

# CAROTID ULTRASOUND HAS A VERY LOW SENSITIVITY FOR NEAR-OCCLUSION

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## BACKGROUND

The ultrasound finding of a very severe stenosis with low flow velocity on ultrasound has been reported to be 71% sensitive and 99% specific for near-occlusion<sup>1-3</sup>. However, underlying studies only included near-occlusion with full collapse (sometime called "string sign"). A large share of near-occlusions have a subtle distal collapse (without full collapse). A recent study suggested a 13% sensitivity, as most near-occlusion without full collapse had high peak systolic velocity (PSV) in the stenosis<sup>4</sup>.

This study aimed to assess the sensitivity of near-occlusion with carotid ultrasound.

## METHODS

One CTA-expert manually re-reviewed 4403 consecutive CTA performed for all indications. Another CTA-expert audited all possible near-occlusion cases. Systematic interpretation to assess if the internal carotid artery (ICA) distal to the stenosis was small and most likely reduced in size by the stenosis<sup>5</sup>. Assessments were based on ICA asymmetry, ICA size, ICA/external carotid artery (ECA) ratio and stenosis severity<sup>5</sup>. Subtle collapses were acknowledged (near-occlusion without full collapse) in addition to severe collapses (near-occlusion with full collapse, "string sign"). The common near-occlusion mimic of ICA asymmetry caused by anatomical variance in the Circle of Willis was categorized as conventional stenosis<sup>6</sup>.

We included all cases with  $\geq 50\%$  carotid stenosis or occlusion on CTA and where ultrasound and CTA was performed within 30 days of each other. According to local criteria stenosis PSV  $>145$  cm/s indicated  $\geq 50\%$  stenosis, near-occlusion diagnosis was set for severe stenosis where PSV was  $<145$  cm/s. The side of most relevant stenosis was analyzed (regardless of symptomatic side).

## RESULTS

388 cases were included, mean delay between exams was 5 days. 104 near-occlusions were included:

- 13 (13%) were mistaken for occlusion.
- 70 (67%) had stenosis PSV  $>145$  cm/s
  - 65 were mistaken for conventional  $\geq 50\%$  stenosis
  - 5 were interpreted as near-occlusion due to various reasons
- 14 (13%) had severe stenosis & stenosis PSV  $<145$  cm/s
  - 11 were interpreted as near-occlusion
  - 3 were mistaken for  $<50\%$  stenosis
- 7 (7%) were uncertain if flow was visible or not (hard to distinguish between near-occlusion and occlusion)

All-in-all, 24 (23%) of near-occlusion were detected in routine practice, of which only 11 were detected by the classical finding of severe stenosis and low flow velocity. Specificity was 99%

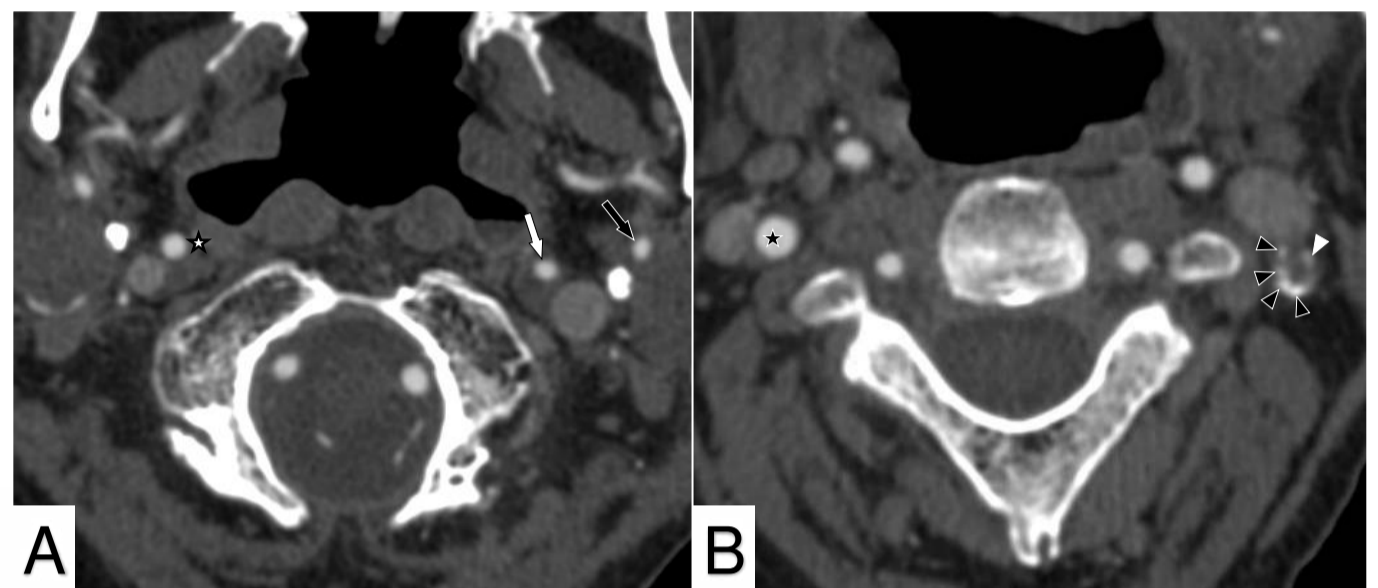
Most near-occlusions were indistinguishable from conventional stenosis by PSV in the stenosis, regardless of what threshold would have been chosen (figure).

