DANISH HEALTH AUTHORITY

2017

Treatment of distal radial fractures

National clinical guideline

Kategori: Faglig rådgivning
Version: 1.1
Format: PDF

ISBN electronic edition: 978-87-7014-313-4

Contact

Sundhedsstyrelsen
Islands Brygge 67
nkrsekretariat@sst.dk
+4572227400

Disclaimer

The Danish Health Authority's national clinical guidelines are systematically prepared statements based on relevant expert knowledge. National clinical guidelines are aimed at facilitating decision-making for professionals concerning appropriate and good clinical healthcare services in specific situations. The national clinical guidelines are publicly available, and patients are also welcome to read the guidelines. National clinical guidelines are classified as professional counselling, which implies that the Danish Health Authority recommends that the guidelines be followed by relevant professionals. The national clinical guidelines are not legally binding, and the professional judgment in the specific clinical situation will always take priority when deciding about appropriate and correct clinical healthcare services. A successful treatment outcome cannot be guaranteed, even if healthcare professionals follow the recommendations. In certain situations, a treatment method with a lower strength of evidence may be preferable, because it is considered a better choice for the patient and by the patient. Generally, healthcare professionals should involve the patient when choosing a particular treatment option.

ISBN electronic edition: 978-87-7014-313-4
Version: 1.1

Sections

Summary of recommendations

1 - Reading guide

2 - Introduction

3 - Surgery indication in case of distal radial fracture

Practice statement

It is good practice to offer surgical treatment of a distal radial fracture to patients of any age when during a conventional wrist X-ray examination, following eventual reduction of the fracture, one or more of the following radiological parameters are found:

- More than 10 degrees of dorsal angulation of the articular surface of the radial in a side view as compared to perpendicular to the longitudinal axis of the radial
- Ulnar variance of more than 2 mm
- Articular step-off of more than 2 mm
- Incongruity of the distal radioulnar joint

In case of well-reduced distal radial fractures with loss of substance/comminuted fracture of the dorsal cortex, it is good practice to monitor the patient closely or to consider primary surgery.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
The treatment of distal radial fractures should always be selected in consultation with the patient. The treating doctor provides guidance to the patient based on a risk assessment of benefits and risks of conservative vs. surgical treatment in consideration of the patient's wishes and needs. Not all patients need or want surgical treatment, even when surgery is indicated by the radiological parameters.

Caution should be exercised as regards the use of surgical intervention in patients with a low level of function assessed as permanent lack of ability to perform daily activities independently.

4 - CT scan in case of distal radial fracture

Practice statement

It is good practice not to perform routine CT scan prior to distal radial fracture surgery.

In case the assessment of a conventional X-ray examination creates doubt as regards choice of treatment method, supplementary CT scan is good practice.

Updating the recommendation is not considered necessary in 2017

5 - Surgery earlier or later than 48 hours following distal radial fracture

Practice statement

It is good practice to perform surgery at a time agreed with the patient and without undue fasting and waiting.

The working group found no evidence which compares differences in effect and risks of surgery within the first 48 hours vs. after 48 hours.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgery at an agreed time may preferably take place in the daytime, e.g. in an outpatient/day surgery setting, where the surgical experts are present and are able to allocate the time needed.

Patients with nerve pressure, dislocations and other similar and competitive disorders, which indicate emergency intervention, must be treated accordingly.

6 - Strategy for surgical treatment in case of distal radial fracture

Practice statement

When surgery is indicated, it is generally good practice to offer open reduction and internal fixation with a volar angular stable locking plate to patients of any age. If this method cannot be used, K-wire osteosynthesis may be considered as the primary choice rather than bridging external fixation.

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

6.1 - K-wire surgery vs. conservative treatment

Weak recommendation

Consider use of K-wires rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**

K-wire osteosynthesis is a brief and relatively simple surgical intervention. However, in most cases reasonable bone quality is a prerequisite for this intervention.

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**

K-wire osteosynthesis is a brief and relatively simple surgical intervention. However, in most cases reasonable bone quality is a prerequisite for this intervention.

6.2 - Bridging external fixation vs. conservative treatment

Weak recommendation

Consider use of bridging external fixation rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**

Treatment involving external fixation necessitates device care and maintenance. Often the patient will need some sort of help, e.g. from a home care nurse.

In the dialogue with the patient concerning selecting a treatment method, the patient should be informed that if external fixation is selected, the device may cause discomfort to him or her during the first 3-6 months. However, in the long term the patient may experience a better treatment effect.

Osteosynthesis with external fixation in most cases requires a reasonable bone quality.

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Treatment involving external fixation necessitates device care and maintenance. Often the patient will need some sort of help, e.g. from a home care nurse.

In the dialogue with the patient concerning selecting a treatment method, the patient should be informed that if external fixation is selected, the device may cause discomfort to him or her during the first 3-6 months. However, in the long term the patient may experience a better treatment effect.

Osteosynthesis with external fixation in most cases requires a reasonable bone quality.

6.3 - Internal fixation with volar angular stable locking plate vs. conservative treatment

Weak recommendation

Consider use of a volar angular stable locking plate rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see PICO 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material and screws in order to reduce the risk of late complications in the form of tendon injuries (40).

If postoperative X-ray control leads to a suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Surgery scheduled for daytime hours (cf. recommendation according to PICO 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see PICO 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material and screws in order to reduce the risk of late complications in the form of tendon injuries (40).

If postoperative X-ray control leads to a suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Surgery scheduled for daytime hours (cf. recommendation according to PICO 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

6.4 - Bridging external fixation vs. volar angular stable locking plate

Weak recommendation

Consider use of a volar angular stable locking plate rather than bridging external fixation of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.
Therefore, surgery scheduled for daytime hours is preferable in most.

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

6.5 - K-wires vs. open reduction and internal fixation with a volar angular stable locking plate

Weak recommendation

Consider use of a volar angular stable locking plate rather than Kwires during distal radial fracture surgery in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to K-wire surgery. This may speak in favour of osteosynthesis with a plate in patients with special needs such as patients with a walking frame.

K-wire osteosynthesis is a brief and simple surgical intervention. In most cases, use of this intervention requires a reasonable bone quality.
Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours (cf. recommendation according to focused question 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to K-wire surgery. This may speak in favour of osteosynthesis with a plate in patients with special needs such as patients with a walking frame.

K-wire osteosynthesis is a brief and simple surgical intervention. In most cases, use of this intervention requires a reasonable bone quality.
Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours (cf. recommendation according to focused question 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

7 - Cast or similar immobilising bandage time after insertion of a volar angular stable locking plate

Weak recommendation

Consider use of short-term cast or similar immobilising bandage(less than 2 weeks) following insertion of a volar angular stable locking plate rather than long-term cast or similar immobilising bandage(more than 5 weeks).

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
In case of identifying instability of scapholunate or distal radioulnar joints by fluoroscopy (52) after completion of the surgery, the issue should be handled according to local guidelines, possibly including consulting with a hand surgeon.

8 - Independent vs. supervised rehabilitation following distal radial fracture

Practice statement

It is good practice not to prescribe rehabilitation supervised by an occupational therapist or a physiotherapist on a routine basis to patients with uncomplicated cases. This is due to finding no difference in the effect as compared to independent rehabilitation based on a written training plan following a single instruction.

As a minimum, it is good practice to offer guidance and practical instruction concerning self-rehabilitation following distal radial fracture to all patients regardless of the treatment method.

Updating the recommendation is not considered necessary in 2017

Remark: **Practical advice and special patient considerations**
All patients are entitled to receive a rehabilitation plan, if rehabilitation is justified from a medical view at the time of discharge from the hospital.

Patients require instructions and knowledge of an appropriate rehabilitation programme as well as the amount of daily training and the physical load in daily activities. It is a good idea to hand out written guidance on these matters and advice on where to look for additional guidance to the patient at the time of cast or similar immobilising bandage removal.

Rehabilitation supervised by an occupational therapist or a physiotherapist specialising in rehabilitation in case of hand issues should be offered to patients with complicated cases, for example in case of major oedema, signs of incipient CRPS-related disabling reduced range of movement and/or pain.

1 - Reading guide

A top layer is defined as the minimum information clinicians need to be able to apply the recommendation in their own practice, and has been developed through extensive user testing by clinicians in seven countries through the DECIDE research project. The top layer format is especially adapted for use in the guidelines for the GRADE method.

The top layer consists of:

- **The recommendation:** Written in structured and active language.
- **The strength of the recommendation**: Communicated with colour codes and text.
- **Key information**: Brief information about the balance between benefits and drawbacks, the quality of the documentation, preferences and values and resource considerations.
- **Rationale:** Balancing the different key factors that lead to the direction and strength of the recommendation in question

In addition, the following are associated with each individual recommendation:

- **Documentation**: Relevant Summary of Findings tables,
- **Practical information on procedure and risk stratification tools.**
- **Adaptation**: A separate category called "adaptation" is used for modified recommendations to give a description of and rationale for the change.
- **Decision-making aids:** These are being developed, and do not form an integral part of the guideline yet.

The direction and strength of each recommendation are classified according to GRADE on the basis of the four key factors. Apart from this, the strength of the recommendation is assessed on the basis of the following principles:

- **Strong recommendation (green) for a measure:** The benefits clearly outweigh the drawbacks. This means that all, or virtually all, patients will want the recommended treatment.
- **Weak recommendation (yellow) for a measure:** It is more uncertain whether the benefits outweigh the drawbacks. This means that most patients will still want the recommended treatment. However, there is a greater likelihood of variation in individual preferences.
- **Practical advice (grey) for a measure**: Advice based on professional expertise. Not evaluated according to GRADE because of inadequate documentation. This means that they are significantly different from recommendations, and must be based more on personal discretion.

The following article is recommended for a brief and informative introduction to GRADE:
G. Goldet, J. Howick. Understanding GRADE: an introduction. Journal of Evidence-Based Medicine 6 (2013) 50-54.

Explanation and illustration of the information to be found under the recommendations:
For more explanation, see help.magicapp.org

Rationale not to update in 2017
Based on feedback from professional companies, as well as an overall literature search, the Danish Health Authority has decided not to update the guideline in 2017. As a starting point, a decision will be made on the need for updating every three years.

2 - Introduction

Purpose
The purpose of the national clinical guideline on the treatment of distal radial fractures is to provide evidence-based national recommendations for the indication for conservative treatment vs. surgical treatment as well as recommendations for the type of treatment considered most efficient and beneficial for the patient and for rehabilitation following treatment. Attempts are made to clarify which patients will benefit from surgery and to list the appropriate clinical and radiological parameters on which to base the decision about the indication.

The national clinical guideline will hereby contribute to ensuring uniform high quality treatment of patients with distal radial fractures across regions, hospitals and municipalities.

Delimitation of the group of patients
The guideline concerns patients over the age of 18 with a distal radial fracture caused by a low energy trauma. Thus, the guideline does not contain recommendations for fractures caused by a high energy trauma – the most frequent cause in younger people.

The first part of the guideline concerns diagnostics and delimitation of the group of patients to whom additional treatment other than just application of a plaster cast should be offered. The second part of the guideline concerns selecting a treatment method for these patients. The final part concerns time of immobilisation and rehabilitation.

The guideline concerns fractures of AO classification type A2, A3 and AO C1-3. These types of fractures cover what was previously known as Colles-type distal radial fracture. The AO classification is used below, since it is most frequently used classification in a scientific context (1,2) .

The guideline does not address treatment of:
- Isolated ulnar fracture (AO type A1)
- Smith's fracture and AO type B fractures (Chauffeur's fracture and Barton's fracture)
- Open fractures
- Fractures caused by a high energy trauma
- Patients with additional concomitant significant hand and wrist injuries

Wrist fractures are caused by falls, and osteoporotic individuals have an increased risk of fracture if they fall. Therefore, assessment for and treatment of underlying osteoporosis as well as prevention of new falls should be considered in this group of patients. However, this guideline does not shed light on the significance of osteoporosis and prevention of new falls in patients with fractures near the wrist. Both the Danish Endocrine Society (3) and the DHA (4) have prepared nationwide guidelines in this field.

Target group/users
The primary target group for this guideline are doctors specialising in orthopaedic surgery. Furthermore, the guideline is relevant for nurses and doctors receiving acute patients with distal radial fracture as well as all doctors, nurses, physiotherapists and occupational therapists providing and handling outpatient treatment and rehabilitation in a hospital setting or the primary care sector.

The guideline may also be relevant for patients or relatives wishing to find information on treatment of distal radial fracture.

Delimitation of the subject matter
The national clinical guideline contains instructions on how to handle selected and well-defined clinical issues (resulting from 'probing' the patient-care process). These issues were prioritised by the professional working group as the most important areas as regards clarification of the evidence concerning treatment of distal radial fractures.

Based on the above-mentioned delimitation, this guideline focuses on 10 selected areas distributed on 3 main subjects:

Assessing and evaluating a surgery indication:
1: Surgery indication in case of distal radial fracture based on radiological parameters.
2: The value of supplementary CT scan in case of distal radial fracture.
3: The benefits and harms of surgery earlier vs. later than 48 hours following the occurrence of a distal radial fracture.

Strategy for surgical treatment:
Selection of surgical method based on an overall assessment of a comparison in pairs of the effect and risk associated with the most frequently

used treatment methods:

4: Conservative treatment with reduction and plaster/cast or similar immobilising bandages vs. K-wire surgery.
5: Conservative treatment with reduction and plaster/cast or similar immobilising bandages vs. surgery comprising bridging external fixation.
6: Conservative treatment with reduction and plaster/cast or similar immobilising bandages vs. surgery with open reduction and internal fixation with a volar angular stable locking plate.
7: Surgery comprising bridging external fixation vs. surgery with open reduction and internal fixation with volar angular stable locking plate
8: K-wire surgery vs. surgery with open reduction and internal fixation with a volar angular stable locking plate

For all comparisons, it is intended to clarify whether there are special circumstances for the group of patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, and for patients over the age of 65.

Rehabilitation:
9: The effect and risk of short-term (less than 2 weeks) vs. long-term (more than 5 weeks) cast or similar immobilising bandage following surgery with the insertion of a volar angular stable locking plate.
10: The effect of independent rehabilitation (home programme) vs. rehabilitation supervised by a physiotherapist or an occupational therapist

Perspective of the patient
When selecting the focused questions and outcomes, it was important to ensure that the critical effects of the intervention investigated are patient-related, i.e. effects expected to be deemed critical by most patients. Traditionally, assessment of the effect of the treatment of distal radial fractures has mainly been based on radiological parameters. These parameters are not among the outcomes included in this guideline, since, generally, they are poorly correlated to the function and quality of life experienced by the patients (5). The most frequently used patientrelated outcomes (PROM – Patient Reported Outcome Measures) within this field are DASH score (Disabilities of the Arm, Shoulder and Hand score) and PRWE score (Patient Rated Wrist Evaluation score). Both measuring instruments have a score ranging from 0 to 100 with lower scores indicating a better result. The smallest clinically relevant difference is 10 for DASH and 14 for PRWE(6)

The patient organisations of relevance for this guideline were represented in the established reference group. The names of the members of the reference group are included in Appendix 12.

Rationale not to update in 2017
Based on feedback from professional companies, the Danish health Authority has decides not to updata guideline in 2017. As a starting point, a decision will be made on the need for updating every three years.

3 - Surgery indication in case of distal radial fracture

Is there any evidence that one or more of the radiological parameters below, assessed during wrist X-ray examination, may be used as the basis for deciding on a reduction and/or surgery indication?

- More than 10 degrees of dorsal angulation of the articular surface of the radial in a side view measured perpendicular to the longitudinal axis of the radial.
- Ulnar variance of more than 3 mm*
- Intra-articular step-off or diastasis of more than 2 mm
- Incongruity of the distal radioulnar joint
- Loss of substance of the dorsal cortex

*The initial choice, ulnar variance of 3 mm, was made based on the 2009 AAOS guidelines (7)

Background of the choice of question
Conventional wrist X-ray examination is the recognised method for diagnosing distal radial fracture. Along with an assessment of the patient's morbidity and overall functional capacity, the X-ray will in most cases be crucial when planning the further treatment, including deciding whether to offer a conservative treatment with or without reduction or surgery to the patient. There may be disagreement concerning the choice of radiological parameters, on which this assessment should be based.

There has thus been a desire to determine whether the radiological parameters stated indicate that the nature of a given fracture is such that lack of reduction and surgical stabilisation will most likely cause patient discomfort and impaired functional capacity as well as impaired quality of life in the long term.

The radiological parameters stated in the focused question were chosen based on the 2009 AAOS guidelines on distal radial fractures (7)

Practice statement

It is good practice to offer surgical treatment of a distal radial fracture to patients of any age when during a conventional wrist X-ray examination, following eventual reduction of the fracture, one or more of the following radiological parameters are found:

- More than 10 degrees of dorsal angulation of the articular surface of the radial in a side view as compared to perpendicular to the longitudinal axis of the radial
- Ulnar variance of more than 2 mm
- Articular step-off of more than 2 mm
- Incongruity of the distal radioulnar joint

In case of well-reduced distal radial fractures with loss of substance/comminuted fracture of the dorsal cortex, it is good practice to monitor the patient closely or to consider primary surgery.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
The treatment of distal radial fractures should always be selected in consultation with the patient. The treating doctor provides guidance to the patient based on a risk assessment of benefits and risks of conservative vs. surgical treatment in consideration of the patient's wishes and needs. Not all patients need or want surgical treatment, even when surgery is indicated by the radiological parameters.

Caution should be exercised as regards the use of surgical intervention in patients with a low level of function assessed as permanent lack of ability to perform daily activities independently.

Evidence To Decision

Benefits and harms

The X-ray examinations will contribute to clarify the indication for surgery. When surgery is relevant, it will most likely provide a better effect than no surgery. Furthermore, these X-ray examinations are not known to have caused any adverse effects.

Certainty of the Evidence

Only indirect evidence is available. Therefore, the evidence was not assessed.

Preference and values

The patients' preferences are deemed consistent, since most patients would want the intervention based on the assumption that it will provide a better basis for selecting the right treatment and thus obtaining the best possible result.

Rationale

It was not possible to identify evidence from randomised controlled studies describing the effect of decision-making based on the radiological parameters stated. Instead, the radiological parameters suggested emerged from completed cohort studies – studies which are only able to predict the likelihood of a given result (stability of the fracture) by means of regression analysis, as well as followup studies showing that patients with poorer radiological fracture positions than those stated will have a poorer DASH score at follow-up. One of the sources included suggests to decide for or against a surgery intervention based on a suitable mathematical model. The mathematical model has not been clinically validated.

Literature does not support a cut-off for ulnar variance of 3 mm. By contrast, the studies found report convincing data in favour of a cut-off value of 2 mm. Therefore, the working group selected an ulnar variance of 2 mm rather than the initially suggested 3 mm. The recommendations for dorsal angulation and articular step-off are 10 rather than 5 degrees and 2 mm rather than 1 mm, respectively. These measurements are recommended because they are the values included when searching for evidence for recommendations and also because the literature found does not clearly recommend lower cut-off values.

Clinical Question/ PICO

Population: Patients over the age of 18 with distal radial fracture as identified durring wrist X-ray examination and with one or more of the following findings prior to reduction - more than 10 degrees of dorsal angulation of the articular surface of the radial in a side view as compared to perpendicular to the longtudinal axis of the radial -Intra-articular step-off or diastasis of more than 2 mm - Ulnar variance of more than 3 mm - Incongruity of the distal radioulnar joint - Loss of substance of the dorsal cortex

Intervention: Treatment using K-wire, external fixation, ORIF and volar angular stable locking plate or stable reduction (which is still in position at a control after 12-14 days)

Comparator: Conservative treatment with plaster or another immobilising material (no further intervention)

Summary

A review of the literature, including existing guidelines, systematic reviews and randomised controlled studies, did not identify evidence to answer the focused question. Therefore, an additional search for follow-up studies dated 1983 and onwards was performed. This search identified one prognostic study and four follow-up studies, of which three are using DASH as an outcome. Thus, a total of five studies were included to answer the focused question.

