Arthroplasties (with and without bone cement) for proximal femoral fractures in adults (Review)

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[Intervention Review]

Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

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ABSTRACT

Background

Numerous types of arthroplasties may be used in the surgical treatment of a hip fracture (proximal femoral fracture). The main differences between the implants are in the design of the stems, whether the stem is fixed in place with or without cement, whether a second articulating joint is included within the prosthesis (bipolar prosthesis) or whether a partial (hemiarthroplasty) or total whole hip replacement is used.

Objectives

To review all randomised controlled trials that have compared different arthroplasties for the treatment of hip fractures in adults.

Search strategy

We searched the Cochrane Bone, Joint and Muscle Trauma Group's Specialised Register (February 2007), the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, the UK National Research Register, several orthopaedic journals, conference proceedings and reference lists of articles.

Selection criteria

All randomised and quasi-randomised controlled trials comparing different arthroplasties and their insertion with or without cement, for the treatment of hip fractures.

Data collection and analysis

Two review authors independently assessed trial quality, by use of a 10-item checklist, and extracted data.

Main results

Nineteen trials involving 2115 patients were included. One trial involved three comparisons. Cemented prostheses, when compared with uncemented (six trials, 549 participants) were associated with a less pain at a year or later (16/52 versus 28/52; RR 0.51, 95% CI 0.31 to 0.81) and a tendency to better mobility. No significant difference in surgical complications was found. Comparison of unipolar hemiarthroplasty with bipolar hemiarthroplasty (seven trials, 857 participants) showed no significant differences between the two types of implant. Two trials involving 232 patients compared uncemented hemiarthroplasty with a total hip replacement. Both

studies reported increased pain for the uncemented prosthesis and one study found better mobility and a lower long-term revision rate for those treated with a THR. Four trials involving 415 participants compared cemented hemiarthroplasty versus total hip replacement. All trials found little difference between the prostheses, aside from significantly longer surgical times but better functional outcome scores for the THR in three studies.

Authors' conclusions

There is limited evidence that cementing a prostheses in place may reduce post-operative pain and lead to better mobility. There is insufficient evidence to determine the roles of bipolar prostheses and total hip replacement. Further well-conducted randomised trials are required.

PLAIN LANGUAGE SUMMARY

Comparison of different types of artificial hip joints that may be used for treating fractures of the hip

Many different types of artificial hip joints (arthroplasties) may be used to treat a break in the thigh bone (femur) near the hip joint (hip fracture). Differences in these artificial joints include different shapes of the stem set into the bone; the incorporation of a secondary joint (bipolar joint); joints that replace only the ball part of the ball and socket hip joint (hemiarthroplasty) and those that also involve replacing the socket part of the hip joint (total hip replacement). In addition an arthroplasty may be of the press fit type or secured in place within the bone using a glue (bone cement).

Six studies involving 549 participants compared a press fit arthroplasty with one that was secured in place with bone cement. Those joints that were cemented in place seemed to result in less pain and gave possibly better mobility than those that were of the press fit type. Seven trials involving 857 participants compared those prosthesis which have a second joint built into them (bipolar hemiarthroplasties) with those without this additional joint (unipolar hemiarthroplasties). No notable differences between these two types of implant were demonstrated. Five studies of 608 participants compared different types of hemiarthroplasty with a total hip replacement. There was a trend to better functional outcomes after total hip replacement, but firm conclusions could not be made because of the lack of patient numbers.

In summary there is not enough evidence from randomised trials to show which arthroplasty is best. There is some evidence that people with arthroplasties that are cemented in place may have less pain and better mobility after the operation than those, which are inserted as a press fit.

BACKGROUND

Arthroplasty of the hip refers to replacement of all or part of the hip joint with a prosthetic implant. Numerous different types of arthroplasty exist for the hip. Those that involve replacement of the femoral head can be divided into two groups: hemiarthroplasty and total hip replacement (THR). Hemiarthroplasty involves replacing the femoral head with a prosthesis whilst retaining the natural acetabulum and acetabular cartilage. The type of hemiarthroplasty can be divided into two groups: unipolar and bipolar. Total hip replacement involves the replacement of the acetabulum in addition to the femoral head. The acetabular component is usually made of a combination of high density polyethylene and metal, and is often cemented into place. The femoral stems may be either held in place with cement or inserted as a 'press fit', without cement.

Unipolar hemiarthroplasty

The best known of the early hemiarthroplasty designs are the Moore prosthesis (Moore 1952) and the FR Thompson Hip Prosthesis (Thompson 1954). These are both one-piece all-metal implants and remain, 40 years after their introduction, the two most frequently used hemiarthroplasty prostheses. Both these prosthe-

ses were designed before the development of polymethylmethacrylate bone cement and were therefore originally inserted as a 'press fit'. The Moore prosthesis has a femoral stem, which is fenestrated and also has a square stem with a shoulder to enable stabilisation within the femur, which resists rotation within the femoral canal. It is generally used without cement and, in the long term, bone ingrowth into the fenestrations frequently occurs. The Thompson prosthesis has a smaller stem without fenestrations and nowadays is often used in conjunction with cement. Numerous other designs of unipolar hemiarthroplasties exist based on stems that have been used for total hip replacements. Depending on the design of the stem they may be used either with or without cement.

Bipolar prostheses

These prostheses are designed to allow movement to occur, not only between the acetabulum and the prosthesis, but also at a joint within the prosthesis itself. The object of the second joint is to reduce acetabular wear. Some early designs of this prosthesis had a trunion type of joint, which allows axial movement between the head and neck of the prosthesis; one example was the Christiansen prosthesis. The trunion joint has now been superseded by the ball and socket type, which allows universal movement at the inner joint. This type of prosthesis has a spherical inner metal head with a size between 22 to 36 millimetres in diameter. This fits into a polyethylene shell, which in turn is enclosed by a metal cap. There are a number of different types of prostheses with different stem designs. Examples of bipolar prostheses are the Charnley-Hastings, Bateman, Giliberty and the Monk prostheses, but many other types with different stem designs exist. The bipolar concept has been further developed by the incorporation of a modular joint into some of the prostheses. This is a tapered joint in which a socket in the head of the prosthesis fits onto a tapered projection from the stem. The modular joint enables a variety of different stems to be used with or without cement fixation. A range of different heads are available and the options include a bipolar jointed head, ceramic head or a simple unipolar head.

Total hip replacement

This arthroplasty consists of both a femoral component and an acetabular component. Numerous designs of THR exist. Either one or both components may be held in place with cement.
Potential complications of arthroplasty of the hip include wound infection (superficial and deep), dislocation of the prosthesis, loosening of the prosthesis stem, loosening of the acetabular component (THR only), acetabular wear (hemiarthroplasty only), breakage of the implant, disassembly of the implant, and fracture below the implant. The use of THR as a treatment for a hip fracture has been reported in a number of case series with variable results (Lu-Yao 1994).

Bone cement

Polymethylmethacrylate bone cement may be inserted at the time of surgery. It sets hard to form a solid bond between the prosthesis and the femoral bone at the time of surgery. Without cement a firm bond between the prosthesis and femur is dependent upon bony in-growth and osseous integration. Potential advantages of cement are a reduced degree of post-operative pain, as the prosthesis is more firmly fixed within the femur and a reduced long-term revision rate from loosening of the prosthesis. Major side effects of cement are cardiac arrhythmias and cardio-respiratory collapse, which occasionally occur following its insertion. These complications may be fatal. The cause of this is either embolism from marrow contents forced into the circulation (Christie 1994) or a direct toxic effect of the cement. Another consideration with cement is that it makes revision arthroplasty more difficult.

OBJECTIVES

We aimed to compare the relative effects (benefits and harms) of:

(1) identical prostheses inserted with cement versus without cement;

(2) different types of unipolar hemiarthroplasties;

(3) different types of bipolar hemiarthroplasties;

(4) unipolar hemiarthroplasty versus bipolar hemiarthroplasty;

(5) uncemented hemiarthroplasty versus total hip replacement;

(6) cemented hemiarthroplasty versus total hip replacement;

(7) different types of total hip replacement.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised controlled trials comparing different types of arthroplasty and the use of arthroplasty with or without cement for the treatment of fractures of the proximal femur. Quasi-randomised trials and trials in which the treatment allocation was inadequately concealed were considered for inclusion.

Types of participants

Skeletally mature patients with a proximal femoral fracture. The types of fractures studied were all intracapsular hip fractures, but had any study been found on extracapsular fractures they would have been be included.

Types of interventions

Prostheses (unipolar hemiarthroplasty, bipolar hemiarthroplasty, or THR), as described in the 'Background', applied with or without cement.

Types of outcome measures

Data for the following outcomes were sought:
(1) Operative details

- length of surgery (in minutes)
- hypotension during surgery
- operative blood loss (in millilitres)
- post-operative blood transfusion (in units)

(2) Implant related complications

- dislocation of the prosthesis
- loosening of the prosthesis
- acetabular wear
- breakage of the implant
- disassembly of the implant
- fracture below the implant
- complications related to cement insertion
- other surgical complications of fixation (as detailed in each study)
- reoperation and revision rate (within the follow-up period of the study). For the analyses these are separated into 'minor' reoperations such as closed reduction of a dislocation or attention to the wound or surrounding tissues, and 'major' reoperations such as revision or removal of the implant or open reduction of a dislocation.
- superficial wound infection (infection of the wound in which there is no evidence that the infection extends to the site of the implant)
- deep wound infection (infection around the implant)

(3) Post-operative complications

- pneumonia
- thromboembolic complications (deep vein thrombosis or pulmonary embolism)
- any medical complication (as detailed in each individual study)

(4) Hospital stay and use of resources

- length of hospital stay (in days)
- cost of treatment

(5) Anatomical restoration

- leg shortening (preferably > 2 cm)
- external rotation deformity (preferably > 20 degrees)

(6) Final outcome measures

- mortality (within the follow-up period of the study, both early and late)
- pain (persistent pain at the final follow-up assessment)
- residence at final follow up (return to living at home, discharge location)
- mobility (use of walking aids, return of mobility)
- other functional outcomes as listed in each study
- health related quality of life measures

The final outcome measures (6) should be considered the most important outcomes.

Search methods for identification of studies

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (February 2007), the Cochrane Central Register of Controlled Trials (to January 2007), MEDLINE (1966 to January 2007), EMBASE (1988 to January 2007), CINAHL (to January 2007), the UK National Research Register Issue 1, 2007 (www.nrr.nhs.uk/default.htm), and our own reference databases and reference lists of articles. We undertook a general perusal of locally accessible conference proceedings: for example, British Orthopaedic Association Congress 2000, 2001, 2002 and 2003. We also scrutinised weekly downloads of "Fracture" articles in new issues of 17 journals (Acta Orthop Scand; Am J Orthop; Arch Orthop Trauma Surg; Clin J Sport Med; Clin Orthop; Emerg Med Clin North Am; Foot Ankle Int; Injury; J Accid Emerg Med; J Am Acad Orthop Surg; J Arthroplasty; J Bone Joint Surg Am; J Bone Joint Surg Br; J Foot Ankle Surg; J Orthop Trauma; J Trauma; Orthopedics) from AMEDEO (www.amedeo.com). No language restriction was applied.
The following generic search for hip fracture was run for MEDLINE. This was combined with all three stages of the Cochrane optimal trial search strategy (Higgins 2005):
MEDLINE (OVID-WEB)
1. exp Hip Fractures/
2. hip$ or femur$ or femoral$ or trochant$ or pertrochant$ or intertrochant$ or subtrochant$ or intracapsular$ or extracapsular$) adj4 fracture$).tw.
3. or/1-2
4. (pin$1 or nail$ or screw$1 or plate$1 or arthroplast$ or fix$ or prosthes$).tw.
5. Internal Fixators/ or Bone Screws/ or Fracture Fixation, Internal/ or Bone Plates/ or Bone Nails/
6. Arthroplasty/or Arthroplasty, Replacement, Hip/
7. or/4-6
8. and/3,7

The general EMBASE and CINAHL search strategies for hip fracture trials are shown in Appendix 1.

Data collection and analysis

Two review authors independently extracted data for the outcomes listed above and the methodological quality of each trial was assessed independently without masking of journal name and author details. Differences were resolved by discussion. The main assessment of methodology was the quality of allocation concealment. A further nine aspects of methodology were evaluated giving a maximum score for each study of 12. Though the scores of the individual items were summed, this was to gain an overall impression rather than for quantitative purposes.

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

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

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

(4) Were the treatment and control groups adequately described at entry and if so were the groups well matched, or an appropriate co-variate adjustment made? Score 1 if at least four admission details given (e.g. age, sex, mobility, function score, mental test score) with either no important difference between groups or an appropriate adjustment made. Otherwise score 0.

(5) Were the surgeons experienced at both operations prior to commencement of the trial? Score 1 if text states there was an introductory period or all surgeons were experienced in both operations. Otherwise score 0.

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

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

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

(9) Was the timing of outcome measures appropriate?A minimum of 12 months follow up for all surviving participants with active review of participants at set time periods. Score 1 if yes. Otherwise score 0.

(10) Was loss to follow up reported and if so were less than five per cent of surviving participants lost to follow up? Score 1 if yes. Otherwise score 0.

Wherever necessary, and for all studies reported as only a conference abstract, the authors of studies were contacted for additional details of methodology and trial results. The authors of this review would welcome any additional information from trialists.

Data analysis

For each study, relative risks and 95% confidence intervals were calculated for dichotomous outcomes, and mean differences and 95% confidence intervals were calculated for continuous outcomes. Where appropriate, results of comparable groups of trials were pooled using both the fixed-effect and the random-effects models. Heterogeneity between comparable trials was tested using a standard chi-squared test with additional consideration of the I^2 statistic (Higgins 2003). The results for the random-effects model are presented when there is significant heterogeneity ($P < 0.10$; $I^2 = 50\%$ or more) in the results of individual trials. There were insufficient data to perform subgroup analyses or sensitivity analyses.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies.

Nineteen randomised controlled trials were identified and included in this review. One of these (Dorr 1986) compared three types of implant.

Six studies compared a cemented with an uncemented prosthesis. Sonne-Holm 1982 compared an Austin Moore prosthesis with or without cement in 112 patients. Two studies compared a cemented Thompson prosthesis with an uncemented Thompson prosthesis: Branfoot 2000 (91 participants), and Harper 1994 (137 participants). Emery 1991 compared a cemented bipolar Thompson prosthesis with an uncemented bipolar Moore prosthesis in 53 patients. Santini 2005 compared a cemented bipolar hemiarthroplasty with an uncemented bipolar hemiarthroplasty in 106 patients. Dorr 1986 compared a cemented bipolar hemiarthroplasty with an uncemented bipolar hemiarthroplasty with a cemented total hip replacement in 89 patients.

One study (Stock 1997) compared a ceramic head Thompson prosthesis with a conventional metal Thompson prosthesis in 69

patients. It was not stated if cement was used. Livesley 1993 compared an uncemented Moore stem bipolar prosthesis with a hydroxyapatite coated Furlong prosthesis in 82 patients.

Seven studies compared different unipolar hemiarthroplasties with various bipolar hemiarthroplasties. Three studies compared an Austin Moore hemiarthroplasty with the Bateman bipolar hemiarthroplasty (Malhotra 1995, 68 patients; Rosen 1992, 96 patients with 102 fractures and Van Thiel 1988, 93 patients). One study of 48 patients compared a cemented modular unipolar hemiarthroplasty with a cemented modular bipolar hemiarthroplasty (Cornell 1988). Raia 2003 also compared a cemented unipolar prosthesis with a cemented bipolar prosthesis in 115 patients. Two studies (Calder 1996; Davison 2001) compared a cemented Thompson prosthesis with a cemented Monk bipolar prosthesis in 437 patients.

Five studies compared THRs with different types of hemiarthroplasty. Dorr 1986 compared a cemented bipolar hemiarthroplasty with an uncemented bipolar hemiarthroplasty with a cemented THR in 89 patients. Skinner 1989 compared an uncemented Austin Moore hemiarthroplasty with a cemented THR in 180 patients. The STARS 2006 trial compared a cemented bipolar hemiarthroplasty with a cemented THR in 138 patients. Baker 2006 compared a cemented unipolar hemiarthroplasty with a cemented THR for 81 patients. Blomfeldt 2007 compared a cemented Exeter stem bipolar hemiarthroplasty with a cemented Exeter stem total hip replacement for 120 participants.

Further details of these trials are given in the 'Characteristics of included studies'. One study as yet only reported as a conference abstract is awaiting further information (Georgescu 2004). Three ongoing studies were identified. Bonke 1999 compares hemiarthroplasty with a total hip replacement, Moroni 2002 compares an uncemented with a cemented arthroplasty and Parker compares a cemented Thompson prosthesis with an uncemented Austin Moore. Eleven studies were excluded for reasons given in the 'Characteristics of excluded studies'.

Risk of bias in included studies

The methodology of the included studies was generally poor. Eight studies stated they used an appropriate method of randomisation. STARS 2006 used a computerised telephone randomisation service. Baker 2006 used sealed opaque numbered envelopes that were independently prepared. Cornell 1988 used sealed envelopes opened in the operating theatre. Calder 1996, Davison 2001 and Raia 2003 used computer generated random numbers. Branfoot 2000 and Emery 1991 used sealed envelopes. Five studies (Malhotra 1995; Rosen 1992; Sonne-Holm 1982; Stock 1997; Van Thiel 1988) did not state their method of randomisation. Five studies were quasi-randomised. Dorr 1986 and Harper 1994 used the patient's hospital number; Skinner 1989, the day of admission; Santini 2005 alternated days; and Livesley 1993, the week of admission.

For studies comparing different arthroplasties, ideally follow up should be for at least five years. No study achieved this; details of the different follow-up periods are given in the 'Characteristics of included studies'. Cornell 1988, Davison 2001, and Sonne-Holm 1982 were the only studies to have a blinded assessment of outcome.

Assessment of methodology (maximum score 12)

Cemented versus uncemented prosthesis

1 2 3 4 5 6 7 8 9 10 Total Study ID
2 1 1 1 0 1 1 0 0 1 8 Branfoot 2000
0 1 0 1 0 1 1 0 1 1 6 Dorr 1986
2 1 1 1 0 1 1 0 1 0 8 Emery 1991
0 1 0 0 0 1 0 0 1 0 3 Harper 1994
0 1 0 1 0 1 0 0 1 0 4 Santini 2005
1 1 0 0 0 0 1 1 1 1 6 Sonne-Holm 1982

Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

1 2 3 4 5 6 7 8 9 10 Total Study ID
1 0 0 0 0 0 0 0 0 0 1 Stock 1997

Bipolar hemiarthroplasty versus bipolar hemiarthroplasty

1 2 3 4 5 6 7 8 9 10 Total Study ID
0 0 0 1 0 1 1 0 1 1 5 Livesley 1993

Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

1 2 3 4 5 6 7 8 9 10 Total Study ID
2 1 1 1 1 1 1 0 1 0 9 Calder 1996
3 1 0 1 0 1 1 1 0 0 8 Cornell 1988
2 1 0 1 0 1 0 1 1 0 7 Davison 2001
1 0 0 0 1 1 1 0 1 1 6 Malhotra 1995
2 1 0 1 0 0 1 0 1 0 6 Raia 2003
1 0 0 0 0 0 0 0 1 0 2 Rosen 1992
1 0 0 0 0 0 0 0 0 0 0 1 Van Thiel 1988

Hemiarthroplasty versus total hip replacement

1 2 3 4 5 6 7 8 9 10 Total Study ID
3 1 1 1 0 1 1 0 1 1 10 Baker 2006
2 1 1 1 1 1 1 0 1 1 10 Blomfeldt 2007
0 1 0 1 0 1 1 0 1 1 6 Dorr 1986
0 1 0 0 0 1 1 0 1 0 4 Skinner 1989
3 1 1 0 0 0 1 0 1 1 8 STARS 2006

Effects of interventions

Where available, results have been presented in the Analyses.

Cemented versus uncemented prostheses

This comparison was considered in six studies (Branfoot 2000; Dorr 1986; Emery 1991; Harper 1994; Santini 2005; Sonne-Holm 1982) using a variety of implants. The data available from these studies are shown in Analyses 01.01 to 01.19. These are subgrouped according to the basic types of implants used in the studies. The analyses indicate no statistically significant difference between cemented and uncemented prostheses apart from a longer operative time for cemented prosthesis (data from two trials: mean difference 10.75 minutes, 95% CI 2.38 to 19.12 minutes; *see*

Analysis 01.01) and fewer people with pain at later follow up in the cemented prosthesis group (16/52 (31%) versus 28/45 (62%), relative risk (RR) 0.51; 95% confidence interval (CI) 0.31 to 0.81; *see* Analysis 01.18). Failure to regain mobility (33/89 (37%) versus 40/58 (69%)) was statistically significant using the fixed-effect model but not when using the random-effects model (RR 0.52; 95% CI 0.25 to 1.11; *see* Analysis 01.16) which was chosen due to the significant heterogeneity in the results of the three trials included in this analysis (P = 0.008, I2 = 79.5%).

