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A Practical Guide To CT Angio-reconstruction and Interpretation

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Disclosure Statement of Financial Interest

I, Dr Namita Kamath, DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

Carotid Artery Stenosis

Carotid artery stenosis is one of the causes of stroke and TIA.

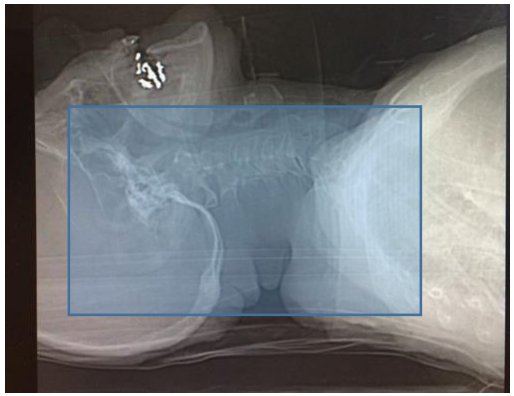
It is due to atherosclerotic disease of the carotid arteries.

There are 4 types of Carotid artery plaques

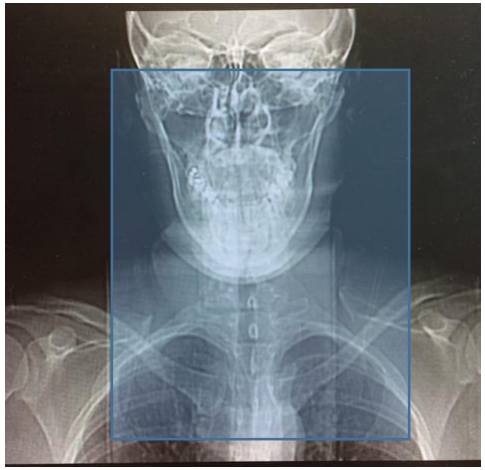
Type I	Predominantly haemorrhage, lipid, cholesterol and proteinaceous material
Type II	Dense fibrous connective tissue with > 50% volume of haemorrhage, lipid, cholesterol and proteinaceous material
Type III	Dense fibrous connective tissue with <50% volume of haemorrhage, lipid, cholesterol and proteinaceous material
Type IV	Dense fibrous connective tissue

Protocol For CT Carotid Angiogram

Preparation: Remove earrings, necklaces and hairgrips
Cannula: PINK or GREEN cannula (18 or 20 gauge)
Position: Supine head first, head in the head holder
Centre: Sternal notch
Injector: 85 ml @ 3.5 to 4 ml per second
Plain scan: AP and lateral scouts

