# Enhancing stroke diagnosis and treatment:

## RapidAI's automated assessment of Hypoperfusion Intensity Ratio

**Abstract:**

The Hypoperfusion Intensity Ratio (HIR) is a critical biomarker in evaluating collateral blood flow and predicting outcomes in acute ischemic stroke patients with large vessel occlusion (LVO). RapidAI's advanced imaging software offers automated calculation of HIR, facilitating swift and accurate clinical decision-making. This white paper explores the significance of HIR in stroke management and demonstrates how RapidAI's technology enhances its assessment, drawing upon existing literature and clinical studies.

**Introduction:**

In the realm of acute ischemic stroke, timely and precise assessment of cerebral perfusion is paramount. The Hypoperfusion Intensity Ratio (HIR), defined as the ratio of brain volume with time-to-maximum (Tmax) >10 seconds to the volume with Tmax >6 seconds, serves as a quantitative measure of collateral circulation. A lower HIR indicates robust collateral flow, correlating with smaller infarct sizes and improved clinical outcomes. RapidAI's imaging solutions provide automated HIR calculations, streamlining the evaluation process and supporting clinicians in making informed treatment decisions.

## The role of HIR in stroke management:

Collateral blood flow significantly influences the progression and prognosis of ischemic stroke. HIR has emerged as a reliable indicator of collateral status:

- **Correlation with collateral status:** Studies have demonstrated that HIR correlates with collateral status assessed via CT angiography. Research indicates that an HIR threshold of >0.45 predicts poor collateral status with a sensitivity of 78% and specificity of 76%.
- **Prediction of infarct growth:** HIR serves as a predictor of infarct growth in patients who do not achieve successful reperfusion. A threshold HIR of 0.34 has been identified to optimally predict infarct growth at 24 hours.
- **Identification of underlying pathologies:** Lower HIR values have been associated with intracranial atherosclerotic stenosis (ICAS)-related LVOs. A study found that an HIR ≤ 0.22 could help predict underlying ICAS before endovascular treatment.
- **Safety and outcome measures:** HIR is a reliable quantitative metric for assessing vascular occlusion and predicting functional outcomes. Higher HIR values correlate with increased infarct volume, lower rates of successful reperfusion, and higher mortality risk. Conversely, lower HIR values are associated with improved collateral circulation and favorable recovery.
- **Impact on mechanical thrombectomy (MT):** The research confirms that a high HIR (>0.4) predicts rapid infarct core growth, reducing the efficacy of reperfusion therapies. This suggests that HIR may be helpful in selecting candidates for spoke to hub transfer for MT.
- **Association with malignant edema:** HIR is a significant predictor of malignant cerebral edema (MCE). Patients with HIR > 0.5 exhibit a higher likelihood of severe brain swelling post-reperfusion, highlighting the need for early intervention.
- **Clinical case analysis:** Data from patient cases with varying HIR values illustrate that lower HIR is linked to better functional outcomes, while higher HIR is associated with increased infarct volume and poor prognosis.

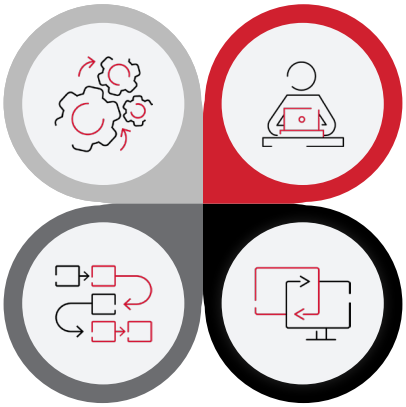
## Challenges in HIR standardization and RapidAI's solutions:

While HIR is a promising biomarker, its clinical application is complicated by variability in measurement techniques and interpretation standards. Differences in imaging protocols, software algorithms, and criteria used for HIR assessment can lead to inconsistencies in reported values, complicating clinical decision-making.

