ClinicalEvidence

Hip fracture

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ABSTRACT

INTRODUCTION: Between 12% and 37% of people will die in the year after a hip fracture, and 10% to 20% of survivors will move into a more dependent residence. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical questions: What are the effects of surgical interventions in people with hip fracture? What are the effects of perisurgical medical interventions on surgical outcome and prevention of complications in people with hip fracture? What are the effects of rehabilitation interventions and programmes after hip fracture? We searched: Medline, Embase, The Cochrane Library, and other important databases up to April 2009 (Clinical Evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 55 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: anaesthesia (general, regional); antibiotic regimens; arthroplasty; choice of implant for internal fixation; conservative treatment; co-ordinated multidisciplinary approaches for inpatient rehabilitation of older people; cyclical compression of the foot or calf; early supported discharge followed by home-based rehabilitation; extramedullary devices; fixation (external, internal); graduated elastic compression; intramedullary devices; mobilisation strategies; nerve blocks for pain control; nutritional supplementation (oral multinutrient feeds, nasogastric feeds); perioperative prophylaxis with antibiotics, with antiplatelet agents, or with heparin (low molecular weight or unfractionated); preoperative traction to the injured limb; and systematic multicomponent home-based rehabilitation.

QUESTIONS

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What are the effects of perisurgical medical interventions on surgical outcome and prevention of complications in people with hip fracture? 20

What are the effects of rehabilitation interventions and programmes after hip fracture? 31

INTERVENTIONS

SURGERY

Trade off between benefits and harms

Internal fixation versus arthroplasty for intracapsular hip fracture 5

Unknown effectiveness

Implants for internal fixation of intracapsular hip fracture versus each other 8

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Likely to be ineffective or harmful

Older fixed nail plates for extramedullary fixation of extracapsular fracture (increased risk of fixation failure compared with sliding hip screws) 13

Intramedullary fixation with condylocephalic nails versus extramedullary fixation with sliding hip screw or fixed nail plate for extracapsular fracture 18

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Beneficial

Perioperative prophylaxis with antibiotics 23

Likely to be beneficial

Perioperative prophylaxis with antiplatelet agents . . 27

Cyclical compression of the foot or calf to reduce venous thromboembolism 29

Oral multinutrient feeds for nutritional supplementation after hip fracture 29

Trade off between benefits and harms

Perioperative prophylaxis with heparin to reduce venous thromboembolism 25

Unknown effectiveness

Regional versus general anaesthesia for hip fracture surgery 21

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Operative-day (less than 24 hours) versus longer-duration multiple-dose antibiotic regimens 24

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Low molecular weight heparin versus unfractionated heparin to reduce venous thromboembolism after hip fracture surgery 26

Graduated elastic compression to prevent venous thromboembolism 28

Nasogastric feeds for nutritional supplementation after hip fracture 30

Unlikely to be beneficial

Preoperative traction to the injured limb 20

REHABILITATION STRATEGIES

Likely to be beneficial

Co-ordinated multidisciplinary approaches for inpatient rehabilitation of older people 33

Unknown effectiveness

Mobilisation strategies applied soon after hip fracture surgery 31

Early supported discharge followed by home-based rehabilitation 35

Systematic multicomponent home-based rehabilitation 36

Covered elsewhere in Clinical Evidence

Fracture prevention

Pressure sores

Key points

- Between 12% and 37% of people will die in the year after a hip fracture, and 10% to 20% of survivors will move into a more dependent residence.
- Surgery is routinely used in the treatment of hip fracture.

  Surgical fixation leads to earlier mobilisation and less leg deformity compared with conservative treatment.

  In people with intracapsular hip fracture, internal fixation is associated with less operative trauma and deep wound sepsis, but is more likely to require subsequent revision surgery, compared with arthroplasty. We don't know the best method for internal fixation, or the best method of arthroplasty, for these fractures.

  Older fixed nail plates for extramedullary fixation of extracapsular fracture increase the risk of fixation failure compared with sliding hip screws. Short intramedullary cephalocondylic nails, Ender nails, and older fixed nail plates increase the risk of re-operation compared with extramedullary fixation with a sliding hip screw device, but we don't know whether other kinds of extramedullary devices are better than the sliding hip screw. We also don't know how different intramedullary devices compare with each other.
- Various perisurgical interventions may be used with the aim of improving surgical outcome and preventing complications.

  Routine preoperative traction to the injured limb has not been shown to relieve pain or to aid subsequent surgery.

  Antibiotic prophylaxis reduces wound infections, but we don't know which is the most effective regimen (regimens assessed are antibiotics given on the day of surgery and single-dose antibiotics versus multiple-dose regimens).

  Antiplatelet agents and heparin reduce the risk of deep vein thrombosis (DVT) when used prophylactically, but both treatments increase the risk of bleeding. We don't know how low molecular weight heparin and unfractionated heparin compare at reducing risk of DVT.

  Cyclical compression devices also reduce the risk of DVT, but we don't know whether graduated elastic compression stockings are effective.

  Oral protein and energy multinutrient feeds may reduce unfavourable outcomes after surgery.

  We don't know whether nerve blocks are effective in reducing pain post-surgery or the pain or requirement for analgesia after surgery. We don't how different anaesthetic regimens compare with each other.

  We don't know whether nasogastric feeds for nutritional supplementation are effective at improving outcomes after hip fracture.
- Various rehabilitation interventions and programmes aim to improve recovery after a hip fracture.

  Co-ordinated multidisciplinary care may improve outcomes compared with usual care, but we don't know which method is best.

  We don't know how effective mobilisation strategies, early supported discharge, or multidisciplinary home-based rehabilitation are at improving outcomes after hip surgery.

Clinical context

DEFINITION

A hip or proximal femoral fracture refers to any fracture of the femur from the hip joint articular cartilage to a point 5 cm below the distal part of the lesser trochanter. Femoral head fractures are not included within this definition. [1] Hip fractures are divided into two groups according to their relationship to the capsular attachments of the hip joint. **Intracapsular fractures** occur proximal to the point at which the hip joint capsule attaches to the femur, and can be subdivided into displaced and undisplaced fractures. [2] Undisplaced fractures include impacted or adduction fractures. Displaced intracapsular fractures may be associated with disruption of the blood supply to the head of the femur, leading to avascular necrosis. **Extracapsular fractures** occur distal to the hip joint capsule. [1] In the most distal part of the proximal femoral segment (below the lesser trochanter), the term "subtrochanteric" fracture is used. Numerous further subclassifications of intracapsular and extracapsular fractures exist. [1] [2]

INCIDENCE/ PREVALENCE

Hip fractures may occur at any age, but are most common in older people (here defined as people aged 65 years and over). In industrialised societies, the mean age of people with hip fracture is about 80 years, and about 80% are female. In the US, the lifetime risk of hip fracture after 50 years of age is about 17% in white women and 6% in white men. [3] A study in the US reported that prevalence increases from about 3/100 women aged 65 to 74 years to 12.6/100 women aged 85 years and above. [4] The age-stratified incidence has also increased in some societies — not only are people living longer, but the incidence of fracture in each age group may have increased. [3] An estimated 1.26 million hip fractures occurred in adults in 1990, with predictions of numbers rising to 7.3 million to 21.3 million by 2050. [5]

AETIOLOGY/ RISK FACTORS

Hip fractures are usually sustained through a fall from standing height or less. The pattern of incidence is consistent with an increased risk of falling, loss of protective reflex mechanisms, and loss of skeletal strength from osteoporosis. All of these increased risks are associated with ageing.

PROGNOSIS

Reported figures for mortality after a hip fracture in adults vary considerably. One-year mortality figures vary from 12% to 37%, [6] with about 9% of these deaths directly attributed to the hip fracture. [7] After a hip fracture, a 15% to 25% decline in the ability to perform daily activities is to be expected, and about 10% to 20% of the survivors will require a change to a more dependent residential status. [8]

AIMS OF INTERVENTION

To improve survival and quality of life; and to minimise complications, disability, and loss of independence associated with hip fracture, with minimum adverse effects.

OUTCOMES

Mortality; **Function and mobility** (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living); **Pain** (includes degree of residual pain); **Quality of life** (health-related quality-of-life measures); **Orthopaedic complications** (rate of non-union, leg shortening, varus deformity, rates of readmission to hospital and re-operation, avascular necrosis, dislocation of an implant, loosening of an implant, implant cut-out, fixation failure, leg shortening, intra-operative fractures, femur fractures, limb deformity, placement of implant, and deep wound infections); **Medical complications** (includes venous thromboembolism, pressure sores, postoperative chest infection, and superficial wound infections); **in the question on the effects of rehabilitation interventions and programmes after hip fracture**, we also report length of stay in hospital.

METHODS

Clinical Evidence search and appraisal April 2009. The following databases were used to identify studies for this systematic review: Medline 1966 to April 2009, Embase 1980 to April 2009, and The Cochrane Library, Issue 2, 2009 (for the Cochrane Database of Systematic Reviews, the Database of Abstracts of Reviews of Effects [DARE], and the Health Technology Assessment [HTA] database). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using pre-determined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews of RCTs and RCTs in any language, at least single-blinded, where possible to blind, and containing 20 or more individuals, of whom 80% or more were followed up. There was no minimum length of follow-up required to include studies. We excluded all studies described as "open", "open label", or not blinded unless blinding was impossible. We included systematic reviews of RCTs and RCTs where harms of an included intervention were studied, applying the same study design criteria for inclusion as we did for benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA), which are added to the reviews as required. Most of the Cochrane reviews covered here include evidence from ran-

domised and quasi-randomised controlled trials; the term RCT has been used to describe both. Where possible, Cochrane reviewers have undertaken sensitivity analyses to assess whether including quasi-randomised trials in meta-analyses affected conclusions. We have reported data for intracapsular and extracapsular fractures separately. The order of interventions in the question on surgical treatment follows two key clinical decisions. Firstly, should an operation be performed? Secondly, if an operation is indicated, should the surgical objective be to fix the fracture or to replace the femoral head (arthroplasty)? It should be noted that the sliding hip screw has been presented as the standard or control device for extracapsular fractures. This is consistent with the Cochrane reviews and most RCTs, but means that the sliding hip screw does not feature as strongly as it might in the interventions table had it been presented as the "experimental" device. In the following review, most data come from people who are aged 65 years or over. It is this group of people to whom the findings of the included reviews and RCTs primarily apply. To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 41). The categorisation of the quality of the evidence (into high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the *Clinical Evidence* population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION What are the effects of surgical interventions in people with hip fracture?

OPTION CONSERVATIVE VERSUS OPERATIVE TREATMENT FOR HIP FRACTURE

Orthopaedic complications

Conservative treatment compared with surgical treatment Conservative treatment of undisplaced intracapsular fractures seems to be associated with an increased risk of non-union compared with internal fixation of the fracture. Conservative treatment of extracapsular fractures seems to be associated with an increased risk of leg shortening and varus deformity at 6 months compared with surgical treatment (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2008, 5 RCTs, 428 people mostly aged over 60 years) comparing conservative versus surgical treatment. [9] Most people in the RCTs identified by the review had extracapsular fractures; the review identified only one RCT in people with undisplaced intracapsular fracture (23 people) and no RCTs in people with displaced intracapsular fracture. Only one RCT (106 people) included in the review used a fixation device with the dynamic features used in contemporary practice (sliding nail plate) for extracapsular fractures. The review found insufficient evidence to determine whether significant differences exist between conservative and surgical treatment in medical complications, mortality, long-term pain, or loss of independence: these outcomes were inadequately reported by the RCTs.

Harms: The RCT (23 people with undisplaced intracapsular fractures) identified by the review comparing conservative treatment versus internal fixation found no significant difference between techniques in non-union of fracture, although the rate of non-union was higher with conservative treatment (10/16 [63%] with conservative treatment *v* 0/7 [0%] with internal fixation; RR 9.88, 95% CI 0.66 to 148.48; length of follow-up not reported). [9] The RCT is likely to have been underpowered to detect a clinically important difference between groups. Nine of the 10 people with non-union having conservative treatment were operated on for secondary displacement; one re-operation was undertaken in the internal fixation group for avascular necrosis. The RCT (106 people with extracapsular fractures) comparing conservative treatment versus a sliding nail plate (the current standard fixation device) found that conservative treatment significantly increased the proportion of people remaining in hospital after 12 weeks, compared with surgical treatment (20/51 [39%] with conservative treatment *v* 11/55 [20%] with surgical treatment; RR 1.96, 95% CI 1.04 to 3.68). This RCT also found that conservative treatment significantly increased the proportion of people with leg shortening at 6 months and varus deformity at 6 months, compared with surgical treatment (leg shortening: 29/39 [74%] with conservative treatment *v* 11/37 [30%] with surgical treatment; RR 2.50, 95% CI 1.47 to 4.24; varus deformity: 19/39 [49%] with conservative treatment *v* 3/35 [9%] with surgical treatment; RR 5.68, 95% CI 1.84 to 17.58). [9]

Comment:

Clinical guide:
Surgical treatment for hip fractures was introduced in the 1950s, with the expectation of improved functional outcome and a reduction in the complications associated with immobilisation and prolonged bed rest. Surgical treatment became the routine management of hip fractures before the widespread use of RCTs to assess the effectiveness of different treatment policies. Given the historical descriptions of conservative treatment and the extensive case series reports on the outcomes of hip fracture treatment, which support the use of surgical treatment, it is unlikely that further RCTs on this question will be conducted. This is particularly pertinent for displaced intracapsular fractures, where there are no reported RCTs comparing conservative versus surgical treatment, and surgical treatment is unanimously recommended by orthopaedic surgeons. Despite providing limited evidence of uncertain reliability, the single RCT in people with undisplaced intracapsular fracture supports surgical treatment. Although we found only limited evidence from RCTs for extracapsular fractures, surgery seemed to improve outcomes compared with conservative treatment. Further RCTs are unlikely to be conducted, as operative treatment has become the standard of care.

OPTION INTERNAL FIXATION VERSUS ARTHROPLASTY FOR INTRACAPSULAR HIP FRACTURE

Mortality
Internal fixation compared with arthroplasty We don't know how internal fixation and arthroplasty compare at reducing mortality in older people with displaced intracapsular fractures (low-quality evidence).

Function and mobility
Internal fixation compared with arthroplasty Internal fixation may be less effective than arthroplasty (both hemiarthroplasty and total hip replacement) at improving hip function at 12 months post-surgery in older people with displaced intracapsular fractures, but we don't know how they compare at improving hip function in the longer term (24 months). We don't know how internal fixation and arthroplasty (all types) compare at increasing the proportion of people who return to their original residence post-surgery, or the proportion of people who regain mobility (low-quality evidence).

Pain
Internal fixation compared with arthroplasty We don't know how internal fixation and arthroplasty compare at reducing pain at 1 year in older people with displaced intracapsular fractures (low-quality evidence).

Quality of life
Internal fixation compared with arthroplasty Internal fixation seems less effective than total hip replacement but as effective as hemiarthroplasty at improving health-related quality-of-life measures at 12 months post-surgery. However, internal fixation seems less effective than hemiarthroplasty at improving health-related quality-of-life measures in the longer term (24 months) (moderate-quality evidence).

Orthopaedic complications
Internal fixation compared with arthroplasty Internal fixation may be more effective at reducing the rate of deep wound infections but may be associated with higher rates of surgery-related complications (including re-operation, non-union of fracture, fixation failure, and avascular necrosis) (low-quality evidence).

Medical complications
Internal fixation compared with arthroplasty We don't know how internal fixation and arthroplasty compare in reducing rates of postoperative medical complications (DVT, pulmonary embolism, and pressure sores) (low-quality evidence).

Note
Most orthopaedic surgeons tend to favour arthroplasty over internal fixation in older people, owing to the reduced re-operation rate. For people aged under 60–70 years, preservation of the femoral head is generally preferred, because the greater expected longer-term survival may lead to higher long-term revision rates due to arthroplasty wear.

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found five systematic reviews [10] [11] [12] [13] [14] and two subsequent RCTs [15] [16] comparing internal fixation versus arthroplasty. We excluded two reviews (search dates 1990 [10] and 2002 [17]) because they have been superseded by reviews with later search dates. Although the RCTs identified by, and inclusion criteria of, the reviews differed to some extent, three reviews (search date 2005, 17 RCTs, 2694 people; [11] search date 2004, 14 RCTs, 2289 people; [12] search date 2006, 15 RCTs, 2255 people [13]) included similar populations (older people aged over 60 years with displaced intracapsular fractures) and came to similar conclusions. Between them, the three reviews identified 22 RCTs (3531 people). [11] [12] [13] The fourth review examined displaced intracapsular hip fractures in people aged 15 to 50 years (search date 2003, 18 studies, 674 people), and is not discussed further here. [14]

We have chosen to report only the largest review in detail for outcomes in older people. [11] The review found no significant difference between internal fixation and arthroplasty (all types, including

hemiarthroplasty and total hip replacement) in mortality within 6 months or at 12 months (within 6 months; 14 RCTs; 2098 people: 118/1064 [11%] with internal fixation *v* 125/1034 [12%] with arthroplasty; RR 0.88, 95% CI 0.70 to 1.11; at 12 months; 12 RCTs; 1966 people: 199/994 [20%] with internal fixation *v* 193/972 [20%] with arthroplasty: RR 0.97, 95% CI 0.82 to 1.16). [11] The review found no significant difference between groups in the proportion of people reporting pain at 1 year, the proportion of people failing to return to their original residence, or the proportion of people failing to regain mobility (pain at 1 year; 5 RCTs; 750 people: 147/342 [43%] with internal fixation *v* 163/408 [40%] with arthroplasty: RR 1.12, 95% CI 0.95 to 1.32; people failing to return to their original residence; 2 RCTs; 372 people: 29/187 [16%] with internal fixation *v* 34/185 [18%] with arthroplasty: RR 0.84, 95% CI 0.54 to 1.33; people failing to regain mobility; 6 RCTs; 593 people: 155/287 [54.0%] with internal fixation *v* 165/306 [53.9%] with arthroplasty: RR 0.99, 95% CI 0.86 to 1.15).

The first subsequent RCT (298 people; mean age over 74 years in all groups) compared internal fixation versus bipolar hemiarthroplasty or total hip replacement in people with displaced intracapsular fractures. [15] Initially, people were allocated to one of two groups based on the treatment choice of participating surgeons. People could be assigned to either a three-way randomisation in which they were randomised to one of the three surgical techniques (207 people; 69 people in each arm) or to a two-way randomisation (91 people) in which they were randomised to either internal fixation or hemiarthroplasty. The RCT combined data from both sets for people allocated to internal fixation or hemiarthroplasty. The RCT found no significant difference in mortality at 24 months between internal fixation and hemiarthroplasty (229 people in analysis: 18/118 [15%] with internal fixation *v* 18/111 [16%] with hemiarthroplasty; P = 0.94) or between internal fixation and total hip replacement (138 people in analysis: 9/69 [13%] with internal fixation *v* 6/69 [9%] with total hip replacement; P = 0.34). The RCT found that hip function (assessed using Hip Rating Questionnaire [assesses four domains of global impact, pain, walking, and function; score of 0–100, where 100 = no disability]) at 12 months was significantly worse with internal fixation compared with hemiarthroplasty (overall score at 12 months [212 people]: 70.6 with internal fixation *v* 77.1 with hemiarthroplasty; mean difference –5.82, 95% CI –10.40 to –1.25; P = 0.01) and compared with total hip replacement (overall score at 12 months [131 people]: 71.8 with internal fixation *v* 79.4 with total hip replacement; mean difference –6.79, 95% CI –13.03 to –0.56; P = 0.03). However, there was no significant difference between groups in hip function at 24 months for either comparison (overall score: fixation versus hemiarthroplasty: 73.2 with internal fixation *v* 76.3 with hemiarthroplasty; mean difference –3.96, 95% CI –9.28 to +1.35; P = 0.14; fixation versus total hip replacement: 75.2 with internal fixation *v* 79.9 with total hip replacement; mean difference –5.81, 95% CI –12.14 to +0.52; P = 0.07). The RCT found that health-related quality of life (assessed using the EuroQol-5d utility score) was significantly worse at 12 months with internal fixation compared with total hip replacement (higher score is favourable; 0.58 with internal fixation *v* 0.70 with total hip replacement; mean difference –0.12, 95% CI –0.024 to –0.01 [as reported in RCT]; P = 0.03). However, there was no significant difference in health-related quality of life at 12 months between internal fixation and hemiarthroplasty (0.58 with internal fixation *v* 0.64 with hemiarthroplasty; mean difference –0.07, 95% CI –0.16 to +0.02; P = 0.15).

The second subsequent RCT (222 people with displaced intracapsular fractures; mean age 83 years) compared internal fixation versus bipolar cemented hemiarthroplasty. [16] The RCT found no significant difference between surgeries in mortality at either 12 months (24/112 [21%] with internal fixation *v* 29/110 [26%] with hemiarthroplasty; RR 0.81, 95% CI 0.51 to 1.30; P = 0.39) or 2 years (39/112 [34.8%] with internal fixation *v* 39/110 [35.4%] with hemiarthroplasty; RR 0.98, 95% CI 0.69 to 1.40; P = 0.92). The RCT found that hip function (assessed using Harris Hip Questionnaire) at 12 months was significantly worse with internal fixation compared with hemiarthroplasty (score at 12 months: 65.8 with internal fixation *v* 72.6 with hemiarthroplasty; mean difference 6.7, 95% CI 1.5 to 11.9; P = 0.01). However, there was no significant difference between groups in hip function at 24 months (score at 24 months: 67.3 with internal fixation *v* 70.6 with hemiarthroplasty; mean difference +3.3, 95% CI –2.5 to +9.2; P = 0.26). The RCT found no significant difference in health-related quality-of-life scores measured using the EuroQol-5d utility scale score at 12 months (higher score is favourable; mean index score: 0.56 with internal fixation *v* 0.65 with hemiarthroplasty; mean difference +0.10, 95% CI –0.008 to +0.22; P = 0.07). However, at 24 months, scores were significantly worse with internal fixation (mean index score: 0.61 with internal fixation *v* 0.72 with hemiarthroplasty; mean difference 0.13, 95% CI 0.01 to 0.25; P = 0.03). The RCT found no significant difference between groups in the Eq-5D visual analogue scale at either 12 or 24 months (mean score [scale of 0–100, where 0 = worst possible health and 100 = best possible health]: at 12 months: 57 with internal fixation *v* 63 with hemiarthroplasty; mean difference +6.2, 95% CI –2.4 to +14.7; P = 0.16; at 24 months: 60 with internal fixation *v* 60 with hemiarthroplasty; mean difference –0.8, 95% CI –9.1 to +7.5; P = 0.84).