Summaries and comments on specific aspects of the six trials are given below.

Sonne-Holm 1982 compared a cemented Austin Moore hemiarthroplasty with an uncemented Austin Moore hemiarthroplasty inserted via a posterior approach in 112 people, provided no operative results. Mortality was reported only at six weeks from operation: there was no difference between the two groups (*see* Analysis 01.14). Functional outcome, recorded in terms of hip movements, pain and mobility, was assessed at six weeks, and three, six and 12 months post-operatively. While no difference between groups was reported for hip mobility at final follow up (*see* Analyses 01.16), significantly better walking was reported at three and six months for those treated with a cemented prosthesis. Pain was assessed using a scale of one (most pain) to six (no pain). Significantly more patients had residual pain at six months for the uncemented group. There was a trend to more pain for the uncemented group at 6 weeks, 3 months and one year, however the difference between groups was not statistically significant (*see* Analysis 01.18).

Harper 1994 compared a cemented Thompson prosthesis with an uncemented Thompson prosthesis in 137 people. Clinical follow up at 8 to 12 weeks after surgery was achieved in only 60 patients (29 cemented, 31 uncemented). There were inconsistencies between the full report (in a thesis) and a conference abstract: one intra-operative death, which occurred in the cemented group, was reported in the thesis, but two deaths in the theatre recovery room were reported in the abstract, which also reported a study population of 140 patients rather than 137. Differences between the two groups in mortality at three months and one year (*see* Analyses 01.14 and 01.15) were not statistically significant. Follow-up assessment of pain at 8 to 12 weeks after surgery was for fewer than 60 participants (exact number not stated). Pain was reported as being significantly reduced (P < 0.001) in participants with a cemented prosthesis.

Branfoot 2000 also compared a cemented Thompson prosthesis with an uncemented Thompson prosthesis in 91 patients. The only operative complications reported were one dislocation and one fracture of the femur, both in the uncemented group. There was no significant difference in mortality, assessed at a mean follow up of 16 months (*see* Analysis 01.15). Pain was graded on a scale of zero (no pain) to three (night pain). The mean pain scores for the 70 surviving participants (0.42 versus 0.24) were reported to be not statistically significantly different. Other assessments using the Harris Hip Score were for limp, mobility, use of walking aids, and activities: none of the Harris Hip Scores showed any statistical difference between the two groups.

Emery 1991 compared a cemented bipolar on a Thompson stem with an uncemented bipolar Thompson stem in 53 patients. Neither of the differences in length of surgery (*see* Analysis 01.01) nor operative blood loss (*see* Analysis 01.02) were statistically significant. Similarly, there were no statistically significant differences between the two groups in the incidence of superficial sepsis (*see* Analysis 01.06) or specific medical complications (*see* Analysis 01.10). Complications not presented in Analysis 01.10 are one gastrointestinal bleed and one renal failure in the cemented groups and one urinary tract infection and a ruptured aortic aneurysm in the uncemented group. There was no significant difference between the two groups in length of hospital stay (*see* Analysis 01.12). Mortality was reported at two weeks, three months and 17 months, with no difference between groups (*see* Analyses 01.13, 01.14 and 01.15). Pain at 17 months (mean follow up) was significantly less in the cemented group (*see* Analysis 01.18: RR 0.39, 95% CI 0.20 to 0.79). In addition, significantly fewer people in this group were more dependent on walking aids (*see* Analysis 01.16: RR 0.53, 95% CI 0.30 to 0.93). Similar numbers were unable to return to their pre-fracture residence (*see* Analysis 01.19).

Dorr 1986 compared a cemented bipolar hemiarthroplasty with an uncemented bipolar hemiarthroplasty in 50 patients. The only surgical complications were two dislocations in the cemented group. No wound infections were reported. Three of the patients with a cemented prosthesis later required revision for the following reasons: removal of cement in the acetabulum, heterotopic ossification and repeated dislocations. One of the uncemented implants was converted to a THR due to loosening. No difference in the length of hospital stay was noted. Patients were assessed at 3, 12 and 24 months post-operatively. Mortality was only reported as "no difference between groups". Mean pain scores on a scale of 0 to 6 (with most pain at 0) were 5.4, 5.2 and 5.1 for the cemented prosthesis and 3.7, 3.6 and 3.0 for the uncemented prosthesis at the three follow-up times: all differences between the two groups were reported to be statistically significant. Mean mobility a scale of 0 to 6 (with worst mobility at 0) for the same time periods (4.0 versus 3.7; 4.2 versus 3.0; and 4.0 versus 3.0) was also reported to be statistically significantly in favour of the cemented prosthesis. Use of walking aids was also less common in the cemented group (*see* Analysis 01.16: 6/37 versus 9/13; RR 0.23, 95% CI 0.10 to 0.53). Gait analysis of walking velocity and single limb stance also showed better results for the cemented prosthesis.

Santini 2005 also compared a cemented bipolar hemiarthroplasty with an uncemented bipolar hemiarthroplasty in 106 patients. Length of surgery was significantly longer in the cemented group (*see* Analysis 01.01: mean difference 18 minutes, 95% CI 2.03 to 34.01 minutes). There was no significant difference in units of blood transfused (*see* Analysis 01.03). Surgical complications reported were one dislocation in the cemented group and two cases of operative fracture of the femur in the uncemented group. There

was no statistically significant difference between the two groups in deep wound infection (*see* Analysis 01.06) or specific medical complications (*see* Analysis 01.10). Complications not presented in Analysis 01.10 are gastric disease (1 versus 1); myocardial infarction or cardiac arrhythmia (4 versus 2) and urinary tract infection (8 versus 9). The mean length of hospital stay was 17 days for both groups (*see* Analysis 01.12). The difference between the two groups in the mean costs (3090 Euros versus 4008 Euros) was entirely due to the difference in cost of the prostheses. One-year mortality was similar between the two groups (*see* Analysis 01.15: 13/53 versus 14/53). Function was assessed using a scoring system for walking, personal activities, daily activities and living conditions. None of the scores, either overall or for the separate items, showed any statistically significant difference between the two groups.

Unipolar hemiarthroplasty versus unipolar hemiarthroplasty (differing head materials)

The only identified study (Stock 1997) compared a Thompson prosthesis with a ceramic head with a conventional metal Thompson prosthesis in 69 patients. It was not mentioned whether cement was used. The only outcome measure reported was the Harris Hip Score for 56 of the participants. The time interval from surgery to assessment was not stated. The mean hip score was 74.5 in the ceramic group and 69.3 in the conventional, a difference that was reported as not being statistically significant (P = 0.177).

Bipolar hemiarthroplasty versus bipolar hemiarthroplasty (differing stem designs)

The one identified study (Livesley 1993) compared an uncemented Moore stem bipolar prosthesis with a hydroxyapatite coated Furlong stem bipolar prosthesis in 82 patients. The various outcome measures recorded are presented in the Analyses 02.01 to 02.11. None of the differences between the two groups in the outcomes shown in the analyses reached statistical significance. There were, however, seven cases of operative fracture of the femur in the Furlong prosthesis group compared with none in the Moore group, a difference that approaches statistical significance (*see* Analysis 02.02). The single reoperation in the Moore group was for persistent thigh pain. The four reoperations in the Furlong group were for dislocation (twice in one patient), deep infection and fracture at the tip of the prosthesis. At follow up, 30 of the Moore prosthesis group were reported to have radiographic evidence of loosening and a further five to have acetabular wear. Conversely, only one Furlong case was reported to have acetabular wear with no radiographic loosening of the prosthesis. There was no statistically significant difference between the two groups in mortality (*see* Analyses 02.08 and 02.09) or the number back at home or able to shop at one year (*see* Analyses 02.10 & 02.11). The study reported without data, that at one year from injury fewer patients in the Furlong group used walking aids (reported P = 0.0001). Some of the other outcomes assessed using a functional assessment scale were reported to show a tendency for better results in the Furlong group; these were rest pain (reported P = 0.05), pain on rising from the chair (P = 0.003), activity pain (P = 0.005), ability to climb stairs (P = 0.05) and the patient's opinion of their hip (P = 0.03). Factors showing a non statistically significant difference were assistance in walking (P = 0.08) and walking distance (P = 0.08).

Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

This was considered in seven studies (Calder 1996; Cornell 1988; Davison 2001; Malhotra 1995; Raia 2003; Rosen 1992; Van Thiel 1988). Three studies (Malhotra 1995; Rosen 1992; Van Thiel 1988) compared an Austin Moore hemiarthroplasty with a Bateman bipolar hemiarthroplasty. Only Malhotra 1995 stated that a posterior approach was used and all implants were used without cement. The other two studies which looked at this comparison did not state the surgical approach or if cement was used. Cornell 1988 and Raia 2003 both compared a cemented unipolar hemiarthroplasty with a cemented bipolar hemiarthroplasty. Calder 1996 compared a cemented unipolar Thompson prosthesis with a cemented Monk bipolar prosthesis for patients aged over 80 years and Davison 2001 compared the same implants in those aged 65 to 79 years.

Summation of the data available from these studies is given in the Analyses 03.01 to 03.12. These indicate no statistically significant differences between the two types of prostheses for the outcomes of dislocation, acetabular erosion, deep wound sepsis, reoperations, deep vein thrombosis, mortality or mobility.

Summaries and comments on specific aspects of the seven trials are given below.

The 68 participants of Malhotra 1995 were much younger (mean age 66 years) and more likely to be male (56%) than in the other studies. Length of surgery was equal in both groups. The difference is mean blood loss (350 ml versus 400 ml) was reported as not statistically significant. Dislocation occurred in one participant of in each group; however, the dislocation in the bipolar group could not be reduced closed and required an open reduction. Both cases of deep wound infection, which occurred in the unipolar group, were treated by a Girdlestone arthroplasty. In addition, two participants of the unipolar group were later revised to a THR for acetabular protrusion. The mean hospital stay was similar in both groups (18.1 versus 17.2 days). No deaths were reported during the two year (average) follow-up period. Malhotra 1995 also stated, without data, that patients treated with the bipolar mobilised more quickly and had less post-operative pain. Follow-up assessment was by the use of a scoring system, which included pain, walking ability and range of hip movement. A greater proportion of 'excellent results' were noted in the bipolar group (24/32 (75%) versus 17/36 (47%)).

Rosen 1992, which included 96 participants, was only reported as a conference abstract with no data. The length of surgery and operative blood loss were stated to be significantly greater for the bipolar hemiarthroplasty. Reoperations were equal in both groups but significantly more post-operative complications occurred in the bipolar group. Mortality was reported as not significantly dif-

ferent between groups. Of only 27 participants followed up, pain was reported to be slightly less in the bipolar group and mobility better in the unipolar group.

Van Thiel 1988, which included 93 participants, was only reported as a conference abstract with no data. The only clinical outcome measure was the Harris Hip Score, which was reported as showing no significant difference between groups. Radiographic parameters of loosening, peri-articular ossification and protrusion acetabuli also showed no significant difference between groups.

Cornell 1988 compared a cemented modular unipolar hemiarthroplasty with a cemented bipolar hemiarthroplasty in 48 patients. All the stems used were identical and all the prostheses were inserted via a posterior approach. Follow up was only six months. Length of surgery and operative blood loss were stated without data as showing no significant difference between the two groups. Dislocation occurred in one person in each group. The only other complication reported was one case of deep vein thrombosis in the bipolar group. Mean length of hospital stay was reported as not being significantly shorter in the unipolar group (10.3 versus 13.4 days). There was no significant difference in mortality at six months (*see* Analysis 03.10: 1/15 versus 2/33; RR 1.10, 95% CI 0.11 to 11.21). Overall hip function was assessed using the Johansen Hip Scoring system, which showed no difference between the two groups (64.9 versus 63.2 points). However, hip movements were stated as being "greater" after the bipolar prosthesis (flexion: 110 versus 104 degrees; rotation: 50 versus 36.6 degrees; abduction: 38 versus 22 degrees). Walking speed was also reported to be better for the bipolar (2.67 versus 1.93 feet/sec, reported P < 0.03) as was the 'get up and go test' (27.3 versus 33.1 seconds), although the last difference was not statistically significant.

Raia 2003 compared a cemented unipolar hemiarthroplasty with a cemented bipolar in 115 people. All prostheses stems were identical and inserted by a posterolateral approach. Follow up was for one year. Mean operative blood loss was similar between the two groups (252 ml versus 237 ml) and there was no statistically significant difference between the two groups in the numbers of participants receiving blood transfusion (15/55 versus 18/60; analysis not shown). One person in the unipolar group had three dislocations and one person in the bipolar group had a single dislocation. All dislocations were treated by closed reduction. The one case of deep sepsis, reported in the unipolar group, required debridement and later implant removal. No other surgical complications were reported. Length of stay on the orthopaedic ward was similar in the two groups (mean 5.5 days versus 5.2 days). Mortality and failure to regain mobility at one year were similar in the two groups as shown in Analyses 03.11 and 03.12 respectively. Seventy-eight participants were assessed at one year from surgery using the Short Form 36 questionnaire and the Musculoskeletal Functional Assessment score. No significant differences or trends were noted between the two groups.

Calder 1996 compared a Thompson prosthesis with a Monk bipolar prosthesis for 250 patients aged over 80 years of age. All prostheses were cemented in place, had identical stems and were inserted via an antero-lateral Hardinge approach. Dislocation occurred twice in the unipolar group and once in the bipolar group (*see* Analysis 03.01). Radiographic evidence of acetabular erosion was seen in three cases, all with unipolar prosthesis; none of these had needed revision surgery by the time of final follow up (*see* Analyses 03.03 and 03.04). Deep wound infection occurred in five unipolar group participants and four bipolar group participants (*see* Analysis 03.05). The length of hospital stay was similar in the two groups (medians: 18 versus 17 days). There was no statistically significant difference between the two groups in mortality at six months (*see* Analysis 03.10) or one year (*see* Analysis 03.11). Other results for this trial were reported as percentages without actual numbers. The proportions of patients with no or mild pain at follow up were reported similar in the two groups (53% versus 55%), as were the proportions returning to their pre-operative place of residence (41% versus 42%). Calder 1996 reported that, after adjustment for confounding factors, the proportion of patients returning to their pre-injury subjective status was significantly greater in the unipolar group (P = 0.041). This statement conflicted with the proportions given in the text (29% versus 40%). There was no statistical difference between the two groups in the proportions of patients who reported a limp (23% versus 25%) or who were satisfied with their operation (67% versus 63%). Similarly, there was no significant difference in the mean Harris Hip Scores of the two groups (70 versus 72). The Nottingham Health Profile, which was conducted on a subgroup of 128 participants, showed no significant difference between implant groups.

Davison 2001 compared a cemented unipolar Thompson prosthesis with a cemented Monk bipolar prosthesis involved 187 participants aged between 65 and 79 years, with a minimum of follow up of two years. Dislocation occurred twice in one unipolar group participant and in two participants of the bipolar group (*see* Analysis 03.01). Open reduction was required for one of the bipolar dislocations (*see* Analysis 03.02). The sole deep wound infection occurred in one patient in the bipolar group (*see* Analysis 03.05). Acetabular erosion requiring revision was required twice in the unipolar group and once in the bipolar group (*see* Analysis 03.04). Other reoperations, all in the bipolar group, were one Girdlestone for sepsis and one biopsy and excision of heterotopic ossification. Other outcomes, which were reported as showing no significant difference between the two groups during the follow-up period of up to five years, were the mean Harris Hip Score, Barthel Index, patient satisfaction, return to pre-injury state and mortality. The Nottingham Health Profile, assessed in 73 participants, was reported as showing a non-statistically significant trend to lower physical mobility for the unipolar group.

Uncemented hemiarthroplasty versus total hip replacement (THR)

This comparison was considered in two quasi-randomised studies (Dorr 1986; Skinner 1989) involving a total of 232 patients.

Where possible, the results are presented in the Analyses (*see* 04.01 to 04.04). Given evidence of statistically significant heterogeneity in the results for 'Reoperations - any' and 'Failure to regain mobility', the random-effects model is used in Analyses 04.02 and 04.04. There was no statistically significant difference between the two groups in the pooled outcomes. Participants treated with an uncemented hemiarthroplasty in Skinner 1989 had an increased degree of residual pain (20/73 versus 0/62, RR 34.91, 95% CI 2.15 to 565.58) and those in Dorr 1986 had significantly higher pain scores.

Dorr 1986 compared an uncemented bipolar hemiarthroplasty with a cemented total hip replacement for 52 patients. Surgical complications comprised seven dislocations in the THR group. No wound infections were reported. One participant of the hemiarthroplasty group required revision for recurrent dislocation and loosening compared with two of the THR group. No difference in the length of hospital stay was noted. Patients were assessed at 3, 12 and 24 months post-operatively. Mortality was only reported as "no difference between groups". Mean pain scores on a scale of 0 to 6 (with most pain scoring 0) were 3.7, 3.6 and 3.0 for the uncemented hemiarthroplasty group and 4.9, 5.5 and 5.5 for the THR group at the three follow-up times; all differences between the two groups were reported to be statistically significant. Mean mobility on a scale of 0 to 6 (with worst mobility at 0), for the same time periods was 3.7, 3.0 and 3.0 versus 4.1, 4.1 and 5.5; none of these differences were reported to be statistically significant. Use of walking aids was statistically significantly more common in those treated with an uncemented hemiarthroplasty (*see* Analysis 04.04: 9/13 versus 7/39; RR 3.86, 95% CI 1.80 to 9.27). Gait analysis also showed a greater degree of impaired gait for the uncemented group.

Skinner 1989 compared an uncemented Moore hemiarthroplasty with a cemented Howse THR in 180 patients. All prostheses were inserted with a posterior-lateral approach. The main implant-related complication was dislocation in 11 hemiarthroplasties and 10 THRs. The only case of deep sepsis occurred in a THR patient. Revision surgery was required in 13 hemiarthroplasties for recurrent dislocation, loosening, fracture around the prosthesis or ectopic calcification. Three of the THRs were revised for recurrent dislocation. There was no statistically significant difference between the two groups in mortality at 2 or 12 months follow up (*see* Analysis 04.03). Pain was more prevalent in those treated with hemiarthroplasty. Mobility, graded on a scale of one to four, was reported to be significantly better for the THR. However, there was no significant difference in the numbers failing to regain their former mobility (*see* Analysis 04.04). A later conference abstract (Ravikumar 1998), reported a 13-year follow up. The mean survival was 3.17 years for the hemiarthroplasty group and 4.27 years for the THR group, with no significant difference found. The number of surviving patients assessed was not stated but would be small given the approximately 85% overall mortality. The mean Harris Hip Score for survivors treated by THR was significantly better than that for those treated by hemiarthroplasty (mean score 80 versus 55). Pain was also reported to be less for THR group survivors, and this group was also stated to be more mobile. The long-term revision rate was significantly higher for hemiarthroplasty (*see* Analysis 04.02: 24/100 versus 5/80; RR 3.84, 95% CI 1.53 to 9.61).

Cemented hemiarthroplasty versus total hip replacement

This was considered in four studies: Baker 2006, Blomfeldt 2007, Dorr 1986 and STARS 2006. Where possible, results are presented in the Analyses (*see* 05.01 to 05.09). Standard deviations for continuous outcomes measures for Baker 2006 and Blomfeldt 2007 were calculated from reported P-values. Surgical time was significantly less for the hemiarthroplasty (*see* Analysis 05.01.01: WMD -19.20 minutes, 95% CI -24.55 to 13.84 minutes). There was an increased risk of dislocation for THR (*see* Analysis 05.02.01: 4/207 versus 13/208; RR 0.34, 95% CI 0.12 to 0.96) and of 'minor' reoperations (*see* Analysis 05.03.01: 2/138 versus 12/139; RR 0.24, 95% CI 0.07 to 0.80). Final functional outcome, based on the Oxford hip score, was superior for the THR in Baker 2006 (mean scores 22.3 versus 18.8; reported P = 0.033. *see* Analysis 05.08). Self reported walking distance was also superior for the THR in this trial (*see* Analysis 05.09.02). Similarly, the Harris hip score, overall and two components, showed better results for the THR in Blomfeldt 2007 (*see* Analyses 05.09.06 to 08). Stars 2006 also found statistically better results for a Hip Rating Questionnaire and EuroQol (*see* Analyses 05.09.01 and 05). There was no statistically significant difference between the two groups in any of the other outcomes, including mortality.

