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Interventions for treating acute elbow dislocations in adults

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ABSTRACT

Background

Dislocation of the elbow joint is a relatively uncommon injury.

Objectives

To assess the effects of various forms of treatment for acute simple elbow dislocations in adults.

Search methods

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (April 2011), the Cochrane Central Register of Controlled Trials (*The Cochrane Library*, 2011 Issue 1), MEDLINE (1948 to March Week 5 2011), EMBASE (1980 to 2011 Week 14), PEDro (April 2011), CINAHL (April 2011), various trial registers, various conference proceedings and bibliographies of relevant articles.

Selection criteria

Randomised or quasi-randomised controlled trials of conservative and surgical treatment of dislocations of the elbow in adults. Excluded were trials involving dislocations with associated fractures, except for avulsion fractures.

Data collection and analysis

Data extraction and assessment of risk of bias were independently performed by two review authors. There was no pooling of data.

Main results

Two small randomised controlled trials, involving a total of 80 participants with simple elbow dislocations, were included. Both trials were methodologically flawed and potentially biased.

One trial, involving 50 participants, compared early mobilisation at three days post reduction versus cast immobilisation. At one year follow-up, the recovery of range of motion appeared better in the early mobilisation group (e.g. participants with incomplete recovery of extension: 1/24 versus 5/26; risk ratio 0.22, 95% confidence interval 0.03 to 1.72). However, the results were not statistically significant. There were no reports of instability or recurrence. One person in each group had residual pain at one year.

The other trial, involving 30 participants, compared surgical repair of the torn ligaments versus conservative treatment (cast immobilisation for two weeks). At final follow-up (mean 27.5 months), there were no statistically significant differences between the two groups in the numbers of patients who considered their injured elbow to be inferior to their non-injured elbow (10/14 versus 7/14; RR 1.43, 95% CI 0.77 to 2.66) or in other patient complaints about their elbow such as weakness, pain or weather-related discomfort. There were no reports of instability or recurrence. There were no statistically significant differences between the two groups in range of motion of the elbow (extension, flexion, pronation, and supination) or grip strength at follow-up. No participants had neurological disturbances of the hand but two surgical group participants had recurrent dislocation of the ulnar nerve (no other details provided). One person in each group had radiologically detected myositis ossificans (bone formation within muscles following injury).

Authors' conclusions

There is insufficient evidence from randomised controlled trials to determine which method of treatment is the most appropriate for simple dislocations of the elbow in adults. Although weak and inconclusive, the available evidence from a trial comparing surgery versus conservative treatment does not suggest that the surgical repair of elbow ligaments for simple elbow dislocation improves long-term function. Future research should focus on questions relating to non-surgical treatment, such as the duration of immobilisation.

PLAIN LANGUAGE SUMMARY

Interventions for treating acute elbow dislocations in adults

Elbow dislocation is where the joint surfaces of the elbow become completely separated from each other. It is a relatively uncommon injury. After the bones of the elbow joint are put back into place, under sedation and/or anaesthesia, the arm is usually immobilised in a cast for a week or more. Removal of the cast is often followed by physical therapy aimed at restoring elbow mobility. Surgery is usually reserved for the more severe dislocations, which are generally associated with a fracture (broken bone).

This review includes two trials, involving a total of 80 adults with simple elbow dislocations that had been put back into place (reduced). Both trials were at risk of bias, which means that their results may not be reliable.

One trial compared early mobilisation of the elbow with immobilisation for three weeks in a plaster cast. This trial found no firm evidence of differences between the two interventions in the recovery of elbow range of motion or pain at one year. None of the trial participants had an unstable elbow or had suffered another dislocation.

The other trial compared surgical repair of the torn ligaments versus conservative treatment (cast immobilisation for two weeks). It found no significant difference between the two groups in the numbers of patients who considered their injured elbow to be inferior to their non-injured elbow or in other patient complaints about their elbow such as weakness, pain or weather-related discomfort. There were also no differences between the groups in the range of motion of the elbow or grip strength at follow-up of around two years. There were two people with surgery-related complications. None of the trial participants had an unstable elbow or had suffered another dislocation.

Overall, the review concluded that there was not enough evidence from randomised controlled trials to show which methods of treatment are better for these injuries.

BACKGROUND

Description of the condition

The elbow is where three bones (the humerus or upper arm bone and the two forearm bones: the radius and ulna) come together.

The ends of the three bones are shaped to form three joint surfaces (articulations) that are contained within a single cavity. The elbow acts as both a hinge joint, which allows bending (flexion) and straightening (extension), and a pivot joint that allows the hand to be rotated palm upwards (supination) and palm downwards (pronation).