These are cohort studies, where the level of quality of evidence is generally low. However, the diversity of the studies makes an actual data synthesis impossible. Therefore, evidence rating of these studies was not carried out.

The prognostic study (8) followed a cohort of approx. 4,000 patients with distal radial fracture for 5.5 years. Based on X-rays, the authors developed a calculation model to predict the risk of early and late displacement, respectively, and the risk of malunion in case primary reduction is the only treatment performed. The study showed that more than 5-10 degrees of

dorsal angulation measured perpendicular to the longitudinal axis of the radial, radial shortening of more than 0 mm (i.e. the distal articular surface of the ulna is longer than the radial) and comminuted fracture with loss of substance of the volar or dorsal cortex are all significant risk factors for fracture redisplacementand/or malunion. In this study, age was the strongest predictor for both fracture redisplacementand malunion irrespective of other factors.

Two follow-up studies (9,10) both followed two groups of patients with intraarticular fractures with articular surface depression and lack of articular surface congruity, respectively, at the time of healing. Both studies showed a significantly increased incidence of radiocarpal arthrosis. However, this was not correlated to changes in the functional gradings at 5.5 and 9 years, respectively.

In a third follow-up study(11), a group of patients was followed for 2.2 years. The patients had all been treated for displaced distal radial fracture with closed reduction or external fixation. The radiological parameters (the difference between the healthy and the fractured side) after the follow-up period were compared to the patients' DASH score. This showed that the DASH score was significantly poorer in case of radial shortening (ulnar variance) of 2 mm or more and more than 15 degrees of dorsal angulation (as compared to the opposite hand).

In a fourth follow-up study (12), the effect of a treatment protocol for patients with distal radial fracture in southern Sweden was validated. In the protocol, the following algorithm was used as an indicator to offer surgery to patients: more than 10 degrees of dorsal angulation or ulnar variance of 2 mm or more and intraarticular step-off of more than 1 mm. Due to this algorithm, the patients were divided into three groups: Non-displaced fractures, which were treated with plaster; displaced fractures, which were reduced and plastered and were still in position at outpatient control after 7-10 days; and, finally, a group of patients who either initially or following outpatient control fell within the radiological algorithm stated and therefore were offered surgery (they were not all operated). For follow-up purposes, a DASH score was calculated for 360 patients after 12 months. The patients in the three groups had an almost identical DASH score mean of 15, 17 and 16, respectively. The patients were compared to a background population, which was matching in age and gender, for which the DASH score was 2.5. On that basis, the authors concluded that a protocol with the measurements stated as a surgery indicator was suitable for bringing all patients to the same level after a year. However, the study showed a tendency towards slightly poorer DASH scores among patients who experienced fracture redisplacementand were offered surgery late. The authors assumed that the finding may be explained by a generally cautious use of surgery in these elderly patients.

The results of the studies included thus point out:

• that there is evidence to recommend an upper limit of dorsal angulation of 5-10 degrees as measured perpendicular to the articular surface of the radial, since further angulation increases the risk of fracture redisplacement, malunion and poorer patient-related outcomes as measured by DASH,
• that articular step-off above a limit of 1-2 mm increases the risk of radiological arthrosis,
• that ulnar variance of 0-2 mm or more increases the risk of fracture collapse, malunion and poorer DASH score, and
• that dorsal loss of substance and comminuted fracture increases the risk of fracture redisplacementand malunion.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
All outcomes				

4 - CT scan in case of distal radial fracture

How is a surgery indication affected by supplementary CT scan following conventional wrist X-ray examination?

Wrist CT scans are more accurate than X-rays to determine the extent and complexity of especially intra-articular fractures. A few departments perform a CT scan as a standard procedure prior to surgery in case of intra-articular distal radial fracture.

There has thus been a desire to determine whether a pre-operative CT scan can add information that will influence on the choice of surgical method and technique, and whether the classification of the fracture will change as a result of supplementing a conventional X-ray examination of the wrist with a CT scan.

Practice statement

It is good practice not to perform routine CT scan prior to distal radial fracture surgery.

In case the assessment of a conventional X-ray examination creates doubt as regards choice of treatment method, supplementary CT scan is good practice.

Updating the recommendation is not considered necessary in 2017

Evidence To Decision

Benefits and harms

There are no available known significant adverse effects of wrist CT scans (16). A CT-scan may provide additional information as a supplement to Xray examination in case of doubt about the type of fracture and treatment method.

Certainty of the Evidence

Only indirect evidence is available. Therefore, the evidence was not assessed.

Preference and values

The patients' preferences are expected to be essentially consistent. Most patients will probably consider an additional examination acceptable if deemed necessary for diagnostics and surgery planning.

Resources and other considerations

A supplementary CT scan entails additional costs and will only aid in selecting a treatment method in case of doubt about the type of fracture.

Rationale

Rationale for recommendation

The available literature confirms that CT scan may be of importance as regards the choice of surgical method. Also, the examination is believed to cause no patient discomfort. The assessment therefore is that it may sometimes be appropriate to perform a supplementary CT scan of a distal radial fracture following X-ray evaluation if the latter creates doubt as regards the choice of treatment method. Due to the extra costs associated with performing a CT scan combined with the fact that it only adds value to the process of predicting the treatment method in case of doubt as regards the type of fracture, a CT scan is not recommended on a routine basis.

Clinical Question/ PICO

Population: Patients over the age of 18 years with distal radius fracture cf. focused question 1
Intervention: CT-scan performed following conventional wrist X-ray examination
Comparator: Wrist X-ray examination

Summary

A review of the literature, including existing guidelines and systematic reviews, and an extended comprehensive search for randomised controlled studies and cohort studies dated 2003 and onwards did not identify studies suitable for use in answering the focused question. A comprehensive search for diagnostic studies and a cross reference search identified three studies (13-15) that indirectly shed light on the question. All three studies investigated whether the surgical methods used by the surgeons involved change depending on the diagnostic images available. The studies investigated whether switches occur from one treatment group to another (conservative treatment, K-wire, external fixation and ORIF with plate osteosynthesis). Potential occurrence of change of surgical technique within a given group was not investigated. Thus, a total of three cross-sectional studies were included to answer the focused question. These studies only assessed the effect indirectly by investigating the intrarater agreement between findings from a wrist X-ray examination and a CT scan, respectively.

These are cohort studies, for which the quality of the evidence is generally low. However, the diversity of the studies makes an actual data synthesis impossible. Therefore, evidence rating of these studies according to the GRADE method was not carried out. Two studies (13,15) investigated the interrater vs. intrarater agreement as regards diagnosing fracture patterns. However, they did not apply AO classification. The results of these two studies are not consistent.

All three studies do conclude that supplementary CT scan with multiplanar reconstructions and possibly 3D reconstruction maps more fracture details. This additional information causes some surgeons to change their indication for treatment in favour of open surgery.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Wrist X-ray examination	CT-scan performed following conventional wrist X-ray examinatio	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
All outcomes					

5 - Surgery earlier or later than 48 hours following distal radial fracture

What is the effect and what are the risks of surgery within the first 48 hours vs. more than 48 hours after deciding that surgery is indicated for a distal radial fracture?

In a number of Danish hospital departments, distal radial fracture surgery is often delayed several days rather than performing emergency surgery within the first 24 hours. The delay is often justified by lack of emergency surgery capacity or a desire to entrust the surgery to a more experienced surgeon. In some hospitals, the patients are handled in a 'sub-acute' outpatient/day surgery setting.

For a large number of patients with a reduced fracture, the decision for a surgery intervention is not made until during an outpatient control after 9-12 days – in case loss of reduction of the fracture is found during the control. (cf. focused question 1).

Accordingly, there has been a desire to determine whether delayed surgery of a distal radial fracture (more than 48 hours after deciding that surgery is indicated) may impact negatively on patient-related outcomes or increase the incidence of complications.

Practice statement

It is good practice to perform surgery at a time agreed with the patient and without undue fasting and waiting.

The working group found no evidence which compares differences in effect and risks of surgery within the first 48 hours vs. after 48 hours.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgery at an agreed time may preferably take place in the daytime, e.g. in an outpatient/day surgery setting, where the surgical experts are present and are able to allocate the time needed.

Patients with nerve pressure, dislocations and other similar and competitive disorders, which indicate emergency intervention, must be treated accordingly.

Evidence To Decision

Benefits and harms

No evidence is available to shed light on the balance between beneficial and adverse effects.

Planned waiting is found to be non-detrimental to the patient, provided he/she is well-informed about the process and is offered appropriate pain relief and cast or similar immobilising bandage during the waiting period.

Certainty of the Evidence

There is no evidence for the recommendation. This means that it is based on consensus among the members of the working group concerning good clinical practice.

Preference and values

The patients' preferences are deemed inconsistent. Some patients would prefer scheduled surgery in case of sufficient pain relief. That would also leave time for providing information to the patients and having a dialogue on the preferred treatment. Other patients would prefer to have the surgery performed as soon as possible.

Rationale

Rationale for recommendation

There is no evidence of a better functional outcome and fewer complications if distal radial fracture surgery is performed within 48 hours. Accordingly to the working group it is not necessary to perform distal radial fracture surgery as an emergency intervention. Planned surgery – as opposed to emergency surgery – allows for scheduling the surgery with an experienced surgeon and to thoroughly inform the patient about the treatment options and the upcoming treatment. A patient-care process involving emergency intervention will, in some cases, comprise several interrupted fasting periods and increase the patient's uncertainty.

Clinical Question/ PICO

Population: Patients over the age of 18 diagnosed with distal radius fracture cf. focused question 1
Intervention: Surgery within the first 48 hours after deciding that surgery id indicated
Comparator: Surgery more than 48 hours after deciding that surgery id indicated

Summary

A review of the literature, including existing guidelines and systematic reviews, and an extended comprehensive search for randomised controlled studies and follow-up studies dated 1983 and onwards did not identify studies that shed light on the question.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Surgery more than 48 hours after deciding that surgery id indic	Surgery within the first 48 hours after deciding that surgery i	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
All outcomes					

6 - Strategy for surgical treatment in case of distal radial fracture

In order to be able to provide an overall recommendation regarding the choice of surgical treatment of distal radial fractures, the literature was reviewed and the evidence assessed for the four most frequently used treatment methods:

- Conservative treatment (reduction and immobilisation using plaster or a similar material) • K-wire osteosynthesis (Kapandji or Willenegger technique)
- Bridging external fixation, when indicated supplemented with K-wires
- Open reduction and internal fixation with a volar angular stable locking plate.

The various methods were assessed against each other as per focused questions 4- 8, and the results of these comparisons are provided in detail in section 5.4.

Practice statement

When surgery is indicated, it is generally good practice to offer open reduction and internal fixation with a volar angular stable locking plate to patients of any age. If this method cannot be used, K-wire osteosynthesis may be considered as the primary choice rather than bridging external fixation.

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Rationale

Rationale for recommendation

The recommendation is based on an assessment of the evidence for the four most frequently used treatment methods, a thorough balancing of beneficial effects against adverse effects, and the expected patient preferences when comparing the individual treatment methods. The quality of the evidence is generally low, but pointing in the same direction.

The patient-related outcomes for volar angular stable locking plate are significantly better after 3 months as compared to the three other methods. After 12 months, the difference between volar angular stable locking plate and the other treatment methods is reduced: There is no longer a significant difference in the patientrelated outcomes when comparing volar angular stable locking plate and conservative treatment and K-wire osteosynthesis, respectively, whereas the difference between volar angular stable locking plate and external fixation remains significant. However, the difference in this comparison is only 8 in terms of DASH score, which is not considered clinically relevant. A difference on this scale should be at least 10 to be clinically relevant (6).

The patient-related outcomes for external fixation are significant and markedly poorer after 3 months as compared to conservative treatment. The patient preference for this method is generally deemed lower as compared to the other methods, since many patients consider the external device uncomfortable. The working group finds that most patients would prefer volar angular stable locking plate rather than the other treatment options, because it allows the patients to regain their daily skills faster.

Rejection of ORIF and volar angular stable locking plate may be due to the patient's desire to avoid surgery or to the surgeon's assessment that K-wire will be sufficient for a simple fracture. A very distal fracture may, in certain situations, be handled better with K-wires, and a very comminuted fracture may sometimes necessitate use of external fixation

The adverse reactions from the four surgical methods are dissimilar due to the nature of the surgical interventions involved, including their extensiveness. A review of the adverse reactions reported in the studies included found a comparable incidence of serious adverse reactions for all four methods.

Treatment with the insertion of a volar angular stable locking plate increases the demands made on surgical skills. When used correctly, this method rarely causes serious adverse reactions

6.1 - K-wire surgery vs. conservative treatment

What is the effect and what are the risks of conservative treatment with reduction and plaster/cast or similar immobilising bandages vs. K-wire surgery (Kapandji or Willenegger technique)?

Do special circumstances apply to patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, or to patients over the age of 65?

Previously, use of K-wire osteosynthesis was quite widespread for the treatment of unstable distal radial fractures, because it is a simple and relatively fast surgical operation. The number of patients operated using this technique has been decreasing in the past 3 to 4 years. In addition, it has been questioned whether it is suitable in elderly patients. Accordingly, there has been a desire to determine whether this surgery technique continues to be indicated, including whether special circumstances apply to patients over the age of 65 and patients with a low level of function, respectively. In Denmark, the Kapandji technique and/or the Willenegger technique have been the most frequently used methods. Therefore, the evidence for the use of these methods vs. conservative treatment is elucidated.

Weak recommendation

Consider use of K-wires rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations

K-wire osteosynthesis is a brief and relatively simple surgical intervention. However, in most cases reasonable bone quality is a prerequisite for this intervention.

Evidence To Decision

Benefits and harms

Complications are not registered systematically in the old literature found.
There are indications that conservatively treated patients have an increased risk of fracture redisplacement and malunion and that K-wire osteosynthesis provides a significantly better result in terms of functional outcome. Thus, beneficial and adverse effects both point in the direction of recommending K-wire osteosynthesis

Certainty of the Evidence

The overall quality of the evidence is low.
The literature found is rather old, and this is reflected in the studies. The evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Also, the evidence was downgraded due to indirectness resulting from lack of use of

patient-related outcomes and an outdated cast or similar immobilising bandage position in the group of conservatively treated patients (volar/ulnar wrist flexion).

Preference and values

Patient values and preferences for conservative treatment vs. K-wire surgery are expected to be individual. Some patients find the thought of outpatient removal of K-wires unpleasant. The reduced risk of long term complications is deemed to outweigh this.

Rationale

Rationale for recommendation

When comparing K-wire surgery to conservative treatment, it is assessed that most patients would prefer a brief surgical intervention with K-wire insertion to conservative treatment, because the prospect of a better final outcome and fewer complications outweighs the undesirable consequences of surgery.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf. focused questions 1
Intervention:	K-wires
Comparator:	Conservative treatment

Summary

The evidence basis for this focused question is a systematic Cochrane review of 2007(17). Supplementary searches did not identify additional literature. The review included five studies (18-22) which are all rather old and of a very varying nature as regards, e.g., patient population, cast or similar immobilising bandage technique and fracture type. The studies did not include patient-related outcomes such as DASH and PRWE, but various older grading systems based on a combination of pain, grip strength, radiological parameters and a few more function-related questions. When assessing the quality of the evidence found, the working group attached greater importance to the studies which used grading systems that were later compared to and validated against DASH. The functional gradings used place the patients in the categories 'excellent', 'good', 'fair' or 'poor'(5).

The Cochrane review contains a meta-analysis of the functional grading 'fair or poor' which does not take the follow-up period into account. In order to obtain an assessment of an effect that corresponds to the focused question asked, new metaanalyses of the functional grading 'fair or poor' for the follow-up periods 6 and 12 months were made. After 12 months, significantly fewer patients scored 'fair or poor' in the group of patients treated with K-wire as compared to the conservatively treated patients. Likewise, the VAS was significantly lower among the K-wire patients after 12 months.

The five studies did not all collect and register complications of the treatments systematically. The working group reviewed the studies systematically and extracted the complications reported. The review identified a predominance of serious complications in the form of malunion and need of surgery due to fracture redisplacement in the group of conservatively treated patients. A smaller number of the patients treated with K-wire also experience fracture redisplacement. However, the risk of re-operation is significantly lower in case of initial K-wire treatment.

The studies included patients aged 18-80 years. Only the study by Azzopardi(18) included patients over 60 years of age

exclusively. In this study, the SF-36 (physical score) had improved significantly after 1 year in patients treated with Kwire osteosynthesis.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Conservative treatment	K-wires	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Functional grading: 'Fair eller Poor' 6 month Excellent, good, fair eller poor Follow up: Mean 6 month	Relative risk 0.76 (CI 95% 0.41 - 1.4) Based on data from 148 patients in 2 studies. (Randomized controlled)	253 per 1000	192 per 1000 Difference: **61 fewer** per 1000 (CI 95% 149 fewer - 101 more)	**Very Low** Lack of blinding, No "intention to treat" analysis and patient attrition poorly described,No actual patient-reported outcomes, bandage positions outdated	A relative risk of less than 1 means that conservative is poorer. However, since 1 is included in the 95% CI, it means no significant effect
Functional grading: 'Fair eller Poor' 12 months Excellent, good, fair eller poor Follow-up: Mean 12 month	Relative risk 0.31 (CI 95% 0.14 - 0.69) Based on data from 85 patients in 2 studies.	452 per 1000	140 per 1000 Difference: **312 fewer** per 1000 (CI 95% 389 fewer - 140 fewer)	**Very Low** Lack of blinding, No "intention to treat" analysis and patient attrition poorly described,No actual patient-reported outcomes, bandage positions outdated	A relative risk of less than 1 means that conservative is poorer. Since 1 is not included in the 95% CI, it means significant effect
Pain occasionally VAS 6 Important	Relative risk 0.5 (CI 95% 0.1 - 2.42) Based on data from 40 patients in 1 studies.	200 per 1000	100 per 1000 Difference: **100 fewer** per 1000 (CI 95% 180 fewer - 284 more)	Lack of blinding, wide confidence intervals and only one study	A relative risk of less than 1 means that conservative is poorer. However, since 1 is included in the 95% CI, it means no significant effect
Return to work Number of patients who had returned to work Follow-up: Mean 12 month 6 Important	Relative risk 0.23 (CI 95% 0.01 - 3.97) Based on data from 11 patients in 1 studies.	333 per 1000	77 per 1000 Difference: **256 fewer** per 1000 (CI 95% 330 fewer - 989 more)	**Low** Lack of blinding, Wide confidence intervals and only one study	A relative risk of less than 1 means that conservative is poorer. However, since 1 is included in the 95% CI, it means no significant effect

Outcome Timeframe	Study results and measurements	Absolute effect estimates Conservative treatment	 K-wires	Certainty of the Evidence (Quality of evidence)	Plain text summary
SF-36 mental score Follow-up: mean 12 month	Measured by: Scale Scale: 0-100 Based on data from: 54 patients in 1 studies.	50.4 (Mean)	51 (Mean) CI 95%	Low Lack of blinding, wide confidence intervals and only one study	No difference between the intervention group and the control group
SF-36 physical score Follow-up: mean 12 month	Measured by: Scale Scale: 0-100 Based on data from: 54 patients in 1 studies.	38.2 (Mean)	42.2 (Mean) CI 95%	Low Lack of blinding, wide confidence intervals and only one study	Use of K-wires is better than conservative treatment in the comprison
Pain Follow-up: Mean 12 month 6 Important	Measured by: VAS Scale: 0-100 Based on data from: 54 patients in 1 studies.	1.2 (Mean)	0.7 (Mean) CI 95%	Low Lack of blinding, wide confidence intervals and only 1 study.	Use of K-wires is better than conservative treatment in the comparison

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations

K-wire osteosynthesis is a brief and relatively simple surgical intervention. However, in most cases reasonable bone quality is a prerequisite for this intervention.

Evidence To Decision

Benefits and harms

Complications are not registered systematically in the old literature found.
There are indications that conservatively treated patients have an increased risk of fracture

redisplacement and malunion and that K-wire osteosynthesis provides a significantly better result in terms of functional outcome. Thus, beneficial and adverse effects both point in the direction of recommending K-wire osteosynthesis.

