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Identifying the most important signs of frailty to predict outcomes after minimally invasive heart valve insertion

Submission date
18/06/2025

Recruitment status
No longer recruiting

Registration date
07/10/2025

Overall study status
Completed

Last Edited
13/04/2026

Condition category
Surgery

[_] 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

Patients who have severe aortic stenosis (narrowing of the heart valve), can either have a new valve placed surgically (requiring the chest to be opened) or by inserting a catheter through a blood vessel in the top of the leg which is called transcatheter aortic valve implantation (TAVI). TAVI can be performed under local anaesthetic, does not involve any major cuts and is normally completed within 1 hour. The procedure does still carry a small risk of complications so it is important we ensure that patients are going to benefit from the procedure by having improvements in symptoms, quality of life and survival.

We know that as a result of the ageing process our body's natural reserves reduce over time. This happens at different rates and to different degrees in each individual. Frailty is a word used to describe a person's mental and physical resilience or their ability to bounce back and recover from events such as illness or injury. We already know that increased frailty can be associated with worse outcomes after TAVI and so an assessment of frailty is useful when considering patients for this procedure.

Frailty itself is a complex process which involves multiple systems within the body and at present there is not an assessment tool which incorporates all the different factors. Current assessments used by doctors are often subjective and only really take into account a person's baseline level of function and other health conditions. There are other, more precise, markers of frailty but at present these are not routinely used day-to-day.

This study has two main aims. Firstly, we want to find out if certain signs of frailty that show up on CT scans can help predict a patient's outcomes after having a TAVI, using historic data. We'll also assess whether these CT scans can identify frailty as well as, or better than, the methods doctors currently use.

Secondly, we'll look at whether CT scans, along with other frailty measures, can help us figure out which patients are likely to gain the most improvement after TAVI.

Who can participate?

All patients with severe aortic stenosis undergoing TAVI as decided by a structural heart multi-disciplinary team, who are over the age of 18 years old are able to take part as long as they satisfy the inclusion and exclusion criteria.

What does the study involve?
The study itself will be split into two different phases:
Phase 1:
Phase one of the study is a retrospective observational study which aims to assess the ability of certain CT markers to predict patient outcomes and identify frailty following TAVI. The clinical team will identify patients who have had a TAVI implanted historically who have completed a minimum of 5 years of follow-up using our local database, which already includes up-to-date outcomes data relating to mortality. Their historic CT scans will then be analysed anonymously using Quantib's AI body composition software to assess fat composition, muscle area/density and bone density. These CT markers will then be directly compared to mortality data and pre-procedure frailty scores to examine whether they can be accurately used to predict outcomes and identify frailty.

Phase 2:
Patients referred for either outpatient or inpatient TAVI will be approached
in the first instance by their clinical team. If the patient agrees to be approached by the research team, then this will take place. All patients recruited will have TAVI as their standard of care and there will be no alterations to the procedure itself. All patients will have had a TAVI CT scan prior to consent as per standard of care.
Prior to their procedure, we plan to perform some brief functional assessments to assess walking speed and grip strength. We will also assess frailty using 4 common scoring systems and conduct a short questionnaire to ascertain each participant's current level of symptoms and quality of life. Bloods will be collected as standard and certain blood markers will be recorded in the database.
At some point after the procedure, we will again measure each participant's CT markers of frailty using their pre-procedural CT scan and Quantib's AI body composition software.
Following their procedure, at the patient's standard planned follow-up at 3 months with the structural heart team, a member of the research team will then repeat the functional assessments and questionnaires in order to identify any improvements post-procedure. This is the end of the study and patients will then continue with their usual clinical care.

What are the possible benefits and risks of participating?
As this study is exploratory there are no direct clinical benefits to the individuals taking part in this study as they will still have their procedure and follow-up as normal. Our hope, however, is that the study will help to benefit future patients by allowing us to generate new ways to identify patients who are likely to receive the most benefit from this procedure.
We believe that there are no additional risks from taking part in the study itself. The TAVI procedure is part of your routine care. Individuals who take part in this study will not undergo any additional procedures. There will still be the same risks associated with the TAVI procedure itself.

Where is the study run from?
Royal Sussex County Hospital (UK)

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

Who is funding the study?
University Hospitals Sussex NHS Foundation Trust (UK)

Who is the main contact?
Dr Timothy Bagnall, timothy.bagnall@nhs.net

Contact information

Type(s)
Scientific, Principal investigator

Contact name
Dr Timothy Bagnall

ORCID ID
https://orcid.org/0009-0007-8703-851X

Contact details
Clinical Research Facility
2nd Floor Sussex House
1 Abbey Road
Brighton
United Kingdom
BN2 1ES
+44 (0)1273 696955
timothy.bagnall@nhs.net

Type(s)
Public

Contact name
Miss Jessica Parker

Contact details
Clinical Research Facility
2nd Floor Sussex House
1 Abbey Road
Brighton
United Kingdom
BN2 1ES
+44 (0)1273 696955
jessica.parker21@nhs.net

Additional identifiers

Integrated Research Application System (IRAS)
349259

Study information

Scientific Title

Identification of the moST useful markers of frailty to pRedict Outcomes in patients undergoiNG transcatheter Aortic Valve implantation.