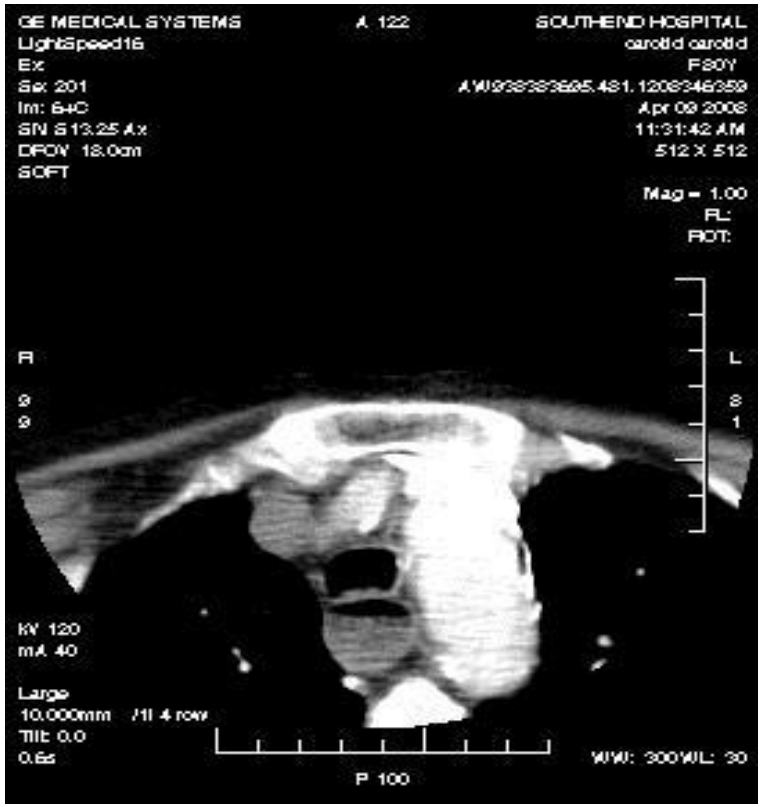


Position the blue box to cover the area required (from just below the arch of the aorta to above the IAMS). Check lateral scout as well.



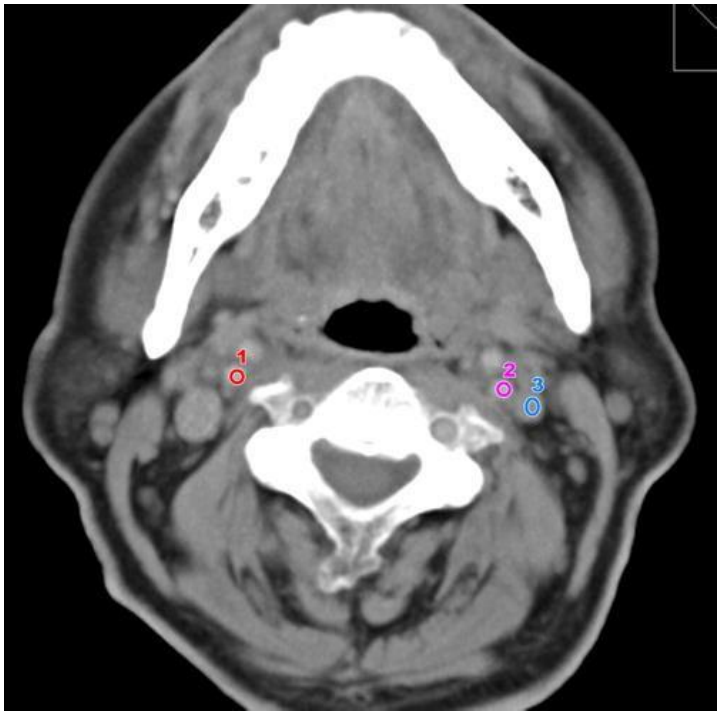
Using SMART PREP

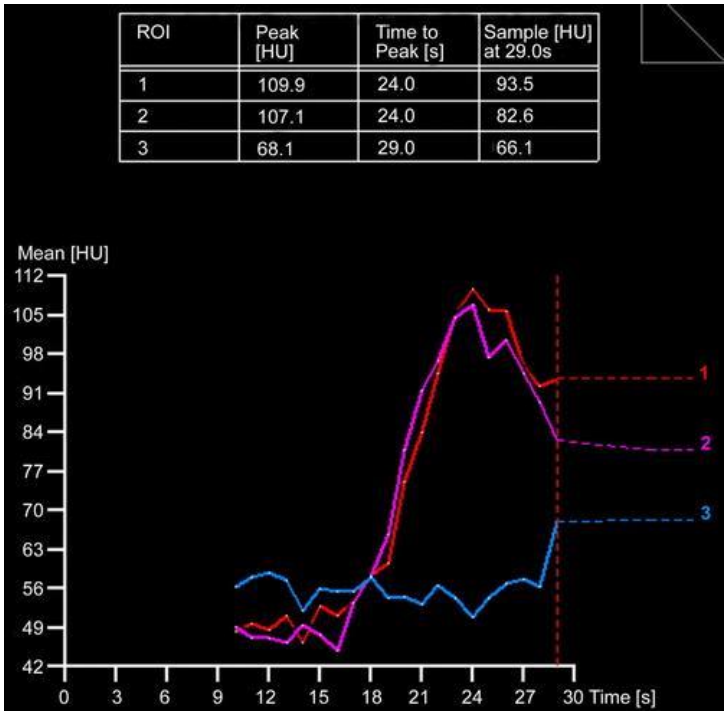
Position the smart prep slice over the arch of the aorta



