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Fasciculation detection using motor unit MRI (MUMRI)

Submission date
04/06/2026

Recruitment status
No longer recruiting

Registration date
17/06/2026

Overall study status
Completed

Last Edited
17/06/2026

Condition category
Nervous System Diseases

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Motor units are the basic building blocks of our skeletal muscles, and each one comprises a single nerve cell and several dozen muscle fibres. Normally several motor units are activated in a co-ordinated fashion resulting in a smooth movement, such as happens during walking or gripping an object. However, sometimes individual motor units fire at random; you may have noticed this after strenuous exercise when it is not uncommon to see tiny ‘quivering’ movements in your muscles. We call these tiny movements fasciculation. Although fasciculation can be a normal phenomenon, in some causes of muscle weakness it happens to a much greater degree, including at rest. Fasciculation can be visible by eye and may be noticed by a doctor during a clinical examination. However, this is only the case for fasciculation in motor units close to the skin surface. In other patients, fasciculation occurs deeper in the muscle where it is not easily visible by eye. In these patients, fasciculation can be detected using techniques such as ultrasound or electromyography of the muscles. These are useful techniques and provide a continuous recording of what is happening in the muscle, but are limited because they only record from part of the muscle at once. More recently, it has become possible to detect fasciculation using magnetic resonance imaging (MRI). We call this technique motor unit MRI (MUMRI). This has the advantage of seeing the whole of the muscle at once.

We have already used MUMRI on our local NHS scanners as part of a research study. We now wish to study how effective different makes and strength of MRI scanners are at detecting fasciculation using MUMRI. To do this we need to test MUMRI on a wide range of scanners across several centres to see if they all give similar results. This is an important step towards eventually rolling MUMRI out across the NHS.

This study does not involve treatment, but will help us to decide the best way to detect fasciculation in patients. This will ultimately help to improve the way we diagnose patients with diseases in which fasciculation is seen. We will record fasciculations using MUMRI in 4 body regions (head and neck, arms, trunk and legs). The study will lead to new information about the relative sensitivity of each type of scanner in detecting fasciculation in both deep and superficial muscles in each of the 4 body regions relevant to the diagnostic criteria of ALS. To compare the total fasciculation frequency (number of events detected in a 3-minute recording) for a given body region detected by each of the scanner makes and magnet strengths.

Who can participate?
To participate in this study you need to meet the following inclusion criteria:
1.. Adult male or female, willing and able to give informed consent
2. Aged 18 years old or over
3. ALS patients with definite or probable motor neuron disease based on the Awaji criteria, or currently under investigation for possible ALS

If you meet any of the following exclusion criteria then you cannot participate in this study:
1. Contra-indication to MRI scanning
2. Implanted cardiac defibrillator
3. Inability to lie flat in the MRI scanner
4. ALS patients in an advanced disease stage (ALSFRS-R < 25) with respiratory insufficiency (forced vital capacity (FVC) < 60%), on non-invasive ventilation or receiving percutaneous gastrostomy feeding

What does the study involve?
The study is a single visit to site and will involve a clinical assessment which will be approximately 30 minutes, to collect information about your condition and your medical history. You will then undergo an MRI scan which will last approximately 1 hour. Your head and neck, upper limbs, trunk and legs will be scanned during this session.
What are the possible benefits and risks of participating?
This study itself will not directly benefit you. The information we get will improve our understanding of how human motor units fasciculate in different muscles, and to show which type of MRI scanner and magnet strength provides the most useful information. We hope that in the future this will help with the diagnosis of patients with diseases that cause excessive fasciculation.
The MRI scanner uses a powerful magnet, and we cannot perform the scan if you have a heart pacemaker, certain kinds of metal implants, or have had metal fragments in your eyes. Before the MRI scan the radiographers will perform a careful screening questionnaire to make sure that none of these apply to you. Provided that you do not have any metal implants, there are no known side effects of being exposed to magnetic fields and there is no radiation or other known danger associated with having an MRI scan. Studies which have looked for any effects of MRI scanning on pregnant subjects have not shown any side effects on the mother or child. However, we exclude participants who are, or may be pregnant as a routine precaution.
Occasionally people find lying in the scanner a little claustrophobic. To minimise any feelings of anxiety and to offer support, the researcher will talk through the process of the scan with you first and what you could expect. They will also remind you that you would be free to leave the scanner at any time should you wish. You will also have access to a two-way communication system with the researcher operating the scan so that you can communicate any feelings of anxiety or distress if you were to feel claustrophobic. You will be monitored throughout the scan and if you appear to show any signs of distress the scan will be stopped. The scanner also makes a range of noises which can be quite loud, so you will be provided with headphones and earplugs to reduce the noise. These headphones also let you listen to music during the scan and allow the radiographer performing the scan to communicate with you throughout the scan to check that you remain comfortable. You will be provided with a hand held buzzer, which you can use to alert the radiographers and end the scan at any point.
When having any kind of scan, there is always a small possibility that an abnormality of which you were unaware could be observed on the images. However, the scans are not being taken for diagnostic purposes, so there is no guarantee that the scans would detect any abnormality which

may be present. The scans that we collect will be reviewed by a radiologist (a specialist doctor who reports MRI scans). If anything out of the ordinary is observed, they will then advise on what further investigations might be necessary.