Certainty of the Evidence

The overall quality of the evidence is low.
The literature found is rather old, and this is reflected in the studies. The evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Also, the evidence was downgraded due to indirectness resulting from lack of use of patient-related outcomes and an outdated cast or similar immobilising bandage position in the group of conservatively treated patients (volar/ulnar wrist flexion).

Preference and values

Patient values and preferences for conservative treatment vs. K-wire surgery are expected to be individual. Some patients find the thought of outpatient removal of K-wires unpleasant. The reduced risk of long term complications is deemed to outweigh this.

Rationale

Rationale for recommendation
When comparing K-wire surgery to conservative treatment, it is assessed that most patients would prefer a brief surgical intervention with K-wire insertion to conservative treatment, because the prospect of a better final outcome and fewer complications outweighs the undesirable consequences of surgery.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf. focused questions 1
Intervention:	K-wires
Comparator:	Conservative treatment

Summary

The evidence basis for this focused question is a systematic Cochrane review of 2007(17). Supplementary searches did not identify additional literature. The review included five studies (18-22) which are all rather old and of a very varying nature as regards, e.g., patient population, cast or similar immobilising bandage technique and fracture type. The studies did not include patient-related outcomes such as DASH and PRWE, but various older grading systems based on a combination of pain, grip strength, radiological parameters and a few more function-related questions. When assessing

the quality of the evidence found, the working group attached greater importance to the studies which used grading systems that were later compared to and validated against DASH. The functional gradings used place the patients in the categories 'excellent', 'good', 'fair' or 'poor'(5).

The Cochrane review contains a meta-analysis of the functional grading 'fair or poor' which does not take the follow-up period into account. In order to obtain an assessment of an effect that corresponds to the focused question asked, new metaanalyses of the functional grading 'fair or poor' for the follow-up periods 6 and 12 months were made. After 12 months, significantly fewer patients scored 'fair or poor' in the group of patients treated with K-wire as compared to the conservatively treated patients. Likewise, the VAS was significantly lower among the K-wire patients after 12 months.

The five studies did not all collect and register complications of the treatments systematically. The working group reviewed the studies systematically and extracted the complications reported. The review identified a predominance of serious complications in the form of malunion and need of surgery due to fracture redisplacement in the group of conservatively treated patients. A smaller number of the patients treated with K-wire also experience fracture redisplacement. However, the risk of re-operation is significantly lower in case of initial K-wire treatment.

The studies included patients aged 18-80 years. Only the study by Azzopardi(18) included patients over 60 years of age exclusively. In this study, the SF-36 (physical score) had improved significantly after 1 year in patients treated with Kwire osteosynthesis.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Conservative treatment	 K-wires	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Functional grading: 'Fair eller Poor' 6 month Excellent, good, fair eller poor Follow up: Mean 6 month	Relative risk 0.76 (CI 95% 0.41 - 1.4) Based on data from 148 patients in 2 studies. (Randomized controlled)	253 per 1000	192 per 1000 Difference: **61 fewer** per 1000 (CI 95% 149 fewer - 101 more)	**Very Low** Lack of blinding, No "intention to treat" analysis and patient attrition poorly described,No actual patient-reported outcomes, bandage positions outdated	A relative risk of less than 1 means that conservative is poorer. However, since 1 is included in the 95% CI, it means no significant effect
Functional grading: 'Fair eller Poor' 12 months Excellent, good, fair eller poor Follow-up: Mean 12 month	Relative risk 0.31 (CI 95% 0.14 - 0.69) Based on data from 85 patients in 2 studies.	452 per 1000	140 per 1000 Difference: **312 fewer** per 1000 (CI 95% 389 fewer - 140 fewer)	**Very Low** Lack of blinding, No "intention to treat" analysis and patient attrition poorly described,No actual patient-reported outcomes, bandage positions outdated	A relative risk of less than 1 means that conservative is poorer. Since 1 is not included in the 95% CI, it means significant effect
Pain occasionally VAS	Relative risk 0.5 (CI 95% 0.1 - 2.42) Based on data from 40 patients in 1 studies.	200 per 1000	100 per 1000	Lack of blinding, wide confidence intervals and only one study	A relative risk of less than 1 means that conservative is poorer. However, since 1 is

Outcome Timeframe	Study results and measurements	Absolute effect estimates Conservative treatment	 K-wires	Certainty of the Evidence (Quality of evidence)	Plain text summary
6 Important		Difference: 100 fewer per 1000 (CI 95% 180 fewer - 284 more)			included in the 95% CI, it means no significant effect
Return to work Number of patients who had returned to work Follow-up: Mean 12 month 6 Important	Relative risk 0.23 (CI 95% 0.01 - 3.97) Based on data from 11 patients in 1 studies.	333 per 1000 Difference: 256 fewer per 1000 (CI 95% 330 fewer - 989 more)	77 per 1000	Low Lack of blinding, Wide confidence intervals and only one study	A relative risk of less than 1 means that conservative is poorer. However, since 1 is included in the 95% CI, it means no significant effect
SF-36 mental score Follow-up: mean 12 month	Measured by: Scale Scale: 0-100 Based on data from: 54 patients in 1 studies.	50.4 (Mean) CI 95%	51 (Mean)	Low Lack of blinding, wide confidence intervals and only one study	No difference between the intervention group and the control group
SF-36 physical score Follow-up: mean 12 month	Measured by: Scale Scale: 0-100 Based on data from: 54 patients in 1 studies.	38.2 (Mean) CI 95%	42.2 (Mean)	Low Lack of blinding, wide confidence intervals and only one study	Use of K-wires is better than conservative treatment in the comprison
Pain Follow-up: Mean 12 month 6 Important	Measured by: VAS Scale: 0-100 Based on data from: 54 patients in 1 studies.	1.2 (Mean) CI 95%	0.7 (Mean)	Low Lack of blinding, wide confidence intervals and only 1 study.	Use of K-wires is better than conservative treatment in the comparison

6.2 - Bridging external fixation vs. conservative treatment

What is the effect and what are the risks of conservative treatment with reduction and plaster/cast or similar immobilising bandages vs. surgical treatment comprising bridging external fixation with or without supplementary K-wires?

Do special circumstances apply to patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, or to patients over the age of 65?

Until a few years ago, external fixation was the most frequently used surgical procedure in Denmark for the treatment of distal radial fracture. Bridging external fixation, in which the actual wrist is fixed, is used more frequently than nonbridging fixation in

which the wrist can move freely. Most often, the fixation is supplemented by K-wires.

In spite of the decline in external fixation, it was considered important to review the evidence for this type of treatment vs. conservative treatment.

Weak recommendation

Consider use of bridging external fixation rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations

Treatment involving external fixation necessitates device care and maintenance. Often the patient will need some sort of help, e.g. from a home care nurse.

In the dialogue with the patient concerning selecting a treatment method, the patient should be informed that if external fixation is selected, the device may cause discomfort to him or her during the first 3-6 months. However, in the long term the patient may experience a better treatment effect.

Osteosynthesis with external fixation in most cases requires a reasonable bone quality.

Evidence To Decision

Benefits and harms

Complications are not registered systematically in the literature found.
However, the number and the severity of the complications are comparable between the two treatment groups.
Superficial pin infection/irritation is not a serious complication and will not influence on the effect of the treatment in the long term. It may, however, cause undue worry for the patient and increase the resource consumption.

Certainty of the Evidence

The overall quality of the evidence is very low.
The literature found is mainly rather old, and this is reflected in the studies. The evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Also, the evidence was downgraded due to indirectness resulting from lack of use of patient-related outcomes and an outdated (39) cast or similar immobilising bandageposition in the group of conservatively treated patients (volar/ulnar wrist flexion).

Preference and values

The patients' preferences are expected to be inconsistent. Some patients would prefer treatment with external fixation, because it will most likely lead to better results in terms of returning to daily activities. Other patients would prefer treatment with plaster to avoid the discomfort caused by the device applied during the external fixation and potential worry as regards device care and maintenance.

Resources and other considerations

Most often, patients with external fixation will need help for pin care from a home care nurse.

Rationale

Rationale for recommendation

When comparing conservative treatment to bridging external fixation, it is assessed that external fixation rather than conservative treatment should be offered to patients in whom surgery is relevant, because the prospect of a better final outcome outweighs the undesirable consequences of surgery and the discomfort from using the external fixation device during the first period of time. A suitable support function as regards device care is a prerequisite for this assessment.

Clinical Question/ PICO

Population:	patients over the age of 18 with distal radial fracture cf. focused questuin 1
Intervention:	External fixation
Comparator:	Conservative treatment

Summary

The evidence basis for this focused question is a systematic Cochrane review(25) of 2007 and two recent randomised clinical studies(26,27).

The studies included in the Cochrane review are all older studies of a very varying nature as regards, e.g., patient population, cast or similar immobilising bandage technique and fracture type. The studies did not include patient-related outcomes such as DASH and PRWE, but various older grading systems based on a combination of pain, grip strength, radiological parameters and a few more function-related questions. When assessing the quality of the evidence found, the working group attached greater importance to the studies which used grading systems that were subsequently compared to and validated against DASH. The functional gradings used place the patients in the categories 'excellent', 'good', 'fair' or 'poor'(5).

The Cochrane review contains a meta-analysis of the functional scoring which does not take the follow-up period into account. In order to obtain an assessment of an effect that corresponds to the focused question asked and to be able to use data from the two recent studies, a new meta-analysis for the variable Functional grading 'fair or poor' for the follow-up periods 3-6 months and 1-10 years was made.

The studies included did not all collect and register complications of the treatments systematically. Therefore, the working group reviewed the studies systematically and extracted the complications reported. The comparison of the complications did not identify any difference in the number of serious complications of the two treatment methods. There was an increased incidence of superficial pin infection/irritation in the group with external fixation. However, this did not affect the treatment result in the long term.

Age was not included as a variable. Therefore, no specific evidence is available for the 65+ age group. The 65+ age group was included in most of the studies.

The literature found shows a better result of conservative treatment for patientrelated outcomes after 3-6 months. This difference is most likely due to discomfort caused by the device in the early phase of the treatment. However, after a year the results are in favour of external fixation.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Conservative treatment	External fixation	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Functional grading: "fair or poor" Follow-up: 3-6 months	Relative risk 2.11 (CI 95% 1.26 - 3.54) Based on data from 165 patients in 3 studies.	189 per 1000	399 per 1000 Difference: **210 more** per 1000 (CI 95% 49 more - 480 more)	**Very Low** Lack of blinding, Most often no "intention to treat" analysis and patient attrition poorly described, no actual patient related outcomes	A relative risk of greather than 1 means that external fixation is poorer than conservative teatment. Since 1 is not included in the 95% CI, it means significant difference
Functional grading: "fair or poor" Follow-up: 1-10 år	Relative risk 0.75 (CI 95% 0.57 - 0.98) Based on data from 558 patients in 10 studies.	309 per 1000	232 per 1000 Difference: **77 fewer** per 1000 (CI 95% 133 fewer - 6 fewer)	**Very Low** Lack of blinding, Most often no "intention to treat" analysis and patient attrition poorly described, no actual patient related outcomes	A relative risk of less than 1 means that external fixation is better than conservative teatment. Since 1 is not included in the 95% CI, it means significant difference

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Treatment involving external fixation necessitates device care and maintenance. Often the patient will need some sort of help, e.g. from a home care nurse.

In the dialogue with the patient concerning selecting a treatment method, the patient should be informed that if external fixation is selected, the device may cause discomfort to him or her during the first 3-6 months. However, in the long term the patient may experience a better treatment effect.

Osteosynthesis with external fixation in most cases requires a reasonable bone quality.

Evidence To Decision

Benefits and harms

Complications are not registered systematically in the literature found.
However, the number and the severity of the complications are comparable between the two treatment groups.
Superficial pin infection/irritation is not a serious complication and will not influence on the effect of the treatment in the long term. It may, however, cause undue worry for the patient and increase the resource consumption.

Certainty of the Evidence

The overall quality of the evidence is very low.
The literature found is mainly rather old, and this is reflected in the studies. The evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Also, the evidence was downgraded due to indirectness resulting from lack of use of patient-related outcomes and an outdated (39) cast or similar immobilising bandageposition in the group of conservatively treated patients (volar/ulnar wrist flexion).

Preference and values

The patients' preferences are expected to be inconsistent. Some patients would prefer treatment with external fixation, because it will most likely lead to better results in terms of returning to daily activities. Other patients would prefer treatment with plaster to avoid the discomfort caused by the device applied during the external fixation and potential worry as regards device care and maintenance.

Resources and other considerations

Most often, patients with external fixation will need help for pin care from a home care nurse.

Rationale

Rationale for recommendation

When comparing conservative treatment to bridging external fixation, it is assessed that external fixation rather than conservative treatment should be offered to patients in whom surgery is relevant, because the prospect of a better final outcome outweighs the undesirable consequences of surgery and the discomfort from using the external fixation device during the first period of time. A suitable support

function as regards device care is a prerequisite for this assessment.

Clinical Question/ PICO

Population: patients over the age of 18 with distal radial fracture cf. focused questuin 1
Intervention: External fixation
Comparator: Conservative treatment

Summary

The evidence basis for this focused question is a systematic Cochrane review(25) of 2007 and two recent randomised clinical studies(26,27).

The studies included in the Cochrane review are all older studies of a very varying nature as regards, e.g., patient population, cast or similar immobilising bandage technique and fracture type. The studies did not include patient-related outcomes such as DASH and PRWE, but various older grading systems based on a combination of pain, grip strength, radiological parameters and a few more function-related questions. When assessing the quality of the evidence found, the working group attached greater importance to the studies which used grading systems that were subsequently compared to and validated against DASH. The functional gradings used place the patients in the categories 'excellent', 'good', 'fair' or 'poor'(5).

The Cochrane review contains a meta-analysis of the functional scoring which does not take the follow-up period into account. In order to obtain an assessment of an effect that corresponds to the focused question asked and to be able to use data from the two recent studies, a new meta-analysis for the variable Functional grading 'fair or poor' for the follow-up periods 3-6 months and 1-10 years was made.

The studies included did not all collect and register complications of the treatments systematically. Therefore, the working group reviewed the studies systematically and extracted the complications reported. The comparison of the complications did not identify any difference in the number of serious complications of the two treatment methods. There was an increased incidence of superficial pin infection/irritation in the group with external fixation. However, this did not affect the treatment result in the long term.

Age was not included as a variable. Therefore, no specific evidence is available for the 65+ age group. The 65+ age group was included in most of the studies.

The literature found shows a better result of conservative treatment for patientrelated outcomes after 3-6 months. This difference is most likely due to discomfort caused by the device in the early phase of the treatment. However, after a year the results are in favour of external fixation.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Conservative treatment	External fixation	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Functional grading: "fair or poor" Follow-up: 3-6 months	Relative risk 2.11 (CI 95% 1.26 - 3.54) Based on data from 165 patients in 3 studies.	**189** per 1000	**399** per 1000 Difference: **210 more** per 1000 (CI 95% 49 more - 480 more)	**Very Low** Lack of blinding, Most often no "intention to treat" analysis and patient attrition poorly described, no actual patient related outcomes	A relative risk of greather than 1 means that external fixation is poorer than conservative teatment. Since 1 is not included in the 95% CI, it means significant difference

Outcome Timeframe	Study results and measurements	Absolute effect estimates Conservative treatment	 External fixation	Certainty of the Evidence (Quality of evidence)	Plain text summary
Functional grading: "fair or poor" Follow-up: 1-10 år	Relative risk 0.75 (CI 95% 0.57 - 0.98) Based on data from 558 patients in 10 studies.	309 per 1000	232 per 1000 Difference: 77 fewer per 1000 (CI 95% 133 fewer - 6 fewer)	Very Low Lack of blinding, Most often no "intention to treat" analysis and patient attrition poorly described, no actual patient related outcomes	A relative risk of less than 1 means that external fixation is better than conservative teatment. Since 1 is not included in the 95% CI, it means significant difference

6.3 - Internal fixation with volar angular stable locking plate vs. conservative treatment

What is the effect and what are the risks of conservative treatment with reduction and plaster vs. surgery with internal fixation and a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, or to patients over the age of 65?

The introduction volar angular stable locking plates has changed the surgical behaviour in many Danish hospital departments over the past 5-6 years. A benefit of this treatment is that the patients, due to major stability of the method, are allowed to start mobilising earlier. The method is more invasive than the previously more frequently used methods, K-wires and external fixation, and therefore requires a somewhat longer surgery time. In addition, it has been stated that the method increases the risk of both flexor and extensor tendon injuries in case the osteosynthesis material and the screws are not placed correctly.

There has been a trend towards offering this type of treatment to more, especially elderly, patients. Therefore, the working group considered it important to clarify whether there is evidence for using volar angular stable locking plates vs. conservative treatment. In particular, we wanted to shed light on the situation for the 65+ age group of patients.

Weak recommendation

Consider use of a volar angular stable locking plate rather than conservative treatment of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see PICO 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material and screws in order to reduce the risk of late complications in the form of tendon injuries (40).

If postoperative X-ray control leads to a suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Surgery scheduled for daytime hours (cf. recommendation according to PICO 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Evidence To Decision

Benefits and harms

In terms of the functional score, the effect of a correctly inserted volar angular stable locking plate is better than that of conservative treatment. The complications were not registered consistently for the two treatment groups. However, when comparing the complications in this study to the complications reported for conservatively treated patients in questions 4 and 5, the amount and significance of the complications are deemed comparable.

Certainty of the Evidence

The overall quality of the evidence is very low. The study included was carried out well. However, the evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Since only one study is available, the evidence was downgraded further due to risk of lack of accuracy.

Preference and values

The patients' preferences are expected to be roughly consistent. It is expected that most patients would consider regaining their normal level of function fast a decisive factor in favour of surgery and that this would outweigh the undesirable consequences of surgery for many of them.

Rationale

Rationale for recommendation

When comparing conservative treatment with reduction and plaster to internal fixation with a volar angular stable locking plate, it was assessed that surgery with the insertion of a volar angular stable locking plate should be offered to patients in whom surgery is relevant. Treatment with the insertion of a volar angular stable locking plate allows the patients to return to their usual daily activities faster and shows significantly better patient-related outcomes after 3 months.

Clinical Question/ PICO

Population: Patients over the age of 18 wuth distal radial fracture cf. focused question 1

Intervention: Volar angular stable lockiing plate

Comparator: Reduction and plaster (conservative treatment)

Summary

In spite of the increasing use of osteosynthesis with a volar angular stable locking plate in recent years, only one randomised controlled study, in which this method was compared to conservative treatment, was found in a search (41). The study comprised 73 patients older than 65. No literature was found describing the difference between the two treatment methods for younger patients. A number of studies exist, however, in which external fixation was compared to volar angular stable locking plate (see focused question 7). Based on the results of focused question 7, the assessment is that the results of the study in patients over the age of 65 can be extrapolated to the wide group of younger patients.

The study included only reported the complications related to the surgical method. Thus, complications related to plaster treatment were not registered systematically.

