

# Pre-operative traction for fractures of the proximal femur in adults (Review)

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[Intervention Review]

# Pre-operative traction for fractures of the proximal femur in adults

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## ABSTRACT

### Background

Following a hip fracture, traction may be applied to the injured limb before surgery.

### Objectives

To evaluate the effects of traction applied to the injured limb prior to surgery for a fractured hip. Different methods of applying traction (skin or skeletal) were considered.

### Search strategy

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (March 2006), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* Issue 1, 2006), MEDLINE (1966 to March 2006), EMBASE (1988 to 2006 Week 11), CINAHL (1982 to March 2006), the UK National Research Register (Issue 1, 2006), conference proceedings and reference lists of articles.

### Selection criteria

All randomised or quasi-randomised trials comparing either skin or skeletal traction with no traction, or skin with skeletal traction for patients with an acute hip fracture prior to surgery.

### Data collection and analysis

Both authors independently assessed trial quality and extracted data. Additional information was sought from all trialists. Wherever appropriate and possible, data were pooled.

### Main results

Ten randomised trials, mainly of moderate quality, involving a total of 1546 predominantly elderly patients with hip fractures, were identified and included in the review. Nine trials compared traction with no traction. Although limited data pooling was possible, overall this provided no evidence of benefit from traction, either in the relief of pain before surgery or ease of fracture reduction or quality of fracture reduction at time of surgery. One of these trials included both skin and skeletal traction groups. This trial and one other compared skeletal traction with skin traction and found no important differences between these two methods, although the initial application of skeletal traction was noted as being more painful and more costly.

## Authors' conclusions

From the evidence available, the routine use of traction (either skin or skeletal) prior to surgery for a hip fracture does not appear to have any benefit. However, the evidence is also insufficient to rule out the potential advantages for traction, in particular for specific fracture types, or to confirm additional complications due to traction use. Further, high quality trials would be required to confirm or refute the absence of benefits of traction.

## PLAIN LANGUAGE SUMMARY

### The routine use of traction before surgery in adults with hip fracture

For people with hip fractures, traction involves either using tapes (skin traction) or pins (skeletal traction) attached to the injured leg and connected to weights via a pulley. The application of traction before surgery is thought to relieve pain and make the subsequent surgery easier. Where traction is not used, the injured limb is usually placed on a pillow and the patient encouraged to adopt a position of greatest comfort.

This review summarising the evidence from randomised controlled trials included 10 trials with 1546 participants. Consistent with the general hip fracture population, most of the trial participants were older persons of around 80 years of age and the majority were female. Nine trials compared traction versus no traction and two trials, including one of the preceding nine trials, compared skin and skeletal traction. As well as limitations in the trial methods, there were very limited data for pooling and a lack of information about the longer-term consequences of applying or not applying traction. Nonetheless, the evidence from the nine trials consistently showed no evidence to support the supposed advantages of traction described above.

## BACKGROUND

It has been, and in some places remains, standard orthopaedic practice to apply skeletal or skin traction to the injured limb following an acute hip fracture, prior to surgery (Billsten 1996; Brink 2005). In this review, the term hip fracture encompasses intracapsular (femur neck) and extracapsular (trochanteric and subtrochanteric) fractures of the proximal femur. Traction may be either 'skin' or 'skeletal'. Skin traction may be applied by way of adhesive tape, tapes bandaged to the limb or a traction boot. Skeletal traction involves passing a metal pin through the proximal tibia or distal femur, under local anaesthesia. Traction is then applied using ropes and weights attached to the end of the tapes or pin.

The main theoretical advantages that are advocated for traction are that it will reduce pain at the fracture site and assist the reduction of the fracture thereby making the subsequent operation easier to perform. For intracapsular fractures further advantages of traction have been proposed in the reduction of circulatory complications. Firstly, traction may reduce any tamponade effect (pressure caused by the build up of excess fluid that acts to compress blood vessels and block blood flow) within the joint (Maruenda 1997). Secondly, it may reduce the movement at the fracture surfaces and

deformity at the fracture site. Either effect proposed for traction might reduce the risk of obstruction of, or damage to the tenuous blood supply to the femoral head via the retinacular vessels. It has been postulated that this might lead to a reduction in the incidence of non-union or avascular necrosis for those fractures treated by internal fixation, however clinical evidence to support this is lacking.

Traction does, however, have potential disadvantages. It makes nursing of the patient more difficult: for example, in lifting the patient onto a bedpan or in pressure area care prior to surgery. Other possible adverse effects of skin traction are damage to the skin by mechanical shearing, ischaemia to the limb from tight bandages or allergy to adhesive strapping. If skeletal traction is used with a tibial pin the application of this can be uncomfortable, with the occasional complication of sepsis at the pin site. Furthermore, clinical studies have suggested that slight flexion, abduction and external rotation of the hip results in the lowest intracapsular pressure (Stromqvist 1988). Traction with the hip in extension may thereby increase intracapsular pressure (Svalastoga 1989), although this may not apply for traction with the hip in

the position described in the previous sentence (Maruenda 1997).

## OBJECTIVES

Our objective was to evaluate the effects (benefits and harms) of pre-operative traction to the injured limb following an acute fracture of the proximal femur in adults. We compared the relative effects of traction versus no traction; and skin versus skeletal traction. We considered these effects primarily in terms of pain relief; ease of fracture reduction and surgery; complications, mainly of immobilisation such as pressure sores; adverse effects of traction; fracture healing complications; and mortality.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

All randomised or quasi-randomised (i.e. those trials which allocated participants to an intervention using methods that are not strictly random such as those based on hospital record number, dates of birth and alternation) controlled trials comparing traction versus no traction, or different types of traction, for patients with an acute fracture of the proximal femur were considered.

#### Types of participants

Skeletally mature patients with a proximal femoral fracture.

#### Types of interventions

Application of skin or skeletal traction to the injured limb.

#### Types of outcome measures

Data for the following outcome measures were collected where available.

- Degree of pain prior to surgery
- Analgesia use prior to surgery
- Ease of fracture reduction or time taken to reduce fracture
- Length of surgery (in minutes)
- Intra-operative blood loss
- Incidence of pressure sores (also termed pressure ulcers).

There are many different pressure sore/ulcer classification systems in use. Typically, the higher the grade the more severe the damage to the tissues. Grade 1 generally represents reddened but unbroken skin (erythema).

- Incidence of thromboembolic complications
- Incidence of other complications (as specified in individual studies)
- Length of hospital stay (days)
- Mortality
- Incidence of fracture non-union
- Incidence of avascular necrosis: aseptic necrosis of bone
- Incidence of other fracture healing complications (as specified in individual studies)
- Patient satisfaction (outcome added in 2006 update)

### Search methods for identification of studies

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (March 2006), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* Issue 1, 2006), MEDLINE (1966 to March week 3 2006), EMBASE (1988 to 2006 week 11), CINAHL (1982 to March week 3 2006), the UK National Research Register Issue 1, 2006 ([www.nrr.nhs.uk/default.htm](http://www.nrr.nhs.uk/default.htm)), our own reference databases and reference lists of articles. We undertook a general perusal of locally accessible conference proceedings: for example, British Orthopaedic Association Congress 2000, 2001, 2002 and 2003. We also scrutinised weekly downloads of "Fracture" articles in new issues of 17 journals (*Acta Orthop Scand*; *Am J Orthop*; *Arch Orthop Trauma Surg*; *Clin J Sport Med*; *Clin Orthop*; *Emerg Med Clin North Am*; *Foot Ankle Int*; *Injury*; *J Accid Emerg Med*; *J Am Acad Orthop Surg*; *J Arthroplasty*; *J Bone Joint Surg Am*; *J Bone Joint Surg Br*; *J Foot Ankle Surg*; *J Orthop Trauma*; *J Trauma*; *Orthopedics*) from AMEDEO ([www.amedeo.com](http://www.amedeo.com)).

No language restriction was applied.

A generic search for hip fracture was run for MEDLINE (2002 onwards) (see [Appendix 1](#)). This was combined with all three stages of the optimal trial search strategy ([Higgins 2005](#)).

The general EMBASE (OVID-WEB) and CINAHL (OVID-WEB) search strategies for hip fracture trials are shown in [Appendix 2](#) and [Appendix 3](#) respectively.

### Data collection and analysis

Copies of all studies identified as eligible were obtained and scrutinised by all three review authors for the first version of this review; and subsequent updates by the two current review authors. Data for the outcomes listed above were extracted by both authors and any disagreement resolved by discussion. All trialists were approached for further information on outcomes and trial methodology.

### Assessment of methodological quality

In this review, risk of bias is implicitly assessed in terms of methodological quality.

For the first version of the review, each trial was assessed independently, without masking of authors or source, by two authors (MP and ET) for its quality of methodology, and differences resolved by discussion. Subsequent assessment of methodological quality has been performed by the two current authors using a similar process.

The main assessment of methodology was by the method of randomisation. In total, we assessed nine aspects of methodology. From the seventh update (Issue 3, 2006) of the review, the scores of the individual items were no longer summed.

(1) Was there clear concealment of allocation? Score 3 (and code A) if allocation clearly concealed (e.g. numbered sealed opaque envelopes drawn consecutively). Score 2 (and code B) if there was a possible chance of disclosure before allocation. Score 1 (and code B) if the method of allocation concealment or randomisation was not stated or was unclear. Score 0 (and code C) if allocation concealment was clearly not concealed such as those trials using quasi-randomisation (e.g. even or odd date of birth).

