THE ROW FOGO CENTRE

For Research into Ageing and the Brain

A Brief Introduction

THE UNIVERSITY *of* EDINBURGH
Row Fogo Centre for Research into Ageing and the Brain

Small Vessel Diseases Research

www.ed.ac.uk/clinical-brain-sciences/research/row-fogo-centre

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Introduction

Over the past two decades, the Row Fogo Centre for Research into Ageing and the Brain has brought together scientific specialties and advanced brain imaging methods from clinical and pre-clinical research to accelerate discoveries about mechanisms of common brain disorders—notably those due to blood vessel disorders—their causes, and treatment.

We are dedicated to fostering greater awareness and comprehension of brain health and vascular disease, particularly Small Vessel Disease, among scientists, healthcare professionals, policymakers, and the public.

Collaboration lies at the heart of our endeavours. Through national and international partnerships, conferences, and knowledge-sharing platforms, we disseminate our results and analysis tools, and facilitate interdisciplinary dialogue, accelerating the pace of discovery and innovation in brain health, and treating long-term vascular disease to improve outcomes.

Such collaborations have led to important advances in understanding of the causes and factors influencing the progression of Small Vessel Disease, imaging methods, image analysis computational mapping and rating tools, and image databases. Many of these tools are freely available and widely used elsewhere.

These tools allow for faster image processing and disease quantification. Therapeutic approaches developed in our centre are now being tested in clinical trials.

None of our achievements would be possible without the Row Fogo Charitable Trust, who have supported our work for the past two decades.

We hope you enjoy reading about the contributions of the Row Fogo Centre, and we look forward to a bright future investigating better ways to maintain brain health, manage Small Vessel Disease, and reduce the global burden of stroke and dementia.

- Professor Joanna Wardlaw, Chair of Applied Neuroimaging; Head of Neuroimaging Sciences and Edinburgh Imaging; Foundation Chair at the Dementia Research Institute; Row Fogo Centre Director

Artwork by India Cawley Gelling

Overview

The main focus of the Row Fogo Centre for Research into Ageing and the Brain is to improve the understanding of how blood vessel diseases can damage the brain, leading to stroke, cognitive decline, dementia, and mobility problems.

We aim to:

- Promote greater understanding of brain health and vascular disease amongst scientists, health professionals, policymakers, and the public
- Facilitate learning, knowledge exchange, and better patient care
- Encourage the best students and scientists worldwide to work on Small Vessel Disease
- Support fundraising towards the Centre's work

Our work would not be possible without the generous support of the Row Fogo Trust since 2001.

The Row Fogo Charitable Trust formed in 1970 from the generosity of Mrs Gladys Row Fogo. Its charitable purposes are wide-reaching with a focus on supporting medical research, care of older people, and a range of activities to help young people, within central Scotland.

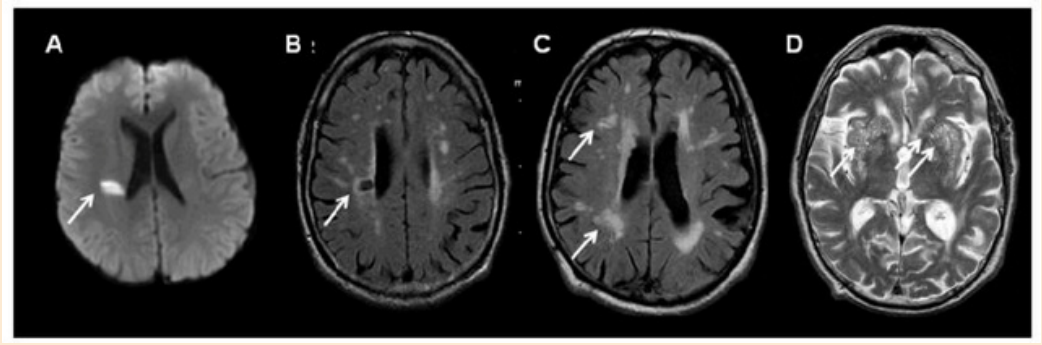
Small Vessel Disease

Cerebral Small Vessel Disease (SVD) refers to a group of neurological disorders characterised by damage to the small blood vessels in the brain, which can lead to a variety of neurodegenerative diseases, such as dementia, and stroke.

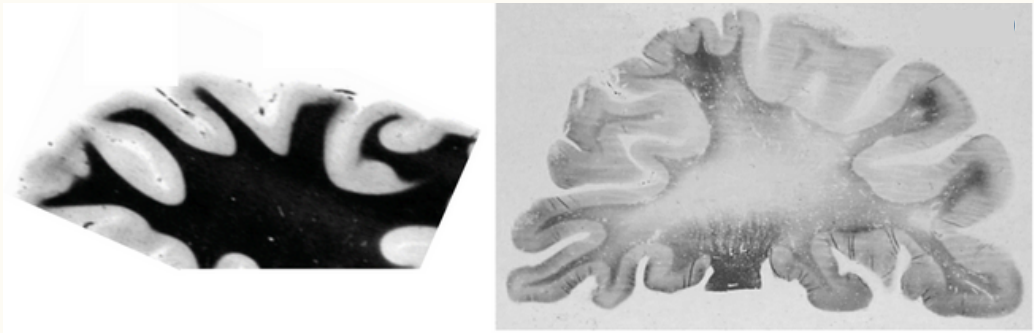
SVD often starts silently and builds up over several years before it is noticed. SVD is still not fully understood, and prevention and treatment remain limited.