The study identified significant and clinically relevant differences in patient-related outcomes (PRWE and DASH) after 3 months in favour of plate insertion in these patients over the age of 65. After a year, there was a trend towards better effect of surgery with the insertion of a plate. However, it should be taken into account that the study only comprised 73 patients.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Reduction and plaster (conservative treatment)	Volar angular stable lockiing plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
PRWE (patient-rated Wrist Evaluation	Measured by: Patient-rated wrist evaluation score Scale: 0-100 Based on data from: 73	54.4 (Mean)	33.7 (Mean)	**Very Low** Lack of blinding and no "intention to treat" analysis	Volar angular stable locking plate is better than conservative treatment in the

Outcome Timeframe	Study results and measurements	Absolute effect estimates Reduction and plaster (conservative treatment)	 Volar angular stable lockiing plate	Certainty of the Evidence (Quality of evidence)	Plain text summary
Score) Follow-up: mean 3 month 9 Critical	patients in 1 studies.	CI 95%		and lack of data for withdrawn patients, wide confidence intervals, only one study	comparison and the difference is significant
Patient-rated wrist evaluation score Follow-up 1 year 9 Critical	Measured by: Patient-rated wrist evaluation score Scale: 0-100 Based on data from: 73 patients in 1 studies.	14.6 (Mean) CI 95%	12.8 (Mean)	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, wide confidence intervals, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is not significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [1] Follow-up: Mean 3 month 9 Critical	Measured by: Patient-rated wrist evaluation score, skala fra: 0 til 100. Scale: 0-100 Based on data from: 73 patients in 1 studies.	23.2 (Mean) CI 95%	13.3 (Mean)	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, wide confidence intervals, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [2] Follow-up: 1 year 9 Critical	Measured by: Patient-rated wrist evaluation score, skala fra: 0 til 100. Scale: 0-100 Based on data from: 73 patients in 1 studies.	8 (Mean) CI 95%	5.7 (Mean)	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is not significant
Pain at rest - 3 month (VAS scale) [3] Follow-up: Mean 3 month 6 Important	Measured by: VAS scale fro: 0-10 Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	0.3 (Mean) CI 95%	0.2 (Mean)	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference

Outcome Timeframe	Study results and measurements	Absolute effect estimates Reduction and plaster (conservative treatment)	 Volar angular stable lockiing plate	Certainty of the Evidence (Quality of evidence)	Plain text summary
Pain at rest - 1 year (VAS scale) Follow-up: Mean 1 year 6 Important	Measured by: VAS scale from: 0 to 10 Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	0.1 (Mean)	0.1 (Mean) CI 95%	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference
Pain during activity - 3 months [4] Follow-up: Mean 3 month 6 Important	Measured by: VAS Scale from: 0-10 Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	1.8 (Mean)	1.4 (Mean) CI 95%	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference
Pain during activity - 1 year Follow-up: Mean 1 year 6 Important	Measured by: VAS Scale from: 0-10 Scale: 0-10 Lower better	0.6 (Mean)	0.7 (Mean) CI 95%	Very Low Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference

1. skala fra 0 to 100
2. Skala fra:0-100
3. 0-10
4. Scale from: 0 to 10

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see PICO 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material and screws in order to reduce the risk of late complications in the form of tendon injuries (40).

If postoperative X-ray control leads to a suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Surgery scheduled for daytime hours (cf. recommendation according to PICO 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Evidence To Decision

Benefits and harms

In terms of the functional score, the effect of a correctly inserted volar angular stable locking plate is better than that of conservative treatment. The complications were not registered consistently for the two treatment groups. However, when comparing the complications in this study to the complications reported for conservatively treated patients in questions 4 and 5, the amount and significance of the complications are deemed comparable.

Certainty of the Evidence

The overall quality of the evidence is very low. The study included was carried out well. However, the evidence was downgraded due to risk of bias, lack of blinding and lack of analysis of patient attrition. Since only one study is available, the evidence was downgraded further due to risk of lack of accuracy.

Preference and values

The patients' preferences are expected to be roughly

consistent. It is expected that most patients would consider regaining their normal level of function fast a decisive factor in favour of surgery and that this would outweigh the undesirable consequences of surgery for many of them.

Rationale

Rationale for recommendation

When comparing conservative treatment with reduction and plaster to internal fixation with a volar angular stable locking plate, it was assessed that surgery with the insertion of a volar angular stable locking plate should be offered to patients in whom surgery is relevant. Treatment with the insertion of a volar angular stable locking plate allows the patients to return to their usual daily activities faster and shows significantly better patient-related outcomes after 3 months.

Clinical Question/ PICO

Population: Patients over the age of 18 wuth distal radial fracture cf. focused question 1
Intervention: Volar angular stable lockiing plate
Comparator: Reduction and plaster (conservative treatment)

Summary

In spite of the increasing use of osteosynthesis with a volar angular stable locking plate in recent years, only one randomised controlled study, in which this method was compared to conservative treatment, was found in a search (41). The study comprised 73 patients older than 65. No literature was found describing the difference between the two treatment methods for younger patients. A number of studies exist, however, in which external fixation was compared to volar angular stable locking plate (see focused question 7). Based on the results of focused question 7, the assessment is that the results of the study in patients over the age of 65 can be extrapolated to the wide group of younger patients.

The study included only reported the complications related to the surgical method. Thus, complications related to plaster treatment were not registered systematically.

The study identified significant and clinically relevant differences in patient-related outcomes (PRWE and DASH) after 3 months in favour of plate insertion in these patients over the age of 65. After a year, there was a trend towards better effect of surgery with the insertion of a plate. However, it should be taken into account that the study only comprised 73 patients.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Reduction and plaster (conservative treatment)	Volar angular stable lockiing plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
PRWE (patient-rated Wrist Evaluation Score) Follow-up: mean	Measured by: Patient-rated wrist evaluation score Scale: 0-100 Based on data from: 73 patients in 1 studies.	54.4 (Mean)	33.7 (Mean) CI 95%	**Very Low** Lack of blinding and no "intention to treat" analysis and lack of data	Volar angular stable locking plate is better than conservative treatment in the comparison and the

Outcome Timeframe	Study results and measurements	Absolute effect estimates Reduction and plaster (conservative treatment)	 Volar angular stable lockiing plate	Certainty of the Evidence (Quality of evidence)	Plain text summary
3 month 9 Critical				for withdrawn patients, wide confidence intervals, only one study	difference is significant
Patient-rated wrist evaluation score Follow-up 1 year 9 Critical	Measured by: Patient-rated wrist evaluation score Scale: 0-100 Based on data from: 73 patients in 1 studies.	14.6 (Mean) CI 95%	12.8 (Mean)	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, wide confidence intervals, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is not significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [1] Follow-up: Mean 3 month 9 Critical	Measured by: Patient-rated wrist evaluation score, skala fra: 0 til 100. Scale: 0-100 Based on data from: 73 patients in 1 studies.	23.2 (Mean) CI 95%	13.3 (Mean)	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, wide confidence intervals, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [2] Follow-up: 1 year 9 Critical	Measured by: Patient-rated wrist evaluation score, skala fra: 0 til 100. Scale: 0-100 Based on data from: 73 patients in 1 studies.	8 (Mean) CI 95%	5.7 (Mean)	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	Volar angular stable locking plate is better than conservative treatment in the comparison and the difference is not significant
Pain at rest - 3 month (VAS scale) [3] Follow-up: Mean 3 month 6 Important	Measured by: VAS scale fro: 0-10 Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	0.3 (Mean) CI 95%	0.2 (Mean)	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference
Pain at rest - 1 year (VAS scale)	Measured by: VAS scale from: 0 to 10	0.1	0.1	**Very Low** Lack of blinding,	No difference

Outcome Timeframe	Study results and measurements	Absolute effect estimates Reduction and plaster (conservative treatment)	 Volar angular stable lockiing plate	Certainty of the Evidence (Quality of evidence)	Plain text summary
Follow-up: Mean 1 year 6 Important	Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	(Mean)	(Mean) CI 95%	no "intention to treat" analysis and lack of data for withdrawn patients, only one study	
Pain during activity - 3 months [4] Follow-up: Mean 3 month 6 Important	Measured by: VAS Scale from: 0-10 Scale: 0-10 Lower better Based on data from: 73 patients in 1 studies.	1.8 (Mean)	1.4 (Mean) CI 95%	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference
Pain during activity - 1 year Follow-up: Mean 1 year 6 Important	Measured by: VAS Scale from: 0-10 Scale: 0-10 Lower better	0.6 (Mean)	0.7 (Mean) CI 95%	**Very Low** Lack of blinding, no "intention to treat" analysis and lack of data for withdrawn patients, only one study	No difference

1. skala fra 0 to 100
2. Skala fra:0-100
3. 0-10
4. Scale from: 0 to 10

6.4 - Bridging external fixation vs. volar angular stable locking plate

What is the effect and what are the risks of surgery comprising bridging external fixation, possibly supplemented with K-wires, vs. open surgery with reduction and insertion of a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, or to patients over the age of 65?

The past 5 to 6 years have seen a shift in surgical methods from external fixation towards osteosynthesis with a volar angular stable locking plate. The topic has been the object of extensive discussion at professional meetings in the field of orthopaedic surgery. Accordingly, there has been a desire to compare the two methods in order to clarify which one of them is more beneficial for the patient as regards effects and risks.

Weak recommendation

Consider use of a volar angular stable locking plate rather than bridging external fixation of distal radial fracture in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.
Therefore, surgery scheduled for daytime hours is preferable in most.

Evidence To Decision

Benefits and harms

The level of function (DASH) is significantly better in the group of patients treated with a volar angular stable locking plate, after both 3 and 12 months. However, the clinically relevant difference evens out over time.
In the opinion of the working group, the severity of the complications in the two groups is comparable.

Certainty of the Evidence

The overall quality of the evidence is low.
The meta-analysis and the supplementary randomised controlled study are of predominantly high quality and include a population which corresponds very much to the one comprised by the guideline. However, the evidence was downgraded due to lack of blinding and lack of analysis of patient attrition.

Preference and values

The patients are expected to have fairly clear preferences, since most patients would prefer internal fixation with a volar angular stable locking plate. A volar angular stable locking plate enables an earlier start-up of a rehabilitation programme. In

contrast, many patients will experience discomfort caused by the external fixation device in their normal daily life. Also, device care and maintenance may cause concern.

Resources and other considerations

Most often, patients with external fixation will need help for pin care from a home care nurse

Rationale

Rationale for recommendation

When comparing external fixation with bridging to internal fixation with a volar angular stable locking plate, the latter is recommended. The results for volar angular stable locking plate in terms of the patient-related outcomes are significantly better after both 3 and 12 months. It is assessed that most patients would select internal fixation with a volar angular stable locking plate because it allows for faster mobilisation rather than external fixation early in the process and the discomfort associated with the use thereof.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf focused question 1
Intervention:	Volar angle stable locking plate
Comparator:	External fixation

Summary

The evidence basis for the recommendation is a systematic review (42) comprising three studies (43-45) with a total of 174 patients, supplemented with a randomised controlled study (46) with 94 patients.

The primary outcome in the systematic review was a patient-related outcome (DASH). A significant difference in the level of function in favour of volar angular stable locking plate was identified after both 3 and 12 months. However, after 12 months the difference was only 8 points, which is not considered clinically relevant (the smallest clinically relevant difference for DASH is 10 points (6)). In the three studies included in the review, the population covered a broad age range from 19 to 87 years. The studies generally only included AO type A2-3 and C1-3. Three study subjects, however, had AO type B fractures, and that AO type is not included for the population defined in the guideline, but the working group finds that this does not significantly affect the transfer of the study results.

The randomised controlled study included assessed pain using a visual analogue scale (VAS) after both 3 and 12 months. The study did not detect any clinical or statistical difference.

In general, the number of complications was low for both treatments. The types of complications differed among the two treatments. Therefore, it makes no sense to test for significance at the level of individual complications. The working group assessed the seriousness of the complications against each other and found no difference between the two types of treatment.

The review of the literature did not identify evidence concerning treatment of patients with a very low level of function. Most often, these patients were excluded from the randomised studies.

The meta-analysis included comprised three studies, one of which excluded patients over the age of 70 years. The other

studies comprised patients aged 19 to 87 years. In the randomised controlled study(46) included, patient ages ranged from 20 to 84 years. Based on the wide age dispersion in the studies included, the assessment is that the results can be extrapolated to the group of patients over the age of 65.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** External fixation Volar angle stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Complications Total number of complications Follow-up:mean 1 year 6 Important	Relative risk 0.71 (CI 95% 0.34 - 1.46) Based on data from 174 patients in 3 studies.	196 per 1000 — 256 per 1000 Difference: 60 more per 1000 (CI 95% 129 fewer - 90 more)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	An odds ratio of less than 1 means that volar angular stable locking plate is associated with fewer complications. Snice 1 is included in the 95% CI, it means no significant effect
DASH (Disabilities of the Arm, Shoulder and Hand score). Follow-up: Mean 3 month 9 Critical	Measured by: Scale from: 0-100 Scale: 0-100 Based on data from: 174 patients in 3 studies.	Difference: MD 15.58 lower (CI 95% 6.64 lower - 24.52 lower)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	Volar angular stable locking plate is better than external fixation. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). Follow-up: Mean 1 year 9 Critical	Measured by: Scale from:0-100 Scale: 0-100 High better Based on data from: 174 patients in 1 studies.	Difference: MD 8 lower (CI 95% 0.44 lower - 15.55 lower)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	Volar angular stable locking plate is better than external fixation. The difference is significant
Pain at rest - 3 month [1] Follow-up: Mean 3 month 6 Important	Measured by: VAS:0-100 Scale: 0-100 Lower better Based on data from: 94 patients in 1 studies.	Difference: MD 3 lower (CI 95% 8 lower - 2 higher)	**Low** Wide confidence intervals, Lack of blinding, not block randomised according to OA groups	No difference
Pain durring activity - 3 month [2] Follow-up: mean	Measured by: VAS (0-100) High better Based on data from: 93 patients in 1 studies.	Difference: MD 6 lower (CI 95% 14 lower - 1 higher)	**Low** Wide confidence intervals, Lack of blinding, not block	No difference

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** External fixation Volar angle stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
3 month 6 Important			randomised according to OA groups	
Pain at rest - 1 year [3] Follow-up: mean 1 year 6 Important	Measured by: VAS (0-100) Scale: 0-100 Lower better Based on data from: 104 patients in 1 studies.	Difference: **MD 2 lower** (CI 95% 5 lower - 1 higher)	**Low** Wide confidence intervals, Lack of blinding, not block randomised according to OA groups	No diference
Pain during activity - 1 year [4] Follow-up:Mean 1 year 6 Important	Measured by: VAS (0-100) Scale: 0-100 Lower better Based on data from: 104 patients in 1 studies.	Difference: **MD 3 higher** (CI 95% 3 lower - 9 higher)	**Low** Lack of blinding, not block randomised according to OA groups	No difference

1. VAS: 0-100
2. Vas (0-100)
3. VAS (0-100)
4. VAS (0-100)

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to conservative treatment. This may speak in favour of applying the method in patients with special needs such as patients with a walking frame.

Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Evidence To Decision

Benefits and harms

The level of function (DASH) is significantly better in the group of patients treated with a volar angular stable locking plate, after both 3 and 12 months. However, the clinically relevant difference evens out over time.
In the opinion of the working group, the severity of the complications in the two groups is comparable.

Certainty of the Evidence

The overall quality of the evidence is low.
The meta-analysis and the supplementary randomised controlled study are of predominantly high quality and include a population which corresponds very much to the one comprised by the guideline. However, the evidence was downgraded due to lack of blinding and lack of analysis of patient attrition.

Preference and values

The patients are expected to have fairly clear preferences, since most patients would prefer internal fixation with a volar angular stable locking

plate. A volar angular stable locking plate enables an earlier start-up of a rehabilitation programme. In contrast, many patients will experience discomfort caused by the external fixation device in their normal daily life. Also, device care and maintenance may cause concern.

Resources and other considerations

Most often, patients with external fixation will need help for pin care from a home care nurse.

Rationale

When comparing external fixation with bridging to internal fixation with a volar angular stable locking plate, the latter is recommended. The results for volar angular stable locking plate in terms of the patient-related outcomes are significantly better after both 3 and 12 months. It is assessed that most patients would select internal fixation with a volar angular stable locking plate because it allows for faster mobilisation rather than external fixation early in the process and the discomfort associated with the use thereof.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf focused question 1
Intervention:	Volar angle stable locking plate
Comparator:	External fixation

Summary

The evidence basis for the recommendation is a systematic review (42) comprising three studies (43-45) with a total of 174 patients, supplemented with a randomised controlled study (46) with 94 patients.

The primary outcome in the systematic review was a patient-related outcome (DASH). A significant difference in the level of function in favour of volar angular stable locking plate was identified after both 3 and 12 months. However, after 12 months the difference was only 8 points, which is not considered clinically relevant (the smallest clinically relevant difference for DASH is 10 points (6)). In the three studies included in the review, the population covered a broad age range from 19 to 87 years. The studies generally only included AO type A2-3 and C1-3. Three study subjects, however, had AO type B fractures, and that AO type is not included for the population defined in the guideline, but the working group finds that this does not significantly affect the transfer of the study results.

The randomised controlled study included assessed pain using a visual analogue scale (VAS) after both 3 and 12 months. The study did not detect any clinical or statistical difference.

In general, the number of complications was low for both treatments. The types of complications differed among the two treatments. Therefore, it makes no sense to test for significance at the level of individual complications. The working group assessed the seriousness of the complications against each other and found no difference between the two types of treatment.

The review of the literature did not identify evidence concerning treatment of patients with a very low level of function. Most often, these patients were excluded from the randomised studies.

The meta-analysis included comprised three studies, one of which excluded patients over the age of 70 years. The other studies comprised patients aged 19 to 87 years. In the randomised controlled study(46) included, patient ages ranged from 20 to 84 years. Based on the wide age dispersion in the studies included, the assessment is that the results can be extrapolated to the group of patients over the age of 65.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** External fixation Volar angle stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Complications Total number of complications Follow-up:mean 1 year 6 Important	Relative risk 0.71 (CI 95% 0.34 - 1.46) Based on data from 174 patients in 3 studies.	**196** per 1000 **256** per 1000 Difference: **60 more** per 1000 (CI 95% 129 fewer - 90 more)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	An odds ratio of less than 1 means that volar angular stable locking plate is associated with fewer complications. Snice 1 is included in the 95% CI, it means no significant effect
DASH (Disabilities of the Arm, Shoulder and Hand score). Follow-up: Mean 3 month 9 Critical	Measured by: Scale from: 0-100 Scale: 0-100 Based on data from: 174 patients in 3 studies.	Difference: **MD 15.58 lower** (CI 95% 6.64 lower - 24.52 lower)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	Volar angular stable locking plate is better than external fixation. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). Follow-up: Mean 1 year 9 Critical	Measured by: Scale from:0-100 Scale: 0-100 High better Based on data from: 174 patients in 1 studies.	Difference: **MD 8 lower** (CI 95% 0.44 lower - 15.55 lower)	**Low** Lack of blinding, possibly attrition bias, wide confidence intervals	Volar angular stable locking plate is better than external fixation. The difference is significant
Pain at rest - 3 month [1] Follow-up: Mean 3 month 6 Important	Measured by: VAS:0-100 Scale: 0-100 Lower better Based on data from: 94 patients in 1 studies.	Difference: **MD 3 lower** (CI 95% 8 lower - 2 higher)	**Low** Wide confidence intervals, Lack of blinding, not block randomised according to OA groups	No difference
Pain durring activity - 3 month [2]	Measured by: VAS (0-100) High better Based on data from: 93	Difference: **MD 6 lower** (CI 95% 14 lower - 1 higher)	**Low** Wide confidence intervals, Lack of	No difference

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** External fixation Volar angle stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Follow-up: mean 3 month 6 Important	patients in 1 studies.		blinding, not block randomised according to OA groups	
Pain at rest - 1 year [3] Follow-up: mean 1 year 6 Important	Measured by: VAS (0-100) Scale: 0-100 Lower better Based on data from: 104 patients in 1 studies.	Difference: **MD 2 lower** (CI 95% 5 lower - 1 higher)	**Low** Wide confidence intervals, Lack of blinding, not block randomised according to OA groups	No diference
Pain during activity - 1 year [4] Follow-up:Mean 1 year 6 Important	Measured by: VAS (0-100) Scale: 0-100 Lower better Based on data from: 104 patients in 1 studies.	Difference: **MD 3 higher** (CI 95% 3 lower - 9 higher)	**Low** Lack of blinding, not block randomised according to OA groups	No difference

1. VAS: 0-100
2. Vas (0-100)
3. VAS (0-100)
4. VAS (0-100)

6.5 - K-wires vs. open reduction and internal fixation with a volar angular stable locking plate

What is the effect and what are the risks of K-wire surgery vs. open reduction and internal fixation with a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function, defined as permanent lack of ability to perform daily activities independently, or to patients over the age of 65?

In recent years, treatment with the insertion of a volar angular stable locking plate has become the preferred surgical method in a number of departments rather than K-wire osteosynthesis. Accordingly, there has been a desire to compare the two methods in order to clarify which one of them is more beneficial for the patient as regards effects and risks.