The STARS 2006 study compared a cemented bipolar hemiarthroplasty with a cemented total hip replacement in 138 patients. The mean surgical time was significantly less in those treated with a cemented hemiarthroplasty (*see* Analysis 05.01: mean difference -21.20 minutes, 95% CI -29.09 to -13.31 minutes). At two-year follow up there were no significant differences between the two groups in the number of dislocations (2 versus 3) or of superficial (2 versus 2) or deep (1 versus 1) wound infections (*see* Analysis 05.02). There were also no significant differences between the two groups in the number of reoperations (Analysis 05.03: 5/69 versus 6/69; RR 0.83, 95% CI 0.27 to 2.60) or medical complications (*see* Analysis 05.04). The mean cost for those treated with a hemiarthroplasty was £15,263 compared with a mean cost of £12,253 for those treated with a THR (reported 95% confidence interval for the difference was £1400 to £7420). The study reported no statistically significant differences between the two groups in mortality (*see* Analysis 05.06) or in residual pain or discomfort at 12 months (*see* Analysis 05.07.01). Patient-reported outcomes were obtained at four months, and one and two years using a Hip Rating Questionnaire (modified Johansen hip scoring system), which assessed impact of the hip problem (global), pain, walking, and function, and the EuroQol (EQ-5D) questionnaire to assess general health status. The P values for these are summarised in Table 1. Those outcomes for walking at four months, one and two years,

and function and overall hip-related functioning at two years were better for patients allocated a THR (*see* Analysis 05.09.01 and 05).

Table 1. STARS 2006: reported P values (unadjusted data)

Outcome	4 months	1 year	2 year
Pain	0.90	0.47	0.53
Walking	0.06	0.05	0.02
Function	0.26	0.32	0.03
Health related quality of life	0.20	0.42	0.05
EuroQol (EQ-5D) general health outcome measure	0.10	0.43	0.005

Baker 2006 compared a cemented unipolar hemiarthroplasty with a cemented total hip replacement in 81 patients. The mean surgical time was less for hemiarthroplasty (78 versus 93 minutes, reported P = <0.001). There were three dislocations in the THR group; one of these was recurrent (*see* Analysis 05.02.01). Three patients in the hemiarthroplasty group required revision surgery: two for acetabular wear and one for fracture around the prosthesis. One patient of the THR group required revision for loosening and one wound required debridement in the same group. Radiographic changes of acetabular wear were also reported for 21 out of 32 cases in the hemiarthroplasty group. Medical complications were reported for 15 patients as detailed in Analysis 05.04. Mortality at three years is given in Analysis 05.06.03, with no statistically significant difference between groups. Functional outcome, based on the Oxford hip score, significantly favoured the THR (mean scores 22.3 versus 18.8; reported P = 0.033. *see* Analysis 05.08). The short form 36 physical and mental scores were reported as not being statistically significantly different between the two groups (38.1 versus 40.5, P = 0.36; and 55.3 versus 52.0, P = 0.35). The self reported walking distance was significantly shorter (1.9 km versus 3.6 km; reported P = 0.039. *see* Analysis 05.09.02).

Blomfeldt 2007 compared a cemented bipolar hemiarthroplasty with a cemented total hip replacement in 120 patients. The mean surgical time was less for hemiarthroplasty (78 versus 102 minutes, reported P = <0.001). Surgical complications were one later fracture below the implant in the THR group, which was treated by plating of the femur, and one deep wound infection in the THR group requiring three debridements and then closure of the wound. There were also two superficial wound infections in each group. Medical complications reported in Blomfeldt 2007 are presented in Analysis 05.04. There was no significant difference between the two groups in mortality at one year (*see* Analysis 05.06.02). Functional outcome, based on the Harris hip score, was statistically significant better for the THR (mean scores 79.4 versus 87.2; reported P = <0.001). The components of pain and function of the Harris hip score both favoured THR, whilst there was no difference between implants for deformity or range of movement. The EuroQol (EQ-5D) assessment was reported to favour THR (mean scores: 0.63 versus 0.68), but the difference the two groups did not reach statistical significance (reported P = 0.636).

DISCUSSION

Many of the trial reports indicated a poor level of methodological rigour, in particular regarding concealment of allocation, assessor blinding and intention-to-treat analysis. Furthermore, many of the studies involved small numbers of patients and had limitations, including inadequate length of follow up, in their assessment and reporting of outcome. In addition some of the studies were only reported as conference abstracts with a failure to provide additional information. The low methodology scoring for these particular studies may reflect poor reporting of the trial rather than poor trial methodology. The variation in characteristics of the prostheses used in the individual trials hampers interpretation of their findings. For instance, in the comparison of cemented versus uncemented prostheses, the two prostheses under test often differ in other important ways as well as in the use of cement. For

most of the findings, it is not possible to attribute an outcome to the intervention under test (cement) or to the other differences in the implants. While remaining a source of heterogeneity, pooling of data from several trials with this comparison should help to address the basic question (whether to use cement of not). The presentation of the results of this review, which subgroups the different combinations of implants under test, also should help to get the answers to the basic questions and explore the differences. So far, the insufficient numbers of studies preclude the drawing of conclusions for any of the comparisons under review.

Cemented versus uncemented prostheses

The six included studies investigating this comparison involved a total of 549 patients. The largest study, Harper 1994 with 137 patients, was of poor methodology with very limited reporting of outcomes and inadequate follow up of patients: therefore no conclusions can be made from this study. Santini 2005 had an inadequate method or randomisation and limited reporting of outcomes. Sonne-Holm 1982 excluded the results of 37 patients who had either died, moved away or had the wrong prosthesis implanted. Branfoot 2000 had limited reporting of results for 91 patients. Dorr 1986 only involved 13 uncemented prostheses. Inadequate trial methodology, heterogeneity in the implants used and other study characteristics, and the limited number of trial participants prevents firm conclusions being made.

Most studies reported increased pain for uncemented prostheses (Dorr 1986; Emery 1991; Harper 1994; Sonne-Holm 1982). This is particularly relevant in Sonne-Holm 1982 which used blinded outcome assessors. Branfoot 2000 however reported on difference in pain levels between groups. Three studies reported better mobility in the cemented group (Dorr 1986; Emery 1991; Sonne-Holm 1982), however Santini 2005 found no difference in walking ability. The reporting of post-operative complications and possible adverse effects of cement was poor, with only Emery 1991 and Santini 2005 listing these. In addition, although all studies reported on mortality, this was poorly documented. Only Harper 1994 commented on any adverse effects of cement, reporting one intra-operative cement-related death.

Skinner 1989 considered hemiarthroplasty versus THR. This study compared an uncemented Moore prosthesis with a cemented THR. Results indicated reduced pain and improved mobility for the cemented prosthesis. As discussed above, these improved outcomes, if true, may be due to either the cement or the difference in type of implant.

Potential biases in the results of the studies may occur if frailer participants are omitted from the cemented group. This is more likely to occur if the method of randomisation was inadequate, which is particularly relevant for the studies of Harper 1994 and Dorr 1986 who both used an open method of randomisation.

In summary, there is limited evidence from randomised studies that cementing a prosthesis in place may reduce the amount of post-operative pain and potentially lead to improved mobility. However, because of the limited number of patients studied, it is not possible to determine if any adverse effects of cement offset these advantages. No study has adequately addressed long-term outcome measures.

Unipolar hemiarthroplasty versus unipolar hemiarthroplasty (differing head materials)

The one trial included for this comparison (Stock 1997) was reported only as a conference abstract without any details of the trial methodology and only one outcome measure, the Harris Hip Score. Thus, no conclusions can be drawn on the relative effects of a ceramic and metal-headed Thompson prosthesis.

Bipolar hemiarthroplasty versus bipolar hemiarthroplasty (differing stem designs)

The one included trial (Livesley 1993) compared two very different prostheses: a standard Austin Moore with its single size fenestrated stem and collar versus a solid collarless hydroxyapatite coated Furlong stem of different sizes. Any difference in the results, for the two implants may be due to either the hydroxyapatite, the collar, the stem shape or the availability of different stem sizes. The results from this small quasi-randomised trial showed a tendency to better final outcome results with the Furlong prosthesis. However, the limitations in the available evidence from this small study means that definite conclusion on the relative effects of the two implants cannot be made.

Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

The limited data available from the seven studies testing this comparison showed no statistically significant differences between the groups. Some significant differences were reported for specific outcomes in individual studies, but confirmatory data were rarely provided. Notably, two of the three studies that compared an Austin Moore hemiarthroplasty with a Bateman bipolar hemiarthroplasty (Rosen 1992; Van Thiel 1988) were only reported as conference abstracts and provided minimal information. The third study (Malhotra 1995) gave more information but the characteristics of the trial participants were markedly different to those of the general population of people with hip fractures. The mean age of the participants was 66 years (as opposed to 75 to 80 years for most other studies), 56% were male (as opposed to 25% to 35% in other studies), and there were no deaths by two years follow up. This as well as the small sample size (68 participants), means that the results of this study, which tended to favour bipolar hemiarthroplasty, may not anyway apply to the general hip fracture population.

Raia 2003 compared cemented unipolar and cemented bipolar arthroplasties in 115 people followed up for one year. No differences in outcomes were noted between groups. Cornell 1988 undertook a similar study with only 48 participants. There appeared

to be a greater range of movement and improved gait for those treated with the bipolar prosthesis but there was no difference in the hip scores between the two groups. Because the number of participants in this study was small, no definite conclusions can be made. The larger study of Calder 1996 for those aged 80 years and over with a more complete reporting of outcomes showed no advantages for the bipolar prosthesis in this age group. In the study involving those aged less than 80 years of age (Davison 2001), again no advantage was demonstrated for the bipolar implant.

Uncemented hemiarthroplasty versus total hip replacement

Two quasi-randomised studies involving a total of 232 participants were identified. Dorr 1986 had only 13 participants in the uncemented group. Both studies reported increased pain for the uncemented prosthesis. Furthermore Skinner 1989 reported better mobility and a lower long-term revision rate for those treated with a THR. It is not possible to be certain if the improved results in the THR group were due to the use of cement or the acetabular replacement as part of the THR. Overall, the available evidence from these two studies is insufficient to draw definite conclusions.

Cemented hemiarthroplasty versus total hip replacement

Four studies involving a total of 415 participants were identified. One now dated and flawed study (Dorr 1986) failed to find any differences between prosthesis. The other three more recent studies (Baker 2006; Blomfeldt 2007; STARS 2006) found little differences between prostheses except for indications of better long term hip function and mobility in the THR group. The two trials added in this update lend support to the tentative conclusions of better function for the THR in older fit populations found by STARS 2006. THR was associated with slightly significantly longer surgical times but more minor surgical reoperations.

AUTHORS' CONCLUSIONS

Implications for practice

The quality and quantity of information extracted from the randomised controlled trials performed to date is insufficient to make any firm conclusion on the optimum choice of arthroplasty for a hip fracture patient. There is some evidence to indicate that cementing a prosthesis in place may reduce pain in the limb and result in improved mobility and that a THR results in less residual pain and better function than an hemiarthroplasty. There is inadequate evidence to support or refute the use of either a bipolar prosthesis.

Implications for research

Further well conducted randomised trials with full reporting of outcomes, blinding of outcome assessors, adequate length of follow up and correct methodology are required to determine the optimum prosthesis (with or without cement) for treating a hip fracture.

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REFERENCES

References to studies included in this review

Baker 2006 ***{published and unpublished data}***

Baker RP, Squires B, Gargan MF, Bannister GC. A randomised controlled comparison of total hip arthroplasty and hemiarthroplasty in mobile independent patients with displaced intracapsular femoral neck fracture [abstract]. *Journal of Bone and Joint Surgery - British Volume* 2006;**88-B**(Supp III):431–2.

* Baker RP, Squires B, Gargan MF, Bannister GC. Total hip arthroplasty and hemiarthroplasty in mobile, independent patients with a displaced fracture of the femoral neck; a randomized, controlled trial. *Journal of Bone and Joint Surgery - American Volume* 2006;**88-A**:2583–9.

Blomfeldt 2007 ***{published data only}***

Blomfeldt R, Tornkvist H, Eriksson K, Soderqvist A, Ponzer S, Tidermark J. A randomised trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. *Journal of Bone and Joint Surgery - British Volume* 2007;**89-B**(2): 160–5.

Branfoot 2000 ***{published and unpublished data}***

Branfoot T, Faraj AA, Porter P. Cemented versus uncemented Thompson's prosthesis: a randomised prospective functional outcome study [abstract]. *Injury* 2000;**31**:280–1.

Calder 1996 ***{published data only}***

Calder SJ, Anderson GH, Gregg PJ. Bipolar hemiarthroplasty for displaced intracapsular hip fractures: a randomised prospective trial [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995; **77**(Suppl 2):214.

Calder SJ, Anderson GH, Harper WM, Gregg PJ. The place of bipolar hemiarthroplasty in displaced intracapsular hip fracture [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995; **77**(Suppl 1):6.

Calder SJ, Anderson GH, Harper WM, Gregg PJ. The use of bipolar hemi-arthroplasty in intracapsular hip fracture - a

prospective randomised trial [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995;**77**(Suppl 1):103.
Calder SJ, Anderson GH, Harper WM, Gregg PJ. The use of the Nottingham Health Profile in a randomised trial of treatment of displaced intracapsular hip fractures [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1994;**76**(Suppl 2 & 3):150.
Calder SJ, Anderson GH, Harper WM, Jagger C, Gregg PJ. A subjective health indicator for follow-up: A randomised trial after treatment of displaced intracapsular hip fractures. *Journal of Bone and Joint Surgery - British Volume* 1995;**77**(3):494–6.
* Calder SJ, Anderson GH, Jagger C, Harper WM, Gregg PJ. Unipolar or bipolar prosthesis for displaced intracapsular hip fracture in octogenarians. A randomised prospective study. *Journal of Bone and Joint Surgery - British Volume* 1996;**78**(3):391–4.
Warwick D, Learmonth ID, Whitehouse S. Unipolar or bipolar prosthesis for displaced intracapsular hip fracture. *Journal of Bone and Joint Surgery - British Volume* 1997;**79**:694–5.

Cornell 1988 ***{published data only}***
Cornell CN, Levine D, Odoherty J, Lyden J. Unipolar versus bipolar hemiarthroplasty for the treatment of femoral neck fractures in the elderly. *Clinical Orthopaedics and Related Research* 1998; **(348)**:67–71.

Davison 2001 ***{published data only}***
Calder SJ, Anderson GH, Gregg PJ. Bipolar hemiarthroplasty for displaced intracapsular hip fractures: a randomised prospective trial [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995; **77**(Suppl 2):214.
Calder SJ, Anderson GH, Harper WM, Gregg PJ. The place of bipolar hemiarthroplasty in displaced intracapsular hip fracture [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995; **77**(Suppl 1):6.
Calder SJ, Anderson GH, Harper WM, Gregg PJ. The use of bipolar hemi-arthroplasty in intracapsular hip fracture - a prospective randomised trial [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1995;**77-B**(Suppl I):103.
Calder SJ, Anderson GH, Harper WM, Gregg PJ. The use of the Nottingham Health Profile in a randomised trial of treatment of displaced intracapsular hip fractures [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1994;**76**(Suppl 2 & 3):150.
Calder SJ, Anderson GH, Harper WM, Jagger C, Gregg PJ. A subjective health indicator for follow-up: A randomised trial after treatment of displaced intracapsular hip fractures. *Journal of Bone and Joint Surgery - British Volume* 1995;**77**(3):494–6.
Davison J, Harper WM, Gregg PJ. Which treatment for the displaced fractures of the femoral neck? A prospective randomised comparison of three surgical procedures [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1997;**79**(Suppl 2):243–4.
* Davison JN, Calder SJ, Anderson GH, Ward G, Jagger C, Harper WM, et al.Treatment for displaced intracapsular fracture of the proximal femur: a prospective, randomised trial in patients aged 65 to 79 years. *Journal of Bone and Joint Surgery - British Volume* 2001; **83**(2):206–12.
Davison JNS, Harper WM, Gregg PJ. Treatment for displaced intracapsular fracture of the proximal femur. A prospective randomised trial in patients aged from 65 to 79 years [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1999;**81**(Suppl 2): 232.

Dorr 1986 ***{published data only}***
Dorr LD, Glousman R, Hoy AL, Vanis R, Chandler R. Treatment of femoral neck fractures with total hip replacement versus cemented and noncemented hemiarthroplasty. *Journal of Arthroplasty* 1986;**1**:21–8.

Emery 1991 ***{published data only}***
Emery RJ, Broughton NS, Desai K, Bulstrode CJ, Thomas TL. Bipolar hemiarthroplasty for subcapital fracture of the femoral neck. A prospective randomised trial of cemented Thompson and uncemented Moore stems. *Journal of Bone and Joint Surgery - British Volume* 1991;**73**:322–4.

Harper 1994 ***{published data only}***
Anderson GH, Dias JJ, Hoskinson J, Harper WM. A randomized study of the use of bone cement with Thompson's prosthesis in the treatment of intracapsular fractures of the femoral neck [Abstract]. *Journal of Bone and Joint Surgery - British Volume* 1992;**74**(Suppl 2): 132–3.
* Harper WM. *Treatment of intracapsular proximal femoral fractures. A prospective randomised trial comparing cemented and uncemented Thompson hemiarthroplasty in the treatment of displaced intracapsular proximal femoral fractures [dissertation]*. Leicester (UK): Univ. of Leicester, 1994.
Harper WM, Gregg PJ. The treatment of intracapsular proximal femoral fractures: A randomized prospective trial [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1992;**74**(Suppl 3):282.

Livesley 1993 ***{published data only}***
Livesley PJ, Srivastiva VM, Needoff M, Prince HG, Moulton AM. Use of a hydroxyapatite-coated hemiarthroplasty in the management of subcapital fractures of the femur. *Injury* 1993;**24**: 236–40.

Malhotra 1995 ***{published data only}***
Malhotra R, Arya R, Bhan S. Bipolar hemiarthroplasty in femoral neck fractures. *Archives of Orthopaedic and Trauma Surgery* 1995; **114**:79–82.

Raia 2003 ***{published data only}***
Chapman CB, Schweppe MW, Raia FJ, Rosenwasser MP. Bipolar versus unipolar prosthesis for displaced femoral neck fractures: is there at difference in quality of life and functional outcome?. American Academy of Orthopaedic Surgeons 68th Annual Meeting; 2001 Feb 28-March 4;San Francisco (CA). 2001:http://www.aaos.org/wordhtml/anmt2001/poster/pe054.htm (accessed 30/11/03).
* Raia FJ, Chapman CB, Herrera MF, Schweppe MW, Michelsen CB, Rosenwasser MP. Unipolar or bipolar hemiarthroplasty for femoral neck fractures in the elderly?. *Clinical Orthopaedics and Related Research* 2003;**(414)**:259–65.
Schweppe MW, Vitale MG, Yaron I, Herrera MF, Sollano JA, Michelsen CB, et al.Randomized evaluation of bipolar versus unipolar hemiarthroplasty for displaced femoral neck fractures in the elderly: preliminary results [abstract]. Trauma Association Annual Meeting;1998 Oct 8-10; Vancouver (BC). 1998:http://www.ota.org/education/amabstracts.htm (accessed 25/11/03).

Rosen 1992 ***{published data only}***
Rosen LL, Miller BJ, Dupuis PR, Jarzem P, Hadjipavlou A. A prospective randomized study comparing bipolar hip arthroplasty and hemiarthroplasty in elderly patients with subcapital fractures

[abstract]. *Journal of Bone and Joint Surgery - British Volume* 1992; **74**(Suppl 3):282.

Santini 2005 ***{published data only}***
Santini S, Rebeccato A, Bolgan I, Turi G. Hip fractures in elderly patients treated with bipolar hemiarthroplasty: comparison between cemented and cementless implants. *Journal of Orthopaedics & Traumatology* 2005;**6**:80–7.

Skinner 1989 ***{published data only}***
Ravikumar KJ, Marsh G, Jairaj P. Internal fixation vs hemiarthroplasty vs total hip replacement for displaced subcapital fractures of the femur - 13 year results of a prospective randomised study [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1998;**80**(Suppl 1):50–1.
Skinner FW, Ellory J, Riley D, Beaumont A. Displaced subcapital fractures of the femur: which operation?[abstract]. *Journal of Bone and Joint Surgery - British Volume* 1988;**70**(4):677.
* Skinner P, Riley D, Ellery J, Beaumont A, Coumine R, Shafighian B. Displaced subcapital fractures of the femur: a prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. *Injury* 1989;**20**(5):291–3.