The elbow is one of the most stable joints in the body. As well as having highly congruous (well matched) joint surfaces, it is further stabilised by the surrounding soft tissue structures. These include the medial and lateral collateral ligaments, joint capsule and muscular structures. The most important stabiliser to valgus stress is the anterior band of the medial collateral ligament (Morrey 1983). The lateral ulnar collateral ligament and the radial collateral ligaments resist posterolateral rotatory instability and varus stresses. Elbow dislocation is where the joint surfaces become separated. The separation can be complete or partial. The latter is also called subluxation. The most common injury mechanism is where a person falls onto an outstretched hand. The resulting (valgus, supination and axial) force transmits to the elbow and separates the forearm bones from the humerus. As the elbow is being dislocated, there is a typical sequence of injury: the lateral ligament tears first, followed by the anterior capsule and posterior capsule and, finally, the medial collateral ligament. In complete elbow dislocations both the medial and lateral collateral ligaments are disrupted. Fractures of the bone ends occur in more severe elbow dislocations (Rockwood 2001). Our review only includes 'simple' dislocation involving soft tissue disruption, with the exception of avulsion fractures where fragments of bone are torn away with the soft tissue from their attachment points. Dislocations with an associated fracture are termed 'complex' dislocations will not be included. Over 90% of elbow dislocations occur in a posterior or posterolateral direction. Anterior or medial dislocations are comparatively rare.

The annual incidence of elbow dislocation has been reported as six to eight dislocations per 100,000 adults. Approximately 60% of dislocations affect the nondominant arm (Josefsson 1986). Elbow dislocations occur more frequently in males and the highest incidence occurs in the 10 to 20 year age group; the median age is 30 years. Approximately 10% to 50% are sports related but dislocations are not unique or common to any particular sport (Hobgood 2008).

Description of the intervention

Typically, elbow dislocation is treated by closed reduction, where the displaced parts are gently manipulated back in place, under sedation and/or anaesthesia. The elbow is then assessed for stability. If stable, the elbow is then immobilised at 90 degrees for between 7 to 14 days in a brace or cast (Rockwood 2001). Removal of the cast is usually followed by physical therapy aimed at restoring mobility. Surgical intervention is usually reserved for dislocations that cannot be reduced safely using closed reduction methods or those that are unstable. Unrecognised fractures may cause a block to reduction or the radial head may become entrapped in the soft tissues of the joint (Hobgood 2008). Surgical intervention includes, where appropriate, open reduction, repair and reattachment of various soft tissues. If the joint remains unstable following soft tissue repair then a hinged external fixator

may be applied (Hobgood 2008). Physical therapy will generally be prescribed after a period of immobilisation to allow healing.

Why it is important to do this review

Long term sequelae from elbow dislocations include pain, recurrent instability, heterotrophic ossification (where bone forms in the wrong places) and loss of range of motion (Josefsson 1984; Melhoff 1988). These unsatisfactory outcomes show the need for an evaluation of current practice. Although there is some consensus on the indications for conservative and surgical management, there is still variation in practice (Rockwood 2001). Additionally, the best type and duration of immobilisation, methods of mobilisation and surgical strategies are unclear (Hobgood 2008; Melhoff 1988).

OBJECTIVES

To assess the effects (benefits and harms) of interventions for treating acute simple elbow dislocations in adults.

We aimed to compare:

1. different methods of closed reduction;
2. different types of post-reduction splinting (functional brace versus plaster cast);
3. different durations of immobilisation, including compared with no immobilisation or early mobilisation;
4. surgical (e.g. repair of soft-tissue structures) versus non-surgical (conservative) intervention (typically, closed reduction and immobilisation);
5. different types of surgery, specifically side of repair of soft-tissue structures, and use of external fixation.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised and quasi-randomised (for example, allocation by hospital number or date of birth) controlled trials comparing different interventions for treating acute elbow dislocations in adults.

Types of participants

Skeletally mature patients with radiologically confirmed acute elbow dislocations. We included only 'simple' dislocation involving soft tissue disruption, with the exception of avulsion fractures. We excluded participants with dislocations with associated fractures or with neurovascular deficit after reduction. Trials with mixed populations, either in terms of participant maturity or type of elbow dislocation, were considered for inclusion provided separate data were available for adults with simple dislocations or the number of participants not meeting the review inclusion criteria were very few.

Types of interventions

For inclusion, trials needed to compare interventions used to treat acute elbow dislocations. For practical reasons, they were to be grouped under the following headings.

1. Non-operative: closed reduction, post reduction cast immobilisation, post reduction functional bracing, early mobilisation, late mobilisation
 2. Operative: open reduction, medial soft tissue repair, lateral soft tissue repair, external fixation
- Trials evaluating use and types of anaesthesia, analgesia or sedation for closed reduction or surgery were excluded; as were those evaluating use, timing or types of examination, such as an arthrogram.

Types of outcome measures

Primary outcomes

- Functional outcome: activities of daily living and return to work/ leisure activities. Ideally, these should be validated scores such as Short Form-36 (SF-36), the Disability of the Arm, Shoulder and Hand questionnaire (DASH), Mayo elbow score, American Shoulder and Elbow Surgeons Elbow Assessment form and Patient Rated Elbow Evaluation.

Secondary outcomes

- Clinical outcome: range of motion, grip strength
- Further or recurrent dislocation
- Pain
- Early and late complications associated with elbow dislocations or their treatment, including reflex sympathetic dystrophy (RSD) and osteoarthritis; wound complications; nerve injury and heterotrophic ossification.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (April 2011), the Cochrane Central Register of Controlled Trials (*The Cochrane Library*, Wiley Online Library 2011, Issue 1), MEDLINE (OvidSP 1948 to March Week 5 2011), EMBASE (OvidSP 1980 to 2011 Week 14), the [Physiotherapy Evidence Database](#) (PEDro) (April 2011), and CINAHL (EBSCOhost 1937 to April 2011). No language restrictions were applied.

