# Diagnostic value of intracranial Time-of-flight-MRA to predict extracranial carotid stenosis in acute ischemic stroke or transient ischemic attack

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## Background

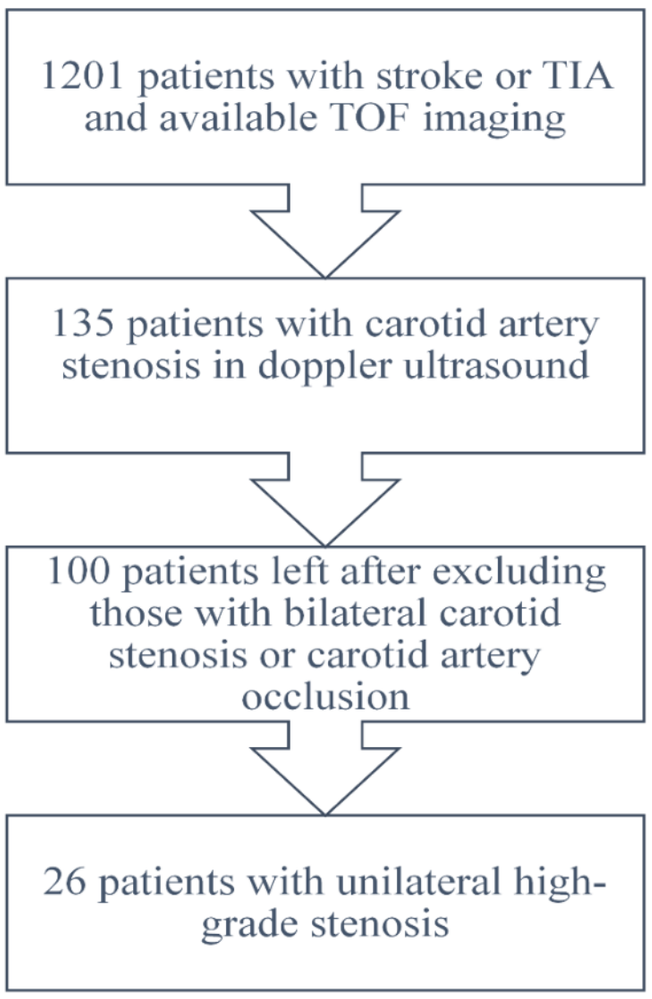
- Diagnostic standard in detecting extracranial carotid artery stenosis (ECAS) is contrast-enhanced CT- or MR-Angiography and Doppler ultrasound. [1]

## Hypothesis

- Time-of-flight MRA (TOF-MRA) could be an additional method to predict extracranial carotid stenosis without using contrast agent.

## Methods

- Retrospective cohort study including patients with acute ischemic stroke or TIA between January 2016 and August 2018 from our departments database.
- Patients with high-grade unilateral ECAS according to NASCET criteria assessed by doppler ultrasound → **case group.**




- Patients without ECAS on Doppler ultrasound → **control group.**
- The intraluminal signal intensities (ISI) on axial TOF-MRA images of the internal carotid artery (C4-segment) were measured.
- Ratios between non-affected and affected side were calculated according to following formula:

**ISI_ratio = ISI_contralateral/ISI_ipsilateral**

- Calculated signal intensity ratios (ISI_ratios) between groups were compared using Mann-Whitney-U-test.

## Results

- 79 patients were included into final analysis.
- ISI_ratios in intracranial C4-segment were significantly higher in patients with unilateral ECAS (n=26, median 73yrs, 60% male) compared to the control group (n=53, median 66yrs, 48% male).

| | Stenosis* | | No stenosis† | |
|---|---|---|---|---|
| | Right‡ | Left§ | Right‡ | Left§ |
| No. | 16 | 10 | 53 | 53 |
| Mean ISI_ratio (± SD) | 1.605 (± 0.50) | 1.410 (± 0.29) | 1.004 (± 0.13) | 1.012 (± 0.13) |
| p-value** | < 0.001 | < 0.001 | | |

* Considering all patients with unilateral highgrade stenosis in DUS
† Considering all patients without any stenosis in DUS
‡ ISI_ratio_right = ISI_left/ ISI_right
§ ISI_ratio_left = ISI_right / ISI_left
** Two-tailed Mann-Whitney-U test comparing cases and controls was performed

*Table 1: Results of ISI_ratios*

- Mean ISI_ratio was 1.605 vs. 1.004 ($p$<0.001) for right-sided stenosis and 1.410 vs. 1.012 ($p$<0.001) for left-sided stenosis.
- Receiver operating characteristic curve (ROC-curve) demonstrated a cut-off value of 1.137 for right-sided [sensitivity/specificity 93%/88%; area under the curve (AUC) 0.93] and 1.168 for left-sided stenosis (sensitivity/specificity 89%/90%; AUC 0.94) in C4 as a very good predictor for high-grade ECAS.

