

Cassola N, Baptista-Silva JCC, Nakano LCU, Flumignan CDQ, Sesso R, Vasconcelos V, Carvas Junior N, Flumignan RLG. Duplex ultrasound for diagnosing symptomatic carotid stenosis in the extracranial segments. Cochrane Database of Systematic Reviews 2022, Issue 7. Art. No.: CD013172. DOI: 10.1002/14651858.CD013172.pub2. Accessed 04 January 2023.

<https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013172.pub2/full?highlightAbstract=ultrasound>

First of all, read the Cochrane review completely. Then answer the following questions below.

These are short answers. Dot points are OK. No referencing required. There is no word count limit.

Q1: What is the clinical question this paper is trying to answer? Why was this study undertaken? [4] *(Think of the context here. What is the background? What is the problem? Why is this research being undertaken? What do the authors want to achieve with this research?)*

Carotid artery stenosis is an important cause of stroke and transient ischemic attack. Correctly and rapidly identifying patients with symptomatic carotid artery stenosis is essential for adequate treatment with early cerebral revascularization.

Doubts about the diagnostic value regarding the accuracy of duplex ultrasound (DUS) and the possibility of using DUS as the single diagnostic test before carotid revascularization are still debated.

This review was undertaken to define whether an individual with symptomatic carotid stenosis should undergo carotid endarterectomy based on DUS alone.

In addition, the authors wanted to assess whether DUS is accurate to identify carotid occlusion and patients with non-significant carotid stenosis who should receive clinical management.

Q2: What is a reference standard? When and why is a reference standard used in research? What was the index test and reference standard for this research? [4]

Reference standard is used in diagnostic accuracy studies.

A reference standard refers to **the best available method for establishing the presence or absence of a condition of interest**, and is also known as the correct representation of the targeted illness.

Evaluations of diagnostic test accuracy require a comparison between the diagnostic test being evaluated, referred to as the index test and a reference standard, used to categorise participants as having or not having a target condition.

Index test used in this study is Duplex ultrasound. Reference standard is CTA, DSA, MRA.

CTA: computed tomography angiography; **DSA:** digital subtraction angiography; **MRA:** magnetic resonance angiography;

Q3. For the literature search, which databases were searched? How was grey literature searched? [4]

searched CRDTAS, CENTRAL, MEDLINE (Ovid), Embase (Ovid), ISI Web of Science, HTA, DARE, and LILACS up to 15 February 2021.

Developed the MEDLINE search strategy with the help of the Cochrane Stroke Group Information Specialist, and we adapted it for the other databases, where necessary.

Authors searched the trial registries for details of ongoing and unpublished trials:

- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov) ([Appendix 7](#));
- World Health Organization International Clinical Trials Registry Platform (ictrptest.azurewebsites.net/Default.aspx).

Also handsearched the reference lists of all included studies and other relevant publications and contacted experts in the field, manufacturers and authors of the included studies to identify additional studies or unpublished data.

Q4: What were the inclusion and exclusion criteria? Outline the criteria used for considering studies as well as participants. [3]

Inclusion: included studies assessing DUS accuracy against an acceptable reference standard (DSA, MRA, or CTA) in symptomatic patients.

Authors considered the classification of carotid stenosis with DUS defined with validated duplex velocity criteria, and the NASCET criteria for carotid stenosis measures on DSA, MRA, and CTA.

Exclusion: Authors excluded

- Studies did not assess or did not provide data on DUS accuracy for symptomatic carotid stenosis, even though it was performed .
- Less than 70% of the participants included were symptomatic.
- Studies did not define the proportion of symptomatic patients.
- Preliminary paper of DUS technique described (subjective visual impression of the degree of stenosis) or no objective criteria to estimate stenosis.
- Time between the index test and the alternative test was not specified or was more than four weeks .
- Accuracy was determined by comparison with the surgical specimen.
- Case-control design.

Q5: What was the sample size? [2]

total of 4957 carotid arteries, with a mean sample size of 126, ranging from 24 to 1011. The mean age of participants was 66.3 years (range 53 to 72 years), and the mean proportion of men was 70% of included participants.

Q6. What are QUADAS-2 and Review Manager tools? How did these tools help the authors for this study? [6]

Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool

QUADAS 2 is used to assess the methodological quality of the included studies.

To assess if the study had low, high, or unclear risk of bias and applicability concerns

This was for each of the four domains (patient selection, index test(s), reference standard, and flow and timing.

ReviewManager is Cochrane's bespoke software for writing Cochrane Reviews

Review Manager 5 was used to construct methodological quality summary graphs.

Q7: Identify five strengths of the review. [5]

adhered to the recommended review methods

performed an extensive search of the literature without language restrictions.

Therefore, they reviewed a large number of publications.