Sonne-Holm 1982 ***{published data only}***
Sonne-Holm S, Dyrbye M, Walter S, Jensen JS. Bone scintigraphy in Moore hemiarthroplasty with and without cement following femoral neck fractures. A controlled study. *Acta Orthopaedica Scandinavica* 1983;**54**(2):194–7.
* Sonne-Holm S, Walter S, Jensen JS. Moore hemi-arthroplasty with and without bone cement in femoral neck fractures. A clinical controlled trial. *Acta Orthopaedica Scandinavica* 1982;**53**(6):953–6.

STARS 2006 ***{published data only}***
Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Displaced intracapsular hip fractures in fit, older people: a randomised comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. *Health Technology Assessment* 2005;**9**(41):iii-iv, ix-x, 1-65. [: http://www.ncchta.org/execsumm/summ941.htm]
* Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty. Treatment of displaced intracapsular hip fractures in healthy older patients. *Journal of Bone and Joint Surgery - American Volume* 2006;**88**(2):249–60.
Keating JF, Masson MA, Forbes JF, Scott NW, Grant A. Randomized trial of reduction and fixation versus bipolar hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures in the fit older patient [abstract]. Orthopaedic Trauma Association Annual Meeting; 2002 October 11-13; Toronto (Ontario). www.hwbf.org/ota/am/ota02/otapa/OTA02641.htm (accessed 17 June 2004).

Stock 1997 ***{published data only}***
Stock M, Halliday M, Wood D, Brennon J, Smith A. A randomised prospective trial comparing ceramic and Thompsons hemiarthroplasty in subcapital femoral fractures [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1997;**79**(Suppl 4):386.

Van Thiel 1988 ***{published data only}***
Van Thiel PH, Snellen JP, Jansen WBJ, Van de Slikke W. Moore prosthesis versus bipolar Bateman prosthesis: a prospective randomised clinical study [abstract]. *Journal of Bone and Joint Surgery - British Volume* 1988;**70**(4):677.

References to studies excluded from this review

Christie 1994 ***{published data only}***
Christie J, Burnett R, Potts HR, Pell AC. Echocardiography of transatrial embolism during cemented and uncemented hemiarthroplasty of the hip. *Journal of Bone and Joint Surgery. British Volume* 1994;**76**(3):409–12.

Clark 2001 ***{published data only}***
Clark DI, Ahmed AB, Baxendale BR, Moran CG. Cardiac output during hemiarthroplasty of the hip. A prospective, controlled trial of cemented and uncemented prostheses. *Journal of Bone and Joint Surgery. British Volume* 2001;**83**(3):414–8.

Faraj 1999 ***{published data only}***
Faraj AA, Branfoot T. Cemented versus uncemented Thompson's prostheses: a functional outcome study. *Injury* 1999;**30**(10):671–5.

Field 2005 ***{published data only}***
Field RE, Rushton N. Five-year clinical, radiological and post-mortem results of the Cambridge Cup in patients with displaced fractures of the neck of the femur. *Journal of Bone and Joint Surgery. British Volume* 2005;**87-B**(10):1344–51.

Gierer 2002 ***{published data only}***
Gierer P, Landes J, Grubwinkler M, Gradl G, Lob G, Andress H-J. The femoral neck fracture in the elderly patient - Cemented or cementless hip arthroplasty?[Die Schenkelhalsfraktur des alten menschenzementierte oder unzementierte endoprothetische versorgung?]. *Zentralblatt fur Chirurgie* 2002;**127**(6):514–8.

Graf 2000 ***{published data only}***
Graf C, Scherer MA, Gumppenberg S. Cemented vs. cement-free endoprothetics in the traumatology of older people [Zementierte vs. zementfreie endoprothetik in der traumatologie des alten menschen]. *Hefte zur der Unfallchirurg* 2000;**282**:343.

Johnson 2001 ***{published data only}***
Johnson MM, Thompson B, Hartford JM. Complications of cemented versus noncemented hemiarthroplasty for femoral neck fractures [abstract]. Mid-America Orthopaedic Association 19th annual meeting; 2001 April 18-22; Amelia Island (FL). http://www.jbjs.org/abstracts/maoa01/abs˙001.htm (accessed 24/11/03).

Karpman 1992 ***{published data only}***
Karpman RR, Lee TJ, Moore BM. Austin-Moore versus bipolar hemiarthroplasty for displaced femoral neck fractures: a randomized prospective study [abstract]. Annual Meeting of the American Academy of Orthopaedic Surgeons; 1992 Feb 20-25; Orlando (FL). http://www.aaos.org/wordhtml/anmeet92/scipro/ppr418.htm (accessed 23/02/01).

Leidinger 2002 ***{published data only}***
Leidinger W, Hoffmann G, Meierhofer JN, Wolfel R. Reduction of severe cardiac complications during implantation of cemented total hip endoprostheses in femoral neck fractures [Verminderung von schweren kardialen Komplikationen wahrend der Implantation von zementierten Hufttotalendoprothesen bei Oberschenkelhalsfrakturen]. *Unfallchirurg* 2002;**105**(8):675–9.

Pitto 2000 ***{published data only}***
Pitto RP, Blunk J, Kossler M. Transesophageal echocardiography and clinical features of fat embolism during cemented total hip arthroplasty. A randomized study in patients with a femoral neck

fracture. *Archives of Orthopaedic and Trauma Surgery* 2000;**120**(1-2):53–8.

Sadr 1977 ***{published data only}***
Sadr B, Arden GP. A comparison of the stability of Proplast-coated and cemented Thompson prostheses in the treatment of subcapital femoral fractures. *Injury* 1977;**8**:234–7.

References to studies awaiting assessment

Georgescu 2004 ***{published data only}***
Georgescu N, Iancu C, Trandabat C, Sirbu P, Alexa O. A prospective randomised study comparing two types of hemiarthroplasty for displaced fractures of the femoral neck in elderly patients [abstract]. *Journal of Bone and Joint Surgery - British Volume* 2004;**86**(Suppl 3):338.

References to ongoing studies

Bonke 1999 ***{published data only}***
Bonke H, Schnater J, Kleijnen J, Raaymakersk E. Hemiarthroplasty or total hip replacement for femoral neck fractures. A preliminary report of a randomized trial [abstract]. *Hefte zur der Unfallchirurg* 1999;**272**:176–7.

Moroni 2002 ***{published data only}***
Moroni A, Pegreffi F, Romagnoli M, Giannini S. Cemented vs uncemented fixation of femoral neck fractures in osteoporotic patients. A prospective randomized study [abstract]. *Hip International* 2002;**12**(2):245–6.

Parker ***{unpublished data only}***
Parker M. Trial of cemented versus uncemented arthroplasty for intracapsular hip fractures. In: National Research Register, Oxford: Update Software. Available from: http://www.nrr.nhs.uk/ViewDocument.asp?ID=N0181123527 (accessed 17 May 2006).

Additional references

Higgins 2003
Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327**:557–60.

Higgins 2005
Higgins JPT, Green S, editors. Highly sensitive search strategies for identifying reports of randomized controlled trials in MEDLINE. Cochrane Handbook for Systematic Reviews of Interventions 4.2.5 [updated May 2005]; Appendix 5b. www.cochrane.org/resources/handbook/hbook.htm (accessed 10 January 2007).

Lu-Yao 1994
Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE. Outcome after displaced fracture of the femoral neck. A meta-analysis of one hundred and six published reports. *Journal of Bone and Joint Surgery. American Volume* 1994;**76**(1):15–25.

Moore 1952
Moore AT. Metal hip joint: a new self-locking vitallium prosthesis. *Southern Medical Journal* 1952;**45**:1015–9.

Ravikumar 1998
Ravikumar KJ, Marsh G, Jairaj P. Internal fixation vs hemiarthroplasty vs total hip replacement for displaced subcapital fractures of the femur - 13 year results of a prospective randomised study [Abstract]. *Journal of Bone and Joint Surgery. British Volume* 1998;**80**(Suppl 1):50–1.

Thompson 1954
Thompson FR. Two and a half years' experience with a vitallium intramedullary hip prosthesis. *Journal of Bone and Joint Surgery. American Volume* 1954;**36**:489–500.

References to other published versions of this review

Parker 2001
Parker MJ, Gurusamy K. Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. *Cochrane Database of Systematic Reviews* 2001, Issue 3.[Art. No.: CD001706. DOI: 10.1002/14651858.CD001706.pub3]

Parker 2004
Parker MJ, Gurusamy K. Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. *Cochrane Database of Systematic Reviews* 2004, Issue 2.[Art. No.: CD001706. DOI: 10.1002/14651858.CD001706.pub3]

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Baker 2006

Methods	Method of randomisation: sealed opaque numbered envelopes. Methodological quality score: 10/12.
Participants	Orthopaedic unit in Bristol, UK. 81 people with an intracapsular fracture. Mean age: 75 years (range 66-86). Percentage male: 21%. Follow up for 8-20 months. Loss to follow up: 3%.
Interventions	Cemented CPT collarless hemiarthroplasty versus cemented CPT collarless total hip replacement. Surgical transgluteal approach for all cases.
Outcomes	Length of surgery Dislocation Fracture around implant Reoperation Radiological signs of acetabular wear Radiological signs of cement wear Superficial wound infection Deep wound infection Mortality Pulmonary embolism Deep vein thrombosis Pneumonia Pressure sores Hematemesis Other medical complications Oxford hip score Self reported walking distance Short form 36 physical and mental score
Notes	Additional information on trial methodology provided by the authors. The standard deviations for the outcomes of length of surgery, Oxford Hip Score, walking distance and short form 36 were estimated from the P values quoted, using the formula in the Cochrane Handbook.

Risk of bias

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

Blomfeldt 2007

Methods	Method of randomisation: sealed envelopes Methodological quality score: 10/12.
Participants	Orthopaedic unit in Stockholm, Sweden. 120 patients with an intracapsular fracture. Mean age: 81 years (range 70-90). Percentage male: 16%. Follow up for 12 months. Loss to follow up: none.
Interventions	Cemented Exeter bipolar hemiarthroplasty versus Exeter stem and OGEE cup total hip arthroplasty. All prosthesis inserted with cement using an anterolateral approach.
Outcomes	Length of surgery Operative blood loss Mean volume of blood transfused Dislocation Later fracture of the femur Superficial wound infection Deep wound infection Re-operations Deep vein thrombosis Pneumonia Pressure sores Atrial fibrillation Myocardial infarction Congestive cardiac failure Mortality at 1 year Harris hip score (total, pain, function, deformity, movement) Ceder disability index Health related quality of life
Notes	

Risk of bias

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

Branfoot 2000

Methods	Method of randomisation: sealed envelopes. Methodological quality score: 8/12.
Participants	Orthopaedic unit in Yorkshire, UK. 91 people with an intracapsular fracture. Mean age: 83 years (range 63-97). Percentage male: 11%.

Branfoot 2000 (*Continued*)

	Follow up for 8-20 months. Loss to follow up: none.
Interventions	Cemented Thompson prosthesis versus uncemented Thompson prosthesis. Surgical approach anterolateral for all cases.
Outcomes	Dislocation Operative fracture femur Mortality Pain at follow up Limp Use of walking aids Activities Mobility
Notes	Study reported as a conference abstract with additional information provided by the authors.

Risk of bias

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

Calder 1996

Methods	Method of randomisation: computer generated random numbers. Methodological quality score: 9/12.
Participants	Orthopaedic unit in Leicester, UK. 250 people with an intracapsular fracture. Mean age: not stated. Median age: 85 years (range not stated). Interquartile range: 82-88 years. All over 80 years. Percentage male: 14%. Follow up for a median of 594/694 days (mean not stated). Loss to follow up: not stated.
Interventions	Cemented Thompson prosthesis versus cemented Monk prosthesis. Surgical approach not stated.
Outcomes	Dislocation Acetabular erosion Deep wound infection Length of hospital stay Mortality Pain at follow up Failure to return to same residence Satisfaction with operation Limp

Calder 1996 (*Continued*)

	Harris Hip Score Nottingham Health Profile
Notes	See Calder SJ et al. J Bone Joint Surg Br 1995;77(3):494-6 for methods. Patients aged less than 80 years randomised to three arms (internal fixation v unipolar prosthesis v bipolar prosthesis and those aged more than 80 years to two arms (unipolar prosthesis v bipolar prosthesis). Calder 1996 reports results for over 80 year olds. Results for under 80 yr olds are reported in Davison 2001 which has been included as a separate study.

Risk of bias

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

Cornell 1988

Methods	Method of randomisation: sealed envelopes containing random generated numbers. Envelopes opened in the operating room. Methodological quality score: 8/12.
Participants	Orthopaedic unit in New York, USA. 48 people with an intracapsular fracture. Mean age: 78 years (range 62-97). Percentage male: 25%. Follow up for six months. Loss to follow up: not stated.
Interventions	Cemented modular unipolar hemiarthroplasty versus cemented modular bipolar hemiarthroplasty (all implant stems identical) All prosthesis inserted via posterior approach.
Outcomes	Operative blood loss Superficial wound infection Dislocation Deep vein thrombosis Length of hospital stay Mortality Hip movements Gait analysis Hip score assessment
Notes	Paper states that the results presented are a preliminary report of the first patients entered in the study with a short follow up. Further information requested from the authors.

Risk of bias

Item	Authors' judgement	Description

Cornell 1988 (*Continued*)

Allocation concealment?	Yes	A - Adequate

Davison 2001

Methods	Method of randomisation: computer generated random numbers. Methodological quality score: 7/12.
Participants	Orthopaedic unit in Leicester, UK. 187 patients with a intracapsular fracture. Mean age: not stated (range not stated). Median ages 75 and 76 years. All aged 65-79 years. Percentage male: 24%. Follow up for minimum two years. Loss to follow up: 18%.
Interventions	Cemented Thompson prosthesis versus cemented Monk prosthesis. Both prosthesis had identical stems. All inserted via a Hardinge direct lateral approach.
Outcomes	Acetabular erosion Dislocation Deep wound sepsis Reoperations Mortality Nottingham Health Profile Harris Hip Score Bartel Score Return to pre-injury state Patient satisfaction
Notes	See Calder SJ et al. J Bone Joint Surg Br 1995;77(3):494-6 for methods. Davison 2001 reports on participants less than 80 years of age randomised to three arms (internal fixation versus unipolar prosthesis versus bipolar prosthesis). Participants who had internal fixation are not included in this review but included in the Cochrane review "Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults".

Risk of bias

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

Dorr 1986

Methods	Method of randomisation: odd or even hospital record number. Methodological quality score: 6/12
Participants	Orthopaedic unit in California, USA. 89 patients with a intracapsular fracture.

Dorr 1986 (*Continued*)

	Mean age: 69 years (range 41-89 years) . Percentage male: 35%. Follow up for a range of two to four years. Loss to follow up: text suggests none.
Interventions	Cemented bipolar hemiarthroplasty versus uncemented bipolar hemiarthroplasty versus cemented total hip replacement. Exact type of prosthetic stem not stated. All prosthesis inserted via posterior approach.
Outcomes	Operative blood loss Superficial wound infection Dislocation Superficial wound infection Deep wound infection Reoperations Length of hospital stay Mortality Pain at follow up Failure to return to same residence Use of walking aids X-ray findings at follow up Gait analysis
Notes	

Risk of bias

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

Emery 1991

Methods	Method of randomisation: sealed envelope opened at the time of operation. Methodological quality score: 8/12.
Participants	Orthopaedic unit in Essex, UK. 53 patients with a intracapsular fracture. Mean age: 79 years (range 61-96). Percentage male: 13%. Follow up for a mean of 17 months. Loss to follow up: no patients lost to follow up other than by death in 14 cases.
Interventions	Cemented bipolar Thompson prosthesis versus uncemented Moore bipolar. Surgical approach not stated.

Emery 1991 (*Continued*)

Outcomes	Length of operation Operative blood loss Superficial wound infection Pulmonary embolism Pressure sores Pneumonia Other medical complications Mortality at 2 weeks, 3 and 17 months Hospital stay Pain at follow up Failure to return to same residence Use of walking aids
Notes	

Risk of bias

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

Harper 1994

Methods	Method of randomisation: even or odd number of medical record. Methodological quality score: 3/12.
Participants	Orthopaedic unit in Leicester, UK. 137 patients with a intracapsular fracture. Mean age: 83 years (range 60-100). Percentage male: 26%. Follow up for a mean of 12 months. Loss to follow up: not stated
Interventions	Cemented Thompson prosthesis versus Thompson prosthesis without cement. Surgical approach direct lateral without osteotomy of the trochanter.
Outcomes	Dislocation Superficial wound sepsis Deep wound sepsis Intra-operative deaths Length of orthopaedic ward stay Mortality Pain at follow up
Notes	Most results for the study from the thesis of Harper. The number of trial participants was stated as 140 in the abstracts but as 137 in the thesis. Also abstract states there were two deaths in the recovery room in the cemented group. Thesis mentions only one intra-operative death.

Harper 1994 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	No	C - Inadequate

Livesley 1993

Methods	Method of randomisation: week of admission. Methodological quality score: 5/12.
Participants	Orthopaedic unit in Mansfield, UK. 82 patients with an intracapsular fracture. Mean age: 81 years (range not stated). Percentage male: not stated. Follow up for 12 months. Loss to follow up: none
Interventions	Uncemented Austin Moore stem bipolar hemiarthroplasty versus hydroxyapatite coated Furlong stem bipolar hemiarthroplasty. Surgical approach not stated.
Outcomes	Dislocation Operative fracture of the femur Later fracture of the femur Wound infection Acetabular wear Reoperations Pressure sores Other medical complications Hospital stay Pain at follow up Mobility Use of walking aids Hip flexion
Notes	

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	No	C - Inadequate

Malhotra 1995

Methods	Method of randomisation: not stated. Methodological quality score: 6/12.
Participants	Orthopaedic unit in New Delhi, India. 68 patients with an intracapsular fracture. Mean age: 67 years (range not stated). Percentage male: 56%. Follow up for a mean of 23/26 months. Range 9-47 months. Loss to follow up: none.
Interventions	Uncemented Austin Moore prosthesis versus uncemented Bateman bipolar prosthesis (Moore stem). Surgical approach not stated.
Outcomes	Length of operation Operative blood loss Dislocation Deep wound infection Acetabular wear Range of hip movement Reoperations Hospital stay Pain at follow up Mobility Grading of outcome
Notes	

Risk of bias

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

Raia 2003

Methods	Method of randomisation: computer generated random numbers. Methodological quality score: 6/12.
Participants	Orthopaedic unit in New York, USA. 115 patients with a intracapsular fracture. Mean age: 82 years (range 65-101). Percentage male: 28%. Follow up: one year. Loss to follow up: 13 (11%).
Interventions	Cemented Unitrax unipolar prosthesis versus cemented Centrax bipolar prosthesis (Howmedica Rutherford, NJ). All inserted via a posterior-lateral surgical approach.

Raia 2003 (*Continued*)

Outcomes	Operative blood loss Number of patients transfused Dislocation Deep wound infection Reoperations Length of acute hospital stay Mortality Failure to regain mobility Short form 36 (SF36) assessment score Musculoskeletal functional assessment score
Notes	

Risk of bias

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

Rosen 1992

Methods	Method of randomisation: not stated. Methodological quality score: 2/12.
Participants	Orthopaedic unit in Montreal, Canada. 96 patients with 102 intracapsular fractures. Mean age: not stated (range not stated). Percentage male: not stated. Follow up for two years. Loss to follow up: four patients lost to follow up but by two years only 25 patients with 27 arthroplasties were reviewed due to deaths and loss to follow up.
Interventions	Austin Moore prosthesis versus Bateman prosthesis. Not stated if with or without cement or which surgical approach used.
Outcomes	Length of operation Operative blood loss Intra-operative complications Post-operative complications Reoperations Mortality Pain at follow up Mobility
Notes	Trial only reported as a conference abstract with limited information.

Risk of bias

Rosen 1992 (*Continued*)

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

Santini 2005

Methods	Method of randomisation: alternate days. Methodological quality score: 4/12
Participants	Orthopaedic unit in Vicenza, Italy. 106 patients with an intracapsular fracture. Mean age: 81 years. Percentage male: 23%. Follow up for 12 months. Loss to follow up: not stated.
Interventions	Cemented bipolar hemiarthroplasty versus uncemented bipolar hemiarthroplasty. Surgical approach lateral for all cases.
Outcomes	Dislocation Operative fracture femur Units of blood transfused Deep wound infection Cardiac complications Gastric complications Pulmonary embolism/pneumonia Pressure sores Length of hospital stay Cost of treatment Mortality at one year Functional score based on walking, personal and daily activities and living conditions
Notes	

Risk of bias

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

Skinner 1989

Methods	Method of randomisation: day of week when admitted. Methodological quality score: 4/12.