At the Row Fogo Centre for Research into Ageing and the Brain, our primary aim is to bridge the gap between understanding SVD and developing effective treatments.

Key to this is the identification of patient symptoms—both established and novel—and understanding SVD as a whole-body phenomenon.



Key imaging characteristics of features of SVD. *Wardlaw et al.* (2013)



Myelin loss in a patient with SVD (normal - right; SVD - left). *Anna Williams.*

Scientific Advisory Board

The Row Fogo Centre for Research into Ageing and the Brain is guided by a distinguished advisory board:

Prof Joannna Wardlaw
Row Fogo Centre Director

Prof Frank-Erik de Leeuw
External Scientific Advisor

Dr Fergus Doubal
PPIE Advisor

Prof Rustam Al-Shahi Salman
Scientific Advisor

Prof Adam Waldman
Scientific Advisor

Dr Maria Valdés Hernández
Row Fogo Lecturer in Medical Image Analysis

Dr Francesca Chappell
Senior Medical Statistician

Dr Rosalind Brown
Research Manager

Core Staff

Scientific Communications Officers:
Gillian Joyce, Jean Balchin

College Representative:
Anne Marie Coriat

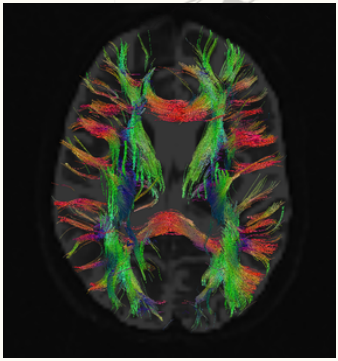
Heads of University of Edinburgh Research Centres:
UK DRI – Giles Hardingham
BHF REA – David Newby

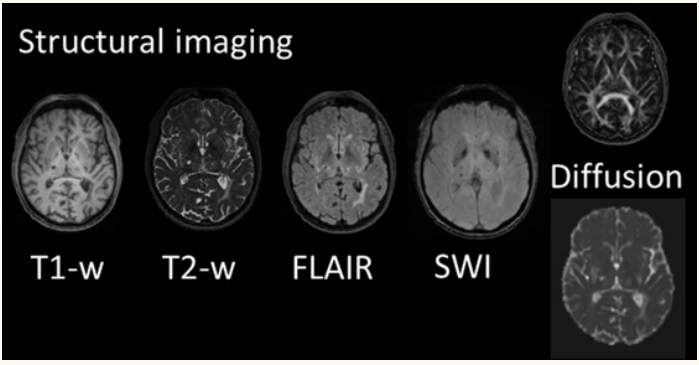
Pioneering imaging techniques

From the earliest days in the early 2000s, the Row Fogo Centre has pioneered sophisticated medical imaging methods such as magnetic resonance imaging (MRI) to find out about how SVD is affecting the brain and blood vessels.

To extract information from brain MRI, our researchers have developed highly specialised MRI methods and computer methods to analyse the images.

The medical image analysis tools and image databanks from our studies allow us to improve early detection and diagnosis of SVD, identify causes and consequences of SVD, and develop methods for the prevention and treatment of SVD.





Staff at the Edinburgh Imaging Facility.

Tractography data visualisation (above). *Susana Muñoz Maniega.*

Structural imaging techniques (left). *Michael Stringer.*

DCE-MRI

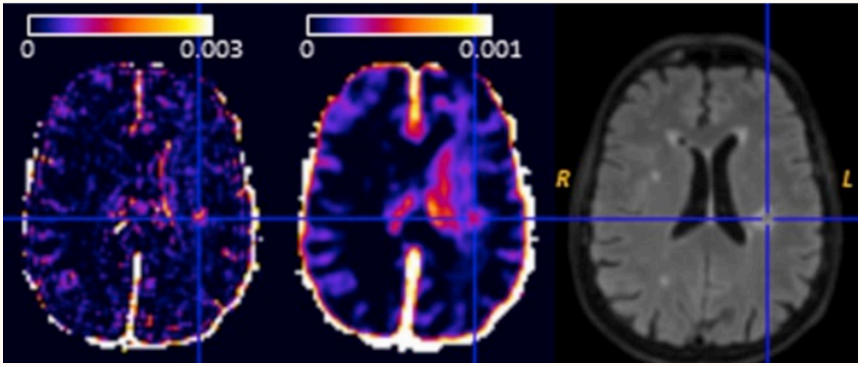
An intact blood-brain barrier (BBB) is crucial for brain health, blocking harmful toxins and pathogens while allowing essential nutrients to pass through to the brain. Unlike conditions such as cancer where gross BBB damage causes visible contrast agent leakage, cerebral Small Vessel Disease exhibits subtler BBB damage.

With dynamic contrast-enhanced MRI (DCE-MRI), researchers can detect slight BBB leakage in SVD-affected brain areas. Whether this leakage is a cause or effect of the disease remains uncertain, and has been a focus of the Row Fogo Centre's research, including in the current Mild Stroke Study 3 (MSS3).

"Our group was the first to measure BBB leakage in reasonably large clinical studies of SVD. We pioneered the use of dynamic contrast-enhanced MRI (DCE-MRI) to assess blood-brain barrier integrity in SVD, a breakthrough initially met with scepticism in the scientific community.

Through collaborative efforts, we refined the methodology over the years, culminating in an international consensus paper published in *Alzheimer's & Dementia* in 2019. Our contributions include open-source software and protocols for BBB leakage quantification, widely adopted by researchers worldwide."