### RapidAI addresses these concerns by:

**Validated performance across diverse healthcare settings:**
RapidAI's technology is rigorously tested across multiple stroke centers, ensuring broad applicability and reliability in clinical environments.

**Real-time analysis:**
RapidAI delivers near-instant HIR outputs, ensuring that stroke teams can make timely, data-driven treatment decisions.



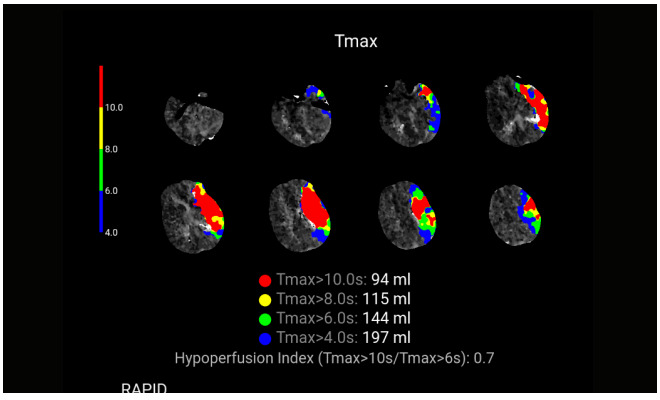
**Standardized HIR calculation:**
RapidAI's automated software ensures consistent and reproducible HIR calculations, minimizing variability associated with manual or differing algorithmic assessments.

**Integration with multi-modal imaging:**
RapidAI combines HIR analysis with computed tomography angiography (CTA), magnetic resonance angiography (MRA), and digital subtraction angiography (DSA) to offer a comprehensive view of collateral circulation.

## Clinical validation and impact:

RapidAI's automated HIR assessment has been validated in multiple clinical studies:

- **DEFUSE 3 trial:** Rapid CTP was utilized to process imaging data, demonstrating that patients with favorable HIR values had significantly less infarct growth at 24 hours.
- **Real-world applications:** Studies have confirmed that RapidAI's automated collateral measurements, including HIR, effectively predict infarct growth rates and clinical outcomes, thereby guiding patient selection for therapies.



## Conclusion:

The integration of RapidAI's automated HIR assessment into clinical practice enhances the evaluation of collateral circulation in acute ischemic stroke patients. By providing rapid and accurate measurements, RapidAI supports clinicians in making timely and informed treatment decisions, ultimately improving patient outcomes. Additionally, RapidAI's standardization of HIR calculation addresses concerns regarding variability and reliability, ensuring its effectiveness as a widely accepted clinical tool.

## References:


1 Lyndon, D., et al. (2021). Hypoperfusion Intensity Ratio correlates with CTA collateral status in large-vessel occlusion acute ischemic stroke. AJNR American Journal of Neuroradiology, 42(8), 1380-1386.

2 RapidAI. (2022). A recap of key results from RapidAI's 2022 publications. RapidAI Blog.

3 Imaoka, Y., et al. (2022). Hypoperfusion Intensity Ratio and CBV index as biomarkers to predict intracranial atherosclerotic stenosis-related LVO. RapidAI Blog.

4 "Rapid CTP." RapidAI.

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6 Use of Imaging to Select Patients for Late Window Endovascular Therapy. RapidAI.

7 Yedavalli, V., et al. (2024). Role of Hypoperfusion Intensity Ratio in vessel occlusions: A review on safety and clinical outcomes. AJNR American Journal of Neuroradiology. http://www.ajnr.org/content/early/2024/10/30/ajnr.A8557


### About RapidAI

RapidAI is the world leader in AI-driven medical imaging analysis and coordinated care. With the industry's most validated clinical AI platform, we empower care teams to rapidly, precisely, and confidently manage life-threatening conditions. Trusted by thousands of hospitals in 100+ countries, RapidAI delivers the deepest level of clinical decision support on the market to help accelerate the time to treatment and enhance patient outcomes. We go beyond the algorithm to drive care team collaboration and efficiencies that expand access to life-saving interventions. At RapidAI, we establish new standards for care teams and the patients they treat.





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