Skinner 1989 (*Continued*)

Participants	Orthopaedic unit in Croydon, UK. 180 people with an acute intracapsular fracture. Mean age: 81 years (range: not stated). Percentage male: 10%. Follow up for 12 months. Loss to follow up: 7% were lost to follow up by 13 years. Loss to follow up at one year not stated.
Interventions	Uncemented Austin Moore prosthesis versus cemented Howes II total hip replacement inserted. All prosthesis inserted via a posterior-lateral approach.
Outcomes	Dislocation Deep wound infection Incidence of second anaesthetic Reoperations Mortality Pain at follow up Mobility Harris Hip Score
Notes	Trial also included a third group which was internal fixation. These patients have been considered in a separate Cochrane review "Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults". The report of Ravikumar 1998 is a long term follow-up report of patients.

Risk of bias

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

Sonne-Holm 1982

Methods	Method of randomisation: not stated. Methodological quality score: 6/12.
Participants	Orthopaedic unit in Hellerup, Denmark. 112 patients with an acute intracapsular fracture. Mean age: 76 years (study criteria was patients aged over 70 years but range was 62-95 years). Percentage male: 33%. Follow up for 12 months. The results for 37 participants were excluded as they had either died, moved away, had the wrong implant inserted or refused to attend.
Interventions	Cemented Moore prosthesis versus Moore prosthesis without cement. All prosthesis inserted using a posterior approach.
Outcomes	Superficial wound infection Deep wound infection Mortality at 6 weeks

Sonne-Holm 1982 (*Continued*)

	Pain Hip movement Mobility Bone scintimetry
Notes	The bone scintimetry was for a subgroup of 29 cases and reported as a separate article (Sonne-Holm 1993).

Risk of bias

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

STARS 2006

Methods	Randomisation by: computer telephone randomisation service. Methodological quality score: 8/12.
Participants	11 hospitals in Scotland, UK. 138 patients with an acute intracapsular fracture. Mean age: 75 years (range 60-93). Male: 32 (23%). Follow up for 24 months. Loss to follow up: 0.7% Inclusion criteria: mobile, mental text score equal to or more than 7/10, age 60 and above, no serious concomitant disease, displaced intracapsular fracture Exclusion criteria: those not satisfying the above criteria
Interventions	Cemented bipolar hemiarthroplasty versus cemented total hip replacement.
Outcomes	Length of surgery in minutes Dislocation Reoperations Superficial wound infection Deep sepsis Deep vein thrombosis (DVT) Pulmonary embolism Cerebrovascular accident Septicaemia Other medical complications Mortality at 4, 12, 24 months Pain at 4, 12, 24 months Walking score at 4,12, 24 months Function score at 4,12, 24 months EQ5D score at 4,12, 24 months Estimated cost for the trial procedures

Notes	Additional information supplied by trialists. Results of comparison with internal fixation were considered in the Cochrane review "Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults". Four of the hemiarthroplasty cases were unipolar rather than bipolar. Approximately 10% of those allocated to THR received a bipolar hemiarthroplasty and a further 6% received a unipolar hemiarthroplasty.

Risk of bias

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

Stock 1997

Methods	Method of randomisation: not stated. Methodological quality score: 1/12.
Participants	Orthopaedic unit in Western Australia. 69 patients with a hip fracture. Mean age: not stated (range not stated). Percentage male: not stated. Follow up and loss to follow up: not stated.
Interventions	Ceramic head Thompson hemiarthroplasty versus metal head Thompson. Not stated if with or without cement or which surgical approach used.
Outcomes	Harris Hip Score
Notes	Trial only reported as a conference abstract with limited information.

Risk of bias

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

Van Thiel 1988

Methods	Method of randomisation: not stated. Methodological quality score: 1/12.
Participants	Orthopaedic unit in Amsterdam, Holland. 93 patients with an intracapsular fracture. Mean age: not stated (range not stated). Percentage male: not stated. Follow up for three years. Loss to follow up: not stated.

Van Thiel 1988 (*Continued*)

Interventions	Austin Moore prosthesis versus Bateman prosthesis. Not stated if with or without cement or which surgical approach used.
Outcomes	Harris Hip Score Radiographic findings
Notes	Trial only reported as a conference abstract with limited information

Risk of bias

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

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

Christie 1994	This randomised trial compared 10 patients allocated to an uncemented Austin Moore hemiarthroplasty with 10 to a cemented Hastings hemiarthroplasty. The outcome measures were emboli within the heart chambers as seen on trans-oesophageal echocardiography and fat in blood samples taken from the right atrium. Cemented arthroplasty produced greater and more prolonged embolic cascades, pulmonary hypertension, diminished oxygen tension and saturation. This biometric study was excluded due to the absence of clinical outcome measures.
Clark 2001	This was a prospective controlled study for 20 patients, treated with either a cemented or an uncemented hemi-arthroplasty. Cardiac output was measured using a transoesophageal Doppler probe. For those treated using cement there was a transient but significant reduction in cardiac output and stroke volume. The study was excluded as there was no randomisation of patients.
Faraj 1999	This study involved 101 patients with an intracapsular femoral neck fracture treated by Thompson's prosthesis. The prosthesis was fixed in the femoral shaft with cement in 23 people and was inserted uncemented in 78 people. There was no statistically significant difference between groups for the Harris Hip Scores or any of the individual components of this score. The study was excluded as there was no randomisation of patients; the use of cement was at the operating surgeons' preference.
Field 2005	This was a randomised study of 24 patients with a displaced intracapsular fracture treated with a cemented Thompson hemiarthroplasty and a hydroxyapatite coated Cambridge acetabular cup against 26 treated with the same implants but the acetabular cup was not coated with hydroxyapatite. Five revision operations were required in the group without the hydroxyapatite coating against none in the other group. The study was excluded because of the limited number of cases using what is at present an experimental new cup.
Gierer 2002	This report compared 35 patients treated with a cemented hip prosthesis with 37 patients with a cementless modular hip prosthesis. Both groups had no difference in their Harris Hip Score at follow up. The study was excluded because the decision on the use of cement was at the surgeon's preference and there was no randomisation of patients.
Graf 2000	This was a comparison of 45 cemented prostheses with 44 uncemented prostheses. It was excluded as it was not a randomised study.
Johnson 2001	This study reported a series of 80 patients with a femoral neck fracture with the first 40 treated with a uncemented unipolar prosthesis and the next 40 with a cemented unipolar prosthesis. The study was excluded as it was not a randomised trial.
Karpman 1992	This study was only reported in the conference proceedings of the American Academy of Orthopaedic Surgeons. The study involved 125 patients randomised to either an Austin Moore prosthesis, cemented bipolar or uncemented bipolar. Follow up of patients ranged from two to five years (mean 3.7 years). Results were presented without data and stated that there was "no significant difference between any of the groups with regard to functional outcome." The study was excluded, as there was inadequate reporting of the trial. Attempts were made to contact the trialists for further information, without success.
Leidinger 2002	This was a randomised study of 72 patients. In the control group of 36 patients, surgical repair was performed with palacos mixed conventionally. In the second group (vacuum group) of 36 patients, surgical repair was performed with palacos mixed in vacuum. Invasive haemodynamic monitoring and transoesophageal echocardiography was performed in all cases. Those in the vacuum group had a lower incidence of echocardiographical changes (86%

(*Continued*)

	versus 14%) and clinical complications (53% versus 11%). Mortality in the control group was 14% compared with 3% in the vacuum group. The study was excluded, as it was not within the remit of this review which is choice of arthroplasty or use of cement. Variations of cementing technique are not included.
Pitto 2000	This was a randomised study of 40 patients in which, for 20 patients, the femoral component was cemented using a contemporary technique. For the other 20 patients, a drainage hole was placed in the trochanteric region, along the prolongation of the linea aspera and a distal hole was placed 2 cm below the tip of the femoral component. The medullary cavity was then aspirated during cement insertion. Embolic phenomena were documented intraoperatively by continuous transoesophageal echocardiographic imaging of the right atrium and ventricle. Patients in the control group showed more severe and longer-lasting episodes of embolism than patients of the bone vacuum group. No other outcome measures were given. The study was excluded because of the small numbers and lack of other outcome measures.
Sadr 1977	This was a comparison of 20 patients with an intracapsular fracture treated using Thompson prosthesis coated with Proplast, compared with 20 patients treated using a cemented Thompson prosthesis. The study stated patients were allocated to one of the groups by a "random selection", but it remained unclear as to the exact method of randomisation. Radiographic loosening occurred in one case of the cemented group versus nine in the Proplast group. Two cases of ectopic calcification and one dislocation were also reported in the Proplast group. Mortality at one year was four in the Proplast group and nine in the uncemented group. Functional outcome for the survivors (excluding the two patients lost to follow up) showed no difference between groups. The study was excluded for the following reasons. 1. It was not possible to be confident that this was a randomised study rather than a case comparison study. 2. The use of Proplast coated prosthesis is no longer prevalent. 3. The total number of patients in the study is small (40) with limited reporting of outcomes for the 25 patients assessed at follow up.

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

Bonke 1999

Trial name or title	Hemiarthroplasty or total hip replacement for femoral neck fractures.
Methods	
Participants	Patients aged 70 or over with a displaced intracapsular fracture of the hip. Target sample size 400 participants.
Interventions	Hemiarthroplasty with total hip replacement
Outcomes	Annual follow up for five years
Starting date	March 1995
Contact information	
Notes	English abstract

Moroni 2002

Trial name or title	Cemented vs uncemented fixation of femoral neck fractures in osteoporotic patients. A prospective randomised study
Methods	
Participants	Elderly patients with a displaced femoral neck fracture
Interventions	Cemented arthroplasty versus HA coated uncemented implant
Outcomes	Harris Hip score Mortality Dislocation Revision surgery
Starting date	
Contact information	
Notes	

Parker

Trial name or title	Trial of cemented versus uncemented arthroplasty for intracapsular hip fractures
Methods	
Participants	Elderly patients with a displaced intracapsular fracture of the hip

Parker (*Continued*)

Interventions	Cemented Thompson prosthesis versus uncemented Austin Moore
Outcomes	Operative complications Medical complications Hospital stay Mortality Pain Regain of function
Starting date	January 2001 350 patients recruited to date. Completion date around 2010
Contact information	Mr M Parker Peterborough & Stamford Hospitals NHS Foundation Trust Peterborough District Hospital Thorpe Road Peterborough PE3 6DA England E-mail: martyn.parker@pbh-tr.nhs.uk
Notes	M Parker is lead author of this review

DATA AND ANALYSES

Comparison 1. Cemented versus uncemented prosthesis

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	2	159	Mean Difference (IV, Fixed, 95% CI)	10.75 [2.38, 19.12]
1.1 Cemented Thompson bipolar versus uncemented Moore bipolar	1	53	Mean Difference (IV, Fixed, 95% CI)	8.0 [-1.82, 17.82]
1.2 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	106	Mean Difference (IV, Fixed, 95% CI)	18.02 [2.03, 34.01]
2 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Cemented Thompson bipolar versus uncemented Moore bipolar	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Mean units blood transfused	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Peri-operative death	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Cemented Thompson versus uncemented Thompson	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Dislocation	4	390	Risk Ratio (M-H, Fixed, 95% CI)	2.00 [0.55, 7.26]
5.1 Cemented Thompson versus uncemented Thompson	2	234	Risk Ratio (M-H, Fixed, 95% CI)	1.83 [0.36, 9.20]
5.3 Cemented bipolar versus uncemented bipolar hemiarthroplasty	2	156	Risk Ratio (M-H, Fixed, 95% CI)	2.31 [0.27, 19.96]
6 Superficial wound infection	4	358	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.26, 3.30]
6.1 Cemented Thompson versus uncemented Thompson	1	143	Risk Ratio (M-H, Fixed, 95% CI)	0.57 [0.10, 3.32]
6.2 Cemented Moore versus uncemented Moore	1	112	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.07, 16.16]
6.3 Cemented Thompson bipolar versus uncemented Moore bipolar	1	53	Risk Ratio (M-H, Fixed, 95% CI)	2.89 [0.12, 67.96]
6.4 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	50	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7 Deep sepsis	4	411	Risk Ratio (M-H, Fixed, 95% CI)	1.35 [0.26, 6.91]
7.1 Cemented Thompson versus uncemented Thompson	1	143	Risk Ratio (M-H, Fixed, 95% CI)	2.58 [0.11, 62.21]
7.2 Cemented Moore versus uncemented Moore	1	112	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.30]

7.4 Cemented bipolar versus uncemented bipolar hemiarthroplasty	2	156	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.12, 72.02]
8 Reoperations - minor	2	141	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.13, 7.50]
8.1 Cemented Thompson versus uncemented Thompson	1	91	Risk Ratio (M-H, Fixed, 95% CI)	0.46 [0.02, 11.03]
8.3 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	50	Risk Ratio (M-H, Fixed, 95% CI)	1.84 [0.09, 36.05]
9 Reoperations - major	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Medical complications	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
10.1 Pulmonary embolism	1	53	Risk Ratio (M-H, Fixed, 95% CI)	4.82 [0.24, 95.88]
10.2 Deep vein thrombosis	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10.3 Pneumonia	1	54	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.22, 4.52]
10.4 Pulmonary embolism or pneumonia	1	106	Risk Ratio (M-H, Fixed, 95% CI)	1.33 [0.31, 5.67]
10.5 Myocardical infarction	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10.6 Pressure sores	2	159	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.20, 3.03]
11 All reported medical complications	2	159	Risk Ratio (M-H, Fixed, 95% CI)	1.11 [0.71, 1.75]
11.1 Cemented Thompson bipolar versus uncemented Moore bipolar	1	53	Risk Ratio (M-H, Fixed, 95% CI)	1.54 [0.58, 4.10]
11.2 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	106	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.60, 1.66]
12 Length of hospital stay	3	296	Mean Difference (IV, Fixed, 95% CI)	-0.95 [-2.82, 0.91]
12.1 Cemented Thompson versus uncemented Thompson	1	143	Mean Difference (IV, Fixed, 95% CI)	-2.18 [-4.80, 0.44]
12.2 Cemented Thompson bipolar versus uncemented Moore bipolar	1	47	Mean Difference (IV, Fixed, 95% CI)	2.30 [-3.50, 8.10]
12.3 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	106	Mean Difference (IV, Fixed, 95% CI)	-0.23 [-3.21, 2.75]
13 Mortality less than 1 month	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
13.1 Cemented Thompson bipolar versus uncemented Moore bipolar	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
14 Mortality 1-3 months	3	308	Risk Ratio (M-H, Fixed, 95% CI)	1.29 [0.76, 2.20]
14.1 Cemented Thompson versus uncemented Thompson	1	143	Risk Ratio (M-H, Fixed, 95% CI)	1.71 [0.68, 4.32]
14.2 Cemented Moore versus uncemented Moore	1	112	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.49, 2.19]
14.3 Cemented Thompson bipolar versus uncemented Moore bipolar	1	53	Risk Ratio (M-H, Fixed, 95% CI)	1.28 [0.32, 5.19]
15 Mortality one year	4	393	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.67, 1.34]

15.1 Cemented Thompson versus uncemented Thompson	2	234	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.56, 1.40]
15.2 Cemented Thompson bipolar versus uncemented Moore bipolar	1	53	Risk Ratio (M-H, Fixed, 95% CI)	1.28 [0.52, 3.19]
15.3 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	106	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.48, 1.78]
16 Failure to regain mobility	3	147	Risk Ratio (M-H, Random, 95% CI)	0.52 [0.25, 1.11]
16.1 Cemented Moore versus uncemented Moore	1	58	Risk Ratio (M-H, Random, 95% CI)	0.96 [0.62, 1.48]
16.2 Cemented Thompson bipolar versus uncemented Moore bipolar	1	39	Risk Ratio (M-H, Random, 95% CI)	0.53 [0.30, 0.93]
16.3 Cemented bipolar versus uncemented bipolar hemiarthroplasty	1	50	Risk Ratio (M-H, Random, 95% CI)	0.23 [0.10, 0.53]
17 Pain at early follow up (3 months)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
17.1 Cemented Moore versus uncemented Moore	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
18 Pain at 1-2 years	2	97	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.31, 0.81]
18.1 Cemented Moore versus uncemented Moore	1	58	Risk Ratio (M-H, Fixed, 95% CI)	0.63 [0.33, 1.22]
18.2 Cemented Thompson bipolar versus uncemented Moore bipolar	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.39 [0.20, 0.79]
19 Failure to return home	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
19.1 Cemented Thompson bipolar versus uncemented Moore bipolar	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 2. Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dislocation	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Operative fracture femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

4 Reoperations - minor	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Reoperations - major	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Pressure sores	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7 Medical complications	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Mortality - 30 days	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Mortality - 1 year	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Failure to return back home at 1 year	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
10.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11 Failure to be able to shop at 1 year	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
11.1 Bipolar Moore stem versus bipolar hydroxyapatite coated Furlong	1	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 3. Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dislocation	5	668	Risk Ratio (M-H, Fixed, 95% CI)	1.09 [0.36, 3.31]
1.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.06, 13.64]
1.2 Cemented unipolar versus cemented bipolar	2	163	Risk Ratio (M-H, Fixed, 95% CI)	1.40 [0.21, 9.20]
1.3 Cemented Thompson unipolar versus cemented Monk bipolar	2	437	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.20, 4.93]

2 Dislocation requiring open reduction	4	418	Risk Ratio (M-H, Fixed, 95% CI)	0.32 [0.03, 3.07]
2.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	0.30 [0.01, 7.05]
2.2 Cemented unipolar versus cemented bipolar	2	162	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.3 Cemented Thompson unipolar versus cemented Monk bipolar	1	188	Risk Ratio (M-H, Fixed, 95% CI)	0.36 [0.01, 8.61]
3 Acetabular erosion on X-rays	3	505	Risk Ratio (M-H, Fixed, 95% CI)	3.83 [0.81, 18.15]
3.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	4.46 [0.22, 89.56]
3.3 Cemented Thompson unipolar versus cemented Monk bipolar	2	437	Risk Ratio (M-H, Fixed, 95% CI)	3.61 [0.59, 22.28]
4 Acetabular erosion requiring revision arthroplaty	3	505	Risk Ratio (M-H, Fixed, 95% CI)	2.97 [0.47, 18.85]
4.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	4.46 [0.22, 89.56]
4.3 Cemented Thompson unipolar versus cemented Monk bipolar	2	437	Risk Ratio (M-H, Fixed, 95% CI)	2.16 [0.20, 23.37]
5 Deep sepsis	4	620	Risk Ratio (M-H, Fixed, 95% CI)	1.34 [0.50, 3.62]
5.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	4.46 [0.22, 89.56]
5.2 Cemented unipolar versus cemented bipolar	1	115	Risk Ratio (M-H, Fixed, 95% CI)	2.75 [0.11, 66.23]
5.3 Cemented Thompson unipolar versus cemented Monk bipolar	2	437	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.29, 2.99]
6 Reoperations - minor	3	370	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.22, 4.31]
6.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	2.68 [0.11, 63.45]
6.2 Cemented unipolar versus cemented bipolar	1	115	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.06, 14.30]
6.3 Cemented Thompson unipolar versus cemented Monk bipolar	1	187	Risk Ratio (M-H, Fixed, 95% CI)	0.54 [0.05, 5.84]
7 Reoperations - major	3	370	Risk Ratio (M-H, Fixed, 95% CI)	1.63 [0.51, 5.25]
7.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	3.56 [0.42, 30.19]
7.2 Cemented unipolar versus cemented bipolar	1	115	Risk Ratio (M-H, Fixed, 95% CI)	2.75 [0.11, 66.23]
7.3 Cemented Thompson unipolar versus cemented Monk bipolar	1	187	Risk Ratio (M-H, Fixed, 95% CI)	0.72 [0.12, 4.20]
8 Reoperations - any reason	3	370	Risk Ratio (M-H, Fixed, 95% CI)	1.41 [0.54, 3.69]
8.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	4.44 [0.55, 36.06]
8.2 Cemented unipolar versus cemented bipolar	1	115	Risk Ratio (M-H, Fixed, 95% CI)	1.83 [0.17, 19.66]

8.3 Cemented Thompson unipolar versus cemented Monk bipolar	1	187	Risk Ratio (M-H, Fixed, 95% CI)	0.65 [0.16, 2.63]
9 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Cemented unipolar versus cemented bipolar	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Mortality - 6 months	3	366	Risk Ratio (M-H, Fixed, 95% CI)	1.13 [0.73, 1.76]
10.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10.2 Cemented unipolar versus cemented bipolar	1	48	Risk Ratio (M-H, Fixed, 95% CI)	1.1 [0.11, 11.21]
10.3 Cemented Thompson unipolar versus cemented Monk bipolar	1	250	Risk Ratio (M-H, Fixed, 95% CI)	1.13 [0.72, 1.78]
11 Mortality 1-2 years	3	433	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.64, 1.26]
11.1 Austin Moore unipolar versus Moore bipolar	1	68	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11.2 Cemented Thompson unipolar versus cemented Monk bipolar	2	365	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.64, 1.26]
12 Failure to regain moblility	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
12.2 Cemented unipolar versus cemented bipolar	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 4. Uncemented hemiarthroplasty versus total hip replacement