- Dr Michael Thrippleton, Research Fellow, HCPC-registered Clinical Scientist



DCE-MRI quantification of blood-brain barrier leakage. *Michael Thrippleton.*

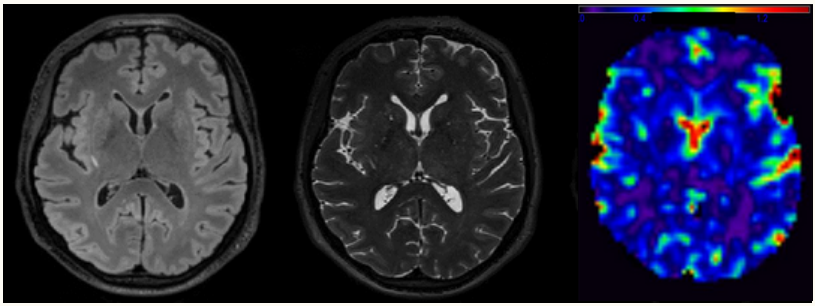
CVR

Cerebrovascular reactivity (CVR) is the brain's ability to maintain adequate blood flow and oxygenation in response to changes in metabolic demand or cerebral perfusion pressure.

CVR is assessed using various imaging techniques and physiological tests to evaluate the brain's ability to regulate blood flow in different conditions, providing valuable insights into cerebrovascular health and functioning.

"Our development and application of CVR as a quantitative imaging biomarker has also been pioneering, including being the first group to use CVR as an outcome measure in an SVD clinical trial."

- Dr Michael Thrippleton, Research Fellow, HCPC-registered Clinical Scientist



MSS3 participant: L-R: Flair, T2, and CVR images. Female, mid-40s. *Michael Thrippleton.*

One such technique was pioneered by Dr Michael Thrippleton and Dr Fergus Doubal—the Carbon Dioxide (CO_2) Inhalation Challenge. Inhalation of CO_2 is a common method to induce hypercapnia and vasodilation. Changes in CBF or CBV during or after CO_2 inhalation can be measured using fMRI, PET, or other imaging modalities to assess CVR.

"We spent a lot of time, many years ago, testing different methods, with different gas concentrations, working out how to do it.

When we started, I thought it would never work, but now it works well; it's a pretty slick technique that's now been exported worldwide."

- Dr Fergus Doubal, Honorary Reader in Stroke Medicine & Consultant Stroke Physician

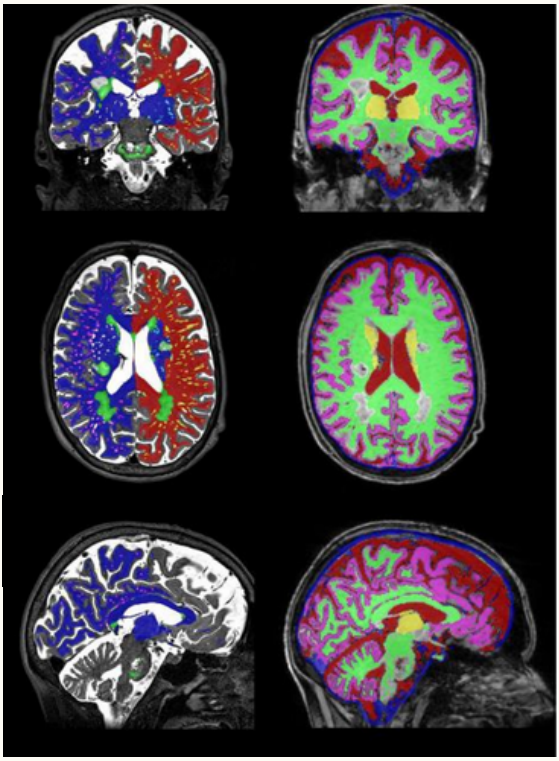
Image Analysis

SVD often manifests as subtle changes on brain imaging, which can be challenging to detect. Software tools enable automated image processing, allowing researchers to identify and quantify SVD-related abnormalities faster and more consistently.

For over a decade, the Row Fogo Centre has led the way in developing methods for neuroimaging analysis, from semi-automatic to fully automatic analysis, culminating in a suite of tools available through the Centre's website.

"Automated data analysis and image processing can streamline research and save us a great deal of time and resources."

- Dr Maria Valdés Hernández, Row Fogo Lecturer in Medical Image Analysis



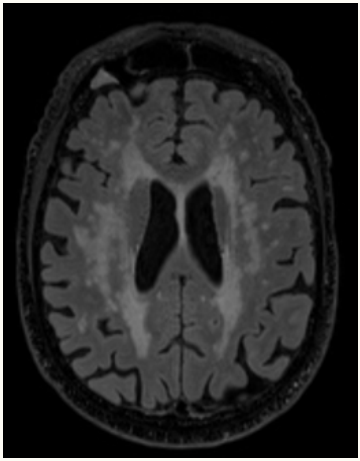
Dr Maria Valdés Hernández specialises in developing computational methods and software tools for extracting structural imaging biomarkers to study the brain. She has collaborated with researchers in many places to enhance multi-site image processing protocols.

At the Row Fogo Centre, Maria continues to refine assessment methods for imaging markers of SVD. Collaborating with colleagues in Edinburgh and elsewhere, she is working on creating a robust suite of innovative software tools for future studies.

Understanding the progressive nature of SVD

The Row Fogo Centre has lead groundbreaking research on the dynamic nature of Small Vessel Disease, particularly through cohort studies, which follow individuals over an extended period.