Harms: The largest review found that, overall, a significantly larger proportion of people required re-operation with internal fixation compared with arthroplasty (17 RCTs; 2697 people: 463/1272 [36%] with in-

ternal fixation *v* 151/1425 [11%] with arthroplasty; RR 3.48, 95% CI 2.93 to 4.12). [11] Another review found that arthroplasty significantly reduced major method-related complications (defined as deep infection for both groups, and, for internal fixation, early re-displacement, non-union, and avascular necrosis) (11 RCTs: 63/924 [7%] with arthroplasty *v* 351/873 [40%] with internal fixation; RR 0.11, 95% CI 0.08 to 0.15). [12]

The review found that internal fixation was associated with a significantly higher rate of non-union of fracture (14 RCTs; 1951 people; 271/950 [29%] with internal fixation *v* 0/1001 [0%] with arthroplasty; RR 40.06, 95% CI 19.07 to 84.18) and avascular necrosis (10 RCTs; 1824 people: 86/885 [10%] with internal fixation *v* 0/939 [0%] with arthroplasty: RR 18.35, 95% CI 7.48 to 45.04). [11]

Arthroplasty was associated with significantly higher rates of dislocation of prosthesis in people having hemiarthroplasty (9 RCTs; 1582 people: 0/808 [0%] with internal fixation *v* 33/774 [4%] with hemiarthroplasty; RR 0.08, 95% CI 0.03 to 0.25) or total hip replacement (6 RCTs; 806 people: 0/473 [0%] with internal fixation *v* 44/333 [13%] with total hip replacement; RR 0.05, 95% CI 0.02 to 0.16). [11] Hemiarthroplasty was also associated with a significantly higher rate of loosening of the prosthesis (4 RCTs; 655 people: 0/328 [0%] with internal fixation *v* 15/327 [5%] with hemiarthroplasty; RR 0.09, 95% CI 0.02 to 0.49).

The review found that, compared with arthroplasty, internal fixation was associated with a significantly lower rate of deep wound infection (14 RCTs; 2606 people; 8/1229 [0.7%] with internal fixation *v* 24/1377 [1.8%] with arthroplasty; RR 0.43, 95% CI 0.21 to 0.86). [11] The review found no significant difference between internal fixation and arthroplasty in the incidence of DVT, pulmonary embolism, or pressure sores (DVT; 8 RCTs; 1339 people: 12/669 [1.7%] with internal fixation *v* 14/670 [2.0%] with arthroplasty; RR 0.93, 95% CI 0.46 to 1.88; pulmonary embolism; 8 RCTs; 1339 people: 11/669 [1.6%] with internal fixation *v* 10/670 [1.5%] with arthroplasty; RR 1.13, 95% CI 0.49 to 2.60; pressure sores; 6 RCTs; 1161 people: 12/592 [2.0%] with internal fixation *v* 12/569 [2.1%] with arthroplasty; RR 0.98, 95% CI 0.46 to 2.06). The review found that, compared with arthroplasty, surgery time with internal fixation was significantly shorter (7 RCTs; 1098 people: WMD fixation *v* arthroplasty –28.4 minutes, 95% CI –29.81 minutes to –26.87 minutes), and that internal fixation was associated with significantly less blood loss during surgery (6 RCTs; 800 people: WMD fixation *v* arthroplasty –188 mL, 95% CI –201 mL to –174 mL), and lower requirement for transfusion (5 RCTs; 1011 people: 39/475 [8%] with internal fixation *v* 132/536 [25%] with arthroplasty; RR 0.19, 95% CI 0.04 to 0.80). [11]

The first subsequent RCT reported significantly higher re-operation rates at 2 years' follow-up with internal fixation compared with hemiarthroplasty (46/118 [39%] with internal fixation *v* 6/111 [5%] with hemiarthroplasty; P less than 0.001) and with total hip replacement (27/69 [39%] with internal fixation *v* 6/69 [9%] with total hip replacement; P less than 0.001). [15] The RCT also found high rates of fixation failure in both fixation groups (44/118 [37%] with internal fixation *v* 0/111 [0%] with hemiarthroplasty; 26/69 [38%] with internal fixation *v* 0/69 [0%] with total hip replacement; significance not assessed for either comparison).

The second subsequent RCT found that internal fixation was associated with a significantly higher rate of complications related to surgical method (complications included mechanical failure of internal fixation/non-union, radiographic loosening of hemiarthroplasty, dislocation of hemiarthroplasty, deep infection, and avascular necrosis) (47/111 [42%] with internal fixation *v* 11/110 [10%] with hemiarthroplasty; RR 4.16, 95% CI 2.28 to 7.58). [16] The major complications related to surgical method were mechanical failure/non-union of fixation in the internal fixation group (40/47 [85%]), and deep infection in the hemiarthroplasty group (7/11 [64%]). The RCT also found that a significantly larger proportion of hips required re-operation in the internal fixation group compared with the hemiarthroplasty group (47/111 [42%] with internal fixation *v* 11/110 [10%] with hemiarthroplasty; RR 4.20, 95% CI 2.30 to 7.65).

Comment:

Factors affecting rate of non-union of fracture:

The review examining displaced intracapsular fractures in younger patients found no significant difference in rates of non-union between displaced fractures and non-displaced fractures, although the rate of non-union was higher with displaced fractures (23/382 [6%] with displaced fractures *v* 1/118 [1%] in non-displaced fractures; RR 7.10, 95% CI 0.97 to 52.08; P = 0.02). [14] The review also found that closed reduction was associated with a significantly lower rate of non-union compared with open reduction (13/275 [4%] with closed reduction *v* 10/89 [11%] for open reduction; RR 0.43, 95% CI 0.19 to 0.92), but with a significantly higher rate of avascular necrosis (77/275 [28%] with closed reduction *v* 9/89 [10%] for open reduction; RR 2.8, 95% CI 1.4 to 5.3). The review found no significant difference between early surgery (within 12 hours) and later surgery in rate of non-union of fracture or in rate of avascular necrosis (non-union of fracture: 13/110 [12%] for early surgery *v* 3/60 [5%] for later surgery; RR 2.34, 95% CI 0.7 to 8.0; avascular necrosis: 15/110 [14%] for early surgery *v* 9/60 [15%] for later surgery; RR 0.91, 95% CI 0.4 to 2.0).

There was a wide range of implants assessed in the RCTs included in the reviews. Many of the RCTs had flawed methods — such as failure to conceal treatment allocation and perform intention-to-treat analysis. Nonetheless, each of the two basic methods of treatment has its advantages and disadvantages, with different specific complications. The available evidence so far is insufficient to determine differences in mortality, but hip function seems better in fitter older people after cemented arthroplasty. The prevalence of non-union and avascular necrosis in younger people should be regarded with caution. Observational studies are the best form of evidence available; RCTs have not been performed as these injuries are rare, often associated with visceral injuries, and are regarded by many surgeons as surgical emergencies. Consequently there may be bias regarding treatment based on fracture pattern, with the most severe displaced fractures having a higher rate of open reduction.

Clinical guide:
The ideal situation is to have a hip fracture reduced and internally fixed, for it to heal without complication, leaving a pain-free hip. However, most orthopaedic surgeons tend to favour arthroplasty in older people, because of the fracture-healing complications of non-union and avascular necrosis after internal fixation, which result in the markedly increased re-operation rate. For younger people (aged under 60–70 years), internal fixation and preservation of the femoral head is generally preferred. The potential benefits of avoiding arthroplasty outweigh the potential risks of re-operation that may occur with internal fixation.

OPTION DIFFERENT TYPES OF IMPLANTS FOR INTERNAL FIXATION OF INTRACAPSULAR HIP FRACTURE VERSUS EACH OTHER

Mortality
Different types of internal fixation implants compared with each other We don't know whether pins for internal fixation of intracapsular fractures are more effective than screws at reducing mortality at 1 year (low-quality evidence).

Function and mobility
Different types of internal fixation implants compared with each other Fixation with screws plus injection of calcium phosphate for augmentation around the screw threads and at the fracture site may be more effective than closed reduction and fixation with two cannulated screws alone at improving walking in the short term post-surgery, but we don't know how they compare in the longer term (low-quality evidence).

Orthopaedic complications
Different types of internal fixation implants compared with each other Hansson pins may be more effective than AO screws at achieving better placement of the implant for internal fixation of intracapsular fractures, but we don't how they compare with each other at reducing the need for re-operation (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2003, 28 RCTs, 5547 people with intracapsular hip fractures) [18] and two subsequent RCTs comparing different types of internal fixation implants versus each other. [19] [20] The authors of the review grouped data to assess 18 comparisons; this reflected the wide variety of implants tested by the RCTs. The numbers of participants in each comparison were insufficient to allow any confident conclusions on the relative performances of individual implants.

The first subsequent RCT compared fixation with two Hansson hook pins versus three titanium AO screws in 199 older people with both displaced and undisplaced hip fractures. [20] It found significantly better placement of the implant with Hansson pins compared with AO screws (87% had good placement with Hansson pins *v* 75% with AO screws; P = 0.04; see comment). The RCT also reported no significant difference between implants in time spent in hospital (no further data reported). The second subsequent RCT compared fixation with screws plus injection of calcium phosphate for augmentation around the screw threads and at the fracture site versus closed reduction and fixation with two cannulated screws alone. [19] The RCT found that walking was "slightly better in the augmented patients during the first weeks, while there were no differences between groups later on" (data not reported).

Harms:

Length of surgery and operative blood loss tended to be less for fixation with two or three screws in comparison with the sliding hip screw. [18] The first subsequent RCT found no significant difference between pins and screws in mortality at 1 year or re-operations after 2 years (mortality at 1 year: 18/98 [18%] with Hansson pins *v* 19/101 [19%] with AO screws; P value not reported; re-operations after 2 years: 23/97 [23%] with Hansson pins *v* 27/101 [27%] with AO screws; P value not reported). [20] The second subsequent RCT found higher rates of re-operation with augmentation compared with no augmentation, although the difference between groups did not reach significance (20/58 [35%] with augmentation *v* 14/60 [23%] without augmentation; P = 0.1). [19]

Comment: While the review and the subsequent RCTs were unable to show any clinically important differences between implants in the incidence of fracture-healing complications, many RCTs reported that fracture-healing complications often reflected poor fracture reduction or implant positioning at the time of surgery. In the first subsequent RCT, the placement of Hansson hook pins was considered acceptable if they were positioned with the distal pin close to the calcar on the AP view and centrally on the lateral view. The placement of AO screws was with one distal screw close to the calcar and two upper screws with as much space between them as possible. [20]

OPTION ARTHROPLASTIES FOR INTRACAPSULAR HIP FRACTURE VERSUS EACH OTHER

Mortality

Cemented compared with uncemented prostheses We don't know how cemented and uncemented prostheses compare at reducing mortality at 1 to 3 months and 1 year in people with intracapsular fractures (low-quality evidence).

Unipolar compared with bipolar hemiarthroplasty We don't know how unipolar and bipolar hemiarthroplasty compare at reducing mortality at 1 to 2 years in older people with hip fractures (low-quality evidence).

Uncemented arthroplasty compared with total hip replacement We don't know how uncemented arthroplasty and total hip replacement compare at reducing mortality at 1 year in people with intracapsular fractures (very low-quality evidence).

Cemented hemiarthroplasty compared with total hip replacement We don't know how cemented hemiarthroplasty and total hip replacement compare at reducing mortality at 1 year in people with intracapsular fractures (low-quality evidence).

Function and mobility

Cemented compared with uncemented prostheses We don't know how cemented and uncemented prostheses compare at increasing the proportion of older people with hip fractures who regain pre-fracture mobility, or the proportion of older people who return home post-surgery (very low-quality evidence).

Unipolar compared with bipolar hemiarthroplasty We don't know how unipolar and bipolar hemiarthroplasty compare at reducing failure to regain mobility at 1 to 2 years in older people with hip fractures (very low-quality evidence).

Uncemented arthroplasty compared with total hip replacement We don't know how uncemented arthroplasty and total hip replacement compare at reducing failure to regain mobility at 1 year in people with intracapsular fractures (very low-quality evidence).

Cemented hemiarthroplasty compared with total hip replacement We don't know how cemented hemiarthroplasty and total hip replacement compare at reducing failure to regain mobility, or at improving hip function, in older people with hip fractures (very low-quality evidence).

Pain

Cemented compared with uncemented prostheses Cemented prostheses may be more effective at reducing the proportion of people who have pain in the hip at 1 year (low-quality evidence).

Cemented hemiarthroplasty compared with total hip replacement We don't know how cemented hemiarthroplasty and total hip replacement compare at reducing residual pain in older people with hip fractures (very low-quality evidence).

Quality of life

Cemented hemiarthroplasty compared with total hip replacement Cemented hemiarthroplasty may be less effective than total hip replacement at improving health-related quality of life in older people with hip fractures (very low-quality evidence).

Orthopaedic complications

Cemented compared with uncemented prostheses We don't know how cemented and uncemented prostheses compare at reducing surgery-related complications (dislocation, deep wound infections, rate of re-operation) in older people with intracapsular fractures (low-quality evidence).

Unipolar compared with bipolar hemiarthroplasty We don't know how unipolar and bipolar hemiarthroplasty compare at reducing deep wound infections, dislocation, acetabular erosion, or rate of re-operation in older people with hip fractures (low-quality evidence).

Uncemented hemiarthroplasty compared with total hip replacement We don't know how uncemented arthroplasty and total hip replacement compare at reducing risk of deep wound infections, dislocations, or major re-operation in older people with intracapsular fractures (low-quality evidence).

Cemented hemiarthroplasty compared with total hip replacement Cemented hemiarthroplasty may be associated with a lower rate of dislocation compared with total hip replacement, but we don't know how the two techniques compare at reducing other surgery-related complications (rate of re-operation or deep wound infection) in older people with hip fractures (low-quality evidence).

Medical complications

Cemented compared with uncemented prostheses We don't know how cemented and uncemented prostheses compare at reducing pressure sores in older people with intracapsular fractures (very low-quality evidence).

Unipolar compared with bipolar hemiarthroplasty We don't know how unipolar and bipolar hemiarthroplasty compare at reducing DVT in older people with hip fractures (very low-quality evidence).

Cemented hemiarthroplasty compared with total hip replacement We don't know how cemented hemiarthroplasty and total hip replacement compare at reducing DVT or pressure sores in older people with hip fractures (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2007, 19 RCTs, 2115 older people with hip fracture) [21] comparing different types of arthroplasty (unipolar hemiarthroplasty, bipolar hemiarthroplasty, and total hip replacement, fixed in place with or without cement).

Cemented versus uncemented prostheses:

Six RCTs (549 people) identified by the review compared a cemented versus an uncemented prosthesis. [21] The review found that a significantly smaller proportion of people with a cemented prosthesis had pain in the hip at 1 to 2 years, compared with uncemented prosthesis (proportion with pain, 2 RCTs; 97 people: 16/52 [31%] with cemented *v* 28/45 [62%] with uncemented; RR 0.51, 95% CI 0.31 to 0.81). [21] It found no significant difference between a cemented and an uncemented prosthesis in mortality at 1 to 3 months, mortality at 1 year, medical complications, or failure to return home (mortality at 1–3 months; 3 RCTs; 308 people: 27/159 [17%] with cemented *v* 20/149 [13%] with uncemented; RR 1.29, 95% CI 0.76 to 2.20; mortality at 1 year; 4 RCTs; 393 people: 48/195 [25%] with cemented *v* 51/198 [26%] with uncemented; RR 0.95, 95% CI 0.67 to 1.34; medical complications; 2 RCTs; 159 people: 27/80 [34%] with cemented *v* 24/79 [30%] with uncemented; RR 1.11, 95% CI 0.71 to 1.75; failure to return home; 1 RCT; 39 people: 3/19 [16%] with cemented *v* 5/20 [25%] with uncemented; RR 0.63, 95% CI 0.17 to 2.29). The review found no significant difference between cemented and uncemented prostheses in the proportion of people who failed to regain pre-fracture mobility (random-effects model: 3 RCTs; 147 people: 33/89 [37%] with cemented *v* 40/58 [69%] with uncemented; RR 0.52, 95% CI 0.25 to 1.11). For the analysis of failure to regain mobility, the review found significant statistical heterogeneity (P = 0.008; significance for heterogeneity set at P less than 0.01) among RCTs. The review did not report on potential sources of heterogeneity: insufficient data to carry out subgroup or sensitivity analyses.

Unipolar versus bipolar hemiarthroplasty:

Seven RCTs (857 people) identified by the review compared unipolar hemiarthroplasty versus bipolar hemiarthroplasty. [21] The review found no significant difference between groups in mortality at 1 to 2 years or in failure to regain mobility (mortality; 3 RCTs; 433 people: 49/228 [21%] with unipolar *v* 49/205 [24%] with bipolar; RR 0.90, 95% 0.64 to 1.26; failure to regain mobility; 1 RCT; 60 people: 8/31 [26%] with unipolar *v* 8/29 [27%] with bipolar; RR 0.94, 95% CI 0.40 to 2.16). [21]

Uncemented hemiarthroplasty versus total hip replacement:

Two RCTs (232 people) identified by the review compared uncemented hemiarthroplasty versus total hip replacement. [21] The review found no significant difference between uncemented hemiarthroplasty and total hip replacement in mortality at 1 year (1 RCT; 180 people: 27/100 [27%] with uncemented unipolar hemiarthroplasty *v* 18/80 [23%] with total hip replacement; RR 1.20, 95% CI 0.71 to 2.02), or failure to regain mobility at 1 year (2 RCTs; 187 people: 20/86 [23%] with uncemented hemiarthroplasty *v* 20/101 [20%] with total hip replacement; RR 1.66, 95% CI 0.31 to 8.92).

Cemented hemiarthroplasty versus total hip replacement:

Four RCTs (428 people) identified by the review [21] compared cemented hemiarthroplasty versus total hip replacement. The review found no significant difference between surgeries in mortality at 1 year, residual pain, or failure to regain mobility (mortality; 2 RCTs; 258 people: 9/129 [7%] with cemented hemiarthroplasty *v* 8/129 [6%] with total hip replacement; RR 1.13, 95% CI 0.45 to 2.83; residual pain; 1 RCT; 121 people: 30/60 [50%] with cemented hemiarthroplasty *v* 29/61 [48%] with total hip replacement; RR 1.05, 95% CI 0.73 to 1.52; failure to regain mobility; 1 RCT; 76 people: 6/37 [16%] with cemented hemiarthroplasty *v* 7/39 [18%] with total hip replacement; RR 0.90, 95% CI 0.33 to 2.44). The review found that total hip replacement significantly improved health-related quality of life on the EuroQol-5d utility score compared with cemented hemiarthroplasty (1 RCT;

131 people [higher score is advantageous]; 0.53 with cemented hemiarthroplasty *v* 0.69 with total hip replacement; mean difference –0.16, 95% CI –0.28 to –0.04). However, there was no significant difference between groups in hip function assessed using the Hip Rating Questionnaire (assesses 4 domains of global impact, pain, walking, and function; score of 0–100, where 100 = no disability; 1 RCT; 116 people: 73.8 with cemented arthroplasty *v* 79.9 with total hip replacement; mean difference –6.10, 95% CI –12.38 to +0.18).

Harms:

Cemented versus uncemented prostheses:
The review found one intra-operative death attributed to the use of cement. [21] The review found no significant difference between cemented and uncemented prostheses in proportion of people with dislocation, deep wound infections, pressure sores, or rate of re-operation (dislocation; 4 RCTs; 390 people: 7/205 [3%] with cemented *v* 2/185 [1%] with uncemented; RR 2.00, 95% CI 0.55 to 7.26; deep wound infections; 4 RCTs; 411 people: 2/222 [0.9%] with cemented *v* 1/189 [0.5%] with uncemented; RR 1.35, 95% CI 0.26 to 6.91; pressure sores; 2 RCTs; 159 people: 3/80 [4%] with cemented *v* 4/79 [5%] with uncemented; RR 0.77, 95% CI 0.20 to 3.03; rate of re-operation [major operation involving revision/removal of implant or open surgery]; 1 RCT; 50 people: 3/37 [8.1%] with cemented *v* 1/13 [7.7%] with uncemented; RR 1.05, 95% CI 0.12 to 9.26).

Unipolar versus bipolar hemiarthroplasty:
The review found no significant difference between unipolar and bipolar hemiarthroplasty in dislocation, acetabular erosion, deep wound infection, DVT, or re-operation (dislocation; 5 RCTs; 668 people: 6/333 [1.8%] with unipolar *v* 6/335 [1.8%] with bipolar; RR 1.09, 95% CI 0.36 to 3.31; acetabular erosion; 3 RCTs; 505 people: 7/258 [2.7%] with unipolar *v* 1/247 [0.4%] with bipolar; RR 3.83, 95% CI 0.81 to 18.15; deep wound infection; 4 RCTs; 620 people: 8/318 [2.5%] with unipolar *v* 5/302 [1.7%] with bipolar; RR 1.34, 95% 0.50 to 3.62; DVT; 1 RCT; 48 people: 0/15 [0%] with unipolar *v* 1/33 [3%] with bipolar; RR 0.71, 95% CI 0.03 to 16.45; re-operation; 3 RCTs; 370 people: 10/186 [5%] with unipolar *v* 7/184 [4%] with bipolar; RR 1.41, 95% CI 0.54 to 3.69). [21]

Uncemented hemiarthroplasty versus total hip replacement:
The review found no significant difference between the two types of prosthesis in dislocation, deep wound infection, or major re-operations (dislocation; 2 RCTs; 232 people: 11/113 [10%] with uncemented hemiarthroplasty *v* 17/119 [14%] with total hip replacement; RR 0.70, 95% CI 0.33 to 1.51; deep wound infection; 2 RCTs; 232 people: 0/113 [0%] with uncemented hemiarthroplasty *v* 1/119 [1%] with total hip replacement; RR 0.27, 95% CI 0.01 to 6.47; major re-operations; 2 RCTs; 232 people: 14/113 [12%] with uncemented unipolar hemiarthroplasty *v* 5/119 [4%] with cemented total hip replacement; RR 2.89, 95% CI 0.98 to 8.51). [21]

Cemented hemiarthroplasty versus total hip replacement:
The review found that cemented hemiarthroplasty was associated with a significantly lower rate of dislocation compared with total hip replacement (4 RCTs; 415 people: 4/207 [2%] with cemented hemiarthroplasty *v* 13/208 [6%] with total hip replacement; RR 0.34, 95% CI 0.12 to 0.96). [21] The review found no significant difference between the two types of prosthesis in major re-operations, or in the proportion of people with deep wound infections, DVT, or pressure sores (re-operations; 4 RCTs; 415 people: 13/207 [6%] with cemented hemiarthroplasty *v* 22/208 [11%] with total hip replacement; RR 0.61, 95% CI 0.32 to 1.15; deep wound infections; 4 RCTs; 415 people: 1/207 [0.5%] with cemented hemiarthroplasty *v* 2/208 [1.0%] with total hip replacement; RR 0.60, 95% CI 0.08 to 4.48; DVT; 3 RCTs; 339 people: 1/170 [0.6%] with cemented hemiarthroplasty *v* 8/169 [5%] with total hip replacement; RR 0.26, 95% CI 0.07 to 1.04; pressure sores; 2 RCTs; 201 people: 0/101 [0%] with cemented hemiarthroplasty *v* 2/100 [2%] with total hip replacement; RR 0.33, 95% CI 0.03 to 3.11).

