotid stenosis with the same level of confidence as DUS

Methods

- Retrospective review (Oct 2019 – Jan 2022)
- Symptomatic carotid stenosis
- Carotid endarterectomy
- Pre-operative DUS and CTA

Demographics, Comorbidities, Medications

	Patients (n = 52)
Mean age ± SD	68.8 ± 9.5
Male, No. (%)	31 (59.6)
Comorbidities, No. (%)	
Diabetes	16 (30.7
Prior CVA	24 (46.1)
Prior MI	12 (23.1)
Documented CAD	23 (44.2)
Smoking	32 (61.5)
HTN	45 (86.5)
HLD	44 (84.6)
Medications, No. (%)	
Beta blocker	19 (36.5)
Aspirin	41 (78.8)
Clopidogrel	20 (38.4)
Warfarin	1 (1.9)
Diuretic	17 (32.7)
Calcium channel blocker	24 (46.1)

Baylor Scott & White HEALTH

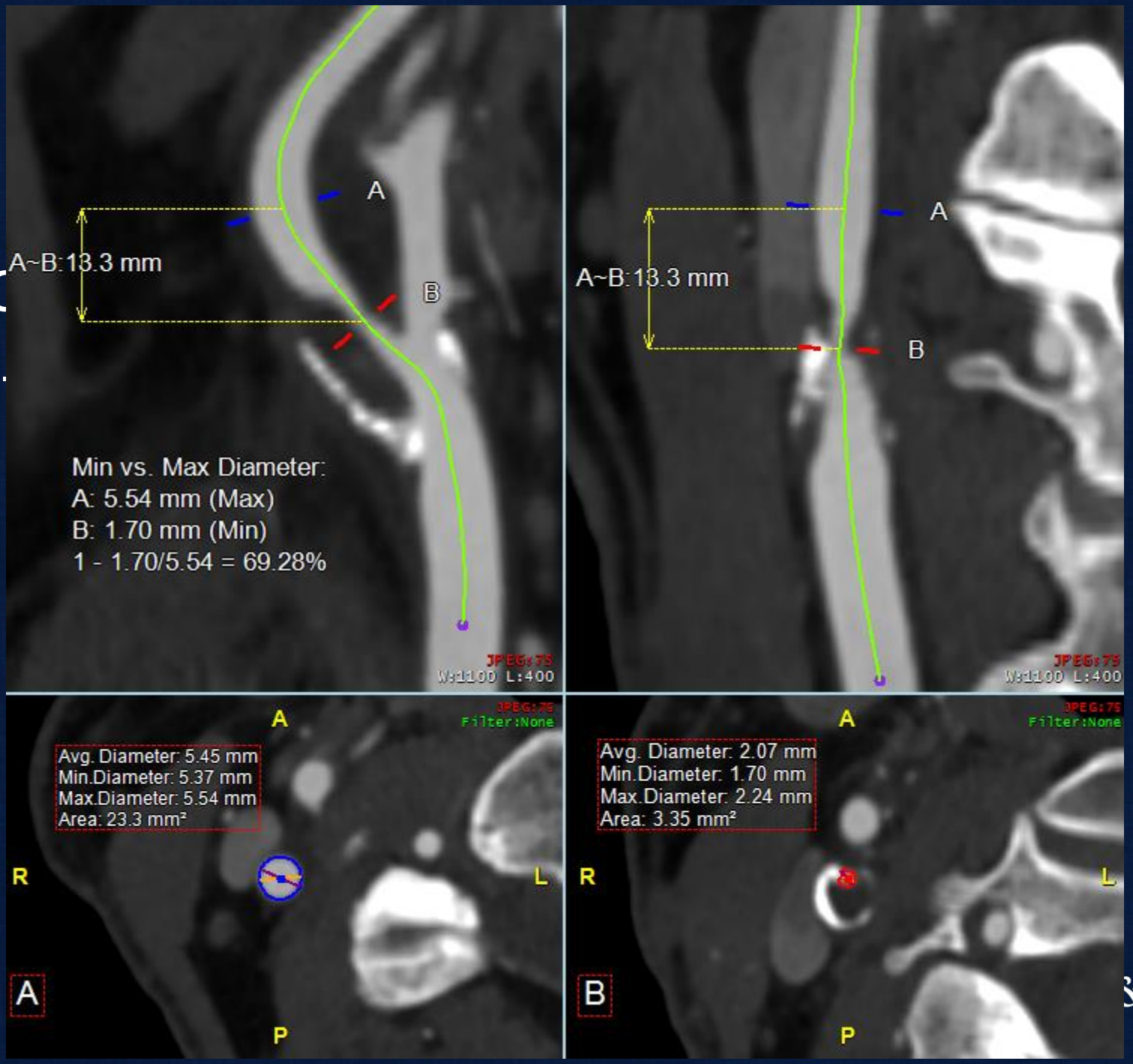
Methods

- Carotid DUS:
  - Peak systolic velocity (PSV)
  - End diastolic velocity (EDV)