(2) Were the inclusion and exclusion criteria clearly defined? Score 1 if text states type of patients included and those excluded. Otherwise score 0.

(3) Were the outcomes of trial participants who withdrew or were excluded after allocation described and included in an intention-to-treat analysis? Score 1 if yes or text states that no post-randomisation exclusions or withdrawals occurred or data are presented clearly showing 'participant flow' which allows this to be inferred. Otherwise score 0.

(4) Were the treatment and control groups adequately described at entry? Score 1 if any four measures such as age, sex, mobility, fracture type, function score and mental test score were given. Otherwise score 0.

(5) Were the care programmes other than trial options identical? Score 1 if text states they were or this can be inferred. Otherwise score 0.

(6) Were the outcome measures clearly defined in the text with a definition of any ambiguous terms encountered? Score 1 if yes. Otherwise score 0.

(7) Were the outcome assessors blind to assignment status? Score 1 if assessors of pain and function at follow up were blinded to treatment outcome. Otherwise score 0.

(8) Was loss to follow up reported and if so were less than 5% of trial participants lost to follow up? Score 1 if yes. Otherwise score 0.

(9) Were the authors able to provide supplementary details of the trial in addition to published data? Score 1 if yes. Otherwise score 0.

#### Data analysis

For individual trials, we report relative risks (RR) with 95% confidence intervals for dichotomous outcomes, and mean differences (MD) and 95% confidence intervals for continuous outcomes. Results of comparable groups of trials were pooled using both the fixed-effect and random-effects models. Heterogeneity between

comparable trials was assessed by visual inspection of the forest plot along with consideration of the test for heterogeneity and the  $I^2$  statistic (Higgins 2003). If we decided to pool the results in the light of statistically significant heterogeneity ( $\chi^2 < 0.10$ ;  $I^2 > 50\%$ ), we presented the results for the random-effects model. There were insufficient data to perform sensitivity analyses.

## RESULTS

### Description of studies

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

The two new studies (Ghnamat 2005; Resch 2005) identified on updating the search from June 2004 to March 2006 were included. All 10 of the randomised controlled trials so far identified were included in this review. The subject-specific MEDLINE database search revealed three full published articles (Anderson 1993; Finsen 1992; Needoff 1993). Handsearching of journals identified the five conference abstracts related to these studies, including the study of Jerre 2000, and the full publications of Jerre 2000 and Resch 1998, previously available only as conference abstracts. Draper 1997 was identified via the UK National Research Register. On contacting the lead author, an internal report and a reference to the published trial report were obtained. The published trial report was only indexed in CINAHL in May 2000. Rosen 2001 was located simultaneously by prospective journal searching and searching the specialised register. Ghnamat 2005, Resch 2005 and Yip 2002 were located via EMBASE.

The trials involved a total of 1546 patients and included both intracapsular and extracapsular fractures. The mean age of trial participants in individual trials ranged between 73 and 81 years. The proportion of females in each study varied from 57% to 85%. The proportion of intracapsular fractures varied from 19% to 58%. Nine studies (Anderson 1993; Draper 1997; Finsen 1992; Ghnamat 2005; Jerre 2000; Needoff 1993; Resch 2005; Rosen 2001; Yip 2002) compared traction with no traction, and two studies (Finsen 1992; Resch 1998) compared skin with skeletal traction. Resch 2005 had two non-traction groups, one involving placement of the injured limb in a specially designed foam pillow and the other where an ordinary pillow was placed under the hip of the injured limb. Five trials (Anderson 1993; Draper 1997; Ghnamat 2005; Resch 1998; Resch 2005) explicitly mentioned the exclusion of patients who were unable to tolerate traction, such as those with skin ulcers.

Details of individual trials are given in the 'Characteristics of included studies' table.

### Risk of bias in included studies

The method of randomisation was not described in [Needoff 1993](#), and only stated as being based on random numbers in [Finsen 1992](#), and entailing the use of a computer-generated programme in [Rosen 2001](#). Details of the methods of randomisation in [Draper 1997](#), [Jerre 2000](#), [Resch 1998](#) and [Resch 2005](#) were obtained by correspondence. In [Draper 1997](#), the order of a pile of pink (for traction) and blue (no traction) data collection booklets was determined using a random numbers table. In [Jerre 2000](#), randomisation was by sealed opaque envelopes and involved the use of a telephone line; allocation concealment seemed very likely for this trial. In [Resch 1998](#) and [Resch 2005](#), the nurse in the emergency department taking care of the patient, after X-ray diagnosis, drew an envelope from a pre-prepared set of closed envelopes. An imbalance between the two groups in [Draper 1997](#) in the numbers of participants, with the possibility that some participants with low mental function scores were not given traction by nursing staff, points to a probable lack of safeguards to allocation concealment in this trial. We were also unable to ascertain if allocation concealment was achieved in [Finsen 1992](#), [Resch 1998](#), [Resch 2005](#) or [Rosen 2001](#). In particular, there was an unexplained imbalance in the number of participants in the three groups in [Resch 2005](#): the number in the special foam pillow group (21) was under half that in each of the other two groups (49 and 53). However, further details supplied for [Rosen 2001](#) showed allocation concealment to be likely for this trial, whereas [Needoff 1993](#) was later confirmed to be quasi-randomised being based on case note numbers. [Anderson 1993](#), [Ghnaimat 2005](#) and [Yip 2002](#) were also quasi-randomised, the treatment allocation being determined by the last digit of the patient registration number. Only two trials ([Anderson 1993](#); [Ghnaimat 2005](#)) included a blinded assessment, which was for ease of fracture reduction in both cases.

The suggestion, put forward by the trial investigators, that trial participants with low mental function scores assigned traction were not generally given traction by the nursing staff involved indicates fundamental problems with the performance of [Draper 1997](#). Although compensatory analyses were carried out by [Draper 1997](#) in an attempt to counteract the difference in mental function scores of the two groups, the highly statistically significant imbalance in the scores (reported to be  $P < 0.001$ ) and the numbers who scored zero (2 participants of the traction group versus 37 of the no traction group) point to more fundamental problems which probably cannot be totally remedied by post-hoc analyses. Draper estimated that approximately 17 people assigned traction were not given traction, but the lack of a definite number also indicates some slackness in the conduct of this trial. Regrettably, data for this trial are no longer available (personal communication).

#### Assessment of methodology scores (items 1 to 9 described in 'Methods of the review')

1 2 3 4 5 6 7 8 9 Trial  
 0 1 0 1 1 1 0 1 0 [Anderson 1993](#)  
 1 1 0 1 1 1 0 1 1 [Draper 1997](#)

1 1 0 0 1 1 0 0 0 [Finsen 1992](#)  
 0 1 0 0 0 0 0 0 0 [Ghnaimat 2005](#)  
 3 0 1 1 1 1 0 0 1 [Jerre 2000](#)  
 0 1 0 1 1 1 0 1 1 [Needoff 1993](#)  
 2 1 1 0 0 1 0 1 1 [Resch 1998](#)  
 2 1 0 0 0 1 0 0 1 [Resch 2005](#)  
 2 1 1 0 1 1 0 1 1 [Rosen 2001](#)  
 0 1 1 1 1 0 0 1 1 [Yip 2002](#)

#### Effects of interventions

Further details, particularly to enable data analysis, were sought from the authors of all the trials. Replies from [Finsen 1992](#) and [Needoff 1993](#) produced no or only limited new information. This reflected the regrettable loss of access to the original data. [Jerre 2000](#) provided supplementary information which included a draft trial report. As well as providing the internal report of his study, [Draper 1997](#) provided some other details of trial methodology. [Resch \(Resch 1998; Resch 2005\)](#) and the authors of [Rosen 2001](#) and [Yip 2002](#) provided further details of trial methodology. Additional results were also provided for [Resch 2005](#) and [Yip 2002](#). The authors of this review would be pleased to receive any further data from the authors of the individual trials as this would permit a more detailed analysis.

All studies except [Draper 1997](#) reported or provided some evidence that patient characteristics were similar for each of the randomised groups. In [Draper 1997](#), the number of trial participants in the two groups differed considerably (182 versus 121), and as indicated above, the mental test scores of participants of the traction group were significantly higher than those of the no traction group. Otherwise, the patient characteristics of the two groups were similar. Given the suggested reason for the imbalance in mental function scores was that traction was not applied to mentally impaired participants, despite them being randomised to the traction group, this trial could not be analysed on an intention-to-treat basis. [Draper 1997](#) attempted to remedy this using statistical methods to exclude an alternative hypothesis that the trial results reflected the difference in mental function scores. However, doubts remain about the validity of the results of this study. The various data provided in the study reports for time intervals, such as time between trauma and surgery, hospital admission and surgery, and treatment (traction) and surgery, showed no apparent difference between the treatment groups in individual studies. The time to surgery was around 24 hours in most trial participants, which reflects current trends. From an inspection of a graph in [Ghnaimat 2005](#), we estimate that the mean time to surgery was between two and three days in this trial. In contrast, the mean time to surgery was 4.7 days in [Yip 2002](#).

The follow-up period included the operation in all studies except [Rosen 2001](#) where participants were followed up until surgery. [Anderson 1993](#) and [Ghnaimat 2005](#) exceeded this by recording the length of hospital stay; [Resch 1998](#) and [Resch 2005](#) monitored

complications such as infection and oedema on the ward for three to four days after the operation; and [Draper 1997](#) assessed pressure sores daily up to the seventh post-operative day. [Jerre 2000](#) was the only study to follow up trial participants after discharge, but even then the length of follow up was only four months. [Yip 2002](#) claimed a follow up of one year, though only data up to one week from admission were provided.