Comment:

Clinical guide:
Results from one RCT [15] identified by the review [21] suggest that, compared with hemiarthroplasty, total hip replacement is associated with better longer-term functional outcome in fitter older people. However, these findings require confirmation by further studies.

The variety of prostheses and surgical techniques used for the three main comparisons, the limited number of people studied, the flawed methods (in particular, failure to conceal treatment allocation and to perform ITT analysis), insufficient length of follow-up, and inadequate reporting of most of the RCTs preclude conclusions on the presence or absence of differences among different types of arthroplasty. Limited evidence suggests that a cemented prosthesis may produce less postoperative pain.

OPTION ARTHROPLASTY VERSUS INTERNAL FIXATION FOR EXTRACAPSULAR HIP FRACTURE

Mortality

Arthroplasty compared with internal fixation We don't know how arthroplasty and internal fixation compare at reducing mortality at 12 months in people with unstable extracapsular fractures (very low-quality evidence).

Function and mobility
Arthroplasty compared with internal fixation We don't know how arthroplasty and internal fixation compare at increasing the proportion of previously independent people who have lost ambulatory independence at discharge from hospital, or at improving Harris hip scores and time to standing and weight-bearing, in people with unstable extracapsular fractures (very low-quality evidence).

Orthopaedic complications
Arthroplasty compared with internal fixation We don't know how arthroplasty and internal fixation compare at reducing surgery-related complications (need for re-operation, local wound infection, and total complications) in people with unstable extracapsular fractures (very low-quality evidence).

Medical complications
Arthroplasty compared with internal fixation We don't know how arthroplasty and internal fixation compare at reducing DVT or cardiovascular and neurological complications in people with unstable extracapsular fractures (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2005, 2 RCTs, 148 people with unstable extracapsular hip fractures) [22] and one subsequent RCT [23] comparing arthroplasty versus internal fixation. One RCT identified by the review compared cemented arthroplasty versus a sliding hip screw. This had weak methods (see comment below). It found no significant difference in mortality at 12 months between arthroplasty and internal fixation (10/43 [23%] with arthroplasty *v* 10/47 [21%] with internal fixation; RR 1.09, 95% CI 0.50 to 2.37). It also found no significant difference in the proportion of previously independent people who had lost ambulatory independence at discharge from hospital between arthroplasty and internal fixation (12/30 [40%] with arthroplasty *v* 14/28 [50%] with internal fixation; RR 0.80, 95% CI 0.45 to 1.42). The other RCT compared uncemented arthroplasty versus an intramedullary nail. It found no significant difference in mortality at 12 months between arthroplasty and internal fixation (58 people; 8/29 [28%] with arthroplasty *v* 4/29 [14%] with internal fixation; RR 2.00, 95% CI 0.68 to 5.91). Although this RCT found a significant difference in longer-term mortality in favour of internal fixation (16/29 [55%] with arthroplasty *v* 5/29 [17%] with internal fixation; RR 3.20, 95% CI 1.35 to 7.58), this result should be viewed with caution because of the variable follow-up times (24–58 months), the lack of a clear difference in mortality at 1 year, and absence of cause-of-death data. The RCT found no significant difference in Harris hip scores (mainly assesses pain and function, score range 0 = severe pain and disability to 100 = no problems) with both treatments at the latest follow-up (mean score: 80 with arthroplasty *v* 82 with internal fixation; P = 0.28). It found no significant difference in postoperative respiratory complications, cardiovascular complications, DVT, or neurological complications (respiratory complications: 3/29 [10%] with arthroplasty *v* 4/29 [14%] with internal fixation; cardiovascular complications: 5/29 [17%] with arthroplasty *v* 2/29 [7%] with internal fixation; DVT: 1/29 [3%] with arthroplasty *v* 0/29 [0%] with internal fixation; neurological complications: 1/29 [3%] with arthroplasty *v* 0/29 [0%] with internal fixation; difference in complications reported as not significant; absolute numbers not reported).

The subsequent RCT compared a sliding hip screw versus a mixture of cemented total hip replacement and cemented bipolar hemiarthroplasty. [23] There was no difference in the mortality at mean follow-up of 3.2 years (2/76 [3%] for arthroplasty *v* 3/80 [4%] for internal fixation). There was a significant difference in the Harris hip scores at the last follow-up and time to standing and weight-bearing (mean Harris hip score: 84.6 ± 7.4 with arthroplasty *v* 81.3 ± 5.6 with sliding hip screw; P = 0.002; mean time for standing and weight-bearing: 8.6 ± 3.6 days with arthroplasty *v* 73.6 ± 11.8 days with sliding hip screw; P less than 0.05). These results for this RCT must be viewed with caution, as both the mortality and the time taken to stand for those treated with a sliding hip screw are extremely atypical for hip fracture patients and not reproduced in other studies.

Harms:

One RCT identified by the review found that arthroplasty significantly increased the proportion of people who received a blood transfusion of at least 400 mL compared with internal fixation (34/43 [79%] with arthroplasty *v* 27/47 [57%] with internal fixation; RR 1.38, 95% CI 1.03 to 1.84). It found no significant difference in local wound complications between arthroplasty and sliding hip screw (3/41 [7%] with arthroplasty *v* 5/43 [12%] with internal fixation; RR 0.63, 95% CI 0.16 to 2.47). Fracture fixation failure resulted in one re-operation in the arthroplasty group and in two people treated with a sliding hip screw. The other major complication in the arthroplasty group was a case of severe hypotension on injection of cement, with death ensuing at 4 days. The other RCT identified also found that arthroplasty significantly increased the proportion of people who received a blood transfusion compared with a proximal femoral nail [PFN]) (27/29 [93%] with arthroplasty *v* 12/29 [41%] with PFN; RR 2.25, 95% CI 1.44 to 3.51; RR calculated by *Clinical Evidence* contributors).

It found that one person in each treatment group had a local wound complication, and one required re-operation for fracture fixation failure. The subsequent RCT showed a significant difference in total complications (4/76 [5%] for arthroplasty *v* 12/80 [15%] with sliding hip screw; P less than 0.05), although definitions and method of diagnosis were not clearly stated. [23]

Comment: The systematic review included people aged 70 years or over with unstable extracapsular fracture. [22] [24] Although the two studies tested the same basic comparison, there were important differences in the types of arthroplasty (cemented *v* uncemented) and types of internal fixation (extramedullary *v* intramedullary). The results from the RCT need to be verified by further studies. [23] The already small numbers of participants and inadequate methods — including insufficient assessment of long-term effect — mean that no definite conclusions can be drawn on the relative effects of the two approaches for people with these fractures. **Clinical guide:** Current treatment usually involves fixation of extracapsular fractures with a sliding hip screw because, compared with intracapsular fractures, there are lower rates of avascular necrosis and non-union. Also, arthroplasty is more technically demanding in this fracture type compared with intracapsular fractures. Current clinical evidence is not robust enough to change this practice.

OPTION OLDER FIXED NAIL PLATES FOR EXTRAMEDULLARY FIXATION OF EXTRACAPSULAR FRACTURE (INCREASED RISK OF FIXATION FAILURE COMPARED WITH SLIDING HIP SCREWS)

Mortality
Compared with sliding hip screws We don't know how older nail plates and sliding hip screws compare at reducing mortality in people with extracapsular hip fracture (low-quality evidence).

Function and mobility
Compared with sliding hip screws We don't know how older nail plates and sliding hip screws compare at improving mobility in people with extracapsular hip fracture (low-quality evidence).

Pain
Compared with sliding hip screws We don't know how older nail plates and sliding hip screws compare at reducing pain in people with extracapsular hip fracture (low-quality evidence).

Orthopaedic complications
Compared with sliding hip screws Older fixed nail plates may be less effective at reducing the risk of fixation failure in people with extracapsular hip fracture (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2005, 12 RCTs, 1546 people, most aged at least 65 years) comparing various extramedullary fixation implants (primarily fixed plates) versus sliding hip screws. [25] The sliding hip screw was presented as the control/standard device.

Fixed nail plates versus sliding screws:
Three RCTs (355 people) identified by the review comparing a Jewett or McLaughlin fixed nail plate versus a sliding hip screw provided only limited data for meta-analysis. [25] None of the RCTs reported a significant difference between fixed nail plates and sliding hip screws in mortality or impairment in mobility (mortality; quantitative data available for 1 RCT; 98 people: 11/47 [23%] with fixed nail plate *v* 9/51 [18%] with sliding hip screw; RR 1.33, 95% CI 0.60 to 2.91; impairment in mobility; 1 RCT: 15/36 [42%] with fixed nail plate *v* 11/42 [26%] with sliding hip screw; RR 1.59, 95% CI 0.84 to 3.01). [25] Two RCTs reported, without data, a tendency for more pain after the fixed nail plate; the third RCT providing data found no significant difference between fixed nail plates and sliding hip screws in pain at follow-up (1 RCT; 78 people: 7/36 [19%] with fixed nail plate *v* 4/42 [10%] with sliding hip screw; RR 2.04, 95% CI 0.65 to 6.42).

Harms: **Fixed nail plates versus sliding screws:**
The review found that a Jewett or McLaughlin fixed nail plate significantly increased the risk of fixation failure compared with a sliding hip screw (2 RCTs; 145 people: 38/62 [61%] with fixed nail plate *v* 12/83 [14%] with sliding hip screw; RR 4.27, 95% CI 2.44 to 7.45). [25] The three RCTs gave no direct comparative information on postoperative complications.

Comment: **Clinical guide:**
Although the evidence from three poor-quality RCTs is insufficient to confirm an overall superiority of the sliding hip screw for mortality and long-term function, the markedly higher fixation failure rate for traditional fixed nail plates is consistent with mechanical and other clinical evaluations, and is sufficient to decide against their use.

OPTION EXTRAMEDULLARY IMPLANTS (OTHER THAN OLDER FIXED NAIL PLATES) VERSUS SLIDING HIP SCREW FOR EXTRACAPSULAR FRACTURE

Mortality
Extramedullary implants (other than older fixed nail plates) compared with sliding hip screws Various extramedullary implants of both sliding and fixed designs (other than older fixed nail plates) seem no more effective than sliding hip screws at reducing mortality in people with extracapsular hip fracture (moderate-quality evidence).

Function and mobility
Extramedullary implants (other than older fixed nail plates) compared with sliding hip screws We don't know how the Medoff plate compares with sliding hip screws at increasing the proportion of people with extracapsular hip fracture who return to living at home post-surgery, or how the Gotfried percutaneous compression plate compares with sliding hip screws at increasing the proportion of people who maintain their independent mobility (low-quality evidence).

Pain
Extramedullary implants (other than older fixed nail plates) compared with sliding hip screws The Pugh nail plate seems no more effective than the sliding hip screw at reducing pain at follow-up in people with extracapsular hip fracture (moderate-quality evidence).

Orthopaedic complications
Extramedullary implants (other than older fixed nail plates) compared with sliding hip screws We don't know how various extramedullary implants of both sliding and fixed designs (other than older fixed nail plates) compare with sliding hip screws at reducing fixation failure rate, need for re-operation, cut-out rate, deep infection, leg shortening, or varus deformity in people with extracapsular hip fracture (low-quality evidence).

Medical complications
Extramedullary implants (other than older fixed nail plates) compared with sliding hip screws The RAB plate and the Pugh nail plate seem to be associated with a similar risk of thromboembolism and DVT, respectively, to the sliding hip screw (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2005, 12 RCTs, 1546 people, most aged at least 65 years) comparing various extramedullary fixation implants (primarily fixed plates) versus sliding hip screws. [25] The sliding hip screw was presented as the control/standard device.

Extramedullary fixation implants (other than fixed nail plates) versus sliding screws:
The review found seven RCTs comparing other different extramedullary implants (RAB fixed nail plate, Pugh nail plate, Medoff sliding plate, and Gotfried percutaneous compression plate) versus sliding hip screws. [25]

Two RCTs (433 people) identified by the review compared a RAB fixed nail plate versus a sliding hip screw. [25] The review found no significant difference in mortality between RAB fixed plates and sliding hip screws (2 RCTs: 25/211 [12%] with RAB plate *v* 36/222 [16%] with sliding hip screw; RR 0.73, 95% CI 0.46 to 1.18). The two RCTs often gave contrasting results in terms of fixation failure, re-operation, and limb deformity. The review found no significant difference between the RAB fixed nail plate and the sliding hip screw in fixation failure, re-operation rate, or varus deformity (fixation failure; 2 RCTs; 352 people: 21/173 [12%] with RAB plate *v* 22/179 [12%] with sliding hip screw; RR 0.99, 95% CI 0.56 to 1.74; re-operation rate; 2 RCTs: 21/173 [12%] with RAB plate *v* 26/179 [15%] with sliding hip screw; RR 0.84, 95% CI 0.49 to 1.43; varus deformity; 2 RCTs; 352 people: 6/173 [3%] with RAB plate *v* 10/179 [6%] with sliding hip screw; RR 0.62, 95% CI 0.23 to 1.67). The review noted significant statistical heterogeneity between the RCTs in the analyses of fixation failure and rate of re-operation (P = 0.02 for both analyses; P less than 0.1 denotes heterogeneity). The review did not report on potential sources of heterogeneity; it reported that there were insufficient data to carry out sensitivity analyses. The review found conflicting results for leg shortening in the two identified RCTs: data reported are as reported in the review. In one RCT, a significantly smaller proportion of people in the RAB plate group had shortening of the leg compared with the sliding hip screw group (2/91 [2%] with RAB plate *v* 15/95 [16%] with sliding hip screw; RR 0.14, 95% CI 0.03 to 0.59), but there was no significant difference between groups in mean leg shortening (2.6 cm with RAB plate *v* 2.4 cm with sliding hip screw; P = 0.65) in the second RCT.

The review identified one RCT (100 people) comparing the Pugh nail plate versus a sliding hip screw. [25] The review found no significant difference between the two implants in mortality, fixation failure, or pain at follow-up (mortality: 10/50 [20%] with Pugh nail plate *v* 5/50 [12%] with sliding hip screw; RR 1.67, 95% CI 0.66 to 4.24; fixation failure: 2/40 [5%] with Pugh nail plate *v* 4/44 [9%] with sliding hip screw; RR 0.55, 95% CI 0.11 to 2.84; pain at follow-up; moderate to severe pain:

3/40 [8%] with Pugh nail plate *v* 4/44 [9%] with sliding hip screw; RR 0.83, 95% CI 0.20 to 3.46). [25]

The review found that the Medoff (sliding) plate significantly reduced the risk of fixation failure compared with the sliding hip screw (2 RCTs; 292 people: 2/123 [2%] with Medoff plate *v* 14/151 [9%] with sliding hip screw; RR 0.20, 95% CI 0.05 to 0.74). [25] It found no significant difference between implants in mortality or in failure to return to living at own home (mortality; 1 RCT; 114 people: 6/54 [11%] with Medoff plate *v* 10/60 [17%] with sliding hip screw; RR 0.67, 95% CI 0.26 to 1.71; failure to return to living at own home; 1 RCT; 68 people: 8/32 [25%] with Medoff plate *v* 11/36 [31%] with sliding hip screw; RR 1.03, 95% CI 0.73 to 1.45).

The review found no significant difference between the Gotfried percutaneous compression plate and a sliding hip screw in mortality or in proportion of people who lost independent mobility (mortality; 2 RCTs; 226 people: 19/108 [18%] with Gotfried plate *v* 21/118 [18%] with sliding hip screw; RR 1.00, 95% CI 0.57 to 1.75; proportion of people who lost independent mobility; 1 RCT; 83 people; 9/39 [23%] with Gotfried percutaneous compression plate *v* 9/44 [20%] with sliding hip screw; RR 1.13, 95% CI 0.50 to 2.55). [25] The review also found no significant difference between the Gotfried percutaneous compression plate and sliding hip screw in fixation failure rate or in re-operation rate (fixation failure rate: 6/108 [6%] with Gotfried plate *v* 4/118 [3%] with sliding hip screw; RR 1.65, 95% CI 0.48 to 5.66; re-operation rate: 5/108 [5%] with Gotfried plate *v* 4/118 [3%] with sliding hip screw; RR 1.39, 95% CI 0.39 to 4.98).

Harms:

Extramedullary fixation implants (other than fixed nail plates) versus sliding screws:
The review found that, compared with the sliding hip screw group, a significantly larger proportion of people in the RAB plate group received a blood transfusion (46/82 [56%] with RAB plate *v* 33/84 [39%] with sliding hip screw; RR 1.43, 95% CI 1.03 to 1.98). [25] The review found no significant difference between RAB plate and sliding hip screw in risk of deep infection or thromboembolism (deep infection; 2 RCTs; 352 people: 3/173 [1.7%] with RAB plate *v* 4/179 [2.2%] with sliding hip screw; RR 0.77, 95% CI 0.18 to 3.41; thromboembolism; 1 RCT; 166 people: 3/82 [3.6%] with RAB plate *v* 3/84 [3.5%] with sliding hip screw; RR 1.02, 95% CI 0.21 to 4.93).

The review found no significant difference between the Pugh nail plate and sliding hip screw in risk of deep infection or DVT (deep infection; 1 RCT; 100 people: 0/50 [0%] with Pugh nail plate *v* 1/50 [2%] with sliding hip screw; RR 0.33, 95% CI 0.01 to 7.99; DVT; 1 RCT; 100 people: 1/50 [2%] with Pugh nail plate *v* 1/50 [2%] with sliding hip screw; RR 1.00, 95% CI 0.06 to 15.55). [25]

The review found no significant difference between Medoff (sliding) plate and sliding hip screw in cut-out rate, although rate of cut out was considerably lower with Medoff plate (2 RCTs; 274 people: 2/123 [2%] with Medoff plate *v* 11/151 [7%] with sliding hip screw; RR 0.27, 95% CI 0.07 to 1.02). [25]

The review found that the Gotfried plate significantly reduced the amount of blood transfused (2 RCTs; 226 people, 191 assessed: WMD –0.46 units, 95% CI –0.82 units to –0.09 units). [25] However, both RCTs reported some intra-operative problems with the Gotfried plate, as it is placed through a small percutaneous incision, meaning that its use may be restricted to certain fracture patterns.

Comment:

The heterogeneity in the findings of the two flawed RCTs identified by the review comparing the RAB fixed nail plate versus a sliding hip screw means that the RAB plate remains of unproven value. The favourable fixation results for the Medoff plate need to be viewed in the context of the unusually high failure rate, especially cut-out, in this RCT, for people receiving the sliding hip screw. There were serious intention-to-treat problems encountered in one of the two RCTs assessing the Gotfried plate, and a general lack of long-term functional outcome data.

OPTION EXTERNAL FIXATION FOR EXTRACAPSULAR FRACTURE

Mortality
Compared with extramedullary fixation using a sliding hip screw We don't know how external fixation and extramedullary fixation using a sliding hip screw compare at reducing mortality in people with extracapsular hip fracture (low-quality evidence).

Function and mobility
Compared with extramedullary fixation using a sliding hip screw We don't know how external fixation and extramedullary fixation using a sliding hip screw compare at decreasing the proportion of people with extracapsular hip fracture who fail to return to their previous residential status, have a reduced walking ability, or have an improvement in Harris hip scores (very low-quality evidence).

Medical complications
Compared with extramedullary fixation using a sliding hip screw External fixation may be associated with an increased risk of superficial infection in people with extracapsular hip fracture (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2005, 12 RCTs, 1546 people, most aged at least 65 years) comparing various extramedullary fixation implants (primarily fixed plates) versus sliding hip screws. [25] The sliding hip screw was presented as the control/standard device. None of the RCTs found a significant difference in mortality between any type of nail plate and a sliding hip screw, although there were differences in other outcomes. [25] One subsequent RCT compared sliding hip screw versus external fixation in a young hip-fracture population in a developing country. [26]

External fixation versus extramedullary fixation:
The review identified two RCTs (140 people) comparing an external fixator versus extramedullary fixation using a sliding hip screw. [25] The review found that, compared with extramedullary fixation, external fixation significantly reduced operative trauma (blood transfusion, 2 RCTs: 1/70 [1.4%] with external fixator *v* 34/70 [48.6%] with sliding hip screw; RR 0.04, 95% CI 0.01 to 0.22). The review found no significant difference between external fixation and sliding hip screw in length of hospital stay (mean difference: –4.60 days, 95% CI –12.64 days to +3.43 days). The review found no significant difference between groups in mortality at 6 months, the proportion of people who failed to return to their previous residential status, or the proportion who had reduced walking ability (mortality at 6 months: 7/50 [14%] with external fixator *v* 8/50 [16%] with sliding hip screw; RR 0.88, 95% CI 0.34 to 2.23; failure to return to previous residential status: 8/43 [19%] with external fixator *v* 10/42 [24%] with sliding hip screw; RR 0.78, 95% CI 0.34 to 1.79; reduced walking ability: 22/43 [51%] with external fixator *v* 23/42 [55%] with sliding hip screw; RR 0.93, 95% CI 0.63 to 1.40). The review reported that one RCT found similar mean Harris hip scores (assesses mainly pain and function, score range 0 = severe pain and disability to 100 = no problems) in the two groups at 6 months (63 with external fixation *v* 62 with sliding hip screw; significance not assessed by review). [25] The subsequent RCT found similar Harris hip scores at 6 months in each group (90 with external fixation *v* 90 with sliding hip screw; significance not assessed). [26] The mean age of hip fractures in the study was 67 years; the aetiology of the fractures and the population characteristics are likely to be different from those usually encountered in developed countries.

Harms:

External fixation versus extramedullary fixation:
The review found that external fixation significantly increased superficial infections compared with extramedullary fixation using a sliding hip screw (2 RCTs; 140 people: 15/70 [21%] with external fixation *v* 3/70 [4%] with sliding hip screw; RR 5.00, 95% CI 1.54 to 16.21). One of the two RCTs attributed the absence of pin track infection in the external fixator group to the use of hydroxyapatite-coated pins. [25] The subsequent RCT reported that "no patient suffered failure of the implant in either group": no comparative data on adverse effects reported. [26]

Comment:

While the short-term results seem promising for the external fixator compared with the sliding hip screw, further evidence is required to confirm this and to determine long-term outcome.

OPTION INTRAMEDULLARY FIXATION WITH SHORT CEPHALOCONDYLIC NAILS VERSUS EXTRAMEDULLARY FIXATION WITH SLIDING HIP SCREW FOR EXTRACAPSULAR HIP FRACTURE

Mortality
Intramedullary fixation with a short cephalocondylic nail compared with extramedullary fixation with a sliding hip screw Cephalocondylic nails (e.g., Gamma nail, intramedullary hip screw, proximal femoral nail, and Targon proximal femoral nail) and sliding screws are equally effective at reducing mortality at 3 to 12 months in people with extracapsular hip fractures (high-quality evidence).

Function and mobility
Intramedullary fixation with a short cephalocondylic nail compared with extramedullary fixation with a sliding hip screw Cephalocondylic nails and sliding screws are equally effective at reducing the proportion of people with extracapsular hip fractures who fail to return to previous residence. Various cephalocondylic nails are as effective as sliding hip screws at improving various measures of walking ability at 3 to 12 months (high-quality evidence).