Methods

- CSA:
  - Semi-automated CTA-derived measurements

- C

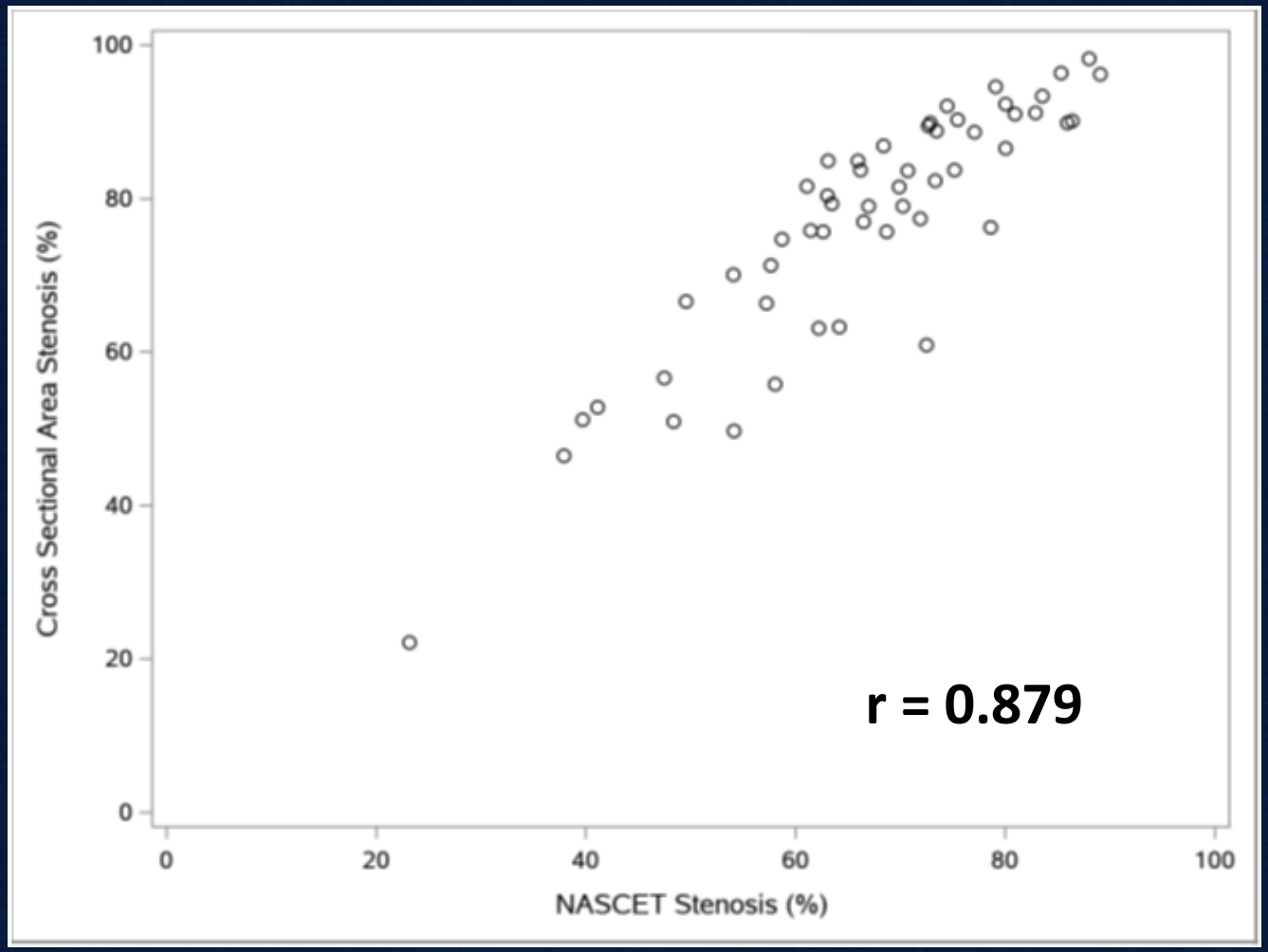

A
A~B:13.3 mm
B
Min vs. Max Diameter:
A: 5.54 mm (Max)
B: 1.70 mm (Min)
1 - 1.70/5.54 = 69.28%
JPEG:75
W:1100 L:400
A
A~B:13.3 mm
B
JPEG:75
W:1100 L:400
A
JPEG:75
Filter:None
Avg. Diameter: 5.45 mm
Min.Diameter: 5.37 mm
Max.Diameter: 5.54 mm
Area: 23.3 mm²
R
L
A
P
A
JPEG:75
Filter:None
Avg. Diameter: 2.07 mm
Min.Diameter: 1.70 mm
Max.Diameter: 2.24 mm
Area: 3.35 mm²
R
L
B
P