### (1) Traction versus no traction

Nine studies ([Anderson 1993](#); [Draper 1997](#); [Finsen 1992](#); [Ghnamat 2005](#); [Jerre 2000](#); [Needoff 1993](#); [Resch 2005](#); [Rosen 2001](#); [Yip 2002](#)) compared the application of skin traction with no traction. [Finsen 1992](#) also compared skeletal traction with no traction, as well as comparing skin with skeletal traction. The results from the 21 trial participants allocated to a special foam pillow in [Resch 2005](#) have not been included. This reflects our concerns about the imbalance in the numbers in this group compared with the other two groups of this trial, and that the non-traction intervention is importantly different from the usual control group intervention that, where described, involved the use of an ordinary pillow.

Various outcome measures were used by the different trials for assessing pain and pain relief. Eight studies ([Anderson 1993](#); [Draper 1997](#); [Ghnamat 2005](#); [Jerre 2000](#); [Needoff 1993](#); [Resch 2005](#); [Rosen 2001](#); [Yip 2002](#)) used a visual analogue pain score to measure pain; [Draper 1997](#) distinguished between the pain patients felt at rest and that felt when moving in bed. [Anderson 1993](#), [Ghnamat 2005](#), [Jerre 2000](#) and [Needoff 1993](#) found no significant difference between the two groups in pain scores. Both [Resch 2005](#) and [Rosen 2001](#) found no significant difference between the two groups in the pain soon after immobilisation (*see* Analysis 01.01). Similar numbers of trial participants in the two groups of [Resch 2005](#) found the process of immobilisation uncomfortable (12/49 versus 13/53; relative risk (RR) 1.00; 95% confidence interval (CI) 0.50 to 1.97; analysis not shown). While [Rosen 2001](#) found no significant difference in the mean reduction in pain scores at 15 minutes after the application of traction or resting the leg on a pillow (1.24 versus 1.44; reported  $P = 0.60$ ), the mean reduction in pain score from that before either traction or control to that assessed the next morning was reported as being significantly less in those allocated traction (1.76 versus 2.82; reported  $P = 0.04$ ). Conversely [Draper 1997](#) reported a statistically significant difference in the scores for rest pain in the first day after injury in favour of the traction group. However, the clinical significance of the difference in the rest pain scores was not stated by [Draper 1997](#) and no difference between the two groups was noted in the much higher pain on movement scores. More traction group participants considered their intervention (traction or pillow rest) painful in [Rosen 2001](#) (27/50 versus 17/50; RR 1.59; 95% CI 1.00 to 2.52). Pain scores were collected five times a day until surgery in [Yip 2002](#). Scores for the evening of admission and the first pain score on the next day were stated to be statistically significantly increased ( $P$  value < 0.001) for the no traction group. However, the clinical

significance of these differences in pain scores was not established. There were no statistically significant differences between groups in the mean daily pain scores for the day of admission or for the following two days.

Analgesic use was recorded by all trials but data for presenting in the analyses were only available from three trials ([Anderson 1993](#); [Resch 2005](#); [Rosen 2001](#)); *see* Analyses 01.02 and 01.03. The data for [Anderson 1993](#) were extracted, from a bar chart of pre-operative analgesia given in the first three days of admission, provided in the trial report. The data from [Rosen 2001](#) represent trial participants who requested pain medication between hospital admission and surgery; on average the time to surgery was between 1.2 days (traction group) and 1.3 days (pillow group). Although there was a tendency for more traction group participants to receive analgesics in the first day in [Anderson 1993](#) there was no significant difference between the two groups (54/101 versus 71/151; RR 1.14, 95% CI 0.89 to 1.46); and there was no difference between the two groups in the proportions of trial participants, still awaiting surgery, who received analgesia in the second day (32/64 versus 44/90; RR 1.02, 95% CI 0.74 to 1.41). [Anderson 1993](#) concluded that there was “no difference” between the groups in terms of analgesic use. Conversely, [Rosen 2001](#) found that as well as a tendency for more traction group participants to receive analgesics before surgery (45/50 versus 39/50; RR 1.15, 95% CI 0.97 to 1.37), significantly more traction group participants received greater than the median value of the medication dosages adjusted for a 24 hour period (32/50 versus 18/50; RR 1.78, 95% CI 1.16 to 2.72). [Resch 2005](#) found no significant difference between the groups in the analgesic use on the ward (mean difference in number of doses -0.20, 95% CI -1.16 to 0.76). [Draper 1997](#) reported that there was no significant difference in the number of doses of analgesics received by participants of the two groups and [Jerre 2000](#) stated there was no significant difference in the analgesic requirements between the two groups. [Finsen 1992](#), while emphasising their reservations about analgesic use as a measure of need for pain relief, noted the skeletal traction group received more pain medication than the no traction group; there was no apparent difference between the skin traction and no traction group. [Needoff 1993](#), where all patients received analgesia on admission, reported a statistically significant increase in the consumption of analgesics in the traction group compared with that for the no traction group in the first day, but not in the second day. Both [Ghnamat 2005](#) and [Yip 2002](#) provided insufficient data for us to confirm the reported lack of statistically significant differences in analgesia requirements between the two groups.

Five studies considered fracture reduction. Both [Anderson 1993](#) and [Ghnamat 2005](#) found no significant difference in ease of fracture reduction as assessed by the operating surgeons who were blinded to treatment (*see* Analysis 01.04 Difficulty in fracture reduction: 15/81 versus 19/102; RR 0.92, 95% CI 0.51 to 1.67). [Finsen 1992](#) found a significantly reduced reduction time for those fractures treated without traction. However [Finsen 1992](#) found no

significant difference between the two groups in the overall operating time. [Jerre 2000](#) considered the quality of fracture reduction and found no significant difference in the quality of fracture reduction related to the use of traction (*see* Analysis 01.05 Poor quality fracture reduction: 2/60 versus 3/60; RR 0.67, 95% CI 0.12 to 3.85). All four studies ([Finsen 1992](#); [Needoff 1993](#); [Resch 2005](#); [Yip 2002](#)) reporting overall operating time found there was no significant difference between the two groups. Pooled data from two studies ([Resch 2005](#); [Yip 2002](#)) are shown in Analysis 01.06 (mean difference 1.28 minutes, 95% CI -4.82 to 7.39 minutes). [Yip 2002](#) also found no significant difference between the two groups in mean intra-operative blood loss (*see* Analysis 01.07). Six studies ([Anderson 1993](#); [Draper 1997](#); [Ghnaimat 2005](#); [Jerre 2000](#); [Needoff 1993](#); [Yip 2002](#)) reported pressure sores. [Anderson 1993](#) reported that all trial participants had grade 1 pressure sores ("simple erythema") during their stay in hospital, but found no significant difference between groups in the numbers of people with grade 2 and above pressure sores (separate data for groups not given in report). Twenty-two separate pressure sites on each person were inspected daily until the seventh post-operative day in [Draper 1997](#). No difference was found in the "global" scores of the two groups, and the only site to show any significant difference, in favour of the traction group, was the heel of the contralateral leg to the injured leg ( $P = 0.016$ ). However, the clinical significance of this finding was questioned by [Draper 1997](#), who indicated that there were no cases of skin ulceration or skin breakage at this site. There were no deep sores in [Draper 1997](#) and few (21) observations of sites with ulceration; [Draper](#) considered that the regular examination of pressure sites might have helped reduce the risk of pressure sores. [Jerre 2000](#) noted that, prior to surgery, five participants of the traction group developed grade 1 pressure or wound sores as opposed to none in the group with no traction (*see* Analysis 01.08: RR 11.0, 95% CI 0.62 to 194.63). [Ghnaimat 2005](#) reported that 14 patients developed a grade 2 pressure sore while in hospital. They reported, without providing data, that there was no significant difference between the two groups in the number of pressure sores. Later complications, all minor, in [Jerre 2000](#) included pressure sores and urinary tract infections but no thromboses or wound infections; post-operative complications occurred in 10 participants of traction group and 13 of those without traction (*see* Analysis 01.08: RR 0.77, 95% CI 0.37 to 1.62). [Needoff 1993](#) indicated that there was no difference in pressure sores between the two groups (personal communication). No trial participant had a pressure sore in [Yip 2002](#) (personal communication). At three to four days follow up, four traction group participants of [Resch 2005](#) had complications (two of erythema, one of oedema, and one of paraesthesia) but none of the control group (*see* Analysis 01.08: RR 9.72, 95% CI 0.54 to 176.00).

Complications directly related to traction were referred to in four studies. [Anderson 1993](#) and [Ghnaimat 2005](#) noted that no trial participant suffered direct skin damage as a result of the applica-

tion of traction and [Yip 2002](#) stated that there were no complications related to either the use or non-use of traction in their trial. Conversely, [Rosen 2001](#) reported that one person in the traction group suffered from transient sensory changes in the leg and a further two people developed superficial skin blisters.