Pain
Intramedullary fixation with a short cephalocondylic nail compared with extramedullary fixation with a sliding hip screw Cephalocondylic nails and sliding screws are equally effective at reducing the proportion of people reporting pain (high-quality evidence).

Orthopaedic complications

Intramedullary fixation with a short cephalocondylic nail compared with extramedullary fixation with a sliding hip screw Cephalocondylic nails are associated with an increased risk of fracture of the femur during operation and at later dates, and with an increased need for re-operation. However, cephalocondylic nails and sliding screws are associated with similar risk of deep wound infections and rate of cut-out of the implant in people with extracapsular hip fractures (high-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found three systematic reviews (search date 2007, 36 RCTs, 5668 people with extracapsular fracture; [27] search date 2004, 24 RCTs, 3459 people; [28] search date 2002, 16 RCTs, 2431 people [29]) and one subsequent RCT [30] comparing cephalocondylic nails (including Gamma nail, intramedullary hip screw, and proximal femoral nail) versus sliding hip screws. All RCTs identified by the second [28] and third [29] reviews were identified by the first review: [27] the second and third reviews reported outcomes only relevant to the harms section, p 16 . Here, we report data from the largest review with the most recent search date. [27] The review carried out a combined analysis and subgroup analysis for four types of cephalocondylic nail identified (Gamma nail, intramedullary hip screw, proximal femoral nail, and Targon proximal femoral nail). We report data from the combined analysis; we have reported subgroup analysis only in cases where direction of effect or significance for a subgroup analysis differs from the combined analysis, or where an outcome of clinical interest is assessed for a specific type of intramedullary nail.

The review found no significant difference between cephalocondylic nails and sliding hip screws in mortality at 3 to 12 months (23 RCTs; 3123 people: 285/1545 [18%] with nail *v* 306/1578 [19%] with sliding hip screw; RR 0.97, 95% CI 0.84 to 1.12). [27] The review also found no significant difference between groups at follow-up (generally 3–12 months) in the proportion of people reporting pain or failing to return to previous residence (pain; 8 RCTs; 897 people: 163/446 [37%] with nail *v* 151/451 [33%] with sliding hip screw; RR 1.10, 95% CI 0.93 to 1.30; failure to return to previous residence; 9 RCTs; 1070 people: 222/520 [43%] with nail *v* 233/550 [42%] with sliding hip screw; RR 1.01, 95% CI 0.88 to 1.16). [27]

The review found that, compared with sliding hip screw, proximal femoral nails significantly reduced the proportion of people who failed to recover previous mobility at 4 months (1 RCT; 83 people: 10/42 [24%] with proximal femoral nail *v* 19/41 [46%] with sliding hip screw; RR 0.51, 95% CI 0.27 to 0.97). [27] However, the review found no significant difference between Gamma nail and sliding hip screw in impaired walking ability (8 RCTs; 1311 people: 280/653 [43%] with Gamma nail *v* 282/658 [44%] with sliding hip screw; RR 1.00, 95% CI 0.89 to 1.13), or between intramedullary hip screw (IMHS) and sliding hip screw in failure to regain mobility (1 RCT; 105 people: 15/52 [29%] with IMHS *v* 16/53 [30%] with sliding hip screw; RR 0.96, 95% CI 0.53 to 1.73).

The subsequent RCT (190 people with extracapsular hip fracture) compared fixation with a Holland nail versus a dynamic hip screw. [30] The RCT found that people in the Holland nail group mobilised significantly faster compared with people in the sliding hip screw group (mean time to mobilisation with a walking frame: 3.6 days with Holland nail *v* 4.3 days with sliding hip screw; P = 0.012). The RCT also found that a significantly larger proportion of people in the Holland nail group regained their level of preoperative mobility at 1 year compared with the sliding hip screw group (49/92 [53%] with Holland nail *v* 30/98 [30%] with sliding hip screw; P less than 0.001). The RCT found no significant difference between fixation techniques in the proportion of people with a postoperative wound infection (5/92 [5%] with Holland nail *v* 10/98 [10%] with sliding hip screw; P = 0.286). Rates of mortality at 30 days, re-operation, and fracture were low in each group (mortality: 7/92 [8%] with Holland nail *v* 6/98 [6%] with sliding hip screw; re-operation: 0/92 [0%] with Holland nail *v* 1/98 [1%] with sliding hip screw; fracture: 0/92 [0%] with Holland nail *v* 0/98 [1%] with sliding hip screw; significance not assessed for any outcome).

Harms:

The review found that, compared with the sliding hip screw, the short cephalocondylic nail significantly increased the risk of fracture of the femur during the operative procedure and later (during operative procedure; 24 RCTs; 3603 people: 35/1804 [1.9%] with nail *v* 6/1799 [0.3%] with sliding hip screw; RR 3.25, 95% CI 1.74 to 6.08; later; 26 RCTs; 3328 people: 39/1683 [2.3%] with nail *v* 2/1645 [0.1%] with sliding hip screw; RR 5.22, 95% CI 2.56 to 10.64). [27] It also found that the short cephalocondylic nail significantly increased re-operation rates compared with the sliding hip screw (23 RCTs; 3388 people: 105/1698 [6%] with nail *v* 64/1690 [4%] with sliding hip screw; RR 1.58, 95% CI 1.17 to 2.12). [27] However, it found no significant difference between short cephalocondylic nails and sliding hip screws in the incidence of deep wound infection or cut-out (wound infection; 18 RCTs; 2595 people: 13/1300 [1.0%] with nail *v* 12/1295 [0.9%] with sliding hip screw; RR 1.08, 95% CI 0.54 to 2.17; cut-out; 27 RCTs; 3803 people; 58/1901 [3.0%] with nail *v* 50/1902 [2.6%] with sliding hip screw; RR 1.15, 95% CI 0.80 to 1.66). The review found that using short

cephalocondylic nails resulted in one additional later femur fracture in every 50 people (95% CI 1 in 33 to 1 in 100), and one extra re-operation in every 50 people (95% CI 1 in 25 to 1 in 100). [27]

The subsequent RCT found that the Holland nail group was associated with a significantly longer operation time compared with the sliding hip screw group (mean operation time: 40.4 minutes with Holland nail *v* 29.7 minutes with sliding hip screw; P less than 0.001). [30] However, the RCT found that fixation with the Holland nail was associated with significantly less blood loss compared with fixation with the sliding hip screw (mean blood loss: 78 mL with Holland nail *v* 160 mL with sliding hip screw; P less than 0.001).

Two smaller reviews attempted to stratify the results according to fracture pattern; [28] [29] the reviews identified similar RCTs, and so we report data from the larger review with the more recent search date. [28] In people with an unstable fracture pattern, the review found no significant difference between sliding hip screws and cephalocondylic nails in cut-out rate, total fixation failure rate, or re-operation (cut-out rate; 11 RCTs; 973 people: 15/462 [3.2%] with nail *v* 15/511 [2.9%] with sliding hip screw; total fixation failure rate; 10 RCTs; 902 people: 23/425 [5.4%] with nail *v* 23/477 [4.8%] with sliding hip screw; re-operation rate; 8 RCTs; 766 people: 20/362 [5.5%] with nail *v* 17/404 [4.2%] with sliding hip screw; RR values presented graphically; all reported as not significant). [28]

Comment:

Clinical guide:
Despite the theoretical mechanical advantages of intramedullary cephalocondylic devices for operative fixation of extracapsular hip fractures, the evidence for designs assessed so far has shown these to be associated with higher risk of fracture fixation complications than the sliding hip screw. This evidence is based on a heterogeneous group of extracapsular hip fractures in the trochanteric region. Even the reviews examining unstable fracture patterns were unable to isolate fractures specifically at the level of the lesser trochanter, "reverse oblique" fracture line patterns, and subtrochanteric fractures, which could benefit most from the mechanical advantage of intramedullary nails. Many of the studies were performed with first-generation implants; several modifications have since been made to their design, which may help to lessen the risk of fracture with contemporary implants. Further studies are required to evaluate the treatment of these fracture patterns and the newer designs of intramedullary nails. Currently, there is no strong evidence to support the superiority of nails in the treatment of these particularly unstable types of fracture pattern.

OPTION INTRAMEDULLARY FIXATION WITH CONDYLOCEPHALIC NAILS VERSUS EXTRAMEDULLARY FIXATION WITH SLIDING HIP SCREW OR FIXED NAIL PLATE FOR EXTRACAPSULAR HIP FRACTURE

Mortality
Intramedullary fixation with condylocephalic nails compared with extramedullary fixation Condylocephalic nails and extramedullary implants are equally effective at reducing mortality (high-quality evidence).

Orthopaedic complications
Intramedullary fixation with condylocephalic nails compared with extramedullary fixation Condylocephalic nails are less effective at reducing the need for re-operation for fixation failure, the proportion of people with leg shortening, and the proportion of people with external rotation deformity. However, condylocephalic nails and extramedullary implants are associated with similar rates of deep wound sepsis (high-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2004, 11 RCTs, 1667 people) comparing intramedullary fixation with condylocephalic nails (Ender nail: 10 RCTs; Harris nail: 1 RCT) versus extramedullary fixation (sliding hip screw: 8 RCTs; fixed nail plate: 3 RCTs). [31] It found no significant difference in mortality between condylocephalic nails and extramedullary implants (7 RCTs; 1090 people: 129/550 [23%] with condylocephalic nails *v* 126/540 [23%] with extramedullary fixation; RR 1.02, 95% CI 0.82 to 1.27). It found that condylocephalic nails significantly reduced the length of surgery, operative blood loss, and the incidence of deep wound sepsis (length of surgery; 1 RCT; 326 people: WMD –22.8 minutes, 95% CI –27.7 minutes to –17.8 minutes; operative blood loss; 1 RCT; 326 people: WMD –208 mL, 95% CI –262 mL to –154 mL; incidence of deep wound sepsis; 7 RCTs; 1103 people: 5/554 [1%] with condylocephalic nails *v* 23/549 [4%] with extramedullary fixation; RR 0.26, 95% CI 0.11 to 0.62).

Harms:

The review found that condylocephalic nails significantly increased the risk of re-operation for fixation failure, incidence of leg shortening, and external rotation deformity (re-operation for fixation failure; 8 RCTs; 1130 people: 118/564 [21%] with condylocephalic nails *v* 31/566 [5%] with extramedullary fixation; RR 3.72, 95% CI 2.54 to 5.44; incidence of leg shortening; 6 RCTs; 845 people: 44/401 [11%] with condylocephalic nails *v* 19/442 [4%] with extramedullary fixation; RR 2.71, 95% CI 1.60 to 4.59; external rotation deformity; 5 RCTs; 741 people: 86/345 [25%] with condylocephalic nails

v 28/396 [7%] with extramedullary fixation; RR 3.73, 95% CI 2.47 to 5.64). [31] Specific to condylocephalic nails were an excess of knee pain and backing out of the nail at the knee, occurring in 30% of cases, often requiring re-operation.

Comment:

Clinical guide:
Condylocephalic nails (such as Ender nails) are inserted at the knee and passed up the medullary cavity across the fracture to the femoral head. They have the advantage of being less traumatic to insert, but the associated benefits of reduced length of surgery, operative blood loss, and wound infection are generally outweighed by the markedly increased incidence of fracture fixation complications. This is reflected in greater limb deformity and in the fourfold increase in the re-operation rate. Longer-term functional outcomes were inconsistently reported, but the greater limb deformity and knee pain associated with condylocephalic nails are consistent with some limited evidence of a poorer return to previous walking ability.

OPTION INTRAMEDULLARY FIXATION DEVICES VERSUS EACH OTHER FOR EXTRACAPSULAR HIP FRACTURE

Mortality
Different types of intramedullary fixation compared with each other Various types of intramedullary fixation device (proximal femoral nail, ACE trochanteric nail, "Gliding" nail, and Russell-Taylor Recon nail) seem as effective as Gamma nails at reducing mortality at 6 to 12 months in people with extracapsular fractures. Dynamically and statically locked intramedullary hip screw seem equally effective at reducing mortality at 6 months (moderate-quality evidence).

Function and mobility
Different types of intramedullary fixation compared with each other We don't know how proximal femoral nails and Gamma nails compare at improving Harris Hip Scores up to 1 year in people with extracapsular fractures (low-quality evidence).

Pain
Different types of intramedullary fixation compared with each other We don't know how proximal femoral nails and Gamma nails compare at reducing pain at follow-up (low-quality evidence).

Orthopaedic complications
Different types of intramedullary fixation compared with each other Various types of intramedullary fixation device (proximal femoral nail, "Gliding" nail, and Russell-Taylor Recon nail) are as effective as the Gamma nail at reducing risk of various orthopaedic complications (deep wound infections, intraoperative fractures, and need for re-operation) in people with extracapsular fractures (moderate-quality evidence).

Medical complications
Different types of intramedullary fixation compared with each other Proximal femoral nail and Gamma nail seem equally effective at reducing the risk of pressure sores and DVT in people with extracapsular fractures. The ACE trochanteric nail and Gamma nail seem equally effective at reducing the risk of DVT in people with extracapsular fractures (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2007, 9 RCTs, 1290 people) comparing the proximal femoral nail (PFN) versus the Gamma nail (4 RCTs; 910 people), the ACE trochanteric nail versus the Gamma nail (2 RCTs; 185 people), the "Gliding" nail versus the Gamma nail (1 RCT; 80 people), the Russell-Taylor Recon nail versus the long Gamma nail (1 RCT; 34 people), and dynamically versus statically locked intramedullary hip screw (IMHS) (1 RCT; 81 people). [32]

The review found no significant difference between the PFN and the Gamma nail in mortality at 12 months, pain at follow-up, or Harris Hip Score at up to 1 year (mortality at 12 months; 3 RCTs; 830 people: 86/415 [21%] with PFN *v* 80/415 [19%] with Gamma nail; RR 1.08, 95% CI 0.82 to 1.41; pain at follow-up; 1 RCT; 156 people; 6/79 [8%] with PFN *v* 14/77 [18%] with Gamma nail; RR 0.42, 95% CI 0.17 to 1.03; Harris Hip Score; 1 RCT; 137 people: 66.8 with PFN *v* 69.5 with Gamma nail; WMD –2.70, 95% CI –8.38 to +2.98). [32]

The review found no significant difference between the ACE trochanteric nail and the Gamma nail in mortality (2 RCTs; 185 people: 2/92 [2.2%] with ACE trochanteric nail *v* 2/93 [2.2%] with Gamma nail; RR 1.00, 95% CI 0.14 to 7.36). [32]

The review found no significant difference between the "Gliding" nail and the Gamma nail in mortality at 6 months (1 RCT; 80 people: 6/40 [15%] with "Gliding" nail *v* 5/40 [13%] with Gamma nail; RR 1.20, 95% CI 0.40 to 3.62). [32]

The review found no significant difference between dynamically and statically locked IMHS in mortality at 1 year (1 RCT; 80 people: 7/41 [17%] with dynamic locking IMHS *v* 9/39 [23%] with static locking IMHS; RR 0.74, 95% CI 0.31 to 1.79). [32]

The RCT (34 people) comparing the Russell-Taylor Recon nail versus the long Gamma nail identified by the review reported no deaths in either arm; no other data reported on our clinical outcomes of interest. [32]

Harms:

The review found no significant difference between the PFN and the Gamma nail in intra-operative fractures, re-operation, or deep wound infection (intra-operative fractures; 4 RCTs; 910 people: 1/455 [0.2%] with PFN *v* 5/455 [1.0%] with Gamma nail; RR 0.33, 95% CI 0.07 to 1.63; re-operation; 4 RCTs; 910 people: 45/455 [9%] with PFN *v* 36/455 [8%] with Gamma nail; RR 1.25, 95% CI 0.83 to 1.90; deep wound infection; 3 RCTs; 830 people: 6/415 [1%] with PFN *v* 6/415 [1%] with Gamma nail; RR 1.01, 95% CI 0.34 to 2.95). [32] The review also found no significant difference between fixations in rates of the postoperative complications of pressure sores and DVTs (pressure sores; 2 RCTs; 406 people; 13/204 [6.3%] with PFN *v* 12/202 [5.9%] with Gamma nail; RR 1.08, 95% CI 0.51 to 2.30; DVT; 2 RCTs; 236 people: 2/119 [2%] with PFN *v* 1/117 [1%] with Gamma nail; RR 1.65, 95% CI 0.22 to 12.29).

The review found no significant difference between the ACE trochanteric nail and the Gamma nail in proportion of people with DVT (2 RCTs; 185 people: 0/92 [0%] with ACE trochanteric nail *v* 1/93 [1%] with Gamma nail; OR 0.33, 95% CI 0.01 to 8.21). [32]

The review found no significant difference between the "Gliding" nail and the Gamma nail in re-operation rate (1 RCT; 80 people: 3/40 [8%] with "Gliding" nail *v* 4/40 [10%] with Gamma nail; RR 0.75, 95% CI 0.18 to 3.14). [32]

The review found no significant difference between statically and dynamically locked IMHS in length of surgery (mean length of surgery: 58.4 minutes with dynamic locking IMHS *v* 58.2 minutes with static locking IMHS; mean difference +0.20 minutes, 95% CI –6.98 minutes to +7.38 minutes). [32] Since the difference between statically and dynamically locking is whether the distal screw is inserted into the circular or oval hole in the nail, logically there should be no difference in surgery time between the procedures.

The review found no significant difference between the Russell-Taylor Recon nail and the long Gamma nail in rate of re-operation (1 RCT; 34 people: 8/17 [47%] with Russell-Taylor Recon nail *v* 5/17 [29%] with Gamma nail; RR 2.13, 95% CI 0.52 to 8.76). [32]

Comment:

Clinical guide:
There is currently insufficient evidence to detect differences in outcomes or complications between individual types of intramedullary nail, and newer designs need to be evaluated against the current "gold standard" of a sliding hip screw. Current choice is determined by surgical preference.

QUESTION What are the effects of perisurgical medical interventions on surgical outcome and prevention of complications in people with hip fracture?

OPTION TEMPORARY TRACTION BEFORE SURGERY FOR HIP FRACTURE

Pain
Compared with no traction Traction is no more effective at reducing the proportion of people requiring analgesia preoperatively (high-quality evidence).

Skeletal compared with skin traction We don't know whether skeletal traction is more effective at reducing analgesic use (low-quality evidence).

Skin traction compared with pillow nursing Skin traction and pillow nursing seem equally effective at alleviating pain (moderate-quality evidence).

Orthopaedic complications
Compared with no traction Traction is no more effective at reducing the subsequent ease and quality of fracture reduction at the time of surgery (high-quality evidence).

Medical complications
Compared with no traction Traction seems to be associated with a similar risk of pressure sores (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2006, 10 RCTs, 1546 people with recent hip fracture) evaluating routine preoperative traction. [33]

Traction versus no traction:
The use of different outcome measures and incomplete data precluded pooling from the nine RCTs identified by the review that compared skin traction versus control (no traction). [33] The review found no overall evidence of benefit from traction in terms of pain relief. Single RCTs identified by the review found no significant difference in the proportion of people requiring analgesia in the 24 hours after admission, or in the proportion of people requiring analgesia before surgery (analgesia after admission; 1 RCT; 252 people: 54/101 [53%] with traction *v* 71/151 [47%] with control; RR 1.14, 95% CI 0.89 to 1.46; analgesia before surgery; 2 RCTs; 183 people: 15/81 [19%] with traction *v* 19/102 [19%] with control; RR 0.92, 95% CI 0.51 to 1.67). There was also no evidence of benefit from traction in terms of the difficulty of fracture reduction at time of surgery or poor-quality fracture reduction (difficulty of fracture reduction at time of surgery; 1 RCT; 109 people: 5/45 [11%] with traction *v* 7/64 [11%] with control; RR 1.02, 95% CI 0.34 to 3.00; poor-quality fracture reduction; 1 RCT; 120 people: 2/60 [3%] with traction *v* 3/60 [5%] with control; RR 0.67, 95% CI 0.12 to 3.85).

Skeletal traction versus skin traction:
Two RCTs identified by the review compared skeletal versus skin traction (1 of which also assessed skin traction versus no traction, reported above). One RCT found an increase in analgesic use with skeletal traction, while the other RCT found a significant, but clinically unimportant, decrease in analgesic use with skeletal traction. The review found no significant difference in length of surgery between skeletal and skin traction (quantitative data for 1 RCT: mean difference: +10.00 minutes, 95% CI –3.65 minutes to +23.65 minutes).

Skin traction versus pillow nursing:
One RCT compared skin traction versus special foam pillow (Lasse pillow) versus ordinary pillow under the hip. [34] The RCT found similar pain alleviation between treatments after immobilisation (0–10 VAS: 3.9 with skin traction *v* 3.8 with Lasse pillow *v* 3.4 with ordinary pillow; analgesic doses: 2.3 with skin traction *v* 3.1 with Lasse pillow *v* 2.5 with ordinary pillow; P = 0.01 for Lasse pillow *v* skin traction/ordinary pillow).

Harms: **Traction versus no traction:**
Four RCTs identified by the review found no significant difference in the proportion of people with pressure sores between traction and control (data available from 1 RCT on people with a preoperative grade 1 pressure sore: 5/60 [8%] with traction *v* 0/60 [0%] with control; RR 11.00, 95% CI 0.62 to 194.63). The three complications directly associated with traction use reported in one RCT were minor (1 person had transient sensory changes in the leg, and 2 had superficial skin blisters). [33]

Skeletal traction versus skin traction:
One RCT identified by the review found that significantly more people found the initial application of traction painful with skeletal compared with skin traction (50% with skeletal *v* 20% with skin; P = 0.03). [33]

Skin traction versus pillow nursing:
The RCT found that 5/123 (4%) people developed erythema, oedema, or paraesthesia, but did not report in which treatment group these people were. [34]

Comment: There is little evidence that traction (skin or skeletal) before surgery reduces analgesic requirements, and it may, in fact, lead to harm.

Clinical guide:
Optimal perioperative pain relief should be managed with appropriate analgesia and early surgical intervention.

OPTION REGIONAL VERSUS GENERAL ANAESTHESIA FOR HIP FRACTURE SURGERY

Mortality
Regional anaesthesia compared with general anaesthesia We don't know whether regional anaesthesia is more effective at reducing mortality at 1 year (low-quality evidence).

Medical complications
Regional anaesthesia compared with general anaesthesia Regional anaesthesia seems to be more effective at reducing the risk of deep vein thrombosis (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2004, 22 RCTs, 2567 people) comparing regional versus general anaesthesia. [35] The review found that, although meta-analysis using the fixed-effect model showed significantly reduced mortality at 1 month with regional anaesthesia (8 RCTs; 1668 people: 56/811 [7%] with regional anaesthesia *v* 86/857 [10%] with general anaesthesia; RR 0.69, 95% CI 0.50 to 0.95), this result did not hold when the random effects model was used (RR 0.68, 95% CI 0.44 to 1.05), or on exclusion of data from the oldest trial (see comment below). Too few people were seen at 1 year of follow-up to confirm any long-term benefit. The review found that, compared with general anaesthesia, regional anaesthesia significantly reduced the risk of DVT and acute postoperative confusion (DVT; 4 RCTs; 259 people; 39/129 [30%] with regional anaesthesia *v* 61/130 [47%] with general anaesthesia; RR 0.64, 95% CI 0.48 to 0.86; see comment below; acute postoperative confusion; 5 RCTs; 237 people: 11/117 [9%] with regional anaesthesia *v* 23/120 [19%] with general anaesthesia; RR 0.50, 95% CI 0.26 to 0.95). There was insufficient evidence for other outcomes to assess whether there were clinically important differences between groups.