Weak recommendation

Consider use of a volar angular stable locking plate rather than Kwires during distal radial fracture surgery in patients of any age when surgery is indicated.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to K-wire surgery. This may speak in favour of osteosynthesis with a plate in patients with special needs such as patients with a walking frame.

K-wire osteosynthesis is a brief and simple surgical intervention. In most cases, use of this intervention requires a reasonable bone quality.
Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours (cf. recommendation according to focused question 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Evidence To Decision

Benefits and harms

The incidence of serious complications was low for both treatments, but higher in patients treated with K-wires.
Surgical treatment with the insertion of a volar fixedangle plate is associated with a better patient-related outcome and a faster effect.

Certainty of the Evidence

The overall quality of the evidence is low.
The evidence was downgraded due to lack of blinding and lack of analysis of patient attrition. The parameter 'return to work' was only reported in one study. Therefore, the associated evidence was downgraded further due to the risk of lack of accuracy.

Preference and values

The patients' preferences are expected to be essentially consistent. A volar angular stable

locking plate enables an earlier start-up of a rehabilitation programme, which is expected to be given a high priority by most patients.

Resources and other considerations

The difference in DASH score is close to being clinically relevant after 3 months, but too low (9 points). Thereafter, the difference between the two groups is only 6 and later 3 points.

Rationale

When comparing K-wire surgery to treatment with the insertion of a volar angular stable locking plate, the effect of the latter is significantly better, but the difference is not considered to be of clinical relevancy. However, K-wire osteosynthesis is associated with a slightly higher incidence of serious complications. This, as well as the faster mobilisation and return to the usual daily activities enabled by osteosynthesis with volar angular stable locking plate, result in a recommendation to offer this treatment to the patients.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf. focused question 1
Intervention:	Volar angular stable locking plate
Comparator:	K-wires

Summary

The evidence is based on five randomised controlled studies (47-51). The working group did not identify systematic reviews of relevance for answering the focused question.

Based on the studies included, a meta-analysis was made of DASH after 3, 6 and 12 months, respectively. The authors of one of the studies (50) contributed with supplementary data to enable these analyses. The populations and fracture delimitations of all five studies correspond to those set up in this guideline. Exact data for the meta-analysis were requested from the author of another study (47), but no data were received. Therefore, this study was not included in the meta-analysis. It is described separately below.

After 3 and 6 months, the DASH score was significantly better in patients treated with a volar plate. After 3 months, the difference in mean DASH score was 9.29. However, the difference must be at least 10 to be clinically relevant, so 9.29 is close to being clinically relevant, but too low (6). The results after 12 months showed a tendency towards better mean DASH score in favour of the use of a volar plate, but the difference was not significant.

In general, the number of serious complications was low for both groups. However, the incidences of fracture redisplacement and re-operation or deep infection were higher in patients operated using K-wires.

A small number of patients treated with a volar plate will require removal of the plate in subsequent elective surgery.

Only one study (47) looked exclusively at the group of patients over the age of 65. This relatively small study in 40 patients found the same DASH and PWRE scores in the two treatment groups after both 3 and 12 months. However, the study identified a significantly faster return to the usual daily activities for patients treated with a volar plate.

None of the studies looked at patients with an impaired level of function separately. In general, the studies did not investigate parameters other than DASH, which is why the number of data in the SoF table is low.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** K-wires	Volar angular stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
DASH (Disabilities of the Arm, Shoulder and Hand score). [1] Follow-up: Mean 3 month 9 Critical	Measured by: Scale from:0-100 Scale: 0-100 High better	Difference: MD 9.29 lower (CI 95% 13.21 lower - 5.38 lower)		**Low** Lack of blinding and no "intention to treat" analysis	Volar angular stable locking plate is better than k-wires. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [2] Follow-up: Mean 6 year 9 Critical	Measured by: Scale from: 0-100 Scale: 0-100 Based on data from: 159 patients in 2 studies.	Difference: MD 6.68 lower (CI 95% 10.15 lower - 3.21 lower)		**Low** Lack of blinding and no "intention to treat" analysis	Volar angular stable locking plate is better than k-wires. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [3] Follow-up: Mean 1 year 9 Critical	Measured by: Scale from 0-100 Scale: 0-100 Based on data from: 76 patients in 2 studies.	Difference: MD 3.04 lower (CI 95% 9.96 lower - 3.87 higher)		**Very Low** Lack of blinding, no "intention to treat" analysis, wide confidence intervals	Volar angular stable locking plate is better than k-wires. The difference is not significant

1. Scale from: 0-100
2. 0-100
3. Scale from: 0-100

Practice statement

It is good practice to be cautious about the use of surgical intervention in patients of any age with a low level of function.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
Surgical treatment with the insertion of a volar angular stable locking plate allows for faster mobilisation (see focused question 9) as compared to K-wire surgery. This may speak in favour of osteosynthesis with a plate in patients with special needs such as patients with a walking frame.

K-wire osteosynthesis is a brief and simple surgical intervention. In most cases, use of this intervention requires a reasonable bone quality.
Insertion of a volar angular stable locking plate requires correct insertion of osteosynthesis material in order to reduce the risk of complications in the form of tendon injuries in the long term (40).

If postoperative X-ray control leads to suspicion of sub-optimal location of the osteosynthesis material (too long screws or too distally located plate), the patients should be informed about this and offered follow-up control for assessment of the need for secondary removal of the osteosynthesis material.

Therefore, surgery scheduled for daytime hours (cf. recommendation according to focused question 3) is preferable in most cases, since this allows for scheduling the surgery with an experienced surgeon.

Evidence To Decision

Benefits and harms

The incidence of serious complications was low for both treatments, but higher in patients treated with K-wires.
Surgical treatment with the insertion of a volar fixedangle plate is associated with a better patient-related outcome and a faster effect.

Certainty of the Evidence

The overall quality of the evidence is low.
The evidence was downgraded due to lack of blinding and lack of analysis of patient attrition. The parameter 'return to work' was only reported in one study. Therefore, the associated evidence was downgraded further due to the risk of lack of accuracy.

Preference and values

The patients' preferences are expected to be essentially consistent. A volar angular stable locking plate enables an earlier start-up of a rehabilitation programme, which is expected to be

given a high priority by most patients.

Resources and other considerations

The difference in DASH score is close to being clinically relevant after 3 months, but too low (9 points). Thereafter, the difference between the two groups is only 6 and later 3 points.

Rationale

Rationale for recommendation

When comparing K-wire surgery to treatment with the insertion of a volar angular stable locking plate, the effect of the latter is significantly better, but the difference is not considered to be of clinical relevancy. However, K-wire osteosynthesis is associated with a slightly higher incidence of serious complications. This, as well as the faster mobilisation and return to the usual daily activities enabled by osteosynthesis with volar angular stable locking plate, result in a recommendation to offer this treatment to the patients.

Clinical Question/ PICO

Population:	Patients over the age of 18 with distal radial fracture cf. focused question 1
Intervention:	Volar angular stable locking plate
Comparator:	K-wires

Summary

The evidence is based on five randomised controlled studies (47-51). The working group did not identify systematic reviews of relevance for answering the focused question.

Based on the studies included, a meta-analysis was made of DASH after 3, 6 and 12 months, respectively. The authors of one of the studies (50) contributed with supplementary data to enable these analyses. The populations and fracture delimitations of all five studies correspond to those set up in this guideline. Exact data for the meta-analysis were requested from the author of another study (47), but no data were received. Therefore, this study was not included in the meta-analysis. It is described separately below.

After 3 and 6 months, the DASH score was significantly better in patients treated with a volar plate. After 3 months, the difference in mean DASH score was 9.29. However, the difference must be at least 10 to be clinically relevant, so 9.29 is close to being clinically relevant, but too low (6). The results after 12 months showed a tendency towards better mean DASH score in favour of the use of a volar plate, but the difference was not significant.

In general, the number of serious complications was low for both groups. However, the incidences of fracture redisplacement and re-operation or deep infection were higher in patients operated using K-wires.

A small number of patients treated with a volar plate will require removal of the plate in subsequent elective surgery.

Only one study (47) looked exclusively at the group of patients over the age of 65. This relatively small study in 40 patients found the same DASH and PWRE scores in the two treatment groups after both 3 and 12 months. However, the study identified a significantly faster return to the usual daily activities for patients treated with a volar plate.

None of the studies looked at patients with an impaired level of function separately. In general, the studies did not

investigate parameters other than DASH, which is why the number of data in the SoF table is low.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** K-wires	 Volar angular stable locking plate	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
DASH (Disabilities of the Arm, Shoulder and Hand score). [1] Follow-up: Mean 3 month 9 Critical	Measured by: Scale from:0-100 Scale: 0-100 High better	Difference: **MD 9.29 lower** (CI 95% 13.21 lower - 5.38 lower)		**Low** Lack of blinding and no "intention to treat" analysis	Volar angular stable locking plate is better than k-wires. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [2] Follow-up: Mean 6 year 9 Critical	Measured by: Scale from: 0-100 Scale: 0-100 Based on data from: 159 patients in 2 studies.	Difference: **MD 6.68 lower** (CI 95% 10.15 lower - 3.21 lower)		**Low** Lack of blinding and no "intention to treat" analysis	Volar angular stable locking plate is better than k-wires. The difference is significant
DASH (Disabilities of the Arm, Shoulder and Hand score). [3] Follow-up: Mean 1 year 9 Critical	Measured by: Scale from 0-100 Scale: 0-100 Based on data from: 76 patients in 2 studies.	Difference: **MD 3.04 lower** (CI 95% 9.96 lower - 3.87 higher)		**Very Low** Lack of blinding, no "intention to treat" analysis, wide confidence intervals	Volar angular stable locking plate is better than k-wires. The difference is not significant

1. Scale from: 0-100
2. 0-100
3. Scale from: 0-100

7 - Cast or similar immobilising bandage time after insertion of a volar angular stable locking plate

What is the effect of short-term (less than 2 weeks) vs. long-term (more than 5 weeks) cast or similar immobilising bandage following surgery with the insertion of volar angular stable locking plate?

Patients treated with K-wires or plaster/cast or similar immobilising bandageafter reduction and patients treated with external fixation are typically immobilised for a minimum of 5 weeks. Treatment involving volar angular stable locking plates is often combined with a less restrictive regimen, where the patients are allowed to start mobilising and training after approx. 2 weeks. Concerns have been expressed as to whether this early mobilisation may lead to inadequate healing of the soft tissue and carpal bone injuries which may accompany distal radial fractures, but are rarely diagnosed acutely(53).

There has therefore been a desire to determine whether soft tissue and carpal bone injuries will heal well in case of early patient mobilisation.

Weak recommendation

Consider use of short-term cast or similar immobilising bandage(less than 2 weeks) following insertion of a volar angular stable locking plate rather than long-term cast or similar immobilising bandage(more than 5 weeks).

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
In case of identifying instability of scapholunate or distal radioulnar joints by fluoroscopy (52) after completion of the surgery, the issue should be handled according to local guidelines, possibly including consulting with a hand surgeon.

Evidence To Decision

Benefits and harms

There were no measurable beneficial effects of shortterm cast or similar immobilising bandage and no adverse effects either.

Certainty of the Evidence

The overall quality of the evidence is low. The evidence was downgraded due to differences in fracture types and the relatively short follow-up period (6 months). Since only one study is available, the quality of the evidence was downgraded due to risk of lack of accuracy.

Preference and values

The patients' preferences are expected to be roughly consistent in favour of early cast or similar immobilising bandage removal. Early cast or similar immobilising bandage removal allows for an earlier start-up of exercises and will also facilitate the daily personal hygiene.

Rationale

Rationale for recommendation
When formulating the recommendation, the working group put a significant emphasis on patient values and preferences, because it was assessed that most patients would prefer early cast or similar immobilising bandage removal and startup of mobilisation after 2 weeks rather than waiting for 5 weeks.

Clinical Question/ PICO

Population: Patients over the age of 18 with distal radius fracture cf. focused question 1, who had undergone surgery with the iinsertion of a volar angular stable locking plate

Intervention: Early mobilisation (within 14 days)

Comparator: Late mobilisation (after 5 weeks)

Summary

The evidence is based on a single randomised clinical study (54). In this study, patients were randomised to two groups. In both groups, surgery was followed by application of a conventional plaster cast for 2 weeks. After this period, one group was instructed to take off a removable cast or similar immobilising bandage daily and to do movement exercises, whereas the other group was not given a training programme and was only instructed to take off the cast or similar immobilising bandage before taking a shower. However, there was no follow-up as to whether the patients had followed the instructions.

There were no differences in the patient-related outcomes, range of movement, grip strength or X-ray findings, between the two groups. The longest follow-up period in the study was 6 months, which is less than the desired period of 12 months.

One patient with an early start of mobilisation and seven patients with a late start of mobilisation had AO group B fractures. These AO type B fractures are not included in this guideline. However, the study was included, since it was shown that these patients with AO type B fractures who had undergone surgery with the insertion of a volar angular stable locking plate did not perform poorer vs. patients with AO type C fractures (55).

The literature found did not elucidate directly any undiagnosed associated carpal injuries heal poorer in case of early mobilisation leading to problems in the long term. It did show, however, that there were no differences between the two groups as regards patient-related outcomes (DASH score) and pain.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Late mobilisation (after 5 weeks)	 Early mobilisation (within 14 days)	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
Pain - 3 months [1] Follow-up: mean 3 months 3 Not Important	Measured by: VAS Scale from: 0-10 Scale: 0-10 Lower better Based on data from: 56 patients in 1 studies.	2.4 (Mean)	2.4 (Mean) CI 95%	**Low** 8 patients had AO B type fractures and therefore did not match our population, only 1 randomised study	No difference
Pain-6 months [2] Follow-up: mean 6 months 6 Important	Measured by: VAS Scale: 0-10 Scale: 0-10 Lower better Based on data from: 54 patients in 1 studies.	1.9 (Mean)	1.5 (Mean) CI 95%	**Low** 8 patients had AO B type fractures and therefore did not match our population, only 1 randomised study, a follow-upperiod of 6 month is significantly different from 12 month which was rhe desired follow-up period in the PICO question	No difference

Outcome Timeframe	Study results and measurements	Absolute effect estimates Late mobilisation (after 5 weeks)	Early mobilisation (within 14 days)	Certainty of the Evidence (Quality of evidence)	Plain text summary
DASH (Disabilities of the Arm, Shoulder and Hand score) [3] Follow-up: Mean 3 months 9 Critical	Measured by: Scale from: 0-100 Scale: 0-100 Based on data from: 56 patients in 1 studies.	**17** (Mean)	**19** (Mean) CI 95%	**Low** 8 patients had AO B type fractures and therefore did not match our population, only 1 randomised study, a follow-upperiod of 6 month is significantly different from 12 month which was the desired follow-up period in the PICO question	No difference
DASH (Disabilities of the Arm, Shoulder and Hand score). [4] Follow-up: Mean 6 month 9 Critical	Measured by: Scale from 1 to 100 Scale: 0-100 Based on data from: 54 patients in 1 studies.	**8.1** (Mean)	**8.5** (Mean) CI 95%	**Very Low** 8 patients had AO B type fractures and therefore did not match our population, only 1 randomised study, a follow-upperiod of 6 month is significantly different from 12 month which was the desired follow-up period in the PICO question, wide confidence intervals	No differnece

1. VAS Scale (0-10)
2. VAS Scale from: 0-10
3. Scale from: 0-100
4. Scale from: 0 to 100

8 - Independent vs. supervised rehabilitation following distal radial fracture

What is the effect of independent rehabilitation based on a written training plan following a single instruction from a healthcare professional vs. rehabilitation supervised by a physiotherapist or an occupational therapist more than once?

Subsequent to distal radial fracture cast or similar immobilising bandage removal, a large part of the patients ask for rehabilitation. The rehabilitation offered varies a great deal among patient groups. In some places, the rehabilitation plan refers the patient to specialised rehabilitation (in a hospital) on a routine basis, while, elsewhere, the patient is referred to general rehabilitation (arranged by the municipality) on a routine basis. Others receive a self-training programme following instruction. Rehabilitation is quite demanding on resources due to the large number of patients. Therefore, it was considered relevant to determine whether the patient will benefit the most from independent rehabilitation based on a written training plan or rehabilitation supervised by a therapist.

In the opinion of the working group, it is within the competencies of the trained therapist to assess the suitability of specific training techniques or treatment modalities for each individual patient. Therefore, the supervised rehabilitation is not specified in details in this guideline.

Practice statement

It is good practice not to prescribe rehabilitation supervised by an occupational therapist or a physiotherapist on a routine basis to patients with uncomplicated cases. This is due to finding no difference in the effect as compared to independent rehabilitation based on a written training plan following a single instruction.

As a minimum, it is good practice to offer guidance and practical instruction concerning self-rehabilitation following distal radial fracture to all patients regardless of the treatment method.

Updating the recommendation is not considered necessary in 2017

Practical advice and special patient considerations
All patients are entitled to receive a rehabilitation plan, if rehabilitation is justified from a medical view at the time of discharge from the hospital.

Patients require instructions and knowledge of an appropriate rehabilitation programme as well as the amount of daily training and the physical load in daily activities. It is a good idea to hand out written guidance on these matters and advice on where to look for additional guidance to the patient at the time of cast or similar immobilising bandage removal.

Rehabilitation supervised by an occupational therapist or a physiotherapist specialising in rehabilitation in case of hand issues should be offered to patients with complicated cases, for example in case of major oedema, signs of incipient CRPS-related disabling reduced range of movement and/or pain.

Evidence To Decision

Benefits and harms

The treatment methods stated are not known to have caused adverse effects. However, the studies concluded that the patients' level of function will benefit from some rehabilitation.

Certainty of the Evidence

The overall quality of the evidence is very low. In general, the studies are characterised by high attrition rates, lack of blinding and wide confidence intervals. Therefore, the evidence was downgraded significantly.

Preference and values

The patients' preferences are deemed inconsistent. It is predicted that most patients will ask for rehabilitation. Some patients will ask for supervised rehabilitation, whereas others would prefer a single instruction.

Resources and other considerations

Some patients will need additional guidance as regards the amount of training during the rehabilitation period.

Rationale

Rationale for recommendation

All patients are entitled to a medical assessment of their rehabilitation needs at the time of discharge from the hospital. In case it is assessed that a patient needs rehabilitation, the patient should, as a minimum, be instructed and guided in independent rehabilitation. Rehabilitation needs will vary quite a lot among patients. However, most patients would want to be offered rehabilitation following distal radial fracture. Based on the available literature, there is no evidence that all patients should be offered supervised rehabilitation. Therefore, supervised rehabilitation training is only recommended for patients with complicated cases.

Clinical Question/ PICO

Population: Patients over the age of 18 with distal radius fracture cf. focused question 1, who had undergone surgery with the insertion of a volar angular stable locking plate

Intervention: Rehabilitation supervised by an occupational therapist or physiotherapist more than once

Comparator: Rehabilitationbased on a training programme following a single instruction form a health care professional at the time of cast or similar immobilising bandage removal

Summary

The evidence for this focused question is based on three randomised controlled studies (56-58). The topic of focused question 10 was the object of a Cochrane review (59) in 2006. The literature included is up to 30 years old and the quality of it is very low. The literature found also comprises two systematic reviews (60,61), in which some of the studies are rather old. Therefore, the working group did not include these studies, but only the more recent literature when answering the focused question.

One study focused on conservatively treated patients, and two other studies focused on patients who had undergone surgery with the insertion of a volar angular stable locking plate. The studies compared supervised rehabilitation to non-supervised rehabilitation. They differ as regards the actual interventions.

In the study (56) focusing on conservatively treated patients, the non-supervised rehabilitation was based on instruction provided twice after cast or similar immobilising bandage removal. The non-supervised rehabilitation was compared to activity-focused supervised training carried out by the patients four times on average. The actual contents of the training are not described in the study.