They followed the standard recommendations of the Cochrane DTA (methods.cochrane.org/sdt/) and their previously published protocol ([Cassola 2018](#)) to avoid bias in the review process.

use of velocity criteria with prespecified thresholds

Q8. The authors have made a statement. "The use of velocity criteria with prespecified thresholds is both a strength and a weakness of this review." Explain how this is a strength as well as a weakness. [2]

Strength because the criteria were same across 2014 to 2018, published and endorsed by the Society for Vascular Surgery® (SVS) and the European Society for Vascular Surgery and the Intersocietal Accreditation Commission (IAC).

Weakness because:

Intersocietal Accreditation Commission (IAC) published some suggested changes for the $\geq 50\%$ carotid artery stenosis criteria in 2021.

The authors therefore had to exclude many studies because their thresholds were too different from those proposed in their protocol or did not describe thresholds. They believed that assessing the accuracy of DUS without a prespecified threshold would lead to unrealistic estimates of accuracy and even more heterogeneity among studies because the same velocity criteria can be used to classify carotid artery stenosis of 50% or 70% depending on the center performing DUS. Higher velocity criteria tend to decrease sensitivity and increase specificity. Therefore, different cut-off velocity thresholds should achieve different estimates of sensitivity and specificity.

Q9: Describe at least ten limitations of the review. [10]

use of velocity criteria with prespecified thresholds

the issue of reproducibility.

Authors found little evidence comparing DUS to reference standards. Furthermore, the authors acknowledge that interobserver variation exists for all the reference tests, but with an acceptable agreement.

Methodological problems in patient inclusion criteria in the included studies could influence an overestimated estimate of prevalence values which were well above what was seen in clinical practice.

found few studies from each category of stenosis

limited information about the mechanism of enrolling participants into the study, patient selection, flow and timing of selection.

Not enough information from previous examinations that had been performed hence sensitivity analysis was not possible.

Published literature has poor-quality studies regarding the accuracy of noninvasive diagnostic imaging of the carotid artery.

The time the authors accepted between the index test and reference standard (four weeks) is another crucial factor in this review: they excluded some studies that exceeded this interval.

it was impossible to perform meta-analysis for all ranges of stenosis and all reference standards proposed due to the small number of studies contributing to this data

Many of the included studies were at high or unclear risk of bias

There was heterogeneity among the studies.

could not assess the generation of technology

Most of the included studies did not report the assessor's proficiency, and, therefore, the authors could not assess this evidence.

Q10: What are the conclusions of this review ? What are the implications of findings for practice and research? Answer briefly. [10]

This review provides evidence that the diagnostic accuracy of DUS is high, especially at discriminating between the presence or absence of significant carotid artery stenosis (< 50% or 50% to 99%). This evidence, plus its less invasive nature, supports the early use of DUS for the detection of carotid artery stenosis. The accuracy for 70% to 99% carotid artery stenosis and occlusion is high.

There was little evidence of the accuracy of DUS when compared with CTA or MRA.

The results of this review should be interpreted with caution due to the limitations.

Implications for practice: (can paraphrase in short)

The findings of this review provide evidence that DUS is accurate at discriminating between the presence or absence of significant carotid artery stenosis (< 50% or 50% to 99%). Therefore, there is evidence to support the use of DUS as the first choice modality for the detection of carotid stenosis. Evidence suggests that no further imaging may be necessary to detect the presence of carotid artery stenosis in cases of DUS detecting > 50% carotid stenosis, given the high value of sensitivity for this category. Nonetheless, if the result is < 50% and clinical suspicion of carotid stenosis is high, another diagnostic test could add clinical information.

The results of this review indicate that DUS sensitivity and specificity for 70% to 99% carotid artery stenosis are high, but clinicians should exercise caution in using DUS as the single preoperative diagnostic method. It could be applicable, especially in centers that do not have immediate access to more sophisticated vascular imaging techniques, and the appropriate treatment time window would be lost.

Proceeding with additional diagnostic tests could improve the accuracy of the carotid stenosis diagnostic, however authors could not assess the accuracy of the DUS as a confirmatory test after a first positive test.

Authors found little evidence regarding the accuracy estimates of DUS versus MRA or CTA as reference standards.

Due to limitations described, there are concerns regarding their applicability, mainly due to the patient selection domain. Therefore, clinicians will have to decide whether additional imaging is necessary after DUS bearing in mind the time when this imaging is performed, and the potential benefits of performing a surgical treatment within a short time.

Implications for research:

more studies with high methodological quality of DUS accuracy would improve clinical decisions in patients with symptomatic carotid stenosis. In future studies, study selection criteria require careful attention: appropriate inclusion and exclusion criteria, and a standardized and replicable threshold to determine carotid stenosis.

future studies could consider assessing the accuracy of DUS as a confirmatory test in patients previously diagnosed with carotid stenosis based on initial tests.

Future studies should also include comparisons of DUS versus CTA or MRA because these are the diagnostic tests performed in the clinical practice pathway (the 'new gold standards'). In particular, the criteria regarding patients with 50% to 69% carotid artery stenosis requires attention to determine the potentiality of using DUS to identify this situation accurately.

Q10: REFLECTION.{10]

need to reflect on what you learnt as a result of learning EBP. It is not about this specific topic.

One mark per point.