Fracture healing complications were not well documented. [Jerre 2000](#) was the only study to report on fracture healing complications for 110 out of 120 trial participants. Fracture healing failures at four months are presented, with separate data for intracapsular and extracapsular fractures, in Analysis 01.09: 14/54 versus 9/56; RR 1.61, 95% CI 0.76 to 3.41. For intracapsular fractures, fracture healing was deemed to have failed in 11 out of 26 intracapsular fractures allocated to traction and nine out of 29 allocated to no traction. For the trochanteric fractures, fracture healing was reported as failing in three out of 28 cases allocated to traction and none out of 27 cases allocated to no traction. None of these differences were statistically significant. [Jerre 2000](#) also reported on fracture compression at one week after surgery and stated there was no significant difference between groups. [Needoff 1993](#) had intended to assess the incidence of avascular necrosis at one year in a subgroup of minimally displaced femoral neck fractures but found there were insufficient numbers of these to continue.

As well as those outcomes already considered above, data were mostly unavailable for many of the other, generally longer-term outcomes such as avascular necrosis (for intracapsular fractures), listed in the protocol for this review, either because these were not recorded or not reported by these studies. [Finsen 1992](#) found an increased blood loss during surgery in the skeletal traction group (significant for trochanteric fractures) but not in the skin traction group when compared with the no traction group. [Anderson 1993](#) found no significant difference in the length of hospital stay (*see* Analysis 01.10). Similarly, [Ghnaimat 2005](#) reported no significant difference in the length of hospital stay (19.1 versus 18.4 days). Two studies ([Finsen 1992](#); [Jerre 2000](#)) reported mortality. [Finsen 1992](#) reported two pre-operative deaths in the no traction group and [Jerre 2000](#) reported that seven deaths had occurred by four-months follow up.

## (2) Skin traction versus skeletal traction

Two studies ([Finsen 1992](#); [Resch 1998](#)) compared skin versus skeletal traction. [Resch 1998](#) found no difference between the two groups in pain soon after traction as measured on a visual analogue scale (*see* Analysis 02.01). [Resch 1998](#) stated that significantly more people (reported  $P = 0.03$ ) found the application of skeletal traction painful (50% of skeletal compared with 20% of skin traction group participants) but data for presentation in the analyses were not available (*see* 'Notes' for [Resch 1998](#) in 'Characteristics of included studies' table). As stated above, [Finsen 1992](#) noted an increase in the use of analgesia medications in the skeletal traction group. Although [Resch 1998](#) reported a small but significant reduction in the mean number of analgesic medications for those treated with skeletal traction (*see* Analysis 02.02: mean

difference 0.80, 95% CI 0.13 to 1.47), they concluded that this difference had no clinical significance.

As noted above, [Finsen 1992](#) reported an increased blood loss for skeletal traction which was significant for trial participants with trochanteric fractures. [Finsen 1992](#) found no difference in the time taken to reduce the fracture or the length of surgery. [Resch 1998](#) reported no significant difference in the length of operation (*see* Analysis 02.03: mean difference -10.0 minutes, 95% CI -23.65 to 3.65 minutes). [Resch 1998](#) stated that no complications were seen in either traction method. [Finsen 1992](#) observed that traction involved additional hospital resources, particularly skeletal traction which required use of an operating theatre. [Resch 1998](#) reported no significant difference in the time spent in the emergency department where the traction was applied.

Neither study recorded longer-term outcomes.

## DISCUSSION

Traction prior to surgery for an acute hip fracture used to be routine and in some hospitals remains standard practice. For example, a survey of 78 hospitals in Sweden ([Billsten 1996](#)) showed that a quarter of these routinely applied skin traction to all hip fractures. Another survey ([Brink 2005](#)) found pre-operative traction was standard practice in 20% of trauma departments in the Netherlands, mainly for an assumed reduction in pain. The two newly included randomised trials in this update together with the seven already included have similar results and all have concluded that since traction does not significantly reduce the degree of pain the patient experiences pre-operatively or aid reduction of the fracture, its routine use may be superfluous. However these studies were mainly of modest quality and had varied and incomplete ascertainment of outcome. Only limited pooling of results was undertaken due to the different outcome measures used or incomplete data. Though statistical corrections for an imbalance of mental function scores in the two groups were performed in [Draper 1997](#), the validity of the results is still questionable due to the underlying possibility of a serious breach of trial protocol. Despite evidence for greater pain and analgesic use associated with traction, [Rosen 2001](#) did not address surgical or post-surgical outcome and concluded that other proposed benefits of traction needed to be addressed in future research. The imbalance in numbers in the three groups of [Resch 2005](#) remains unexplained but the exclusion of the group testing a special pillow has meant that the control groups in the nine trials are comparable. Worrisome reporting discrepancies appeared in [Ghnaimat 2005](#). This trial also had a younger population and a much smaller proportion of intracapsular fractures than the other trials. [Yip 2002](#) also differed from the others particularly in the greater time to surgery (mean time 4.7 days). The extended use of traction resulting from this did not appear to be of advantage: the graphs of pain scores and analgesic requirement presented in the trial report showed a

decline for both groups in pain and analgesic consumption after peaking in the day following admission.

Six studies ([Anderson 1993](#); [Draper 1997](#); [Ghnaimat 2005](#); [Jerre 2000](#); [Needoff 1993](#); [Yip 2002](#)) reported on pressure sores. All participants of [Anderson 1993](#) developed grade 1 pressure sores ("simple erythema") during hospital stay, but data split by treatment group were not available for the 14 more serious pressure sores, three of which developed pre-operatively. [Draper 1997](#) reported that of 46,958 observations of 22 pressure sites in each patient on a daily basis over seven days, there were 21 instances of skin ulceration. Again data split by treatment group were not available, but no difference in the global scores between the two groups was reported in [Draper 1997](#). [Jerre 2000](#) noted that, before surgery, five participants of the traction group developed grade 1 pressure or wound sores as opposed to none in the group with no traction (*see* Analysis 01.08). [Ghnaimat 2005](#) reported that the pressure sores of five of the 14 of the patients developing grade 2 pressure sores in hospital were apparent before the operation. Later complications, all minor, in [Jerre 2000](#) included pressure sores and urinary tract infections but no thromboses or wound infections; post-operative complications occurred in 10 participants of the traction group and 13 of those without traction (*see* Analysis 01.04). [Needoff 1993](#) indicated that there was no difference in pressure sores between the two groups (personal communication). [Resch 1998](#) reported that there were no complications, which may imply that there were no pressure sores in either traction group. Two of the four complications in the skin traction group of [Resch 2005](#) were erythema. No one had a pressure sore in [Yip 2002](#); there were, however, no details of the monitoring of complications in this study.

As well as the limitations in the evidence for the proposed benefits of traction, there was only sparse information on complications, especially those occurring pre-operatively during traction. Though the excess of pre-operative pressure sores, all grade 1, in [Jerre 2000](#) in the traction group could have occurred by chance, the increase is notable. Such an increase is also plausible since the use of traction inhibits the proper turning of the patient. However, [Draper 1997](#) considered that their results enabled them to conclude that traction does not cause sores. There was no information provided in [Jerre 2000](#) on whether surgery was delayed in those with pressure sores, but overall there was no significant difference between the two groups in the mean time (both under 24 hours) between the start of traction (or acting as a control) and surgery. All three complications directly linked to traction use in [Rosen 2001](#) were minor and resolved without sequelae.

Neither study comparing the two methods found any major difference between skeletal and skin traction. Again the data are insufficient to confirm this.

It is unknown if the arguments for and against traction apply equally for both intracapsular and extracapsular fractures. Though

both Finsen 1992 and Jerre 2000 presented separate data for extracapsular and intracapsular fractures, the numbers of patients within these groups were too small to be able to draw any significant conclusions. Resch 2005 stated without providing evidence that “fracture type did not affect outcome”. There are no available data to clarify whether subgroups of hip fracture patients, such as those with displaced intracapsular fractures or subtrochanteric fractures might benefit from application of traction.

Patient satisfaction with, and toleration of, the interventions under test, and resource outcomes were not listed in the protocol but are nonetheless important and are even more so if the application of traction does not appear to reduce pre-operative pain and clinical outcome, or affect fracture fixation and longer-term outcome. However, none of the included studies reported patient satisfaction nor systematically recorded resource outcomes.

## AUTHORS' CONCLUSIONS

### Implications for practice

From the limited evidence available, there is no proven benefit for the routine use of traction (either skin or skeletal) prior to surgery for a hip fracture. However, the limited numbers of patients involved and the flawed methodology of the studies means that potential advantages for traction, in particular for specific fracture types, cannot be excluded. The potential for complications, such as pre-operative pressure sores, arising from the use of traction should also be considered.

### Implications for research

The trials so far conducted have not shown any benefit from the use of traction prior to surgery for hip fracture but were not suffi-

cient to confirm this, nor additional complications due to traction use. In any future studies planned, the aim should be to minimise bias particularly by allocation concealment and blind assessment of appropriate outcome measures, including patient satisfaction and fracture healing complications, defined in the study protocol. Confounding should be minimised by ensuring that, other than the traction option, care programmes are the same for all participants. Full reporting of trial methods and outcomes, including the provision of standard deviations where appropriate, is also essential. Given the potential of trials to influence both clinical practice and future research, we recommend that original data should be retained to enable future scrutiny.

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\* *Indicates the major publication for the study*

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies [ordered by study ID]

#### Anderson 1993

Methods	Randomised by last digit of patient's registration number.
Participants	252 people with a proximal femoral fracture Orthopaedic hospital in Leicester, UK Excluded: patients refusing consent, senile patients, and patients with conditions which contraindicated the use of skin traction as specified in the published article Average age: 81 years Females: 77% Intracapsular: 46% Assigned: 101/151 [traction / control]
Interventions	Pre-operative skin traction using 2.3 kg weight of traction applied via Hamilton-Russell traction versus those nursed free in bed (exact method of nursing the injured limb not specified)
Outcomes	Length of follow up: unknown (until discharge) Daily pain scores (visual analogue score 0 [no pain] to 10 [worst pain]) Difficulty in fracture reduction Analgesic use on day 1, 2 and 3 Pressure sores (grades 1 and 2; reference to Morison 1989. Grade 1 = "simple erythema") Length of hospital stay
Notes	Pain scale direction inferred.

