A report for
Universitätsklinikum Schleswig-Holstein/Campus Kiel
on Shared Decision Making
for the treatment of distal radius fractures in adults

Kleijnen Systematic Reviews Ltd

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Kleijnen Systematic Reviews Ltd
Unit 6, Escrick Business Park
Riccall Road
Escrick
York
YO19 6FD
United Kingdom
Telephone: +44 (0)1904 727980
Fax: +44 (0)1904 720429
Email: robert@systematic-reviews.com
Website: www.systematic-reviews.com

Carol Forbes
Lisa Stirk
Jos Kleijnen
Robert Wolff

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LIST OF ABBREVIATIONS

AAOS	American Academy of Orthopaedic Surgeons
AWMF	Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften
BOA	British Orthopaedic Association
BSSH	British Society for Surgery of the Hand
CADTH	Canadian Agency for Drugs and Technologies in Health
CDSR	Cochrane Database of Systematic Reviews
CI	Confidence interval
CRD	Centre for Reviews and Dissemination
CrI	Credible interval
CRPS	Complex regional pain syndrome
CTS	Carpal tunnel syndrome
DARE	Database of Abstracts of Reviews of Effects
DASH	Disabilities of the Arm, Shoulder and Hand
DRF	Distal radius fracture
EQ-5D	European quality of life-5 dimensions
FAQ	Frequently asked question
GIN	Guidelines International Network
GSTS	German Society for Trauma Surgery
HTA	Health technology assessment
KSR	Kleijnen Systematic Reviews Ltd
MA	Meta-analysis
MD	Mean difference
MFA	Musculoskeletal Function Assessment Questionnaire
MTC	Mixed treatment comparison
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NMA	Network meta-analysis
NOS	Newcastle-Ottawa-Scale
NR	Not reported
NS	Not statistically significant
OR	Odds ratio
PA	Post-traumatic arthritis
PICOS	Participants, intervention, comparators, outcomes and study design
PRISMA	Preferred reporting items for systematic reviews and meta-analysis
PRWE	Patient-Rated Wrist Evaluation
PTI	Pin track infection
RCT	Randomised controlled trial
SBU	Swedish Council on Health Technology Assessment
SDM	Shared decision making

SF-12	Short-Form Health Survey-12
SF-36	Short-Form Health Survey-36
SMD	Standardised mean difference
SR	Systematic review
SUCRA	Surface under the cumulative ranking curve
VAS	Visual analogue scale
WHOQOL	Brief World Health Organization Quality of Life Assessment instrument
WMD	Weighted mean difference

1. PROJECT OBJECTIVE

A key aim of the research project “Making SDM a reality” is to create interactive websites to inform patients as part of shared decision making (SDM).

To support this, Kleijnen Systematic Reviews Ltd (KSR) has prepared an evidence report with a synthesis of the literature underpinning the supporting evidence table of the relevant treatment options.

The objective of this evidence report is to present a comparative summary of outcomes resulting from the treatment of uncomplicated distal radius fractures in adults.

2. METHODS

2.1 INCLUSION CRITERIA

The research question underpinning the literature searches for this topic was developed in conjunction with clinical departments at Universitätsklinikum Schleswig-Holstein/Campus Kiel. The question was framed in terms of participants, intervention, comparators, outcomes and study design (PICOS), see Table 1.

As detailed below, literature searches were carried out using a stepwise approach to identify relevant studies according to study design. In the first step, searches aimed to identify relevant systematic reviews and guidelines. For this project, no topic-wide searches for randomised controlled trials (RCTs) or observational studies were conducted as relevant results were extracted from the identified literature.

Table 1: Inclusion/exclusion criteria for evidence selection

PICOS item	Included	Excluded
Population	• Adults (≥ 18yrs) with closed, dislocated fractures of the distal radius.	• Children (< 18yrs) • Open fractures • Complicated fractures, e.g. Intra-articular fracture; open fracture; comminuted fracture • Fractures of the distal radius that require open surgical procedures to repair
Intervention	Any of the following used to treat a simple uncomplicated, closed, radius fracture. • Closed reposition and cast • Percutaneous fixation (wire) and cast • External fixation • Open reposition without cast	• Open reposition and cast (and other open procedures) specifically used to treat a complicated or open distal radius fractures • Open surgery for uncomplicated fractures, aimed only at avoiding the use of a cast
Comparator	Where relevant as above	
Outcomes	• Description of treatment option • Pain • Operational capability (activities of daily living, range of motion) • Time spent in hospital • Time to return to work • Time to return to normal activities • Swelling/oedema • Adverse effects of treatment • Long-term complications	
Study designs	• Guidelines • Systematic reviews • Meta-analyses • NMA/MTC	
MTC = mixed treatment comparison; NMA = network meta-analysis		

In consultation with the commissioner, questions frequently asked by patients (FAQs), in respect of outcomes identified in the literature, were developed into an evidence table outline.

2.2 LITERATURE SEARCHES

Literature searches were carried out using a stepwise approach to identify relevant studies according to study design:

1. Systematic reviews and guidelines
2. Randomised controlled trials
3. Observational studies
4. Supplementary searches

As a number of relevant systematic reviews and guidelines were identified (Step 1) no further searches were conducted to identify RCTs (Step 2) and observational studies (Step 3).

The search strategies were developed specifically for each database and the keywords adapted according to the configuration of each database. Searches were limited by date range for systematic reviews and guidelines to 2012-2019. Where appropriate, searches were limited to remove animal studies. Searches were not limited by language or publication status.

Handling of citations

Identified references from the bibliographic database searches were downloaded into EndNote bibliographic management software for further assessment and handling. Individual records within the EndNote libraries were tagged with searching information, such as searcher, date searched, database host, database searched, strategy name and iteration, theme or search question. This enabled the information specialist to track the origin of each individual database record, and its progress through the screening and review process.

Quality assurance within the search process

The main Embase strategy was independently peer reviewed by a second KSR Information Specialist. Strategy peer review was informed by items based on the Canadian Agency for Drugs and Technologies in Health (CADTH) checklist.[1]

Literature search - resources

Systematic reviews and guidelines:

The following systematic review specific databases were searched from 2012 to present:

- Cochrane Database of Systematic Reviews (CDSR) (Wiley): Issue 1 of 12, Jan 2019
- Database of Abstracts of Reviews of Effects (DARE) (CRD) (Internet): up to 14.1.19 (https://www.crd.york.ac.uk/CRDWeb/)
- Health Technology Assessment (HTA) database (CRD) (Internet): up to 14.1.19 (https://www.crd.york.ac.uk/CRDWeb/)

- KSR Evidence (Internet): up to 14.1.19 (https://ksrevidence.com/)
- Epistemonikos (Internet): up to 14.1.19 (https://www.epistemonikos.org/)

The following guidelines resources were searched from 2012 to present:

- NICE (Internet): up to 14.1.19 (https://www.nice.org.uk/)
- ECRI Institute Guidelines Trust (Internet): up to 14.1.19 (https://guidelines.ecri.org/)
- NHS Evidence (Internet): up to 14.1.19 (https://www.evidence.nhs.uk/)
- Guidelines International Network (GIN) (Internet): up to 14.1.19 (http://www.g-i-n.net/library/international-guidelines-library)

Full details of all search strategies are presented in Appendix 1.

RCTs

As the search for secondary sources and, thereby, reference checking was sufficient, no additional searches for primary studies were undertaken.

Observational studies

As the search for secondary sources was sufficient, no additional searches for observational studies were undertaken.

Supplementary searches

The bibliographies of included studies, guidelines, health technology appraisals and review articles were checked for additional relevant articles.

2.3 METHODS OF DATA SELECTION, PRIORITISATION, EXTRACTION AND ANALYSIS

Data selection

Two reviewers independently inspected the title and abstract of each reference identified by the search and determined the potential relevance of each article. For potentially relevant articles, or in cases of disagreement, the full article was obtained, independently inspected, and inclusion criteria applied. Any disagreements were resolved through discussion.

Data extraction

An evidence hierarchy was used to select the most appropriate study(ies) to populate the evidence table. Where more than one study could provide evidence for the table, the most relevant studies were extracted using the following criteria: recency (most recent preferred), quality (highest quality preferred), representativeness (populations representative of the general target population preferred). Where there were gaps in the evidence table (no meta-analysis, systematic review or guideline available), as described

before, relevant RCTs would have been searched for and extracted, and where no RCTs would have been identified, observational studies would have been used.

For each study, data were extracted by one reviewer and checked by another. Any disagreements were resolved by consensus.

3. RESULTS

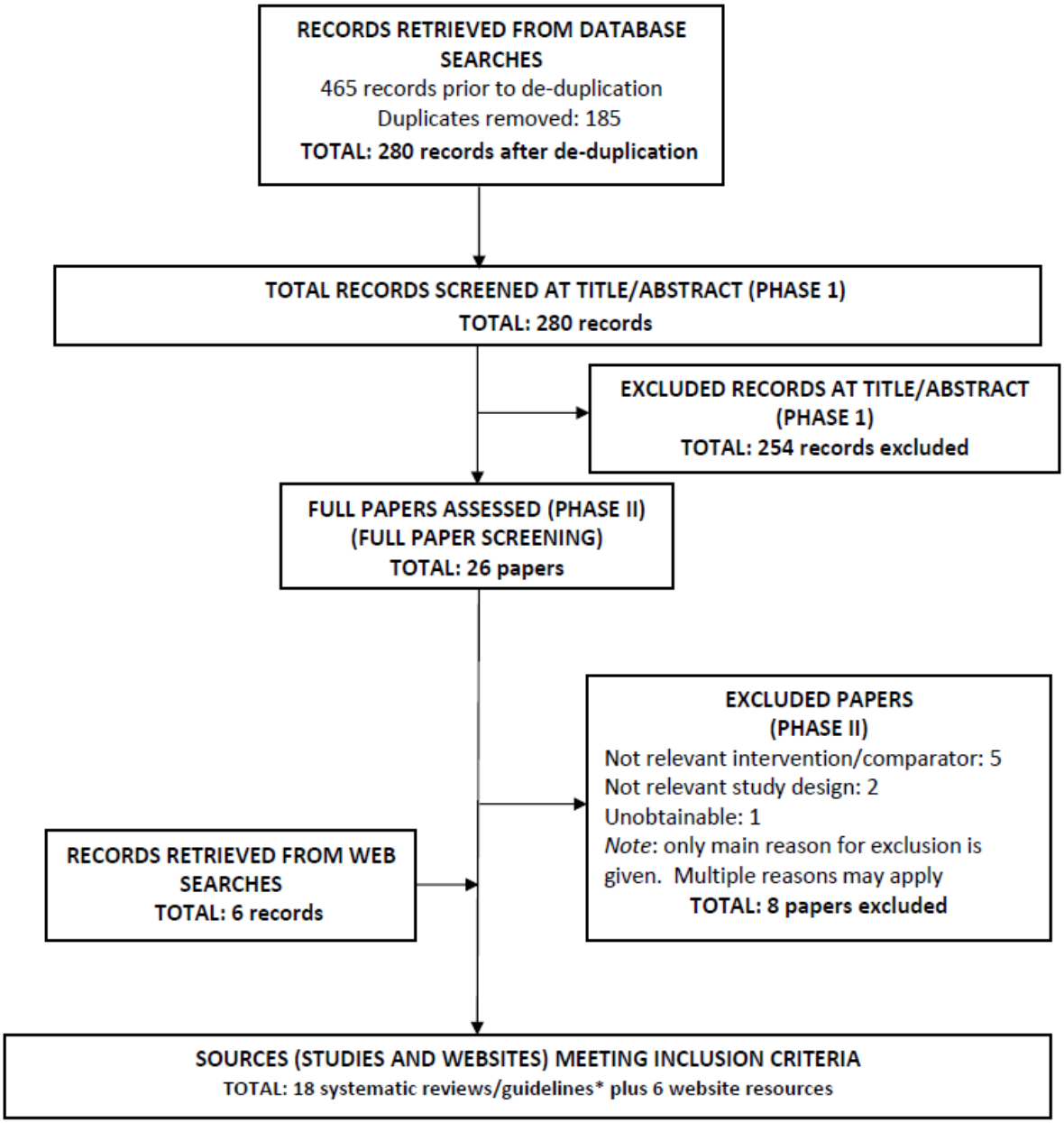
3.1 LITERATURE SEARCHES AND INCLUSION ASSESSMENT

For this evidence report, systematic searches for systematic reviews and guidelines were supplemented by hand searches.

Systematic searches were conducted on 14 January 2019 to identify relevant frequently asked questions (FAQs) and to answer the clinical questions focusing on systematic reviews, meta-analyses and evidence-based guidelines. A total of 465 references were retrieved from these literature searches. After de-duplication, 280 titles and abstracts were screened by two reviewers. Full papers were obtained for 26 citations, of which 18 met the inclusion criteria. Two of the papers related to the same set of treatment guidelines. In addition, to the 18 papers, six patient-friendly websites were identified through Google searches. These provided additional information on the different treatments, in terms of what they involve and how patients may feel.

A summary of the study selection process according to modified PRISMA reporting guidelines is reported in Figure 1. The full list of formally included studies prior to prioritisation is provided in Appendix 2.

Figure 1: Summary of study selection process



*Two publications[2, 3] related to the same set of guidelines (The British Society for Surgery of the Hand. Best practice for management of distal radius fractures (DRFs) 2018)

3.2 Overview of the evidence

Relevant treatments were:

- Closed reposition and cast
- Percutaneous fixation (wire) and cast
- External fixation
- Open reposition without a cast

In consultation with the commissioner, and with additional input from the literature, 15 FAQs of most concern to patients were grouped into four main questions and developed into an evidence table outline (see Table 2). The key evidence sources used to support each of the FAQs (from the 18 papers and six websites selected for inclusion in the review) are shown in Table 3. These included nine systematic reviews, five of which included network meta-analyses comparing different treatment options and three of which included meta-analyses. In addition, two guidelines and five websites including patient friendly treatment summaries and/or decision aids were included.

Across the nine systematic reviews, the reviews included either RCTs only (seven reviews) or a combination of RCTs and observational studies (two reviews). However, the quality of the evidence (even in those reviews including only RCTs) was low (i.e. high risk of bias) or unclear. The guideline recommendations were also generally based on weak evidence and where reported were only weak or limited recommendations. A summary of the types of patients and studies included in the various reviews and guidelines included in the review (and the risk of bias) is summarised in Table 3.

