

Artificial intelligence project for improved sarcoma diagnoses for patient benefit

Submission date 06/12/2024	Recruitment status Recruiting	<input type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
Registration date 09/01/2025	Overall study status Ongoing	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
Last Edited 17/12/2024	Condition category Cancer	<input type="checkbox"/> Individual participant data <input type="checkbox"/> Record updated in last year

Plain English summary of protocol

Background and study aims

Cancer treatment is determined by how tumours are classified by pathologists, who provide diagnoses which encompass prognoses and predictions of responses to therapies.

Reaching a tissue diagnosis today requires more time than hitherto allocated to pathologists, driven by the rapidly increasing knowledge of important prognostic factors, an understanding of the molecular basis of disease and the availability of targeted and personalised treatments. Diagnoses must be highly specific and accurate, distinguishing cancer subtypes from each other and from other diseases such as bone and soft tissue tumours versus regenerative /degenerative musculoskeletal (MSK) disease.

The increasing workload and complexity in reaching pathological diagnoses is compounded by a declining workforce: 29% of all UK-based pathologists are aged 55 and over. MSK pathology is specifically affected as there is a serious shortfall in pathologists in this subspecialty area. Although primary MSK sarcomas represent about 2% of all cancers, there are over 100 subtypes described, as well as many common conditions that mimic sarcoma. The diagnosis has huge treatment implications and therefore crucially important to get right. Sarcomas can occur anywhere in the body (e.g. breast, lung) so they are frequently first encountered by non-expert MSK pathologists. This often leads to excessive consultant time in reaching diagnoses, and ordering inappropriate and excessive immunohistochemical and genetic tests. This protracts patients' journeys to treatment, resulting in unnecessary costs.

This study aims to find out whether artificial intelligence (AI) is a solution to these challenges and can help support (not replace) pathologists as already shown for common cancers (e.g. prostate and bowel).

Who can participate?

Patients who had a diagnosis of sarcoma or a mimic of sarcoma and whose tissue has been processed as part of their clinical care. The study is fully inclusive of all genders, age ranges, ethnicities and members of all socio-economic groups.

What does the study involve?

As AI requires large numbers of cases and pathology slides must be digitised to generate whole-slide images (WSIs). The availability of digital scanners across the UK has made this possible. This study will gather large numbers of sarcoma cases using archived slides/data from the last 40

years and prospectively. Members of direct clinical care teams will gather pathology images /data from up to 50,000 patients. The project will run for 10 years (collecting images/data for 5 years and 5 years follow-up).

What are the possible benefits and risks of participating?

The study aims to produce an AI algorithm to aid sarcoma diagnosis in the future. There are no direct benefits or risks to current patients.

Where is the study run from?

University College London (UK)

When is the study starting and how long is it expected to run for?

March 2023 to December 2033

Who is funding the study?

The majority of the funding has been secured from UK Research and Innovation (UKRI) along with smaller grants from Tom Prince Cancer Trust, Skeletal Cancer Trust, Sarcoma UK, Chordoma UK and Bone Cancer Research Trust (UK)

Who is the main contact?

Prof. Adrienne M Flanagan, a.flanagan@ucl.ac.uk

Contact information

Type(s)

Public, Scientific, Principal investigator

Contact name

Prof Adrienne Flanagan

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Additional identifiers

Clinical Trials Information System (CTIS)

Nil known

Integrated Research Application System (IRAS)

328987

Protocol serial number

EDGE 161548

Study information

Scientific Title

An artificial intelligence solution for diagnosing, prognosticating as well as predicting the outcome of sarcomas and their mimics: a multi-centre study

Acronym

AI-SCOPE

Study objectives

It is hypothesised that artificial intelligence (AI) can be used to support pathologists in classifying sarcomas (rare cancers of bone and soft tissue) and their mimics and provide improved or similar classification performance compared to pathologists.

It is hypothesised that the AI Classifier will save pathologists' time and improve the patients' diagnostic pathways and that cost efficiencies can be made.

Ethics approval required

Ethics approval required

Ethics approval(s)

approved 12/12/2023, Health and Social Care Research Ethics Committee B (HSC REC B) (Office for Research Ethics Committee Northern Ireland (ORECNI), Lissue Industrial Estate West, 5 Rathdown Walk, Lisburn, BT28 2RF, United Kingdom; +44 (0)28 95 361400; info.orecni@hscni.net), ref: 23/NI/0166

Study design

Multi-centre observational pseudonymised cohort study

Primary study design

Observational

Study type(s)

Diagnostic

Health condition(s) or problem(s) studied

Bone and soft tissue tumours and their mimics

Interventions

This study involves a large-scale collection of digitised whole slide images (WSI), together with related demographic and clinical data, from a cohort of 35,000 - 50,000 patients which will be obtained from multiple hospital sites.

There is no recruitment to the study and no intervention.

Because of the rarity of sarcoma, this can only be achieved using retrospective cases archived over many years. The identification and preparation of the WSI and related clinical data,

including its deidentification and pseudonymisation, will be undertaken at each collaborating pathology site by the direct clinical care team. Only de-identified and pseudonymised data will be accessible to researchers. The diagnoses given by the resulting algorithm will be compared with the diagnosis given by a panel of pathologists.