#### *Risk of bias*

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

#### Draper 1997

Methods	Randomised using a random numbers table to order colour coded booklets (pink = traction; blue = no traction) into a pile. The top envelope of the pile was withdrawn when a patient was admitted into the study. Possibility of post-randomisation exclusions or transfer of patients from one group to another (see Notes).
Participants	303 people with a proximal femoral fracture Orthopaedic hospital in Hull, UK Excluded: patients refusing consent; multiple fractures or injuries; presence of pressure sores graded 3 or above at hospital admission; transfer from another hospital; fracture not considered suitable for surgical treatment; absence, paralysis or severe contraction of lower limb; presence of skin condition severe enough to prevent application of skin extension tapes. Average age: 80.5 years

**Draper 1997** (Continued)

	Female: 84.5% Intracapsular: 48.5% Assigned: 121/182 [traction / control]
Interventions	Pre-operative skin traction using 2.5 kg weight of traction applied via Hamilton-Russell traction versus those nursed free in bed (injured limb placed on pillow; patient encouraged to adopt position of greatest comfort)
Outcomes	Length of follow up: 7th post-operative day Pain scores (visual analogue scale: 0 [no pain] to 10 [excruciating pain]): at rest and during movement in bed, pre-operative only. Analgesic consumption Pressure sores (22 pressure sites inspected and graded. Graded using Torrance 1983. Score 1 = blanching (skin goes white on pressure) erythema, score 2 = non blanching erythema, score 3 = ulceration)
Notes	Additional report of trial provided by main author. The number of participants in the two groups were dissimilar (121 versus 182), as was the number of participants with low (0) mental test scores (2 versus 37). The authors suggested the reason for this might be failure by nursing staff to apply traction to mentally confused participants allocated to the traction group; these were then included in the non-traction group. Because of this potential bias in the different characteristics of the two groups, analysis of co-variance was undertaken by the authors to try to correct for the imbalance.

**Risk of bias**

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Finsen 1992**

Methods	Randomised by the use of random numbers. 38 post-randomisation exclusions: 21 impacted fractures, 17 who had surgery within 6 hours of admission.
Participants	118 people with a proximal femoral fracture Orthopaedic hospital in Orkanger, Norway Average age: 79 years Female: 74% Intracapsular: 58% Assigned: ?/?/? Assessed: 26/29/25 [skin traction / skeletal traction / control]
Interventions	Pre-operative skin traction using 3 kg weight of traction applied via a pulley at the end of the bed versus pre-operative skeletal traction (10% of body weight) applied via a Steinman pin versus those nursed free in bed (injured leg placed on pillow)
Outcomes	Length of follow up: included surgery; analgesic data for 24 hours Analgesic consumption

**Finsen 1992** (Continued)

	Time taken in fracture reduction Operation time Operative blood loss Mortality	
Notes	Reply received: no new information	
<b>Risk of bias</b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	B - Unclear

**Ghnamat 2005**

Methods	Randomised by last digit of hospital admission number.	
Participants	74 people with a proximal femoral fracture Orthopaedic hospital in Zarqa, Jordan Excluded: patients refusing consent, patients with conditions which contraindicated the use of skin traction: e.g. skin ulceration, severe oedema or peripheral arterial disease, lower limb deformities, allergy to adhesive bandages Average age: 73 years Females: 57% (see Notes) Intracapsular: 19% (see Notes) Assigned: 36/38 [traction / control]	
Interventions	Pre-operative skin traction using 6 lb weight of traction applied via longitudinal traction versus those nursed free in bed (exact method of nursing the injured limb not specified)	
Outcomes	Length of follow up: unknown (until discharge or up to 7 days?) Daily pain scores (visual analogue score 0 [no pain] to 10 [worst pain]) Difficulty in fracture reduction (see Notes) Analgesic use on days 1 to 7 Pressure sores (grades 1 and 2; no mention of classification system) Complications related to traction Length of hospital stay	
Notes	Text and tables contradictory for sex ratio, present values are calculated from the text (ratio female to male: 2/1.5). This also applied to the number of intracapsular fractures, again the number in the text was used in the review. Percentages given for the fracture reduction results do not tally with the numbers randomised. Pain scale direction inferred.	
<b>Risk of bias</b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>

**Ghnamat 2005** (Continued)

Allocation concealment?	No	C - Inadequate
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**Jerre 2000**

Methods	Randomised by sealed opaque envelopes and involving the use of a telephone line. No post-randomisation exclusions.
Participants	120 people with a proximal femoral fracture Orthopaedic hospital in Goteborg, Sweden Average age: 80 years (range 50-96) Female: 76% Intracapsular: 50% Assigned: 60/60 [traction / control]
Interventions	Pre-operative skin traction using 3 kg weight of traction applied to the leg via a foam rubber boot and straps and the leg placed in a traction sled versus those nursed free in bed (exact method of nursing the injured limb not specified)
Outcomes	Length of follow up: 4 months Pain scores (visual analogue scale: 0 [pain-free] to 10 [worst pain imaginable]) at 1, 4 and 12 hours after 'treatment' (application of traction or allocation to control group) Supplementary analgesic consumption Quality of fracture reduction Pre-operative complications (pressure sores: all grade 1; classification system not stated) Post-operative complications (e.g. urinary tract infections, red spots, pressure sores) Fracture healing complications Wound infection Thrombosis Fracture compression Mortality
Notes	Reply from authors of trial with supplementary information of trial methodology and results. 30 cervical fractures and 30 trochanteric fractures were allocated to traction and 30 cervical fractures and 30 trochanteric fractures to 'no traction'.

**Risk of bias**

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

**Needoff 1993**

Methods	Randomisation based on case note number. 3 post-randomisation exclusions: not operated on.
Participants	67 people with a proximal femoral fracture Orthopaedic hospital in Nottingham, UK Excluded: 33 patients with mini-mental state examination score of 23 or less out of 30 points Average age: 78 years Female: 77% Intracapsular: 50% Assigned: 32/35 [traction / control]
Interventions	Pre-operative skin traction using 2.5 kg weight of traction applied via skin traction over a pulley at the end of the bed versus those nursed free in bed (injured leg in comfortable position - flexion, abduction and external rotation - with pillow under thigh)
Outcomes	Length of follow up: unknown (2 days?) Pain scores (visual analogue scale: 0 (pain-free) to 10 (worst pain possible)) Analgesic consumption Operating time Pressure sores (no description of classification system or monitoring of these)
Notes	Reply received: method of randomisation, no difference in care programmes, or pressure sores.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

**Resch 1998**

Methods	Randomised by closed envelopes. After X-ray diagnosis, the nurse in the emergency department taking care of the patient drew an envelope from a pre-prepared set of closed envelopes.
Participants	78 people with a displaced proximal femoral fracture Orthopaedic hospital in Lund, Sweden Excluded: 75 patients unable to give informed consent Average age: 81 years Female: 73% Intracapsular: 55% Assigned: 40/38 [skin traction / skeletal traction]
Interventions	Pre-operative skin traction using 3 kg weight of traction applied to the leg via a foam rubber boot and straps and the leg placed in a traction sled versus pre-operative skeletal traction (5% to 10% of body weight) applied via a K-wire through the proximal tibia

**Resch 1998** (Continued)

Outcomes	<p>Length of follow up: 3-4 days                  Pain scores (visual analogue scale: 0 [pain-free] to 10 [worst pain imaginable])                  Use of analgesics                  Complications related to traction                  Length of operation                  Time spent in hospital departments</p>	
Notes	<p>Abstract only available for the first version of review.                  Small discrepancies in denominators for numbers of participants who found the application of traction painful. Text gives 7/35 versus 16/43. Possible intention-to-treat problem but also could be results for trochanteric (35) versus cervical (43) fractures. Results from abstract (and summary of full report) retained for this outcome.                  Information on method of randomisation received indirectly from authors. Also confirmation that no patient was lost to follow up.</p>	
<b>Risk of bias</b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	B - Unclear

**Resch 2005**

Methods	<p>Randomised by closed envelopes. After X-ray diagnosis, the nurse in the emergency department taking care of the patient drew an envelope from a pre-prepared set of closed envelopes. Queried imbalance in the numbers in the 3 intervention groups with the trialists but this remained unexplained (49; 21; 53).</p>	
Participants	<p>123 people with a displaced proximal femoral fracture                  Orthopaedic hospital in Lund, Sweden                  Excluded: patients unable to give informed consent; local problems that would prohibit the use of skin traction such as ulcers, eczema or perivascular disease                  Average age: 81 years                  Female: 73%                  Intracapsular: 46%                  Assigned: 49/21/53 [skin traction / Lasse pillow / control]</p>	
Interventions	<p>Pre-operative skin traction using 3 kg weight of traction applied to the leg via a foam rubber boot and straps and the leg placed in a traction sled versus those with their lower leg placed in a special foam pillow (Lasse pillow) that allowed some movement while preventing inadvertent movement of the injured leg versus those nursed free in bed (injured leg in resting position with pillow placed under thigh).                  Leg position - 30 degrees flexion and slight outward rotation of the hip and supported by pillows - same in the 3 groups</p>	
Outcomes	<p>Length of follow up: 3-4 days                  Pain scores (visual analogue scale: 0 [pain-free] to 10 [worst pain imaginable])                  Use of analgesics                  Complications (erythema (2), oedema (1) and paraesthesia (1))                  Length of operation</p>	