In MEDLINE, the sensitivity-maximizing version of the Cochrane Highly Sensitive Search Strategy for identifying randomised controlled trials ([Lefebvre 2011](#)) was combined with the subject specific search (see [Appendix 1](#)). Search strategies are also shown for *The Cochrane Library*, EMBASE and CINAHL (see [Appendix 1](#)). We searched the following web sites to identify additional unpublished and ongoing studies: [Current Controlled Trials](#), [Centre Watch](#); [Trials Central](#), [WHO International Clinical Trials Registry Platform](#) (all to June 2010) and the [UK National Research Register](#) (to September 2007). We also searched the following sites for conference proceedings: the [American Society for Surgery of the Hand](#), the [Orthopaedic Trauma Association](#), the [Journal of Bone and Joint Surgery - British Volume](#), the [Journal of Bone and Joint Surgery - American Volume](#), and the [American Academy of Orthopaedic Surgeons](#) (to June 2010).

Searching other resources

We checked the reference lists of articles, reviews and textbooks for possible relevant studies.

Data collection and analysis

Selection of studies

Two review authors (FT and MS) screened the title, abstract and descriptors of identified studies for possible inclusion. The full text of potential studies were then obtained, where possible. From the full text, two authors independently assessed potentially eligible trials for inclusion and resolved any disagreement through discussion.

Data extraction and management

Trial details and data were independently extracted by two authors (FT and MS) using a pre-piloted data extraction form and if necessary adjudicated by a third author before being entered into RevMan. Study design, characteristics of study population, interventions, duration of treatments and outcomes were recorded. Attempts were made to contact trial authors for missing data and trial information.

Assessment of risk of bias in included studies

Two review authors (FT and MS) independently assessed risk of bias using The Cochrane Collaboration's 'Risk of bias' tool (Higgins 2008). They were not blinded to author and source institution. Included items were sequence generation for randomisation, concealment of allocation, blinding (of participants, care providers and outcome assessors), incomplete outcome data, selective outcome reporting and other potential sources of bias (for example, an extreme baseline imbalance in patient characteristics). Any disagreement was resolved by consensus.

Measures of treatment effect

We calculated risk ratios (RR) with 95% confidence intervals (95% CI) for dichotomous data, and mean differences (MD) and 95% CIs for continuous data. Should studies be pooled in future, we plan to calculate mean differences (MD) and 95% CIs if studies used the same outcome measures for continuous data. If studies use different but comparable continuous outcome measures, we plan to use standardised mean differences (SMD) with 95% CIs.

Unit of analysis issues

In each study, the unit of randomisation is the individual patient.

Dealing with missing data

Where possible, we performed intention-to-treat analyses that included all participants randomly assigned to the intervention groups. Should this be possible in future, we would investigate the effect of drop outs and exclusions, initially by conducting worst and best scenario analyses. We were alert to the potential mislabelling or non identification of standard errors and standard deviations. Should there have been missing standard deviations that could not have been derived from confidence interval data, we would not have assumed values in order to present these in the analyses.

Assessment of heterogeneity

We specified a priori that heterogeneity would be identified by visually examining the forest plots and consideration of the Cochrane Q statistic and I^2 values. Decisions regarding heterogeneity would then be made on the basis of the clinical effect. We planned to report this decision in the text.

Assessment of reporting biases

Should sufficient data have been available, we would have attempted to assess publication bias by preparing a funnel plot. Our search of 'grey literature' and pursuit of trials listed in clinical trial registers should have helped to avoid publication bias.

Data synthesis

Should the pooling of data be possible and appropriate in future, we will pool data using the fixed-effect model and 95% confidence intervals. We will consider using a random-effects model where there is excessive and unexplained heterogeneity.

Subgroup analysis and investigation of heterogeneity

There were insufficient data to conduct subgroup analyses. In our protocol, we set out planned subgroup analyses by age, gender, type and duration of the dislocation, and patient subgroup (e.g. athletes, military recruits, others). Additionally, we planned to explore the potential effects of treatment variations among trials testing comparable comparisons in an attempt to explain heterogeneity.

Sensitivity analysis

There were insufficient data to conduct our planned sensitivity analyses, for testing either the exclusion of trials at high or unclear risk of selection bias or the effects of missing data.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#); [Characteristics of ongoing studies](#).

Results of the search

A total of 383 references were identified by the electronic database searches: the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (6); Cochrane Central Register of Controlled Trials (24); MEDLINE (92); EMBASE (176); Physiotherapy Evidence Database (8); CINAHL (77). After study selection, two trials were included (Josefsson 1987; Rafai 1999) and five were excluded (Bek 2009; Fan 1995; Josefsson 1984a; Maripuri 2007; Taha 2000). One ongoing trial was also identified (NTR2025) by a search of the WHO International Clinical Trials Registry Platform.

Both included studies were fully reported in medical journals. The main report for Josefsson 1987 was in English and for Rafai 1999, in French. The latter was translated into English by one review author (JCT). Unsuccessful requests were made for information from the trial investigators of both trials.

Included studies

More extensive details of the individual trials are presented in the [Characteristics of included studies](#).