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Surgical outcomes	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Dislocation	2	232	Risk Ratio (M-H, Fixed, 95% CI)	0.70 [0.33, 1.51]
1.2 Superficial wound sepsis	1	52	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Deep wound infection	2	232	Risk Ratio (M-H, Fixed, 95% CI)	0.27 [0.01, 6.47]
2 Reoperations	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2.1 Reoperations - minor	2	232	Risk Ratio (M-H, Random, 95% CI)	0.72 [0.26, 2.04]
2.2 Reoperations - major	2	232	Risk Ratio (M-H, Random, 95% CI)	2.89 [0.98, 8.51]
2.3 Reoperations - any	2	232	Risk Ratio (M-H, Random, 95% CI)	0.94 [0.24, 3.67]
2.4 Long term revision rate	1	180	Risk Ratio (M-H, Random, 95% CI)	3.84 [1.53, 9.61]
3 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Mortality 3-4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Mortality - 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Final outcomes for survivors	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4.1 Residual pain	1	135	Risk Ratio (M-H, Random, 95% CI)	34.91 [2.15, 565.58]
4.2 Failure to regain mobility	2	187	Risk Ratio (M-H, Random, 95% CI)	1.66 [0.31, 8.92]

Comparison 5. Cemented hemiarthroplasty versus total hip replacement

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Operative outcomes	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Length of surgery	3	339	Mean Difference (IV, Fixed, 95% CI)	-19.20 [-24.55, -13.84]
1.2 Operative blood loss	1	120	Mean Difference (IV, Fixed, 95% CI)	-140.0 [-221.30, -58.70]
1.3 Mean volume blood transfused	1	120	Mean Difference (IV, Fixed, 95% CI)	-70.0 [-207.95, 67.95]
2 Surgical outcomes	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Dislocation	4	415	Risk Ratio (M-H, Fixed, 95% CI)	0.34 [0.12, 0.96]
2.2 Fracture around implant	2	219	Risk Ratio (M-H, Fixed, 95% CI)	2.93 [0.12, 69.83]
2.3 Later fracture below implant	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.02]
2.4 Superficial wound infection	4	415	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.23, 2.19]
2.5 Deep wound infection	4	415	Risk Ratio (M-H, Fixed, 95% CI)	0.6 [0.08, 4.48]
3 Reoperations	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Reoperations - minor	3	277	Risk Ratio (M-H, Fixed, 95% CI)	0.24 [0.07, 0.80]
3.2 Reoperations - major	3	277	Risk Ratio (M-H, Fixed, 95% CI)	1.47 [0.45, 4.76]
3.3 Reoperations - any	4	415	Risk Ratio (M-H, Fixed, 95% CI)	0.61 [0.32, 1.15]
4 Medical complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Deep vein thrombosis	3	339	Risk Ratio (M-H, Fixed, 95% CI)	0.26 [0.07, 1.04]
4.2 Pulmonary embolism	2	219	Risk Ratio (M-H, Fixed, 95% CI)	4.95 [0.87, 28.07]
4.3 Pneumonia	2	201	Risk Ratio (M-H, Fixed, 95% CI)	0.55 [0.12, 2.47]
4.4 Pressure sores	2	201	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.03, 3.11]
4.5 Myocardial infarction	2	258	Risk Ratio (M-H, Fixed, 95% CI)	1.33 [0.31, 5.83]
4.6 Cerebrovascular accident	1	138	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 6.90]
4.7 Haematesis	1	81	Risk Ratio (M-H, Fixed, 95% CI)	2.93 [0.12, 69.83]
4.8 Cardiac arrythmia	2	201	Risk Ratio (M-H, Fixed, 95% CI)	2.96 [0.31, 28.01]
4.9 Congestive cardiac failure	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.02]
4.10 Hyponatraemia	1	81	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.76]
4.11 All medical complications	3	339	Risk Ratio (M-H, Fixed, 95% CI)	0.84 [0.50, 1.41]
5 Hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6 Mortality	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Mortality at 3-4 months	1	138	Risk Ratio (M-H, Fixed, 95% CI)	2.5 [0.50, 12.45]
6.2 Mortality at 1 year	2	258	Risk Ratio (M-H, Fixed, 95% CI)	1.13 [0.45, 2.83]
6.3 Mortality at 2 years	2	219	Risk Ratio (M-H, Fixed, 95% CI)	1.76 [0.81, 3.82]
7 Final outcomes for survivors (dichotomous outcomes)	3	308	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.72, 1.45]
7.1 Residual pain one year	1	121	Risk Ratio (M-H, Fixed, 95% CI)	1.05 [0.73, 1.52]
7.2 Failure to regain mobility	1	76	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.33, 2.44]
7.3 Poor comorbidity index	1	111	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.15, 6.98]
8 Final outcomes for survivors (continuous outcomes for which a lower score is advantagous)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

8.1 Oxford Hip Score	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9 Final outcomes for survivors (continuous outcomes for which a higher score is advantagous)	3	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9.1 Hip rating questionnaire	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.2 Self reported walking distance (kilometres)	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.3 Short form 36 physical score	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.4 Short form 36 mental score	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.5 EuroQol (EQ-5d) questionnaire	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.6 Harris Hip Score for pain	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.7 Harris Hip Score for function	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.8 Harris Hip Score - total score	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable

Analysis 1.1. Comparison 1 Cemented versus uncemented prosthesis, Outcome 1 Length of surgery (minutes).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Cement N	Mean(SD)	Uncemented N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Cemented Thompson bipolar versus uncemented Moore bipolar							
Emery 1991	27	70 (19.8)	26	62 (16.6)		72.6 %	8.00 [-1.82, 17.82]
Subtotal (95% CI)	**27**		**26**			**72.6 %**	**8.00 [-1.82, 17.82]**
Heterogeneity: not applicable							
Test for overall effect: Z = 1.60 (P = 0.11)							
2 Cemented bipolar versus uncemented bipolar hemiarthroplasty							
Santini 2005	53	75 (22.43)	53	56.98 (55)		27.4 %	18.02 [2.03, 34.01]
Subtotal (95% CI)	**53**		**53**			**27.4 %**	**18.02 [2.03, 34.01]**
Heterogeneity: not applicable							
Test for overall effect: Z = 2.21 (P = 0.027)							
Total (95% CI)	**80**		**79**			**100.0 %**	**10.75 [2.38, 19.12]**
Heterogeneity: Chi^2 = 1.10, df = 1 (P = 0.30); I^2 =9%							
Test for overall effect: Z = 2.52 (P = 0.012)							
Test for subgroup differences: Chi^2 = 1.10, df = 1 (P = 0.30), I^2 =9%							

Analysis 1.2. Comparison 1 Cemented versus uncemented prosthesis, Outcome 2 Operative blood loss (ml).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 2 Operative blood loss (ml)

Study or subgroup	Cement N	Mean(SD)	Uncemented N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Cemented Thompson bipolar versus uncemented Moore bipolar						
Emery 1991	27	325 (131)	26	276 (133)		49.00 [-22.10, 120.10]

Analysis 1.3. Comparison 1 Cemented versus uncemented prosthesis, Outcome 3 Mean units blood transfused.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 3 Mean units blood transfused

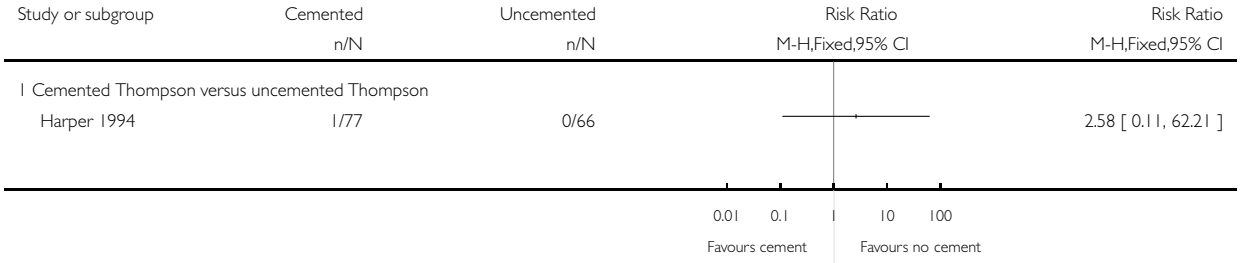
Study or subgroup	Cemented N	Mean(SD)	Uncemented N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Cemented bipolar versus uncemented bipolar hemiarthroplasty						
Santini 2005	53	1.69 (2.01)	53	1.64 (2)		0.05 [-0.71, 0.81]

Analysis 1.4. Comparison 1 Cemented versus uncemented prosthesis, Outcome 4 Peri-operative death.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 4 Peri-operative death

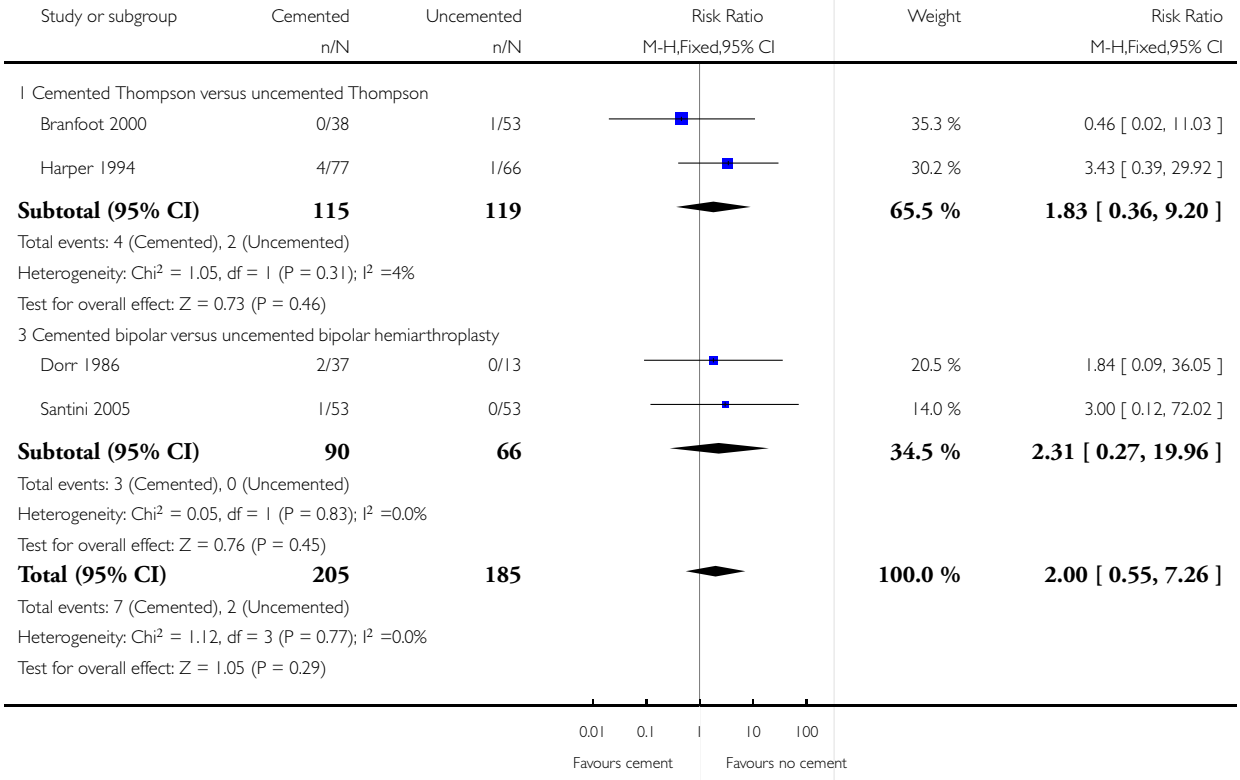


Analysis 1.5. Comparison 1 Cemented versus uncemented prosthesis, Outcome 5 Dislocation.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 5 Dislocation

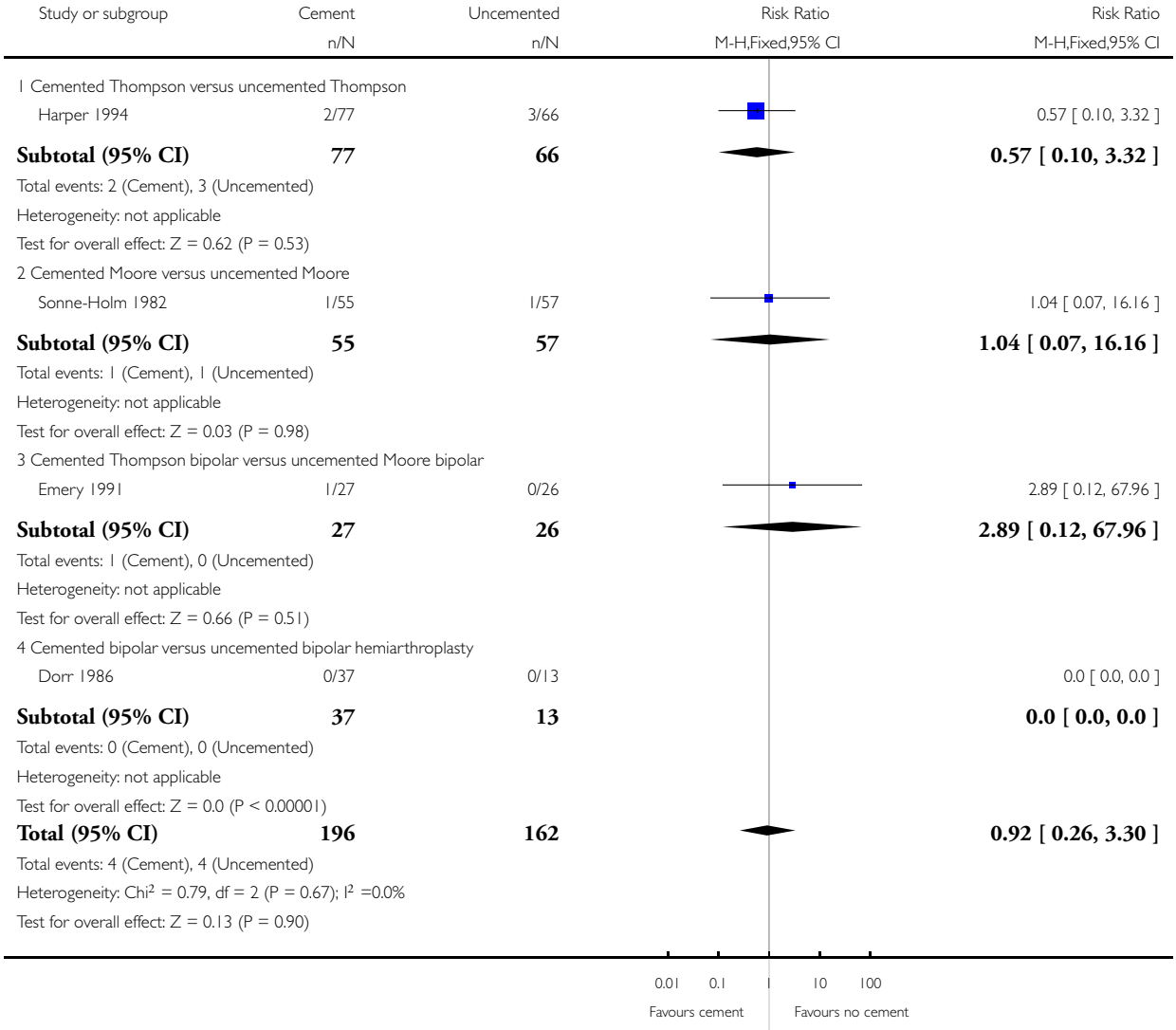


Analysis 1.6. Comparison 1 Cemented versus uncemented prosthesis, Outcome 6 Superficial wound infection.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 6 Superficial wound infection

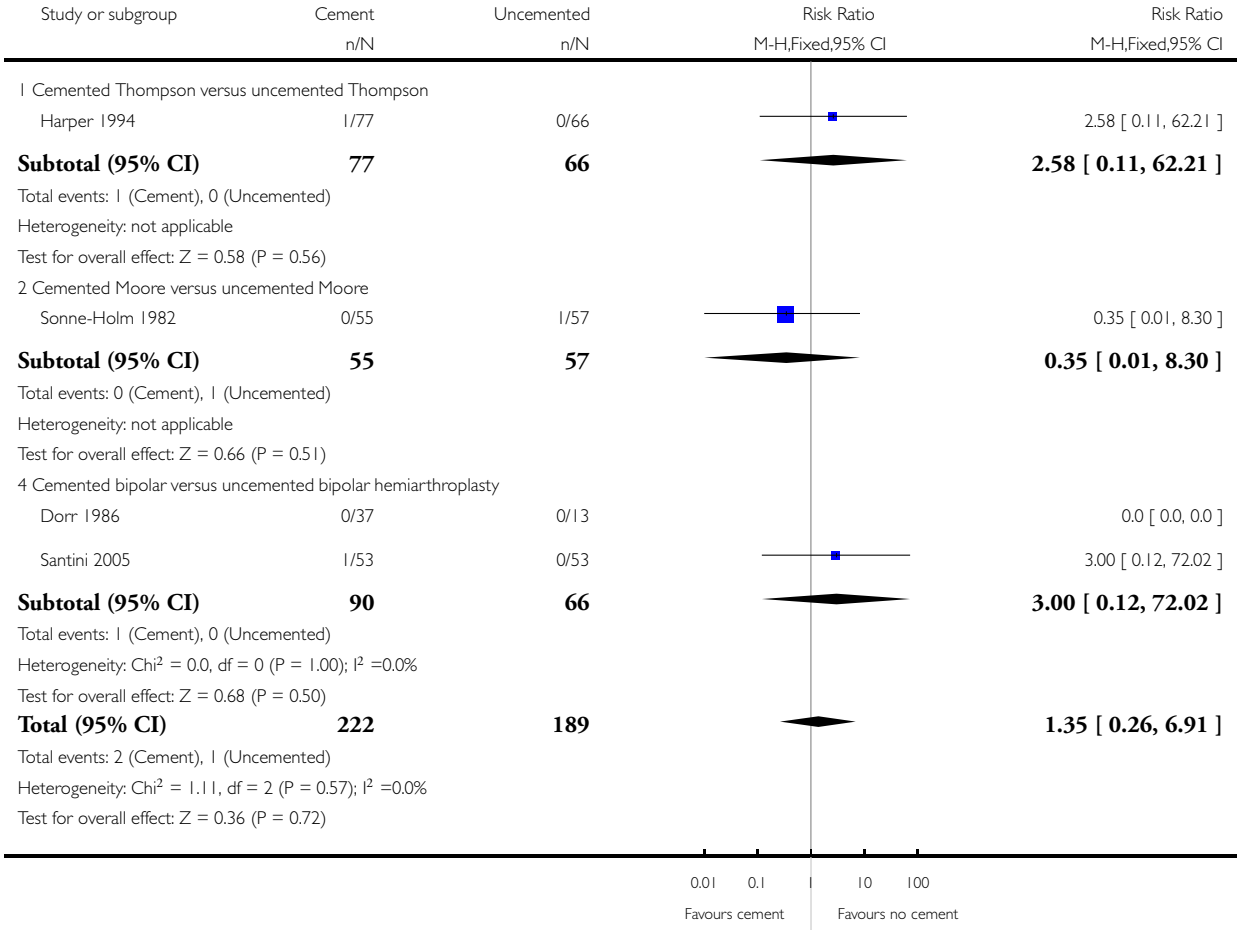


Analysis 1.7. Comparison 1 Cemented versus uncemented prosthesis, Outcome 7 Deep sepsis.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 7 Deep sepsis