This allows researchers to track changes in SVD-related markers, symptoms, and outcomes over time. This longitudinal perspective provides valuable insights into disease dynamics, including identifying risk factors for progression, understanding the natural history of the disease, and assessing the efficacy of interventions.

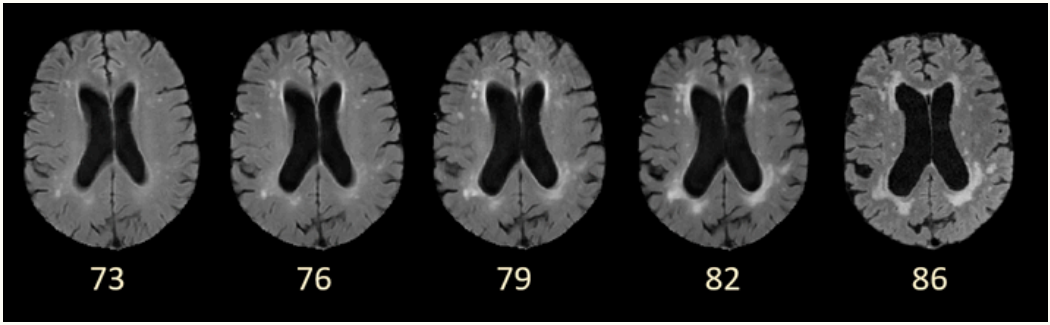


"We're known for these big cohort studies, which have illuminated the changing nature of SVD."

- Dr Fergus Doubal, Honorary Reader in Stroke Medicine & Consultant Stroke Physician

A FLAIR scan from a lacunar stroke patient with severe WMH burden (Fazekas score of 6) (left). *Michael Stringer.*

Longitudinal changes of an LBC1936 participant (below).



For example, the Mild Stroke Study 3 (MSS3) is a research project aiming to understand how small blood vessel problems in the brain affect people who have had minor strokes. The team examined up to 300 adults over one year, conducting detailed assessments of their health, thinking abilities, lifestyle, and eye and brain scans.

Some members of the MSS3 study team.

MRI brain scans are used to evaluate the potential changes in SVD lesions over time, the integrity of both white and grey matter, the function and blood flow in small brain vessels, as well as the presence of blood-brain barrier leakage.

The study team also conducts imaging of the retinal small vessels, records blood pressure and systemic vascular compliance, and gathers comprehensive information regarding participants' medical history and lifestyle factors.

In doing so, the MSS3 team hopes to better understand the connections between small vessel dysfunction, the development of SVD lesions, and the clinical, cognitive, and physical manifestations of SVD.

Artwork by India Cawley Gelling

Members of the Edinburgh Imaging team using the MRI machine.

Preclinical Research

Preclinical research involving rodent models provides a valuable platform for investigating the underlying mechanisms, progression, and potential treatments for SVD.

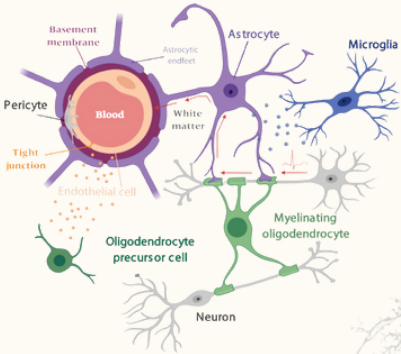
"Our investigation, which took the human findings back into rodent models, reveals the pivotal role of dysfunctional endothelial cells lining small vessels in the SVD progression. These endothelial cells are essential elements of the vascular system and can release abnormal proteins that seep into the neighbouring brain.

This causes damage primarily to oligodendrocytes—thereby disrupting myelin production and subsequent nerve function. Observations from both rodent models and human postmortem tissue imply that endothelial cell dysfunction might represent an early event in the development of SVD."

- Anna Williams, Professor of Regenerative Neurology and Honorary Consultant Neurologist

Various factors, including genetic mutations and lifestyle choices such as high blood pressure, smoking, and diet, can contribute to endothelial cell distress.

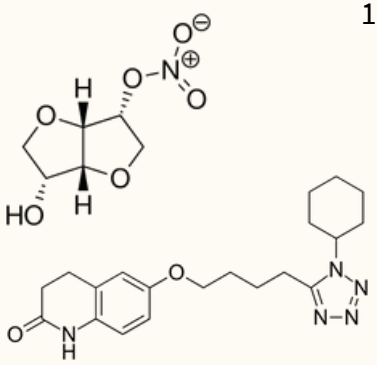
"The creation of a genetically modified rodent, which lacks a particular gene linked to SVD, provides us with an exclusive model free from complicating elements such as hypertension and diabetes. This enables us to isolate and delve into the fundamental mechanisms driving the disease.



We found that the rodent model exhibited pathological, imaging, clinical, and behavioural characteristics akin to human SVD, presenting a platform for studying disease exacerbation through interventions such as inducing diabetes."

Rodent models may also be used to explore the efficacy and mechanisms of drugs currently in clinical trials for SVD, such as isosorbide mononitrate (ISMN) and cilostazol (tested via the LACI trials).

By testing these drugs in rodents, we can assess their effects at various doses and stages of the disease progression, providing insights through reverse translation.



Skeletal formulae of isosorbide mononitrate (top) and cilostazol (bottom).

"There's never a shortage of things to do. Our research is continuously evolving, with a particular focus on addressing endothelial cell dysfunction.