SMART PREP

If there is no smart prep:
Lag time of 18 sec if upper limb is cannulated
and
23 sec if lower limb is cannulated

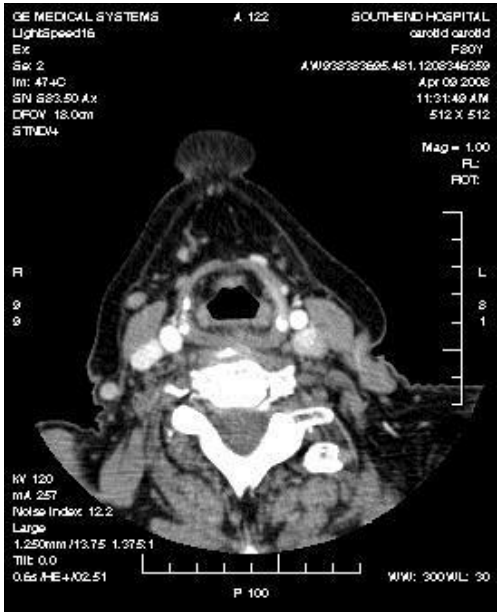


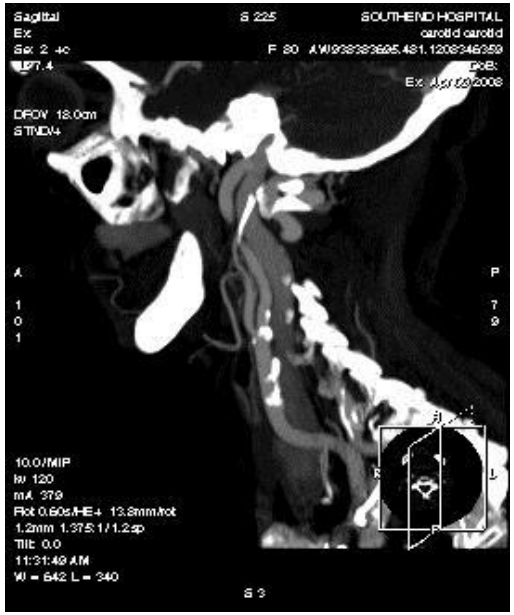


Ref: Radiographics

Things To Remember

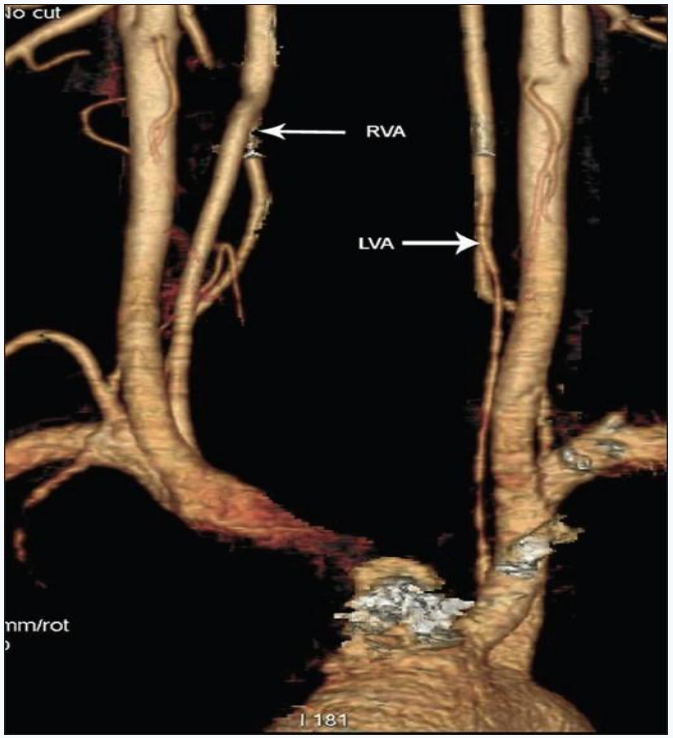
- Check all the images before getting the patient off the table.
- Raw data can be manipulated into multiple MIPs or VRs





