STROKE

THE CHALLENGE OF ACCURATE STROKE ASSESSMENT

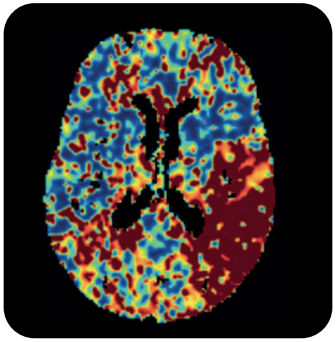
Acute ischemic stroke is a leading cause of morbidity in aging populations worldwide, making timely prevention and treatment critical. Seeking emergency medical care at the first signs of stroke is essential for improving outcomes.

To diagnose stroke, computed tomography (CT) or magnetic resonance imaging (MRI) are typically employed. Ideally, advanced imaging techniques like CT perfusion or MR perfusion and diffusion sequences are included in the diagnostic protocol.

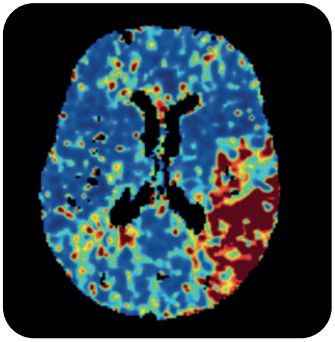
Perfusion maps, such as Tmax, are often used as pseudo-markers of the ischemic 'penumbra'—the area of potentially salvageable tissue. In contrast, markers such as cerebral blood flow (CBF) and the apparent diffusion coefficient (ADC) are commonly associated with irreversible tissue damage.

KEY CONSIDERATIONS IN STROKE IMAGING AND DIAGNOSIS

- **Critical for Timely Intervention:** Accurately estimating the core and penumbra is vital for guiding treatment decisions, particularly in cases with unknown or delayed presentation after stroke onset.
- **Data Processing Challenges:** Achieving automated, reliable quantification of lesion volumes and their precise locations remains a complex task, requiring robust processing systems to ensure accurate diagnostics.



SVD Tmax



Vascular Model

THE VASCULAR MODEL: ADVANCING STROKE SOLUTIONS

At Cercare Medical, the Vascular Model (VM) is a key component, offering enhanced clarity in detecting hypoperfused areas where traditional models often fall short.

- **Enhanced Visualization of Hypoperfused Tissue*:** The VM provides clearer insight into potentially hypoperfused regions, helping clinicians make more informed decisions.
- **Improved Alignment with Final Infarct**:** Our research suggests that lesions identified using the VM more accurately reflect follow-up infarction, offering a more reliable diagnostic tool.
- **Better Correlation with Neurological Deficits***:** Lesions observed using the VM may correspond more closely with patients' neurological symptoms than those detected by standard techniques.

STROKE SOLUTIONS FROM CERCARE MEDICAL

Cercare Medical offers a suite of advanced, AI-driven imaging solutions for comprehensive stroke assessment, all part of the **Cercare Medical Neurosuite**.

This suite includes four distinct products:
Cercare CT Stroke, Cercare CT Stroke Advanced, Cercare MR Stroke, and **Cercare MR Stroke Advanced**, each designed to enhance diagnostic accuracy using both CT and MRI technologies with a special focus on metabolic brain perfusion.

For **Cercare CT Stroke Advanced** users, there are additional tools available, including **ASPECTS+, LVO/MeVO+**, and **ICH+**, providing further precision in stroke diagnosis and treatment planning.

MR Stroke Advanced also includes **DWI/FLAIR mismatch++**, offering additional insights for assessing acute stroke and tissue viability.

Cercare Medical has developed specialized metabolic brain perfusion maps, including oxygen extraction fraction (OEF) and cerebral metabolic rate of oxygen (CMRO2), in addition to traditional perfusion markers—such as relative cerebral blood flow (rCBF), relative cerebral blood volume (rCBV), mean transit time (MTT), and time to maximum (Tmax)— to provide a more accurate understanding of ischemic tissue and its progression.

***Mikkelsen et al., 2015 – Springer Link.**
Biased Visualization of Hypoperfused Tissue by Computed Tomography Due to Short Imaging Duration: Improved Classification by Image Down-Sampling and Vascular Models.

****Otgonbaatar, et al., 2024 – AJNR.**
Quantification of Infarct Core Volume in Patients with Acute Ischemic Stroke Using Cerebral Metabolic Rate of Oxygen in CT Perfusion.

*****Mouridsen et al., - Sage Journals.**
Reliable Estimation of Capillary Transit Time Distributions Using DSC-MRI.

+Pending FDA. For Research Only. Not for Clinical Use.
++Pending CE/FDA. Research Only. Not for Clinical Use.