While drug interventions are a possibility, we seek more targeted approaches to minimise systemic effects. Gene therapy is a promising avenue, whereby we aim to identify and rectify specific gene or protein disturbances in endothelial cells."

"For instance, in our transgenic rodent model, we explore the potential of using a targeted virus delivery system to replace the deficient gene selectively.

Although still in the early stages, this approach offers precision in correcting the disease pathology, through the selective nature of viral vectors."

Anna Williams, Professor of Regenerative Neurology and Honorary Consultant Neurologist

Linking retinal changes to brain changes

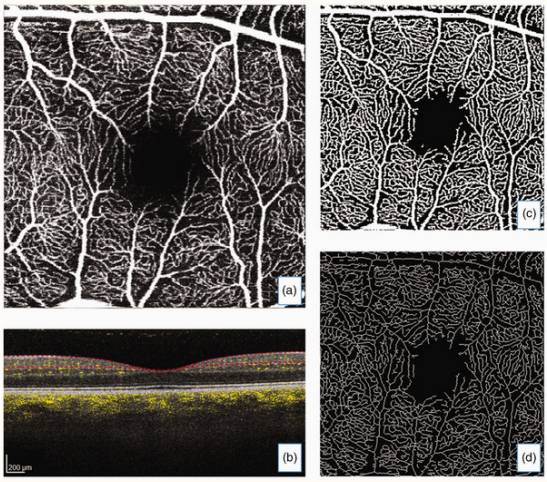
The Row Fogo Centre has led the way in utilising retinal imaging as a tool for understanding cerebral Small Vessel Disease.

Retinal imaging offers the opportunity to directly visualise blood vessels at the back of the eye which are related to the brain's blood vessels. This detailed vision enables in-depth examination of vascular structures and health indicators related to the brain.

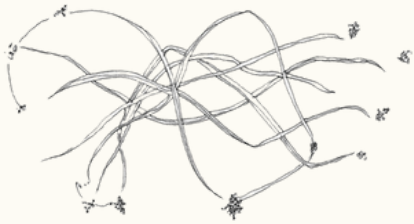
Because the retina is a direct extension of the central nervous system, changes in retinal vessels may precede or coincide with vascular changes in the brain. Studying retinal microvascular abnormalities may provide insights into the early stages of SVD development and progression, potentially enabling early detection and intervention.

"We were among the first groups worldwide to link abnormalities in the small blood vessels in the eye with abnormalities in the small blood vessels of the brain."

- Dr Fergus Doubal, Honorary Reader in Stroke Medicine & Consultant Stroke Physician



Artwork by India Cawley Gelling



(a) Enface optical coherence tomography angiography (OCTA) transverse image of the superficial vascular complex with (b) corresponding structural and OCTA flow image where yellow colouration represents blood flow in vessels and segmentation (red dotted lines) bounds the internal limiting membrane to inner plexiform layer. Processed images: (c) adaptive threshold with Hessian filter and (d) skeletonized image.
Stuart Wiseman et al.

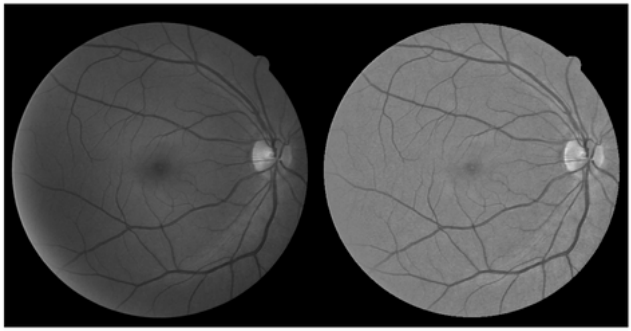
Recent advancements, including sophisticated retinal imaging techniques employed through Dr Stuart Wiseman's Stroke Association project, allow for more precise assessment of vascular health using mathematical parameters such as complexity and vessel branching patterns.

Building upon this foundation, the Row Fogo Centre has embarked on a retinal CVR trial, aiming to assess vascular response patterns in both the brain and retina.

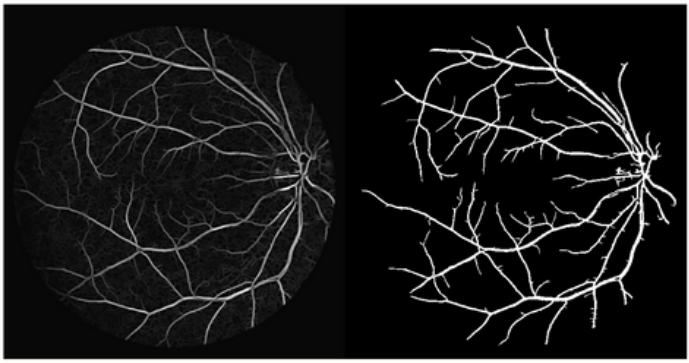
Initial findings show promise, suggesting that retinal CVR measurements could offer a simpler and more accessible alternative to traditional brain imaging methods.

"If retinal imaging proves viable for assessing vascular reactivity, we could democratise this diagnostic process, potentially shifting from specialised settings like research centres or hospitals with MRI scanners to routine examinations at high street opticians. This would not only enhance accessibility but would significantly reduce costs associated with vascular health assessments."

