

Transcranial Doppler Uses in Acute Ischemic Stroke

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P: In patients presenting to the ED with acute ischemic stroke

I: Does the use of transcranial doppler

C: Compared to usual diagnostic studies (CT and CT-A)

O: Provide additional data that can favorably affect clinical management/outcomes

Title/Author	Objective/Study Design	Results	Limitations	Comments
Yield of Transcranial Doppler in Acute Cerebral Ischemia. Alexandrov et al. <i>Stroke</i> 1999;30.	<ul style="list-style-type: none"> •Eval the yield of TCD and confirm accuracy in ED •130 patients •TCD performed before or after CT scan •Fast track insonation protocol •TCD interpreted immediately by neurologist-blind to angio results 	69% of thrombolysis-eligible patients had proximal occlusion on TCD, 24% in “strokes” and 0% in TIA Compared to CTA: 87% sensitivity 88% specificity 87% PPV 88% NPV No delays in routine eval or tPA admin	15% absent temporal window Requires dedicated sonographer Did not report inclusion criteria or patient characteristics	TCD had highest yield in patients with thrombolysis-eligible patients.
Validation of Transcranial Doppler with CTA in Acute Cerebral Ischemia. Tsivgoulis et al. <i>Stroke</i> . 2007;38.	<ul style="list-style-type: none"> •Diagnostic accuracy of TCD v. CTA •132 patients •Fast track protocol •All included pt’s received CTA 	Compared to CTA: 79% sensitivity 94% specificity 87% PPV 88% NPV Accuracy for proximal MCA 100%	11% absent temporal window Requires dedicated sonographer	TCD is very accurate for MCA occlusion, and overall has good agreement with CTA when performed in narrow time window.
Additional Information Given to a Multimodal Imaging Stroke Protocol by Transcranial Doppler Ultrasound in the Emergency Room. Brunser et al. <i>Cerebrovascular Diseases</i> 2010	<ul style="list-style-type: none"> • Does TCD generate useful information in stroke protocol? • 97 pts with ischemic stroke <24h • Stroke protocol of CT, CTA, MRI then TCD w/in 6h • Observer blinded to results of imaging studies 	TCD provided additional info in 35% of cases Most frequent additional info was collateral pathways Management changed in 8% NIHSS >10 more likely to have management changed (p=0.004)	Abstract only	Used in conjunction with current stroke protocol imaging, TCD may alter initial management, especially in patients with NIHSS >10.

Intervention

Transcranial Doppler Ultrasound Criteria for Recanalization After Thrombolysis for MCA Stroke. Burgin et al. <i>Stroke</i> 2000; 31	<ul style="list-style-type: none"> • Compare TCD after tPA to angiography • 25 patients with MCA occlusion on TCD, treated with tPA • Repeat TCD and angiography 	Complete recanalization on TCD: 91% sensitive, 93% specific Partial recanalization: 100% sensitive, 76% specific Complete occlusion: 50% sensitive, 100% specific	Time delays between TCD and angiography Power TCD compared to MRA and CTA which differ	TCD may have good sensitivity and specificity for complete recanalization after tPA. Specificity for partial or complete occlusion could indicate benefit from further intervention.
Use of Emergency Department Transcranial Doppler Assessment of Reperfusion After IV tPA for Ischemic Stroke. Phillips et al. <i>The Journal of Emergency Medicine</i> . 2009.	<ul style="list-style-type: none"> • Use of TCD to guide therapy after failure of tPA • Case report: 75 yo male • No improvement after IV tPA • TCD showed MCA occlusion 	TCD directed intra-arterial tPA and Merci thrombectomy	Single case report	Suggests that TCD can be used for real-time monitoring during tPA admin, and help to determine further therapy.

Pitfalls: Temporal Window and Operator-Dependency

Accuracy of Transcranial Doppler Compared with CT in Diagnosing Arterial Obstructions in Acute Ischemic Strokes. Brunser et al. <i>Stroke</i> 2009; 40.	<ul style="list-style-type: none"> • Eval diagnostic accuracy of PMD-TCD compared with CTA • 100 pts • Fast track protocol • CTA and TCD performed upon presentation 	Compared to CTA: PLR 13.7 NLR 0.19 95% sensitivity 94% specificity Increase in post-test probability with +TCD and NIHSS 7-15	Patients without temporal window excluded from study (n=12) No patients in study with ACA occlusion-TCD less sensitive for this.	PMD-TCD may be more sensitive than TCD, but results may be skewed by exclusion criteria and chance study population
Noninvasive Intracranial Cerebral Flow Velocity Evaluation in the Emergency Department by Emergency Physicians. <i>Academic Emergency Medicine</i> . Shafe et al. 2004; 11.	<ul style="list-style-type: none"> • Test feasibility of bedside TCD in critically ill patient in ED • 30 intubated pts • ED resident and assistant used Doppler to identify MCA and flow velocity 	Adequate tracings in 83% No disruption in resuscitation Median time= 1.9 minutes	Patient population-trauma and intubated patients Power No comparison to standard (e.g. invasive flow monitoring)	Suggests that TCD training can be effective in as little as 1 hour. Possible to obtain flow info in minutes at bedside.

Bottom Line: This is a non-invasive, time sensitive technique may assist as an aid in diagnosis and localization of ischemic stroke. Similar to ultrasound, there are significant user dependent pitfalls. It is commonly used to follow SAH patients as a means of monitoring cerebral vasospasm in ICU settings. It is a dynamic test that may as well assist in defining response to thrombolytics and could serve to help guide therapeutic interventions.