STROKE

Cercare Medical Neurosuite is fully automatic limiting the need of manual interventions by users, allowing an easier access to patients' stroke assesment .

MR STROKE: LESION IDENTIFICATION AND QUANTIFICATION

Cercare Medical's MR Stroke solutions provide outlines for suspected stroke lesions (including core and hypoperfused volumes) and mismatch results supporting clinicians in the treatment decisions.

On **Fig. 1**, the infarct lesion is shown in purple and the hypoperfused volume in yellow.

The results can be displayed as mosaics, as shown in **Fig. 1**, to show the full results at a glance, compatible with all DICOM viewers (e.g., PACS viewer) and also by email notification.

The results can also be displayed separately, as shown in **Fig. 2**, allowing the user to scroll through the series to analyze the results in more depth

In the MR Stroke example in **Fig. 2**, the infarct lesion (purple) is overlaid on the DWI series, and the hypoperfused volume (yellow) is overlaid on the MinIP. Overlay outputs are fully customizable to the user's preferences.

USE OF ADVANCED PERFUSION MAPS

OEF and CMRO2 maps are unique advanced biomarkers provided by Cercare perfusion processings. Jointly, they can provide deeper insight into tissue metabolism and viability.

In Bani-Sadr et al. Study **Fig. 3** "Oxygen Extraction Fraction Mapping on Admission Magnetic Resonance Imaging May Predict Recovery of Hyperacute Ischemic Brain Lesions After Successful Thrombectomy: A Retrospective Observational Study", 2024, Stroke AHA, it is shown that those markers can be used as predictive tools in stroke care.

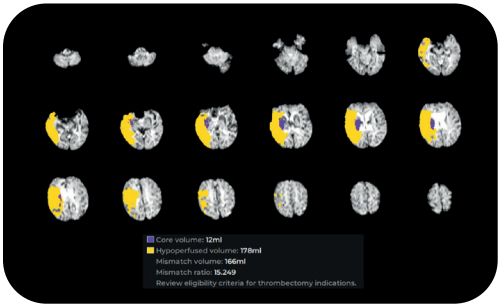
In another study, titled "Quantification of Infarct Core Volume in Patients with acute Ischemic Stroke Using Cerebral Metabolic Rate of Oxygen (CMRO2) in CT Perfusion", ANJR, 2024, **Fig. 4**, researchers highlight that CMRO2 mapping provides improved delineation of the infarct core compared to conventional perfusion parameters, supporting its value as a more precise imaging biomarker for early stroke assessment.

In the MR stroke example, **Fig. 5**, we can observe an elevated OEF in the affected region indicating compensatory oxygen extraction fraction by the brain tissue in response to the ischemia. The CMRO2 map shows a decrease in the same area, compared to the contralateral side, indicating that increased OEF has only partially allowed for sustained normal tissue oxygen metabolism in the affected area.

All figures are presented on the next page.

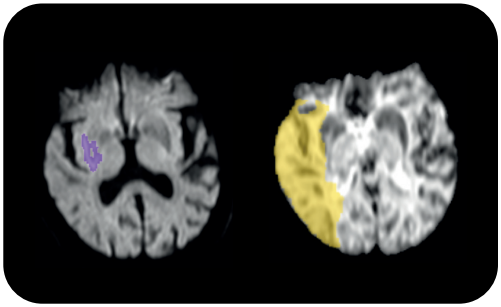
STROKE

Fig. 1:



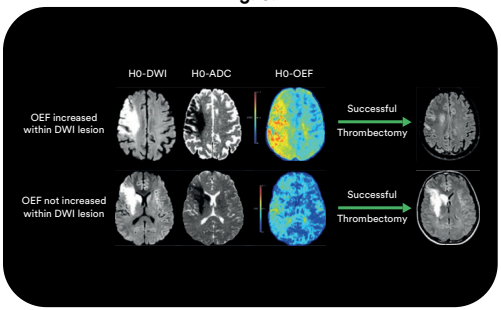
Mosaic view of the outlined suspected stroke volumes (core -in purple- and hypoperfused -in yellow-).

Fig. 2:



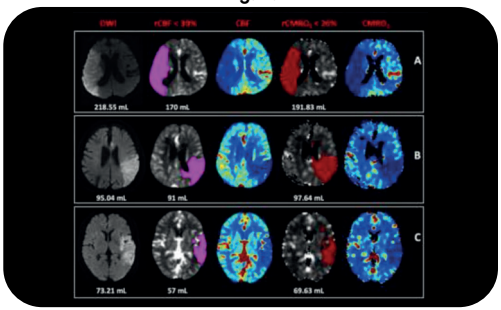
Independent series displaying suspected outlined core (on the left) and hypoperfused (on the right) volumes.