Acronym
STRONG-AV

Study objectives
Transcatheter aortic valve insertion (TAVI) is now a well-established treatment for patients with severe aortic stenosis which can improve survival and quality of life. It is often performed in patients for whom surgery is deemed to be high risk, although there is also some growing evidence for the use of TAVI in carefully-selected lower risk patient populations. As these procedures are often performed in older, higher-risk patients with multiple comorbidities, we know that mortality rates are still quite high post-procedure. Patient selection is therefore crucial to ensure that we identify individuals who will have the best short and long-term outcomes in terms of both quality of life and survival.

We know from previous evidence that frailty can be associated with poorer outcomes following TAVI. Despite national guidelines encouraging the use of frailty assessments prior to TAVI, there is currently no consensus regarding the most appropriate tool to do so. Current frailty assessments tools are also often relatively subjective.

This study aims to investigate whether CT can be used as a more objective marker to accurately identify frailty and predict outcomes in patients undergoing TAVI.

The project itself will be split into two different phases:

Phase 1:
This phase of the project is a retrospective single-centre observational study which will aim to assess the ability of CT to identify frailty and predict outcomes in relationship to mortality following TAVI.

Phase 2:
This phase of the project is a prospective single-centre observational study which aims to assess whether frailty and frailty markers on CT can be used to predict symptomatic and functional outcomes following TAVI.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 10/03/2025, Surrey Borders Research and Ethics Committee (Equinox House, Nottingham, NG2 4LA, United Kingdom; +44 (0)20 7104 8057; surreyborders.rec@hra.nhs.uk), ref: 25/LO/0131

Primary study design
Observational

Study design
Retrospective and prospective single-centre observational study

Study type(s)

Other, Quality of life, Screening, Efficacy

Health condition(s) or problem(s) studied
Frailty and its relationship to outcomes in people undergoing transcatheter aortic valve implantation

Interventions
Current methodology:
The project itself will be split into two different phases:

Phase 1:
This part of the project will aim to assess the ability of CT to predict patient outcomes and identify frailty following TAVI. The clinical team will identify patients who have had a TAVI implanted historically and have completed 5 years of follow-up using our local database which already includes up-to-date outcomes data relating to mortality. Their historic CT scans will then be analysed using Quantib body composition software to assess markers of frailty, including sarcopenia and osteopenia. A section of the CT will be selected at a particular level of the spinal column. The scan will then be analysed by the software to assess fat composition, muscle area and density and bone density. These CT markers will then be directly compared to mortality data and pre-procedure frailty scores to examine whether they can be accurately used to predict outcomes and identify frailty.

Phase 2:
This phase of the study aims to recruit 100 patients with severe aortic stenosis in whom the heart MDT has recommended TAVI as a treatment plan. All patients recruited will have TAVI as their standard of care and there will be no alterations to the procedure itself. All patients will have had a TAVI CT scan prior to consent as per standard of care. Prior to their procedure, we plan to perform some brief functional assessments to assess their walking speed and grip strength. We will also assess frailty using 4 common scoring systems and conduct a short questionnaire to ascertain their quality of life pre-procedure. Bloods will be collected as standard and certain blood markers will be recorded in the database.

The pre-procedural CT scan will be analysed using the same markers assessed in phase 1 and the CT measurements will be recorded in the database.

At the patient's standard planned follow-up at 3 months with the structural heart team, a member of the research team will then repeat the functional assessments and questionnaire in order to identify any improvements post-procedure. This is the end of the study and patients will continue their usual clinical care.

Previous methodology:
The project itself will be split into two different phases:

Phase 1:
This part of the project will aim to assess the ability of CT to predict patient outcomes and identify frailty following TAVI. The clinical team will identify patients who have had a TAVI implanted historically and have completed 5 years of follow-up using our local database which already includes up-to-date outcomes data relating to mortality. Their historic CT scans will then be analysed using Quantib body composition software to assess markers of frailty, including sarcopenia and osteopenia. A section of the CT will be selected at a particular level of the spinal column. The scan will then be analysed by the software to assess fat composition, muscle area and density and bone density. These CT markers will then be directly compared to mortality data

and pre-procedure frailty scores to examine whether they can be accurately used to predict outcomes and identify frailty.

Phase 2:
This phase of the study aims to recruit 92 patients with severe aortic stenosis in whom the heart MDT has recommended TAVI as a treatment plan. All patients recruited will have TAVI as their standard of care and there will be no alterations to the procedure itself. All patients will have had a TAVI CT scan prior to consent as per standard of care. Prior to their procedure, we plan to perform some brief functional assessments to assess their walking speed and grip strength. We will also assess frailty using 4 common scoring systems and conduct a short questionnaire to ascertain their quality of life pre-procedure. Bloods will be collected as standard and certain blood markers will be recorded in the database.

The pre-procedural CT scan will be analysed using the same markers assessed in phase 1 and the CT measurements will be recorded in the database.