- Dr Michael Stringer, Stroke Association Post-Doctoral Fellow, Research Fellow, Medical Physicist



Fractal analysis of the retinal vascular network in fundus images. *T. J. MacGillivray et al.*



Lymphatic Imaging

Dr Michael Stringer and colleagues are exploring lymphatic imaging techniques using an intravenous contrast injection, avoiding invasive procedures near the spine.

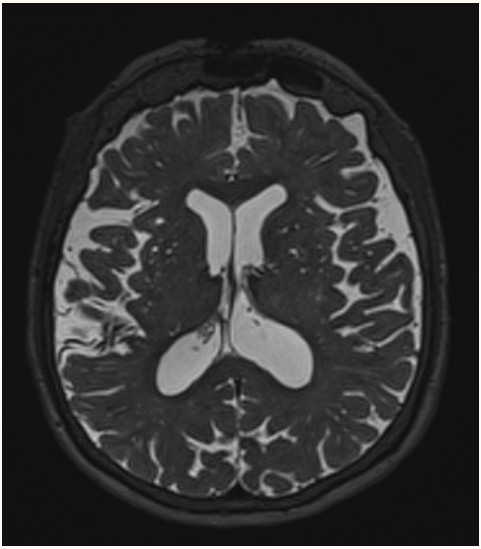
"By suppressing signals from cerebrospinal fluid (CSF), we see an enhancement of these lymphatic vessels which suggests the tracer is getting from the blood into the lymphatic vessels, which might be a sign of waste clearance."

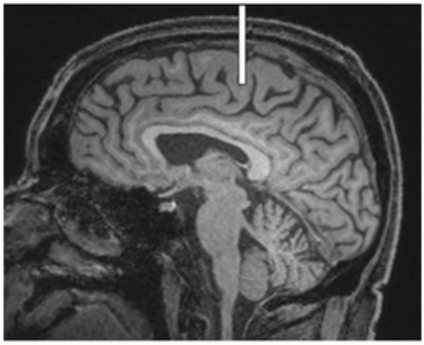
"Collaborating with colleagues in our Fondation Leducq Network and the Karolinska Institutet, our pilot study shows promising results correlating signal intensity with perivascular spaces, indicative of waste clearance.

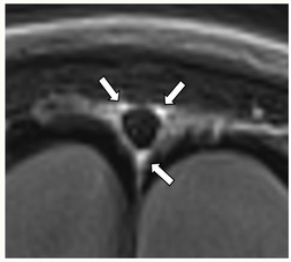
We are currently translating this method from rodent models to clinical scans, and we're hoping for a less invasive means of measuring lymphatic flow. Early stages show progress, with plans to analyse a full dataset by year-end."

- Dr Michael Stringer, Stroke Association Post-Doctoral Fellow, Research Fellow, Medical Physicist

High number of perivascular spaces.
Maria Valdés Hernández.







Slice through the sagittal sinus (top) showing (bottom) meningeal lymphatics that drain the brain waste fluid.
Michael Thrippleton and Michael Stringer.

Cognition

Cognitive impairment is a common and often debilitating consequence of SVD. Research into cognition provides insights into the impact of SVD on daily functioning, quality of life, and independence, guiding interventions to optimise patient outcomes.

R4VaD is a UK-wide observational study of cognitive, physical, and neuropsychiatric complications after stroke. Patients can experience memory, thinking or mood changes, or dementia, after a stroke but enough is not yet known about how to treat these conditions. R4VaD is looking at these conditions to help more people to make a better recovery.

The aim of R4VaD is to improve our understanding of the rates of and risk factors for post-stroke cognitive impairment (PSCI), while informing patient services, intervention targets, and research into mechanisms.

R4VaD
Rates Risks and Routes to Reduce Vascular Dementia

"I hope the research provides understanding about why certain groups of individuals develop issues with memory and thinking after stroke, how to identify these patients, and gain insight into recovery pathways. This information could then be used to inform preventative management and treatment for conditions such as dementia after stroke.

The rich data we are collecting could also be used to generate new research questions which are clinically important and relevant to those living with dementia after stroke."

- Dr Ellen Backhouse, Research Fellow, Centre for Clinical Brain Sciences

Artwork by India Cawley Gelling

International Networks & Collaborations

Collaboration between international research centres and interdisciplinary researchers is crucial in advancing our understanding of Small Vessel Disease.

SVD is a complex condition with multifaceted underlying mechanisms, including vascular, neurodegenerative, and inflammatory processes.

The Row Fogo Centre draws together expertise from various disciplines such as neurology, radiology, pathology, genetics, medical physics, image analysis, and epidemiology to comprehensively investigate the diverse aspects of SVD pathology, risk factors, and clinical manifestations.

Moreover, SVD is a global health challenge affecting millions of people worldwide—and its prevalence is expected to rise with ageing populations.

International collaboration enables researchers to study SVD in diverse populations, considering genetic, environmental, and socio-cultural factors that may influence disease susceptibility, progression, and response to treatment.

COEN / JPND

The EU Joint Programme – Neurodegenerative Disease Research (JPND) is the largest global research initiative aimed at tackling the challenge of neurodegenerative diseases.

JPND endeavors to enhance collaborative funding across member nations to advance research targeting the origins, treatments, and caregiving methods for individuals affected by neurodegenerative diseases. JPND's overarching objective is to discover remedies for neurodegenerative diseases and facilitate timely diagnoses to enable targeted interventions at an early stage.

The COEN Initiative began in June 2010 with the UK Medical Research Council (MRC), Deutsche Zentrum für Neurodegenerative Erkrankungen (DZNE, Germany), and the Canadian Institutes of Health Research (CIHR).