Where is the study run from?
The study is run from 6 centres across England and Scotland: Newcastle Upon Tyne Hospitals NHS Foundation Trust, NHS Tayside, Oxford University Hospitals NHS Foundation Trust, King's College Hospitals NHS Foundation Trust, Sheffield Teaching Hospitals NHS Foundation Trust and Leeds Teaching Hospitals NHS Foundation Trust.

When is the study starting and how long is it expected to run for?
February 2025 to June 2026

Who is funding the study?
LifeArc and Medical Research Council (MRC)

Who is the main contact?
Roger Whittaker, Professor of Clinical Neurophysiology
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Contact information

Type(s)
Principal investigator, Scientific, Public

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Additional identifiers

Integrated Research Application System (IRAS)
331986

Study information

Scientific Title

Observational multi-centre study comparing fasciculation frequency detected using motor unit MRI (MUMRI) across scanner make and magnet strength

Acronym
FINALSUM

Study objectives
In this project, we will perform a multi-centre observational study in patients with confirmed or suspected ALS where we will record fasciculation using MRI in each of 4 body regions (head and neck, arms, trunk, and legs). The study will lead to new information about the relative sensitivity of each type of scanner in detecting fasciculation in both deep and superficial muscles in each of the 4 body regions relevant to the diagnostic criteria of ALS. To compare the total fasciculation frequency (number of events detected in a 3-minute recording) for a given body region detected by each of the scanner makes and magnet strengths.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 31/07/2024, HRA and Health and Care Research Wales (HCRW) (Health Research Authority, 2 Redman Place, Stratford, London, E20 1JQ, United Kingdom; +44 207 104 8000; approvals@hra.nhs.uk), ref: 24/PR/0706

Primary study design
Observational

Secondary study design
Cross sectional study

Study type(s)

Health condition(s) or problem(s) studied
Fasiculation frequency in Amyotrophic Lateral Sclerosis (ALS) patients with definite or probable motor neuron disease

Interventions
Particiapnts who take part in the study will undergo a clinical assessment to capture details such as age, gender, presence/absence of fasiculation or other motor neurone signs, age and site of symptom onset and complete the ALS FRS symptom score. The clinical assessment will last approximately 30 minutes in total. During part 2, participants will have an MRI scan. The radiographer will place MR recording coils over the head and neck, the torso and the legs. Images will be taken of the head and neck, arms, torso, and legs. MR images will first be taken at rest, and then during gentle movements of the arms (elbow flexion and extension) and legs (ankle dorsiflexion and plantar flexion). The entire scan will take approximately 1 hour.

Intervention Type
Other

Primary outcome(s)

1. Number of fasciculation events detected by MUMRI in each body region measured using Count of fasciculation events detected in a 3-minute recording, by each of the scanner makes and magnet strengths, using MUMRI within each of the four predefined body regions, reported as number of fasiculation events per region at Visit 1 (Single Study Visit)

2. Number of fasciculating muscles detected by MUMRI in each body region measured using Count of individual muscles demonstrating at least one fasciculation event , detected by each of the scanner makes and magnet strengths, using MUMRI within each of the four predefined body regions. Reported as total number of fasciculating muscles per region at Visit 1 (Single Study Visit)

Key secondary outcome(s)

Completion date
07/06/2026

Eligibility

Key inclusion criteria
1. Adult male or female, willing and able to give informed consent
2. Aged 18 years old or over
3. ALS patients with definite or probable motor neuron disease based on the Awaji criteria, or currently under investigation for possible ALS

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 Years

Upper age limit
99 Years

Sex
All

Total final enrolment
65

Key exclusion criteria
1. Contra-indication to MRI scanning
2. Implanted cardiac defibrillator
3. Inability to lie flat in the MRI scanner
4. ALS patients in an advanced disease stage (ALSFRS-R < 25) with respiratory insufficiency (forced vital capacity (FVC) < 60%), on non-invasive ventilation or receiving percutaneous gastrostomy feeding

Date of first enrolment
10/02/2025

Date of final enrolment
07/06/2026

Locations

Countries of recruitment
United Kingdom

England

Scotland

Study participating centre
The Newcastle upon Tyne Hospitals NHS Foundation Trust
Freeman Hospital
Freeman Road
High Heaton
Newcastle upon Tyne
England
NE7 7DN

Study participating centre
Leeds Teaching Hospitals NHS Trust
St. James's University Hospital
Beckett Street
Leeds
England
LS9 7TF

Study participating centre
Sheffield Teaching Hospitals NHS Foundation Trust
Northern General Hospital
Herries Road
Sheffield
England
S5 7AU

Study participating centre
King's College Hospital NHS Foundation Trust
Denmark Hill

London
England
SE5 9RS

Study participating centre
Oxford University Hospitals NHS Foundation Trust
John Radcliffe Hospital
Headley Way
Headington
Oxford
England
OX3 9DU

Study participating centre
Tayside
Ninewells Hospital
Dundee
Scotland
DD1 9SY

Sponsor information

Organisation
Newcastle upon Tyne Hospitals NHS Foundation Trust

ROR
https://ror.org/05p40t847

Funder(s)

Funder type

Funder Name
LifeArc

Alternative Name(s)

Funding Body Type
Private sector organisation

Funding Body Subtype
Other non-profit organizations

Location
United Kingdom

Funder Name
Medical Research Council

Alternative Name(s)
Medical Research Council (United Kingdom), UK Medical Research Council, Medical Research Committee and Advisory Council, MRC

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available