Table 2: List of FAQs

FAQ Details	Evidence
1. What does the treatment involve?	
1.1 What happens to me during the treatment?	• Websites and patient friendly leaflets
1.2 Where and when will the treatment take place?	
1.3 Will I need an anesthetic?	
1.4 How long might I be in hospital?	
1.5 Will I need to take any medicines?	
1.6 Will I have to go back into hospital?	
2. How might I feel after my treatment?	
2.1 What symptoms might I experience?	• Websites and patient friendly leaflets
2.2 How much pain will I be in?	• Systematic reviews including Pain VAS scores • Treatment guidelines
2.3 How long will my symptoms last?	• Websites and patient friendly leaflets
3. What are the side effects of treatment?	
3.1 What side effects might I experience from my treatment?	• Systematic reviews reporting on all complications • Systematic reviews reporting on minor complications • Systematic reviews reporting on major complications • Systematic reviews reporting on PTI - pin track infections • Systematic reviews reporting on malunion • Treatment guidelines
3.2 What is my risk of long-term complications?	• Systematic reviews reporting on CRPS - complex regional pain syndrome • Systematic reviews reporting on CTS - carpal tunnel syndrome • Systematic reviews reporting on secondary displacement • Systematic reviews reporting on PA - post-traumatic arthritis • Treatment guidelines
4. What will be the impact on my daily living?	
4.1 How might my wrist movement be affected?	• Systematic reviews reporting on functional outcomes (overall good/excellent) • Systematic reviews reporting on grip strength • Systematic reviews reporting on other wrist motion parameters (e.g. wrist extension; wrist flexion; wrist supination; wrist pronation; radial deviation; radial inclination, etc.) • Treatment guidelines

FAQ Details	Evidence
4.2 How might my day-to-day activities be affected?	• Systematic reviews reporting on patient reported outcome measures – DASH • Systematic reviews reporting on patient reported outcome measure – PRWE • Treatment guidelines
4.3 Will it affect my quality of life?	• Systematic reviews reporting on HRQoL (using EQ-5D; MFA; SF-36; SF-12; WHOQoL-Brief) • Treatment guidelines
4.4 When can I return to work?	• Websites and patient friendly leaflets

CRPS = complex regional pain syndrome; CTS = carpal tunnel syndrome; DASH = Disabilities of the Arm, Shoulder, and Hand; EQ-5D = European Quality of Life Instrument-5 Dimensions; HRQoL = health-related quality of life; MFA = Musculoskeletal Function Assessment Questionnaire; PA = post-traumatic arthritis; PRWE = Patient-Rated Wrist Evaluation; PTI = pin track infection; SF-12 = Short-Form Health Survey- 12; SF-36 = Short-Form Health Survey- 36; VAS = visual analogue scale; WHOQOL-Brief = Brief World Health Organization Quality of Life Assessment instrument

Table 3: Studies providing supporting evidence for FAQs

Evidence name	Evidence type	What does the treatment involve?	How might I feel after my treatment?	What are the side effects of treatment?	What will be the impact on my daily living?	Age group (adults vs. older adults)	Risk of bias (types of study included)
Wang 2017[4]	SR with NMA	-	-	✓	-	Adults range 18 to 92 yrs	Unclear risk of bias (RCTs)
Chen 2016[5]	SR with MA	-	✓	✓	✓	Adults ≥ 60 yrs	High risk of bias (RCTs & observational)
Zhao 2015[6]	SR with NMA	-	-	✓	-	Adults range 20 to 86 yrs	Unclear risk of bias (RCTs)
Vannabouathong 2018[7]	SR with NMA	-	✓	✓	-	Adults/elderly range 14 to 93yrs	High/unclear risk of bias (RCTs)
Lameijer 2017[8]	SR	-	-	✓	-	Adults range 25 to 54 yrs	High (n=7)/moderate (n=9)/low (n=3) (RCTs)
Xu 2016[9]	SR with NMA	-	-	✓	-	Adults range 18 to 87 yrs	Unclear risk of bias (RCTs)
Qiu 2015[10]	SR with NMA	-	-	✓	-	Adults range 18 to 87 yrs	Unclear risk of bias (RCTs)
Van Son 2013[11]	SR with MA	-	-	-	✓	Adults including some elderly	Mainly high risk of bias (RCTs & observational)
Song 2015[12]	SR with MA	-	✓	✓	✓	Adults ≥ 45 yrs	High risk of bias (RCTs)
BOA & BSSH 2017[2, 3]	Guidelines	-	✓	✓	✓	Adults ≥16yrs	Mainly lower level evidence (RCTs & observational)
Danish Health Authority 2016[13]	Guidelines	-	✓	✓	✓	Adults ≥18yrs	Mainly lower level evidence with weak/conditional recommendations (RCTs & observational)
OrthoInfo[14]	Website	✓	✓	✓	✓	Not reported	Not reported
Hospital for Special Surgery[15]	Website	✓	✓	-	✓	Not reported	Not reported
NHS Choices[16]	Website	✓	✓	-	✓	Not reported	Not reported

Evidence name	Evidence type	What does the treatment involve?	How might I feel after my treatment?	What are the side effects of treatment?	What will be the impact on my daily living?	Age group (adults vs. older adults)	Risk of bias (types of study included)
GSTS[17] - German	Website	✓	✓	-	✓	Not reported	Not reported
Patient+ Decision Aid[18]	Website	✓	✓	✓	✓	Not reported	Not reported

☑ Indicates evidence available for the FAQ

AAOS = American Academy of Orthopaedic Surgeons; AWMF = Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften; BOA = British Orthopaedic Association; BSSH = British Society for Surgery of the Hand; FAQ = frequently asked question; GSTS = German Society for Trauma Surgery; MA = meta-analysis; NHS = National Health Service; NMA = network meta-analysis; SBU = Swedish Council on Health Technology Assessment; SR = systematic review

3.3 FAQ 1. WHAT DOES THE TREATMENT INVOLVE?

A distal radius fracture is more commonly known as a broken wrist.

The radius is the larger of the two bones that form the forearm. Distal radius fractures happen when the area of the radius bone nearest the wrist (the distal end) breaks. This is a very common injury often occurring when people put out their hands to stop themselves falling. It is the most common type of adult fracture (25%) especially in older patients and those with osteoporosis.[17] The radius is the most common bone to break in the arm. The bone can break in different ways and the way in which the bone breaks affects the type of treatment you need to repair the break.

This decision aid focuses on uncomplicated fractures which include:[13]

- *Colles fracture*. Is one of the most common types of wrist fracture, where the broken fragment of the radius tilts upwards.
- *Intra-articular fracture.* A fracture that extends into the wrist joint. ("Articular" means "joint")
- *Extra-articular fracture.* A fracture that does not extend into the joint is called an extra-articular fracture.
- *Comminuted fracture.* When a bone is broken into more than two pieces, it is called a comminuted fracture.
- *Displaced fracture.* When the ends of the bone move out of place and do not line up properly.
- *Non-displaced fracture*. When the broken bits of bone stay in place.

The following types of fracture are not relevant to this decision aid:

- *Open fracture.* When a fractured bone breaks the skin, it is called an open fracture. These types of fractures require immediate medical attention because of the risk for infection.
- *Complicated fracture*. A fracture which is more difficult to treat such as intra-articular fractures, open fractures, comminuted fractures, and displaced fractures.

The doctor will assess the type of fracture by taking X-rays. If the doctor finds that the broken bones have not broken the surface of the skin and the break is not a certain type of complicated break, there are four different treatments that could be used.

Using information taken from patient leaflets and websites,[14, 16, 18, 19] Table 4 summarises details of the treatments and how they work.

Table 4: A summary of the different treatments used to treat a wrist fracture (closed distal radius fracture) and what they involve

Question	Closed reposition and cast	Percutaneous fixation (wire) and cast	External fixation	Open reposition without a cast
1.1 What happens to me during the treatment?	A closed reposition involves a doctor moving the broken bones back into position by manipulating your arm and hand. A cast (usually made from plaster or fibreglass)* is then put on your arm to hold the bones in the correct position whilst they heal.	Percutaneous fixation or pinning is a type of surgery, which involves inserting metal pins into the bone on either side of the fracture through small incisions (cuts) in the skin. Wires are then fastened to the pins and a cast (usually made from plaster or fibreglass)* is put on your arm to hold the bones in the correct position whilst they heal. It is used for fractures which may not be stable using only a cast, and which may need extra support.	External fixation is a type of surgery which involves inserting metal pins into the bone on either side of the fracture through small incisions (cuts) in the skin. These are then fixed to a stabilising framework (usually made of metal or other material) on the outside of your arm, to hold the bones in the correct position whilst they heal.	During open reposition surgery, the doctor makes an incision (cut) to reveal the broken bones and then moves them into the correct position. Internal (inside your arm) pins and plates are used to hold the bones in the correct position whilst they heal. This type of treatment is usually used for more serious cases, but it may also be used if your doctor finds that they cannot move the broken bones back and/or hold them in the correct position using one of the other three techniques.
1.2 Where and when will the treatment take place?	May be performed in the emergency room, fracture clinic or similar.	This will usually be carried out in an operating or similar type room.	This will usually be carried out in an operating or similar type room.	This will usually be carried out in an operating or similar type room.
1.3 Will I need an anesthetic?	The doctor will give you pain killers and your arm will be numbed, whilst the bones are moved back into position, but you will be awake throughout the treatment. The doctor	The doctor will give you pain killers and your arm will be numbed, whilst the pins are inserted and the bones moved back into position. This will be performed in the operating	The doctor will give you pain killers and your arm will be numbed, whilst the pins are inserted and the bones moved back into position. This will be performed in the	A general or regional anaesthetic will usually be used. You will usually be asleep or tranquilised. You will also be given pain killers.

Question	Closed reposition and cast	Percutaneous fixation (wire) and cast	External fixation	Open reposition without a cast
	may give medicine to relax you.	theatre. The doctor may give medicine to relax you.	operating theatre. The doctor may give medicine to relax you.	
1.4 How long might I be in hospital?	This can be performed as an outpatient, which means you can usually return home the same day.	This can be performed as an outpatient, which means you can usually return home the same day.	This can be performed as an outpatient, which means you can usually return home the same day.	Average hospital stay is 4.4 days[17]
1.5 Will I need to take any medicines?	You will be given pain killers to take if necessary.	You will be given pain killers to take if necessary, and also antibiotics which you should take to avoid any infections.	You will be given pain killers to take if necessary, and also antibiotics which you should take to avoid any infections.	You will be given pain killers to take if necessary, and also antibiotics which you should take to avoid any infections.
1.6 Will I have to go back into hospital?	You will probably be asked to come back to hospital in order to check that the bones are healing correctly and that there are no problems with the cast. The cast will also need to be removed and it is likely that you may need to have the cast removed and replaced on multiple occasions. It may also be necessary to return back to the hospital if you experience any problems which your doctor will explain further. Your doctor will monitor how well the bones are healing	You will probably be asked to come back to hospital in order to check that the bones are healing correctly and that there are no problems with the wires or the cast. The cast and wires will also need to be removed and it is likely that you may need to have the cast removed and replaced on multiple occasions. It may also be necessary to return back to the hospital if you experience any problems which your doctor will explain further. Your doctor will monitor how well the bones are healing and	You will probably be asked to come back to hospital in order to check that the bones are healing correctly and that there are no problems with external frame. The frame will also need to be removed. It may also be necessary to return back to the hospital if you experience any problems which your doctor will explain further. Your doctor will monitor how well the bones are healing and offer advice on when to return to work and	You will probably be asked to come back to hospital in order to check that the bones and surgical wound are healing correctly. It may also be necessary to return back to the hospital if you experience any problems which your doctor will explain further. Depending on the type of plates using to fix the bones back together these may need to be removed once the bones are sufficiently healed and this will involve another operation in hospital.

Question	Closed reposition and cast	Percutaneous fixation (wire) and cast	External fixation	Open reposition without a cast
	and offer advice on when to return to work and normal activities. They may also suggest that you see a physiotherapist if your wrist remains stiff, is weak or you experience problems with everyday tasks.	offer advice on when to return to work and normal activities. They may also suggest that you see a physiotherapist if your wrist remains stiff, is weak or you problems with everyday tasks.	normal activities. They may also suggest that you see a physiotherapist if your wrist remains stiff, is weak or you problems with everyday tasks.	Your doctor will monitor how well the bones are healing and offer advice on when to return to work and normal activities. They may also suggest that you see a physiotherapist if your wrist remains stiff, is weak or you problems with everyday tasks.

* NOTE: Casts will need to be removed and replaced several times during the healing period to insure snug and secure support of the fracture. Casts may be applied either "above elbow" or "below elbow" and may include the thumb or not, depending on the particular type of injury and physician preference.
Casts are generally made from plaster early in the treatment, which allows for some degree of swelling and the more rigid and lighter-weight fiberglass material during later stages of healing.

Unless otherwise stated, information is taken from the following sources: CORE Institute Patient Education;[19] NHS Choices;[16] Patient+ Decision Aid;[18] OrthoInfo;[14] Hospital for Special Surgery[15]

FAQ 1: EVIDENCE SUMMARY

What does the treatment involve?

Closed reposition and cast:

This involves the doctor moving the broken bones back into position by manipulating the arm and hand, and then putting a plaster cast on the arm to hold the bones in position whilst they heal. This can be done in the emergency room, fracture clinic, or similar room without the need to put you to sleep in an operating surgery (general anaesthetic). The doctor can give you pain killers and numb your arm; you may also be given a sedative to relax you. You can usually leave hospital the same day, but will need to keep the cast on for a few weeks until the bones heal. You may need to the cast removed and a new one(s) or a removable splint applied, as the bones heal.

Percutaneous fixation (wire) and cast:

This is a type of surgery which involves inserting metal pins into the bone either side of the break through small cuts in the skin. Wires are then fastened to the pins to hold then wrist bones in place and a cast (plaster or fibreglass) is applied to hold the bones in position whilst they heal. This can be done in the emergency room, fracture clinic, or similar room without the need to put you to sleep in an operating surgery (general anaesthetic). The doctor can give you pain killers and numb your arm; you may also be given a sedative to relax you. You may also need to take antibiotics to reduce the risk of getting an infection where the pins go into the skin. You can usually leave hospital the same day, but will need to keep the cast on for a few weeks until the bones heal. You may need to have the cast removed and a new one(s) or a removable splint applied, as the bones heal. The wires and pins will also need to be removed once the bones are healed.

