ISRCTN76296703 https://doi.org/10.1186/ISRCTN76296703

Effectiveness and cost-effectiveness of reverse shoulder arthroplasty versus hemiarthroplasty versus non-surgical care for acute 3 and 4 part fractures of the proximal humerus in patients aged over 65 years – the PROFHER-2 randomised trial

Submission date
05/04/2018

Recruitment status
No longer recruiting

Registration date
05/04/2018

Overall study status
Completed

Last Edited
18/12/2025

Condition category
Injury, Occupational Diseases, Poisoning

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

Plain English summary of protocol

Background and study aims
Breaking (fracturing) the upper part of the arm at the shoulder (proximal humerus) most commonly occurs in people over 65 years old from a simple fall. When the bone is broken into more than 2 parts (typically 3 or 4 parts), patients may undergo surgery to replace the broken bone with an artificial shoulder joint. There are two main types of joint replacement used: hemiarthroplasty (replacing the broken ball of the joint) and reverse shoulder arthroplasty (replaces the ball with a socket and the socket with a ball [hence 'reverse']). Another common treatment is non-surgical care where the arm is supported in a sling to allow the broken bone to heal naturally. Following each of these treatments, physiotherapy is needed to regain arm function. It is not known which surgery leads to the best recovery and whether surgery is better than non-surgical care. The aim of this study is to assess whether reverse shoulder arthroplasty is more effective than hemiarthroplasty at restoring use of the shoulder and arm, whether shoulder replacement surgery is more effective than non-surgical treatment for these fractures, and which treatment is best value for money.

Who can participate?
Patients aged 65 and over who have a confirmed three or four part fracture of the proximal humerus

What does the study involve?
Patients are assessed for eligibility and a routine x-ray is taken to confirm a three or four part fracture. Patients who agree to take part are randomly allocated to receive one of three treatments: either hemiarthroplasty, reverse shoulder arthroplasty, or non-surgical care. If patients need general anaesthetic to treat a dislocation they receive one of the two types of

surgery. All patients receive physiotherapy and rehabilitation, and have the usual check-ups with their treating doctor. Questionnaires assess how well patients can use their arm and shoulder, pain and health status over a two-year period and patients are also followed up after five years to assess whether they need any further surgery.

What are the possible benefits and risks of participating?
Proximal humeral fractures are painful and debilitating injuries. This study will determine which of the current treatments leads to better outcomes and provide definitive guidance on the treatment of these injuries for patients in the future. The risks and burdens associated with this study are low as all of the treatments are routinely used within the NHS. It is not anticipated that involvement in this study will harm or disadvantage participants. Along with the risks of general anaesthetic, reverse shoulder arthroplasty and hemiarthroplasty have significant potential risks and complications, which include deep prosthetic infection, prosthetic instability and dislocation, haematoma, neurological injury, intra-operative fracture, and loosening of the components with time, all of which may require revision surgery. Whilst patients in the non-surgical treatment group avoid the risks associated with anaesthesia and surgery, if pain or function remains poor, delayed surgery with reverse shoulder arthroplasty may be required, on the advice of the treating clinician. This would however not usually be considered before 6 months to allow an adequate period of rehabilitation to be pursued.

Where is the study run from?
1. South Tees Hospitals NHS Foundation Trust (UK)
2. Oxford University Hospitals NHS Foundation Trust (UK)
3. Barts Health NHS Trust (UK)

When is the study starting and how long is it expected to run for?
December 2017 to July 2025

Who is funding the study?
National Institute for Health Research Health Technology Assessment Programme (UK)

Who is the main contact?
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Additional identifiers

Protocol serial number
HTA 16/73/03

Study information

Scientific Title
PROximal Fracture of the Humerus: Evaluation by Randomisation trial no. 2 (PROFHER-2 trial): a three-arm randomised controlled trial to assess the effectiveness and cost-effectiveness of reverse shoulder arthroplasty versus hemiarthroplasty versus non-surgical care for acute three and four-part fractures of the proximal humerus in patients over 65 years of age

Acronym
PROFHER-2

Study objectives
Reverse shoulder arthroplasty is superior to hemiarthroplasty in the treatment of three and four part proximal humeral fractures.

Ethics approval required
Old ethics approval format

Ethics approval(s)

Approved 15/05/2018, North East – Tyne and Wear South (HRA Newcastle, Newcastle Blood Donor Centre, Holland Drive, Newcastle NE2 4NQ, UK; +44 (0)207 104 8084; tyneandwearsouth.rec@hra.nhs.uk), ref: 18/NE/0125

Study design
Multi-centre randomized controlled superiority pragmatic trial

Primary study design
Interventional

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Three and four part proximal humeral fractures

Interventions
The clinical care team will assess potential patient eligibility, and a routine x-ray will be taken to confirm a three or four part fracture. Patients who agree to take part will receive one of the three treatments selected at random using a computer system. If patients need general anaesthetic to treat a dislocation they will receive one of the two types of surgery.

1. Intervention: Reverse Shoulder Arthroplasty (RSA)
RSA will be performed under general anaesthesia and anterior (delto-pectoral) or superior (McKenzie type) surgical approaches may be used as per the treating surgeon's usual practice. The fractured anatomical articular head fragment of the humerus will be removed and the glenoid (socket) on the scapula prepared to receive a metal backed base plate, fixed with screws, which is designed to accept the implantation of a prosthetic hemi-sphere on the glenoid surface. The humerus will be prepared to receive the implantation of a humeral prosthetic stem component that has a socket-like design that articulates with the glenoid sphere. The stem of the humeral component may be cemented in place or inserted without cement as a 'press-fit', as per the treating surgeon's usual practice. The remaining tuberosity fragments and associated rotator cuff attachments will be repaired around the humeral component, to help with stability of the joint replacement and with rotational control of the shoulder following healing.
Following surgery the shoulder will be immobilised in a supportive arm sling and a graduated rehabilitation program followed. Physiotherapy guidance developed by consensus by the British Elbow and Shoulder Society physiotherapists for the purposes of this trial will be provided to all trial centres. The guidance recommends supervised physiotherapy with the aim of gradually increasing range of motion and function. Internal rotation (i.e. hand behind back movement) will be avoided following RSA to protect the joint until clinician review (at around 6 weeks). This is due to the biomechanics of RSA and the increased risk of dislocation with such movements.