Resch 2005 (Continued)

	Time spent in hospital departments	
Notes	Possible intention-to-treat problem. Reply received: method of randomisation, some baseline characteristics and complications split by treatment group.	
<b>Risk of bias</b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	B - Unclear

Rosen 2001

Methods	Randomised using a computer programme to randomly assign 100 sequential 'slots' to #1 or #2; these were then assigned as traction or pillow.	
Participants	<p>100 people with a proximal femoral fracture                      Orthopaedic hospital in New York, USA                      Excluded: patients younger than 50 years of age, underlying dementia, other concomitant injury, presentation more than 24 hours after the initial injury. Patients had to have adequate cognitive function to be considered for inclusion.                      Average age: 78 years (range 50-97 years)                      Female: 78%                      Intracapsular: 55% (in text), 43% (in table)                      Assigned: 50/50 [traction / control]</p>	
Interventions	Pre-operative skin traction using 5 pounds weight of traction applied via a foam traction boot versus those nursed free in bed (injured leg in resting position with pillow placed under thigh)	
Outcomes	<p>Length of follow up: till surgery                      Pain scores (visual analogue scale: 0 [no pain] to 10 [extreme pain]): 15 minutes after application traction or leg rested on pillows and the following morning.                      Pain on application traction/rest on pillows                      Analgesic consumption                      Complications of traction</p>	
Notes	Reply received: method of randomisation, all patients received allocated treatment, identical pre-operative care.	
<b>Risk of bias</b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	B - Unclear

**Yip 2002**

Methods	Randomised by last digit of patient's registration number.	
Participants	311 people with a proximal femoral fracture Orthopaedic hospital in Hong Kong Excluded: patients with senile dementia or taking regular analgesia prior to admission Average age: 79 years Females: 66% Intracapsular: % not stated Assigned: 166/145 [traction / control]	
Interventions	Pre-operative skin traction using 2 kg weight of traction applied via a foam boot versus those nursed free in bed (injured leg placed on pillow)	
Outcomes	Length of follow up: one year (however, only data up to one week from admission were presented). Pain scores (visual analogue score: 0 [no pain] to 2 [worst pain]) assessed 4 times each day pre-operatively Analgesic use pre-operatively Operative blood loss Operative time Complications (no description of recording of these, including the monitoring of pressure sores)	
Notes	Reply received: no difference in care programmes, confirmation of no loss to follow-up, no pressure sores, full results for operative time. Top end (2) of pain scale inferred from graph in article.	
<b><i>Risk of bias</i></b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	No	C - Inadequate

## DATA AND ANALYSES

### Comparison 1. Pre-operative traction versus no traction

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain soon after immobilisation (Visual Analogue Scale: 0: none to 10: worst imaginable)	2	202	Mean Difference (IV, Fixed, 95% CI)	0.27 [-0.40, 0.94]
2 Analgesic use on ward	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Day 1	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Day 2	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.3 Until surgery	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.4 High analgesic use	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Analgesic use on ward (number of doses)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4 Difficulty in fracture reduction	2	183	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.51, 1.67]
5 Poor quality fracture reduction	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6 Length of operation (minutes)	2	413	Mean Difference (IV, Fixed, 95% CI)	1.28 [-4.82, 7.39]
7 Intra-operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8 General complications	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8.1 Pre-operative (pressure sores)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8.2 Post-operative (pressure sores etc)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8.3 Complications at 3-4 days	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Fracture fixation failure	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 All fractures	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Intracapsular fracture	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.3 Extracapsular fracture	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Length of hospital stay (days)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

### Comparison 2. Skin traction versus skeletal traction

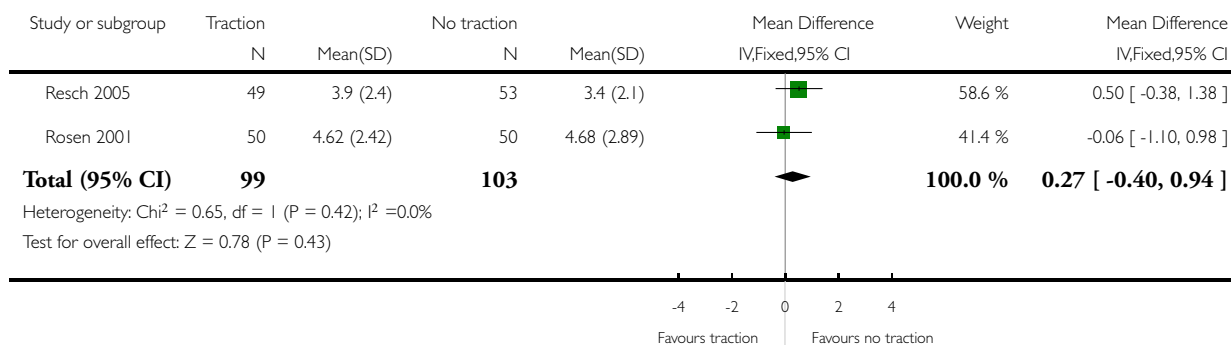
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain soon after traction (Visual Analogue Scale: 0: none to 10: worst imaginable)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Analgesic use on ward (number of doses)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

### Analysis 1.1. Comparison 1 Pre-operative traction versus no traction, Outcome 1 Pain soon after immobilisation (Visual Analogue Scale: 0: none to 10: worst imaginable).

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 1 Pain soon after immobilisation (Visual Analogue Scale: 0: none to 10: worst imaginable)

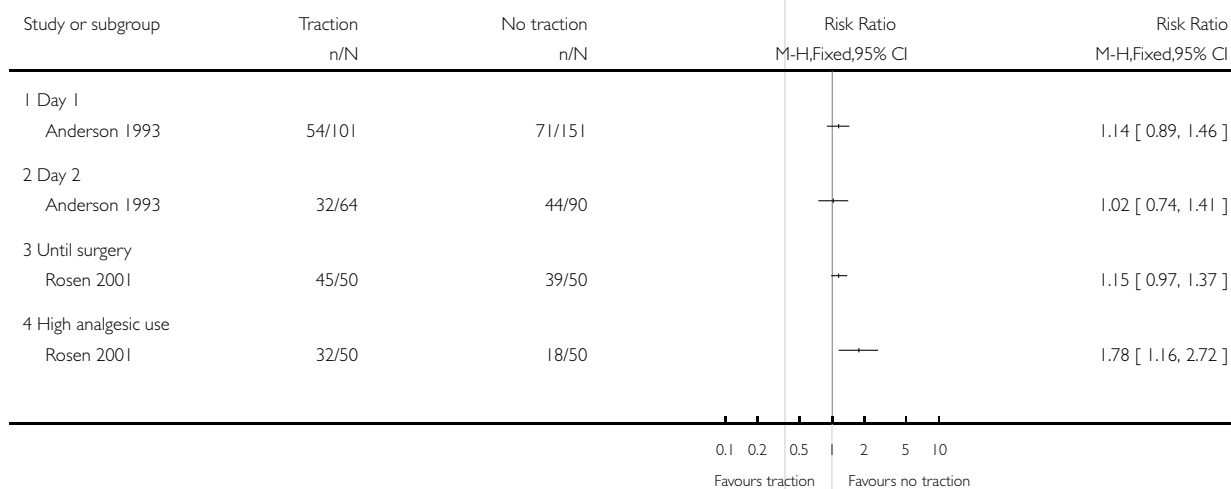


### Analysis 1.2. Comparison 1 Pre-operative traction versus no traction, Outcome 2 Analgesic use on ward.

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 2 Analgesic use on ward

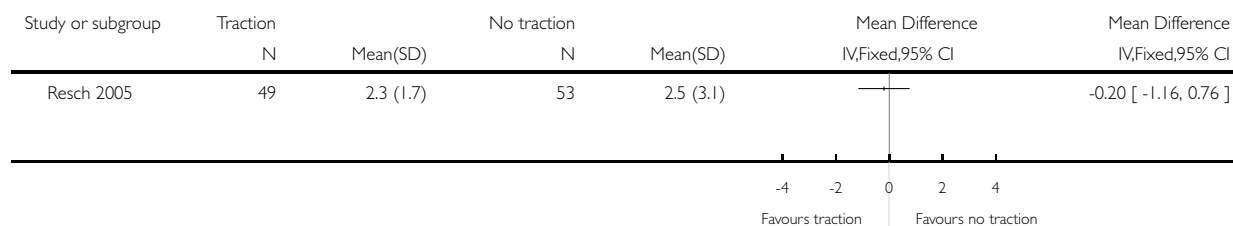


### Analysis I.3. Comparison I Pre-operative traction versus no traction, Outcome 3 Analgesic use on ward (number of doses).