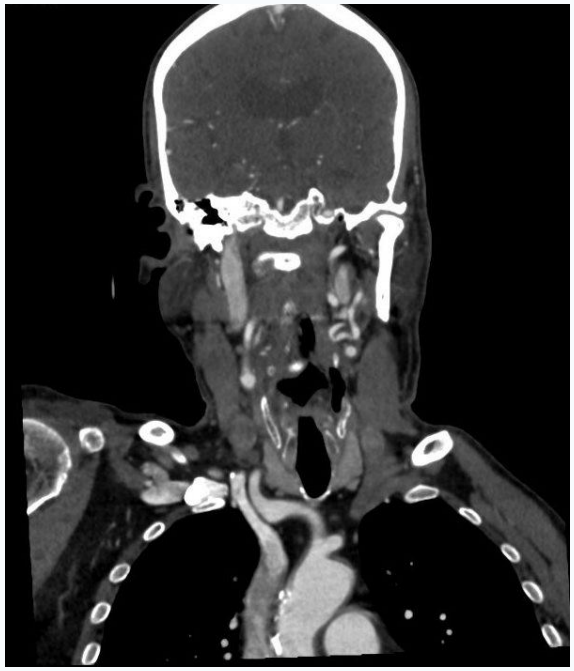
What Are MIP And VR Images?

Maximum Intensity Projection (MIP)



Volume Rendered (VR)

Good Roadmap To Anatomic Variants



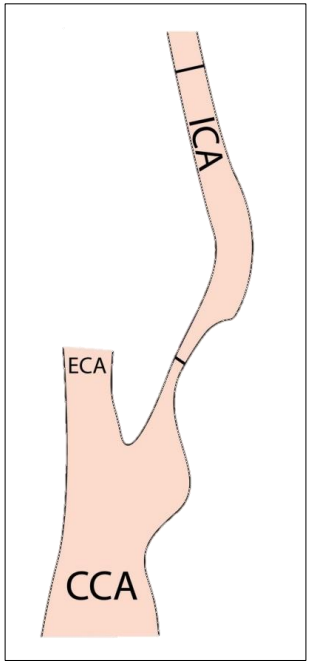
CT Angiography

DSA

CT Angiography and DSA showing bovine arch

North American Symptomatic Carotid Endarterectomy Trial (NASCET)

The North American Symptomatic Carotid Endarterectomy Trial (NASCET) demonstrated a conclusive benefit for carotid endarterectomy in patients with symptomatic 70-99% ICA stenosis.



NASCET was established by angiographic calculation of ICA stenosis percentage using the following formula

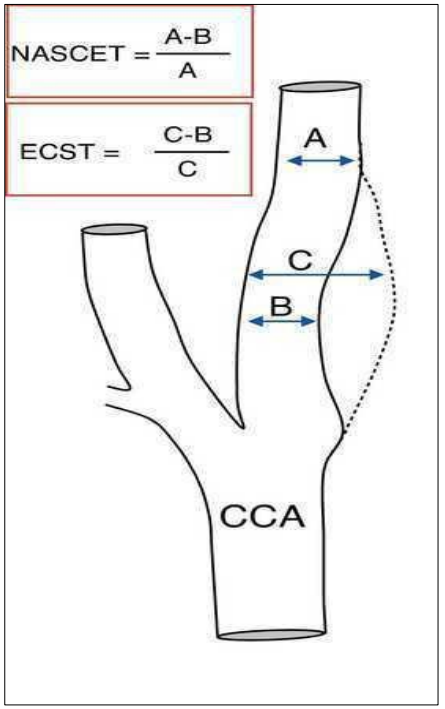
$$\%\ ICA\ Stenosis = \left(1 - \left[\frac{Narrowest\ ICA\ Diameter}{Diameter\ normal\ distal\ Cervical\ ICA}\right]\right) x\ 100$$