2. Intervention: Hemiarthroplasty (HA)
HA will be performed under general anaesthesia and anterior (delto-pectoral) or superior (McKenzie type) surgical approaches may be used as per the treating surgeon's usual practice. The fractured, anatomical, articular head fragment of the humerus will be removed and the humerus prepared to accept a humeral stem implant that replaces the spherical head fragment. The stem of the humeral component may be cemented in place or inserted without cement as a 'press-fit', as per the treating surgeon's usual practice. The remaining tuberosity fragments and associated rotator cuff are repaired to the proximal humerus and prosthesis, thus effectively reconstructing "normal" anatomy around the prosthesis. The native glenoid is not instrumented

and articulates with the replaced humeral component, thus only half the joint is replaced in this procedure.
Following surgery the shoulder will be immobilised in a supportive arm sling and a graduated rehabilitation program followed. Physiotherapy guidance developed by consensus by the British Elbow and Shoulder Society physiotherapists for the purposes of this trial will be provided to all trial centres. The guidance recommends supervised physiotherapy with the aim of gradually increasing range of motion and function.

3. Control: Non-Surgical Care
Non-surgical management will involve supporting the injured arm in a sling for a period of three weeks and patients will be provided with a sling care leaflet at the time of randomisation.
The arm and shoulder will then be gently mobilised under supervision of a physiotherapist with the aim of increasing range of motion and performing active exercises beyond six weeks. Physiotherapy sessions will be tailored but include advice and education on a home exercise programme predominantly based on daily functional tasks. The physiotherapy sessions will include a combination of exercise, soft tissue techniques, joint mobilisations, stretching and relaxation techniques. The exact treatments will be individualised on a per patient basis to ensure that rehabilitation is tailored to individual needs in line with routine conservative care.

During the study, participants will need to come to the hospital for 1 visit where their shoulder will be assessed, and they will be asked some questions about their arm and shoulder function, pain and health status. Participants will also complete postal questionnaires to assess how well patients can use their arm and shoulder, pain and health status at 1 and 2 years post randomisation. We also plan to follow-up patients after five years to assess whether they need any further surgery.

Intervention Type
Procedure/Surgery

Primary outcome(s)
Pain and impairment impact on daily living activities, measured using the Oxford Shoulder Score at baseline, 6 months, 1 year and 2 years post randomisation

Key secondary outcome(s))
1. Quality of life measured using EQ-5D-5L at baseline, 6 months, 1 year and 2 years post randomisation
2. Pain measured using the Patient-Reported Outcomes Measurement Information System (PROMIS) pain interference at baseline, 6 months, 1 year and 2 years post randomisation
3. Pain measured using a visual analogue pain scale at baseline, 6 months, 1 year and 2 years post randomisation
4. Range of shoulder motion measured at discharge from physiotherapy and independently assessed at 6 months post randomisation (i.e. not by the treating surgeon)
5. Healing and implant position using AP and Axillary (and scapular Y view if available) X-rays taken at 6 months post-surgery
6. Further procedures and complications recorded by clinicians at 6 months, 1 year and 2 years post randomisation
7. Grip strength to assess frailty and as a predictor of morbidity and mortality, measured at baseline
8. Physiotherapy requirements and use (including time to start of physiotherapy; number of sessions; modalities used; and duration of rehabilitation) collected during the trial

Completion date
14/07/2025

Eligibility

Key inclusion criteria
1. Adult patients aged 65 years or over
2. Radiographically confirmed acute three-part (including surgical neck) or four-part displaced fracture of the proximal humerus (Neer Classification) including head-splitting fractures of the humeral head and fracture dislocations
3. Trial interventions can be provided within 5 weeks of injury
4. Patient is deemed by the clinical care team to be fit for surgery
5. Able to provide full informed consent

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Senior

Lower age limit
65 years

Upper age limit
100 years

Sex
All

Total final enrolment
359

Key exclusion criteria
1. Patients who are unable to adhere to trial procedures or complete questionnaires
2. Polytrauma – where one or more additional fractures, which may affect the outcome measures for the trial, are present or other body-systems are affected
3. Open fractures or fractures where there is severe soft tissue compromise requiring urgent surgery
4. Pathological (other than osteoporotic) fractures
5. Presence of axillary nerve palsy (given that this results in a weakening of the deltoid muscle, upon which the shoulder relies for function)

Date of first enrolment
01/06/2018

Date of final enrolment
31/05/2021

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
South Tees Hospitals NHS Foundation Trust
The James Cook University Hospital
Marton Road
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Study participating centre
Oxford University Hospitals NHS Foundation Trust
John Radcliffe Hospital
Headley Way
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Study participating centre
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Sponsor information

Organisation
South Tees Hospitals NHS Foundation Trust

ROR
https://ror.org/02js17r36

Funder(s)

Funder type
Government

Funder Name
Health Technology Assessment Programme

Alternative Name(s)
NIHR Health Technology Assessment Programme, Health Technology Assessment (HTA), HTA

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
Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol article		13/04/2023	04/12/2025	Yes	No
HRA research summary			28/06/2023	No	No
Study website	Study website	11/11/2025	11/11/2025	No	Yes