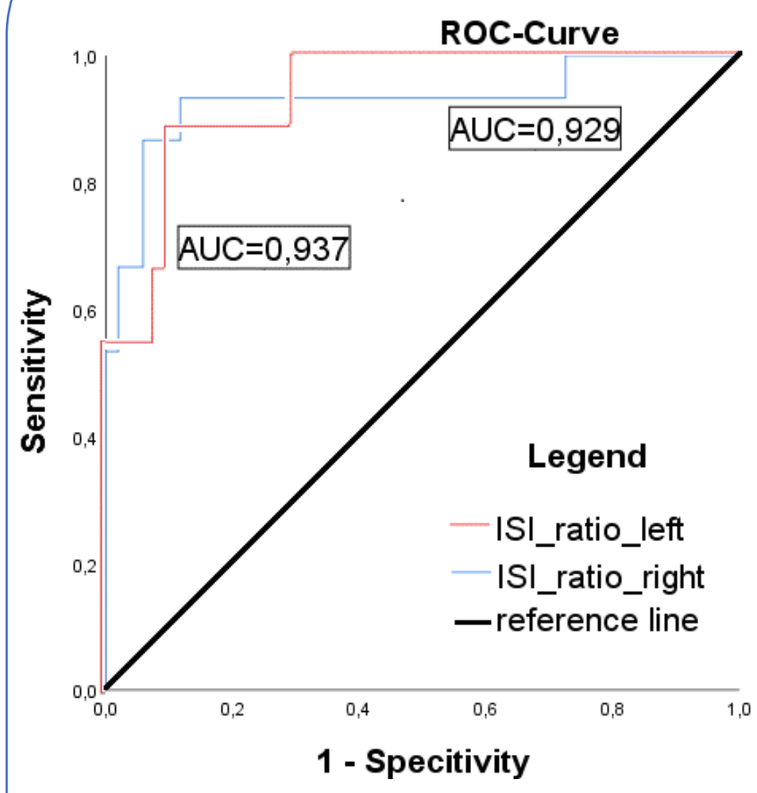



*Figure 1: ROC-curves for ISI_ratios in C4 segment*

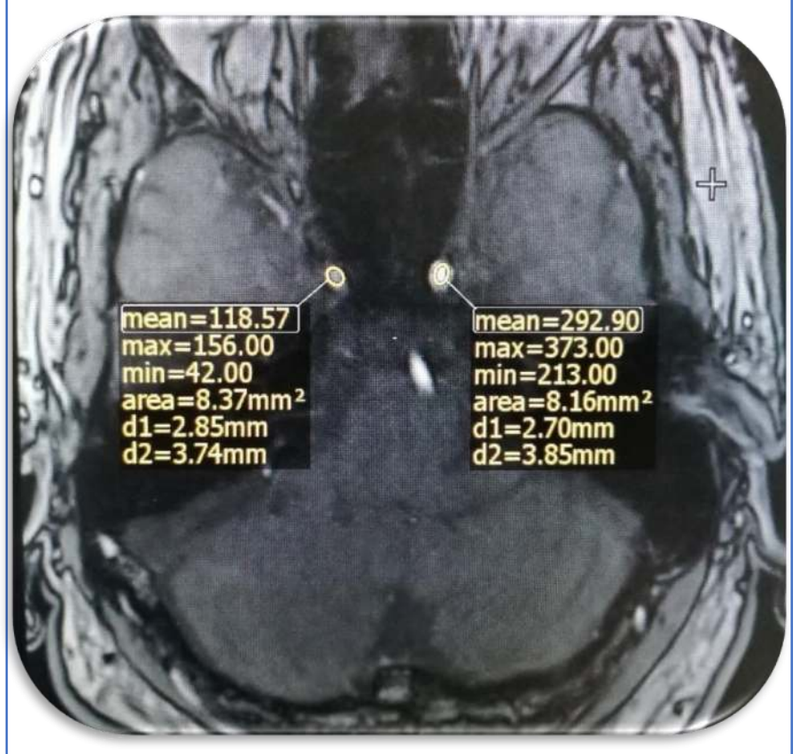



*Figure 2: ISI difference in a patient with right-sided stenosis*

## Conclusions

- Ratios of the signal intensity (ISI_ratios) on axial TOF-MRA can be used as a contrast-agent free method to discriminate therapeutically relevant unilateral ECAS in patients with acute ischemic stroke or transient ischemic attack.

## References

- 1. Eckstein, H.H., et al., *The diagnosis, treatment and follow-up of extracranial carotid stenosis.* Dtsch Arztebl Int, 2013. 110(27-28): p. 468-76.