References
Ota H, et al. Quantitative Vascular Measurements in Arterial Occlusive Disease. RadioGraphics 2005;25:1141-1158.

The European Carotid Surgery Trial (ECST)

The European Carotid Surgery Trial (ECST) also demonstrated benefits for carotid endarterectomy in patients with symptomatic higher than 80% ICA stenosis.

ECST was established by angiographic calculation of ICA stenosis percentage using the following formula:

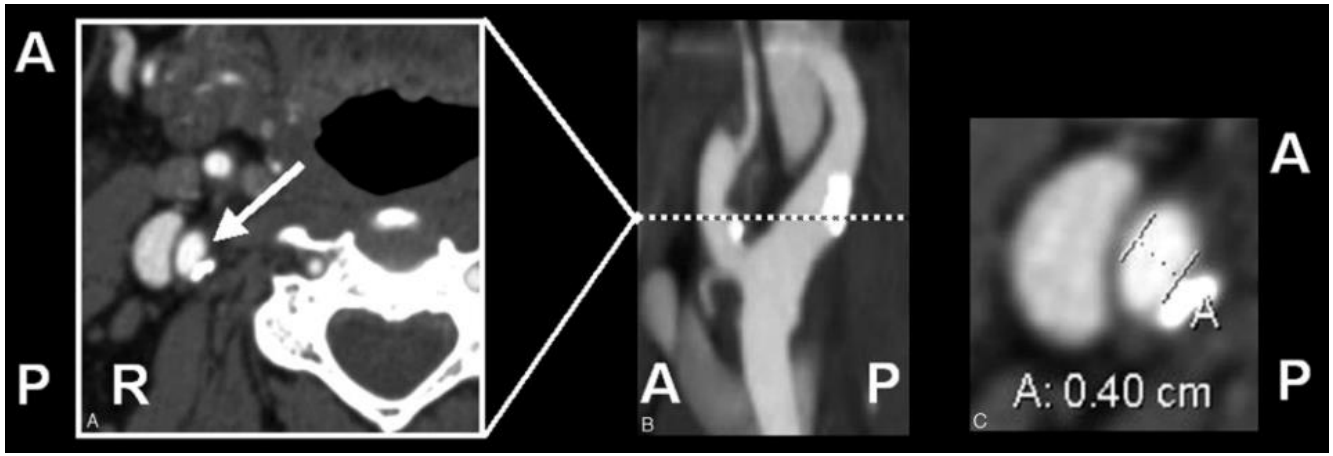


$$\%\ ICA\ Stenosis = \left[1 - \left(\frac{Diameter\ of\ the\ most\ stenotic\ part}{Estimated\ original\ diameter\ at\ the\ site\ of\ the\ stenosis}\right)\right] x\ 100$$

How To Measure Carotid Artery Stenosis (1/2)

Measurement on source images

- At maximal luminal narrowing and in the first normal distal arterial segment where the walls are parallel
- True cross-sectional measurement perpendicular to the long axis of the vessel by using curved MPR
- Window and level settings of 1000 W / 500 L