At the patient's standard planned follow-up at 3 months with the structural heart team, a member of the research team will then repeat the functional assessments and questionnaire in order to identify any improvements post-procedure. This is the end of the study and patients will continue their usual clinical care.

Intervention Type
Other

Primary outcome(s)
Current primary outcomes as of 13/04/2026:
Phase 1:
The primary outcome is the ability of CT markers of frailty to predict 5-year survival (in days). The following measurements will be recorded at a single timepoint for each patient using a section of imaging at the level of the L3 lumbar vertebrae:
1. Muscle Area (Psoas/Abdominal/Long Spine) (cm2)
2. Muscle Density (Psoas/Abdominal/Long Spine) (HU)
3. Total Vertebral Bone Density (HU)
4. Total Subcutaneous Fat Area (cm)
5. Total Subcutaneous Fat Density (HU)
6. Total Visceral Fat Area (cm2)
7. Total Visceral Fat Density (HU)

Phase 2:
Sarcopenia and its effect on symptomatic/functional capacity following TAVI. Sarcopenia will be assessed by measuring Muscle area (cm2) and density (HU) on CT at the level of the L3 vertebra. Changes in symptoms and functional capacity will be assessed by measuring the following at baseline and then at 3 months post-procedure:
1. Six-minute walk test (metres)
2. Hand Grip Strength (kg)
3. Kansas City Cardiomyopathy Questionnaire Score (Points)

Previous primary outcomes:
Phase 1:
The primary outcome is the ability of CT markers of frailty to predict 5-year survival (in days). The following measurements will be recorded at a single timepoint for each patient using a section of imaging at the level of the L3 lumbar vertebrae:

1. Total Psoas Muscle Area (cm2)
2. Total Psoas Muscle Density (HU)
3. Total Vertebral Bone Density (HU)
4. Total Subcutaneous Fat Area (cm)
5. Total Subcutaneous Fat Density (HU)
6. Total Visceral Fat Area (cm2)
7. Total Visceral Fat Density (HU)

Phase 2:
Sarcopenia and its effect on symptomatic/functional capacity following TAVI. Sarcopenia will be assessed by measuring Psoas Muscle area (cm2) and density (HU) on CT at the level of the L3 vertebra. Changes in symptoms and functional capacity will be assessed by measuring the following at baseline and then at 3 months post-procedure:
1. Six-minute walk test (metres)
2. Hand Grip Strength (kg)
3. Kansas City Cardiomyopathy Questionnaire Score (Points)

Key secondary outcome(s)
Phase 1:
Correlation between frailty as assessed using current subjective assessment methods and each of the CT markers of frailty (detailed above). Frailty is currently assessed and scored by TAVI operators using the following frailty indices recorded at baseline:
1. Katz Index of Activities of Daily Living Index (0 (Low: Very Dependent) -6 (High: Independent)
2. Karnofsky Performance Scale (0 (Dead) – 100 (Normal, no complaints, no evidence of disease)
3. Rockwood Clinical Frailty Scale (1 (Very Fit)-9 (Terminally ill)

Phase 2:
The effects of each of the following frailty markers on symptomatic/functional capacity following TAVI (using the same outcome measures as above):
Frailty assessed using the following frailty indices at baseline and at 3 months:
1. Rockwood Clinical Frailty Scale (1-9)
2. Katz Index (0-6)
3. Karnofsky Performance Scale (0-100)
4. Fried Frailty Index (0-5)

Blood tests will be measured at baseline, including:
1. Haemoglobin level (g/dL)
2. Albumin (g/L)
3. CRP (mg/L)

The following additional CT markers of frailty will be measured at baseline:
1. Vertebral Bone Density (HU)
2. Subcutaneous and Visceral Fat Area (cm2)
3. Subcutaneous and Visceral Fat Density (HU)

Completion date
01/05/2026

Eligibility

Key inclusion criteria

Phase 1:
Patients over the age of 18 years who have undergone TAVI implantation who have completed 5 years of follow-up

Phase 2:
Patients over the age of 18 years who have been referred for Transcatheter Aortic Valve Implantation

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 Years

Upper age limit
100 Years

Sex
All

Total final enrolment
834

Key exclusion criteria
Phase 1:
1. No pre-procedure CT
2. Poor quality CT Imaging
3. Previous request to opt out of data usage.

Phase 2:
1. No CT prior to procedure
2. Poor quality CT data unsuitable for analysis
3. Emergency Procedure
4. Unable to complete pre-procedure assessments
5. Unable to attend follow-up appointment

Date of first enrolment
13/03/2025

Date of final enrolment
31/01/2026

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Sussex Cardiac Centre
Royal Sussex County Hospital
Eastern Road
Brighton
England
BN2 5BE

Sponsor information

Organisation
University Hospitals Sussex NHS Foundation Trust

ROR
https://ror.org/03wvsyq85

Funder(s)

Funder type
Not defined

Funder Name
University of Brighton

Alternative Name(s)
University of Brighton UK

Funding Body Type
Government organisation

Funding Body Subtype
Universities (academic only)

Location
United Kingdom

Funder Name
University Hospital Sussex NHS Foundation Trust

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Data sharing statement to be made available at a later date