External fixation:

This type of surgery is similar to the percutaneous (wire) and cast, but instead of wires attached to the pins, an external metal frame is fixed to the pins, which fits on the outside of the arm. This may or may not go across (bridge) the wrist. The frame and pins will be removed once the wrist has healed.

Open reposition without a cast:

This type of surgery is carried out in an operating surgery usually when you are asleep (under general anaesthetic). A cut is made in the skin and the doctor will move the muscles aside to fix metal plate(s) using screws to the broken bones to bring them back and hold them in position. The doctor can give you pain killers for when you wake up from surgery. You may also need to take antibiotics to reduce the risk of getting an infection where the doctor has cut the skin. The average stay in hospital is usually around four days. The metal plate(s) and screws may or may not be removed once the wrist bones have healed.

3.4 FAQ 2. How might I feel after my treatment?

What symptoms might I experience?

Common symptoms experienced after breaking your wrist include:[16]

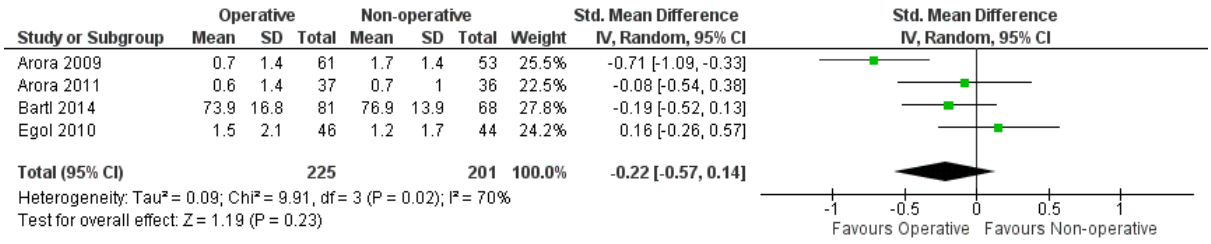
- Pain (especially on little finger side of wrist)[16]
- Swelling (wrist may look larger or there may be a lump)[16]
- Stiffness[16]
- Numbness[16]
- Hypersensitivity (wrist may be very sensitive to touch but should settle with regular firm massage)[16]

How much pain will I be in?

Comparison between non-surgical and surgical treatment in older patients

One systematic review (Chen 2016[5]) reported on pain after treatment in older populations (60 years and older). Closed reduction and cast (non-surgical treatment) was compared with open reduction and internal plate (surgical treatment). Pain was measured using a visual analogue scale (0 [no pain] to 10 [severe pain]). Four studies were included (two RCTs and two non-randomised studies), with a total of 225 patients receiving non-operative treatment and 201 undergoing surgical treatment. Pain was measured after at least a follow-up period of approximately 12 months. The pooled standardised mean difference (standardised mean difference (SMD) -0.22, 95% confidence interval (CI): -0.57 to 0.14) suggested that there was no significant difference in pain between older patients undergoing surgical and non-surgical treatment for distal radius fracture, after a period of approximately one year (see Figure 2). However, heterogeneity (I^2=70%) was detected, which suggests that the findings should be interpreted with caution.

Figure 2: Summary of pooled mean VAS pain scores in studies comparing non-operative to surgical treatment of distal radius fractures in older adults (Chen 2016)



Includes two RCTs (Arora 2011;[20] Bartl 2014[21]) and two observational studies (Arora 2009;[22] Egol 2010[23]):

How long will my symptoms last?

The duration of symptoms varies between individual patients. Most fractures will hurt moderately from a few days to a couple of weeks.[14] Some patients can experience pain whilst carrying rigorous activities for up to one year.[14] Most patients experience stiffness in their wrist and this will last for a month or two and is usually minor.[14] However, it can take up to two years in some cases to completely disappear.[14] Swelling may make the wrist look

larger or there may be a lump around the area of the break, in some cases up to 12-18 months and some may never totally disappear.[16]

FAQ 2: EVIDENCE SUMMARY

How might I feel after my treatment?

Common symptoms experienced after breaking your wrist include:

Pain (can be more painful in the little finger)
How long you will experience these symptoms varies between individual patients. However, most patients feel moderate pain for a few days and even up to two weeks. You may even experience pain whilst carrying rigorous activities for up to one year. Though evidence is limited, there seems to be no clear differences in the amount of pain *older adults* feel after undergoing treatment by *closed reduction with a cast*, as opposed to undergoing more extensive treatment involving surgery to have a metal plate inserted to repair the fracture (*open reposition without a cast*). No evidence was found on pain differences in *younger adults*.

Swelling (wrist may look larger or there may be a lump)
Swelling may make the wrist look larger and/or there may be a lump around the area which is broken as the bones heal. Lumps can in some cases take up to 12-18 months to disappear and in some cases may never totally disappear.

Stiffness
Most patients experience stiffness in their wrist and this will last for a month or two but is usually minor. However, it can take up to two years in some cases to completely disappear.

Numbness
Hypersensitivity (wrist may be very sensitive to touch but should settle with regular firm

3.5 FAQ 3: WHAT ARE THE COMPLICATIONS OF TREATMENT?

What complications might I experience from my treatment?

Healing complications

A recent systematic review and Bayesian network meta-analysis (NMA) (Vannabouathong 2018[7]) of RCTs assessed fracture healing complications in adults (range of mean ages 34.5 to 77.4 years) undergoing treatment for distal radius fracture. Fracture healing complications included in this analysis were loss of reduction, malunion, delayed union, nonunion, and refracture. The NMA included seven different treatment options: closed reduction and plaster cast; external fixation; intramedullary nailing; K-wires; or surgery with plate fixation. Fracture healing complications included: loss of reduction, malunion, delayed union, non-union, and refracture; loss of fracture reduction was the most commonly assessed healing complication. Outcomes were reported between three months and two years after treatment; most assessed complications one year after treatment.

Plate fixation had the lowest probability of fracture healing complications, with significantly fewer events relative to external fixation, K-wire, plaster cast and intramedullary nailing (see Table 5). This was also confirmed by the surface under the cumulative ranking curve (SUCRA) analysis (see Table 6). The authors concluded that in terms of a reduction in fracture healing complications, open reduction and internal fixation with a plate offer the best results for adult patients with a distal radius fracture. However, of the 25 RCTs included in the analysis, nine were rated as at high risk of bias and the remainder had one or more criteria rates as at unknown risk of bias; none of the included trials were rated as at low risk of bias across all of the assessment criteria.

Table 5: Summary of NMA evidence (Vannabouathong 2018) for relative probability of patients experiencing healing complications after distal radius fracture repair

	External fixation	Percutaneous fixation (wire) and cast	Closed reposition and cast	Open reposition without a cast	
		K-wire fixation	Plaster cast	Plate fixation	Intramedullary nail
External fixation	-	OR 0.36 (95% CrI: 0.07 to 1.63)	OR 0.03 (95% CrI: 0.01 to 0.11)	OR 0.25 (95% CrI: 0.07 to 0.86)	OR 0.00 (95% CrI: 0.00 to 1.55)*
K-wire fixation	NS no further details	-	OR 0.07 (95% CrI: 0.01 to 0.34)	OR 0.09 (95% CrI: 0.02 to 0.36)	OR 0.00 (95% CrI: 0.00 to 4.52)*
Plaster cast	NS no further details	NS no further details	-	OR 0.01 (95% CrI: 0.00 to 0.03)	OR 0.00 (95% CrI: 0.00 to 68.92)*
Plate fixation	OR 0.25 (95% CrI: 0.07 to 0.86)	OR 0.09 (95% CrI: 0.02 to 0.36)	OR 0.01 (95% CrI: 0.00 to 0.03)	-	OR 0.00 (95% CrI: 0.00 to 0.15)*
Intramedullary nail	NS no further details	NS no further details	NS no further details	OR 0.00 (95% CrI: 0.00 to 0.35)	-

Comparison is row versus column
CrI = credible interval; NR = not reported; OR = odds ratio
Healing complications include: loss of (fracture) reduction, malunion, delayed union, non-union, and refracture.
Intramedullary nail was compared to plate fixation by two studies that were not otherwise connected to the network (cf. Figure 2 of Vannabouathong 2018)

Table 6: Summary of NMA evidence (Vannabouathong 2018) for the relative ranking of treatments (probability of healing complications) for distal radius fracture repair

Interventions		SUCRA values
Closed reposition and cast	*Plaster cast*	21.9%
Percutaneous fixation (wire) and cast	*K-wire fixation*	50.9%
External fixation	*External fixation*	72.4%
Open reposition without a cast	*Plate fixation*	99.3%
	Intramedullary nail	5.6%

NOTE: Greater SUCRA values indicate higher rank of the treatment (i.e. lower probability of healing complications after treatment)
SUCRA = surface under the cumulative ranking curve

Malunion

The systematic review carried out to inform treatment guidelines from the Danish Health Authority 2016[13] identified a number of serious complications and in particular malunion and a need for surgery due to fracture redisplacement in patients with distal radius fracture who were treated conservatively (i.e. closed reduction and cast). In comparison a smaller number of the patients treated with percutaneous wire (K-wires) also experienced a fracture redisplacement, but the risk of re-operation was significantly lower with K-wire treatment than conservative treatment. This finding was based on a review of the evidence from five studies[24-28] carried out the guideline working group, though the guideline group commented that studies did not all collect and register the complications in a systematic way and the evidence for this finding was judged as based on low quality evidence.

Minor and major complications in older patients

One systematic review (Chen 2016[5]) in elderly adults (aged 60 years and above) reported that there was no significant difference between closed reduction and cast (non-surgical treatment) and open reduction and internal plate (surgical treatment), with respect to the occurrence of minor complications (odds ratio (OR) 1.12, 95% CI: 0.50 to 2.52; 7 studies; I^2=63%)[20-23, 29-31] and nerve lesions (OR 1.76, 95% CI; 0.90 to 3.45; 7 studies; I^2=0%).[20-23, 29-31] There were differences between the two types of treatment with respect to major complications (OR 0.44, 95% CI: 0.22 to 0.89; 6 studies; I^2=0%)[20-23, 30, 31] and tendon injury (OR 0.30, 95% CI: 0.12 to 0.78; 6 studies; I^2=16%),[20-23, 29-31] both favouring the non-surgical treatment of distal radius fractures in older adults However, these findings were based mainly on smaller retrospective studies that had some methodological concerns. Despite this there is a suggestion that non-operative treatment (closed reduction and cast) may be favourable in terms of a lower probability of complications than surgery (open reduction and plating) for the treatment of distal radius fractures in older adults.

Pin track infection

Pin track infection is a particular complication associated with the use surgical pins to and wires. One systematic review by Xu 2016[9] assessed the probability of pin tract infection using a NMA including seven different treatments for distal radius fractures in adults (where reported, age ranged 18 to 87 years). The treatments included: closed reposition and cast (plaster fixation); percutaneous fixation (wire) and cast (K-wire fixation); external

fixation (bridging external fixation; non-bridging external fixation); open reposition without a cast (dorsal plating; volar plating; or dorsal and volvar plating).

When compared to bridging external fixation patients, there was no significant difference (p-values were all over 0.05) in the odds of PTI occurring after K-wire fixation and surgery using dorsal plating for a distal radius fracture (see Table 6). However, there was a significant difference in favour of bridging external fixation when compared with non-bridging external fixation. Plaster cast and all forms of surgery using internal plating (i.e. those treatments which did not involve external pinning), also naturally had significantly lower probabilities of PTI (see Table 7).

Table 7: Summary of NMA evidence (Xu 2016) for relative probability of patients experiencing PTI after distal radius fracture repair

Interventions		Number of patients	Odds ratio (OR) with 95% confidence interval (CIs) in comparison with bridging external fixation	p-value
Closed reposition and cast	*Plaster cast*	84	0.231 (95% CI: 0.056 to 0.951)	0.042
Percutaneous fixation (wire) and cast	*K-wire fixation*	243	0.594 (95% CI: 0.172 to 2.050)	0.410
External fixation	*Non-bridging external fixation*	525	2.091 (95% CI: 1.447 to 3.020)	<0.001
	Bridging external fixation	496	-	-
Open reposition without a cast	*Dorsal plating*	71	0.290 (95% CI: 0.060 to 1.395)	0.123
	Volar plating	128	0.277 (95% CI: 0.090 to 0.852)	0.025
	Dorsal and volar plating	258	0.270 (95% CI: 0.087 to 0.833)	0.023

The treatment rankings based on the surface under the cumulative ranking curves (SUCRA) and predicted probability values are shown in Table 7. These again suggested that K-wire fixation and bridging fixation are better than non-bridging external fixation in terms of reducing the probability of PTI. The authors concluded that surgery with plating and closed reduction with cast, appear to be the best treatments for distal risk facture with respect to the probability of PTI as they avoid the use of pins, but where pins are used, K-wire and bridging external fixation would appear to be preferable over non-bridging fixation. However, the evidence is based on evidence from RCTs with relatively small sample sizes and poor reporting in some cases meant that the risk of bias within the trials could not be properly assessed.

Table 8: Summary of NMA evidence (Xu 2016) for the relative ranking of treatments (probability of PTI) for distal radius fracture repair

Interventions		Number of patients	Relative ranking of treatments	
			SUCRA values	Estimated predictive probabilities
Closed reposition	*Plaster cast*	84	76.6%	76.3%

and cast				
Percutaneous fixation (wire) and cast	*K-wire fixation*	243	38.4%	38.5%
External fixation	*Non-bridging external fixation*	525	0.5%	0.6%
	Bridging external fixation	496	21.8%	21.7%
Open reposition without a cast	*Dorsal plating*	71	68.0%	68.3%
	Volar plating	128	71.1%	71.1%
	Dorsal and volar plating	258	76.3%	76.3%

PTI = pin track infection; SUCRA = surface under the cumulative ranking probabilities
NOTE: Greater SUCRA/predictive probability values indicate higher rank of the treatment (i.e. lower probability of PTI after treatment)

What is my risk of long-term complications?