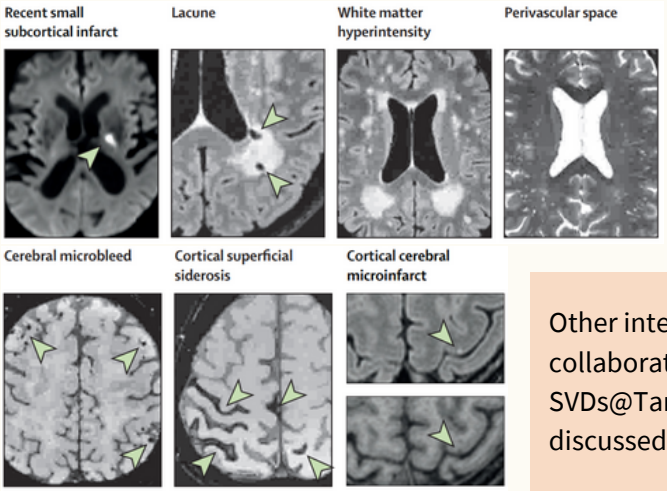
STRIVE Collaboration (2013 / 2023)

The COEN Initiative funded and led to publication in 2013 of the STandards for ReportIng Vascular changes on nEuroimaging (STRIVE-1), which aimed to enhance the consistency and quality of research in Small Vessel Disease (SVD). It clarified definitions of various SVD features on neuroimaging, such as recent small subcortical infarcts, lacunes of presumed vascular origin, white matter hyperintensities, perivascular spaces, cerebral microbleeds, and brain atrophy.

Since its publication, STRIVE-1 findings and recommendations have been widely adopted in clinical and research settings, standardizing image acquisition, reporting, and interpretation.

However, the field has seen significant advancements since 2013, prompting an update. Led by Professor Joanna Wardlaw (University of Edinburgh), Professor Marco Duering (University Hospital Munich and Medical Image Analysis Center Basel), Professor Eric Smith (University of Calgary), and Professor Martin Dichgans (University Hospital Munich), 54 international experts convened to develop STRIVE-2, building on the approach of STRIVE-1.

STRIVE-2 focuses on neuroimaging features and research applications, updating existing features and introducing emerging ones like cortical cerebral microinfarcts and incidental diffusion-weighted imaging positive lesions. Furthermore, it offers detailed guidance on key quantitative imaging markers of brain structure and function, along with standards for imaging and analyzing SVD.



MRI features of lesions related to Small Vessel Disease (STRIVE-2). *Joanna Wardlaw.*

Other international networks and collaborations include the SVDs@Target and the R4VaD projects, discussed elsewhere in this booklet.

SVD Treatments

The Row Fogo Centre has led the way with the Lacunar Intervention Trials (LACI-1, LACI-2) randomised controlled trials testing two repurposed drugs, cilostazol and isosorbide mononitrate (ISMN), to prevent worsening of SVD.

There are medications commonly used for other vascular conditions that may hold the potential to enhance small vessel function and prevent further vascular brain damage.

LACI-1 tested whether a much larger scale study testing the effects of cilostazol and ISMN on preventing brain damage from Small Vessel Disease would be feasible. The team found that cilostazol and ISMN are well tolerated when the dose is escalated, without safety concerns, in patients with lacunar stroke. These findings led the way for LACI-2, a larger trial with a longer follow-up period.

laci-1 PREVENT - SVD LACunar Intervention TRIAL 1

laci-2 LACunar Intervention TRIAL 2

Following LACI-1, the researchers wanted to test whether the study methods were practical so that patients and trial centres could follow the procedures for up to a year. The LACI-2 team also needed to establish how many patients developed recurring stroke or had a decline in their cognitive abilities.

The results indicate that the LACI-2 trial was practical, and ISMN and cilostazol were well-tolerated and safe. These medications have the potential to decrease the risk of recurrent stroke, dependence, and cognitive decline following a lacunar (small vessel) stroke, and they may also mitigate other adverse effects of SVD.

This information is key to staging a much larger clinical trial, LACI-3, to find out if these drugs can prevent worsening of Small Vessel Disease in patients with lacunar ischaemic stroke, and testing in cognitive, covert, and other stroke presentations of SVD.

"With the LACI trials, we're hopefully getting close to possible treatments for Small Vessel Disease. The idea of repurposing existing drugs is a lot more efficient than development from scratch, and with the LACI trials, we're also setting up a framework that can be used for other trials.

We're not the only place repurposing drugs, but we *are* setting up an advanced framework for this process. These trials are important because Small Vessel Disease is a pervasive disease which often results in stroke for many individuals."

- Professor Joanna Wardlaw, Chair of Applied Neuroimaging; Head of Neuroimaging Sciences and Edinburgh Imaging; Foundation Chair at the Dementia Research Institute; Row Fogo Centre Director

Multicentre Studies & Trials

The Row Fogo Centre understands the importance of multicentre studies and trials in studying cerebral Small Vessel Disease.

Involving multiple centres allows researchers to recruit a more diverse patient population, enhancing the generalisability of study findings. Moreover, the increased sample size enhances the study's ability to draw robust conclusions about SVD-related factors, outcomes, and interventions.

The SVDs@Target programme was funded by the EU Horizon 2020 programme, with researchers in several European centres investigating the blood-brain barrier and vascular dysfunction in sporadic and genetic SVDs (INVESTIGATE@SVDs, ZOOM@SVDs) and treatments (TREAT@SVDs).