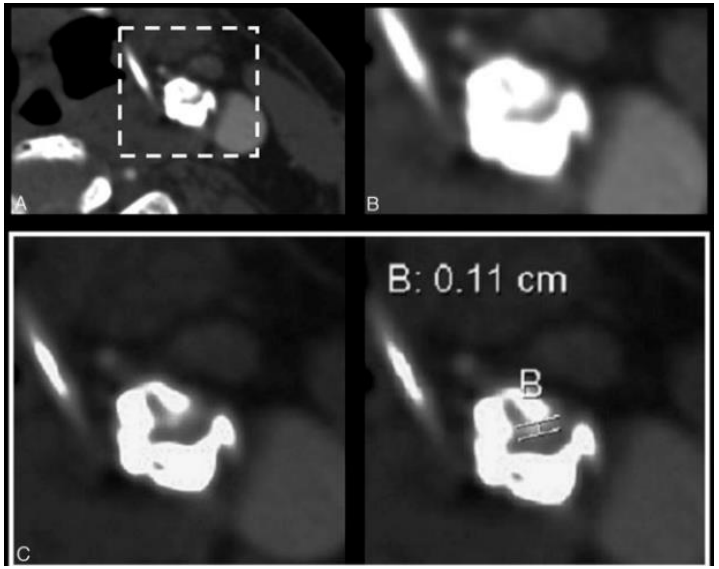


Ref: Bartlet et al AJNR

How To Measure Carotid Artery Stenosis (2/2)

Bartlett et al. have recently proposed the direct measurement of carotid bulb diameter and its correlation to the percent stenosis as determined by the NASCET criteria.

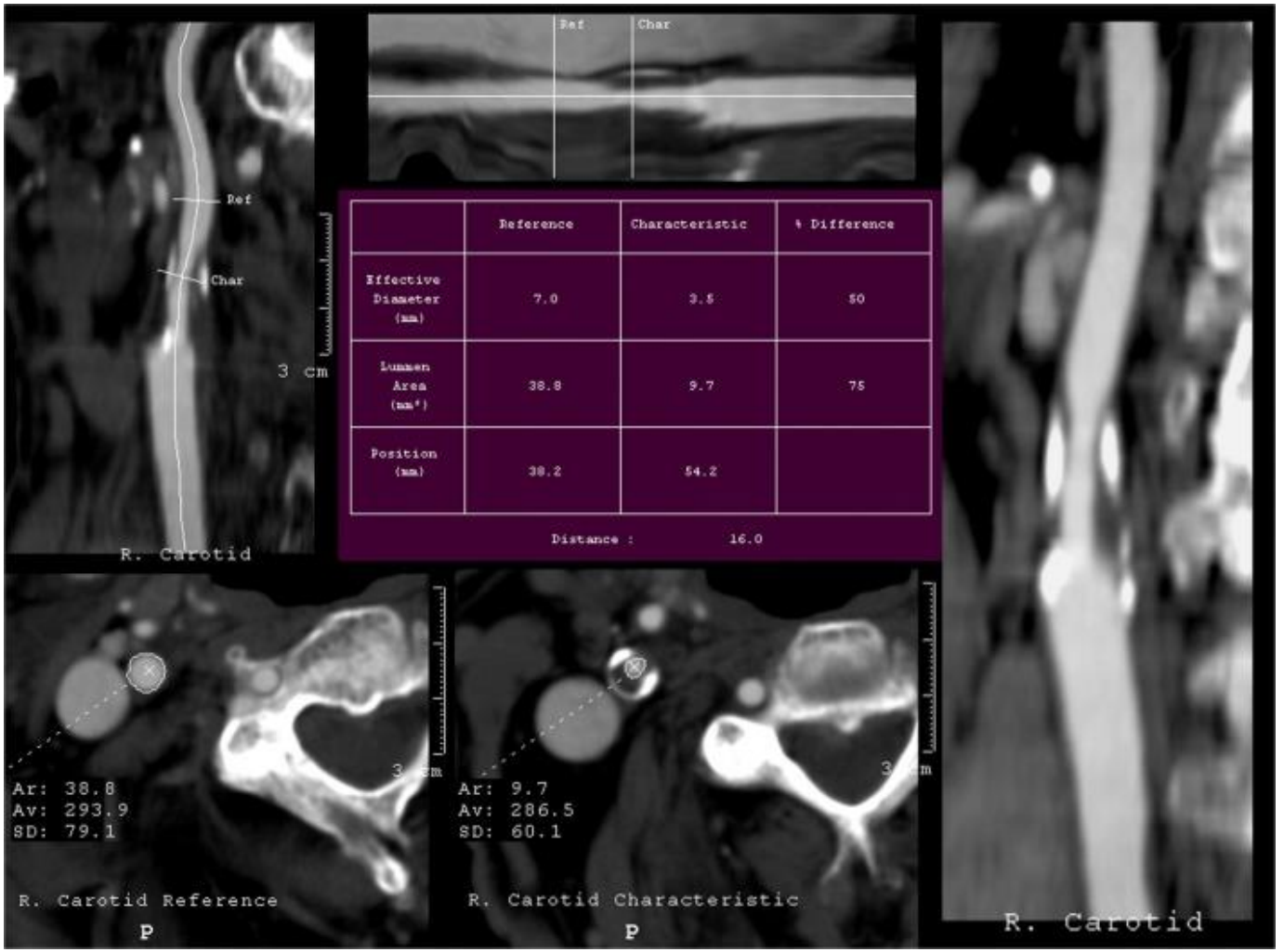
Carotid bulb diameter	Carotid stenosis
>2.2 mm	<50%
< 1.3 mm	> 70%
< 1.1 mm	Critical stenosis