In addition to experiencing potential complications from the different fracture treatments, patients may also experience other long-term complications including those resulting from the fracture itself. These include:

- Post-traumatic arthritis (PA)
- Chronic complex regional pain syndrome (CRPS)
- Carpal tunnel syndrome (CTS)

Post-traumatic arthritis (PA)

One systematic review by Lameijer 2017[8] assessed the prevalence of radiological PA across 19 studies of non-osteoporotic adult patients (18 to 49 years for women and 18 to 59 years for men) with a closed distal radius fracture. The weighted mean age of patients at the time of distal radius fracture was 37 years (range 25 to 54 years) and follow-up for PA was 13 months to 38 years. The nineteen studies included eight prospective and 11 retrospective cohort studies with a total of 733 patients; seven studies were graded as high quality, nine as moderate quality and three as low quality according to the Newcastle-Ottawa Scale (NOS) quality assessment. The level of evidence was overall graded as low quality (level 3 using the Oxford Centre for Evidence-based Medicine grading). The weighted prevalence of radiological PA was 50% (343 out of a total of 683 patients). When only 'open source' data were considered, the weighted prevalence dropped to 37%. Further analyses suggested that there may be a link between the development of PA after a distal radius fracture and certain functional outcomes after fracture repair. These included limited radial deviation and flexion, and articular incongruence. However, there did not appear to be a link between the development of PA after distal radius fracture and grip strength after fracture repair.

Chronic complex regional pain syndrome (CRPS)

One recent systematic review and NMA (Wang 2017[4]) reported on the relative odds of patients experiencing CRPS after the repair of a distal radius fracture. The review included 17 randomised controlled trials and a total of 1658 patients. Where reported, patient age

ranged from 18 to 92 years; all were in mixed gender Caucasian populations with the exception of two trials in Asian populations. Seven different treatment options were considered including: closed reposition and cast (plaster fixation); percutaneous fixation (wire) and cast (K-wire fixation); external fixation (bridging external fixation; non-bridging external fixation); open reposition without a cast (dorsal plating; volar plating; or dorsal and volvar plating).

When compared to bridging external fixation patients, there was no significant difference (p-values were all over 0.05) in the odds of CRPS occurring after any of the treatments for a distal radius fracture (see Table 9).

Table 9: Summary of NMA evidence (Wang 2017) for relative probability of patients experiencing CRPS after distal radius fracture repair

Interventions		Number of patients	Odds ratio (OR) with 95% confidence interval (CIs) in comparison with bridging external fixation	p-value
Closed reposition and cast	*Plaster cast*	84	0.609 (95% CI: 0.178 to 2.082)	0.429
Percutaneous fixation (wire) and cast	*K-wire fixation*	154	2.097 (95% CI: 0.299 to 14.689)	0.456
External fixation	*Non-bridging external fixation*	525	0.762 (95% CI: 0.420 to 1.383)	0.372
	Bridging external fixation	452	-	-
Open reposition without a cast	*Dorsal plating*	132	1.143 (95% CI: 0.250 to 5.060)	0.860
	Volar plating	123	1.209 (95% CI: 0.327 to 4.469)	0.776
	Dorsal and volar plating	188	1.631 (95% CI: 0.327 to 8.138)	0.551

However, when the treatment rankings based on the surface under the cumulative ranking curves (SUCRA) and predicted probability values were considered, there was a suggestion that plaster fixation and non-bridging external fixation were more effective in reducing the probability of CRPS (see Table 10). Therefore, it would appear that plaster fixation (closed reposition and cast) and non-bridging external fixation might be the better treatment methods to reduce the risk of CRPS in patients with distal radius fracture, compared with bridging external fixation, K-wire fixation, dorsal plating, volar plating, dorsal and volar plating. This suggests that based on this NMA, non-invasive treatments appear more favourable.

Table 10: Summary of NMA evidence (Wang 2017) for the relative ranking of treatments (probability of CRPS) for distal radius fracture repair

Interventions		Number of patients	Relative ranking of treatments	
			SUCRA values	Estimated predictive probabilities
Closed reposition and cast	*Plaster cast*	84	76.5%	77.0%

Percutaneous fixation (wire) and cast	*K-wire fixation*	154	24.5%	24.5%
External fixation	*Non-bridging external fixation*	525	71.4%	71.3%
	Bridging external fixation	452	51.5%	51.5%
Open reposition without a cast	*Dorsal plating*	132	48.3%	48.9%
	Volar plating	123	44.5%	43.7%
	Dorsal and volar plating	188	33.2%	33.2%
CPRS = Chronic complex regional pain syndrome; SUCRA = Surface under the cumulative ranking curve *NOTE*: Greater SUCRA/predictive probability values indicate higher rank of the treatment (i.e. lower probability of CRPS after treatment)				

Another similar, but slightly older systematic review and NMA (Qiu 2015[10]) was also identified, but not extracted (see Appendix 2). This evaluated the same seven interventions and reported similar data and conclusions.

The systematic review and meta-analysis by Chen 2016[5] (including two RCTs[20, 21] and four retrospective studies[22, 29-31]) carried out in elderly patients (60 years and over) with distal radius fracture compared operative versus nonsurgical procedures reported that the incidence of CRPS in the nonsurgical and operative groups was 4.8% (18 of 372) and 2.9% (11 of 368), respectively.[5]

Carpal tunnel syndrome (CTS)

One systematic review and NMA (Qiu 2015[10]) evaluated the probability of developing CTS after treatment for distal radius fracture in adults. The review included 19 randomised controlled trials and a total of 1,805 patients. Where reported, patient age ranged from 17 to 87 years; all were in mixed gender populations including studies from across Europe, Australia, North America, China, Taiwan and Singapore. Seven different treatment options were considered including: closed reposition and cast (plaster fixation); percutaneous fixation (wire) and cast (K-wire fixation); external fixation (bridging external fixation; non-bridging external fixation); open reposition without a cast (dorsal plating; volar plating; or dorsal and volvar plating).

The results of the NMA reporting on 12 trials assessing CTS, amongst distal radius fracture patients treated with non-bridging external fixation, K-wire fixation, plaster fixation, dorsal plating, volar plating, and dorsal and volar plating when compared to patients treated with bridging external fixation (see Table 11).

Table 11: Summary of NMA evidence (Qiu 2015) for relative probability of patients experiencing CTS after distal radius fracture repair

External fixation		Percutaneous fixation (wire) and cast	Closed reposition and cast	Open reposition without a cast		
Bridging external fixation	OR 0.86 (0.17, 4.85)	OR 1.82 (0.07, 52.85)	OR 0.70 (0.09, 5.75)	OR 0.17 (0.02, 1.54)	OR 1.18 (0.18, 6.71)	OR 0.46 (0.02, 13.66)
OR 1.16 (0.21, 5.73)	**Non-bridging external fixation**	OR 2.05 (0.06, 98.55)	OR 0.79 (0.06, 10.91)	OR 0.19 (0.01, 3.05)	OR 1.34 (0.11, 14.26)	OR 0.53 (0.01, 22.71)
OR 0.55 (0.02, 13.49)	OR 0.49 (0.01, 17.04)	**K-wire fixation**	OR 0.37 (0.02, 8.71)	OR 0.09 (0.00, 3.87)	OR 0.68 (0.02, 10.39)	OR 0.25 (0.02, 3.29)
OR 1.42 (0.17, 11.23)	OR 1.26 (0.09, 17.88)	OR 2.72 (0.11, 66.07)	**Plaster fixation**	OR 0.24 (0.01, 4.57)	OR 1.72 (0.15, 13.45)	OR 0.68 (0.03, 13.65)
OR 5.97 (0.65, 58.68)	OR 5.24 (0.33, 86.17)	OR 11.33 (0.26, 606.17)	OR 4.10 (0.22, 82.99)	**Dorsal plating**	OR 7.00 (0.54, 95.61)	OR 2.75 (0.05, 142.87)
OR 0.85 (0.15, 5.61)	OR 0.75 (0.07, 9.15)	OR 1.47 (0.10, 40.76)	OR 0.58 (0.07, 6.60)	OR 0.14 (0.01, 1.85)	**Volar plating**	OR 0.42 (0.02, 12.08)
OR 2.20 (0.07, 60.60)	OR 1.88 (0.04, 75.01)	OR 3.96 (0.30, 59.50)	OR 1.47 (0.07, 30.95)	OR 0.36 (0.01, 19.66)	OR 2.40 (0.08, 60.90)	**Dorsal and volar plating**
OR odds ratio (,) 95% confidence intervals						

The lowest risk of CTS appeared to be in patients treated with dorsal plating and this was confirmed by the highest SUCRA value of 89.4% (see Table 12).

Table 12: Summary of NMA evidence (Qiu 2015) for the relative ranking of treatments (probability of CTS) for distal radius fracture repair

Interventions		**Number of patients**	**SUCRA values**
Closed reposition and cast	*Plaster cast*	84	51.9%
Percutaneous fixation (wire) and cast	*K-wire fixation*	243	24.1%
External fixation	*Non-bridging external fixation*	525	49.3%
	Bridging external fixation	496	37.1%
Open reposition without a cast	*Dorsal plating*	71	89.4%
	Volar plating	128	40.2%
	Dorsal and volar plating	258	57.9%

CTS = carpal tunnel syndrome; SUCRA = Surface under the cumulative ranking curve
NOTE: Greater SUCRA values indicate higher rank of the treatment (i.e. lower probability of CTS after treatment)

Another similar, but slightly older systematic review and NMA (Zhao 2015[6]) was also identified, but not extracted (see Appendix 2). This evaluated the same seven interventions and reported similar data and conclusions.

FAQ 3: EVIDENCE SUMMARY

What are the complications of treatment?

Common side effects experienced by many patients after treatment for a distal radius fracture include:

Problems with healing

This can include the bones not healing (non-union), not healing in the correct position (malunion), the bones rebreaking (refracture) or the loss of fracture reduction. There is some evidence that patients who undergo closed reduction with a cast may experience more healing complications including malunion and non-union. This means they may require further treatment including surgery to repair the fracture. Patients who have an open reduction to fit a metal plate appear to have the lowest probability of fracture healing complications.

Infections

If you have had surgery to insert pins (*external fixation or percutaneous* [K-wire] *fixation*) or have had an *open reduction* (surgery to insert a metal plate), the wound can become infected. In the case of pins the infection can travel down the pins into the body and this is known as pin track infection. Therefore, treatments which avoid the use of pins are best at avoiding pin track infection (*closed reduction and cast*). Where pins are used, there is some evidence that pin track infections are less likely if *percutaneous fixation* (K-wire) and or external metal frames that bridge over the wrist joint (bridging *external fixation*) are used instead of external metal frames that do not bridge over the wrist joint (non-bridging e*xternal fixation*).

Less common, but more serious, longer term complications can include:

Post-traumatic arthritis

This is a long-term condition where arthritis affects the injured wrist joint. It can cause pain, stiffness and affect the function and shape of the wrist.

Chronic complex regional pain syndrome

This is where a patient experiences persistent severe and debilitating pain. There is some evidence that patients who have a *closed reduction with a cast* or have treatment using *external fixation* where the metal frame does not go across the wrist joint (non-bridging *external fixation*), may be less likely to suffer from chronic complex regional pain syndrome in comparison with other treatments (bridging *external fixation* [where the metal frame goes across the wrist joint]; *percutaneous K-wire fixation*; *open reduction* to insert a metal plate [dorsal and/or volar]). However, in older individuals the incidence of chronic complex regional pain syndrome was reported as higher with nonsurgical treatment (4.8%) in comparison to surgical treatment (2.9%).

Carpal tunnel syndrome

This is a painful condition which affects the hand and fingers, and can also cause tingling, numbness and difficulties gripping objects. There is some evidence that patients who have surgery to *insert a metal (dorsal) plate,* may be less likely to suffer from carpal tunnel syndrome in comparison with other treatments.

Complications overall

In older patients, having a closed reduction & cast may be more favourable in terms of complications overall, when compared with surgery, but this is based on weak evidence.

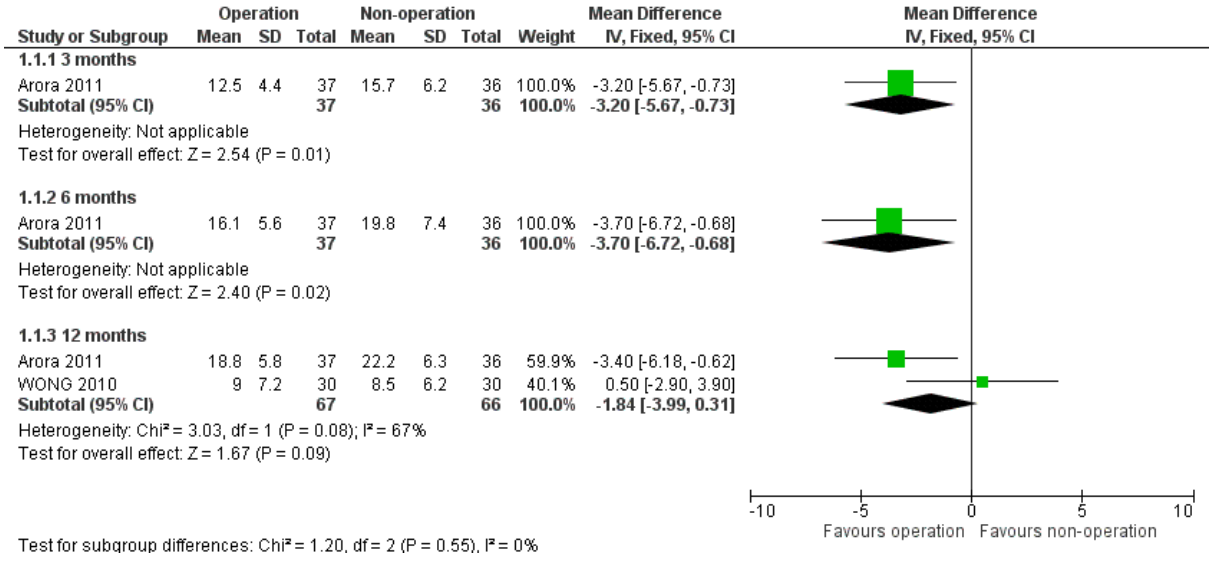
3.6 FAQ 4. WHAT WILL BE THE IMPACT ON MY DAILY LIVING?

How might my wrist movement be affected?

Comparison of range in grip strength between surgical and non-surgical treatments in older adults (≥ 45 years)

A systematic review and meta-analysis of RCTs (Song 2015[12]) in patients with a distal radius fracture aged 45 years and older, compared conservative treatment (closed reduction and cast) with surgery and evaluated grip strength at three, six and 12 months follow-up. Two RCTs[20, 32] reported on grip strength and the findings are summarised in Figure 3.