Harms: Anaesthesia failure and complications specific to the method of anaesthesia were rarely reported in the trials included in the review. [35]

Comment: Selection bias limits the outcomes of many of these studies. [35]

Clinical guide:
Choice of anaesthesia should be at the discretion of an experienced anaesthetist, and delays to surgery should be avoided. Further RCTs with appropriate case mix are necessary.

OPTION NERVE BLOCKS FOR PAIN CONTROL BEFORE AND AFTER HIP FRACTURE SURGERY

Pain
Compared with no nerve blocks Nerve blocks inserted during admission may be more effective at reducing pain both pre- and postoperatively in people with recent hip fractures. We don't know whether nerve blocks given on admission are more effective at reducing the proportion of people who require analgesia within 24 hours of surgery, or whether nerve blocks inserted during surgery are more effective at improving pain postoperatively (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2008, 17 RCTs, 888 people with recent hip fracture) assessing the effects of nerve blocks. [36] The RCTs identified by the review were small and used different types of nerve block, which were inserted at varying times. Nine RCTs identified by the review compared preoperative nerve block versus no nerve block, and the remaining eight RCTs compared perioperative nerve block versus no nerve block.

Many of the RCTs identified by the review had methodological flaws (including no assessment of nerve block failure rate, variation in and limited reporting of outcomes measured, and lack of blinding), and so the review could not pool data for the different types of nerve block assessed. [36] Overall, the review found that nerve blocks were associated with reduced use of parenteral or oral analgesia to control pain from the fracture or operation, or during surgery.

The review found that nerve blocks given on admission significantly reduced pain (assessed by visual analogue scale) compared with no nerve block (3 RCTs assessing the 3 in 1 nerve block; 210 people: WMD –0.52, 95% CI –0.80 to –0.25). [36] The review found that, compared with no nerve block, nerve blocks reduced the proportion of people requiring analgesia within 24 hours of admission or surgery, although not all differences between groups were significant (lateral cutaneous nerve block at surgery; 2 RCTs; 51 people: 19/26 [73%] with nerve block *v* 25/25 [100%] with control; RR 0.75, 95% CI 0.53 to 1.07; 3 in 1 block at surgery; 1 RCT; 33 people: 7/17 [41%] with nerve block *v* 16/16 [100%] without block; RR 0.43, 95% CI 0.25 to 0.75; 3 in 1 block plus subcostal block at surgery; 1 RCT: 13/25 [52%] with nerve block *v* 22/24 [92%] with control; RR 0.57, 95% CI 0.38 to 0.84). It is not clear whether this reduction in analgesia was associated with clinical benefit. Administration of nerve blocks at the time of admission to hospital significantly reduced the proportion of people with unsatisfactory pain control preoperatively compared with no block (5 RCTs; 298 people: 18/150 [12%] with nerve block *v* 47/148 [32%] with no block; RR 0.37, 95% CI 0.23 to 0.61). Of the five RCTs assessing preoperative pain relief, four RCTs (258 people) assessed the effects of the 3 in 1 nerve block and the remaining RCT (40 people) assessed the psoas block. The review found that, compared with no block, administration of nerve block at admission to hospital also significantly reduced the proportion of people with unsatisfactory pain control postoperatively (1 RCT; 40 people: 1/20 [5%] with nerve block *v* 10/20 [50%] with control; RR 0.10, 95% CI 0.01 to 0.71). However, the review found no significant difference in the proportion of people with unsatisfactory postoperative pain control between nerve block administered after surgery (femoral nerve catheter) and no nerve block (1 RCT; 42 people: 15/21 [71%] with continuous femoral nerve block *v* 15/21 [71%] with no block; RR 1.00, 95% CI 0.68 to 1.47): this result is

possibly to be expected, as the femoral nerve catheter may miss part of the innervation of the hip joint.

Harms: The review found that nerve blocks were associated with a significantly lower risk of pneumonia compared with no nerve block (5 RCTs; 259 people: 12/129 [9%] with nerve block *v* 25/130 [19%] with no block; RR 0.49, 95% CI 0.26 to 0.94). [36] However, the review found no significant difference between nerve blocks and no nerve block in the proportion of people with nausea and/or vomiting (6 RCTs; 300 people: 18/141 [13%] with nerve block *v* 25/159 [16%] with no block; RR 1.05, 95% CI 0.63 to 1.75; RR as reported in review): both analyses included data from RCTs of nerve blocks administered at admission and during surgery.

Comment: **Clinical guide:**
It is unclear whether nerve blocks confer any clinical benefit compared with other methods of analgesia (oral and parenteral analgesia) in hip fracture. The potential for less postoperative confusion, earlier mobilisation, and possible reduction of respiratory infection merit further study.

OPTION PERIOPERATIVE PROPHYLAXIS WITH ANTIBIOTICS

Orthopaedic complications
Compared with placebo or no antibiotics Prophylactic antibiotics (both single-dose preoperatively and multi-dose perioperatively) are more effective at reducing the risk of postoperative deep wound infections (moderate-quality evidence).

Medical complications
Compared with placebo or no antibiotics Prophylactic antibiotics (both single-dose preoperatively and multi-dose perioperatively) are more effective at reducing the risk of superficial infections and urinary tract infections. Single-dose antibiotics given preoperatively seem more effective at reducing the risk of respiratory infection (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, **see table, p 41 .**

Benefits: **Antibiotics versus placebo or no antibiotics:**
We found two systematic reviews (search date 2000, 15 RCTs; [37] search date 2000, 22 RCTs [38]). There were 14 RCTs common to both reviews. The second review also covered other closed long bone fractures. [38] The reviews differed in their analysis of the RCTs. The first review found that antibiotics of any dose or duration significantly reduced surgical wound infection compared with no antibiotics (placebo or control) (10 RCTs; 2417 people: OR 0.55, 95% CI 0.35 to 0.85). [37] The separate results for deep and superficial wound infection did not reach significance (deep infection, 6 RCTs: OR 0.53, 95% CI 0.20 to 1.38; superficial infection, 7 RCTs: OR 0.67, 95% CI 0.44 to 1.01). [37] The second review reported separate analyses comparing multiple-dose perioperative and single-dose preoperative antibiotic regimens versus placebo or no prophylaxis (control). [38] It found that, compared with control, multiple-dose antibiotic regimens significantly reduced the incidence of deep wound infection, superficial wound infection, and urinary tract infection (deep wound infection; 11 RCTs; 1896 people: 12/961 [1%] with antibiotic *v* 40/935 [4%] with control; RR 0.29, 95% CI 0.15 to 0.65; superficial wound infection; 7 RCTs; 1366 people: 22/705 [3%] with antibiotic *v* 38/661 [6%] with control; RR 0.48, 95% CI 0.28 to 0.81; urinary tract infection; 2 RCTs; 500 people: 31/259 [12%] with antibiotic *v* 44/241 [18%] with control; RR 0.66, 95% CI 0.43 to 1.00). [38] However, it found no significant difference in the incidence of respiratory tract infections between multiple-dose perioperative antibiotic regimens and control (14/259 [5%] with antibiotic *v* 16/241 [7%] with control; RR 0.81, 95% CI 0.41 to 1.63). For single-dose preoperative antibiotic regimens, the review found that, compared with control, antibiotics significantly reduced deep wound infection, superficial wound infection, urinary tract infection, and respiratory infection (deep wound infection; 7 RCTs; 3500 people: 20/1745 [1%] with antibiotic *v* 51/1755 [3%] with control; RR 0.40, 95% CI 0.24 to 0.67; superficial wound infection; 7 RCTs; 3500 people: 59/1745 [3%] with antibiotic *v* 87/1755 [5%] with control; RR 0.69, 95% CI 0.50 to 0.95; urinary tract infection; 4 RCTs; 2975 people: 131/1493 [9%] with antibiotic *v* 212/1482 [14%] with control; RR 0.63, 95% CI 0.53 to 0.76; respiratory infection: 41/1493 [3%] with antibiotic *v* 92/1482 [6%] with control; RR 0.46, 95% CI 0.33 to 0.65). [38]

Harms: **Antibiotics versus placebo or no antibiotics:**
One review found that adverse effects of antibiotics (allergy, rashes, and GI complaints) were reported rarely. [38] It found that, although adverse effects were more common with multiple-dose perioperative antibiotics compared with control, the difference was not significant (4 RCTs; 582 people: 24/520 [5%] with antibiotic *v* 12/362 [3%] with control; RR 1.83, 95% CI 0.96 to 3.50). [38]

Comment: **Clinical guide:**
Many different antimicrobials were studied (all active against *Staphylococcus aureus*). Aside from short-acting single-dose regimens, indirect and direct comparisons show similar effectiveness of single- and multiple-dose regimens.

OPTION OPERATIVE-DAY (LESS THAN 24 HOURS) VERSUS LONGER-DURATION MULTIPLE-DOSE ANTIBIOTIC REGIMENS

Orthopaedic complications
Operative-day (less than 24 hours) compared with longer-duration multiple-dose antibiotic regimens Regimens of less than 24 hours' duration given on the day of operation and multiple-dose regimens in which antibiotics are given for more than 24 hours seem equally effective at reducing the risk of overall wound infections and deep wound infections in people having hip surgery (moderate-quality evidence).

Medical complications
Operative-day (less than 24 hours) compared with longer-duration multiple-dose antibiotic regimens We don't know how regimens of less than 24 hours' duration given on the day of operation and multiple-dose regimens in which antibiotics are given for more than 24 hours compare at reducing the risk of superficial wound infections in people having hip surgery (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: **Operative-day (less than 24 hours) versus longer-duration (greater than 24 hours) multiple-dose antibiotic regimens:**
We found two systematic reviews (both with search date 2000). [37] [38] The reviews had slightly different inclusion criteria. There were two RCTs in common to both reviews; in these two RCTs, the antibiotic use in the extended group was for 7 days. The first review found no significant difference in overall wound infection between extended (greater than 24 hours) and operative-day (less than 24 hours) antibiotic use (3 RCTs: OR 1.15, 95% CI 0.58 to 2.25). [37] Both reviews found limited evidence of no significant difference in deep wound infection between extended and operative-day antibiotic use (first review, [37] 3 RCTs: OR 0.99, 95% CI 0.36 to 2.69; second review, [38] 2 RCTs; 224 people: 3/124 [2.4%] with antibiotics for less than 24 hours *v* 2/100 [2.0%] with longer use; RR 1.10, 95% CI 0.22 to 5.34). Similarly, both reviews found no significant difference in superficial wound infection between extended compared with operative-day antibiotic use (antibiotics for longer use *v* less than 24 hours: first review, [37] 3 RCTs: OR 1.31, 95% CI 0.53 to 3.22; second review, [38] 1 RCT; 131 people: 4/65 [6%] with antibiotics for less than 24 hours *v* 6/56 [11%] with longer use; RR 0.57, 95% CI 0.17 to 1.93).

Harms: **Operative-day (less than 24 hours) versus longer-duration (greater than 24 hours) multiple-dose antibiotic regimens:**
See harms of antibiotics versus placebo or no antibiotics, p 23 .

Comment: Many different antimicrobials were studied (all active against *Staphylococcus aureus*). Aside from short-acting single-dose regimens, indirect and direct comparisons show similar effectiveness of single- and multiple-dose regimens.

OPTION SINGLE-DOSE (LONG-ACTING) VERSUS MULTIPLE-DOSE ANTIBIOTIC REGIMENS

Orthopaedic complications
Single-dose regimens compared with multiple-dose regimens We don't know how single-dose and multiple-dose antibiotic regimens compare at reducing the rate of deep wound infection. We don't know how a single dose of long-acting antibiotics and multiple doses of shorter-acting antibiotics compare at reducing overall rate of wound infection and rate of deep wound infection after hip surgery. However, a single dose of short-acting antibiotic may be less effective than multiple doses of the same antibiotic at reducing the rate of deep wound infection (low-quality evidence).

Medical complications
Single-dose regimens compared with multiple-dose regimens We don't know how single-dose and multiple-dose antibiotic regimens compare at reducing the rate of superficial wound infection. We don't know how a single dose of long-acting antibiotics and multiple doses of shorter-acting antibiotics compare at reducing rate of superficial wound infection, urinary tract infections, and respiratory infections after hip surgery. However, a single dose of short-acting antibiotic may be less effective than multiple doses of the same antibiotic at reducing the rate of superficial wound infection and urinary tract infections (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

Single-dose versus multiple-dose antibiotic regimens:
We found two systematic reviews (both with search date 2000). [37] [38] Both reviews provided limited evidence from RCTs with generally lower-quality scores (for concealment of allocation and assessor blinding) for direct comparisons of single- and multiple-dose antibiotics. [37] [38] One review found no significant difference between multiple-dose (ranging from more than 1 day to 14 days) and single-dose (given immediately before surgery) regimens in overall wound infection, deep wound infection, or superficial wound infection (overall wound infection; multiple *v* single dose; 4 RCTs: OR 0.93, 95% CI 0.39 to 2.24; deep wound infection; 4 RCTs: OR 0.79, 95% CI 0.24 to 2.62; superficial wound infection; 4 RCTs: OR 1.10, 95% CI 0.39 to 3.08). [37] The second review made two comparisons. [38] It found that a single dose of short-acting antibiotics was significantly less effective than multiple doses of the same antibiotic in reducing wound infection (deep wound infection; 2 RCTs; 1021 people: 9/465 [1.9%] with single dose *v* 1/456 [0.2%] with multiple dose; RR 7.89, 95% CI 1.01 to 61.98; superficial wound infection; 1 RCT: RR 4.82, 95% CI 1.08 to 21.61; urinary tract infection; 1 RCT: RR 1.81, 95% CI 1.01 to 3.23). [38] It found no significant difference between single-dose long-acting antibiotics and any multiple-dose regimen of shorter-acting antibiotics (deep wound infection; 3 RCTs; 1747 people: 4/596 [0.7%] with single dose *v* 14/1151 [1.2%] with multiple dose; RR 0.57, 95% CI 0.20 to 1.64; superficial wound infection; 2 RCTs: RR 1.01, 95% CI 0.35 to 2.93; urinary tract infection; 1 RCT: RR 0.69, 95% CI 0.37 to 1.32; respiratory infection; 1 RCT: RR 0.31, 95% CI 0.04 to 2.48). [38]

Harms:

Single-dose versus multiple-dose antibiotic regimens:
See harms of antibiotics versus placebo or no antibiotics, p 23 .

Comment:

Many different antimicrobials were studied (all active against *Staphylococcus aureus*). Aside from short-acting single-dose regimens, indirect and direct comparisons show similar effectiveness of single- and multiple-dose regimens.

OPTION HEPARIN AND LOW MOLECULAR WEIGHT HEPARIN (PERIOPERATIVE PROPHYLAXIS)

Mortality
Compared with placebo or no treatment Heparin may be no more effective at reducing overall mortality after a hip fracture (low-quality evidence).

Unfractionated heparin compared with low molecular weight heparin (LMWH) We don't know how unfractionated heparin and LMWH compare at reducing mortality in people having surgery for hip fracture (low-quality evidence).

Medical complications
Compared with placebo or no treatment Heparin may be more effective at reducing the risk of DVT in people having surgery for hip fracture, but we don't know whether it is more effective at reducing pulmonary embolism (low-quality evidence).

Unfractionated heparin compared with LMWH Unfractionated heparin may be less effective at reducing the risk of DVT, but we don't know whether it is more effective at reducing pulmonary embolism, in people having surgery for hip fracture (very low-quality evidence).

Note
Heparin increases the risk of bleeding.

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found one systematic review (search date 2002, 20 RCTs, 1843 older people, primarily women, having surgery for hip fracture). [39] Overall, quality of identified trials was poor.

Heparin versus placebo or no treatment:
The review identified 10 RCTs (826 people) comparing unfractionated heparin versus placebo or no treatment, and five RCTs (373 people) comparing low molecular weight heparin (LMWH) versus placebo or no treatment. [39] It found that heparin significantly reduced lower-limb DVTs compared with placebo or no treatment (13 RCTs; 993 people: 124/474 [26%] with heparin *v* 219/519 [42%] with control; RR 0.60, 95% CI 0.50 to 0.71; NNT 6, 95% CI 4 to 8). It found no significant difference between heparin and placebo or no treatment in pulmonary embolism or in overall mortality after hip fracture (pulmonary embolism; 10 RCTs; 854 people: 13/404 [3%] with heparin *v* 14/454 [3%] with control; RR 1.00, 95% CI 0.49 to 2.02; overall mortality after hip fracture; 8 RCTs; 730 people: 42/356 [12%] with heparin *v* 38/374 [10%] with control; RR 1.16, 95% CI 0.77 to 1.74). [39]

Unfractionated heparin versus LMWH:
See benefits of low molecular weight heparin versus unfractionated heparin, p 26 .

Harms: We found three systematic reviews. [39] [40] [41]

Heparin versus placebo or no treatment:
The first review in people with hip fracture found limited evidence of no significant difference between heparin and placebo in wound haematoma, wound infection, blood loss, people receiving transfusion (wound haematoma; 2 RCTs; 81 people: 3/39 [8%] with heparin *v* 3/42 [7%] with control; RR 1.10, 95% CI 0.23 to 5.29; wound infection; 2 RCTs: RR 1.13, 95% CI 0.30 to 4.27; blood loss; 2 RCTs: WMD +47.21 mL, 95% CI –32.74 mL to +127.16 mL; people receiving transfusion; 3 RCTs: RR 0.90, 95% CI 0.66 to 1.21). [39] There were no reports of post-phlebitic leg (a serious post-thrombotic complication, with chronic venous insufficiency, featuring oedema, statis dermatitis, and ulceration of the leg). The second review (search date not reported) summarised the risk of bleeding or need for transfusion in 70 or more RCTs of prophylactic subcutaneous unfractionated heparin in people having general, orthopaedic, and urological surgery. [40] It found that, overall, heparin significantly increased excessive bleeding or need for transfusion compared with control (419/7027 [6%] with heparin *v* 244/6504 [4%] with control; OR 1.66, reported as significant, CI not reported).

Unfractionated heparin versus LMWH:
See harms of low molecular weight heparin versus unfractionated heparin, p 26 .

Comment: **Clinical guide:**
Follow-up in most of the RCTs was generally inadequate: it was too short — surveillance often stopping at the end of treatment — and the diagnostic methods for DVT and pulmonary embolism were not optimal. There was a lack of data on harms — specifically bleeding, wound complications, and post-phlebitic leg. While the evidence that heparins reduce the incidence of thromboembolic complications is substantial, the extent to which this benefit is offset by adverse events remains controversial. Further long-term studies are necessary.

OPTION LOW MOLECULAR WEIGHT HEPARIN VERSUS UNFRACTIONATED HEPARIN TO REDUCE VENOUS THROMBOEMBOLISM AFTER HIP FRACTURE SURGERY

Mortality
Low molecular weight heparin (LMWH) compared with unfractionated heparin We don't know how LMWH and unfractionated heparin compare at reducing mortality in people having surgery for hip fracture (low-quality evidence) (low-quality evidence).

Medical complications
LMWH compared with unfractionated heparin LMWH may be more effective at reducing the risk of DVT, but we don't know whether it is more effective at reducing pulmonary embolism in people having surgery for hip fracture (very low-quality evidence).

LMWH compared with LMWH plus pulsatile foot pumps We don't know how LMWH alone and LMWH plus pulsatile foot pumps compare at reducing the risk of DVT (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2002, 20 RCTs, 1843 older people, primarily women, having surgery for hip fracture). [39] Overall, trial quality was poor.

Low molecular weight heparin (LMWH) versus unfractionated heparin:
The review identified five RCTs (644 people) comparing LMWH versus unfractionated heparin. It found evidence of a significant reduction of DVT in people taking LMWH (47/252 [19%] with LMWH *v* 64/227 [28%] with unfractionated heparin; RR 0.67, 95% CI 0.48 to 0.94), but found that this finding was not robust when conducting sensitivity analyses restricting the evidence to that from the three better-quality RCTs (RR 0.91, 95% CI 0.61 to 1.36), or testing the potential effects of post-randomisation exclusions. [39] Based on limited numbers, the review found no significant difference in pulmonary embolism or mortality between LMWH and unfractionated heparin (pulmonary embolism, 4 RCTs; 354 people: 7/189 [4%] with LMWH *v* 1/165 [1%] with unfractionated heparin; RR 3.29, 95% CI 0.82 to 13.32; mortality; 3 RCTs; 242 people: 6/122 [5%] with LMWH *v* 7/120 [6%] with unfractionated heparin; RR 0.85, 95% CI 0.31 to 2.36).

LMWH alone versus LMWH plus pulsatile foot pumps:
We found one RCT, which found no significant difference in DVT between enoxaparin and enoxaparin plus pulsatile foot pumps (13/97 [13%] with enoxaparin *v* 9/103 [9%] with enoxaparin plus pulsatile foot pumps; reported as not significant; P value not reported). [42] The mean age in this RCT was 40 years (range 19–80 years); the number of older people with acute hip fractures was small.

Harms: We found two systematic reviews. [39] [41]

LMWH versus unfractionated heparin:
The first review in people with hip fracture found limited evidence showing no significant differences in wound haematoma (2 RCTs; 81 people: 3/39 [8%] with heparin *v* 3/42 [7%] with control; RR 1.10, 95% CI 0.23 to 5.29). [39] The second review (search date 1991) included comparisons of LMWH and unfractionated heparin in 27 RCTs of people having orthopaedic surgery, and reported no evidence of a difference in bleeding complications between groups. [41]

LMWH alone versus LMWH plus pulsatile foot pumps:
The RCT found similar numbers of wound complications with enoxaparin and enoxaparin plus pulsatile foot pumps (22% with enoxaparin *v* 19% with enoxaparin plus pulsatile foot pumps; significance not reported). [42]

Comment: **Clinical guide:**
Follow-up in most of the RCTs was generally inadequate: it was too short — surveillance often stopping at the end of treatment — and the diagnostic methods for DVT and pulmonary embolism were not optimal. There was a lack of data on harms — specifically bleeding, wound complications, and post-phlebitic leg. While the evidence that heparins reduce the incidence of thromboembolic complications is substantial, the extent to which this benefit is offset by adverse events remains controversial. Further long-term studies are necessary.

OPTION ANTIPLATELET AGENTS (PERIOPERATIVE PROPHYLAXIS)

Mortality
Compared with placebo or no treatment Preoperative prophylaxis with aspirin is no more effective at reducing overall mortality in people having surgery for hip fracture (moderate-quality evidence).