&White

Results

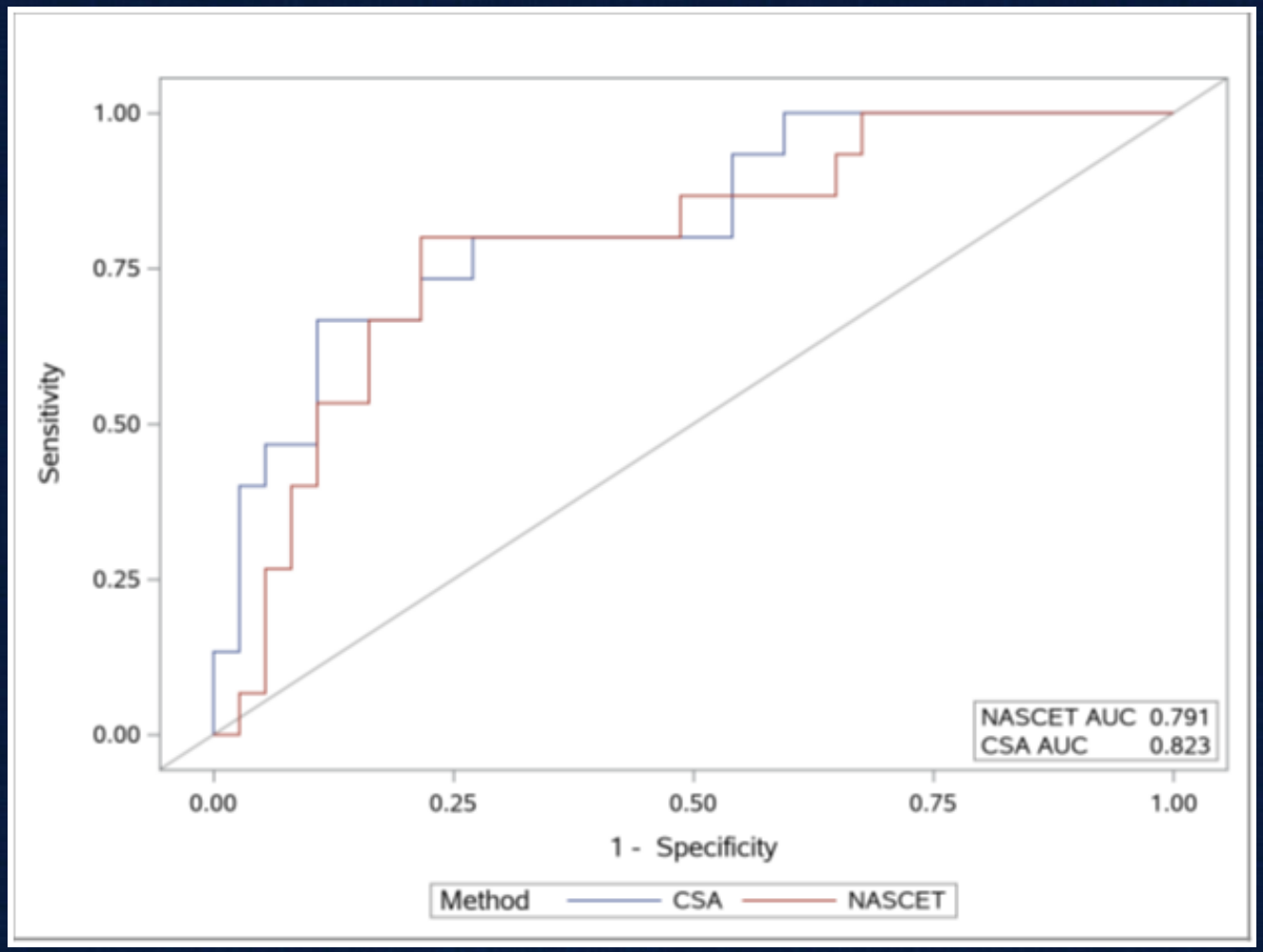
Baylor Scott & White HEALTH

Scatter Plot with Spearman Correlation



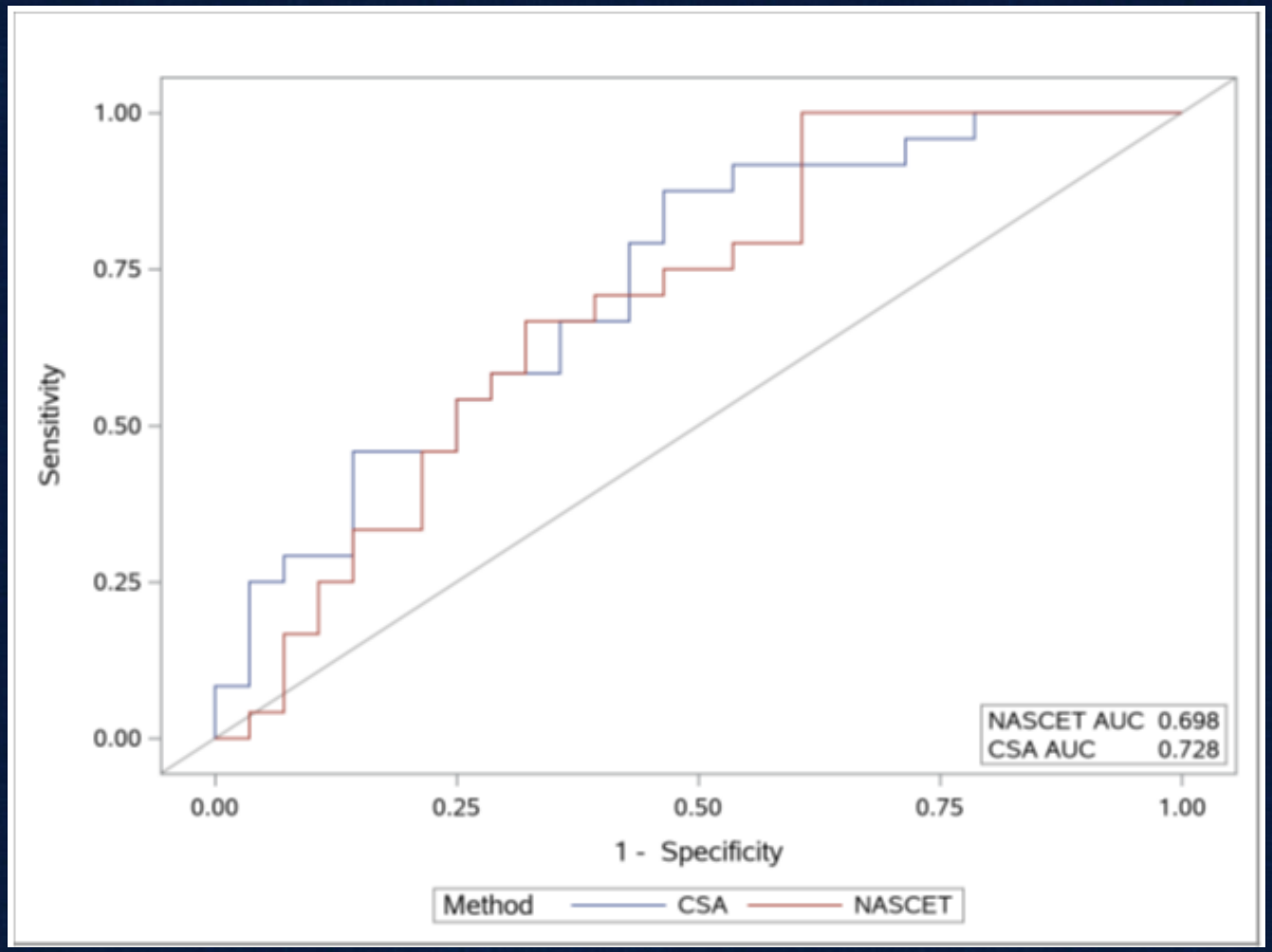
Baylor Scott & White HEALTH

Receiver Operator Curve, EDV > 140



Baylor Scott & White HEALTH

Receiver Operator Curve, EDV > 100



Baylor Scott & White HEALTH

Conclusion

- CSA is an accurate method of calculating carotid artery stenosis based on agreement with DUS velocity criteria
- CSA provides additional information that may aid in the evaluation of carotid stenosis for stroke prevention

Questions

Baylor Scott & White HEALTH

References

1. North American Symptomatic Carotid Endarterectomy Trial (NASCET) Collaborators. Beneficial Effect of Carotid Endarterectomy in Symptomatic Patients with High-Grade Carotid Stenosis. N Engl J Med 1991; 325:445-453.
2. AbuRahma AF, Avgerinos ED, Chang RW, et al. Society of Vascular Surgery Guidelines Clinical Practice Guidelines for Management of Extracranial Cerebrovascular Disease. J Vasc Surg 2022 Jan;75(1):4S-22S.
3. Moralis MM, Anacleto A, Filho CM, et al. Peak Systolic Velocity for Calcified Plaques Fails to Estimate Carotid Stenosis Degree. Ann Vasc Surg 2019 Aug;59:1-4.
4. Carnicelli AP, Stone JJ, Doyle A, et al. Cross-sectional area for the calculation of carotid artery stenosis on computed tomographic angiography. J Vasc Surg 2013 Sep;58(3):659-65.