Critical Stenosis

Ref: Bartlet et al AJNR

Measurements



Ref: Kristina et al Insights Imaging. 2018 Aug; 9(4): 527–534.

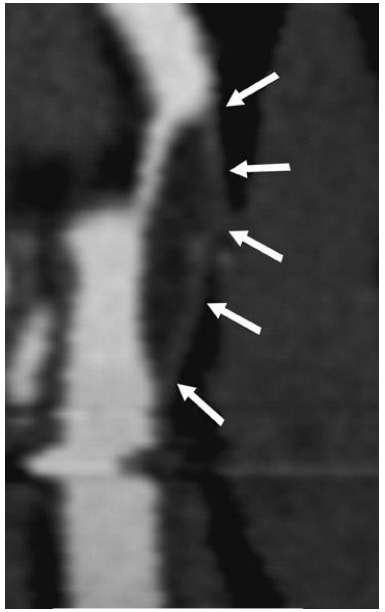
Plaque Characterisation

CTA is able to provide accurate plaque characterisation

HU similar to muscle-fibrous tissue
Low attenuation values - lipid/necrotic core

Certain plaque morphologies have been associated with higher stroke risk:

1. Large lipid / necrotic core
2. Thin / ruptured fibrous cap
3. Plaque ulceration
4. Intraplaque hemorrhage



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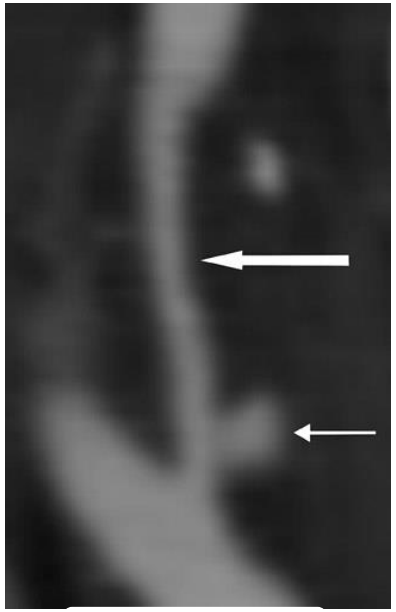

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thank you
danke
謝謝
ngiyabonga
teşekkür ederim
gracias
merci
obrigado
bedankt
спасибо
dziękuję
go raibh maith agat
sukriya
kop khun krap
terima kasih
감사합니다
ありがとう
arigatô
dakujem
мерси
mochchakkeram
tapadh leat
dank je
grazie
takk
taiku
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Баярлалаа
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