Medical complications
Compared with placebo or no treatment Perioperative and postoperative antiplatelet prophylaxis is more effective at reducing the risk of DVT and pulmonary embolism in people having surgery for hip fracture (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, **see table, p 41 .**

Benefits: We found one systematic review (search date 1990, 53 RCTs, 8400 people) comparing prophylaxis with an antiplatelet agent versus placebo or no prophylaxis in surgical and high-risk medical patients. [43] We also found one subsequent multicentre RCT (13,356 people having surgery for hip fracture) that compared aspirin versus placebo. [44] Participants of this trial were allowed to receive other forms of thromboprophylaxis, such as heparin. The review included 11 RCTs in people having traumatic orthopaedic surgery; most of the 964 people had surgery for a hip fracture. [43] The review found that, compared with control, antiplatelet prophylaxis significantly reduced the incidence of DVT and pulmonary embolism (DVT; 10 RCTs; 898 people: 163/454 [36%] with antiplatelet prophylaxis *v* 186/444 [42%] with control; percentage odds reduction 31%; P = 0.02; pulmonary embolism; 11 RCTs; 998 people: 14/504 [3%] with antiplatelet prophylaxis *v* 34/494 [7%] with control; percentage odds reduction 60%; P less than 0.005). Separate results for mortality in the 11 orthopaedic trauma RCTs were not provided in the review. [43] In the subsequent large RCT, treatment (aspirin or placebo) was started preoperatively and continued for 35 days. [44] The RCT found that aspirin significantly reduced the incidence of any symptomatic DVT, proximal DVT, venous thromboembolism (symptomatic DVT or non-fatal pulmonary embolism), or fatal pulmonary embolism compared with placebo (any symptomatic DVT: 69/6679 [1.0%] with aspirin *v* 97/6677 [1.5%] with placebo; RR 0.71, 95% CI 0.52 to 0.97; proximal DVT: 26/6679 [0.4%] with aspirin *v* 43/6677 [0.6%] with placebo; RR 0.60, 95% CI 0.37 to 0.98; RR calculated by *Clinical Evidence* contributors; venous thromboembolism: 87/6679 [1.3%] with aspirin *v* 122/6677 [1.8%] with control; RR 0.71, 95% CI 0.54 to 0.94; fatal pulmonary embolism: 18/6679 [0.3%] with aspirin *v* 43/6677 [0.6%] with placebo; RR 0.42, 95% CI 0.24 to 0.73). [44] The RCT found no significant difference in overall mortality between aspirin and placebo (447/6679 [7%] with aspirin *v* 461/6677 [7%] with placebo; RR 0.97, 95% CI 0.85 to 1.10). [44]

Harms: The systematic review found two fatal bleeds, both with antiplatelet treatment, across all surgical procedures. [43] The review found that, across all surgical procedures, antiplatelet treatment significantly increased the proportion of people who received blood transfusions, compared with placebo (45 RCTs; 7606 people: 28/3798 [0.7%] with antiplatelet treatment *v* 15/3808 [0.4%] with placebo; P = 0.04). The subsequent RCT also found that fatal bleeds were rare (13/6679 [0.2%] with aspirin *v* 15/6677 [0.2%] with control), but that aspirin significantly increased the proportion of people with postoperative bleeds requiring transfusion, compared with placebo (197/6679 [2.9%] with aspirin *v* 157/6677 [2.4%] with control; RR 1.25, 95% CI 1.02 to 1.54), and the proportion of people with

non-fatal GI bleeds not requiring transfusion (182/6679 [2.7%] with aspirin *v* 122/6677 [1.9%] with control; RR 1.49, 95% CI 1.19 to 1.87). [44] The RCT found no significant difference in evacuation of haematoma or wound infection (haematoma: 24/6679 [0.4%] with aspirin *v* 33/6677 [0.5%] with control; RR 0.73, 95% CI 0.43 to 1.23; wound infection: 98/6679 [1.5%] with aspirin *v* 84/6677 [1.3%] with control; RR 1.17, 95% CI 0.87 to 1.56; all RR values calculated by *Clinical Evidence* contributors). [44]

Comment: **Clinical guide:**
The large RCT of aspirin prophylaxis provides data on both benefits and complications of aspirin in contemporary practice. [44] In this trial, the use of other thromboprophylaxis such as heparins was allowed. Subgroup analyses of people receiving unfractionated heparin, LMWH, or thromboembolism deterrent stockings found a consistent effect of aspirin on venous thromboembolism. However, the trial does not provide evidence on the relative effects of aspirin and these other methods of thromboprophylaxis. The trial found an excess of postoperative bleeds requiring transfusion amounting to an absolute increase of 6 per 1000 people. However, the excess was reduced to one additional bleed per 1000 people in those people who had not received concomitant heparin prophylaxis.

OPTION GRADUATED ELASTIC COMPRESSION (THROMBOEMBOLISM STOCKINGS)

Medical complications
Graduated elastic compression with or without antithrombotics compared with no prophylaxis We don't know whether graduated elastic compression stockings with or without other antithrombotic measures are more effective at reducing medical complications in people with hip fractures, but they are more effective at reducing the risk of DVT in people with orthopaedic conditions (high-quality evidence).

Note
We found no direct information from RCTs about thromboembolism stockings for prevention of thrombotic complications in people with hip fracture.

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found two systematic reviews (search dates 1998 and 2003), [45] [46] neither of which found RCTs specifically in people with hip fracture. Both reviews included four orthopaedic RCTs each, with only two RCTs being common to both reviews. While their trial populations, presented data, and analyses differed, both reviews had similar findings for people (predominantly having surgery) who were at moderate or high risk of DVT. The most recent review found that graduated elastic compression significantly reduced DVT compared with no prophylaxis (7 RCTs; 1027 people: 81/536 [15%] with stockings *v* 144/491 [29%] with control; OR 0.36, 95% CI 0.26 to 0.49). [46] The review presented a separate comparison of graduated compression stockings added to other antithrombotic measures (aspirin, dextran 70, heparin, sequential compression) versus these antithrombotic measures alone. This also found that adding graduated elastic compression to other antithrombotic measures significantly reduced DVT compared with other antithrombotic measures alone (9 RCTs; 1184 people: 18/589 [3%] with stockings *v* 84/595 [14%] with control; Peto OR 0.22, 95% CI 0.15 to 0.34). The earlier review (search date 1998) presented a separate analysis for people with hip replacement, which showed similar findings to the above. [45] Reflecting the general lack of RCT evidence, neither review presented data on mortality or pulmonary embolism.

Harms: The reviews provided little information on complications associated with stockings or compliance and comfort. [45] [46] The earlier review reported that manufacturers of stockings advise against their use in people with an ankle:brachial pressure index of less than 0.7. [45] People with peripheral arterial disease or with diabetes and neuropathy were stated to be at higher risk of worsening ischaemia, but we found no evidence from RCTs to measure this risk. [45] The more recent review suggested that complications needed to be examined further in orthopaedic patients because of concerns that complications resulting from improperly worn graduated compression stockings might outweigh benefits. [46]

Comment: **Clinical guide:**
There was insufficient evidence to determine the relative effects of above-knee compared with below-knee stockings. Most of the RCTs identified by the reviews assessed above-knee/thigh-length stockings. [45] [46] It is unclear whether extrapolation from general surgery or elective hip replacement studies is appropriate for hip fracture. While the review found that thromboembolism stockings reduced the incidence of DVT detected by screening methods such as 125-I fibrogen uptake test, the effect on clinically symptomatic venous thromboembolism is unknown. Further studies are necessary.

OPTION CYCLICAL COMPRESSION OF THE FOOT OR CALF

Mortality
Compared with no compression We don't know whether cyclical compression of the foot or calf is more effective at reducing overall mortality (very low-quality evidence).

Medical complications
Compared with no compression Cyclical compression of the foot or calf may be more effective at reducing the risk of DVT and pulmonary embolism in people with hip fracture (low-quality evidence).

Note
Cyclical compression devices (foot or calf pumps) have been associated with non-compliance and skin abrasion.

For GRADE evaluation of interventions for hip fractures, **see table, p 41 .**

Benefits: We found one systematic review (search date 2002, 5 RCTs, 487 people) comparing cyclical compression of the calf or foot using mechanical pumping devices versus no compression. [39] The review found that, compared with no compression, cyclical compression significantly reduced the risk of DVT and pulmonary embolism (DVT: 16/221 [7%] with compression *v* 52/229 [23%] with control; RR 0.31, 95% CI 0.19 to 0.51; pulmonary embolism: 5/238 [2%] with compression *v* 16/249 [6%] with control; RR 0.40, 95% CI 0.17 to 0.96). The review found no significant difference in the incidence of fatal pulmonary embolism or overall mortality, but the data were insufficient to draw firm conclusions (4 RCTs; 256 people; overall mortality: 7/128 [5%] with compression *v* 15/128 [12%] with control; RR 0.50, 95% CI 0.22 to 1.14).

Harms: Problems with skin abrasion and compliance were reported in four of the five RCTs of cyclical compression devices identified by the review (no further data reported). [39]

Comment: The quality of trials reported in the review was poor. [39] In particular, there was inadequate allocation concealment and failure to conduct intention-to-treat analysis. While the review found that cyclical compression reduced the incidence of DVT detected by screening methods such as venography, the effect of cyclical compression on clinically symptomatic venous thromboembolism is unknown.

OPTION ORAL MULTINUTRIENT FEEDS FOR NUTRITIONAL SUPPLEMENTATION AFTER HIP FRACTURE

Mortality
Compared with no dietary supplement Oral multinutrient feeds may be no more effective at reducing mortality in people with hip fracture (very low-quality evidence).

Protein supplementation compared with no protein supplementation Protein supplementation may be no more effective at reducing mortality (very low-quality evidence).

Additional nutritional supplementation compared with normal food and beverage Additional intravenous supplementation for 3 days followed by oral nutritional supplements for 10 days may be more effective at reducing mortality at 120 days in healthy older people with a hip fracture (low-quality evidence).

Medical complications
Compared with no dietary supplements Oral multinutrient supplements may be more effective at reducing a composite outcome of postoperative complications and mortality at 30 days (very low-quality evidence).

Protein supplementation compared with no protein supplementation Protein supplementation may be more effective at reducing a composite outcome of postoperative complications and mortality (very low-quality evidence).

Additional nutritional supplementation compared with normal food and beverage Additional intravenous supplementation for 3 days followed by oral nutritional supplements for 10 days may be more effective at reducing postoperative complications at 30 days in healthy older people with a hip fracture (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, **see table , p 41 .**

Benefits: We found one systematic review (search date 2006, 21 RCTs, 1727 people). [47]

Oral multinutrient feeds versus control:
Eight RCTs (448 people) identified by the review compared oral multinutrient feeds (providing non-protein energy, protein, some vitamins, and minerals) versus no dietary supplement. [47] The review found that oral multinutrient feeds significantly reduced unfavourable outcome (postoperative complications or mortality combined; 3 RCTs; 139 people: 14/66 [21%] with multinutrient feeds *v*

26/73 [36%] with no supplement; RR 0.52, 95% CI 0.32 to 0.84). However, the review found no significant difference in mortality alone between oral multinutrient feeds and no dietary supplement (7 RCTs; 337 people: 15/161 [9%] with multinutrient feeds *v* 17/176 [10%] with no supplement; RR 0.89, 95% CI 0.47 to 1.68).

Protein supplementation in oral feeds and other nutritional supplementation versus no protein supplementation:
Three RCTs (325 people) identified by the review assessed protein supplementation in an oral feed. [47] The review found that protein in an oral feed significantly reduced unfavourable outcome (postoperative complications or mortality combined) compared with no protein (2 RCTs; 223 people: 66/113 [58%] with protein *v* 82/110 [75%] with no protein; RR 0.78, 95% CI 0.65 to 0.95). However, protein in an oral feed had no significant effect on mortality alone (3 RCTs; 314 people: 28/158 [18%] with protein *v* 20/156 [13%] with no protein; RR 1.38, 95% CI 0.82 to 2.34). Two RCTs identified by the review (1 assessing intravenous thiamine and other water-soluble vitamins and 1 assessing alfacalcidol) found no evidence of benefit for either vitamin supplement.

Additional nutritional supplementation versus normal food and beverage:
One RCT (80 people) compared adding a 3-day intravenous nutritional supplement followed by a 10-day oral nutritional supplement versus ordinary hospital food and beverage in older people after hip fracture. [48] The RCT found significantly fewer complications at 30 days and less mortality at 120 days with nutritional supplementation (complications: 6 events *v* 33 events; P less than 0.01; mortality: 0 events *v* 4 events, P less than 0.05). There were limitations in study design and number of people, and no confidence intervals were reported.

Harms: The review found little evidence about adverse effects associated with nutritional supplementation. [47] The subsequent RCT of additional nutritional supplementation did not report on adverse effects. [48]

Comment: The quality of trials reported in the review was generally poor. [47] Defects included inadequate numbers of people, methodological problems (inadequate allocation concealment, assessor blinding, and ITT analysis), and limited outcome assessment.

Clinical guide:
Many people who have hip fractures are malnourished before their injury, and dietary intake in hospital by people recovering from hip fracture in hospital is frequently insufficient. Nutritional supplementation consisting of oral protein and energy feeds are of potential benefit, but more evidence is required to confirm this and to determine whether this is the best approach, in particular for more malnourished patients. Further RCTs are necessary.

OPTION NASOGASTRIC FEEDS FOR NUTRITIONAL SUPPLEMENTATION AFTER HIP FRACTURE

Mortality
Compared with control We don't know whether nasogastric multinutrient feeding is more effective at reducing mortality at 6 months (very low-quality evidence).

Nasogastric plus oral multinutrient feeds compared with control We don't know whether nasogastric multinutrient feeds plus oral supplements are more effective at reducing mortality at 6 months (very low-quality evidence).

Medical complications
Nasogastric plus oral multinutrient feeds compared with control We don't know whether nasogastric multinutrient feeds plus oral supplements are more effective at reducing overall complications at 6 months (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 2006, 21 RCTs, 1727 people). [47]

Nasogastric multinutrient feeds versus control:
The review identified four RCTs (377 people), [47] comparing nasogastric feeds versus control. The review found no significant difference in mortality between nasogastric multinutrient feeding and control (3 RCTs; 280 people: 14/142 [10%] with nasogastric feeds *v* 14/138 [10%] with control; RR 0.99, 95% CI 0.50 to 1.97), but the RCTs included people with differing characteristics, particularly nutritional status.

Nasogastric multinutrient feeds plus oral multinutrient feeds versus control:
One RCT (57 people) identified by the review found no significant difference between nasogastric multinutrient feeding plus oral supplement and control in mortality or overall complications (mortal-

ity: 4/27 [15%] with nasogastric feeds *v* 6/30 [20%] with control; RR 0.74, 95% CI 0.23 to 2.35; overall complications: 18/27 [67%] with nasogastric feeds *v* 18/30 [60%] with control; RR 1.11, 95% CI 0.75 to 1.65) at 6 months. [47]

Harms: The review found little evidence about adverse effects associated with nutritional supplementation. [47] Nasogastric feeds were sometimes tolerated poorly. Complications of nasogastric tube feeding included bloating and anorexia. The review found no reports of feed-induced diarrhoea or aspiration pneumonia.

Comment: The quality of trials reported in the review was generally poor. [47] Defects included inadequate numbers of people, methodological problems (inadequate allocation concealment, assessor blinding, and ITT analysis), and limited outcome assessment.

Clinical guide:
Many people who have hip fractures are malnourished before their injury, and dietary intake in hospital by people recovering from hip fracture in hospital is frequently insufficient. The benefits of nasogastric feeding are uncertain, and its use should probably be reserved for severe malnourishment where oral supplementation is not possible. Further RCTs are necessary.

QUESTION What are the effects of rehabilitation interventions and programmes after hip fracture?

OPTION MOBILISATION STRATEGIES APPLIED SOON AFTER HIP FRACTURE SURGERY

Mortality
Different mobilisation strategies compared with each other We don't know how more-intensive mobilisation strategies and less-intensive strategies compare at reducing mortality after hip fracture surgery (very low-quality evidence).

Function and mobility
Different mobilisation strategies compared with each other More-intensive mobilisation strategies may be more effective at improving function and mobility (assessed using various measures) than less-intensive strategies in people after surgery for hip fracture (very low-quality evidence).

Orthopaedic complications
Different mobilisation strategies compared with each other Initiating weight-bearing earlier may be more effective than starting weight-bearing later at reducing rate of avascular necrosis in people after surgery for hip fracture, but we don't know how different mobilisation strategies compare at reducing other orthopaedic complications (very low-quality evidence).

Length of hospital stay
Different mobilisation strategies compared with each other We don't know how more-intensive mobilisation strategies and less-intensive strategies compare at reducing length of hospital stay in people after surgery for hip fracture (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found two systematic reviews (search date 2006, 7 RCTs, 688 people; [49] and search date 1980–2007, 5 RCTs, number of people in each RCT not reported [50] on the effects of early mobilisation strategies after hip fracture. The first review identified RCTs assessing six different mobilisation strategies started soon after hip fracture surgery. [49] The review with the later search date assessed the effects of various hip fracture rehabilitation practices in older people, and included both RCTs and observational data (prospective and retrospective cohort studies), [50] with interventions distributed across six categories (care pathways; early rehabilitation; interdisciplinary care; occupational and physical therapy; exercise; and unspecified intervention) and three settings (acute setting; inpatient care; and outpatient care). [50] In many of the RCTs identified, several interventions were used simultaneously. All five RCTs identified by the review with the later search date [50] were identified by the first review. [49] The two additional RCTs identified by the first review were published before 1980. Neither review pooled data, as no comparisons evaluated by the RCTs were sufficiently similar for meta-analysis. [49] [50] The second review [50] did not report data on outcomes assessed, and so we report data as reported in the first review. [49] We also found one additional RCT [51] and one subsequent RCT. [52]

The first RCT (273 people) identified by the review compared weight-bearing started early at 2 weeks versus later at 12 weeks after internal fixation of a displaced intracapsular fracture. [49] It did not report on mobility or function. It found no significant difference in mortality at 1 year between the two groups (19/141 [13%] with early weight-bearing *v* 24/132 [18%] with later weight-bearing; RR 0.74, 95% CI 0.43 to 1.29).

The second and third RCTs identified by the review provided only limited data for their comparison of a more-intensive versus a less-intensive regimen of physiotherapy. [49] The second RCT (100 people, mean age 73 years) identified by the review found no significant difference in length of hospital stay between twice-daily physiotherapy and once-daily physiotherapy (mean difference in stay –2.80 days, 95% CI –12.09 days to +6.49 days). The third RCT (88 women aged 61–89 years) identified by the review also found no significant difference between more-intensive (greater than 6 hours/week) and less-intensive physiotherapy (15–30 minutes each weekday) in length of hospital stay (median: 32 days with more intensive *v* 34 days with less intensive; reported as not significant; P value not reported) and no difference in mobility in those completing the study (analysis not by ITT: proportion of people able to walk with walking sticks: 90% with more-intensive physiotherapy *v* 90% with less-intensive physiotherapy; absolute numbers not reported; significance not assessed by review).

The fourth RCT (80 people, mean age 80 years) identified by the review compared adding a quadriceps muscle-strengthening exercise programme to conventional physiotherapy versus conventional physiotherapy alone. [49] It found that adding quadriceps muscle-strengthening exercises significantly improved mobility scores and leg extension power at 16 weeks (mobility scores: absolute numbers not reported; P less than 0.05; leg extension power; fractured leg: mean difference 11.80 watts, 95% CI 2.93 watts to 20.67 watts). It found no significant difference between groups in mortality, activities of daily living as measured by Barthel Index, length of hospital stay (mortality: 4/40 [10%] with quadriceps strengthening *v* 4/40 [10%] with no strengthening; activities of daily living as measured by Barthel Index: absolute numbers not reported; P less than or equal to 0.05; median length of hospital stay: 39 days with quadriceps strengthening *v* 40 days with no strengthening).

The fifth RCT (40 women aged 69–97 years) identified by the review compared a treadmill gait-retraining programme versus a conventional gait-retraining programme. [49] It found no significant difference between treadmill and conventional training in the proportion of women who failed to recover pre-fracture mobility (7/20 [35%] with treadmill *v* 12/20 [60%] with control; RR 0.58, 95% CI 0.29 to 1.17). The RCT also found no significant difference in the mean length of hospital stay (54 days with treadmill *v* 67 days with control; reported as not significant, no further data reported). There were no deaths reported in the RCT.

The sixth RCT (27 women aged 79–87 years) identified by the review found that neuromuscular stimulation of the quadriceps muscle significantly reduced the proportion of women who failed to recover pre-fracture mobility at 3 months compared with placebo stimulation (3/12 [25%] with stimulation *v* 9/12 [75%] with placebo stimulation; RR 0.33, 95% CI 0.12 to 0.94).

The seventh RCT (80 people, aged 64–98 years) identified by the review compared 2-week programmes of weight-bearing versus non-weight-bearing exercise. [49] It found that, at 2 weeks, significantly fewer people doing weight-bearing exercise were unable to walk unassisted or using just one walking stick (33/41 [80%] with weight-bearing *v* 37/39 [95%] with non-weight-bearing; RR 0.85, 95% CI 0.72 to 1.00), or unable to do a lateral step-up on the fractured leg with nil or one-hand support (18/40 [45%] with weight-bearing *v* 30/37 [81%] with non-weight-bearing; RR 0.56, 95% CI 0.38 to 0.81). The review found no significant difference between the two groups in other objective measures of mobility and function: gait parameters, overall physical performance and mobility score, and balance (gait parameters: 0.91 steps per second with weight-bearing *v* 0.71 steps per second with non-weight-bearing; mean difference +0.20 steps per second, 95% CI –0.02 steps per second to +0.42 steps per second; overall physical performance and mobility score [0 = failure, 12 = top score]: 7.5 with weight-bearing *v* 6.8 with non-weight-bearing; mean difference +0.70, 95% CI –0.53 to +1.93; balance [functional reach distance]: 11.5 cm with weight-bearing *v* 9.4 cm with non-weight-bearing; mean difference +2.10 cm, 95% CI –1.64 cm to +5.84 cm). There was no significant difference in length of hospital stay between weight-bearing and non-weight-bearing exercise (mean difference –2.3 days, 95% CI –8.9 days to +4.3 days). [49]

The additional RCT (60 people) compared early ambulation (1–2 days post-operation) versus delayed ambulation (3–4 days post-operation) after hip fracture surgery. [51] The RCT found that functional levels at 7 days were significantly higher with early ambulation compared with delayed ambulation (average distance walked: 66.0 m with early *v* 29.7 m with delayed; P = 0.03). The RCT found no significant difference in the number of people who were discharged directly home with early ambulation compared with late (17% with early *v* 3% with late; absolute numbers not reported; P = 0.19).