In one of the studies (57) focusing on operated patients, the non-supervised training was based on a home programme upon receipt of instructions and hand-out of a diary to each patient, in which he/she was to make notes about the training. The weekly duration of the training was 4.6 hours on average. This was compared to 12 times treatment supervised by a therapist chosen by the patient and comprising 1 hour of training per week. The contents of the supervised training are not described in the study. After 6 weeks and 24 weeks, there was no difference between the two groups in terms of the patient-related outcome PRWE.

In the other study focusing on operated patients (58), each patient was instructed how to exercise and train at home beyond the pain threshold by a surgeon. The surgeon also handed out wrist cast or similar immobilising bandage to be applied by the patient as needed. This was compared to the 'usual' occupational therapy. The contents and extent of this training are not described in the study.

A meta-analysis of the two studies identified no difference between non-supervised training following a single instruction and training supervised by a physiotherapist or occupational therapist in terms of PRWE and DASH after 6 weeks, 3 and 6 months. Patients with complications were not included in any of these three studies.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Rehabilitationbased on a training programme following a single	Rehabilitation supervised by an occupational therapist or physi	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
PRWE og DASH Follow-up: mean 8 weeks 6 Important	Based on data from: 118 patients in 2 studies.	Difference: **SMD 0.42 lower** (CI 95% 0.79 lower - 0.05 lower)		**Very Low** Lack of blinding and high patient attrition rate, wide confidence intervals. The recommendation will vary depending on the upper and lower limits	No difference
PRWE og DASH Follow-up: Mean 6 months 6 Important	Based on data from: 75 patients in 1 studies.	Difference: **MD 1.1 higher** (CI 95% 2.18 lower - 4.38 higher)		**Very Low** Lack of blinding and high patient attrition rate, only 1 published study	No difference
Pain [1] Follow-up: Mean 3 months 6 Important	Measured by: VAS (Scale 0-10) Scale: 0-10 Lower better Based on data from: 72 patients in 1 studies.	Difference: **MD 0.1 higher** (CI 95% 0.46 lower - 0.26 higher)		**Very Low** Lack of blinding and high patient attrition rate, wide confidence intervals. The recommendation will vary depending on the upper and lower limits, only 1 published study	No dofference
Pain Follow-up: Mean 6 months 6 Important	Measured by: VAS (Scale 0-10) Scale: 0-10 Lower better Based on data from: 76 patients in 1 studies.	Difference: **MD 0.4 lower** (CI 95% 0.22 lower - 1.02 lower)		**Very Low** Lack of blinding and high patient attrition rate, wide confidence intervals. The recommendation will vary depending on the upper and lower limits, only 1 published study	No difference
Function - 6				**Very Low**	No difference

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Rehabilitationbased on a training programme following a single	Rehabilitation supervised by an occupational therapist or physi	**Certainty of the Evidence** (Quality of evidence)	**Plain text summary**
weeks, PRWE, activity part (PRWE function) Follow-up: Mean 6 weeks 9 Critical	Based on data from: 35 patients in 1 studies.	Difference: **MD 6.8 lower** (CI 95% 25.55 lower - 11.95 higher)		Lack of blinding, uncertainty due to only one published study	
Function - 24 weeks, PRWE, activity part (PRWE function) Follow-up: mean 24 weeks 9 Critical	Based on data from: 33 patients in 1 studies.	Difference: **MD 5.1 lower** (CI 95% 24.33 lower - 14.03 higher)		**Very Low** Lack of blinding, uncertainty due to only one published study,wide confidence intervals, the recommendation will vary depending on the upper and lower limits	No difference
Pain - 6 weeks, PRWE, pain part Follow-up: Mean 6 weeks 6 Important	Based on data from: 35 patients in 1 studies.	Difference: **MD 5.5 lower** (CI 95% 23.03 lower - 12.03 higher)		**Very Low** Lack of blinding, uncertainty due to only one published study,wide confidence intervals, the recommendation will vary depending on the upper and lower limits	No difference
Pain - 24 weeks, PRWE, pain part Follow-up: Mean 24 weeks 6 Important	Based on data from: 33 patients in 1 studies.	Difference: **MD 8.4 lower** (CI 95% 27.07 lower - 10.27 higher)		**Very Low** Lack of blinding and a 19% patient attrition rate, uncertainty due to only one published study,wide confidence intervals, the recommendation will vary depending on the upper and lower limits	No difference

1. VAS (Scale 0-10)

9 - Background

The treatment of distal radial fractures has undergone a major development within the past 30 years. It has changed from being very defensive – based on the assumption that most patients would not obtain a better outcome from surgery – towards an increased willingness to perform surgery. Included is, e.g., an increased frequency of offering surgery to elderly patients aged up to 80-90 years.
The changed treatment strategy has probably been driven by the development within the speciality field and medical science in general. During the same period, the proportion of active elderly people in the Danish population has increased.
The majority of distal radial fractures are due to falls onto an outstretched arm from an upright position. There is a predominance of women among the patients due to the fact that osteoporosis is often an underlying cause.

The Danish incidence has been stable at approx. 20,000 fractures per year. Therefore, distal radial fracture is one of the most frequently treated fractures in the Danish healthcare system. The annual incidence of distal radial fracture was 1:100 in the 50+ age group during the period 2003-2013. During the same period, distal radial fracture surgery was performed in between 3,000 and 4,000 patients each year. There was a slight increase in the number of surgical interventions during this period and a simultaneous change of preferred surgical methods from the less invasive methods, including K-wires and external fixation, towards internal fixation with the insertion of plate and screws. This change has taken place gradually, along with the development and marketing of new and better implants for the more invasive methods, including anatomical plates with fixed-angle screws.

Based on the above, it was decided to review the evidence for the treatment of distal radial fracture in Denmark to provide national evidence-based recommendations for the treatment of this type of fracture.

10 - Treatment algorithm for distal radial fracture with dorsal angulation

Appendix 2: Treatment algorithm for distal radial fracture with dorsal angulation

NCG Distal radius fracture – treatment algorithm 2014

In case of suspected distal radius fracture, perform an X-ray examination of the wrist.

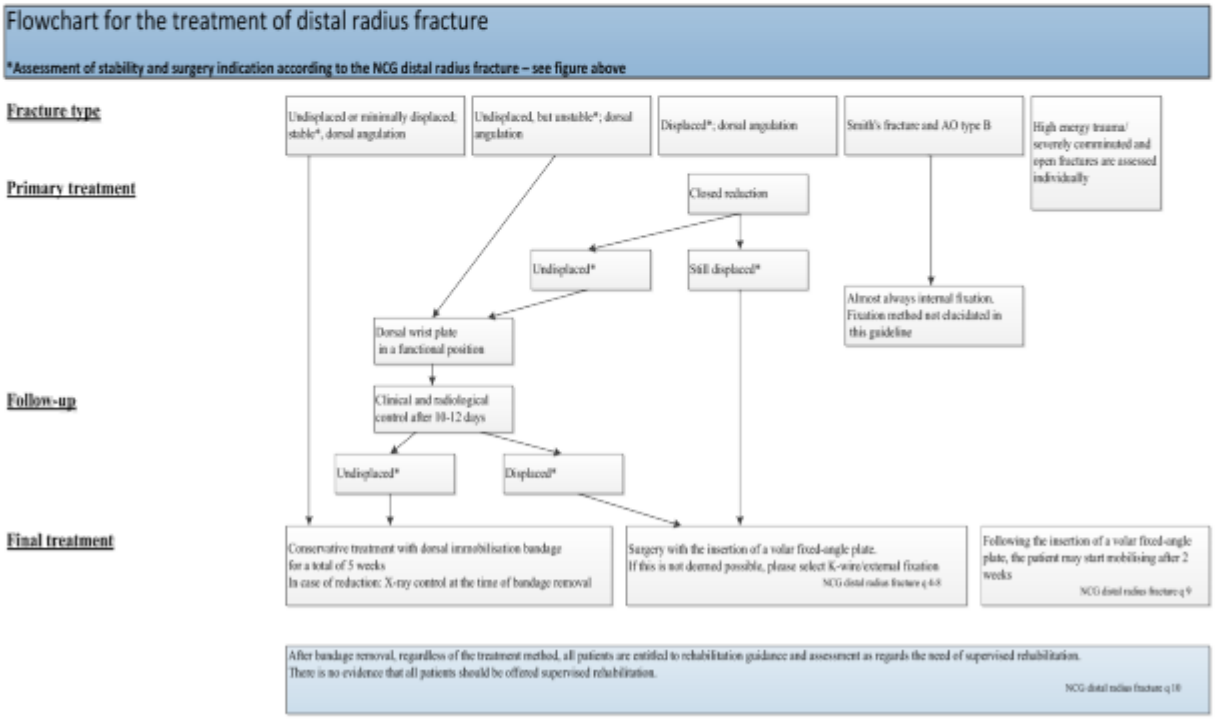
If one or more of the following conditions are met, the fracture should be considered unstable and/or displaced, which means that reduction and/or surgery is indicated:

- More than 10 degrees of dorsal angulation of the articular surface of the radius in a side view as compared to perpendicular to the longitudinal axis of the radius
- Ulnar variance of more than 2 mm
- Articular step-off of more than 2 mm
- Incongruity of the distal radioulnar joint
- Loss of substance/comminuted fracture of the dorsal cortex of the distal radius

NCG distal radius fracture q 1

If relevant following a medical assessment, perform a supplementary CT scan to clarify doubt as regards surgery indication or method.

NCG distal radius fracture q 2



11 - Radiological measuring of the radial - angle and length

Appendix 3: Radiological measuring of the radial – angle and length

Normal right wrist

Ulnar variance of 1 mm

11 degrees of volar angulation of the articular surface of the radial

12 - Implementation

The regions and the regional hospitals play an important role in facilitating the implementation of the national clinical guideline through communicating the content of the guideline and supporting the practical application of the guideline. To support application of the national clinical guideline locally, it should preferably be attuned with or integrated into process descriptions, instructions and guidelines which are already in use in clinical practice. Each regional hospital should ensure that the recommendations of relevance to departments at that hospital are incorporated into instructions and guidelines at hospital and/or department level. Additionally, individual departments may benefit from presenting the national clinical guideline at morning conferences or similar meetings or during actual teaching. Such departments are mainly emergency rooms and departments, orthopaedic surgery departments such as hand surgery units and physiotherapy/occupational therapy departments. Furthermore, it may be advantageous to include a link to the full national clinical guideline in pre-existing documents.

The professional organisations are important stakeholders as regards disseminating knowledge of the guideline, and the relevant professional organisations in connection with this guideline are the Danish Society of Radiology (DRS), the Danish Orthopaedic Society (DOS), the Danish Society for Surgery of the Hand (DSFH), the Danish Orthopaedic Society for Traumatology (DOT), the Danish College of General Practitioners (DSAM), the former Danish Society of Occupational Hand Therapy (Ergoterapifagligt Selskab for Håndterapi), the Danish Society of Physiotherapy (DSF), the Danish Nursing Society (DASYS), the Danish Society of Orthopaedic Surgery Nurses (FSOS, Fagligt Selskab for Ortopædkirurgiske Sygeplejersker) and the Danish Association of Nurses Working in Emergency Rooms (Sammenslutningen af sygeplejersker, der arbejder i akutmodtagelser). The working group, therefore, suggests to mention the national clinical guideline on the websites of the relevant professional organisations, including a description of the implications of it for the professional group in question and with a link to the full version of the guideline. Also, the working group suggests to present the guideline at annual meetings and theme days and to communicate information via professional magazines and electronic newsletters.

The professional organisations are represented in the working group, and the individual members will support this implementation process in their respective organisations.

As a starting point, implementation of the national clinical guideline on the treatment of distal radial fractures is a regional responsibility.

In addition to publication of the full guideline, it has been decided to publish a quick guide which is a short version of 1-2 A4 pages. It only contains the guideline recommendations and key messages with specification of evidence rating and strength of the recommendations in pictograms.

The DHA has published a digital implementation toolbox at its website. The toolbox is meant to assist the manager or project manager who is to work on implementing national clinical guidelines locally. The toolbox contains an implementation model and tools for the implementation and is based on a review of the evidence of the effect of interventions.

13 - Monitoring

The work on this national clinical guideline was initiated due to a shift in treatment methods and major variations among hospitals and regions as regards the willingness to perform surgery. Furthermore, the practice as regards rehabilitation varies considerably. The guideline recommendations are expected to address these challenges. In the opinion of the working group, the most important expected results or effects to which this guideline is to contribute are:

- More consistent practice across hospitals and regions as regards the willingness to perform surgery
- More consistent practice across hospitals and regions as regards the type of surgical method. The use of internal fixation with a volar angular stable locking plate is expected to increase
- More consistent practice as regards rehabilitation.

Consistent practice: Willingness to perform surgery

The frequency of surgery in case of distal radial fracture varies significantly among regions and hospitals. In some departments, a large part of the patients with distal radial fracture are operated, whereas other departments exercise caution as regards the use of surgical treatment and tend to prefer conservative treatment. Therefore, this guideline is expected to result in a more consistent practice. This can be monitored based on extracts from the Danish National Patient Registry (LPR) at specified intervals such as four times per year.

A more consistent practice may reflect a tendency towards following the guideline recommendations in relation to indicating surgery – and possibly supplementary CT scan – in practice. In addition, this is expected to result in offering optimal treatment to the patients so that, in the long term, patients with wrist fractures will experience fewer complications and obtain the best possible functional capacity.

Consistent practice: Treatment method

The other reason for initiating the work on this guideline was the shift, over the past 10 years, as regards the preferred surgical method towards osteosynthesis with a volar angular stable locking plate rather than external fixation – without sufficient support from the literature in this field. A key message in the guideline is that osteosynthesis with a volar angular stable locking plate is generally recommended rather than K-wires and external fixation, since the patient-related effects in terms of DASH and PRWE are significantly better for the osteosynthesis method. Therefore, it is relevant to monitor whether osteosynthesis with a volar angular stable locking plate will be the most preferred surgical method in future. This can be assessed based on extracts from the Danish Fracture Database and the LPR, for example four times per year. Furthermore, when the recommendation is followed, patients with wrist fractures are expected to experience fewer complications and obtain the best possible functional capacity.

Consistent practice: Rehabilitation

The guideline recommendations in relation to rehabilitation are based on consensus among the members of the working group concerning good clinical practice, since the existing literature does not provide evidence for supervised rehabilitation vs. a single instruction for uncomplicated cases.

Therefore, it may be relevant to monitor whether the patients are offered rehabilitation, the type of it and whether they complete it.

Danish Fracture Database

The working group draws attention to the Danish Fracture Database – a new database under development, which is popular among clinicians. This database allows to monitor the type of surgical method used and the time of surgery. In

future, it may be possible to pool data from this database with data from the LPR and possibly patient-reported data.

For example, it might be interesting to monitor:

- the complication rate, including the number of re-operations, in relation to the time of surgery
- the correlation between the number of operations and the time of surgery, including within the first 24 hours, and whether the number of operations increases if monitored after more than 10 days (the time of control for conservatively treated fractures)

Ongoing monitoring and feedback

The working group also draws attention to the possibility of campaign measurements, in which wrist fractures are brought into focus during (a few) specific weeks of the year, e.g. during medical record audit, and where the patients are followed up at a specific time following the occurrence of a wrist fracture and where their level of function is assessed. This will enable focused, real-time and local monitoring which, in general, promotes implementation. It also enables obtaining data that may be used for research into the development of the patients' level of function.

14 - Update and further research

As a starting point, a decision will be made on the need for updating every three years from the date of publication, unless new evidence or the technological development in this field justifies otherwise.

Sub-field 1: Rehabilitation following distal radial fracture.

Based on the work on this guideline, the working group finds that there is an extensive need for further research into the need for and effect of various rehabilitation programmes, including occupational therapy and physiotherapy. Likewise, it remains unclear whether rehabilitation needs vary according to type of treatment, and whether patient age, comorbidities and complications should influence on the rehabilitation offered.

There is a need to identify the preferred components of supervised rehabilitation, since lack of this information is one of the weaknesses of the currently available studies concerning this topic.

Sub-field 2: National monitoring project in the form of a cohort study.

As part of the monitoring of the effect of this guideline, the working group recommends national focus weeks of a duration of 2-3 weeks for nationwide collection of data on patients with distal radial fracture. Such cohort would be very suitable for investigating whether delay of the surgery, after deciding that surgery is indicated, impacts on the final outcome for the patients in terms of Quick DASH, DASH and/or PRWE(12,62). Also, it would be possible to test many of the patient preferences stated in this guideline with a view to updating future revisions of this guideline according to the results. The special groups of elderly patients and patients with a low level of function who have not been studied in the available literature could be described with a national cohort study.

A national cohort study would be of major professional interest, since it would be able to provide results unaffected by the inclusion and exclusion criteria that always limit the results from randomised controlled studies.

15 - Description of the method used

The national clinical guideline on the treatment of distal radial fractures was prepared by a working group established by the DHA with representatives from relevant specialities and professions. In a number of meetings, the working group delimited and clarified 10 key focused questions ('PICO' questions).

This national clinical guideline was prepared following the method described in detail in the DHA's NCG method guide (in Danish only).

Initially, the working group identified the pre-existing guidelines in this field. The group identified two national guidelines in this field, an American guideline from the AAOS(7) and a Norwegian guideline from the Norwegian Knowledge Centre for the Health Services in Oslo, Norway(63). However, based on an AGREE II assessment of quality and relevance none of these guidelines were deemed suitable for answering the questions asked directly.

This was followed by a systematic literature search for systematic survey articles and a second search for randomised clinical studies dated 2003 and onwards. Studies matching the population selected and the focused questions were selected and validated using AMSTAR for the assessment of systematic survey articles and Cochrane's tool for the assessment of Risk of Bias for the randomised controlled studies. Bias in diagnostic studies was assessed using the tool QUADAS II. Where necessary, a few supplementary meta-analyses were made using Review Manager. Where possible, profiles of the overall evidence for the individual PICO questions were prepared. Please refer to Appendix 11 for further details.

The initial searches identified no literature to support the individual questions. This was the case for PICO 1-3. Therefore, for these questions, it was decided to extend the search back to 1983 and to search for follow-up studies as well. Appendix 10 includes a detailed description of the literature search.

During the work on preparing the guideline, the process and the recommendations were presented to and discussed with a broad-based reference group, and a draft guideline was subjected to a wide public consultation.

The members of the working group and the reference group are listed in Appendix 12.

16 - Focused questions

The working group weighted the various outcomes as Critical (C), Important (I), less important (-), adverse reactions (A). This weighting was used in GRADE profiles when preparing the Summary of findings (SoF) tables.

Focused question 1: Is there any evidence that one or more of the radiological parameters below, assessed during wrist X-ray examination, may be used as the basis for deciding on a reduction and/or surgery indication?

Population
Patients over the age of 18 with distal radial fracture as identified during wrist X-ray examination and with one or more of the following findings prior to reduction

- More than 10 degrees of dorsal angulation of the articular surface of the radial in a side view as compared to perpendicular to the longitudinal axis of the radial
- Intra-articular step-off or diastasis of more than 2 mm
- Ulnar variance of more than 3 mm
- Incongruity of the distal radioulnar joint
- Loss of substance of the dorsal cortex

Intervention/index test
Treatment using K-wire, external fixation, ORIF and volar angular stable locking plate or stable reduction (which is still in position at a control after 12-14 days)

Comparison/reference standard
Conservative treatment with plaster or another immobilising material (no further intervention)

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
- Return to work (I)
- Movement (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

Focused question 2: How is a surgery indication affected by supplementary CT scan following conventional wrist X-ray examination?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1

Intervention/index test
CT-scan performed following conventional wrist X-ray examination

Comparison/reference standard
Wrist X-ray examination

Outcome [indicate whether the outcome is important or critical]
- Wrist X-ray examination
- Changed treatment indication (C)
- Changed fracture classification (AO
- and others) (I)
- No adverse reactions

Focused question 3: What is the effect and what are the risks of surgery within the first 48 hours vs. more than 48 hours after deciding that surgery is indicated for a distal radial fracture?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1

Intervention/index test
Surgery within the first 48 hours after deciding that surgery is indicated

Comparison/reference standard
Surgery more than 48 hours after deciding that surgery is indicated

Outcome (measured after 3 and 12 months)

• DASH/PRWE (C)
• Pain (VAS) (I)
• Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
• Return to work (I)
• Movement (-)
• Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
• CRPS (A)
• Finger stiffness (A)

Focused question 4: What is the effect and what are the risks of conservative treatment with reduction and plaster/cast or similar immobilising bandage vs. Kwire

surgery (Kapandji or Willenegger technique)?