## REFERENCES

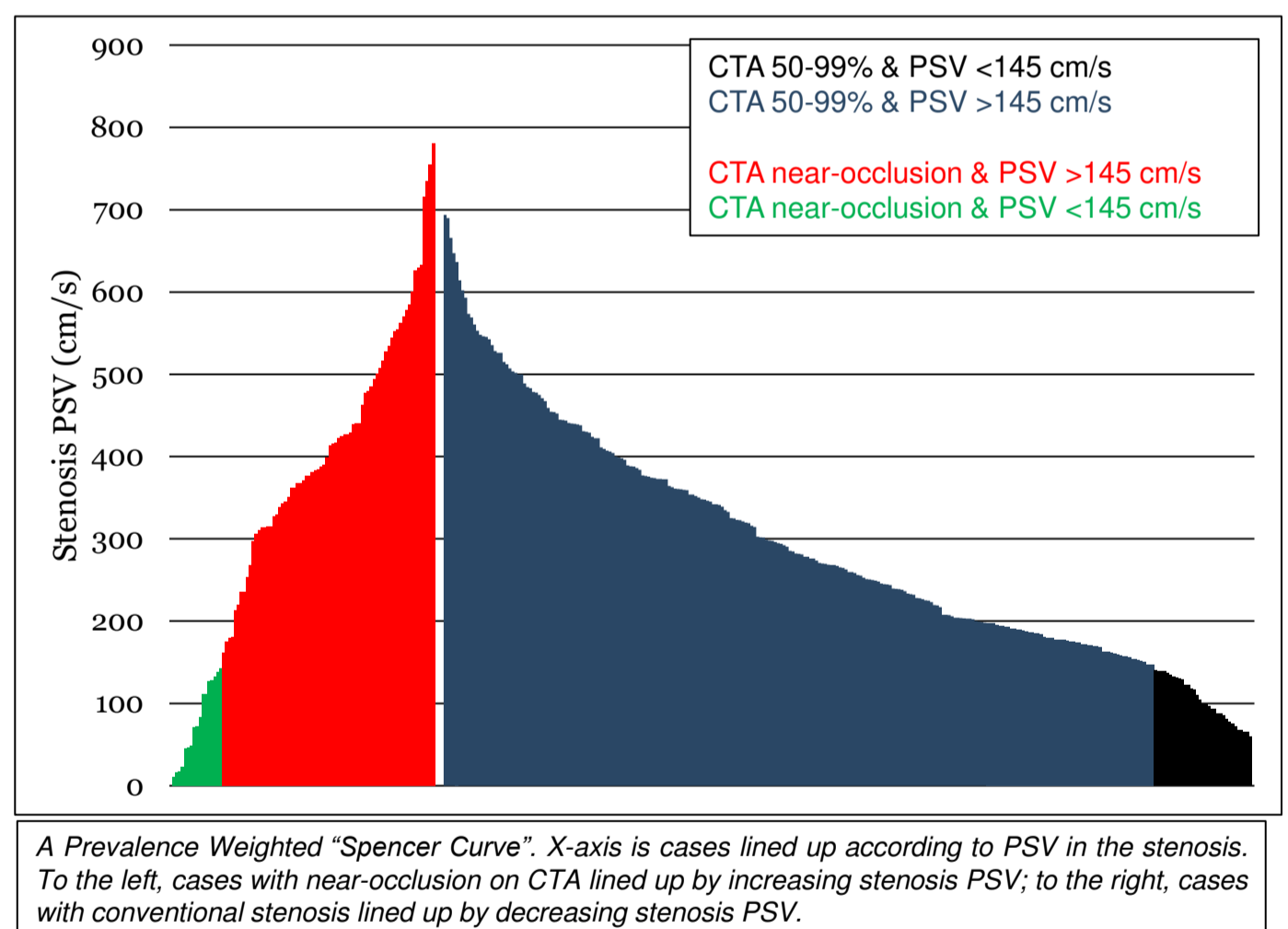
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## BASIC FACTS ABOUT NEAR-OCCLUSION

- Near-occlusion is severe stenosis causing distal artery size reduction
- Near-occlusion is an angiography diagnosis
- Near-occlusion is likely caused by flow reduction
- Near-occlusion includes more than "string sign" – the distal collapse is often subtle
- Major trial findings for 50-99% stenoses are not applicable to near-occlusion.
- In guidelines, symptomatic near-occlusion does not have a strong indication for CEA/CAS



Left-sided near-occlusion. A) Axial view distal to the stenosis. B) Axial view of stenosis. Distal ICA (white arrow) is small, smaller than right ICA (White star) and similar as left ECA (Black arrow). The left-sided stenosis is severe (White arrowhead), a calcified stenosis (black arrowheads). No relevant stenosis on right side (black star). Ultrasound misclassified this case as conventional stenosis as stenosis PSV was 370 cm/s.



A Prevalence Weighted "Spencer Curve". X-axis is cases lined up according to PSV in the stenosis. To the left, cases with near-occlusion on CTA lined up by increasing stenosis PSV; to the right, cases with conventional stenosis lined up by decreasing stenosis PSV.

## CONCLUSION

Carotid ultrasound has a very low sensitivity for near-occlusion as most near-occlusion have high stenosis PSV.