Figure 3: Summary of pooled mean grip strength scores in studies comparing non-operative to surgical treatment of distal radius fractures in adults aged 45 years and older (Song 2015)



Included RCTS: Arora 2011;[20] Wong 2010[32]

A significant difference in favour of surgical treatment (compared with conservative treatment) was reported for grip strength at three months (mean difference (MD) -3.20; 95% CI: -5.67 to -0.73; one study; n=73)[20] and six months (MD -3.70; 95% CI: -6.72 to -0.68; one study; n=73),[20] but no significant differences were evident after 12 months (MD -3.70; 95% CI: -3.99 to 0.31; two studies; n=133; I^2=67%).[20, 32] However, these findings were based mainly on one small study and the findings after 12 months, though based on two studies and including almost twice as many patients, showed evidence of heterogeneity. Overall the review concluded that there appeared to be no difference with respect to functional outcomes such as grip strength in the longer term, between conservative and surgical treatments to repair distal radius fractures in adults aged 45 years and over. The clinical significance of differences in grip strength up to six months in favour surgery was unclear.

In addition, one systematic review and meta-analysis (Chen 2016[5]) in older adults aged 60 years and older also compared grip strength in patients receiving conservative treatment versus surgical treatment. Considering grip strength at least 12 months after treatment, using data from one RCT[20] and four retrospective studies,[22, 23, 29, 30] there appeared to be a statistically significant difference in favour of operative treatment (MD -2.10; 95% CI: -4.12

to -0.08). However, this pooled value was based mainly on poor quality studies and there was evidence of a high level of heterogeneity (I^2=78%), so the findings may not be reliable. Overall, the authors concluded that the evidence does not support operative treatment as better in comparison with conservative treatment in older adults with distal radius fractures.

Comparison in range of motion between surgical and non-surgical treatments

A number of outcomes assessing range of wrist motion were assessed in a systematic review and meta-analysis of RCTs (Song 2015[12]) in patients with a distal radius fracture aged 45 years and older. The review compared conservative treatment (closed reduction and cast) with surgery.

Statistically significant differences favouring surgical treatment in comparison with conservative treatment were reported for ulnar variance at three, six and 12-months follow-up. In contrast, analyses of radial inclination and palmar inclination suggested significant differences favouring conservative treatment in comparison with surgery at three, six and 12 months follow-up. No significant differences between conservative and surgical treatment were reported at any time point for radial deviation, ulnar deviation, palmar flexion, and dorsal extension. However, in general the analyses included only small numbers of studies with limited population sizes and a number of the analyses showed moderate to high levels of heterogeneity (radial inclination, radial deviation, ulnar deviation, palmar flexion, and dorsal extension). Overall, there was little evidence of any real differences in the range of wrist motion after conservative versus surgical treatments for distal radius wrist fracture in adults aged 45 years and over. A summary of these findings is reported in Table 13.

Table 13: Summary of evidence (Song 2015) on range of wrist movement outcomes in patients (≥ 45 years) receiving conservative versus surgical treatment after distal radius fracture

Outcome	Number of studies	Number of patients		Weighted mean difference (WMD) and 95% confidence intervals (CIs)			Heterogeneity (I^2 value)
		Conservative treatment	Surgical treatment	3 mths follow-up	6 mths follow-up	12 mths follow-up	
Radial inclination	4[21, 24, 32, 33]	227	223	-3.49 (95% CI: -4.87 to -2.17)	-4.00 (95% CI: -5.01 to -2.99)	-3.20 (95% CI: -4.25 to -2.14)	65%
Palmar inclination	3[21, 24, 32]	199	193	-7.04 (95% CI: -7.54 to -6.54)	-7.00 (95% CI: -7.51 to -6.49)	-7.00 (95% CI: -7.50 to -6.50)	0%
Ulnar variance	3[20, 24, 32]	154	156	1.10 (95% CI: 0.46 to 1.74)	1.10 (95% CI: 0.46 to 1.74)	0.60 (95% CI: 0.15 to 1.04)	44%
Radial deviation	2[20, 33]	173	170	0.00 (95% CI: -3.21 to 3.21)	1.00 (95% CI: -3.49 to 5.49)	-4.16 (95% CI: -16.15 to 7.84)	96%
Ulnar deviation	3[20, 32, 33]	175	172	-2.00 (95% CI: -6.59 to 2.59)	-2.00 (95% CI: -6.59 to 2.59)	-4.73 (95% CI: -15.98 to 6.53)	96%
Palmar flexion	4[20, 21, 32, 33]	336	309	5.55 (95% CI: -1.50 to 12.61)	-3.00 (95% CI: -8.31 to 2.31)	-1.19 (95% CI: -9.14 to 6.76)	90%
Dorsal extension	4[20, 21, 32, 33]	336	309	3.86 (95% CI: -1.32 to 9.03)	0.00 (95% CI: -5.28 to 5.28)	-3.08 (95% CI: -8.05 to 1.89)	85%

Comparison in range of motion between surgical and non-surgical treatments in older adults (≥ 60 years)

A further systematic review and meta-analysis (Chen 2016[5]) of RCTs and observational studies in older adults (60 years and over) with distal radius fracture, comparing conservative treatment versus surgical treatment, reported a similar lack of evidence to support any differences in the range of wrist motion after treatment (see Table 14).

Table 14: Summary of evidence (Chen 2016) on range of wrist movement outcomes in patients (≥ 60 years) receiving conservative versus surgical treatment after distal radius fracture

Outcome	Number of studies	Number of patients		Weighted mean difference (WMD) and 95% confidence intervals (CIs)	Heterogeneity (I^2 value)
		Conservative treatment	Surgical treatment		
Extension motion	4*	168	155	-3.46 (95% CI: -12.62 to 5.70)	93%
Flexion motion	4*	168	155	1.02 (95% CI: -4.24 to 6.28)	79%
Supination motion	4*	168	155	1.45 (95% CI: -0.33 to 3.24)	29%
Pronation motion	4*	168	155	0.48 (95% CI: -1.07 to 2.03)	0%
Ulnar deviation	4*	168	155	-2.24 (95% CI: -5.81 to 1.33)	79%
Radial deviation	4*	168	155	1.30 (95% CI: -0.31 to 2.92)	0%
*Included studies: Arora 2009;[22] Arora 2011;[20] Aktekin 2010;[29] Egol 2014[23]					

How might my day-to-day activities be affected?

Comparison of functional outcome after treatment (good/excellent)

A recent systematic review and Bayesian NMA (Vannabouathong 2018[7]) of RCTs assessed function after treatment (defined as excellent or good) in adults undergoing treatment for distal radius fracture. The NMA included seven different treatment options: closed reduction and plaster cast; external fixation; intramedullary nailing; K-wires; or surgery with plate fixation. Functional outcome was assessed by different tools, the most common been the Gartland-Werley scale.

Six trials (277 patients) assessed function at three months; none of the trials reported data on intramedullary nailing at three months. There were no statistically significant differences between any of the treatments with respect to the number of patients achieving a good/excellent functional outcome. Similarly, six trials (325 patients) assessed function at six months and again no statistically significant differences were found between any of the treatments; none of the trials reported data on intramedullary nailing at six months. A final analysis of function was carried out for 17 trials (1,123 patients) reporting data at 12 months or later. All of the comparisons between the different treatments showed no statistically significant differences with the exception of the comparison between plaster cast and plate fixation, where function appeared better after plate fixation (OR 4.27, 95% CrI: 1.07 to 15.12).

SUCRA values across all time points are shown in Table 15 and also suggested that overall open reduction with internal plate fixation, is the best treatment for adult patients with a distal radius fracture.

Table 15: Summary of NMA evidence (Vannabouathong 2018) for the relative ranking of treatments (probability of functional outcome – good/excellent) for distal radius fracture repair

Interventions		SUCRA values		
		3 months (n=277)	6 months (n=325)	≥ 12 months (n= 1,123)
Closed reposition and cast	*Plaster cast*	11.3%	10.8%	6.5%
Percutaneous fixation (wire) and cast	*K-wire fixation*	80.1%	59.6%	54.8%
External fixation	*External fixation*	45.3%	42.3%	45.1%
Open reposition without a cast	*Plate fixation*	63.3%	87.3%	83.0%
	Intramedullary nail	No data	No data	60.6%

SUCRA = Surface under the cumulative ranking curve
NOTE: Greater SUCRA values indicate higher rank of the treatment (i.e. higher probability of good/excellent functional outcome)

Additional recommendations from treatment guidelines published by the Danish Health Authority in 2016[13] state that based on low level evidence, K-wires (percutaneous fixation with wire and cast) provide a better functional outcome in comparison with conservatively treatment (closed reduction and cast). Similarly, but based on very low evidence, correctly positioned volar angular stable locking plate (open reposition without cast) is recommended over conservative treatment, based on evidence from functional scores.[13]

DASH score

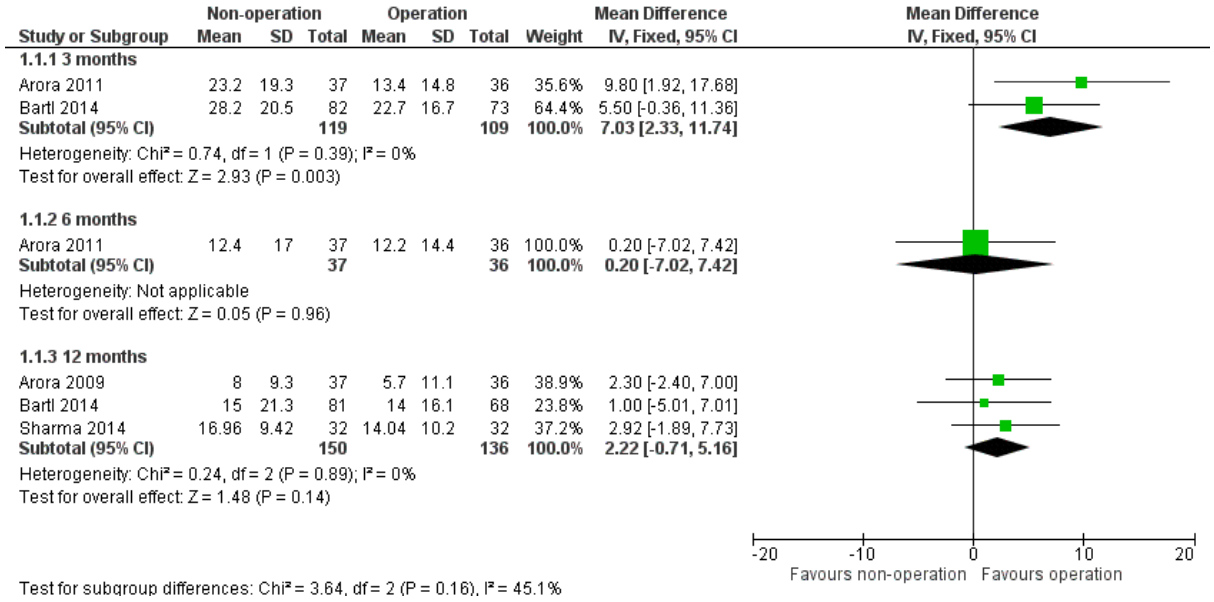
The Disabilities of the Arm, Shoulder and Hand (DASH) tool is a 30-item, patient assessment questionnaire designed to measure physical function and symptoms in patients with any injury or disorder of arm, shoulder or hand, including distal radius fractures. The overall score ranges from 0 to 100 with lower scores indicating a better result. Guidelines from the Danish Health Authority 2016[13] suggest that the smallest clinically relevant difference in DASH score is 10.

DASH score in older adults (≥ 45 yrs)

A systematic review and meta-analysis of RCTs (Song 2015[12]) comparing non-operative treatment versus surgical treatment in adults aged 45 years and over, reported on DASH scores. RCTs were pooled and suggested that three months after treatment significantly higher DASH scores (i.e. improved function) were associated with non-operative treatment in comparison with surgery (mean difference: 7.03; 95% CI: 2.33 to 11.74; two studies; n=228).[20, 21] However, when scores were assessed at six and 12 months no significant differences between the two types of treatment were evident (see Figure 4). There was no evidence of heterogeneity between the studies, but the findings were based on a limited number of small studies. Overall the authors concluded that there were no differences in

functional outcome between non-operative and surgical treatment of distal radius fractures in adults aged 45 years and over.

Figure 4: Summary of pooled mean DASH scores in studies comparing non-operative to surgical treatment of distal radius fractures in adults aged 45 years and older (Song 2015)



Included RCTs: Arora 2011;[20] Bartl 2014[21]

Evidence from a second systematic review and meta-analysis (Chen 2016[5]) of two RCTs and five observational studies in elderly patients with distal radius fracture aged 60 years and over, also reported similar findings with no evidence of differences between non-operative and surgical treatment.

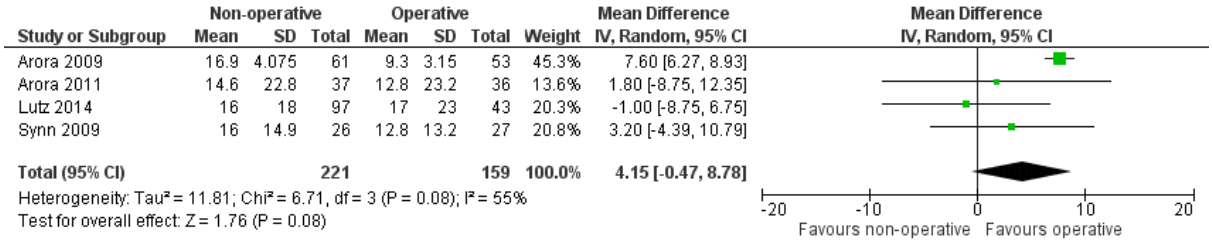
PRWE score

The Patient Rated Wrist Evaluation (PRWE) score is another frequently used patient reported outcome measure used to assess wrist function after fracture. Guidelines from the Danish Health Authority 2016[13] suggest that the smallest clinically relevant difference in PRWE score is 14.

PRWE score in older adults (≥ 60 years)

One systematic review and meta-analysis (Chen 2016[5]) of RCTs and observational studies in older patients aged 60 years and older, reported that there were no significant differences between non-operative and surgical treatments with respect to wrist function assessed using PRWE (see Figure 5).