Do special circumstances apply to patients with a low level of function or to patients over the age of 65?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 as well as patients over the age of 65 and patients with a low level of function (not able to go shopping without assistance)

Intervention/index test
K-wire surgery (Kapandji or Willenegger technique)

Comparison/reference standard
Conservative treatment (closed reduction and plaster or similar immobilising material)

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
- Return to work (I)
- Movement (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

Focused question 5: What is the effect and what are the risks of conservative treatment with reduction and plaster/cast or similar immobilising bandage vs. surgical treatment comprising bridging external fixation with or without supplementary K-wires?

Do special circumstances apply to patients with a low level of function or to patients over the age of 65?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 as well as patients over the age of 65 and patients with a low level of function (not able to go shopping without assistance)

Intervention/index test
Surgery with bridging external fixation

Comparison/reference standard
Conservative treatment (closed

reduction and plaster or similar immobilising material)

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
- Return to work (I)
- Movement (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

Focused question 6: What is the effect and what are the risks of conservative treatment with reduction and plaster vs. surgery with internal fixation and a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function or to patients over the age of 65?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 as well as patients over the age of 65 and patients with a low level of function (not able to go shopping without assistance)

Intervention/index test
Surgery with ORIF and insertion of a volar angular stable locking plate

Comparison/reference standard
Conservative treatment (closed reduction and plaster or similar immobilising material)

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
- Return to work (I)
- Movement (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

Focused question 7: What is the effect and what are the risks of surgery comprising bridging external fixation, possibly supplemented with K-wires, vs. open surgery with reduction and insertion of a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function or to patients over the age of 65?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 as well as patients over the age of 65 and patients with a low level of function (not able to go shopping without assistance)

Intervention/index test
Surgery with bridging external fixation

Comparison/reference standard
Surgery with ORIF and insertion of a volar angular stable locking plate

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
- Return to work (I)
- Movement (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

Focused question 8: What is the effect and what are the risks of K-wire surgery vs. open reduction and internal fixation with a volar angular stable locking plate?

Do special circumstances apply to patients with a low level of function or to patients over the age of 65?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 as well as patients over the age of 65 and patients with a low level of function (not able to go shopping without assistance)

Intervention/index test
K-wire surgery (Kapandji or Willenegger technique)

Comparison/reference standard
Surgery with ORIF and insertion of a volar angular stable locking plate

Outcome (measured after 3 and 12 months)
• DASH/PRWE (C)
• Pain (VAS) (I)
• Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
• Return to work (I)
• Movement (-)
• Median, ulnar, radial nerve affection (A)
• Tendon injury (A)
• CRPS (A)
• Finger stiffness (A)

Focused question 9: What is the effect of short-term (less than 2 weeks) vs. longterm (more than 5 weeks) cast or similar immobilising bandagefollowing surgery with the insertion of a volar angular stable locking plate?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 and treated with ORIF and insertion of a volar angular stable locking plate

Intervention/index test
Postoperative cast or similar immobilising bandage time < 2 weeks

Comparison/reference standard
Postoperative cast or similar immobilising bandage time >/= 5 weeks

Outcome (measured after 3 and 12 months)
• DASH/PRWE (C)
• Pain (VAS) (I)
• Re-operation due to complication (non-simple removal of osteosynthesis material) (I)
• Return to work (I)
• Movement (-)
• Median, ulnar, radial nerve affection (A)
• Tendon injury (A)
• CRPS (A)
• Finger stiffness (A)

Focused question 10: What is the effect of independent rehabilitation based on a written training plan following a single instruction from a healthcare professional vs. rehabilitation supervised by a physiotherapist or an occupational

therapist more than once?

Population
Patients over the age of 18 diagnosed with DRF cf. PICO 1 and treated with either conservative treatment, K-wire osteosynthesis, bridging external fixation or ORIF with insertion of a volar angular stable locking plate

Intervention/index test
Rehabilitation supervised by a physiotherapist or an occupational therapist more than once – after cast or similar immobilising bandage removal

Comparison/reference standard
Independent rehabilitation based on a written training plan following a single instruction from a healthcare professional after cast or similar immobilising bandage removal

Outcome (measured after 3 and 12 months)
- DASH/PRWE (C)
- Pain (VAS) (I)
- Movement (I)
- Return to work (I)
- Re-operation due to complication (non-simple removal of osteosynthesis material) (-)
- Median, ulnar, radial nerve affection (A)
- Tendon injury (A)
- CRPS (A)
- Finger stiffness (A)

17 - Description of the strength and implications of the recommendations

Presented below are, firstly, the four types of recommendations to be used in case of evidence and, afterwards, the recommendations which may be given for questions for which the systematic search showed that there was no evidence.

The four types of evidence-based recommendations
A recommendation can be either for or against a given intervention. A recommendation can be either strong or weak/conditional. Therefore, the following four types of recommendations are available:

Strong recommendation for ↑↑
Give/use …

The DHA makes a strong recommendation for in case of high-quality evidence showing that the desirable consequences of an intervention clearly outweigh its undesirable consequences.

The following will point in the direction of a strong recommendation for:
• High-quality evidence
• High intended effect and few, if any, unintended adverse effects of the intervention
• The patients' values and preferences are well-known and consistent in favour of the intervention

Implications:
• Most patients would want the intervention.
• The vast majority of clinicians would prescribe the intervention.

Weak/conditional recommendation for ↑
Consider …

The DHA makes a weak/conditional recommendation for when the desirable consequences of an intervention are judged to marginally outweigh its undesirable consequences or when the available evidence cannot rule out a significant benefit of an existing practice if the adverse effects of the latter are judged to be few or absent.

The following will point in the direction of a weak recommendation for:
• Low-quality evidence
• The intended effect of the intervention is assessed to marginally outweigh the unintended adverse effects
• Preferences and values vary significantly among patients or are unknown

Implications:
• Most patients would want the intervention, but a substantial number would not
• The clinicians will need to help the patient make a decision that matches the patient's values and preferences.

Weak/conditional recommendation against ↓
Use only … upon due consideration, since the beneficial effect is uncertain and/or low and there are documented adverse effects such as …

The DHA makes a weak/conditional recommendation against when the undesirable consequences of an intervention are judged to outweigh its desirable consequences

and this is unsupported by strong evidence. This recommendation is also made in case of strong evidence of both beneficial and adverse effects when the balance between them is difficult to determine.

The following will point in the direction of a weak recommendation against:
• Low-quality evidence
• Uncertain effect of the intervention
• Uncertain adverse effects of the intervention
• The unintended adverse effects of the intervention are assessed to marginally outweigh the intended effect
• Preferences and values vary significantly among patients or are unknown

Implications:
• Most patients would not want the intervention, but a certain number would
• The clinicians will need to help the patient make a decision that matches the patient's values and preferences.

Strong recommendation against ↓↓
Do not give/do not use/avoid …

The DHA makes a strong recommendation against in case of high-quality evidence showing that the undesirable consequences of an intervention clearly outweigh its desirable consequences. The DHA also makes a strong recommendation against when the review of the evidence shows with great certainty that an intervention is useless.

The following will point in the direction of a strong recommendation against:
• High-quality evidence
• The intended effect of the intervention is low
• Some or significant unintended adverse effects of the intervention
• The patients' values and preferences are well-known and consistent against the intervention

Implications:
• Most patients would not want the intervention.
• Clinicians would typically not prescribe the intervention.

The two types of good practice recommendations

Good practice √
For:
It is good practice to …

Against:
It is not good practice to …
It is not good practice, on a routine basis, to …
It is good practice to avoid …
It is good practice to avoid, on a routine basis, …

Good practice based on professional consensus among the members of the working group that prepared the clinical guideline. The recommendation may be either for or against the intervention. A good practice recommendation is made when relevant evidence is not available.

18 - Search description

The literature searches were performed in a predefined group of databases selected for search for clinical guidelines in general. For a detailed description, please see the DHA's NCG method guide (in Danish only). The searches were performed by the Medical Library, Aalborg University Hospital, by Conni Skrubbeltrang in collaboration with special subject adviser Camilla Ryge. Search protocols with the search strategies for the individual databases are available via sst.dk (in Danish only).

An initial search for clinical guidelines was performed in the following sources of information: the Guidelines International Network (G-I-N), NICE (UK), the National Guideline Clearinghouse, the Scottish Intercollegiate Guidelines Network (SIGN), the HTA database, the Cochrane Library, the SBU (Sweden), the Swedish National Board of Health and Welfare, the Norwegian Directorate of Health, the Norwegian Knowledge Centre for the Health Services, Medline and Embase.

The searches were performed during the period January to May 2014 and comprised a total of five searches. As a starting point, the searches focused on literature published during the period 2003 to 2014. In case a search did not identify relevant literature within this 10-year period, it was extended to older literature. The date ranges appear from the search protocols.

The first search was for international guidelines published during the period 2003 to 2014. The second search was a follow-up search for meta-analyses and systematic reviews. The third search was an additional follow-up search for randomised controlled studies. In a fourth search, the third search was extended back to 1983 for PICO 1 and 3, and in a fifth search it was extended to comprise follow-up studies or cohort studies as well.

The literature identified in searches was supplemented by known literature from other sources, primarily for use in the Reference list of background literature.

The search for guidelines included the following search terms:
English: distal radial fracture*, distal radial fracture* Colles fracture*, Barton fracture*, Smith fracture* fractura radii (distralis), wrist fracture, Colles' fracture, radial fractures.

Danish: distale radial frakturer, håndledsnære underarmsbrud, håndledsbrud, Colles frakturer.

Norwegian: distale radial frakturer, distal radial fraktur, distale radial, håndleddsbrudd, Colles fraktur, fractura Collesi.

Swedish: Colles fraktur, fraktura Collesii, distala radial frakturen, distala radial frakturer, underarmsfraktur, handledsfraktur, handledsbrott.

For the follow-up searches, the list of search terms is very long, and reference is therefore made to the search protocols.

Inclusion criteria:
Years of publication: The past 10 years (2003 through April 2014), for supplementary searches 1983-2002.

Languages: English, Danish, Norwegian and Swedish

Document types: Guidelines, clinical guidelines, meta-analyses, systematic reviews, randomised controlled studies, follow-up studies and cohort studies.

Figure 1: Background search: Clinical guidelines and Cochrane reviews

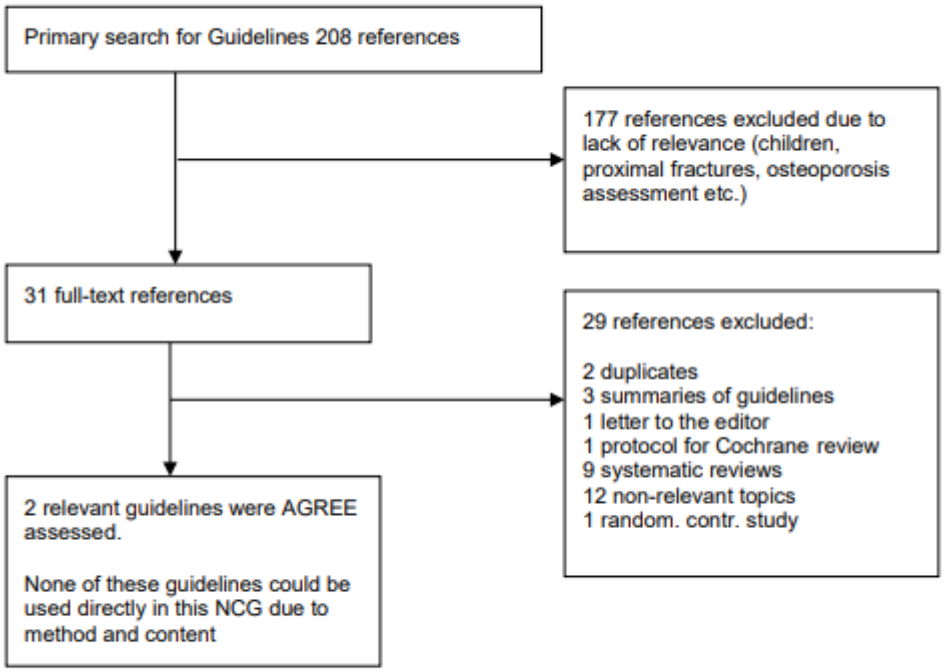


Figure 2: Secondary literature: Follow-up systematic reviews and meta-analyses

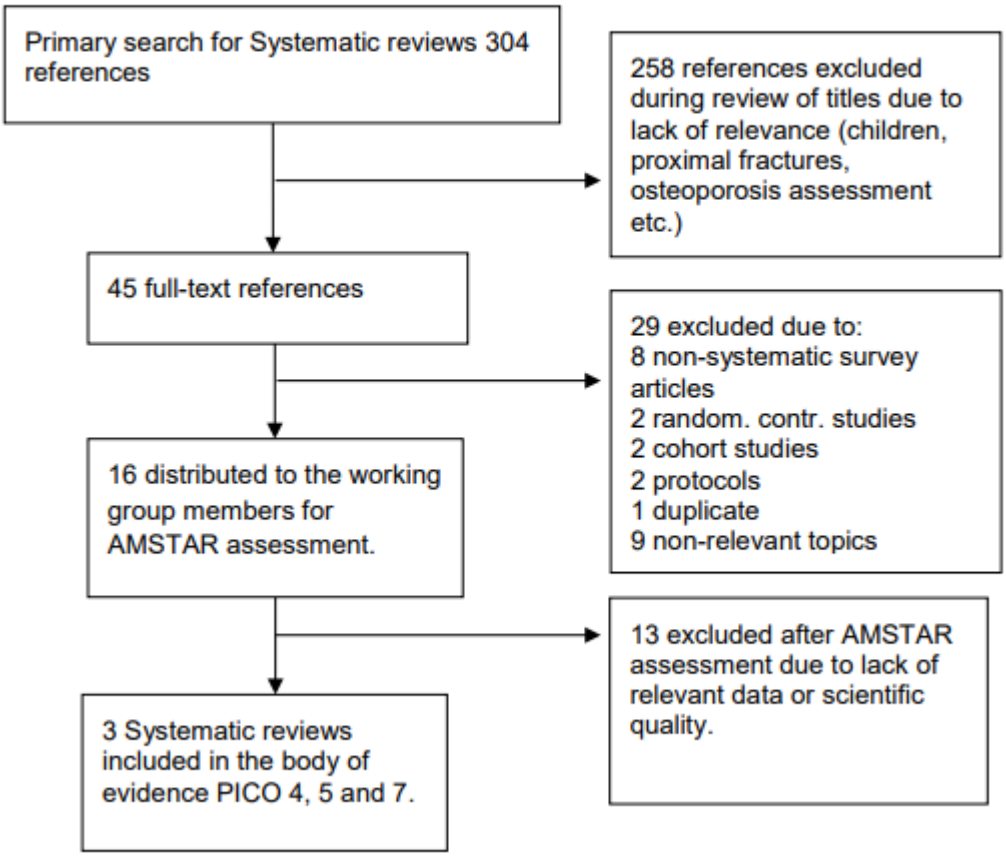


Figure 3: Follow-up search for randomised controlled studies

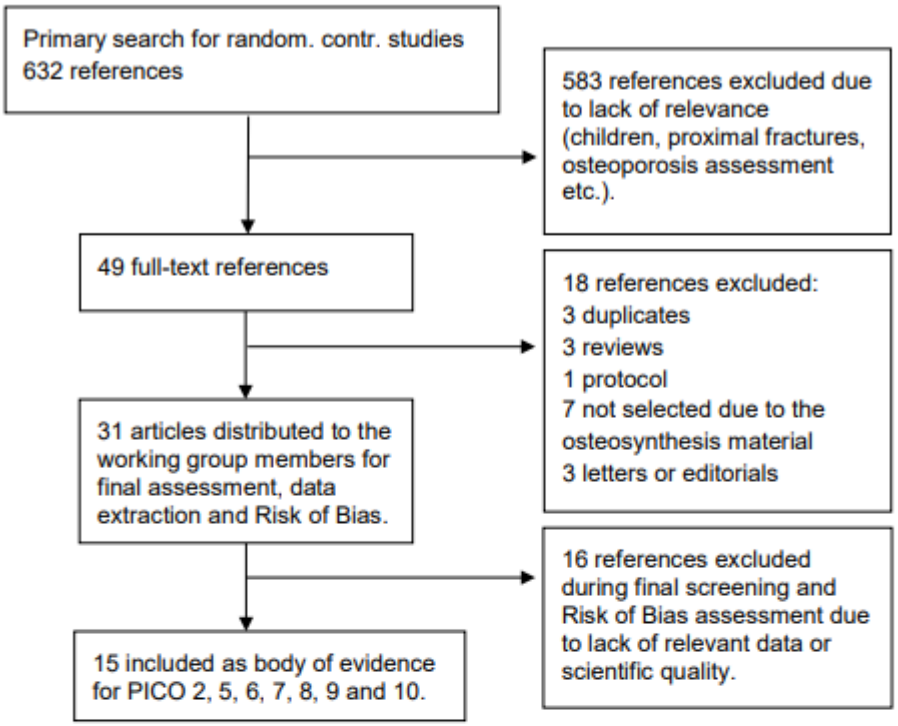


Figure 4: Extended follow-up search for randomised controlled studies

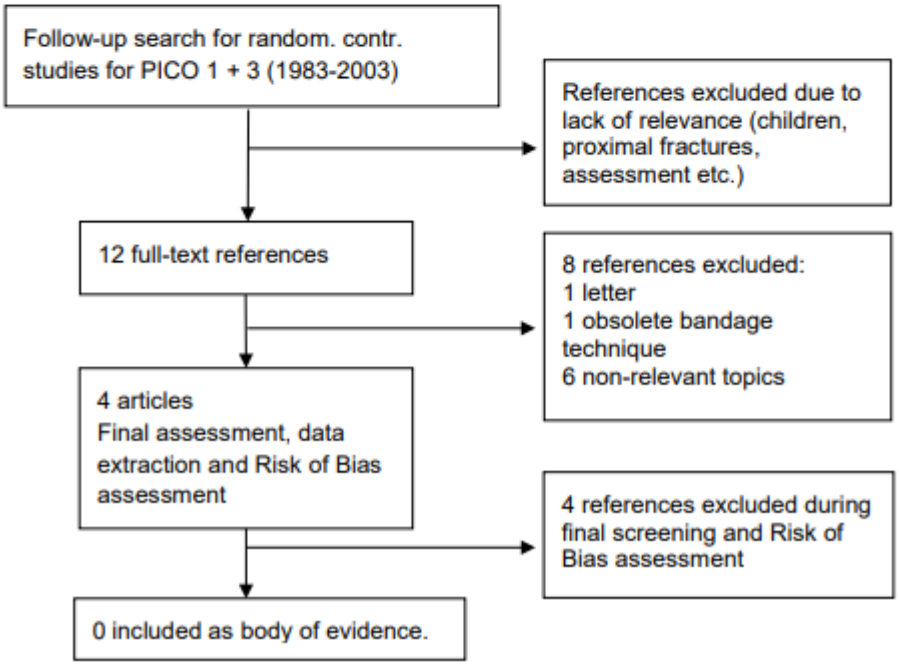
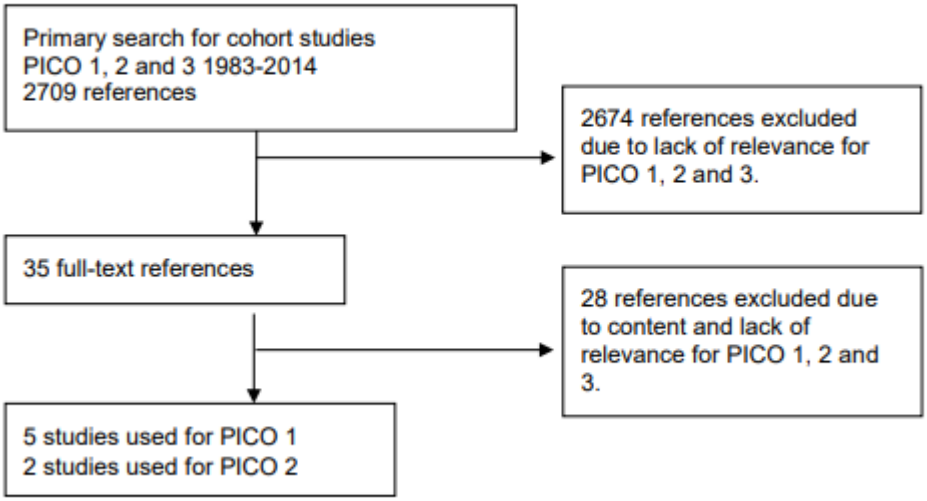


Figure 5: Extended follow-up search for cohort studies



19 - Assessment of evidence

The working group's AGREE assessments of guidelines are available here (in Danish only).