Fig. 3:



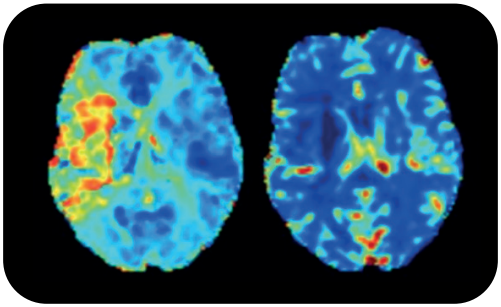
Bani Sadr: "Oxygen Extraction Fraction Mapping on Admission Magnetic Resonance Imaging May Predict Recovery of Hyperacute Ischemic Brain Lesions After Successful Thrombectomy: A Retrospective Observational Study". AHA Journal. Published October 2024.

Fig. 4:



Quantification of Infarct Core Volume in Acute Ischemic Stroke Using Cerebral Metabolic Rate of Oxygen ($CMRO_2$) in CT perfusion. Adapted from AJNR, 2024

Fig. 5:



(L) Oxygen extraction fraction (OEF).
(R) Relative cerebral metabolic rate of oxygen (rCMRO2).

KEY FEATURES

Cercare Medical Neurosuite offers a comprehensive suite of AI-driven imaging tools for stroke assessment, consisting of four distinct products: **Cercare CT Stroke, Cercare CT Stroke Advanced, Cercare MR Stroke**, and **Cercare MR Stroke Advanced**. These solutions are designed to enhance stroke diagnosis and treatment planning with cutting-edge features.

STROKE LESIONS IDENTIFICATION AND QUANTIFICATION
Each solution automatically identifies suspected infarcted and hypoperfused lesions. These results can be obtained using literature-based thresholds method (CE & FDA cleared) or our unique AI-based method (CE marked only).

ICH DETECTION+*
The AI-powered ICH detection module, available in **Cercare Stroke Advanced** products, helps rule out stroke-related intracerebral hemorrhage as part of the comprehensive stroke assessment.

OCCLUSION DETECTION+*
Cercare Medical Neurosuite automatically detects the potential location of large/medium vessel occlusions (LVO/MeVO), enabling targeted ischemic stroke diagnosis.

ASPECT SCORING+*
Cercare Medical Neurosuite automatically detects potential early infarct changes on Non-Contrast CT.

PERFUSION PARAMETRIC MAPS
Gain deeper insights into brain tissue viability with advanced perfusion maps. Each product generates both traditional perfusion maps (CBV, CBF, MTT, etc.) and unique perfusion biomarkers (CTH, OEF-based models, and rCMRO2-based models) to provide critical information on tissue health and progression. Maps can be displayed in greyscale or with onboard color maps.

DWI/FLAIR MISMATCH++**
For evaluating wake-up strokes with unknown onset times, this feature identifies mismatch between DWI and FLAIR to help determine stroke timing and treatment eligibility (pending CE/FDA clearance).

CMRO2 THRESHOLDING+
Utilizes cerebral metabolic rate of oxygen ($CMRO_2$) mapping to enhance infarct core detection, providing more accurate tissue viability assessment and aiding clinical decision making.

WORKS WITH BOTH CT AND MRI
Cercare Medical Neurosuite provides stroke and perfusion parametric maps for both CT and MRI modalities, ensuring comprehensive stroke assessment in a single application.

WORKS WITH YOUR EXISTING PROTOCOLS
Cercare Medical solutions require no changes to your existing clinical protocols, providing immediate benefits upon implementation.

MULTI-VENDOR COMPATABILITY
Cercare Medical Neurosuite products are fully compatible with all scanner types, providing seamless integration and optimal flexibility with your existing equipment.

FLEXIBLE INTEGRATION
The solutions integrate easily into your current clinical workflows, utilizing standard DICOM files for imaging outputs, and ensuring compatibility with PACS and viewer systems.

DICOM STRUCTURED REPORTING
Generates comprehensive, standards based structured reports directly in DICOM format, enabling seamless integration with PACS, RIS, and downstream systems for improved communication and documentation.

AUTOMATIC REMOVAL OF LOW-QUALITY CTP VOLUMES
Detects and excludes motion corrupted or poor quality CTP volumes, ensuring cleaner datasets and more reliable perfusion analysis.

HL7/FHIR SUPPORT
Supports modern interoperability standards, including HL7 and FHIR, to ensure compatibility with hospital information systems and enable efficient clinical data exchange.

CONFIGURABLE SUMMARY SERIES
Combines multiple series into a single one, reducing the number sent to PACS and enabling faster assessment.

AUTOMATIC MOTION CORRECTION
Patient motion can degrade image quality, but **Cercare CT/MR Stroke** products automatically correct for motion artifacts, ensuring high-quality imaging.