Figure 5: Summary of pooled mean PRWE scores in studies comparing non-operative to surgical treatment of distal radius fractures in adults aged 60 years and older (Chen 2016)



*Included: one RCT (*Arora 2011[20]*) and three observational studies (*Arora 2009;[22] Lutz 2014;[31] Synn 2009[34])

Will it affect my quality of life?

A systematic review from 2013 (Van Son 2013[11]) reviewed studies evaluating health status (HS) and health-related quality of life (HRQoL) during recovery from distal radius fracture in adults. In general, no differences in quality of life were found between different types of treatments. However, this review only considered studies published up to 2012 and the authors commented that the studies on which their findings were based were of low quality.

The review included a RCT which found no significant differences in the quality of life of patients (between two weeks and up to 12 months) after undergoing closed reduction with a cast versus those patients undergoing percutaneous pinning.[35] Two further studies suggested that after 12 months there were no differences in health status between patients treated conservatively (closed reduction and cast) and those patients treated surgically.[24, 36] One of these two studies[24] that used the Short Form 36 (SF-36) tool, was also included in a systematic review to support guidelines from the Danish Health Authority 2016.[13] SF-36 is a commonly used and validated tool for measuring a patients' experience or quality of life. The tool assesses both a patients' mental and physical wellbeing with score ranging between 0 and 100 (lower scores indicate more disability and poorer quality of life). The Danish guidelines also reported that the evidence from this one study was of low quality and suggested no significant difference in quality of life between percutaneous wire fixation (K-wires) and closed reduction with cast, despite the study suggesting a difference in SF-36 scores for physical function in favour of K-wires at 12 months.[24]

In addition, the review from Van Son 2013[11] reported that closed reduction with cast immobilisation appeared comparable with supplementary percutaneous pinning and that health status in patients undergoing surgery with plate fixation was comparable to that of patients treated with external fixation. However, again the evidence to support these findings was based on two low quality randomised controlled trials.[37, 38]

When can I return to work?

Recovery time after closed reposition and cast

A cast is usually applied for five to six weeks[18] During this time it will not be possible to move the wrist, but it should be possible to move the elbow and fingers, in fact it is important to keep the fingers moving and to use gentle exercises and stretches (as advised

by the doctor and/or physiotherapist) to make sure the fingers don't get stiff.[16] This means that any day-to-day activities which involve movement of the wrist will be affected for around six weeks. In addition, during this time the cast will need to be kept dry.[16, 18] So for instance the cast will need to be covered with a plastic bag when showering. The cast can also be a bit cumbersome.[18]

Once the cast is removed to normal light activities can be resumed, including housework, but avoiding lifting heavy items at first. Most people can return to light exercise such as swimming and lower body exercises within one or two months of the cast been removed.[14] More strenuous exercises and sports (e.g. skiing, football etc.) can be resumed after at least three months (up to six months).[14, 18] Once the wrist has enough movement and strength to grip the steering wheel and controls, driving can resume (this is usually a few weeks after removal of the cast).[16]

Full recovery normally can take at least a year and you can have stiffness and aching for around two years.[14] In older patients (over 50 years) or those who have osteoporosis or osteoarthritis this may take longer.[14]

Recovery time after percutaneous fixation (wire) and cast

Guidelines from the Danish Health Authority 2016[13] report that there is no significant difference between the number of patients who had returned to work 12 months after treatment in comparison with conservative treatment (i.e. closed reduction and cast).

Full recovery after treatment with K-wires can normally take at least a year and stiffness and aching may last for around two years.[14] In older patients (over 50 years) or those who have osteoporosis or osteoarthritis this may take longer.[14]

Recovery time after external fixation

The skin around the surgical incision sites must be kept clean and dry for five days or until the frame and sutures (stitches) are removed, whichever occurs later.[14]

Full recovery after treatment with external fixation can normally take at least a year and stiffness and aching may last for around two years.[14] In older patients (over 50 years) or those who have osteoporosis or osteoarthritis this may take longer.[14]

Recovery time after open reposition without a cast (used only for closed, uncomplicated radius fractures)

After surgery, patients usually wear a removable splint rather than a cast and as the broken bones will usually be held together with metal plates and screws, placed fixed inside the arm. However, the skin around the surgical incision site must be kept clean and dry for five days or until the sutures (stitches) are removed, whichever occurs later.[14]

This means the wrist can be used as normal whenever it feels comfortable (usually within two to four weeks).[18] Most people can return to light exercise such as swimming and lower body exercises within one or two months after surgery.[14] More strenuous exercises and

sports (e.g. skiing, football etc.) can be resumed after at least three months (up to six months).[14, 18]

Full recovery after treatment with open reposition without a cast can normally take at least a year and stiffness and aching may last for around two years.[14] In older patients (over 50 years) or those who have osteoporosis or osteoarthritis this may take longer.[14]

FAQ 4: EVIDENCE SUMMARY

What will be the impact on my daily living?

Researchers have looked into how the different treatments for distal wrist fracture might affect the function of patients' wrists (grip strength and range of wrist motion), their quality of life and how they are able to carry out everyday activities.

In general, there appears to be no real difference in how well patients are able to move their wrist and grip objects after their wrist has healed (around a year after treatment). This means that whether you undergo a *closed reduction plus cast*, versus undergoing other treatments *involving surgery (including using pins, wires and metal plates)*, it seems to make little difference and this also applies to older patients as well as younger patients. However, the type of treatment patients have will make a difference as to how quickly they can start to move and use their wrist.

Those patients who have an *open reduction without a cast* (surgery to fix metal plate(s)) are usually able to use their wrist sooner (usually as soon as they feel comfortable within two to four weeks). Any metal frames or wires fixed to the bones by pins will need to be removed. Patients who have surgery will also need to keep their wounds (including any areas where pins enter the skin) clean and dry until the area(s) have healed (usually around five days or so). Most people can return to light exercise within one or two months after surgery and can resume more strenuous exercises and sports (e.g. skiing, football etc.) after at least three months (up to six months).

In comparison*, plaster casts* need to be kept dry and can be cumbersome. They will also restrict your movement, until your wrist has healed and they can be removed (usually within five to six weeks).

Regardless of the type of treatment you have, full recovery usually takes up to one year and you may still have stiffness and aching for up two years. In older patients (over 50 years) or those who have osteoporosis or osteoarthritis this may take longer.

Overall, there is little evidence that the overall quality of life of patients is different depending on which treatment they choose, especially after one year.

4. SUMMARY OF FINDINGS FROM GUIDELINES AND DECISION AIDS

Two recently published treatment guidelines for distal radius fractures (Danish Health Authority 2016[13] and British Society for Surgery of the Hand Guidelines 2018[3]) provided evidence statements regarding the advantages and disadvantages of the different treatments. However, the level of evidence for these statements in most cases was low or very low. A summary of these findings is reported in Table 16.

Table 16: Summary of evidence - Danish Health Authority Guidelines 2016 and British Society for Surgery of the Hand Guidelines 2018

Treatment	Guideline evidence statements
Closed reposition and cast	**Closed reposition & cast** - appears to have greater fracture redisplacement & malunion compared to **K-wires**.[13]
	Closed reposition & cast may be preferred to avoid discomfort of **external fixation** & potential worry about device care.[13]
Percutaneous fixation (K-wire) & cast	**K-wires** provide significantly better function **than closed reduction & cast**.[13] Patients may find thought of outpatient removal of **K-wires** unpleasant.[13] **K-wires** do not provide better patient reported outcome at 1yr compared to **closed reposition & cast**.[3]
External fixation	E**xternal fixation** – many patients experience discomfort during normal daily life & device care/maintenance may cause concern in comparison with **open reduction without cast**[13] **External fixation** - will need help from pin care nurse[13]
	Number & severity of complications comparable between **external fixation** and **closed reduction and cast**.[13] Superficial pin infection/irritation associated with **external** fixation not serious long term, but may cause undue worry.[13] **External fixation** is most likely lead to earlier return to daily activities.[13] **External fixation** does not provide a better patient reported outcome at 1yr compared to **closed reposition & cast**.[3]
Open reposition without a cast	**Surgery & volar angular stable locking plate** has better function than **closed reposition & cast**.[13] Number & severity of complications comparable between **open reposition without cast** and **closed reposition & cast**[13] A quicker return to normal function may outweigh any undesirable consequences with **surgery & volar angular stable locking plate**.[13] **Surgery & plate fixation** does not provide a better patient reported outcome at 1yr in comparison to **closed reposition & cast**.[3]
	Incidence of serious complications is low for both **open reposition without cast** and K-wires, but is higher with **K-wires**.[13] Patients with **surgery & volar angular locking plate** have better & quicker return to function than **K-wires**.[13] Better patient-related outcomes with **surgery & volar angular locking plate** with faster effect & earlier rehabilitation start in comparison with **K-wires**.[13] **Surgery & plate fixation** does not give better 1yr patient reported outcomes than **K-wires** for dorsally displaced fractures.[3] **Surgery & volar angular stable locking plate** associated with higher levels of function ≤12mths, but similar long-term levels of function in comparison with **external fixation**.[13]
Very low quality evidence	Low quality evidence

A decision aid produced by Patient+ (URL: https://www.decisionaid.info/pp/distalradius/intro/) reported a number of advantages and disadvantages for closed reduction and cast and surgery (including insertion of wires and plates). These are summarised in Table 17.

Table 17: Summary of advantages and disadvantages of conservative and surgical treatments for distal radius fracture (Patient+ decision aid)

Treatment	Advantages	Disadvantages
Closed reposition and cast	Avoids the risks, discomforts and inconveniences of surgery.	The cast limits your wrist movement for six weeks. You will need to protect the cast from getting wet (i.e. shower with a bag over it). The cast can be cumbersome. There is a risk that the fracture may heal with too much 'bend' or 'shortening' – this depends on your age and how out of place the bones are.
Open reposition without cast (surgery with plate)	After surgery you can wear a removable splint rather than a cast. You can start using your wrist as soon as you feel comfortable.	All types of surgery carry risks (around 17 out of every 100 patients having surgery will have a problem related to the surgery).[39] Around nine out of every 100 people will have a minor problem (e.g. superficial infection or haematoma).[39] Around eight out of every 100 people will have major problem which results in the need for further surgery (e.g. infection, irritation/injury of tendons, a screw that is too long or enters the joint).[39]
NOTES *In people below 65 years old:* The decision aid states that it is unknown whether there is a difference in the symptoms, limitations, and adverse events between people treated with a cast or with surgery. *In people aged 65 years and above:* After six months there appears to be no difference in symptoms or limitations between people treaded with a cast or surgery.		

EVIDENCE SUMMARY FROM GUIDELINES AND OTHER RESOURCES

Advantages and disadvantages

Closed reposition and cast:

Advantages

- Avoids the risks, discomforts and inconveniences of surgery
- Avoids the risk of infection

Disadvantages

- Cast limits your wrist movement for six weeks
- Cast can be cumbersome and needs to be kept dry
- There is a risk that the wrist may not always heal properly and you may need surgery later

Percutaneous fixation (wire) and cast:

Advantages

- None identified

Disadvantages

- You may find thought of outpatient removal of the pins and wire(s) unpleasant
- You will need to take care of the area around the pins to prevent infection
- You may find the pins and wires cumbersome
- You may be unsure about looking after the wire and pins

External fixation:

Advantages

- None identified

Disadvantages

- You may find the frame cumbersome
- You may find thought of outpatient removal of the external frame unpleasant
- You will need to take care of the area around the pins to prevent infection
- You may find the frame and pins cumbersome
- You may be unsure about looking after the frame and pins

Open reposition without a cast:

Advantages

- You can start using your wrist as soon as you feel comfortable.
- You will not need to wear a cast

Disadvantages

- All types of surgery carry risks (around 17 out of every 100 patients will have a problem related to the surgery)
- Around nine out of every 100 people will have a minor problem (e.g. superficial infection or haematoma)
- Around eight out of every 100 people will have major problem which results in the need for further surgery (e.g. infection, irritation/injury of tendons, a screw that is too long or enters the joint)

5. DISCUSSION

5.1 SUMMARY OF FINDINGS

The report focuses on evidence from systematic reviews and guidelines, including a number of systematic reviews with meta-analyses and MTC. These types of evidence form the highest levels of the evidence hierarchy, though in many cases the trials/studies included in the reviews had some methodological issues and were at risk of bias. In addition, information has been taken from a number of patient friendly websites and a recent patient decision aid. In many cases the research focuses on the main differences between conservative treatment (closed reduction and cast) and surgery (e.g. open reduction and the insertion of pins and plates). This comparison appears particularly pertinent and of interest to the treatment of older patients. Evidence regarding the insertion of pins and subsequent fixation using a metal frame or wires is based on MTC comparing multiple treatment methods including closed reduction and surgery involving different types of metal plates (dorsal and volar).

A summary of the findings for each of the four FAQ is shown in Table 18.

5.2 STRENGTHS, LIMITATIONS AND UNCERTAINTIES

Overall, there appears to be little recent good quality evidence regarding the risk of complications and final outcomes (quality of life, wrist function, and return to normal activities) of patients receiving different treatments for distal radius fracture. Recent research in the form of systematic reviews and guidelines, particularly with respect to the quality of life of patients and wrist function, focuses on the differences between non-surgical and surgical treatments, often with a particular interest in older patients. There was little evidence from studies including younger patients, with respect to these and other outcomes. There was also little evidence relating specifically to the use of percutaneous wires and external frames (Table 18).