The subsequent RCT (160 people who had been transferred to an inpatient rehabilitation unit post surgical fixation for hip fracture) compared higher-dose weight-bearing exercise versus limited weight-bearing exercise. [52] It is unclear how soon after hip surgery exercise was initiated. People in the more-intensive exercise group undertook weight-bearing exercise (5 weight-bearing exercises

in addition to walking on a treadmill with partial body weight support) for 60 minutes a day for 16 weeks, whereas the control group undertook exercise (5 exercises in sitting or lying position in addition to a small amount of walking using parallel bars or walking aids) for a total of 30 minutes per day for 4 weeks. The RCT found no significant difference between higher-dose and limited weight-bearing exercise in knee extensor strength in the fractured leg or in walking speed (time taken to walk 6 m) at either 4 weeks or 16 weeks (at 4 weeks; difference between groups: knee extensor strength: –0.1 kg, 95% CI –1.3 kg to +1.1 kg; P = 0.853; walking speed: +0.03 m/second, 95% CI –0.03 m/second to +0.10 m/second; P = 0.345; at 16 weeks; knee extensor strength: +0.6 kg, 95% CI –0.8 kg to +2.1 kg; P = 0.389; walking speed: +0.01 m/second, 95% CI –0.08 m/second to +0.11 m/second; P = 0.793). Initially, 404 people were screened for inclusion in the RCT, with 244 being excluded due to cognitive impairment/inability or unwillingness to consent/medical co-morbidities or inability to bear weight. The sample may therefore not be representative of all people with hip fracture.

Harms:

The first RCT identified by the review found that weight-bearing started at 2 weeks compared with 12 weeks after internal fixation of a displaced intracapsular fracture significantly reduced avascular necrosis of the femoral head (3/116 [3%] with early weight-bearing *v* 9/96 [9%] with late weight-bearing; RR 0.28, 95% CI 0.08 to 0.99). [49] It found no significant difference between early and later weight-bearing in non-union or overall unfavourable outcome (death, fixation failure, or infection) at 1 year (42/141 [30%] with early weight-bearing *v* 50/132 [38%] with late weight-bearing; RR 0.79, 95% CI 0.56 to 1.10).

The second and third RCTs identified by the review comparing more-intensive versus less-intensive physiotherapy, both assessed orthopaedic/mechanical complications such as re-displacement. [49] The second RCT did not report data on orthopaedic complications or wound infection separately for each treatment group. The third RCT found no significant difference in the occurrence of orthopaedic complications between more- and less-intensive physiotherapy (6/44 [14%] with more-intensive *v* 4/44 [9%] with less-intensive; RR 1.50, 95% CI 0.45 to 4.95); all 10 people with complications were withdrawn from the trial. It also found that significantly more people having more-intensive physiotherapy did not complete their training regimen (24/44 [55%] with more-intensive *v* 13/44 [30%] with less-intensive; RR 1.85, 95% CI 1.09 to 3.14).

The fourth, fifth, and sixth RCTs identified by the review gave no information on adverse effects, such as fracture healing complications. [49]

The seventh RCT identified by the review, which compared 2-week programmes of weight-bearing versus non-weight-bearing exercise, found no significant difference between groups in the proportion of people who found the exercises difficult or very difficult (14/40 [35%] with weight-bearing *v* 12/37 [32%] with non-weight-bearing; RR 1.08, 95% CI 0.58 to 2.02) or who experienced moderate or worse pain while performing the exercises (17/40 [43%] with weight-bearing *v* 18/37 [47%] with non-weight-bearing; RR 0.87, 95% CI 0.54 to 1.43).

The second review, [50] additional RCT, [51] and subsequent RCT [52] gave no information on adverse effects.

Comment:

Most of the eight RCTs identified were small and all had methodological limitations, especially inadequate follow-up. [49] [51] The first RCT identified by the review, comparing early versus later weight-bearing, was undertaken in 1968 and may not reflect current practice. [49] The additional RCT reported a "failed early ambulation group" (FEA) (17 people) as opposed to a "True Early Ambulation group" (TEA) (19 people). [51] The FEA group was removed from analysis. This group had significantly more cardiovascular instability, and worse results for all outcome measures. It is unlikely that this represents a harm — the probable reason for the failure of early ambulation was the underlying frailty and cardiovascular instability. These patients should perhaps have been excluded at consent to randomisation stage. There is also no "failed delayed ambulation" group with which to compare, so that we cannot say for certain whether those in the FEA group would have done better had their ambulation been delayed until day 3 or 4.

OPTION CO-ORDINATED MULTIDISCIPLINARY APPROACHES FOR INPATIENT REHABILITATION OF OLDER PEOPLE

Mortality

Compared with usual care Co-ordinated multidisciplinary rehabilitation seems no more effective at reducing mortality after hip fracture surgery (moderate-quality evidence).

Function and mobility

Compared with usual care Co-ordinated multidisciplinary rehabilitation may be more effective at improving mobility and function after hip fracture surgery, but we don't know whether it is more effective at increasing the proportion of people who return home on discharge from hospital (low-quality evidence).

Orthopaedic complications
Compared with usual care Co-ordinated multidisciplinary rehabilitation may be no more effective at reducing hospital readmission rate at 12 months or time to hospital readmission (low-quality evidence).

Medical complications
Compared with usual care Co-ordinated multidisciplinary rehabilitation seems more effective at reducing medical complications (including pressure sores, chest infections, and cardiac complications) after hip fracture surgery (moderate-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found four systematic reviews (search date 2002, 9 RCTs, 1887 older people; [53] search date 1998 [included cohorts and RCTs in people with any fracture of the lower limbs, pelvis, upper limbs or spine which required hospital care either as an inpatient or in ambulatory care]; [54] search date 2005, 11 RCTs, 2177 older people with hip fracture; [55] and search date 1980–2007) [50] comparing coordinated multidisciplinary approaches for inpatient rehabilitation of older people versus usual orthopaedic care. Between them, the reviews identified 12 RCTs. The review with the latest search date assessed the effects of various hip fracture rehabilitation practices in older people, and included both RCTs and observational data (prospective and retrospective cohort studies), [50] with interventions distributed across six categories (care pathways; early rehabilitation; interdisciplinary care; occupational and physical therapy; exercise; and unspecified intervention) and three settings (acute setting; inpatient care; and outpatient care). [50] In many of the RCTs identified, several interventions were used simultaneously. Ten of the RCTs identified by the first review [55] were identified by the review with the later search date. [50] The review with the later search date did not pool data, and so we report results from the largest review focusing on people with hip fracture. [55] The review defined a multidisciplinary approach as a service offered by a multidisciplinary team with the goal of reducing disability through improved task-oriented behaviour. We also found one subsequent RCT. [56]

The review found that multidisciplinary care significantly reduced the proportion of people with "poor outcome" (composite outcome of death or admission to nursing home after discharge from hospital) (10 RCTs; 2029 people: 227/992 [23%] with multidisciplinary care *v* 281/1037 [27%] with usual care; RR 0.84, 95% CI 0.73 to 0.96; P = 0.01). [55] The review found no significant difference in mortality between co-ordinated multidisciplinary rehabilitation and usual care (11 RCTs: RR 0.89, 95% CI 0.74 to 1.07; absolute numbers not reported). It also found no significant difference between groups in the proportion of people returning home after hip fracture, although the proportion of people returning home was larger with multidisciplinary care (11 RCTs; 1949 people: 720/952 [76%] with multidisciplinary care *v* 705/997 [71%] with usual care; RR 1.07, 95% CI 1.00 to 1.15; P = 0.06).

The subsequent RCT (199 people) found that, compared with usual care in an orthopaedic ward, a multidisciplinary treatment approach carried out in a geriatric ward significantly increased the proportion of people who achieved independence in personal activities of daily living (assessment included the Katz ADL index) at 12 months (33/84 [39%] with multidisciplinary approach *v* 17/76 [22%] with usual care: OR 3.49, 95% CI 1.31 to 9.23) and the proportion of people who were able to walk independently indoors without a walking aid at 12 months (35/84 [42%] with multidisciplinary approach *v* 22/76 [29%] with usual care: OR 3.01, 95% CI 1.18 to 7.61). [56] However, the RCT found no significant difference between groups at 12 months in mortality (16/102 [16%] with multidisciplinary approach *v* 18/97 [19%] with usual care: P = 0.591), in the proportion of people who had regained their pre-fracture level of mobility (52/84 [62%] with multidisciplinary approach *v* 40/76 [53%] with usual care: P = 0.236), or in the proportion of people who had returned to their previous residence (67/84 [80%] with multidisciplinary approach *v* 57/76 [75%] with usual care; P = 0.471). The RCT found no significant difference between groups in the number of readmissions to hospital at 12 months (38 with multidisciplinary approach *v* 30 with usual care; P = 0.484).

Harms: The largest review gave no information on adverse effects of multidisciplinary rehabilitation programmes. [55] One identified review reported data on adverse effects: [53] the two remaining systematic reviews gave no information on adverse effects. [50] [54] One RCT identified by the review found that co-ordinated multidisciplinary care significantly reduced the incidence of pressure sores compared with usual care (1 RCT; 206 people: 27/103 [26%] with multidisciplinary care *v* 43/103 [42%] with usual care; RR 0.63, 95% CI 0.43 to 0.93). [53] Another RCT identified by the review found that co-ordinated multidisciplinary care significantly reduced the proportion of people with chest infection, cardiac problems, or pressure sores (1 RCT; 71 people: 6/38 [16%] with multidisci-

plinary care *v* 13/33 [39%] with usual care; RR 0.40, 95% CI 0.17 to 0.94). [53] A third RCT identified by the review found no significant difference between multidisciplinary and usual care in overall complications (overall complications not further defined; 61/120 [51%] with multidisciplinary care *v* 56/123 [46%] with usual care; RR 1.12, 95% CI 0.86 to 1.45). The review identified two RCTs that assessed carer burden. Neither found a clinically important difference resulting from co-ordinated multidisciplinary care (no further data reported). The review reported that another RCT found no clinically important differences in home nursing, food service, or help from others between multidisciplinary and usual care (no further data reported). [53]

The subsequent RCT gave no information on adverse effects. [56]

Comment:

Clinical guide:
There was considerable variation in the approaches falling within the description of co-ordinated multidisciplinary approaches, assessed by the 11 RCTs in the review that pooled data. [55] Although there was a general lack of information on the nature of the care provided to the control groups, it is clear that "usual" care also varied. Given this variety — often inherent in trials of complex interventions — and the accompanying variation in the study populations, outcome measurement, and other aspects of trial methods, it is prudent to focus on the overall question. Thus, from the information currently available, as determined by the subgroup analyses conducted in a review with an earlier search date, [53] it is not possible to separate out the relative effects of each aspect/characteristic of the multidisciplinary interventions. The overall result points to, but does not confirm, a tendency to better outcome in people receiving co-ordinated multidisciplinary inpatient rehabilitation. The optimal structure, setting, and intensity of this care are not known. [55]

OPTION EARLY SUPPORTED DISCHARGE FOLLOWED BY HOME-BASED REHABILITATION

Function and mobility
Compared with usual care Early discharge to "hospital at home" care after hip fracture surgery may be more effective at improving mobility scores at 12 months, but it may be no more effective at improving functional ability in less-disabled people with a favourable home situation (low-quality evidence).

Length of hospital stay
Compared with usual care Early discharge to "hospital at home" care after hip fracture surgery may be more effective at reducing length of hospital stay, but it may be less effective at reducing length of hospital stay for acute care and overall length of care in less-disabled people with a favourable home situation (very low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits:

We found two systematic reviews (search date 1998 [included cohorts and RCTs in people with any fracture of the lower limbs, pelvis, upper limbs or spine that required hospital care either as an inpatient or in ambulatory care]; [54] search date 1980–2007 [50] assessing the effects of early supported discharge in people with hip fracture. The review with the earlier search date identified one RCT (241 people, 31% with hip fracture) [57] and five non-randomised comparative studies. [54] However, the RCT did not carry out a subgroup analysis in people with hip fracture and so we do not report data from the RCT here. [57]

The review with the later search date assessed the effects of various hip fracture rehabilitation practices in older people, and included both RCTs and observational data (prospective and retrospective cohort studies), [50] with interventions distributed across six categories (care pathways, early rehabilitation, interdisciplinary care, occupational and physical therapy, exercise, and unspecified intervention) and three settings (acute setting, inpatient care, and outpatient care). [50] In many of the RCTs identified, several interventions were used simultaneously. The second review identified two RCTs (reported in 3 articles) [58] [59] [60] comparing early supported discharge (ESD) versus control. [50] The review did not pool data, and so we report data from individual RCTs identified by the review.

The first RCT (66 people with hip fracture reported in 2 published articles) [58] [59] identified by the review compared accelerated discharge to "hospital at home" versus conventional hospital rehabilitation. It found that ESD significantly improved activities of daily living as assessed by Barthel Index scores (mean scores: 97.0 for ESD *v* 94.0 for hospital rehabilitation; P less than 0.05). [58] It found that, although length of hospital stay was significantly shorter for people having ESD compared with hospital rehabilitation (mean: 7.8 days with ESD *v* 14.3 days with hospital rehabilitation; P less than 0.05), the overall length of care was significantly longer (mean: 28.3 days with ESD *v* 14.3 days with hospital rehabilitation; P less than 0.001). The RCT found no significant difference between groups in the modified Barthel Index scores at 12 months (median Barthel Index score: 97 with ESD *v* 97 with hospital rehabilitation; P= 0.250). [59] However, it found that, compared with hospital rehabilitation, ESD significantly reduced carer burden at 12 months, as rated by the Caregiver

Strain Index, when measured relative to baseline values (median CSI score: 1 with ESD *v* 4 with hospital rehabilitation; P = 0.02).

The second RCT (81 people with hip fracture) identified by the review compared home rehabilitation consisting of about five visits from a physiotherapist versus institutional rehabilitation. [60] It found that home rehabilitation significantly improved mobility scores at 12 months compared with institutional rehabilitation (absolute numbers presented graphically; P less than 0.05); it provided no data on other outcomes. [60] Length of hospital stay for acute care was significantly longer with home compared with institutional rehabilitation (mean difference 1.90 days, 95% CI 0.66 days to 3.14 days). However, people having institutional rehabilitation stayed in the rehabilitation hospital for an average of 36 days, being seen by a physiotherapist on a daily basis.

Harms: There were only limited data on adverse effects provided by the RCTs. [58] [59] [60] One RCT found no significant difference between groups in fall rates (6/34 [18%] with home rehabilitation *v* 4/32 [13%] with hospital rehabilitation; RR 1.41, 95% CI 0.44 to 4.55). [58]

Comment: **Clinical guide:**
Both RCTs emphasised the careful selection of people for ESD and home-based rehabilitation. [58] [59] [60] These were generally people who were the least disabled and who had suitable and supportive home environments. Thus the application of these findings to other people with hip fracture is questionable. "Hospital at home" generally refers to a package of home-based nursing and rehabilitation services. The focus is on enabling the early discharge of people with hip fracture from an acute hospital back to their homes. Two of the three RCTs assessed this option. In the third RCT, home-based rehabilitation was limited to about five visits from a physiotherapist. [60] High losses to follow-up and inadequate outcome assessment greatly restrict the usefulness of this trial. We also found one systematic review (search date 2000) that had identified no RCTs or other studies assessing the relative effects of rehabilitation in care homes compared with hospital for more dependent and frail people. [61]

OPTION SYSTEMATIC MULTICOMPONENT HOME-BASED REHABILITATION AFTER HIP FRACTURE

Function and mobility
Compared with usual care We don't know whether a systematic home-based multicomponent rehabilitation programme is more effective at improving balance, function, or lower extremity strength scores at 12 months' follow-up in people who have had surgery for a hip fracture (low-quality evidence).

For GRADE evaluation of interventions for hip fractures, see table, p 41 .

Benefits: We found one systematic review (search date 1980–2007, 1 RCT; 73 people aged 65 years or more recently discharged from hospital after suffering a stroke or hip fracture) [50] and one additional RCT [62] assessing the effects of early supported discharge (ESD) in people with hip fracture. The review assessed the effects of various hip fracture rehabilitation practices in older people, and included both RCTs and observational data (prospective and retrospective cohort studies), [50] with interventions distributed across six categories (care pathways, early rehabilitation, interdisciplinary care, occupational and physical therapy, exercise, and unspecified intervention) and three settings (acute setting, inpatient care, and outpatient care). [50] In many of the RCTs identified, several interventions were used simultaneously.

The RCT identified by the review compared six or more face-to-face contacts from members of a multidisciplinary team versus three or fewer face-to-face contacts. [63] The RCT found no significant difference in various outcome scores for function, disability, handicap depression, quality of life, and therapy outcome measures in the hip fracture subgroup of 58 people between more versus fewer face-to-face contacts (median Barthel Index score: 20 with 6 or greater face-to-face contacts *v* 20 with 3 or less face-to-face contacts; median EuroQol-5D [Quality of Life] Score; 0.62 with 6 or greater face-to-face contacts *v* 0.67 with 3 or less face-to-face contacts; median EQ-VAS; 0.71 with 6 or greater face-to-face contacts *v* 0.7 with 3 or less face-to-face contacts; median Frenchay Activities Index [FAI]; 19 with 6 or greater face-to-face contacts *v* 19 with 3 or less face-to-face contacts; P greater than 0.05 for all outcomes).

The additional RCT (304 people who had had surgery for hip fracture and returned home within 100 days, 12 months' follow-up) compared systematic home-based multicomponent rehabilitation addressing physical impairments and activities of daily living versus usual care. [62] It found no significant difference between groups in recovery at 12 months to pre-fracture levels of self-care, home management, and social activity (self-care: 74% with multicomponent rehabilitation *v* 74% with usual care; absolute numbers not reported; P = 0.89; home management: 44% with multicomponent rehabilitation *v* 48% with usual care; absolute numbers not reported; P = 0.59; social activity; mean score at 12 months [higher score indicates better performance]: 6.17 with multicomponent

rehabilitation *v* 6.71 with usual care; P = 0.25). The RCT found no significant difference between the systematic programme and usual care in walking at 6 months, although walking was marginally better with the systematic programme (mean score in qualitative gait at 6 months [higher score indicates better performance]; 6.09 multicomponent rehabilitation with *v* 5.75 with usual care; P = 0.08).

Harms: The review [50] and the RCT identified by the review gave no information on adverse effects. [63]

The additional RCT found that a similar proportion of people reported falls (19% with multicomponent rehabilitation *v* 17% with usual care) or admission to hospital (11% with multicomponent rehabilitation *v* 13% with usual care; absolute numbers not reported for either outcome) at 6 months. [62]

Comment: The failure of the first RCT to find a difference between the systematic programme and usual care may be contextual, and coincided with an increased use of home services in the usual-care group. [62] The failure of the second RCT to show any benefit might be specific to hip fracture as a condition or to the intervention, but it is hard to draw meaningful conclusions from a small sample. [63]

Clinical guide:
While home-based rehabilitation after hip fracture might appear to meet the agenda of patient choice, and seem an attractive option in service planning, there is insufficient evidence from clinical trials to make recommendations on its effectiveness for any outcomes.

GLOSSARY

Arthroplasty The use of a surgically inserted device to replace one or both sides of a joint after fracture or for arthritis of the joint.

External fixator A variant of the extramedullary fixation implant in which the stabilising component is held outside the thigh by pins or screws driven into the bone on either side of the fracture.

Extramedullary fixation implant A device consisting of a nail or screw, passed up the femoral neck to the femoral head, which is connected to a side plate secured to the lateral side of the femur using screws.

Fixed nail plate A device used for internal fixation of hip fractures, which consists of a rigid nail driven through the fracture site and attached to a plate on the outside (extramedullary) lateral surface of the femur.

Internal fixation The use of devices (usually metal) to immobilise fractures, inserted surgically.

Total hip replacement The use of a surgically inserted device to replace both sides of the hip joint.

Varus deformity A deformity occurring in a limb, for any reason, in which the segment of the limb below the site of deformity is adducted towards the midline. When used for assessing bone healing of a hip fracture, it refers to healing of the proximal femur with the femoral neck lying in a more horizontal position, leading to shortening of the limb.

Barthel index The Barthel scale or Barthel ADL index is a scale used to measure performance in basic activities of daily living (ADL). It uses 10 variables describing ADLs and mobility. A higher number is associated with a greater likelihood of being able to live with a degree of independence.

Bipolar hemiarthroplasty A type of hip arthroplasty in which the femoral head is replaced with an artificial femoral head containing an internal articulation.

Cephalocondylic nail A device used for internal fixation of hip fractures, consisting of a nail inserted into the interior (medulla) of the femur from its upper end and passed across the fracture site towards the knee with a lag screw interlocking the nail and passing up into the femoral head.

Condylocephalic nail A device used for internal fixation of hip fractures, consisting of a nail inserted into the interior (medulla) of the femur from the knee and passed across the fracture site towards the femoral head.

Cut-out Refers to when a screw or nail cuts out of the bone (e.g., the femoral head) into which it was originally placed.

High-quality evidence Further research is very unlikely to change our confidence in the estimate of effect.

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

RAB fixed nail plate A type of fixed nail plate that has an additional oblique strut connecting the nail and the plate.

Sliding hip screw A device used for internal fixation of hip fractures, consisting of a lag screw that is passed across the fracture site and then attached to a plate on the outside (extramedullary) lateral surface of the femur. The design allows the lag screw to slide into a sleeve on the plate to accommodate shortening at the fracture site. This sliding capability is referred to as dynamic fixation. The sliding hip screw is the most common device in use.

Sliding nail plate A device used for internal fixation of hip fractures, similar to a fixed nail plate (see above), but with a sliding capability allowing movement to accommodate shortening at the fracture site. The sliding hip screw is the most common device in use.

Unipolar hemiarthroplasty A type of hip arthroplasty in which the femoral head is replaced with a monoblock metallic femoral head.

Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Arthroplasties for intracapsular hip fracture versus each other One updated systematic review found no new evidence for the comparison of cemented versus uncemented prostheses, unipolar versus bipolar hemiarthroplasty, or uncemented hemiarthroplasty versus total hip replacement. [21] Updated results for cemented hemiarthroplasty versus total hip replacement found no significant difference between techniques for various outcomes (mortality, residual pain, and failure to regain mobility). The review found that total hip replacement improved health-related quality of life on the EuroQol-5d utility score compared with cemented hemiarthroplasty, but there was no significant difference between techniques in hip function assessed using the Hip Rating Questionnaire. Categorisation unchanged (Unknown effectiveness).

Co-ordinated multidisciplinary approaches for inpatient rehabilitation of older people Two systematic reviews [50] [55] and one RCT added. [56] One review assessed the effects of various hip fracture rehabilitation practices in older people, and included both RCTs and observational data (prospective and retrospective cohort studies). [50] In many of the RCTs identified, the review reported that several interventions were used simultaneously, and the review did not pool data. The second review and subsequent RCT found similar results for multidisciplinary approaches compared with usual care. [55] [56] The review found that multidisciplinary care reduced the proportion of people with "poor outcome" (composite outcome of death or admission to nursing home after discharge from hospital), [55] and the subsequent RCT found that a multidisciplinary treatment approach increased the proportion of people who achieved independence in personal activities of daily living compared with usual care in an orthopaedic ward. [56] However, both the review and the RCT found no significant difference between groups in mortality or in the proportion of people who had returned to their previous residence. [55] [56] Categorisation unchanged (Likely to be beneficial).