Design

Both included trials were parallel randomised controlled trials with two intervention groups.

Setting

Both trials were single-centre trials conducted in a hospital setting. [Josefsson 1987](#) took place in Malmo, Sweden and [Rafai 1999](#) in Casablanca, Morocco. Neither trial reported on the period of trial recruitment.

Interventions

[Josefsson 1987](#) compared surgical repair of torn ligaments with conservative management (cast immobilisation for two weeks), while [Rafai 1999](#) compared early mobilisation starting at three days with cast immobilisation for three weeks.

Participants

The two trials involved a total of 80 adults with 80 dislocated elbows. The proportion of male participants was 33% in [Josefsson 1987](#) and 86% in [Rafai 1999](#); and the mean ages were 35 and 25 years respectively. The youngest recorded participant was 16 years old and the oldest was 70 years old.

Outcomes

Final follow-up was at an average of 27.5 months (range 12 to 59 months) in [Josefsson 1987](#), and at 12 months in [Rafai 1999](#). Neither trial reported on validated patient reported measures of upper-limb function. However, [Josefsson 1987](#) reported on the return to previous occupation, and patient complaints relating to function. Both trials reported on range of motion and instability. [Josefsson 1987](#) also reported on complications.

Excluded studies

The full reasons for excluding five studies are given in the [Characteristics of excluded studies](#). Two studies ([Bek 2009](#); [Taha 2000](#)) were excluded because they involved a paediatric population. We were unable to locate a copy of a Chinese trial ([Fan 1995](#)). We excluded [Josefsson 1984a](#) because its focus was on the use of arthrography, and [Maripuri 2007](#) because it was not randomised.

Ongoing studies

One ongoing study was identified ([NTR2025](#)). This multi-centre randomised clinical trial is comparing functional treatment versus plaster cast immobilisation for simple elbow dislocations. The study commenced in August 2009, with a recruitment target of 100 participants and a one year follow-up. For more information, see the [Characteristics of ongoing studies](#).

Risk of bias in included studies

[Figure 1](#) presents the risk of bias judgements for the individual items for the two trials.

Figure 1. Risk of bias summary: review of authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding (performance bias and detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Josefsson 1987	?	?	-	?	?	?
Rafai 1999	?	?	-	?	?	?

Allocation

[Josefsson 1987](#) used random selection from a pool of sealed envelopes, while [Rafai 1999](#) allocated by drawing lots. The lack of information to judge whether there was adequate sequence generation or allocation concealment meant that we judged that both trials had an unclear risk of selection bias.

The differences between the two groups in the length of follow-up in [Josefsson 1987](#) and the discrepancies between text and figures in [Rafai 1999](#) prompted unclear risk of bias judgements for this item.

Blinding

Blinding of participants and care providers was not possible in either trial. Additionally, neither trial report mentioned assessor blinding. We decided that both trials could be at high risk of detection bias.

Selective reporting

While there was insufficient information, including a lack of trial protocols, to permit judgement, we considered that neither trial was at high risk of reporting bias given that both reported on a typical set of outcomes for people with elbow dislocation.

Incomplete outcome data

Other potential sources of bias

There was a lack of information to judge on other potential sources of bias; for instance bias resulting from major imbalances in key baseline characteristics.

Effects of interventions

The two included trials tested different comparisons.

Early mobilisation versus cast immobilisation

Rafai 1999 compared early mobilisation versus cast immobilisation for three weeks in 50 adults, who were followed up for one year. At one year, one participant of the early mobilisation group versus five in the cast immobilisation failed to regain full extension. The same results applied for the recovery of flexion and pronation-supination (see Analysis 1.1); the difference between the two groups was not statistically significant (risk ratio (RR) 0.22, 95% confidence interval (CI) 0.03 to 1.72). One person in each group had residual pain at one year (see Analysis 1.2). There were no reports of instability or recurrence.

Surgical versus conservative treatment

Josefsson 1987 compared surgical versus conservative treatment in 30 adults, of whom 28 were available at follow-up of one year or more (mean 27.5 months). At final follow-up, none of the trial participants had changed their occupation because of their injury. Also at this time, there was no significant difference between the two groups in the numbers who considered their injured elbow to be inferior to their non-injured elbow (10/14 versus 7/14; RR 1.43, 95% CI 0.77 to 2.66; see Analysis 2.1); nor were there differences between the two groups in other patient complaints such as weakness, pain or weather-related discomfort (see Analysis 2.1). There were no cases of instability, subluxation or recurrent dislocation in either group. Josefsson 1987 also found no statistically significant differences between the two groups in elbow range of motion (extension, flexion, pronation, and supination) or grip strength at follow-up. Analysis 2.2 shows the data for extension and flexion at 10 weeks and final follow-up. These data show the tendency for worse extension in the surgery group; this is reflected also in the higher incidence of subjectively-reported limitations in extension in this group. No participants had neurological disturbances of the hand. Two participants in the surgery group had recurrent dislocation of the ulnar nerve (there were no further details given). One person in each group had radiologically detected myositis ossificans; both patients had reduced extension.

One trial (Rafai 1999), involving 50 participants, compared early mobilisation at three days post reduction versus cast immobilisation. At one year follow-up, the recovery of range of motion appeared better in the early mobilisation group but the results were not statistically significant. There were no reports of instability or recurrence. One person in each group had residual pain at one year.