SVDS @target

The Row Fogo Centre, and researchers from the University of Vermont, the University of Utrecht, and the Ludwig Maximilian University of Munich, focused on identifying common molecular, cellular, and physiological mechanisms governing blood flow regulation and microvessel function across different SVDs.

It sought to understand how these shared defects contribute to brain damage, leading to stroke and dementia. Through experimental interventions in both isolated microvessels and patients, the network aimed to validate the relevance of these mechanisms and biomarkers, paving the way for potential therapeutic interventions.

INVESTIGATE@SVDs was an MRI study in three centres at 3T to assess blood brain barrier function, microvascular function, and pulsality.

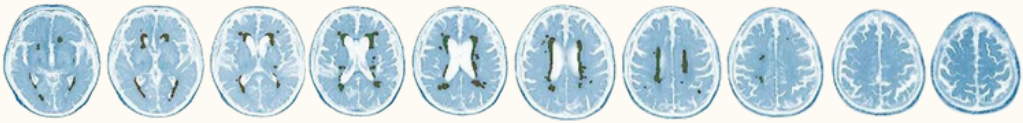
INVESTIGATE SMALL VESSEL DISEASES SVD

ZOOM SMALL VESSEL DISEASES SVD

The ZOOM@SVDs study aimed to establish measures of cerebral small vessel dysfunction on 7T MRI as novel disease markers of SVDs.

TREAT@SVDs was a randomised trial in five centres to determine the effects of different blood pressure lowering agents on microvascular function in patients with distinct SVDs.

TREAT SMALL VESSEL DISEASES SVD



Guidelines & Standards

The Row Fogo Centre has led the way in providing standardised frameworks for conducting research studies, clinical guidelines, and clinical trials related to SVD.

European Stroke Organisation (ESO) Clinical Guidelines for Small Vessel Disease

These ESO guidelines provide evidence-based recommendations to assist with clinical decisions about management of SVD, specifically white matter hyperintensities and lacunes, to prevent adverse clinical outcomes.

Part 1: Covert Small Vessel Disease

Patients with cerebral Small Vessel Disease (SVD) and hypertension are recommended to maintain well-controlled blood pressure levels, as lower targets may potentially slow down SVD progression. However, the use of antiplatelet drugs such as aspirin in SVD is not advised due to insufficient evidence supporting their efficacy.

There is limited evidence regarding the effectiveness of lipid-lowering therapies in SVD. Smoking cessation is emphasized as a health priority, and regular exercise is recommended as it may positively impact cognition. Adopting a healthy diet, good sleep habits, and measures to avoid obesity and stress are encouraged for overall health in individuals with SVD. There is currently insufficient evidence to support glucose control in the absence of diabetes or the use of conventional Alzheimer's dementia treatments.

Part 2: Lacunar Ischemic Stroke

A quarter of ischemic strokes are of lacunar subtype, characterized by mild neurological symptoms. These strokes typically arise from intrinsic cerebral small vessel pathology, presenting distinct risk factor profiles and outcome rates compared to other stroke subtypes.

Part 2 of the ESO Clinical Guidelines for Small Vessel Disease recommends that patients with suspected acute lacunar ischemic stroke receive intravenous alteplase, antiplatelet drugs, and refrain from blood pressure lowering, following current acute ischemic stroke guidelines. For secondary prevention, single antiplatelet treatment long-term, blood pressure control, and lipid lowering are recommended according to current guidelines. Smoking cessation, regular exercise, adoption of other healthy lifestyle modifications, and avoidance of obesity are advised for general health benefits.

Clinical services & Translation

As Dr Fergus Doubal points out, identifying gaps in our current understanding of SVD is essential for directing future research efforts. Through translation, researchers can identify areas where further investigation is needed to address unanswered questions or unmet clinical needs in the management of SVD.

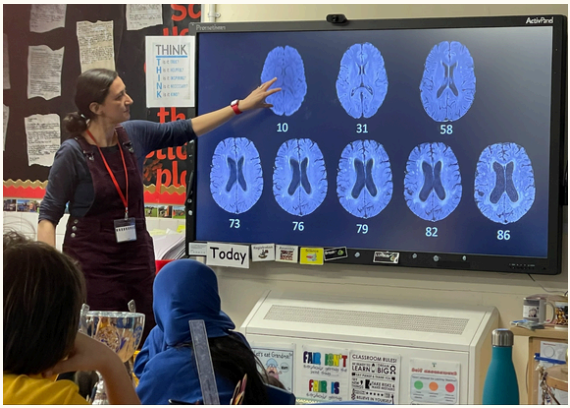
"Future plans for the Row Fogo Centre include a specialised SVD clinic wherein research-led recommendations are brought directly to patients. A lot of this is common sense—don't smoke, don't drink too much, don't have too much salt in your diet, eat well, exercise regularly—but hopefully it will be targeted at the right people."

- Dr Fergus Doubal, Honorary Reader in Stroke Medicine & Consultant Stroke Physician

"Translating research findings into accessible formats, such as patient information sheets or educational materials, is essential for empowering patients and their families with knowledge about SVD.

Providing accurate and understandable information helps patients make informed decisions about their healthcare and encourages active participation in their treatment and management plans."

- Dr Carmen Arteaga Reyes, Clinical Research Fellow in Studies of Cerebral Small Vessel



Dr Susana Muñoz Maniega teaching school children about the brain.

Prof Joanna Wardlaw and team examining artist India Cawley Gelling's work.