The working group's AMSTAR assessments of guidelines are available here (partially in English).

Evidence profiles are available here (partially in English).

Overview of primary studies with associated risk of bias assessments are available here (partially in English).

20 - Working group and reference group

The working group
The working group that prepared the national clinical guideline on the treatment of distal radial fractures consists of the following persons:

• Peter Frandsen (chairman), medical consultant, the Danish Health Authority

• Nanna Salling, staff doctor, Department of Orthopaedic Surgery, Herlev Hospital, appointed by the Danish Orthopaedic Society for Traumatology

• Thomas Sandholdt Andreasen, staff doctor, Department of Orthopaedic Surgery, Odense University Hospital, appointed by the Danish Orthopaedic Society for Traumatology

• Anders Ditlev Foldager-Jensen, consultant doctor, Department of Orthopaedic Surgery, Aarhus University Hospital, appointed by the Danish Society for Surgery of the Hand

• Hans Tromborg, consultant doctor, Department of Orthopaedic Surgery, Odense University Hospital, appointed by the Danish Society for Surgery of the Hand

• Anette Skjold Sørensen, occupational therapist, Department of Rehabilitation, Odense University Hospital, appointed by the Danish Association of Occupational Therapists

• Kirsten Krabsen, clinical nurse specialist, Emergency Department, Viborg Regional Hospital, Regional Hospital Central Jutland, appointed by the Danish Nursing Society

• Anette Pedersen, charge nurse, Department of Orthopaedic Surgery, Aalborg University Hospital, appointed by the Danish Nursing Society

• Claus Munk Jensen, chief consultant doctor, Department of Orthopaedic Surgery, Gentofte Hospital, appointed by the Danish Orthopaedic Society

• Karen-Lisbeth Bay Dirksen, consultant doctor, Diagnostic Imaging Department, Nordsjællands Hospital, appointed by the Danish Society of Radiology

• Trine Torfing, speciality responsible, consultant doctor, Department of Radiology, Odense University Hospital, appointed by the Danish Society of Radiology

• Ynse de Boer, general practitioner, Lægerne i Vestergade Helsinge (the general practitioners in Vestergade, Helsinge, Denmark), appointed by the Danish College of General Practitioners

• Josef M. Andersen, physiotherapist in private practice, FysioConsultCopenhagen, appointed by the Danish Society of Physiotherapy

Conflicts of interest
Any person who works within public administration and has a personal interest in the outcome of a specific case may not participate in any processing of that case. If

a person has conflicting interests, there is a risk that he or she may not provide an independent assessment of a given case. Declaration of interest forms for all the working group members are available here (in Danish only).

The reference group
The reference group was appointed by regions, municipalities, patient organisations and other relevant stakeholders in this field, and its assignment has been to comment on the delimitation of and the professional content of the guideline.

The reference group in connection with the national clinical guideline on the treatment of distal radial fractures consists of the following persons:

• Peter Frandsen (chairman), medical consultant, the DHA

• Benn Duus, chief consultant doctor, Department of Orthopaedic Surgery, Bispebjerg Hospital, appointed by the Capital Region of Denmark

• Ulrich Jensen, chief consultant, the health staff, Region of Southern Denmark, appointed by the Region of Southern Denmark

• Christian Pedersen, chief consultant doctor, Speciality of Orthopaedic Surgery, Aalborg University Hospital, appointed by the North Denmark Region

• Torben Bæk Hansen, professor, chief consultant doctor, Department of Orthopaedic Surgery, Regional Hospital Holstebro, appointed by the Central Denmark Region

• Jesper Ryg, specialist registrar, Department of Geriatric Medicine, Odense University Hospital, appointed by the Danish Geriatric Society

• Elna Kæstel, Head of Centre, Orthopaedic Rehabilitation Centre, City of Aarhus, appointed by the Local Government Denmark

• Bente Langdahl, professor, consultant doctor, Department of Endocrinology and Internal Medicine, Aarhus University Hospital, appointed by the Danish Osteoporosis Society

• Kasper Ø. Nielsen, Head of Section, the Danish Ministry of Health, appointed by the Danish Ministry of Health

Secretariat
The secretariat for both groups:
• Malene Kristine Nielsen (project manager), Head of Section, the Danish Health Authority

• Camilla Ryge, special subject adviser, the Danish Health Authority

• Annette de Thurah, method consultant, the Danish Health Authority

• Conni Skrubbeltrang, search specialist, the Danish Health Authority

• Annette Wittrup Schmidt, Head of Section, the Danish Health Authority

Peer review and public consultation
Prior to publication, the national clinical guideline on the treatment of distal

radial fractures was submitted for consultation among the following parties:
- the Danish Trade Association for Private Hospitals and Clinics
- the Danish Orthopaedic Society for Traumatology
- the Danish Orthopaedic Society
- the Danish Society of Radiology
- the Danish College of General Practitioners
- the Danish Society of Physiotherapy
- the Danish Geriatric Society
- the Danish Society for Surgery of the Hand
- the Danish Nursing Society
- the Danish Regions
- the Danish Association of Occupational Therapists
- the Local Government Denmark
- the Danish Ministry of Health
- the Danish Osteoporosis Society

During the same period of time, the guideline was peer reviewed by:
- Per Hølmer, consultant doctor, Nordsjællands Hospital and the Copenhagen University Hospital
- Hebe Kvernmo, professor, Tromsø University Hospital, Norway

21 - Abbreviations and concepts

CRPS Complex Regional Pain Syndrome

CT Computer Tomography

DASH Disabilities of the Arm, Shoulder and Hand – a validated tool for measuring the overall patient-experienced function of the arm, shoulder and hand

DRF Distal Radial Fracture – wrist fracture

LPR The Danish National Patient Registry

ORIF Open Reduction Internal Fixation – an abbreviation for open surgical treatment comprising realignment of the bone fracture into the normal position and fixation with a plate on the bone to keep the fracture stable

PICO Population Intervention Comparator Outcome

PROM Patient Reported Outcome Measures

PRWE Patient Rated Wrist Evaluation – a validated tool for measuring the patient-experienced function of the wrist

SF-36 Short Form 36 – a validated tool for measuring the patientexperienced quality of life

SoF Summary of Findings tables

VAS Visual Analogue Scale – scale for quantification of pain

22 - Reference list

(1) Ploegmakers JJW, Mader K, Pennig D, Verheyen CCPM. Four distal radial fracture classification systems tested amongst a large panel of Dutch trauma surgeons. Injury 2007;38(11):1268-72.

(2) van Leerdam R,H., Souer JS, Lindenhovius ALC, Ring DC. Agreement between Initial Classification and Subsequent Reclassification of Fractures of the Distal Radius in a Prospective Cohort Study. Hand 2010;5(1):68-71.

(3) Dansk Endokrinologisk Selskab. NBV: Osteoporose. : Dansk Endokrinologisk Selskab, 2013.

(4) Sundhedsstyrelsen. Faldpatienter i den kliniske hverdag : rådgivning fra Sundhedsstyrelsen. Kbh. : Sundhedsstyrelsen, 2006.

(5) Kwok IHY, Leung F, Yuen G. Assessing results after distal radius fracture treatment: a comparison of objective and subjective tools. Geriatr orthop surg rehabil 2011;2(4):155-60.

(6) Sorensen AA, Howard D, Tan WH, Ketchersid J, Calfee RP. Minimal clinically important differences of 3 patient-rated outcomes instruments. Journal of Hand Surgery - American Volume 2013;38(4):641-649.

(7) American Academy of Orthopaedic Surgeons (AAOS). American Academy of Orthopaedic Surgeons clinical practice guideline on the treatment of distal radius fractures. Rosemont (IL) : American Academy of Orthopaedic Surgeons (AAOS), 2009 (NGC:007579).

(8) Mackenney PJ, McQueen MM, Elton R. Prediction of instability in distal radial fractures. Journal of Bone and Joint Surgery - Series A 2006;88(9):1944-1951.

(9) Lutz M, Arora R, Krappinger D, Wambacher M, Rieger M, Pechlaner S. Arthritis predicting factors in distal intraarticular radius fractures. Arch Orthop Trauma Surg 2011;131(8):1121-6.

(10) Catalano LW3, Cole RJ, Gelberman RH, Evanoff BA, Gilula LA, Borrelli JJ. Displaced intra-articular fractures of the distal aspect of the radius. Long-term results in young adults after open reduction and internal fixation. J Bone Joint Surg Am 1997;79(9):1290-302.

(11) Wilcke MKT, Abbaszadegan H, Adolphson PY. Patient-perceived outcome after displaced distal radius fractures. A comparison between radiological parameters, objective physical variables, and the DASH score. J Hand Ther 2007;20(4):290-299.

(12) Abramo A, Kopylov P, Tagil M. Evaluation of a treatment protocol in distal radius fractures: a prospective study in 581 patients using DASH as outcome. Acta Orthop 2008;79(3):376-85.

(13) Harness NG, Ring D, Zurakowski D, Harris GJ, Jupiter JB. The influence of three-dimensional computed tomography reconstructions on the characterization and treatment of distal radial fractures. Journal of Bone and Joint Surgery - Series A 2006;88(6):1315-1323.

(14) Arora S, Grover SB, Batra S, Sharma VK. Comparative evaluation of postreduction intra-articular distal radial fractures by radiographs and multidetector computed tomography. Journal of Bone and Joint Surgery - Series A 2010;92(15):2523-2532.

(15) Hunt JJ, Lumsdaine W, Attia J, Balogh ZJ. AO type-C distal radius fractures: the influence of computed tomography on surgeon's decision-making. ANZ J Surg 2013 Sep;83(9):676-678.

(16) Biswas D, Bible JE, Bohan M, Simpson AK, Whang PG, Grauer JN. Radiation exposure from musculoskeletal computerized tomographic scans. J Bone Joint Surg Am 2009 Aug;91(8):1882-1889.

(17) Handoll HH, Vaghela MV, Madhok R. Percutaneous pinning for treating distal radial fractures in adults. Cochrane Database Syst Rev 2007(3):CD006080.

(18) 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):837-840.

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

(20) Rodriguez-Merchan E. 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.

(21) 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.

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

(23) 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.

(24) Stoffelen DV, Broos PL. Kapandji pinning or closed reduction for extraarticular distal radius fractures. J Trauma 1998;45(4):753-7.

(25) Handoll Helen HG, Huntley James S, Madhok R. External fixation versus conservative treatment for distal radial fractures in adults. Cochrane Database of Systematic Reviews 2007(3):CD006194.

(26) Foldhazy Z, Leif A. External fixation versus closed treatment of displaced distal radial fractures in elderly patients: A randomized controlled trial. Current Orthopaedic Practice 2010;21(3):288-295.

(27) ur Rahman O, Khan MQ, Rasheed H, Ahmad S. Treatment of unstable intraarticular fracture of distal radius: POP casting with external fixation. JPMA J Pak Med Assoc 2012;62(4):358-362.

(28) Roumen RM, Hesp WL, Bruggink ED. Unstable Colles' fractures in elderly patients. A randomised trial of external fixation for redisplacement. J Bone Joint Surg Br 1991;73(2):307-11.

(29) Stein H, Volpin G, Horesh Z, Hoerer D. Cast or external fixation for fracture of the distal radius. A prospective study of 126 cases. Acta Orthop Scand 1990;61(5):453-456.

(30) Howard PW, Stewart HD, Hind RE, Burke FD. External fixation or plaster for severely displaced comminuted Colles' fractures? A prospective study of anatomical and functional results. J Bone Joint Surg Br 1989;71(1):68-73.

(31) Jenkins NH, Jones DG, Mintowt-Czyz W. External fixation and recovery of function following fractures of the distal radius in young adults. Injury 1988;19(4):235-8.

(32) Horne JG, Devane P, Purdie G. A prospective randomized trial of external fixation and plaster cast immobilization in the treatment of distal radial fractures. J Orthop Trauma 1990;4(1):30-4.

(33) Abbaszadegan H, Jonsson U. External fixation or plaster cast for severely displaced Colles' fractures? Prospective 1-year study of 46 patients. Acta Orthop Scand 1990;61(6):528-30.

(34) Kapoor H, Agarwal A, Dhaon BK. Displaced intra-articular fractures of distal radius: a comparative evaluation of results following closed reduction, external fixation and open reduction with internal fixation. Injury 2000;31(2):75-9.

(35) Hegeman JH, Oskam J, Van Der Palen J, Ten Duis HJ, Vierhout PAM. Primary external fixation versus plaster immobilization of the intra-articular unstable distal radial fracture in the elderly. Aktuelle Traumatol 2004;34(2):64-70.

(36) Zheng HL, Wu E, Guo T, Cai J, Zhang Y. [A comparison of conservative and surgical treatment of distal radius unstable fracture]. Journal of Clinical Orthopaedics 2003;6(3):211-213.

(37) Young CF, Nanu AM, Checketts RG. Seven-year outcome following Colles' type distal radial fracture. A comparison of two

treatment methods. J Hand Surg [Br] 2003;28(5):422-426.

(38) Merchan EC, Breton AF, Galindo E, Peinado JF, Beltran J. Plaster cast versus Clyburn external fixation for fractures of the distal radius in patients under 45 years of age. Orthop Rev 1992;21(10):1203-9.

(39) Gupta A. The treatment of Colles' fracture. Immobilisation with the wrist dorsiflexed. J Bone Joint Surg Br 1991;73(2):312-5.

(40) Tarallo L, Mugnai R, Adani R, Catani F. A new volar plate DiPhos-RM for fixation of distal radius fracture: preliminary report. Tech hand up extrem surg 2013;17(1):41-5.

(41) 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 Dec 7;93(23):2146-2153.

(42) Walenkamp MM, Bentohami A, Beerekamp MS, Peters RW, van der Heiden R, Goslings JC, et al. Functional outcome in patients with unstable distal radius fractures, volar locking plate versus external fixation: a meta-analysis. Strategies Trauma Limb Reconstr 2013;8(2):67-75.

(43) Egol K, Walsh M, Tejwani N, McLaurin T, Wynn C, Paksima N. Bridging external fixation and supplementary Kirschner-wire fixation versus volar locked plating for unstable fractures of the distal radius: a randomised, prospective trial. J Bone Joint Surg Br 2008;90(9):1214-1221.

(44) Wilcke MKT, Abbaszadegan H, Adolphson PY. Wrist function recovers more rapidly after volar locked plating than after external fixation but the outcomes are similar after 1 year. Acta Orthop 2011;82(1):76-81.

(45) Wei DH, Raizman NM, Bottino CJ, Jobin CM, Strauch RJ, Rosenwasser MP. Unstable distal radial fractures treated with external fixation, a radial column plate, or a volar plate. A prospective randomized trial. J Bone Joint Surg Am 2009 Jul;91(7):1568-1577.

(46) Williksen JH, Frihagen F, Hellund JC, Kvernmo HD, Husby T. Volar locking plates versus external fixation and adjuvant pin fixation in unstable distal radius fractures: a randomized, controlled study. J Hand Surg [Am] 2013 Aug;38(8):1469-1476.

(47) Goehre F, Otto W, Schwan S, Mendel T, Vergroesen PP, Lindemann-Sperfeld L. Comparison of palmar fixed-angle plate fixation with K-wire fixation of distal radius fractures (AO A2, A3, C1) in elderly patients. J hand surg , Eur vol 2014 Mar;39(3):249-257.

(48) Hollevoet N, Vanhoutie T, Vanhove W, Verdonk R. Percutaneous K-wire fixation versus palmar plating with locking screws for Colles' fractures. Acta Orthop Belg 2011;77(2):180-187.

(49) Marcheix PS, Dotzis A, Benko PE, Siegler J, Arnaud JP, Charissoux JL. Extension fractures of the distal radius in patients older than 50: a prospective randomized study comparing fixation using mixed pins or a palmar fixed-angle plate. J hand surg , Eur vol 2010 Oct;35(8):646-651.

(50) McFadyen I, Field J, McCann P, Ward J, Nicol S, Curwen C. Should unstable extra-articular distal radial fractures be treated with fixed-angle volar-locked plates or percutaneous Kirschner wires? A prospective randomised controlled trial. Injury 2011 Feb;42(2):162-166.

(51) Rozental TD, Blazar PE, Franko OI, Chacko AT, Earp BE, Day CS. Functional outcomes for unstable distal radial fractures treated with open reduction and internal fixation or closed reduction and percutaneous fixation. A prospective randomized trial. J Bone Joint Surg Am 2009 Aug;91(8):1837-1846.

(52) Kwon BC, Baek GH. Fluoroscopic diagnosis of scapholunate interosseous ligament injuries in distal radius fractures. Clin Orthop 2008;466(4):969-976.

(53) Forward DP, Lindau TR, Melsom DS. Intercarpal ligament injuries associated with fractures of the distal part of the radius. Journal of Bone and Joint Surgery - Series A 2007;89(11):2334-2340.

(54) Lozano-Calderon SA, Souer S, Mudgal C, Jupiter JB, Ring D. Wrist mobilization following volar plate fixation of fractures of the

distal part of the radius. J Bone Joint Surg Am 2008 Jun;90(6):1297-1304.

(55) Souer JS, Ring D, Jupiter JB, Matschke S, Audige L, Marent-Huber M, et al. Comparison of AO Type-B and Type-C volar shearing fractures of the distal part of the radius. J Bone Joint Surg Am 2009;91(11):2605-11.

(56) Maciel JS, Taylor NF, McIlveen C. A randomised clinical trial of activityfocussed physiotherapy on patients with distal radius fractures. Arch Orthop Trauma Surg 2005;125(8):515-520.

(57) Krischak GD, Krasteva A, Schneider F, Gulkin D, Gebhard F, Kramer M. Physiotherapy after volar plating of wrist fractures is effective using a home exercise program. Arch Phys Med Rehabil 2009 Apr;90(4):537-544.

(58) Souer JS, Buijze G, Ring D. A prospective randomized controlled trial comparing occupational therapy with independent exercises after volar plate fixation of a fracture of the distal part of the radius. J Bone Joint Surg Am 2011 Oct 5;93(19):1761-1766.

(59) Handoll H, Madhok R, Howe TE. A systematic review of rehabilitation for distal radial fractures in adults. BR J HAND THER 2003;8(1):16-23.

(60) Valdes K, Naughton N, Michlovitz S. Therapist supervised clinic-based therapy versus instruction in a home program following distal radius fracture: A systematic review. J Hand Ther 2014;27(3):165-173.

(61) Bruder A, Taylor NF, Dodd KJ, Shields N. Exercise reduces impairment and improves activity in people after some upper limb fractures: a systematic review. J Physiother 2011;57(2):71-82.

(62) Schonnemann JO, Hansen TB, Soballe K. Translation and validation of the Danish version of the Patient Rated Wrist Evaluation questionnaire. J Plast Surg Hand Surg 2013;47(6):489-492.

(63) Frønsdal KB, Kvernmo HD, Hove LM, Husby T, Røkkum M, Odinsson A, et al. Behandling av håndleddsbrudd (distale radiusfrakturer) hos voksne. Oslo : Kunnskapssenteret, 2013 (Rapport fra Kunsskapssenteret nr. 3).

References