The other trial (Josefsson 1987), involving 30 participants, compared surgical repair of torn ligaments versus conservative treatment (two weeks cast immobilisation). At final follow-up (mean 27.5 months), there were no statistically significant differences between the two groups in patient-reported complaints about their elbow such as pain or weakness. There were no reports of instability or recurrence. Josefsson 1987 found no statistically significant differences between the two groups in elbow range of motion or grip strength at follow-up. Two participants of the surgery group had recurrent dislocation of the ulnar nerve, and one person in each group had radiologically detected myositis ossificans.

Overall completeness and applicability of evidence

There is a lack of evidence to address all five comparisons set out in our objectives. The available evidence is limited to two small under-powered randomised controlled trials, both of which found no statistically significant differences between outcomes. Nonetheless, the interventions and study populations (although demographically different) of the two included trials are relevant to current practice. Additionally, although sub-optimal, the outcomes assessed by both trials are relevant. However, the lack of assessment of patient-reported function in Rafai 1999 greatly reduces its usefulness.

Quality of the evidence

Both trials included in this review had methodological weaknesses that make them susceptible to bias. There was no assurance of allocation concealment in either trial and both were at high risk of detection bias, reflecting the lack of blinding of outcome assessment. Overall, the quality of the available evidence is low.

DISCUSSION

Summary of main results

This review includes two randomised controlled trials, each testing a different comparison, in people with simple elbow dislocations.

Potential biases in the review process

While our search was comprehensive, it is possible that we have missed small trials that are unreported or only reported in conference abstracts. Additionally, although we anticipate that it would not have been suitable, we were unable to obtain a copy of a trial reported in Chinese. Our attempts to contact trial authors for further clarification of trial methods were unsuccessful.

Agreements and disagreements with other studies or reviews

A recent systematic review (de Haan 2009) included the same two randomised controlled trials that we have included and three comparative observational studies. Based on the results of Josefsson 1987, de Haan 2009 found there was no difference between surgical treatment and plaster immobilisation. However, on the inclusion of data from observational studies, de Haan 2009 found a better outcome for functional treatment (early mobilisation) versus plaster immobilisation. Our restriction to evidence from randomised controlled trials does not allow for this second finding. de Haan 2009 concluded that the quality of the available evidence is low, which is in agreement with our findings.

AUTHORS' CONCLUSIONS

Implications for practice

Overall, there is a lack of evidence to inform clinical decisions for treating acute simple elbow dislocations in adults. Nonetheless, clinicians should note that, while weak and inconclusive, the available evidence from a trial comparing surgery versus conservative

treatment did not suggest that the surgical repair of elbow ligaments for simple elbow dislocation improved long-term function.

Implications for research

Future research should focus on questions relating to non-surgical treatment, such as the duration of immobilisation. The results of the multi-centre ongoing trial (NTR2025) should help inform both future practice and on whether there is a need for further trials on the key comparison of early mobilisation (functional treatment) versus plaster cast immobilisation for simple elbow dislocations that are stable after reduction. All future research evaluating key interventions for these injuries should meet robust contemporary standards of design, conduct, and reporting, including the use of secure randomisation methods and validated outcome measures of function and health-related quality of life.

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Morrey BF, An KN. Articular and ligamentous contributions to the stability of the elbow joint. *American Journal of Sports Medicine* 1983;**11**(5):315–9.

Rockwood 2001

Ring, D. Simple elbow dislocations. In: Bucholz, W editor (s). *Rockwood and Green's Fractures in Adults*. 6. Vol. 1, Philadelphia: Lippincott Williams & Wilkins, 2001: 1024–33.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Josefsson 1987

Methods	<p>Randomisation method: pooled sealed envelopes</p> <p>Assessor blinding: not stated</p> <p>Loss to follow-up: 2 participants (7%)</p>
Participants	<p>Emergency Room, Malmo General Hospital, Sweden</p> <p>Period of study: not stated</p> <p>30 participants</p> <p>Inclusion criteria: acute elbow dislocation, 16 years old or older, previously symptom free elbow</p> <p>Exclusion criteria: dislocation with concomitant fracture (unless small avulsed fracture)</p> <p>Diagnosis: not stated, presume clinical and radiological.</p> <p>Presentation: acute</p> <p>Sex: 10 male (33%)</p> <p>Age: mean 35 years; range 16 to 70 years</p>
Interventions	<p>Dislocations were initially reduced and immobilised in the emergency department. Elbows were then re-examined under general anaesthetic (mean 4 days later, range 1 to 7 days).</p> <p>1. Surgery. Both the medial and lateral sides of the joint were explored by two separate lengthwise incisions. The muscles originating from the epicondyles were inspected as were the medial and lateral collateral ligaments and anterior capsule and brachialis muscle. Ligamentous and muscular injuries were sutured in their substance or via epicondylar drill holes using absorbable polyglycolic acid sutures. The elbows were then immobilised for a planned two weeks in plaster cast at 90 degrees of flexion. After removal of the cast active motion of the elbow was encouraged.</p> <p>2. Conservative treatment. The elbows were then immobilised for a planned two weeks in plaster cast at 90 degrees of flexion. After removal of the cast active motion of the elbow was encouraged.</p> <p>Assigned: 15/15</p> <p>Analysed: 14/14 at follow-up</p>
Outcomes	<p>Length of follow-up: mean 27.5 months, 12 to 59 months (also, 5 and 10 weeks)</p> <p>Elbow range of motion: extension, flexion, pronation and supination</p> <p>Varus and valgus stability</p> <p>Neurological evaluation, including grip strength</p> <p>Flexion and extension strength</p> <p>Patient 'complaints': limited motion, weakness, discomfort, pain, instability, subluxation, recurrent dislocation</p> <p>X-ray at follow-up: myositis ossificans</p>
Notes	
<i>Risk of bias</i>	