Table 18: Summary of effects of different treatments for distal radius fractures in adults

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
FAQ 1. What does the treatment involve?					
What happens to me during the treatment?	Bones are moved back by manipulating the arm and held in position by a cast	Type of surgery. Metal pins inserted into bone and held in position by wires	Type of surgery. Metal pins inserted into bone and held in position by external metal frame	Open surgery to move bones and held in place by internal metal plate(s) and screws	Patient websites and information leaflets[14 15 16 17 18]
Where and when will the treatment take place?	Emergency room, fracture clinic or similar	Operating room or similar	Operating room or similar	Operating room or similar	
Will I need an anaesthetic?	Pain (plus sedative if needed) medication	Pain (plus sedative if needed) medication	Pain (plus sedative if needed) medication	General anaesthetic	
How long might I be in hospital?	Usually outpatient	Usually outpatient	Usually outpatient	Average 4.4 days[17]	
Will I need to take any medicines?	Pain medication	Pain medication and antibiotics	Pain medication and antibiotics	Pain medication and antibiotics	
Will I have to go back to hospital?	Yes, multiple visits	Yes, multiple visits	Yes, multiple visits	Yes, multiple visits	
FAQ 2. How might I feel after my treatment?					
What symptoms might I experience?	Pain Swelling Stiffness Numbness Hypersensitivity	Pain Swelling Stiffness Numbness Hypersensitivity	Pain Swelling Stiffness Numbness Hypersensitivity	Pain Swelling Stiffness Numbness Hypersensitivity	Patient websites and information leaflets[14 15 16 17 18]
How much pain will I be in?	-	-	-	*VAS pain score:* SMD -0.22, 95% CI: -0.57 to 0.14* (versus closed reduction)	Systematic review & meta-analysis (Chen 2016[5])
How long will my symptoms last?	Varies between individual patients.	Varies between individual patients.	Varies between individual patients.	Varies between individual patients.	Patient websites and information leaflets[14 15 16]

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
	Often pain up to 1yr, stiffness usually 1-2 mths (up to 1yr); swelling can be 12-18mths.	Often pain up to 1yr, stiffness usually 1-2 mths (up to 1yr); swelling can be 12-18mths.	Often pain up to 1yr, stiffness usually 1-2 mths (up to 1yr); swelling can be 12-18mths.	Often pain up to 1yr, stiffness usually 1-2 mths (up to 1yr); swelling can be 12-18mths.	[17] [18]
FAQ 3. What are the side effects of treatment?					
What side effects might I experience from my treatment?	*Healing complications (≈1yr):* SUCRA=21.9%	*Healing complications (≈1yr):* SUCRA=50.9%	*Healing complications (≈1yr):* SUCRA=72.4%	*Healing complications (≈1yr):* SUCRA=99.3% (highest favoured treatment)	Systematic review & Bayesian NMA (Vannabouathong 2018[7])
	-	*Malunion*: Re-operation risk significantly lower with K-wire treatment than conservative treatment	-	-	Systematic review informing guidelines (Danish Health Authority 2016[13]) – based on limited evidence
	Minor complications: OR 1.12, 95% CI: 0.50 to 2.52 (versus open surgery & plate)*	-	-	-	Systematic review & meta-analysis (Chen 2016[5])*
	Nerve lesions: OR 1.76, 95% CI: 0.90 to 3.45 (versus open surgery & plate)*	-	-	-	
	Major complications: OR 0.44, 95% CI: 0.22 to 0.89 (versus open surgery & plate)*	-	-	-	

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
	Tendon injury: OR 0.30, 95% CI: 0.12 to 0.78 (versus open surgery & plate)*	-	-	-	
	Pin track infections: SUCRA=76.6% - (favoured treatment)	*Pin track infections*: SUCRA=38.4%	*Pin track infections*: SUCRA=21.8% (bridging)/0.5% non-bridging	*Pin track infections*: SUCRA=68.0% (dorsal plating)/71.1% (volar plating)/76.3% (dorsal & volar plating) - (favoured treatment)	Systematic review and MTC (Xu 2016[9])
What is my risk of long-term complications?	Prevalence = 37% (open source data) to 50% (poor quality clinical study evidence)				Systematic review & NMA (Lameijer 2017[8])
	CRPS: SUCRA=77.0% - (favoured treatment)	*CRPS*: SUCRA=24.5%	*CRPS*: SUCRA=71.3% (non-bridging) /51.5% (bridging)	*CRPS*: SUCRA=48.9% (dorsal plating)/43.7% (volar plating)/33.2% (dorsal & volar plating)	Systematic review & NMA (Wang 2017[4])
	CTS: SUCRA=51.9%	*CTS*: SUCRA=24.1%	*CTS*: SUCRA=49.3% (non-bridging) /37.1% (bridging)	*CTS*: SUCRA=89.4% (dorsal plating)/40.2% (volar plating)/57.9% (dorsal & volar plating) - (favoured treatment)	Systematic review & NMA (Qiu 2015[10])
FAQ 4. What will be the impact on my daily living?					
How might my wrist movement be affected?	-	-	-	*Grip strength*: *3mths (vs. closed reduction)* - MD-3.20;	Systematic review & meta-analysis (Song 2015[12]) – limited evidence

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
				95% CI: -5.67 to -0.73 - (favoured treatment) *6mths (vs. closed reduction)* - MD -3.70; 95% CI: -6.72 to -0.68- (favoured treatment)	
				12mths (vs. closed reduction) - MD -3.70; 95% CI: -3.99 to 0.31 (NS)	
				12mths (vs. closed reduction)* - MD -2.10; 95% CI: -4.12 to -0.08 - (favoured treatment)	Systematic review & meta-analysis (Chen 2016[5])*
	Range of motion - radial inclination (vs. surgery): 3mths (WMD -3.49, 95% CI: -4.87 to -2.17), 6mths (WMD -4.00, 95% CI: -5.01 to -2.99), and 12 mths (WMD -3.20, 95% CI: -4.25 to -2.14) – (favoured treatment) *Range of motion - palmar inclination (vs. surgery)*: 3mths (WMD -7.04, 95% CI: -7.54 to -	-	-	*Range of motion - radial deviation/ ulnar deviation/ palmar flexion/ dorsal extension*: NS differences between closed reduction & surgical treatment	Systematic review & meta-analysis (Song 2015[12]) – limited evidence

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
	6.54), 6mths (WMD -7.00, 95% CI: -7.51 to -6.49), and 12 mths (WMD -7.00, 95% CI: -7.50 to -6.50) – (favoured treatment)				
How might my day-to-day activities be affected?	*Functional outcome (12mths):* NS differences between treatment options, except open surgery	*Functional outcome (12mths):* NS differences between treatment options	*Functional outcome (12mths):* NS differences between treatment options	*Functional outcome (12mths vs. closed reduction):* OR 4.27, 95% CrI: 1.07 to 15.12 - (favoured treatment) SUCRA=83%	Systematic review & Bayesian NMA (Vannabouathong 2018[7])
		Functional outcome: preferred over closed reduction		*Functional outcome:* preferred over closed reduction	Guidelines informed by a systematic review (Danish Health Authority 2016[13]) – low/v. low level evidence
	DASH score (3mths) (vs. surgery): MD 7.03; 95% CI: 2.33 to 11.74 – (favoured treatment)	-	-	-	Systematic review & meta-analysis (Song 2015[12]) – based on limited number of studies
	DASH score (6mths & 12mths) (vs. surgery): NS differences				
	PRWE score (vs. surgery): NS difference*	-	-	-	Systematic review & meta-analysis (Chen 2016[5])*
Will it affect my quality of life?	-	*SF-36 scores (vs. closed reduction):* NS	-	*SF-36 scores (vs. closed reduction):* NS	Systematic review (Van Song 2013[11]) – low level

FAQ/*outcomes*	Closed reposition & cast	Percutaneous fixation (wire) & cast	External fixation	Open reposition without cast	Evidence
		differences		differences	evidence
					Guidelines informed by a systematic review (Danish Health Authority 2016[13]) – low level evidence
When can I return to work?	*Recovery time*: 5-6 wks to cast removal and return to light exercise/activities after 1-2mths; return to strenuous exercise up to 6mths.	*Recovery time*: skin around surgical incisions kept clean/dry for 5 days or until wire/stitches removed.	*Recovery time*: skin around surgical incisions kept clean/dry for 5 days or until frame/stitches removed	*Recovery time*: skin around surgical incisions kept clean/dry for 5 days or until stitches removed. Return to activities as soon as patient feels able.	Patient websites and information leaflets[14]
	-	*Return to work (12mths) (vs. closed reduction):* NS differences	-	-	Guidelines informed by a systematic review (Danish Health Authority 2016[13]) – low level evidence

* Older population

NOTE: Greater SUCRA values indicate higher rank of the treatment (i.e. lower probability of healing complications after treatment)

CI = confidence interval; CRPS = complex regional pain syndrome; Crl = credible interval; CTS = carpal tunnel syndrome; DASH = Disabilities of the Arm, Shoulder and Hand; MD = mean difference; MTC = mixed treatment comparison; mths = months; NS = not statistically significant; OR = odds ratio; PA = post-traumatic arthritis; PRWE = Patient Rated Wrist Evaluation; SD standard difference; SF-36 = Short Form 36; SUCRA = surface under the cumulative ranking curve; wks = weeks; WMD = weighted mean difference

✓ No significant difference or based on patient website/information

✓ Statistically significant different

6. REFERENCES

[1] Canadian Agency for Drugs and Technologies in Health. *PRESS - Peer Review of Electronic Search Strategies: 2015 Guideline Explanation and Elaboration (PRESS E&E) [Internet]*. Ottawa: CADTH, 2016 [accessed 28.11.17] Available from: https://www.cadth.ca/resources/finding-evidence/press

[2] British Orthopaedic Association (BOA), British Society for Surgery of the Hand. *British Orthopaedic Association audit standards for trauma: the management of distal radial fractures [Internet]*: British Orthopaedic Association (BOA), British Society for Surgery of the Hand, 2017 [accessed 14.1.18]. 1p. Available from: https://www.boa.ac.uk/wp-content/uploads/2017/12/BOAST-Management-of-Distal-Radial-Fractures.pdf

[3] British Orthopaedic Association (BOA), British Society for Surgery of the Hand. *Best practice for management of distal radial fractures (DRFs) [Internet]*: British Orthopaedic Association (BOA), British Society for Surgery of the Hand, 2018 [accessed 14.1.18]. 106p. Available from: https://www.boa.ac.uk/wp-content/uploads/2016/08/Blue-Book-DRF-Final-Draft.pdf

[4] Wang JH, Sun T. Comparison of effects of seven treatment methods for distal radius fracture on minimizing complex regional pain syndrome. *Arch Med Sci* 2017;13(1):163-73.

[5] Chen Y, Chen X, Li Z, Yan H, Zhou F, Gao W. Safety and efficacy of operative versus nonsurgical management of distal radius fractures in elderly patients: a systematic review and meta-analysis. *J Hand Surg Am* 2016;41(3):404-13.

[6] Zhao HL, Wang GB, Jia YQ, Zhu SC, Zhang FF, Liu HM. Comparison of risk of carpal tunnel syndrome in patients with distal radius fractures after 7 treatments. *Med Sci Monit* 2015;21:2837-44.

[7] Vannabouathong C, Hussain N, Guerra-Farfan E, Bhandari M. Interventions for distal radius fractures: a network meta-analysis of randomized trials. *J Am Acad Orthop Surg* 2018;Epub ahead of print.

[8] Lameijer CM, Ten Duis HJ, Dusseldorp IV, Dijkstra PU, van der Sluis CK. Prevalence of posttraumatic arthritis and the association with outcome measures following distal radius fractures in non-osteoporotic patients: a systematic review. *Arch Orthop Trauma Surg* 2017;137(11):1499-513.

[9] Xu GY, Qiu Y, Mao HJ. A network meta-analysis of outcomes of 7 surgical treatments for distal radius fractures. *Am J Ther* 2016;23(6):e1320-8.

[10] Qiu WJ, Li YF, Ji YH, Xu W, Zhu XD, Tang XZ, et al. The comparative risk of developing postoperative complications in patients with distal radius fractures following different treatment modalities. *Sci Rep* 2015;5:15318.

[11] Van Son MA, De Vries J, Roukema JA, Den Oudsten BL. Health status and (health-related) quality of life during the recovery of distal radius fractures: a systematic review. *Qual Life Res* 2013;22(9):2399-416.

[12] Song J, Yu AX, Li ZH. Comparison of conservative and operative treatment for distal radius fracture: a meta-analysis of randomized controlled trials. *Int J Clin Exp Med* 2015;8(10):17023-35.

[13] Danish Health Authority. *National clinical guideline on the treatment of distal radial fractures [Internet]*. Copenhagen: Danish Health Authority, 2016 [accessed 14.1.19] Available from: http://sundhedsstyrelsen.dk/da/udgivelser/2014/~/media/22E568AA633C49A9A0A128D5FDC4D8B7.ashx

[14] OrthoInfo. Distal radius fractures (broken wrist) [Internet]. American Academy of Orthopaedic Surgeons, [accessed 23.1.19]. Available from: https://orthoinfo.aaos.org/en/diseases--conditions/distal-radius-fractures-broken-wrist/

[15] Hospital for Special Surgery (HSS). Distal radius fractures of the wrist: avoiding complications with proper diagnosis and treatment [Internet]. New York: Hospital for Special Surgery (HSS), [accessed 23.1.19]. Available from: https://www.hss.edu/conditions_distal-radius-fractures-of-the-wrist.asp

[16] NHS. Broken arm or wrist [Internet]. NHS, [accessed 23.1.19]. Available from: https://www.nhs.uk/conditions/broken-arm-or-wrist/

[17] Deutsche Gesellschaft für Unfallchirugie. Distale Radiusfraktur (= Handgelenksnaher Speichenbruch) [Internet]. Deutsche Gesellschaft für Unfallchirugie, [accessed 23.1.19]. Available from: https://www.dgu-online.de/patienteninformation/haeufige-diagnosen/senioren/distale-radiusfraktur.html

[18] PATIENT+. Decision Aid: Distal radius fracture [Internet]. Utrecht, The Netherlands: PATIENT+, [accessed 23.1.19]. Available from: https://www.decisionaid.info/pp/distalradius/intro/

[19] The CORE Institute. *Patient education: Distal radius fracture [Internet]*. Phoenix, AZ: The CORE Institute, 2017 [accessed 13.2.19]. 2p. Available from: http://www.thecoreinstitute.com/patient-education/Distal-Radius-FX.pdf

[20] Arora R, Lutz M, Deml C, Krappinger D, Haug L, Gabl M. A prospective randomized trial comparing nonoperative treatment with volar locking plate fixation for displaced and unstable distal radial fractures in patients sixty-five years of age and older. *J Bone Joint Surg Am* 2011;93(23):2146-53.

[21] Bartl C, Stengel D, Bruckner T, Gebhard F. The treatment of displaced intra-articular distal radius fractures in elderly patients. *Dtsch Arztebl Int* 2014;111(46):779-87.