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: I Pre-operative traction versus no traction

Outcome: 3 Analgesic use on ward (number of doses)

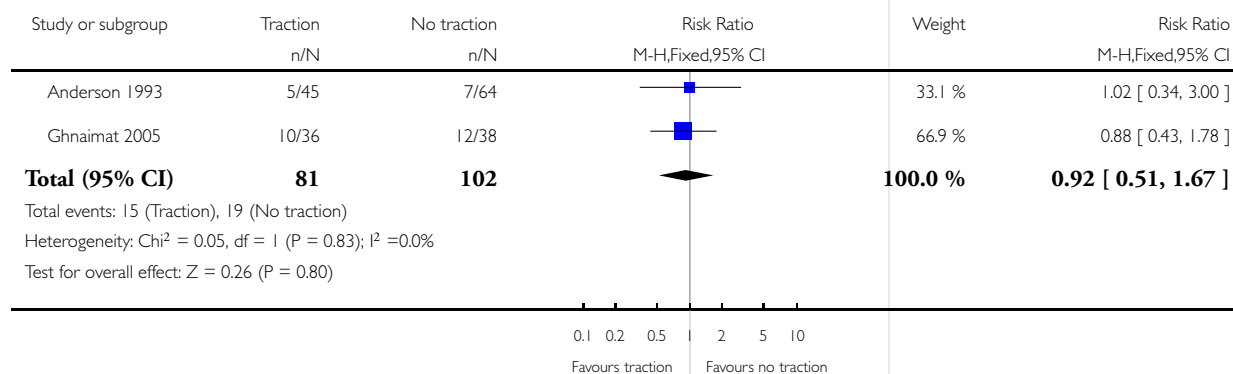


### Analysis I.4. Comparison I Pre-operative traction versus no traction, Outcome 4 Difficulty in fracture reduction.

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: I Pre-operative traction versus no traction

Outcome: 4 Difficulty in fracture reduction

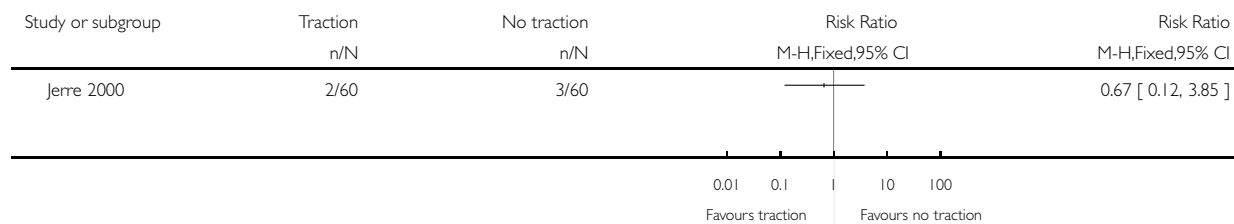


### Analysis I.5. Comparison I Pre-operative traction versus no traction, Outcome 5 Poor quality fracture reduction.

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: I Pre-operative traction versus no traction

Outcome: 5 Poor quality fracture reduction

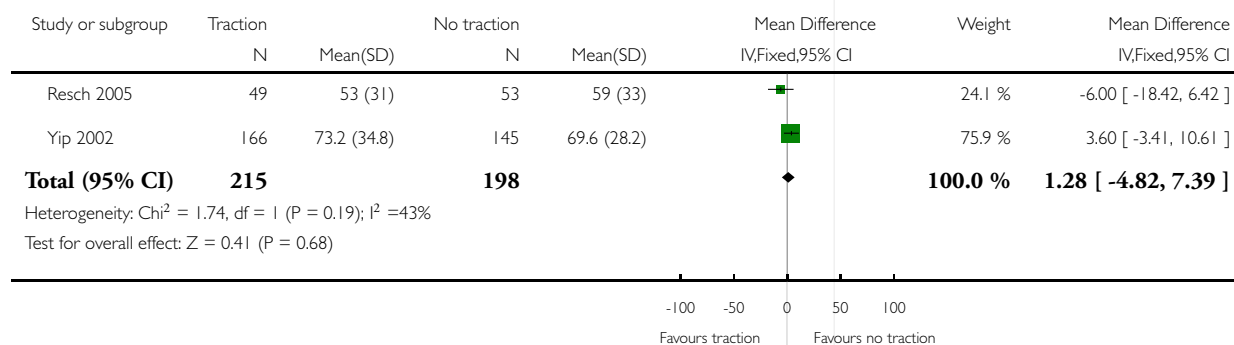


### Analysis I.6. Comparison I Pre-operative traction versus no traction, Outcome 6 Length of operation (minutes).

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: I Pre-operative traction versus no traction

Outcome: 6 Length of operation (minutes)

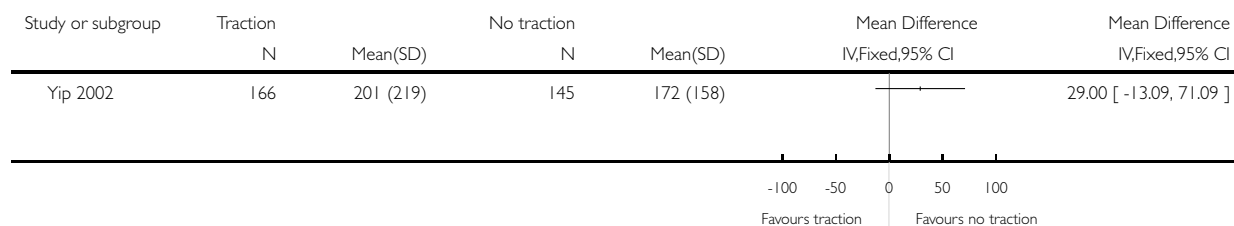


### Analysis 1.7. Comparison 1 Pre-operative traction versus no traction, Outcome 7 Intra-operative blood loss (ml).

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 7 Intra-operative blood loss (ml)

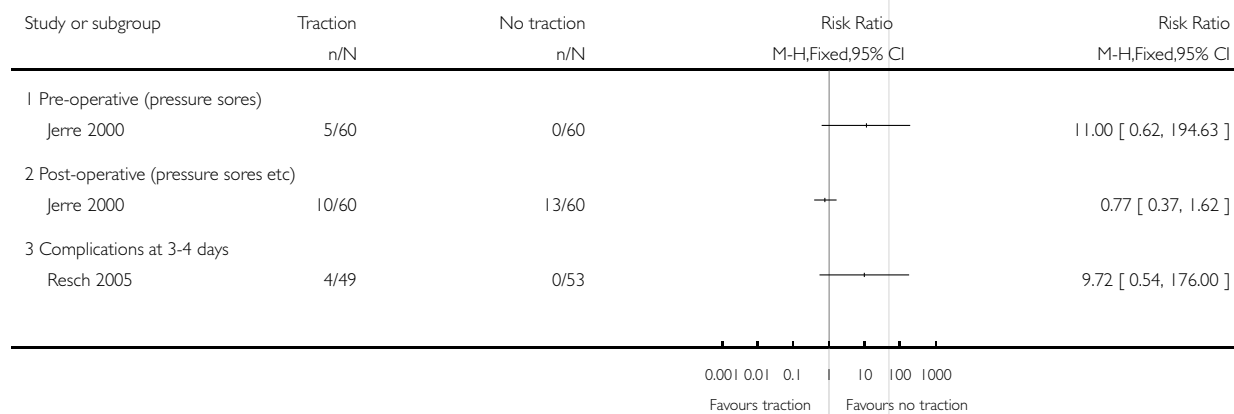


### Analysis 1.8. Comparison 1 Pre-operative traction versus no traction, Outcome 8 General complications.

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 8 General complications

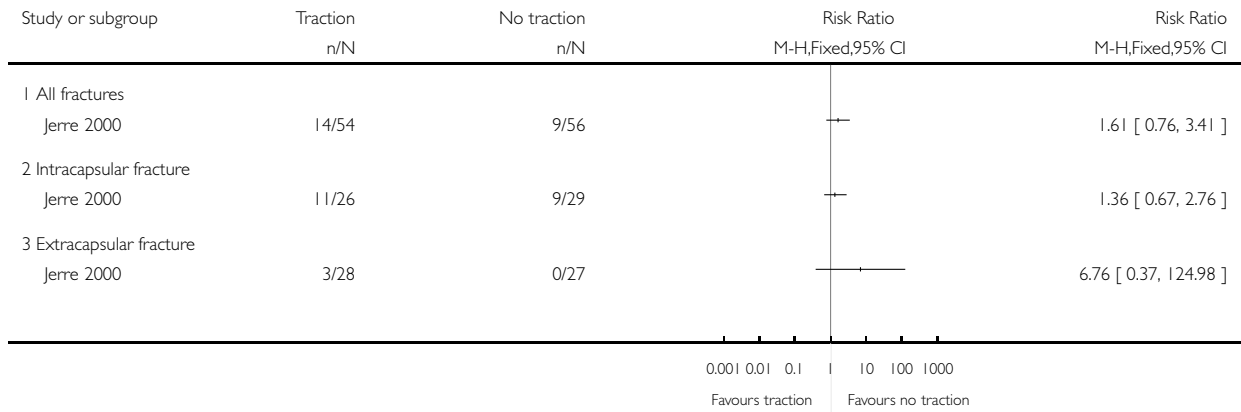


**Analysis 1.9. Comparison 1 Pre-operative traction versus no traction, Outcome 9 Fracture fixation failure.**

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 9 Fracture fixation failure