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"... random selection from a pool of thirty sealed envelopes." "Thirty consecutive patients..."
Allocation concealment (selection bias)	Unclear risk	"... random selection from a pool of thirty sealed envelopes. Fifteen of the envelopes indicated surgical and 15 indicated non-surgical treatment." Potential lack of allocation concealment once group size of 15 reached. Adequate safeguards not apparent
Blinding (performance bias and detection bias) All outcomes	High risk	Participants or clinicians unable to be blinded. No mention of blinding of outcome assessors
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	One patient in each group unable to attend follow-up. Unlikely to affect conclusions. However, variable timing of follow-up (mean follow-up was 31 months in the surgical group versus 24 months in the conservative treatment group)
Selective reporting (reporting bias)	Unclear risk	Insufficient information available.
Other bias	Unclear risk	Study appears to be free of other sources of bias.

Rafai 1999

Methods	Randomisation method: drawing of lots Assessor blinding: not stated Loss to follow-up: not reported
Participants	Centre Hospitaliere Universitaire Ibn Rochd, Casablanca, Morocco Period of study: over 2 years 50 consecutive participants. Inclusion criteria: young person, normal psychological profile, posterior dislocation of elbow, stable reduction of the elbow, no previous elbow problems Exclusion criteria: unstable reduction of elbow Diagnosis: posterior dislocation of the elbow in adults Presentation: acute, within 24 hours of injury Sex: 43 male (86%) Age: mean 25 years; range 16 to 67 years

Interventions	Reduction under general anaesthesia, and stability checks before: 1. Early mobilisation: mobilisation started after 3 days (if appropriate). Self-rehabilitation at 3 times a day for 10 minutes increasing range of mobilisation over time. For the first 3 weeks, the arm was kept in a sling when not exercising. 2. Immobilisation: plaster cast immobilisation at 90 degrees for 3 weeks, followed by rehabilitation Assigned: 26/24 Analysed: 26/24 at follow-up	
Outcomes	Length of follow up: 12 months (also at 7, 15, 21, 36 and 51 days, and 2, 3 and 6 months for group 1 and 21, 36 and 51 days, and 2, 3 and 6 months for group 2). Thus, 9 visits for group 1 and 7 visits for group 2 Elbow range of motion: extension, flexion, pronation and supination (second pair were reported together) Pain Instability and recurrence	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	“Nous avons mené une étude prospective randomisée”. “La méthode thérapeutique a été choisie par tirage au sort ..” Translated as “drawing of lots”; but still unclear
Allocation concealment (selection bias)	Unclear risk	“La méthode thérapeutique a été choisie par tirage au sort ..”. Translated as “drawing of lots”. Adequate safeguards not apparent
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and personnel unable to be blinded. No mention of blinding of outcome assessors
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Based on calculated percentages in the text, all participants were accounted for. However, the figures in the trial report gave a different answer
Selective reporting (reporting bias)	Unclear risk	Insufficient information available.
Other bias	Unclear risk	Study appears to be free of other sources of bias. However, baseline characteristics were not split by treatment group

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Bek 2009	Pulled elbow rather than dislocated elbow. Paediatric population
Fan 1995	We were unable to obtain a copy of this Chinese trial, nor its abstract. It may not be randomised
Josefsson 1984a	While the allocation of surgery and non-surgery in 14 patients was randomised, this was a study of the use of arthrography for diagnosing ligament injury
Maripuri 2007	Retrospective non-randomised study.
Taha 2000	Pulled elbow rather than dislocated elbow. Paediatric population

Characteristics of ongoing studies *[ordered by study ID]*

NTR2025

Trial name or title	Functional treatment versus plaster for simple elbow dislocations (FuncSiE): a randomised trial
Methods	Multi-centre randomised clinical trial
Participants	Patients aged 18 years or older with a simple elbow dislocation that can be reduced. Target sample size: 100
Interventions	<p>1. Functional treatment group: The affected arm will be put in a pressure bandage for up to three weeks. Early active movements within the limits of pain are allowed. Usually by the second day the patients are instructed to do two exercises by a physical therapist, which are gradually expanded if tolerated.</p> <p>2. Plaster group: The affected arm will be put in plaster of Paris for three weeks. At three weeks after dislocation the plaster will be removed and full mobilisation (flexion, extension, pronation and supination) will be initiated by practicing under supervision of a physical therapist. Physical therapy sessions will be held at regular intervals, preferably 2 times a week during 12 weeks</p>
Outcomes	Primary outcome (Quick-DASH) and secondary outcomes (MEPI, Oxford Elbow Score, pain, range of motion, secondary intervention rates, complication rates, SF-36, and EQ-5D) will be compared at baseline, at 1, 3 and 6 weeks, and at 3, 6, and 12 months after start of treatment, using both univariate and multivariable analyses. Costs for (in)formal healthcare consumption will be determined for both interventions. Cost-effectiveness will be expressed as cost per quality of life year (QALY) gained
Starting date	26 Aug 2009; planned closing date: 31 Dec 2012
Contact information	D den Hartog, MD Erasmus MC, Dept of Surgery-Traumatology Mailbox H-822k 's-Gravendijkwal 230, 3015 CE Rotterdam P.O. Box 2040, 3000 CA Rotterdam, The Netherlands Tel: +31-10 7031050 Fax: +31-10 7032396 d.denhartog@erasmusmc.nl