[22] Arora R, Gabl M, Gschwentner M, Deml C, Krappinger D, Lutz M. A comparative study of clinical and radiologic outcomes of unstable colles type distal radius fractures in patients older than 70 years: nonoperative treatment versus volar locking plating. *J Orthop Trauma* 2009;23(4):237-42.

[23] Egol KA, Walsh M, Romo-Cardoso S, Dorsky S, Paksima N. Distal radial fractures in the elderly: operative compared with nonoperative treatment. *J Bone Joint Surg Am* 2010;92(9):1851-7.

[24] Azzopardi T, Ehrendorfer S, Coulton T, Abela M. Unstable extra-articular fractures of the distal radius: a prospective, randomised study of immobilisation in a cast versus supplementary percutaneous pinning. *J Bone Joint Surg Br* 2005;87(6):837-40.

[25] Stoffelen DV, Broos PL. Closed reduction versus Kapandji-pinning for extra-articular distal radial fractures. *J Hand Surg Br* 1999;24(1):89-91.

[26] Rodriguez-Merchan EC. Plaster cast versus percutaneous pin fixation for comminuted fractures of the distal radius in patients between 46 and 65 years of age. *J Orthop Trauma* 1997;11(3):212-7.

[27] Gupta R, Raheja A, Modi U. Colles' fracture: management by percutaneous crossed-pin fixation versus plaster of Paris cast immobilization. *Orthopedics* 1999;22(7):680-2.

[28] Shankar NS, Craxford AD. Comminuted Colles' fractures: a prospective trial of management. *J R Coll Surg Edinb* 1992;37(3):199-202.

[29] Aktekin CN, Altay M, Gursoy Z, Aktekin LA, Ozturk AM, Tabak AY. Comparison between external fixation and cast treatment in the management of distal radius fractures in patients aged 65 years and older. *J Hand Surg Am* 2010;35(5):736-42.

[30] Chan YH, Foo TL, Yeo CJ, Chew WY. Comparison between cast immobilization versus volar locking plate fixation of distal radius fractures in active elderly patients, the Asian perspective. *Hand Surg* 2014;19(1):19-23.

[31] Lutz K, Yeoh KM, MacDermid JC, Symonette C, Grewal R. Complications associated with operative versus nonsurgical treatment of distal radius fractures in patients aged 65 years and older. *J Hand Surg Am* 2014;39(7):1280-6.

[32] Wong TC, Chiu Y, Tsang WL, Leung WY, Yam SK, Yeung SH. Casting versus percutaneous pinning for extra-articular fractures of the distal radius in an elderly Chinese population: a prospective randomised controlled trial. *J Hand Surg Eur Vol* 2010;35(3):202-8.

[33] Sharma H, Khare GN, Singh S, Ramaswamy AG, Kumaraswamy V, Singh AK. Outcomes and complications of fractures of distal radius (AO type B and C): volar plating versus nonoperative treatment. *J Orthop Sci* 2014;19(4):537-44.

[34] Synn AJ, Makhni EC, Makhni MC, Rozental TD, Day CS. Distal radius fractures in older patients: is anatomic reduction necessary? *Clin Orthop Relat Res* 2009;467(6):1612-20.

[35] American College of Radiology. *ACR–SPR–SSR practice parameter for the performance of radiography of the extremities [Internet]*: American College of Radiology, 2018 [accessed 14.1.18]. 8p. Available from: https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Rad-Extremity.pdf?la=en

[36] Hagino H, Nakamura T, Fujiwara S, Oeki M, Okano T, Teshima R. Sequential change in quality of life for patients with incident clinical fractures: a prospective study. *Osteoporos Int* 2009;20 (5):695–702.

[37] Harley BJ, Scharfenberger A, Beaupre LA, Jomha N, Weber DW. Augmented external fixation versus percutaneous pinning and casting for unstable fractures of the distal radius—A prospective randomized trial. *J Hand Surg Am* 2004;29(5):815–824.

[38] Grewal R, Perey B, Wilmink M, Stothers K. A randomized prospective study on the treatment of intra-articular distal radius fractures: Open reduction and internal fixation with dorsal plating versus mini open reduction, percutaneous fixation, and external fixation. *J Hand Surg Am* 2005;30(4):764-772.

[39] Bentohami A, de Burlet K, de Korte N, van den Bekerom MP, Goslings JC, Schep NW. Complications following volar locking plate fixation for distal radial fractures: a systematic review. *J Hand Surg Eur Vol* 2014;39(7):745-54.

[40] Swedish Council on Health Technology Assessment (SBU). *Treatment options of arm fractures in the elderly: a systematic review and assessment of the medical, economic, social and ethical aspects*. Stockholm: Swedish Council on Health Technology Assessment (SBU), 2017 Available from: https://www.sbu.se/262e

[41] Walenkamp MM, Aydin S, Mulders MA, Goslings JC, Schep NW. Predictors of unstable distal radius fractures: a systematic review and meta-analysis. *J Hand Surg Eur Vol* 2016;41(5):501-15.

[42] Ju JH, Jin GZ, Li GX, Hu HY, Hou RX. Comparison of treatment outcomes between nonsurgical and surgical treatment of distal radius fracture in elderly: a systematic review and meta-analysis. *Langenbecks Arch Surg* 2015;400(7):767-79.

[43] Bartl C, Stengel D, Gulke J, Gebhard F. [Clinical results following conservative and surgical treatment of osteoporotic distal radius fractures in the elderly: overview of best available evidence]. *Unfallchirurg* 2016;119(9):723-31.

[44] American Academy of Orthopaedic Surgeons. *Appropriate use criteria for treatment of distal radius fractures [Internet]*. Rosemont, IL: American Academy of Orthopaedic Surgeons, 2013 [accessed 14.1.18]. 67p. Available from: https://www.aaos.org/research/Appropriate_Use/DRF_AUC.pdf

[45] AWMF. *[Distal radius fracture] [Internet]*: AWMF, 2015 [accessed 14.1.19] Available from: http://www.awmf.org/leitlinien/detail/ll/012-015.html

APPENDIX 1: SEARCH STRATEGIES

Systematic reviews and guideline search results

Database	Dates	Results
CDSR	2012 - Iss 1, Jan 2019	14
DARE	2012 - 31.3.15	37
HTA	2012 - 31.3.18	3
KSR Evidence	2012 - 14.1.19	157
Epistemonikos	2012 - 14.1.19	230
NICE	2012 - 14.1.19	10
ECRI Guidelines	2012 - 14.1.19	0
NHS Evidence	2012 - 14.1.19	11
GIN	2012 - 14.1.19	3
Total		**465**
Total after de-duplication		**280**

Search strategies

Cochrane Database of Systematic Reviews (CDSR) (Wiley): Issue 1 of 12, January 2019
Searched: 14.1.19

#1 MeSH descriptor: [Radius Fractures] this term only 426
#2 MeSH descriptor: [Colles' Fracture] this term only 99
#3 MeSH descriptor: [Forearm Injuries] this term only 34
#4 MeSH descriptor: [Wrist Injuries] this term only 141
#5 #1 or #2 or #3 or #4 591
#6 MeSH descriptor: [Radius] this term only 171
#7 MeSH descriptor: [Wrist] this term only 310
#8 MeSH descriptor: [Wrist Joint] explode all trees 235
#9 #6 or #7 or #8 704
#10 MeSH descriptor: [Fractures, Bone] explode all trees 5204
#11 MeSH descriptor: [Fractures, Closed] this term only 117
#12 MeSH descriptor: [Fracture Fixation] explode all trees 1552
#13 MeSH descriptor: [Fracture Healing] this term only 495
#14 #10 or #11 or #12 or #13 5341
#15 #9 and #14 100
#16 #5 or #15 616
#17 ((radius or radial or radii or wrist* or radiocarpal or 'radio carpal' or forearm* or arm or arms or DRUJ) near/5 (fracture* or broken or break*)):ti,ab 1255
#18 ((Barton* or Colles* or Galeazzi* or Smith* or Chauffer* or die-punch or 'die punch') near/5 fracture*):ti,ab 224
#19 #16 or #17 or #18 with Cochrane Library publication date Between Jan 2012 and Jan 2019, in Cochrane Reviews 14

Database of Abstracts of Reviews of Effects (DARE) (CRD): 2012 - 31.3.15
Health Technology Assessment Database (HTA) (CRD): 2012 - 31.3.18
Searched: 14.1.19
https://www.crd.york.ac.uk/CRDWeb/

1 MeSH DESCRIPTOR Radius Fractures EXPLODE ALL TREES 42
2 MeSH DESCRIPTOR Colles' Fracture EXPLODE ALL TREES 4
3 MeSH DESCRIPTOR Forearm Injuries EXPLODE ALL TREES 48
4 MeSH DESCRIPTOR Wrist Injuries EXPLODE ALL TREES 28
5 #1 OR #2 OR #3 OR #468
6 MeSH DESCRIPTOR Radius EXPLODE ALL TREES 7
7 MeSH DESCRIPTOR Wrist EXPLODE ALL TREES 10
8 MeSH DESCRIPTOR Wrist Joint EXPLODE ALL TREES 18
9 #6 OR #7 OR #8 34
10 MeSH DESCRIPTOR Fractures, Bone EXPLODE ALL TREES 1065
11 MeSH DESCRIPTOR Fractures, Closed EXPLODE ALL TREES 19
12 MeSH DESCRIPTOR Fracture Fixation EXPLODE ALL TREES 277
13 MeSH DESCRIPTOR Fracture Healing EXPLODE ALL TREES 83
14 #10 OR #11 OR #12 OR #13 1101
15 #9 AND #14 7
16 #5 OR #15 70
17 ((radius or radial or radii or wrist* or radiocarpal or radio carpal or forearm* or arm or arms or DRUJ) near5 (fracture* or broken or break*)) 144
18 ((Barton* or Colles* or Galeazzi* or Smith* or Chauffer* or die-punch or die punch) near5 fracture*) 12
19 #16 OR #17 OR #18 164
20 (#19) IN DARE FROM 2012 TO 2019 37
21 (#19) IN HTA FROM 2012 TO 2019 3

KSR Evidence (Internet): 2012 - 14.1.19
Searched: 14.1.19
https://ksrevidence.com/
1 (radius or radial or radii or wrist* or radiocarpal or "radio carpal" or forearm* or "fore arm*" or DRUJ) and (fracture* or broken or break*) in All text 157
2 "Barton* fracture*" or "Colles* fracture*" or "Galeazzi* fracture*" or "Smith* fracture*" or "Chauffer* fracture* or "die-punch fracture*" or "die punch fracture*" in All text -
3 #1 or #2 157
4 Filtered by Publication date: 2019, 2018, 2017, 2016, 2015, 2014, 2013, 2012 154

Epistemonikos (Internet): 2012 - 14.1.19
Searched: 14.1.19
https://www.epistemonikos.org/en/
Publication type limit: Systematic Review
1 (radius or radial or radii or wrist* or radiocarpal or "radio carpal" or forearm* or "fore arm*" or DRUJ) and (fracture* or broken or break*) 230
2 "Barton* fracture*" or "Colles* fracture*" or "Galeazzi* fracture*" or "Smith* fracture*" or "Chauffer* fracture* or "die-punch fracture*" or "die punch fracture*" 0
3 1 or 2 230

NICE Guidelines: 2012 - 14.1.19
https://www.nice.org.uk/
Search terms: fracture or radius or radial or wrist or arm
Document type: Guidance
Status: published
10/146 records found

ECRI Institute Guidelines Trust: 2012 - 14.1.19
https://guidelines.ecri.org/
Search terms: fracture OR fractures OR radius OR radial OR wrist OR arm
0/115 records found

NHS Evidence: 2012 - 14.1.19
Searched: 14.1.19
https://www.evidence.nhs.uk/
Search terms: fracture or radius or radial or wrist or arm
Evidence type: Guidance
Date: 01/01/2012 – 14/01/2019
11/1688 records found

Guidelines International Network (GIN) Library (Internet): up to 14.1.19
Searched: 14.1.19
https://www.g-i-n.net/library/international-guidelines-library
Search terms: fracture or fractures or radius or radial or wrist or arm
Evidence type: Guideline
Publication status: Published
3/55 records found

APPENDIX 2: OVERVIEW OF INCLUDED STUDIES

Evidence name	Evidence type	What does the treatment involve?	How might I feel after my treatment?	What are the side effects of treatment?	What will be the impact on my daily living?
SBU 2017[40]	SR	-	✓	✓	✓
Wang 2017[4]	SR with NMA	-	-	✓	-
Chen 2016[5]	SR with MA	-	✓	✓	✓
Zhao 2015[6]	SR with NMA	-	-	✓	-
Vannabouathong 2018[7]	SR with NMA	-	✓	✓	-
Lameijer 2017[8]	SR	-	-	✓	-
Xu 2016[9]	SR with NMA	-	-	✓	-
Walenkamp 2016[41]	SR with MA	-	-	✓	-
Ju 2015[42]	SR with MA	-	✓	-	-
Qiu 2015[10]	SR with NMA	-	-	✓	-
Van Son 2013[11]	SR with MA	-	-	-	✓
Song 2015[12]	SR with MA	-	✓	✓	✓
Bartl 2016[43]	SR with MA	-	-	-	✓
AAOS 2013[44]	Guidelines	-	✓	✓	✓
BOA & BSSH 2017[2, 3]	Guidelines	-	✓	✓	✓
Danish Health Authority 2016[13]	Guidelines	-	✓	✓	✓
AWMF 2015[45] **– German**	Guidelines	-	-	✓*	-
OrthoInfo[14]	Website	✓	✓	✓	✓
Hospital for Special Surgery[15]	Website	✓	✓	-	✓
NHS Choices[16]	Website	✓	✓	-	✓
GSTS[17] **- German**	Website	✓	✓	-	✓
CORE Institute	Website	✓	✓	✓	✓
Patient+ Decision Aid[18]	Website	✓	✓	✓	✓

✓ Indicates evidence available for the FAQ

* NOTE: This German language guideline expired on 09/02/2019 and so will considered with caution as a secondary (not primary) evidence source

AAOS = American Academy of Orthopaedic Surgeons; AWMF = Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften; BOA = British Orthopaedic Association; BSSH = British Society for Surgery of the Hand; FAQ = frequently asked question; GSTS = German Society for Trauma Surgery; MA = meta-analysis; NHS = National Health Service; NMA = network meta-analysis; SBU = Swedish Council on Health Technology Assessment; SR = systematic review