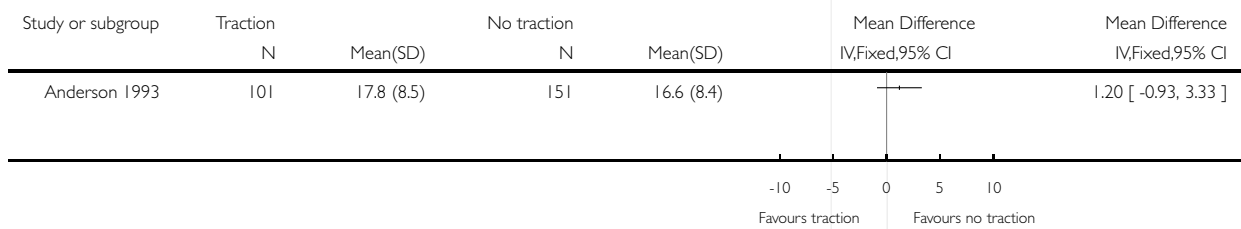


**Analysis 1.10. Comparison 1 Pre-operative traction versus no traction, Outcome 10 Length of hospital stay (days).**

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 1 Pre-operative traction versus no traction

Outcome: 10 Length of hospital stay (days)

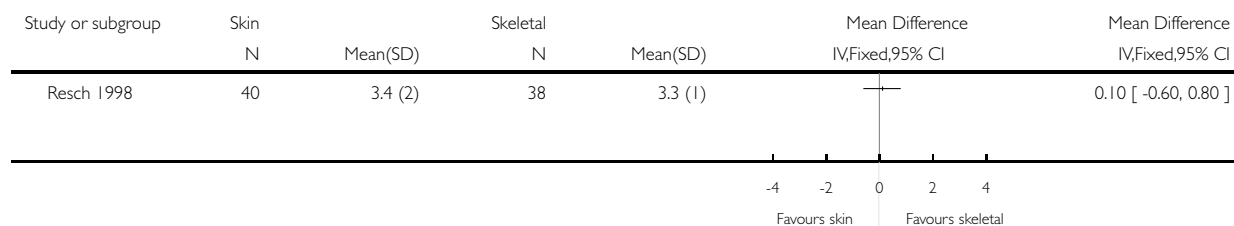


**Analysis 2.1. Comparison 2 Skin traction versus skeletal traction, Outcome 1 Pain soon after traction (Visual Analogue Scale: 0: none to 10: worst imaginable).**

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 2 Skin traction versus skeletal traction

Outcome: 1 Pain soon after traction (Visual Analogue Scale: 0: none to 10: worst imaginable)

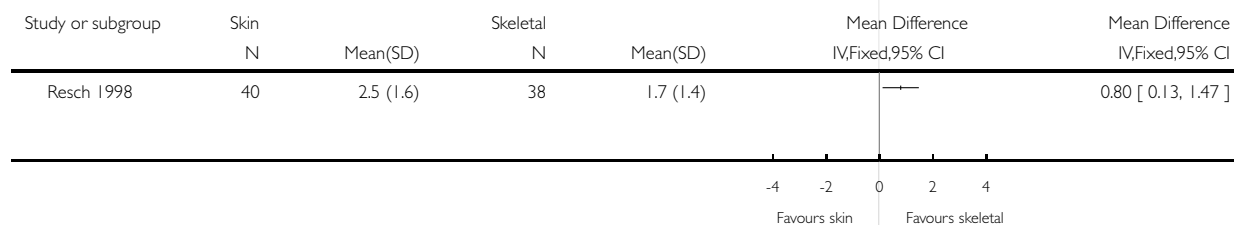


**Analysis 2.2. Comparison 2 Skin traction versus skeletal traction, Outcome 2 Analgesic use on ward (number of doses).**

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 2 Skin traction versus skeletal traction

Outcome: 2 Analgesic use on ward (number of doses)

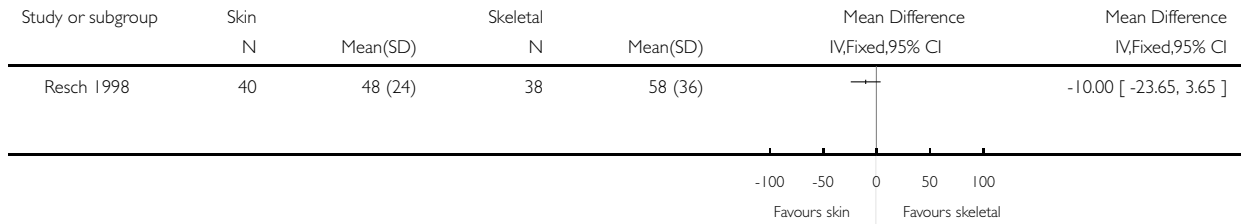


### Analysis 2.3. Comparison 2 Skin traction versus skeletal traction, Outcome 3 Length of surgery (minutes).

Review: Pre-operative traction for fractures of the proximal femur in adults

Comparison: 2 Skin traction versus skeletal traction

Outcome: 3 Length of surgery (minutes)



## APPENDICES

### Appendix 1. Search strategy for MEDLINE (OVID-WEB)

1. exp Hip Fractures/
2. hip\$ or femur\$ or femoral\$ or trochant\$ or petrochant\$ or intertrochant\$ or subtrochant\$ or intracapsular\$ or extracapsular\$ adj4 fracture\$).tw.
3. or/1-2
4. (pin\$1 or nail\$ or screw\$1 or plate\$1 or arthroplast\$ or fix\$ or prosthes\$).tw.
5. Internal Fixators/ or Bone Screws/ or Fracture Fixation, Internal/ or Bone Plates/ or Bone Nails/
6. Arthroplasty/ or Arthroplasty, Replacement, Hip/
7. or/4-6
8. and/3,7

### Appendix 2. Search strategy for EMBASE (OVID-WEB)

#### EMBASE

1. exp Hip Fracture/
2. ((hip\$ or ((femur\$ or femoral\$) adj3 (neck or proximal))) adj4 fracture\$).tw.
3. or/1-2
4. exp Randomized Controlled trial/
5. exp Double Blind Procedure/
6. exp Single Blind Procedure/
7. exp Crossover Procedure/
8. Controlled Study/
9. or/4-8
10. ((clinical or controlled or comparative or placebo or prospective\$ or randomi#ed) adj3 (trial or study)).tw.

(Continued)

11. (random\$ adj7 (allocat\$ or allot\$ or assign\$ or basis\$ or divid\$ or order\$)).tw.
12. ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj7 (blind\$ or mask\$)).tw.
13. (cross?over\$ or (cross adj1 over\$)).tw.
14. ((allocat\$ or allot\$ or assign\$ or divid\$) adj3 (condition\$ or experiment\$ or intervention\$ or treatment\$ or therap\$ or control\$ or group\$)).tw.
15. or/10-14
16. or/9,15
17. limit 16 to human
18. and/3,17

### Appendix 3. Search strategy for CINHAI (OVID-WEB)

1. exp Hip Fractures/
2. ((hip\$ or ((femur\$ or femoral\$) adj3 (neck or proximal))) adj4 fracture\$).tw.
3. or/1-2
4. Traction/
5. traction\$.tw.
6. or/4-5
7. and/3,6

### WHAT'S NEW

Last assessed as up-to-date: 18 May 2006.

12 September 2008	Amended	Converted to new review format.
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### HISTORY

Protocol first published: Issue 3, 1996

Review first published: Issue 3, 1997

19 May 2006	New citation required but conclusions have not changed	<p>In this (the seventh) update, published in Issue 3, 2006, the search for trials was extended to March 2006. Both newly identified studies were included (Ghnaimat 2005; Resch 2005). Details of the method of randomisation for Resch 1998 were included. A reference to a survey on the use of pre-operative traction in Dutch hospitals was added. Various changes were made in line with recommendations in the Cochrane Handbook and Style Guidelines. There was no change to the conclusions.</p> <p>For details of all updates, please see 'Notes'.</p>
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## CONTRIBUTIONS OF AUTHORS

Martyn Parker initiated and designed the review, usually contacted trialists for further information and compiled the first drafts of the review and most of the subsequent updates. Helen Handoll located the review studies, contacted some of the trialists for further information, checked data entry and critically rewrote the first draft and most of the subsequent updates. All other tasks were shared. Dr Edward To, now in Hong Kong, was involved in the early stages, primarily quality assessment and data extraction of the first version of the review, but is not a named author. Helen Handoll and Martyn Parker are guarantors of the review.

## DECLARATIONS OF INTEREST

None known

## SOURCES OF SUPPORT

### Internal sources

- University of Teesside, Middlesbrough, UK.
- Peterborough and Stamford Hospitals NHS Foundation Trust, UK.

### External sources

- No sources of support supplied

## NOTES

The first update of the review, published in Issue 4, 1998, incorporated data from a full report of an included trial originally only available in abstract. There was no change to the conclusions.

The second update of the review, published in Issue 2, 2000, included a new trial. There was no change to the conclusions.

The third update of the review, published in Issue 1, 2001, included a new trial. Relative risks instead of Peto odds ratios were presented for dichotomous outcomes. There was no change to the conclusions.

The fourth update of the review, published in Issue 3, 2001, included a new trial. (Rosen 2001). Extra references for one trial (Draper 1997) were added. There was no change to the conclusions.

The fifth update of the review, published in Issue 3, 2003, included one new trial (Yip 2002). An extra reference for one trial (Rosen 2001) was added. There was no change to the conclusions.

The sixth update of the review, published in Issue 4, 2004, included references to commentaries on two trials. Various changes were made in line with recommendations in the Cochrane Reviewers' Handbook and Style Guidelines. There was no change to the conclusions.

## INDEX TERMS

### Medical Subject Headings (MeSH)

\*Traction; Femoral Fractures [surgery]; Hip Fractures [\*surgery]; Preoperative Care; Randomized Controlled Trials as Topic

### MeSH check words

Adult; Humans