Intervention Type

Other

Primary outcome(s)

The primary outcome measure is whether the algorithm has predicted the diagnosis correctly. The algorithm ranks the diagnosis in order of likelihood with the highest ranking being compared to the diagnosis agreed on by a panel of pathologists and/or additional molecular tests and is categorised as being correct or incorrect and a confusion table will be constructed. Measured at a single timepoint.

Key secondary outcome(s)

Measured at a single timepoint:

1. Diagnostic pathway efficiency and speed, measured as the rate at which a patient receives a diagnosis
2. The number of ancillary tests required, measured as the numbers requested by pathologists prior to reaching a diagnosis
3. Pathologist diagnostic efficiency, measured as the number of pathologists able to make accurate diagnoses without the need for excessive tests and referrals
4. Pathological and epidemiological insights into sarcomas, measured through the review of a large number of retrospective cases along with the development of an algorithm to improve diagnosis prospectively.
5. Prognosis and prediction of response to treatment, assessed by linking the algorithm's predictions with demographic and clinical outcome data ranging from the patient's initial date of diagnosis to either their date of death or date last seen.

Following exploratory data analysis with correlation plots, histograms and frequency tables, statistical modelling will be performed using survival analysis with Cox proportional hazard estimates and log-rank test as appropriate. Statistical significance will be set at 5%. Further statistical methods and machine learning techniques such as the random forest algorithm may be used to improve prediction of prognosis.

Completion date

31/12/2033

Eligibility

Key inclusion criteria

Patients who had a diagnosis of sarcoma or a mimic of sarcoma and whose tissue has been processed as part of their clinical care. The study is fully inclusive of all genders, age ranges, ethnicities and members of all socio-economic groups.

Participant type(s)

Patient

Healthy volunteers allowed

No

Age group

All

Lower age limit

1 days

Upper age limit

100 years

Sex

All

Total final enrolment

50000

Key exclusion criteria

Does not meet the inclusion criteria

Date of first enrolment

01/10/2023

Date of final enrolment

31/12/2029

Locations**Countries of recruitment**

United Kingdom

England

Wales

Study participating centre

Royal National Orthopaedic Hospital NHS Trust

Brockley Hill

Stanmore

United Kingdom

HA7 4LP

Study participating centre

Manchester University NHS Foundation Trust

Cobbett House

Oxford Road

Manchester
United Kingdom
M13 9WL

Study participating centre

The Newcastle upon Tyne Hospitals NHS Foundation Trust

Freeman Hospital
Freeman Road
High Heaton
Newcastle upon Tyne
United Kingdom
NE7 7DN

Study participating centre

The Royal Marsden NHS Foundation Trust

Fulham Road
London
United Kingdom
SW3 6JJ

Study participating centre

Nottingham University Hospitals NHS Trust - Queen's Medical Centre Campus

Nottingham University Hospital
Derby Road
Nottingham
United Kingdom
NG7 2UH

Study participating centre

Oxford University Hospitals NHS Foundation Trust

John Radcliffe Hospital
Headley Way
Headington
Oxford
United Kingdom
OX3 9DU

Study participating centre

Great Ormond Street Hospital Central London Site

Great Ormond Street
London

United Kingdom
WC1N 3JH

Study participating centre

Swansea Bay University Local Health Board

One Talbot Gateway
Seaway Drive
Seaway Parade Industrial Estate
Baglan Port Talbot
West Glamorgan
United Kingdom
SA12 7BR

Study participating centre

University College London Hospitals NHS Foundation Trust

250 Euston Road
London
United Kingdom
NW1 2PG

Study participating centre

The Robert Jones and Agnes Hunt Orthopaedic Hospital NHS Foundation Trust

Gobowen
Oswestry
United Kingdom
SY10 7AG

Study participating centre

Sheffield Teaching Hospitals NHS Foundation Trust

Northern General Hospital
Herries Road
Sheffield
United Kingdom
S5 7AU

Study participating centre

Cambridge University Hospitals NHS Foundation Trust

Cambridge Biomedical Campus
Hills Road

Cambridge
United Kingdom
CB2 0QQ

Sponsor information

Organisation

University College London

ROR

<https://ror.org/02jx3x895>

Funder(s)

Funder type

Government

Funder Name

UK Research and Innovation

Alternative Name(s)

UKRI

Funding Body Type

Government organisation

Funding Body Subtype

National government

Location

United Kingdom

Funder Name

Tom Prince Cancer Trust

Alternative Name(s)

UKRI

Funding Body Type

Government organisation

Funding Body Subtype

National government

Location

United Kingdom

Funder Name

Skeletal Cancer Trust

Funder Name

Sarcoma UK

Alternative Name(s)

SUK

Funding Body Type

Government organisation

Funding Body Subtype

Trusts, charities, foundations (both public and private)

Location

United Kingdom

Funder Name

Chordoma UK

Funder Name

Bone Cancer Research Trust

Alternative Name(s)

The Bone Cancer Research Trust, BCRT

Funding Body Type

Government organisation

Funding Body Subtype

Trusts, charities, foundations (both public and private)

Location

United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated and/or analysed during the current study will be published as a supplement to the results publication

IPD sharing plan summary

Published as a supplement to the results publication