NTR2025 (Continued)

Notes	A protocol for this trial is available.
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DATA AND ANALYSES

Comparison 1. Early mobilisation versus cast immobilisation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Range of motion deficiencies	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Incomplete recovery of extension at 12 months	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Incomplete recovery of flexion at 12 months	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 Incomplete recovery of pronosupination at 12 months	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Pain and instability	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Residual pain	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 Instability / recurrence	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 2. Surgery versus conservative treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Patient complaints	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Injured elbow inferior to non-injured elbow	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Limited motion (extension)	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 Weakness	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.4 Weather-related discomfort	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.5 Pain on effort	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.6 Tenderness	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.7 Pain at rest	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.8 Feeling of instability	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Range of motion (compared with contralateral side)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Extension (degrees) at 10 weeks	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 Extension (degrees) at > 1 year	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.3 Flexion (degrees) at 10 weeks	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.4 Flexion (degrees) at > 1 year	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

3.1 Recurrent dislocation of ulnar nerve	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 Myositis ossificans	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Analysis 1.1. Comparison 1 Early mobilisation versus cast immobilisation, Outcome 1 Range of motion deficiencies.

Review: Interventions for treating acute elbow dislocations in adults

Comparison: 1 Early mobilisation versus cast immobilisation

Outcome: 1 Range of motion deficiencies

Analysis 1.2. Comparison 1 Early mobilisation versus cast immobilisation, Outcome 2 Pain and instability.

Review: Interventions for treating acute elbow dislocations in adults

Comparison: 1 Early mobilisation versus cast immobilisation

Outcome: 2 Pain and instability

Analysis 2.1. Comparison 2 Surgery versus conservative treatment, Outcome 1 Patient complaints.

Review: Interventions for treating acute elbow dislocations in adults

Comparison: 2 Surgery versus conservative treatment

Outcome: 1 Patient complaints

(Continued ...)

(... Continued)

Analysis 2.2. Comparison 2 Surgery versus conservative treatment, Outcome 2 Range of motion (compared with contralateral side).

Review: Interventions for treating acute elbow dislocations in adults

Comparison: 2 Surgery versus conservative treatment

Outcome: 2 Range of motion (compared with contralateral side)

Analysis 2.3. Comparison 2 Surgery versus conservative treatment, Outcome 3 Complications.

Review: Interventions for treating acute elbow dislocations in adults

Comparison: 2 Surgery versus conservative treatment

Outcome: 3 Complications

APPENDICES

Appendix I. Search strategies

The Cochrane Library (Wiley Online Library)

#1 MeSH descriptor Elbow, this term only (108)

#2 MeSH descriptor Elbow Joint, this term only (151)

#3 (#1 OR #2) (253)

#4 MeSH descriptor Dislocations, this term only (169)

#5 MeSH descriptor Joint Instability, this term only (413)

#6 (#4 OR #5) (564)

#7 (#3 AND #6) (18)

#8 ((elbow* or ulnohumeral or radiohumeral) NEAR/3 (dislocat* or sublux* or instability or unstable))::ti,ab,kw (21)

#9 (#7 OR #8) (24)

MEDLINE (OvidSP)

- 1 (Elbow/ or Elbow Joint/) and (Joint Instability/ or Dislocation/) (1812)
- 2 ((elbow\$ or ulnohumeral or radiohumeral) adj3 (dislocat\$ or sublux\$ or instability or unstable)).tw. (1058)
- 3 or/1-2 (2089)
- 4 Randomized controlled trial.pt. (303135)
- 5 Controlled clinical trial.pt. (82081)
- 6 randomized.ab. (210341)
- 7 placebo.ab. (123185)
- 8 Drug therapy.fs. (1438791)
- 9 randomly.ab. (152769)
- 10 trial.ab. (217176)
- 11 groups.ab. (1018216)
- 12 or/4-11 (2656661)
- 13 exp Animals/ not Humans/ (3561297)
- 14 12 not 13 (2252839)
- 15 and/3,14 (92)

EMBASE (OvidSP)