AUTOMATIC IMAGE FUSION
The software handles automatic co-registration of imaging series and sequences, enabling faster image interpretation without manual adjustments.

CONFIGURABLE MONTAGES AND OVERLAY SERIES
Mix and match any anatomical series with a lesion overlay.

+Pending FDA. For Research Only. Not for Clinical Use.
++Pending CE/FDA. For Research Only. Not for Clinical Use.
*Part of CT Stroke Advanced.
**Part of MR Stroke Advanced.

CERCARE MEDICAL NEUROSUITE

CT - STROKE

CERCARE CT STROKE

Fully automated computation of CT perfusion maps and automated delineation of infarct core and hypoperfused volumes for a complete decision-support stroke solution using threshold methods.

CE	FDA CLEARED	
✓	✓	**SVD-BASED PERFUSION MAPS** CBF, CBV, MTT, Tmax, MaxIP, TTP
✓	✓	**THRESHOLD-BASED LESION QUANTIFICATION** Tmax and CBF thresholds and mismatch

CERCARE CT STROKE ADVANCED

Complete decision-support stroke solution with fully automated computation of CT perfusion maps — ASPECTS, ICH, and LVO/MeVO — and automated delineation of infarct core and hypoperfused volumes, using either threshold methods or Cercare Medical's unique AI algorithm.

CE	FDA CLEARED	
✓	✓	**SVD-BASED PERFUSION MAPS** CBF, CBV, MTT, Tmax, MaxIP, TTP
✓	✓	**VASCULAR MODEL-BASED PERFUSION MAPS** CBF, CBV, MTT, Delay, CTH, COV, OEF, CMRO2, LOI
✓	✓	**THRESHOLD-BASED LESION QUANTIFICATION** Tmax and CBF thresholds and mismatch
✓		**ADVANCED THRESHOLD-BASED LESION QUANTIFICATION** Delay and CMRO2 thresholds and mismatch
		ADD-ONS:
✓		**ASPECTS**
✓		**ICH DETECTION**
✓		**DENSITY-BASED LVO DETECTION**
✓		**AI-BASED LVO/MeVO DETECTION**

CERCARE CONEBEAM CT PERFUSION*

Complete decision-support stroke solution with fully automated computation of CT perfusion maps and automated delineation of infarct core and hypoperfused volumes, using either threshold methods or Cercare Medical's unique AI algorithm.

CBCT Perfusion brings CT-quality perfusion directly to the angio suite using standard C-arm systems*.

* CE-Marked.
* FDA Clearance Expected in 2026.

CE	FDA CLEARED	
✓		**SVD-BASED PERFUSION MAPS** CBF, CBV, MTT, Tmax, MaxIP, TTP
✓		**VASCULAR MODEL-BASED PERFUSION MAPS** CBF, CBV, MTT, Delay, CTH, COV, OEF, CMRO2, LOI
✓		**THRESHOLD-BASED LESION QUANTIFICATION** Tmax and CBF thresholds and mismatch
✓		**ADVANCED THRESHOLD-BASED LESION QUANTIFICATION** Delay and CMRO2 thresholds and mismatch

MR - STROKE

CERCARE MR STROKE

Fully automated computation of MR perfusion maps and automated delineation of infarct core and hypoperfused volumes for a complete decision-support stroke solution using threshold methods.

CE	FDA CLEARED	
✓	✓	**DIFFUSION** Mean DWI, B0, ADC
✓	✓	**SVD-BASED DSC PERFUSION MAPS** CBF, CBV, MTT, Tmax, MinIP, TTP
✓	✓	**THRESHOLD-BASED LESION QUANTIFICATION** Tmax and ADC thresholds and mismatch

CERCARE MR STROKE ADVANCED

Complete decision-support stroke solution with fully automated computation of MR perfusion maps and automated delineation of infarct core and hypoperfused volumes, using either threshold methods or Cercare Medical's unique AI algorithm.

CE	FDA CLEARED	
✓	✓	**DIFFUSION** Mean DWI, B0, ADC
✓	✓	**SVD-BASED DSC PERFUSION MAPS** CBF, CBV, MTT, Tmax, MinIP, TTP
✓	✓	**VASCULAR MODEL-BASED DSC PERFUSION MAPS** CBF, CBV, MTT, Delay, CTH, COV, OEF, CMRO2, Leakage, LOI
✓	✓	**THRESHOLD-BASED LESION QUANTIFICATION** Tmax and ADC thresholds and mismatch
✓		**ADVANCED THRESHOLD-BASED LESION QUANTIFICATION** Delay and CMRO2 thresholds and mismatch
✓		**AI-BASED LESION QUANTIFICATION** Core and Hypoperfusion lesion and mismatch
		RESEARCH - NO CE/FDA Clearance DWI/FLAIR mismatch

Stroke2_Jan2026