Conservative versus operative treatment for most types of hip fracture One updated systematic review found no new evidence on the effects of conservative treatment versus operative treatment. Categorisation unchanged (Unlikely to be beneficial). [9]

Early supported discharge followed by home-based rehabilitation One systematic review added found no new evidence on the effects of early supported discharge. [50] Categorisation unchanged (Unknown effectiveness).

Internal fixation versus arthroplasty for intracapsular hip fracture One systematic review added reached similar conclusions to previously reported reviews (internal fixation is associated with a higher rate of re-operation compared with arthroplasty and no significant difference between treatments in mortality at 1 year); this review supports previously reported evidence. [13] We have previously identified a larger review that identified the same RCTs, and so absolute numbers have not been reported for the review added at this update. [13] One RCT added found no significant difference between internal fixation and bipolar cemented hemiarthroplasty in mortality at either 12 or 24 months. [16] Hip function at 12 months was worse with internal fixation compared with hemiarthroplasty, but there was no significant difference between groups at 24 months. The RCT found conflicting results for health-related quality of life. Internal fixation was associated with a higher rate of complications related to surgical method and a higher rate of re-operation. The operation selection relates to the type of fracture (whether it is undisplaced or displaced) and the age and co-morbidities of the patient. For younger people (aged under 60–70 years), internal fixation and preservation of the femoral head is generally preferred. The potential benefits of avoiding arthroplasty outweigh the potential risks of re-operation that may occur with internal fixation. Categorisation unchanged (Trade-off between benefits and harms).

Intramedullary fixation devices versus each other for extracapsular hip fracture One updated systematic review found no significant difference in various clinical postoperative outcomes and complications between different types of intramedullary fixation. [32] There is currently insufficient evidence to compare differences in outcomes or complications between individual types of intramedullary nail. Categorisation unchanged (Unknown effectiveness).

Intramedullary fixation with short cephalocondylic nail versus extramedullary fixation with sliding hip screw for extracapsular hip fracture One updated review [27] found similar results to those previously reported. The review found no significant difference between short cephalocondylic nails and sliding hip screws in various measures of mobility but found that short cephalocondylic nails are associated with higher rates of complication (re-operation rates and risk of fracture of the femur during operation) compared with sliding hip screws. [27] One RCT added found that, compared with fixation with a sliding hip screw, fixation with Holland nail was associated with more favourable outcomes for mobility (faster return to mobilisation and increased probability of return to level of preoperative mobility) but was associated with increased blood loss during surgery. [30] Categorisation unchanged (Unlikely to be beneficial).

Mobilisation strategies applied soon after hip fracture surgery One systematic review added [50] found no new evidence to that previously reported. The review did not pool data for RCTs assessing mobilisation strategies. One

RCT published subsequent to the search date of the review found no significant difference between higher-dose weight-bearing exercise and limited weight-bearing exercise in knee extensor strength in the fractured leg or in walking speed. [52] Categorisation unchanged (Unknown effectiveness).

Nerve blocks for pain control before and after hip fracture surgery One updated systematic review reached the same conclusions as previously reported. [36] The review reported that most RCTs identified were of poor quality and, although nerve blocks (administered at admission to hospital and during surgery) seem to be associated with improvements in various outcomes (including pain and requirement for analgesia after surgery), it is unclear whether improvements are of clinical benefit. Categorisation unchanged (Unknown effectiveness).

Systematic multicomponent home-based rehabilitation One systematic review added found no new evidence on the effects of early supported discharge. [50] Categorisation unchanged (Unknown effectiveness).

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TABLE **GRADE evaluation of interventions for hip fracture**

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of surgical interventions in people with hip fracture?									
2 (129) [9]	Orthopaedic complications	Conservative treatment *v* surgical treatment	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
At least 16 (at least 2618) [11] [15] [16]	Mortality	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for methodological issues of RCTs included in meta-analysis (concealing treatment allocation and no ITT analysis). Directness point deducted for wide range of implants assessed
At least 8 (at least 1113) [11] [15] [16]	Function and mobility	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for methodological issues of RCTs included in meta-analysis (concealing treatment allocation and no ITT analysis). Directness point deducted for wide range of implants assessed
5 (at least 750) [11]	Pain	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for methodological issues of RCTs included in meta-analysis (concealing treatment allocation and no ITT analysis). Directness point deducted for wide range of implants assessed
2 (520) [15] [16]	Quality of life	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	0	0	Moderate	Quality point deducted for double analysis of some people included in the RCT
At least 19 (at least 3217) [11] [12] [15] [16]	Orthopaedic complications	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for methodological issues of RCTs included in meta-analysis (concealing treatment allocation and no ITT analysis). Directness point deducted for wide range of implants assessed
At least 8 (at least 1339) [11] [15] [16]	Medical complications	Internal fixation *v* arthroplasty (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for methodological issues of RCTs included in meta-analysis (concealing treatment allocation and no ITT analysis). Directness point deducted for wide range of implants assessed
1 (198) [20]	Mortality	Different types of internal fixation implants *v* each other (intracapsular hip fracture)	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
1 (118) [19]	Function and mobility	Different types of internal fixation implants *v* each other (intracapsular hip fracture)	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
2 (317) [20] [19]	Orthopaedic complications	Different types of internal fixation implants *v* each other (intracapsular hip fracture)	4	−1	0	−1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for narrow range of techniques assessed

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
At least 4 (at least 393) [21]	Mortality	Cemented *v* uncemented prostheses	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
At least 3 (at least 147) [21]	Function and mobility	Cemented *v* uncemented prostheses	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, methodological flaws in RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up) and statistical heterogeneity among RCTs included in meta-analysis. Directness point deducted for wide range of prostheses and surgical techniques used
2 (97) [21]	Pain	Cemented *v* uncemented prostheses	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
At least 4 (at least 411) [21]	Orthopaedic complications	Cemented *v* uncemented prostheses	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
2 (159) [21]	Medical complications	Cemented *v* uncemented prostheses	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
3 (433) [21]	Mortality	Unipolar *v* bipolar hemiarthroplasty	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
1 (60) [21]	Function and mobility	Unipolar *v* bipolar hemiarthroplasty	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
At least 5 (at least 668) [21]	Orthopaedic complications	Unipolar *v* bipolar hemiarthroplasty	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
1 (48) [21]	Medical complications	Unipolar *v* bipolar hemiarthroplasty	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
1 (180) [21]	Mortality	Uncemented arthroplasty *v* total hip replacement	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
2 (187) [21]	Function and mobility	Uncemented arthroplasty *v* total hip replacement	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
2 (232) [21]	Orthopaedic complications	Uncemented arthroplasty *v* total hip replacement	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
2 (258) [21] [15]	Mortality	Cemented hemiarthroplasty *v* total hip replacement	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
2 (194) [21] [15]	Function and mobility	Cemented hemiarthroplasty *v* total hip replacement	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
1 (121) [21]	Pain	Cemented hemiarthroplasty *v* total hip replacement	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
1 (131) [21]	Quality of life	Cemented hemiarthroplasty *v* total hip replacement	4	−2	0	−1	0	Very low	Quality points deducted for sparse data, and for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
4 (415) [21]	Orthopaedic complications	Cemented hemiarthroplasty *v* total hip replacement	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
At least 3 (at least 339) [21]	Medical complications	Cemented hemiarthroplasty *v* total hip replacement	4	−1	0	−1	0	Low	Quality point deducted for methodological flaws of RCTs included in meta-analysis (failure to conceal treatment allocation, no ITT analysis, incomplete reporting, and short follow-up). Directness point deducted for wide range of prostheses and surgical techniques used
3 (304) [22] [23]	Mortality	Arthroplasty *v* internal fixation (extracapsular hip fracture)	4	−2	0	−1	0	Very low	Quality points deducted for inadequate methodologies and for no long-term results. Directness point deducted for disparity in comparators assessed
3 (at least 116) [22] [23]	Function and mobility	Arthroplasty *v* internal fixation (extracapsular hip fracture)	4	−2	−1	−1	0	Very low	Quality points deducted for inadequate methodologies and for no long-term results. Consistency point deducted for conflicting results. Directness point deducted for disparity in comparators assessed
3 (298) [22] [23]	Orthopaedic complications	Arthroplasty *v* internal fixation (extracapsular hip fracture)	4	−2	0	−1	0	Very low	Quality points deducted for inadequate methodologies and for no long-term results. Directness point deducted for disparity in comparators assessed
1 (58) [22]	Medical complications	Arthroplasty *v* internal fixation (extracapsular hip fracture)	4	−3	0	−1	0	Very low	Quality points deducted for sparse data, inadequate methodologies, and no long-term results. Directness point deducted for disparity in comparators assessed
1 (98) [25]	Mortality	Older nail plates *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for sparse data and for poor quality of RCT
1 (78) [25]	Function and mobility	Older nail plates *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for sparse data and for poor quality of RCT
1 (78) [25]	Pain	Older nail plates *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for sparse data and for poor-quality studies
2 (145) [25]	Orthopaedic complications	Older nail plates *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for sparse data and for poor quality of RCTs in analysis
6 (873) [21]	Mortality	Extramedullary fixation implants (other than older fixed nail plates) *v* sliding hip screws	4	−1	0	0	0	Moderate	Quality point deducted for methodological flaws in RCTs included in meta-analysis (no ITT analysis in one RCT, and lack of long-term functional data)
2 (147) [21]	Function and mobility	Extramedullary fixation implants (other than older fixed nail plates) *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for sparse data and for methodological flaws in RCTs included in meta-analysis (no ITT analysis in one RCT, and lack of long-term functional data)

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
1 (84) [21]	Pain	Extramedullary fixation implants (other than older fixed nail plates) *v* sliding hip screws	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
6 (936) [21]	Orthopaedic complications	Extramedullary fixation implants (other than older fixed nail plates) *v* sliding hip screws	4	−2	0	0	0	Low	Quality points deducted for methodologically flawed studies and statistical heterogeneity among RCTs in meta-analysis of some outcomes (no ITT analysis in one RCT, and lack of long-term functional data)
2 (266) [21]	Medical complications	Extramedullary fixation implants (other than older fixed nail plates) *v* sliding hip screws	4	−1	0	0	0	Moderate	Quality point deducted for methodologically flawed studies (lack of long-term functional data)
1 (100) [25]	Mortality	External fixation *v* extramedullary fixation	4	−1	0	−1	0	Low	Quality point deducted for sparse data. Directness point deducted for lack of long-term follow-up
3 (at least 85) [25] [26]	Function and mobility	External fixation *v* extramedullary fixation	4	−2	0	−2	0	Very low	Quality points deducted for sparse data and incomplete reporting of results (no statistical assessment in some outcomes). Directness points deducted for population differences (differences in age of population and aetiology of fractures) and for no long-term results
2 (140) [25]	Medical complications	External fixation *v* extramedullary fixation	4	−1	0	−1	0	Low	Quality point deducted for sparse data. Directness point deducted for no long-term results
24 (3313) [27] [30]	Mortality	Intramedullary fixation with a short cephalocondylic nail *v* extramedullary fixation with a sliding hip screw	4	0	0	0	0	High	
At least 10 (at least 1260) [27] [30]	Function and mobility	Intramedullary fixation with a short cephalocondylic nail *v* extramedullary fixation with a sliding hip screw	4	0	0	0	0	High	
8 (897) [27]	Pain	Intramedullary fixation with a short cephalocondylic nail *v* extramedullary fixation with a sliding hip screw	4	0	0	0	0	High	
At least 28 (at least 3993) [27] [30]	Orthopaedic complications	Intramedullary fixation with a short cephalocondylic nail *v* extramedullary fixation with a sliding hip screw	4	0	0	0	0	High	
7 (1090) [31]	Mortality	Intramedullary fixation with condylocephalic nails *v* extramedullary fixation	4	0	0	0	0	High	
8 (1130) [31]	Orthopaedic complications	Intramedullary fixation with condylocephalic nails *v* extramedullary fixation	4	0	0	0	0	High	
8 (1209) [32]	Mortality	Different types of intramedullary fixation *v* each other	4	0	0	−1	0	Moderate	Directness point deducted for narrow range of comparators (most comparisons compare one intramedullary fixation device versus Gamma nail)

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
1 (137) [32]	Function and mobility	Different types of intramedullary fixation *v* each other	4	−1	0	−1	0	Low	Quality point deducted for sparse data. Directness point deducted for narrow range of comparators (most comparisons compare one intramedullary fixation device versus Gamma nail)
1 (156) [32]	Pain	Different types of intramedullary fixation *v* each other	4	−1	0	−1	0	Low	Quality point deducted for sparse data. Directness point deducted for narrow range of comparators (most comparisons compare one intramedullary fixation device versus Gamma nail)
6 (1024) [32]	Orthopaedic complications	Different types of intramedullary fixation *v* each other	4	0	0	−1	0	Moderate	Directness point deducted for narrow range of comparators (most comparisons compare one intramedullary fixation device versus Gamma nail)
At least 4 (at least 591) [32]	Medical complications	Different types of intramedullary fixation *v* each other	4	0	0	−1	0	Moderate	Directness point deducted for narrow range of comparators (most comparisons compare one intramedullary fixation device versus Gamma nail)
What are the effects of perisurgical medical interventions on surgical outcomes and prevention of complications in people with hip fracture?									
3 (435) [33]	Pain	Traction *v* no traction	4	0	0	0	0	High	
2 (229) [33]	Orthopaedic complications	Traction *v* no traction	4	0	0	0	0	High	
1 (120) [33]	Medical complications	Traction *v* no traction	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
2 (number not reported) [33]	Pain	Skeletal traction *v* skin traction	4	−1	−1	0	0	Low	Quality point deducted for incomplete reporting. Consistency point deducted for conflicting results
1 (number not reported) [34]	Pain	Skin traction *v* pillow nursing	4	−1	0	0	0	Moderate	Quality point deducted for incomplete reporting
8 (1668) [35]	Mortality	Regional *v* general anaesthesia	4	−1	−1	0	0	Low	Quality point deducted for selection bias. Consistency point deducted for conflicting results with different methods of statistical analysis
4 (259) [35]	Medical complications	Regional *v* general anaesthesia	4	−1	0	0	0	Moderate	Quality point deducted for selection bias
9 (408) [36]	Pain	Nerve block *v* no nerve block	4	0	0	−2	0	Low	Directness points deducted for uncertainty about clinical benefit and for comparing different types of nerve blocks that were inserted at different times
At least 11 (at least 2500) [37] [38]	Orthopaedic complications	Prophylaxis with antibiotics *v* placebo/no prophylaxis	4	−1	0	0	0	Moderate	Quality point deducted for incomplete reporting of results
At least 7 (at least 2500) [37] [38]	Medical complications	Prophylaxis with antibiotics *v* placebo/no prophylaxis	4	−1	0	0	0	Moderate	Quality point deducted for incomplete reporting of results
At least 3 (at least 224) [37] [38]	Orthopaedic complications	Operative-day (less than 24 hours) antibiotics *v* longer-duration antibiotics	4	−1	0	0	0	Moderate	Quality point deducted for incomplete reporting of results

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
At least 3 (at least 121) [37] [38]	Medical complications	Operative-day (less than 24 hours) antibiotics *v* longer-duration antibiotics	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
At least 4 (at least 1747) [37] [38]	Orthopaedic complications	Single-dose regimens *v* multiple-dose regimens	4	−2	0	0	0	Low	Quality points deducted for methodological flaws of RCTs included in meta-analysis (impaired concealment of allocation and no assessor blinding) and incomplete reporting of results
At least 2 (numbers not reported) [37] [38]	Medical complications	Single-dose regimens *v* multiple-dose regimens	4	−2	0	0	0	Low	Quality points deducted for methodological flaws of RCTs included in meta-analysis (impaired concealment of allocation and no assessor blinding) and incomplete reporting of results
8 (730) [39]	Mortality	Heparin *v* placebo/no treatment	4	−2	0	0	0	Low	Quality points deducted for poor follow-up and inadequate diagnosis of DVT/PE
At least 13 (at least 993) [39]	Medical complications	Heparin *v* placebo/no treatment	4	−2	0	0	0	Low	Quality points deducted for poor follow-up and inadequate diagnosis of DVT/PE
3 (242) [39]	Mortality	LMWH *v* unfractionated heparin	4	−2	0	0	0	Low	Quality points deducted for poor follow-up and inadequate diagnosis of PE/DVT
5 (479) [39]	Medical complications	LMWH *v* unfractionated heparin	4	−2	−1	0	0	Very low	Quality points deducted for poor follow-up and inadequate diagnosis of PE/DVT. Consistency point deducted for conflicting results on re-analysis
1 (200) [39]	Medical complications	LMWH *v* LMWH plus pulsatile foot pumps	4	−2	0	−1	0	Very low	Quality points deducted for poor follow-up and inadequate diagnosis of DVT. Directness point deducted for inclusion of people under 65 years of age
1 (13356) [44]	Mortality	Antiplatelets *v* placebo or no treatment	4	0	0	−1	0	Moderate	Directness point deducted for non-controlled use of other thromboprophylaxis
11 (14254) [43] [44]	Medical complications	Antiplatelet agents *v* placebo or no treatment	4	0	0	−1	0	Moderate	Directness point deducted for non-controlled use of other thromboprophylaxis
16 (2191) [46]	Medical complications	Graduated elastic compression with or without antithrombotics *v* no prophylaxis	4	0	0	−1	+1	High	Directness point deducted for inclusion of people with different underlying conditions. Effect-size point added for OR less than 0.5
4 (256) [39]	Mortality	Cyclical compression of foot or calf *v* no compression	4	−2	0	−1	0	Very low	Quality points deducted for poor allocation concealment and no ITT analysis. Directness point deducted for uncertain benefit on clinical outcomes
5 (487) [39]	Medical complications	Cyclical compression of foot or calf *v* no compression	4	−2	0	−1	+1	Low	Quality points deducted for poor allocation concealment and no ITT analysis. Directness point deducted for uncertain benefit on clinical outcomes. Effect-size point added for RR less than 0.5
7 (337) [47]	Mortality	Oral multinutrient feeds *v* no dietary supplement	4	−3	0	0	0	Very low	Quality points deducted for poor allocation concealment, no assessor blinding, and no ITT analysis
3 (139) [47]	Medical complications	Oral multinutrient feeds *v* no dietary supplement	4	−3	0	−1	0	Very low	Quality points deducted for sparse data, poor allocation concealment, no assessor blinding, and no ITT analysis. Directness point deducted for composite outcome in one study

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
3 RCTs (at least 314) [47]	Mortality	Protein supplementation *v* no protein	4	−3	0	−1	0	Very low	Quality points deducted for poor allocation concealment, no assessor blinding, and no ITT analysis. Directness point deducted for composite outcome in 1 study
2 (223) [47]	Medical complications	Protein supplementation *v* no protein supplementation	4	−3	0	−1	0	Very low	Quality points deducted for poor allocation concealment, no assessor blinding, and no ITT analysis. Directness point deducted for composite outcome
1 (80) [48]	Mortality	Additional nutritional supplementation *v* normal food and beverage	4	−2	0	0	0	Low	Quality points deducted for sparse data and methodological limitations
1 (80) [48]	Medical complications	Additional nutritional supplementation *v* normal food and beverage	4	−2	0	−1	0	Very low	Quality points deducted for sparse data and methodological limitations. Directness point deducted for uncertainty about type of complication
3 (280) [47]	Mortality	Nasogastric multinutrient feeds *v* control	4	−1	0	−2	0	Very low	Quality point deducted for methodological weaknesses in RCTs included in meta-analysis (inadequate allocation concealment, assessor blinding, and no ITT analysis). Directness points deducted for uncertainty about benefit and for inclusion of people with different nutritional status
1 (57) [47]	Mortality	Nasogastric multinutrient feeds plus oral multinutrient feeds *v* control	4	−2	0	−2	0	Very low	Quality points deducted for sparse data and for methodological weaknesses of RCT (inadequate allocation concealment, assessor blinding, and no ITT analysis). Directness points deducted for uncertainty about benefit and for inclusion of people with different nutritional status
1 (57) [47]	Medical complications	Nasogastric multinutrient feeds plus oral multinutrient feeds *v* control	4	−2	0	−2	0	Very low	Quality points deducted for sparse data and for methodological weaknesses (inadequate allocation concealment, assessor blinding, and no ITT analysis). Directness points deducted for uncertainty about benefit and for inclusion of people with different nutritional status
What are the effects of rehabilitation interventions and programmes after hip fracture?									
2 (353) [49]	Mortality	Different mobilisation strategies *v* each other	4	−1	0	−2	0	Very low	Quality point deducted for poor follow-up. Directness points deducted for wide range of interventions and comparisons
8 (808) [49] [51] [52]	Function and mobility	Different mobilisation strategies *v* each other	4	−2	0	−2	0	Very low	Quality points deducted for poor follow-up and flaws in analysis. Directness points deducted for wide range of interventions and comparisons
2 (300) [49] [51] [52]	Orthopaedic complications	Different mobilisation strategies *v* each other	4	−2	0	−2	0	Very low	Quality points deducted for poor follow-up and flaws in analysis. Directness points deducted for wide range of interventions and comparisons, and for use of composite outcome in one RCT
5 (388) [49] [51] [52]	Length of hospital stay	Different mobilisation strategies *v* each other	4	−2	0	−1	0	Very low	Quality points deducted for poor follow-up and flaws in analysis. Directness point deducted for wide range of interventions and comparisons

Important outcomes	Mortality, function, and mobility (includes proportion of people returning to previous residential status; mobility status; measures of mobility and competence in activities of daily living), pain, quality of life, orthopaedic complications (see Outcomes section for outcomes included), medical complications (see Outcomes section for outcomes included), length of stay in hospital, adverse effects								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
12 (at least 199) [55] [56]	Mortality	Co-ordinated multidisciplinary rehabilitation *v* usual care	4	0	0	−1	0	Moderate	Directness point deducted for wide range of interventions and comparisons
12 (at least 2228) [55] [56]	Function and mobility	Co-ordinated multidisciplinary rehabilitation *v* usual care	4	0	0	−2	0	Low	Directness points deducted for wide range of interventions and comparisons and for use of a composite outcome
1 (199) [56]	Orthopaedic complications	Co-ordinated multidisciplinary rehabilitation *v* usual care	4	−2	0	−1	0	Low	Quality points deducted for sparse data and incomplete reporting of results
3 (520) [53]	Medical complications	Co-ordinated multidisciplinary rehabilitation *v* usual care	4	0	0	−1	0	Moderate	Directness point deducted for wide range of interventions and comparisons
2 (147) [58] [60]	Function and mobility	Early discharge to "hospital at home" *v* usual hospital care	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
2 (147) [58] [60]	Length of hospital stay	Early discharge to "hospital at home" *v* usual hospital care	4	−2	−1	0	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Consistency point deducted for conflicting results
2 (362) [63] [62]	Function and mobility	Systematic multi-component home-based rehabilitation *v* usual care	4	−1	0	−1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for uncertainty about benefit

Type of evidence: 4 = RCT; 2 = Observational consistency: similarity of results across studies
Directness: generalisability of population or outcomes
Effect size: based on relative risk (RR) or odds ratio (OR). PE, pulmonary embolism.