1. Elbow Dislocation/ (787)
2. Elbow/ and Dislocation/ (700)
3. ((elbow\$ or ulnohumeral or radiohumeral) adj3 (dislocat\$ or sublux\$ or instability or unstable)).tw. (1207)
4. or/1-3 (1947)
5. exp Randomized Controlled Trial/ (293412)
6. exp Double Blind Procedure/ (102620)
7. exp Single Blind Procedure/ (14142)
8. exp Crossover Procedure/ (30643)
9. Controlled Study/ (3484988)
10. or/5-9 (3552508)
11. ((clinical or controlled or comparative or placebo or prospective\$ or randomi#ed) adj3 (trial or study)).tw. (542170)
12. (random\$ adj7 (allcat\$ or allot\$ or assign\$ or basis\$ or divid\$ or order\$)).tw. (134423)
13. ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj7 (blind\$ or mask\$)).tw. (131769)
14. (cross?over\$ or (cross adj1 over\$)).tw. (55817)
15. ((allcat\$ or allot\$ or assign\$ or divid\$) adj3 (condition\$ or experiment\$ or intervention\$ or treatment\$ or therap\$ or control\$ or group\$)).tw. (161395)
16. or/11-15 (812984)
17. or/10,16 (3932783)
18. limit 17 to human (2378993)
19. and/4,18 (176)

CINAHL (EBSCO)

- S1 (MH "Elbow Dislocation") (93)
- S2 (MH "Elbow") OR (MH "Elbow Joint") (2120)
- S3 (MH "Dislocations") OR (MH "Joint Instability") (4882)
- S4 S2 and S3 (204)
- S5 TX (elbow* N3 dislocate*) or (elbow* N3 sublux*) or (elbow* N3 instability) or (elbow* N3 unstable) (140)
- S6 TX (ulnohumeral N3 dislocate*) or (ulnohumeral N3 sublux*) or (ulnohumeral N3 instability) or (ulnohumeral N3 unstable) (3)
- S7 TX (radiohumeral N3 dislocate*) or (radiohumeral N3 sublux*) or (radiohumeral N3 instability) or (radiohumeral N3 unstable) (0)
- S8 S5 or S6 or S7 (142)
- S9 S1 or S4 or S8 (352)
- S10 (MH "Clinical Trials+") (113165)

S11 (MH "Comparative Studies") (61009)
 S12 (MH "Prospective Studies+") (144906)
 S13 (MH "Crossover Design") (7533)
 S14 (MH "Double-Blind Studies") or (MH "Single-Blind Studies") or (MH "Triple-Blind Studies") (24216)
 S15 (MH "Placebos") (6535)
 S16 (MH "Random Assignment") (28713)
 S17 PT Clinical Trial (58106)
 S18 TI ((clinical or controlled or comparative or placebo or prospective or randomised or randomized) and (trial or study)) or AB ((clinical or controlled or comparative or placebo or prospective or randomised or randomized) and (trial or study)) (166061)
 S19 TI (random* and (allocat* or allot* or assign* or basis* or divid* or order*)) or AB (random* and (allocat* or allot* or assign* or basis* or divid* or order*)) (25945)
 S20 TI ((singl* N1 blind*) or (doubl* N1 blind*) or (trebl* N1 blind*) or (tripl* N1 blind*) or (singl* N1 mask*) or (doubl* N1 mask*) or (trebl* N1 mask*) or (tripl* N1 mask*)) or AB ((singl* N1 blind*) or (doubl* N1 blind*) or (trebl* N1 blind*) or (tripl* N1 blind*) or (singl* N1 mask*) or (doubl* N1 mask*) or (trebl* N1 mask*) or (tripl* N1 mask*)) (14503)
 S21 TI (crossover or cross-over or "cross over") or AB (crossover or cross-over or "cross over") (5692)
 S22 S10 or S11 or S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21 (377080)
 S23 S9 and S22 (Published Date from: -20100631) (77)

PEDro

1. Abstract & Title: dislocate
 Body Part: Forearm or elbow
 Match all search terms (AND) (4)
 2. Abstract & Title: sublux
 Body Part: Forearm or elbow
 Match all search terms (AND) (4)
 3. Abstract & Title: instability
 Body Part: Forearm or elbow
 Match all search terms (AND) (1)
 4. Abstract & Title: unstable
 Body Part: Forearm or elbow
 Match all search terms (AND) (0)
 5. Abstract & Title: pulled
 Body Part: Forearm or elbow
 Match all search terms (AND) (2)

HISTORY

Protocol first published: Issue 3, 2009

Review first published: Issue 4, 2012

CONTRIBUTIONS OF AUTHORS

This review was initiated by Fraser Taylor who conceived and designed the review. The review was produced in collaboration with Martyn Sims, Peter Herbison and Jean Claude Theis, and was coordinated by Fraser Taylor.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Otago District Health Board, New Zealand.

Funding for one review author (FT) to attend training courses in May 2008. Martyn Sims is an employee of Otago District Health Board.

- University of Otago, New Zealand.

Professor Peter Herbison and Associate Professor Jean Claude Theis are employees of the University of Otago.

External sources

- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The Science Citation Index (ISI) and the Library and Information Science and Technology Abstracts were not available for searching and are therefore not included.

INDEX TERMS

Medical Subject Headings (MeSH)

*Early Ambulation; Acute Disease; Casts, Surgical; Elbow Joint [*injuries; surgery]; Immobilization [*methods]; Joint Dislocations [surgery; *therapy]; Ligaments, Articular [*injuries; surgery]; Manipulation, Orthopedic [methods]; Range of Motion, Articular; Treatment Outcome

MeSH check words

Adult; Humans