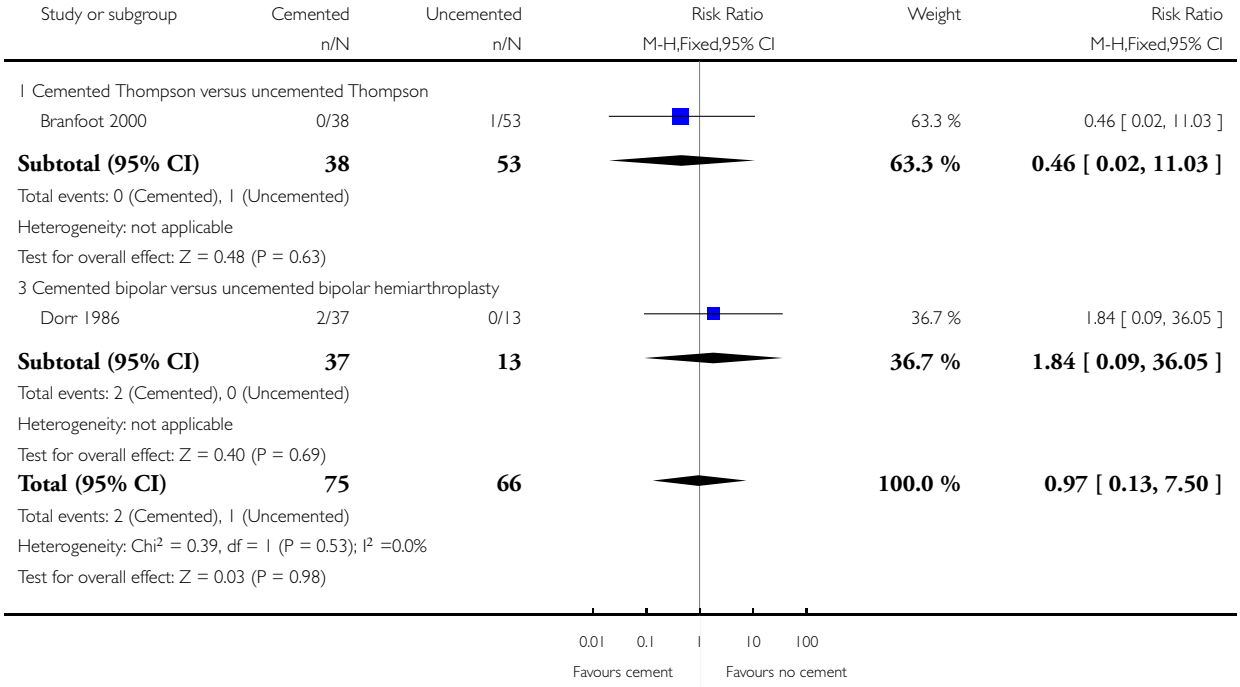


Analysis 1.8. Comparison 1 Cemented versus uncemented prosthesis, Outcome 8 Reoperations - minor.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 8 Reoperations - minor

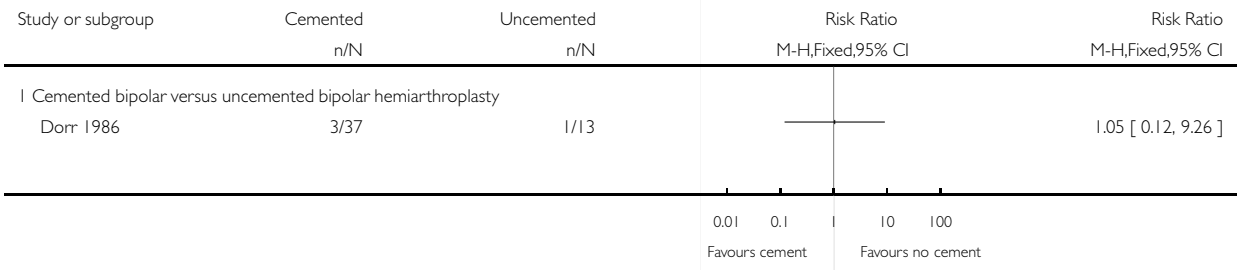


Analysis 1.9. Comparison 1 Cemented versus uncemented prosthesis, Outcome 9 Reoperations - major.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 9 Reoperations - major

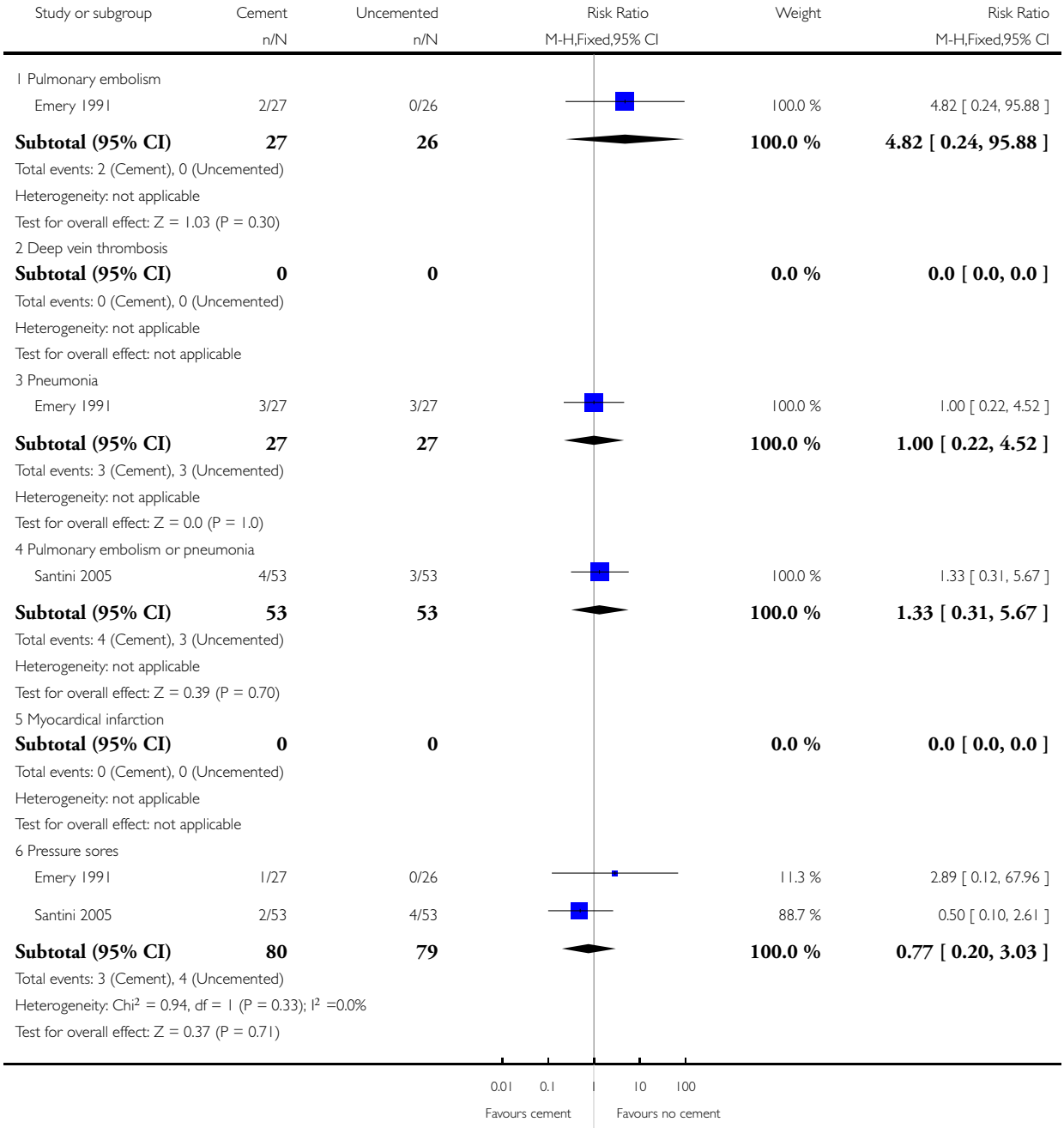


Analysis 1.10. Comparison 1 Cemented versus uncemented prosthesis, Outcome 10 Medical complications.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 10 Medical complications



Analysis 1.11. Comparison 1 Cemented versus uncemented prosthesis, Outcome 11 All reported medical complications.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 11 All reported medical complications

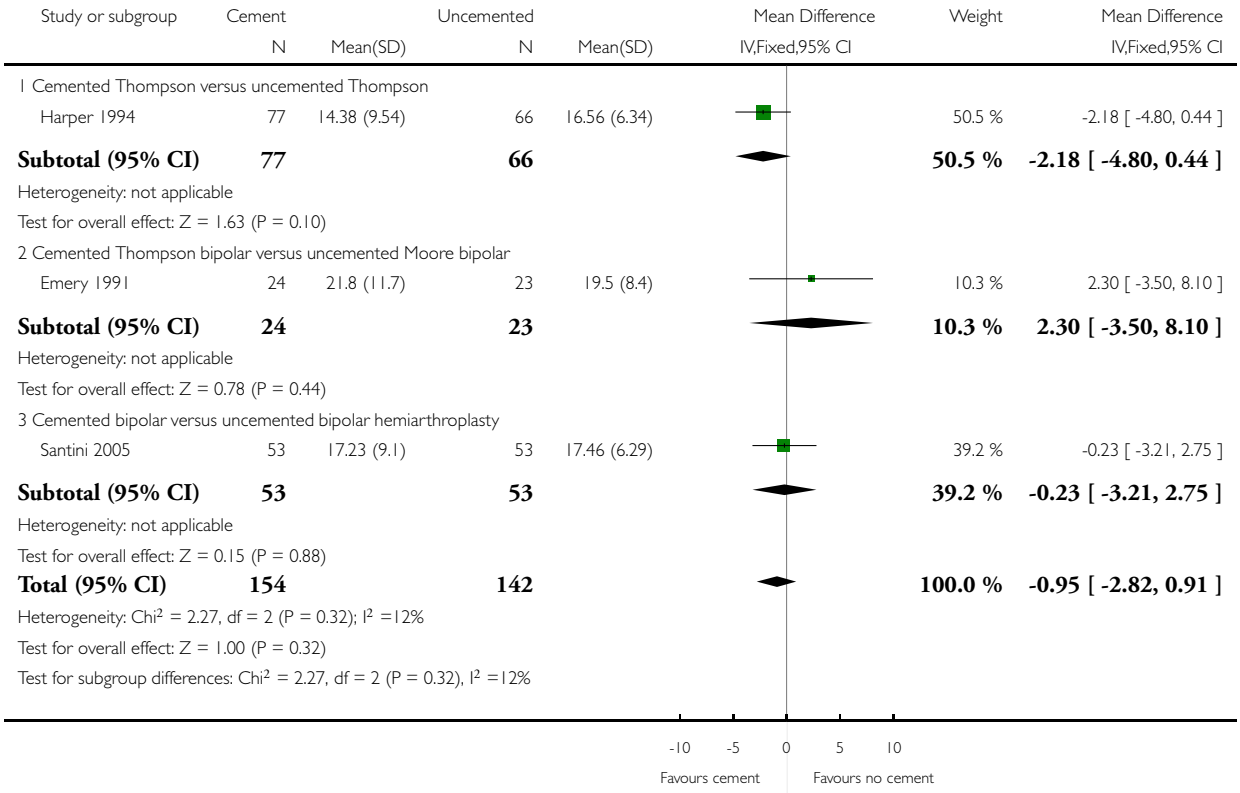
Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Cemented Thompson bipolar versus uncemented Moore bipolar					
Emery 1991	8/27	5/26		21.1 %	1.54 [0.58, 4.10]
Subtotal (95% CI)	**27**	**26**		**21.1 %**	**1.54 [0.58, 4.10]**
Total events: 8 (Cement), 5 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.87 (P = 0.39)					
2 Cemented bipolar versus uncemented bipolar hemiarthroplasty					
Santini 2005	19/53	19/53		78.9 %	1.00 [0.60, 1.66]
Subtotal (95% CI)	**53**	**53**		**78.9 %**	**1.00 [0.60, 1.66]**
Total events: 19 (Cement), 19 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
Total (95% CI)	**80**	**79**		**100.0 %**	**1.11 [0.71, 1.75]**
Total events: 27 (Cement), 24 (Uncemented)					
Heterogeneity: Chi^2 = 0.59, df = 1 (P = 0.44); I^2 =0.0%					
Test for overall effect: Z = 0.47 (P = 0.64)					

Analysis 1.12. Comparison 1 Cemented versus uncemented prosthesis, Outcome 12 Length of hospital stay.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 12 Length of hospital stay

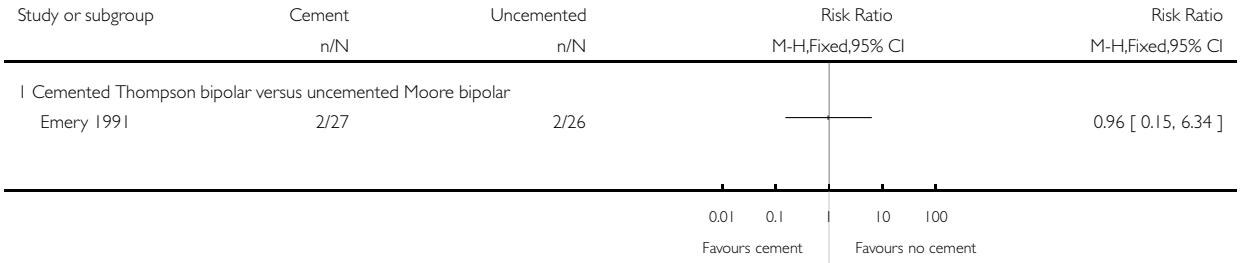


Analysis 1.13. Comparison 1 Cemented versus uncemented prosthesis, Outcome 13 Mortality less than 1 month.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 13 Mortality less than 1 month

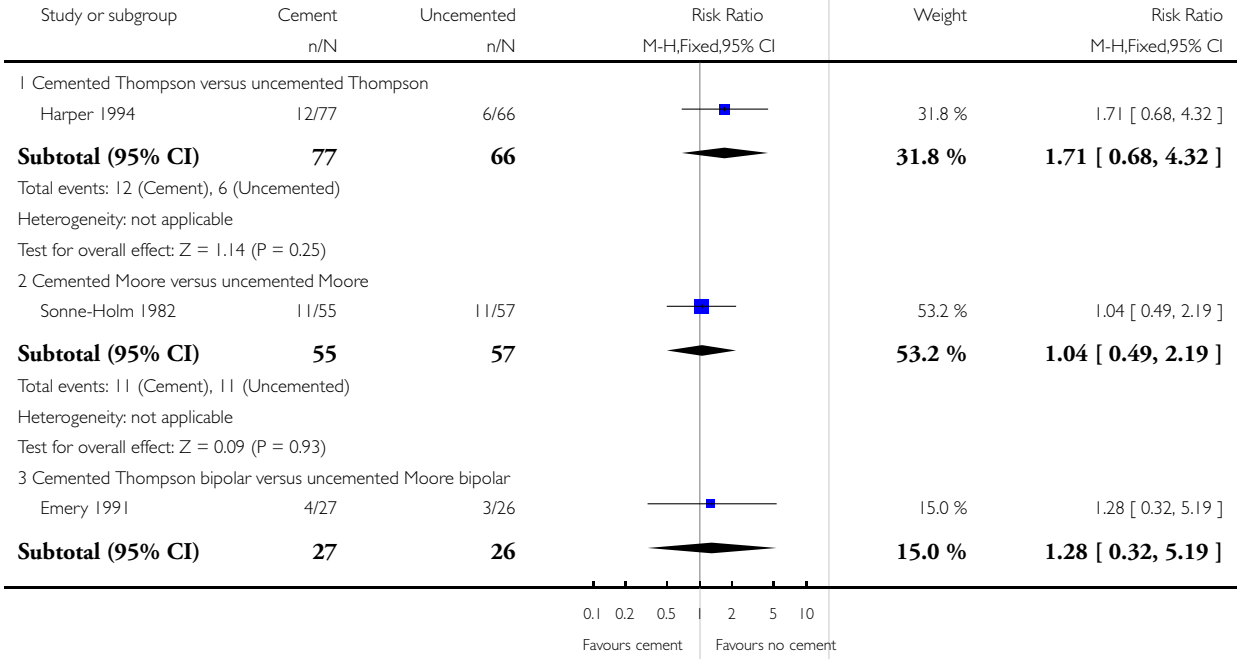


Analysis 1.14. Comparison 1 Cemented versus uncemented prosthesis, Outcome 14 Mortality 1-3 months.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 14 Mortality 1-3 months



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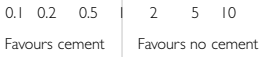
Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 4 (Cement), 3 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.35 (P = 0.73)					
Total (95% CI)	**159**	**149**		**100.0 %**	**1.29 [0.76, 2.20]**
Total events: 27 (Cement), 20 (Uncemented)					
Heterogeneity: Chi^2 = 0.69, df = 2 (P = 0.71); I^2 =0.0%					
Test for overall effect: Z = 0.93 (P = 0.35)					



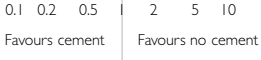
Analysis 1.15. Comparison 1 Cemented versus uncemented prosthesis, Outcome 15 Mortality one year.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 15 Mortality one year

Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Cemented Thompson versus uncemented Thompson					
Branfoot 2000	7/38	14/53		23.3 %	0.70 [0.31, 1.56]
Harper 1994	20/77	17/66		36.5 %	1.01 [0.58, 1.76]
Subtotal (95% CI)	**115**	**119**		**59.9 %**	**0.89 [0.56, 1.40]**
Total events: 27 (Cement), 31 (Uncemented)					
Heterogeneity: Chi^2 = 0.55, df = 1 (P = 0.46); I^2 =0.0%					
Test for overall effect: Z = 0.51 (P = 0.61)					
2 Cemented Thompson bipolar versus uncemented Moore bipolar					
Emery 1991	8/27	6/26		12.2 %	1.28 [0.52, 3.19]
Subtotal (95% CI)	**27**	**26**		**12.2 %**	**1.28 [0.52, 3.19]**
Total events: 8 (Cement), 6 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.54 (P = 0.59)					
3 Cemented bipolar versus uncemented bipolar hemiarthroplasty					
Santini 2005	13/53	14/53		27.9 %	0.93 [0.48, 1.78]
Subtotal (95% CI)	**53**	**53**		**27.9 %**	**0.93 [0.48, 1.78]**
Total events: 13 (Cement), 14 (Uncemented)					
Heterogeneity: not applicable					



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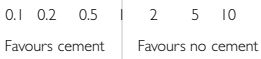
Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.22 (P = 0.82)					
Total (95% CI)	**195**	**198**		**100.0 %**	**0.95 [0.67, 1.34]**
Total events: 48 (Cement), 51 (Uncemented)					
Heterogeneity: Chi^2 = 1.03, df = 3 (P = 0.79); I^2 =0.0%					
Test for overall effect: Z = 0.31 (P = 0.76)					



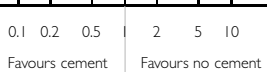
Analysis 1.16. Comparison 1 Cemented versus uncemented prosthesis, Outcome 16 Failure to regain mobility.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 16 Failure to regain mobility

Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Cemented Moore versus uncemented Moore					
Sonne-Holm 1982	19/33	15/25		37.4 %	0.96 [0.62, 1.48]
Subtotal (95% CI)	**33**	**25**		**37.4 %**	**0.96 [0.62, 1.48]**
Total events: 19 (Cement), 15 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.19 (P = 0.85)					
2 Cemented Thompson bipolar versus uncemented Moore bipolar					
Emery 1991	8/19	16/20		34.2 %	0.53 [0.30, 0.93]
Subtotal (95% CI)	**19**	**20**		**34.2 %**	**0.53 [0.30, 0.93]**
Total events: 8 (Cement), 16 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.20 (P = 0.028)					
3 Cemented bipolar versus uncemented bipolar hemiarthroplasty					
Dorr 1986	6/37	9/13		28.4 %	0.23 [0.10, 0.53]
Subtotal (95% CI)	**37**	**13**		**28.4 %**	**0.23 [0.10, 0.53]**
Total events: 6 (Cement), 9 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 3.48 (P = 0.00050)					
Total (95% CI)	**89**	**58**		**100.0 %**	**0.52 [0.25, 1.11]**



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Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Total events: 33 (Cement), 40 (Uncemented)					
Heterogeneity: $Tau^2 = 0.35$; $Chi^2 = 9.77$, df = 2 (P = 0.01); $I^2 = 80\%$					
Test for overall effect: Z = 1.68 (P = 0.092)					

Analysis 1.17. Comparison 1 Cemented versus uncemented prosthesis, Outcome 17 Pain at early follow up (3 months).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 17 Pain at early follow up (3 months)

Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cemented Moore versus uncemented Moore				
Sonne-Holm 1982	7/29	10/22		0.53 [0.24, 1.17]

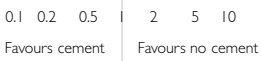
Analysis 1.18. Comparison 1 Cemented versus uncemented prosthesis, Outcome 18 Pain at 1-2 years.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 18 Pain at 1-2 years

Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Cemented Moore versus uncemented Moore					
Sonne-Holm 1982	10/33	12/25		46.7 %	0.63 [0.33, 1.22]
Subtotal (95% CI)	**33**	**25**		**46.7 %**	**0.63 [0.33, 1.22]**
Total events: 10 (Cement), 12 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.37 (P = 0.17)					
2 Cemented Thompson bipolar versus uncemented Moore bipolar					
Emery 1991	6/19	16/20		53.3 %	0.39 [0.20, 0.79]
Subtotal (95% CI)	**19**	**20**		**53.3 %**	**0.39 [0.20, 0.79]**
Total events: 6 (Cement), 16 (Uncemented)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.61 (P = 0.0090)					
Total (95% CI)	**52**	**45**		**100.0 %**	**0.51 [0.31, 0.81]**
Total events: 16 (Cement), 28 (Uncemented)					
Heterogeneity: Chi^2 = 0.92, df = 1 (P = 0.34); I^2 =0.0%					
Test for overall effect: Z = 2.81 (P = 0.0049)					



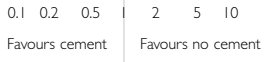
Analysis 1.19. Comparison 1 Cemented versus uncemented prosthesis, Outcome 19 Failure to return home.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 1 Cemented versus uncemented prosthesis

Outcome: 19 Failure to return home

Study or subgroup	Cement n/N	Uncemented n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cemented Thompson bipolar versus uncemented Moore bipolar				
Emery 1991	3/19	5/20		0.63 [0.17, 2.29]

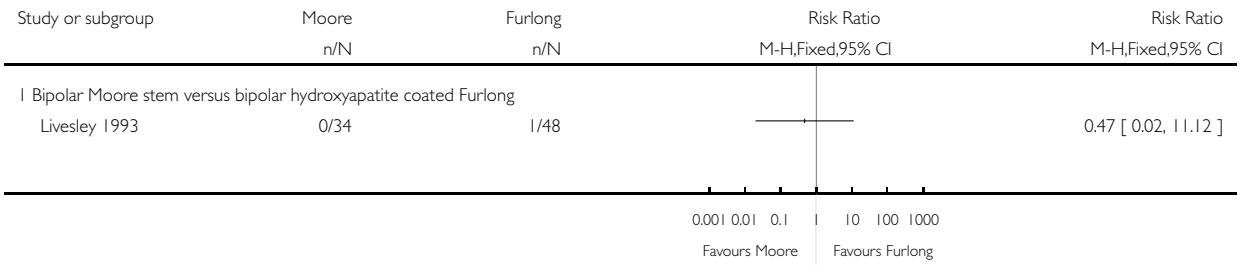


Analysis 2.1. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 1 Dislocation.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 1 Dislocation

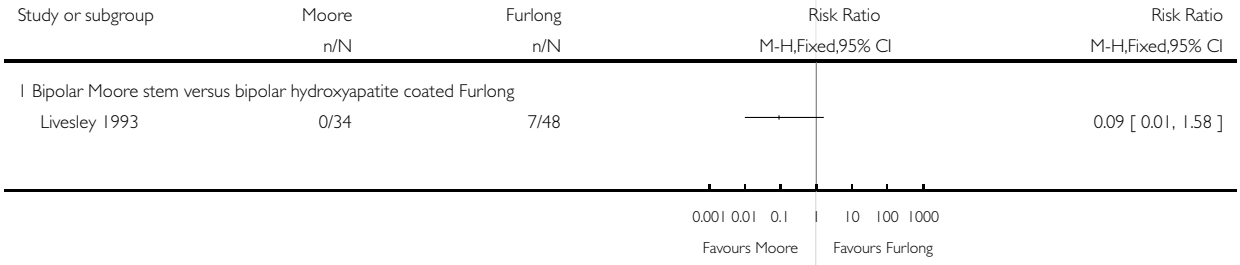


Analysis 2.2. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 2 Operative fracture femur.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 2 Operative fracture femur

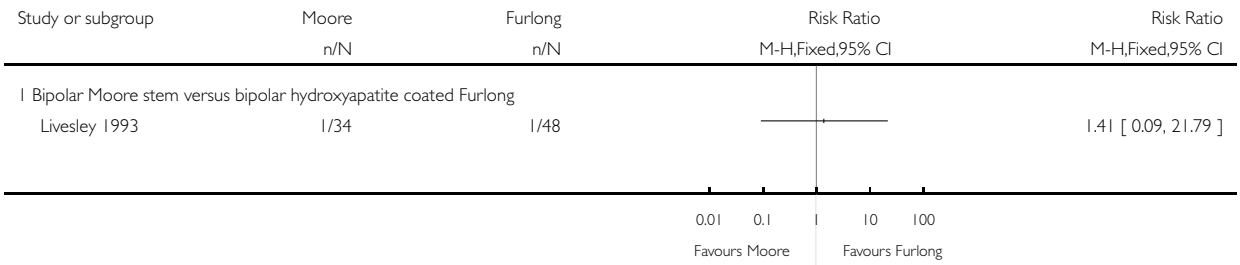


Analysis 2.3. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 3 Wound infection.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 3 Wound infection

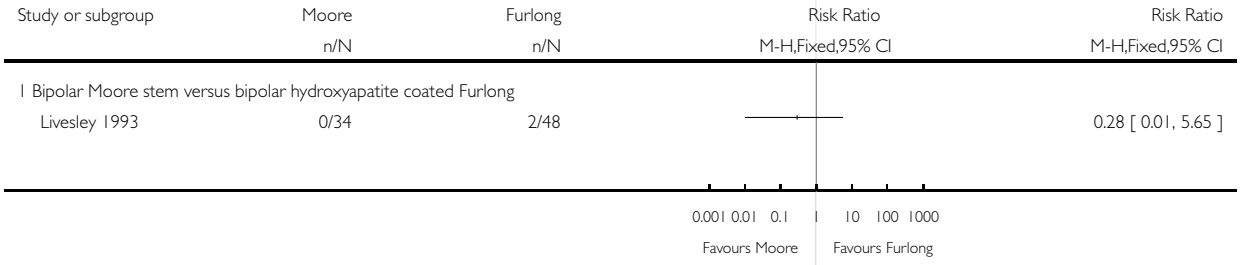


Analysis 2.4. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 4 Reoperations - minor.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 4 Reoperations - minor

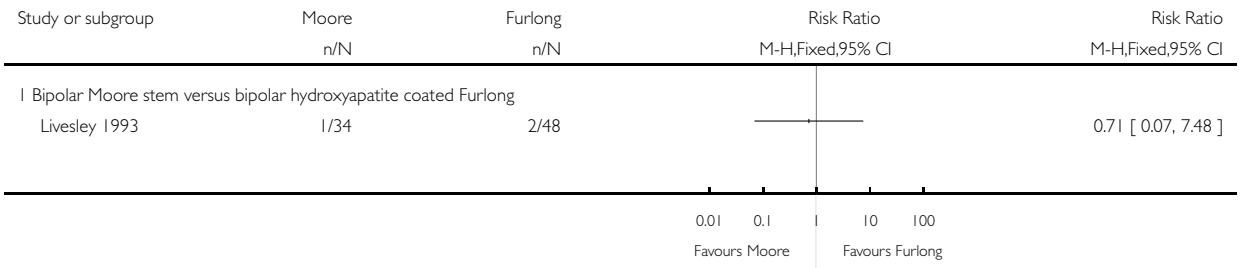


Analysis 2.5. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 5 Reoperations - major.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 5 Reoperations - major

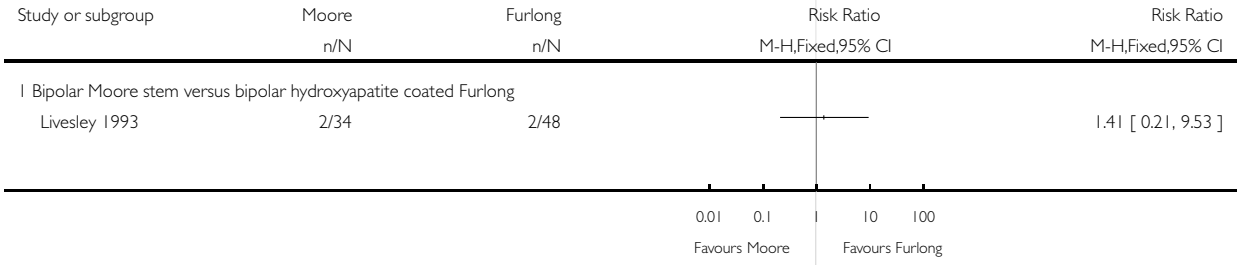


Analysis 2.6. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 6 Pressure sores.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 6 Pressure sores

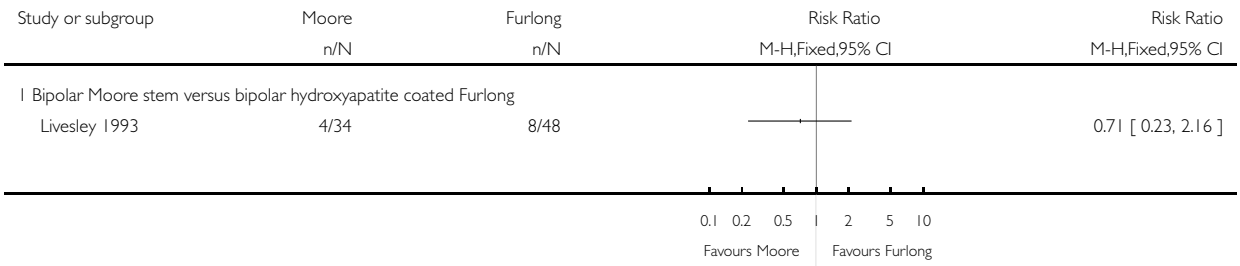


Analysis 2.7. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 7 Medical complications.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 7 Medical complications

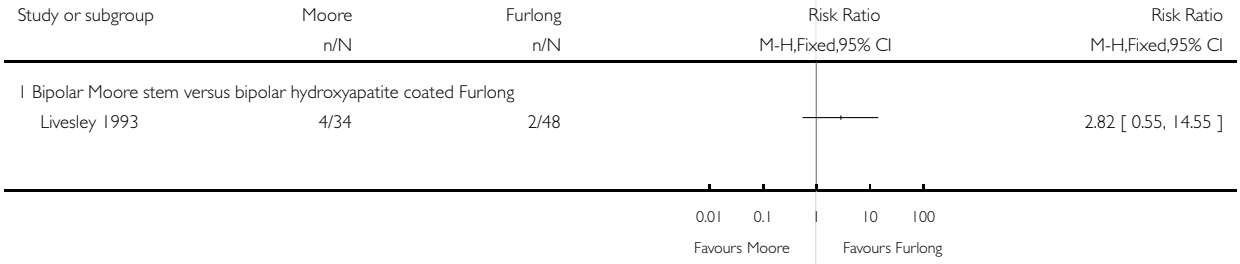


Analysis 2.8. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 8 Mortality - 30 days.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 8 Mortality - 30 days

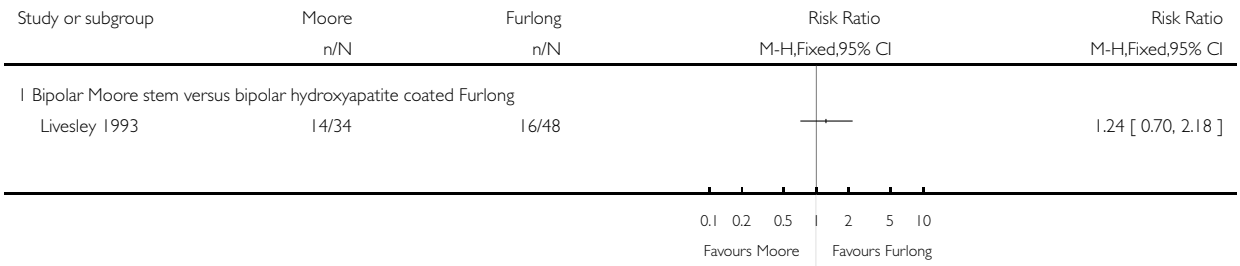


Analysis 2.9. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 9 Mortality - 1 year.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 9 Mortality - 1 year

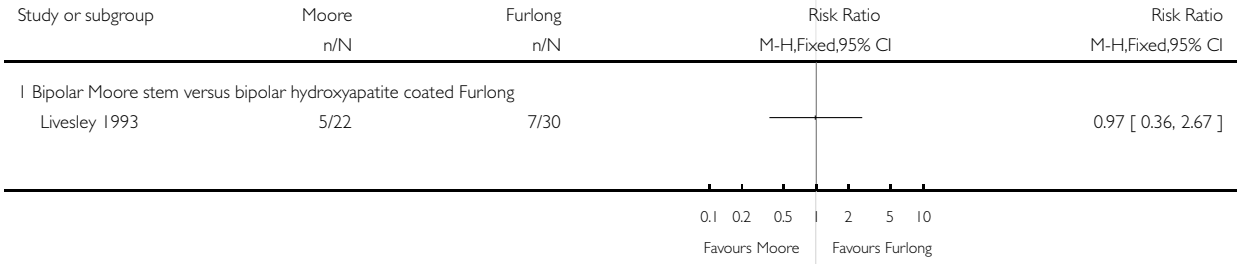


Analysis 2.10. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 10 Failure to return back home at 1 year.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 10 Failure to return back home at 1 year

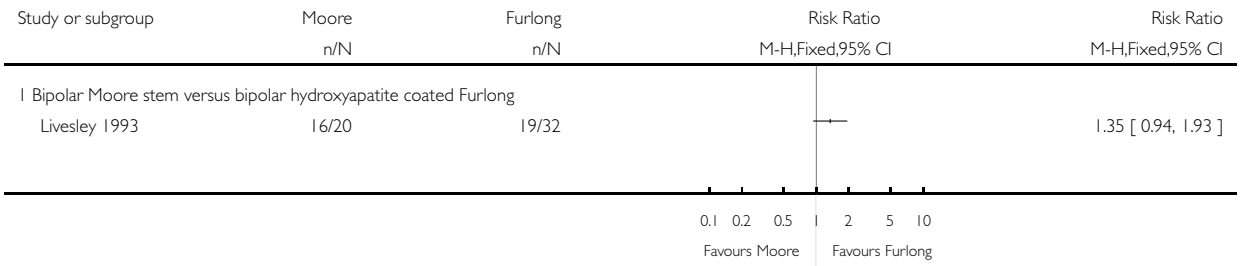


Analysis 2.11. Comparison 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs), Outcome 11 Failure to be able to shop at 1 year.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 2 Bipolar hemiarthroplasty vesus bipolar hemiarthroplasty (different stem designs)

Outcome: 11 Failure to be able to shop at 1 year

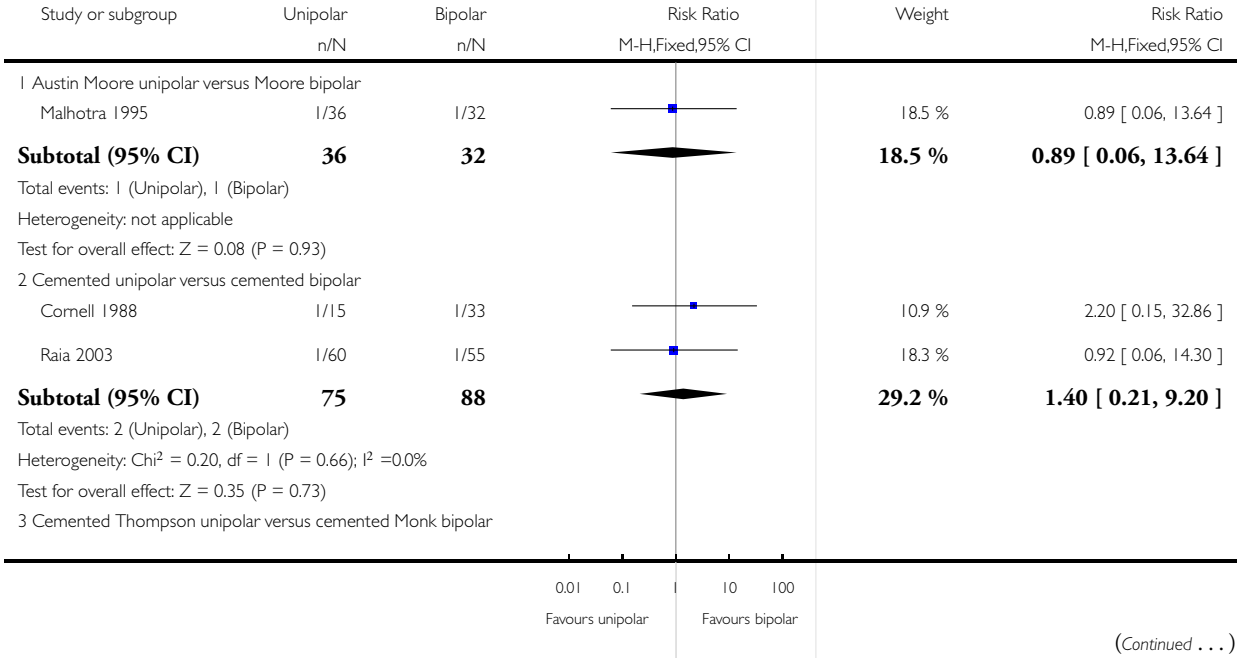


Analysis 3.1. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 1 Dislocation.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 1 Dislocation



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Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Calder 1996	2/132	1/118		18.5 %	1.79 [0.16, 19.46]
Davison 2001	1/90	2/97		33.7 %	0.54 [0.05, 5.84]
Subtotal (95% CI)	**222**	**215**		**52.2 %**	**0.98 [0.20, 4.93]**
Total events: 3 (Unipolar), 3 (Bipolar)					
Heterogeneity: Chi² = 0.49, df = 1 (P = 0.49); I² =0.0%					
Test for overall effect: Z = 0.02 (P = 0.98)					
Total (95% CI)	**333**	**335**		**100.0 %**	**1.09 [0.36, 3.31]**
Total events: 6 (Unipolar), 6 (Bipolar)					
Heterogeneity: Chi² = 0.80, df = 4 (P = 0.94); I² =0.0%					
Test for overall effect: Z = 0.14 (P = 0.88)					

Analysis 3.2. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 2 Dislocation requiring open reduction.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 2 Dislocation requiring open reduction

Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Austin Moore unipolar versus Moore bipolar				
Malhotra 1995	0/36	1/32		0.30 [0.01, 7.05]
Subtotal (95% CI)	**36**	**32**		**0.30 [0.01, 7.05]**
Total events: 0 (Unipolar), 1 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.75 (P = 0.45)				
2 Cemented unipolar versus cemented bipolar				
Cornell 1988	0/15	0/32		0.0 [0.0, 0.0]
Raia 2003	0/60	0/55		0.0 [0.0, 0.0]
Subtotal (95% CI)	**75**	**87**		**0.0 [0.0, 0.0]**
Total events: 0 (Unipolar), 0 (Bipolar)				
Heterogeneity: Chi² = 0.0, df = 0 (P<0.00001); I² =0.0%				
Test for overall effect: Z = 0.0 (P < 0.00001)				

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Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
3 Cemented Thompson unipolar versus cemented Monk bipolar				
Davison 2001	0/91	1/97		0.36 [0.01, 8.61]
Subtotal (95% CI)	**91**	**97**		**0.36 [0.01, 8.61]**
Total events: 0 (Unipolar), 1 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.64 (P = 0.52)				
Total (95% CI)	**202**	**216**		**0.32 [0.03, 3.07]**
Total events: 0 (Unipolar), 2 (Bipolar)				
Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.94); I^2 =0.0%				
Test for overall effect: Z = 0.98 (P = 0.33)				

Analysis 3.3. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 3 Acetabular erosion on X-rays.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 3 Acetabular erosion on X-rays

Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Austin Moore unipolar versus Moore bipolar					
Malhotra 1995	2/36	0/32		26.2 %	4.46 [0.22, 89.56]
Subtotal (95% CI)	**36**	**32**		**26.2 %**	**4.46 [0.22, 89.56]**
Total events: 2 (Unipolar), 0 (Bipolar)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.98 (P = 0.33)					
3 Cemented Thompson unipolar versus cemented Monk bipolar					
Calder 1996	3/132	0/118		26.1 %	6.26 [0.33, 120.00]
Davison 2001	2/90	1/97		47.7 %	2.16 [0.20, 23.37]
Subtotal (95% CI)	**222**	**215**		**73.8 %**	**3.61 [0.59, 22.28]**
Total events: 5 (Unipolar), 1 (Bipolar)					
Heterogeneity: Chi^2 = 0.31, df = 1 (P = 0.58); I^2 =0.0%					
Test for overall effect: Z = 1.38 (P = 0.17)					
Total (95% CI)	**258**	**247**		**100.0 %**	**3.83 [0.81, 18.15]**

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Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 7 (Unipolar), 1 (Bipolar)					
Heterogeneity: Chi² = 0.34, df = 2 (P = 0.84); I² =0.0%					
Test for overall effect: Z = 1.69 (P = 0.090)					

Analysis 3.4. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 4 Acetabular erosion requiring revision arthroplaty.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 4 Acetabular erosion requiring revision arthroplaty

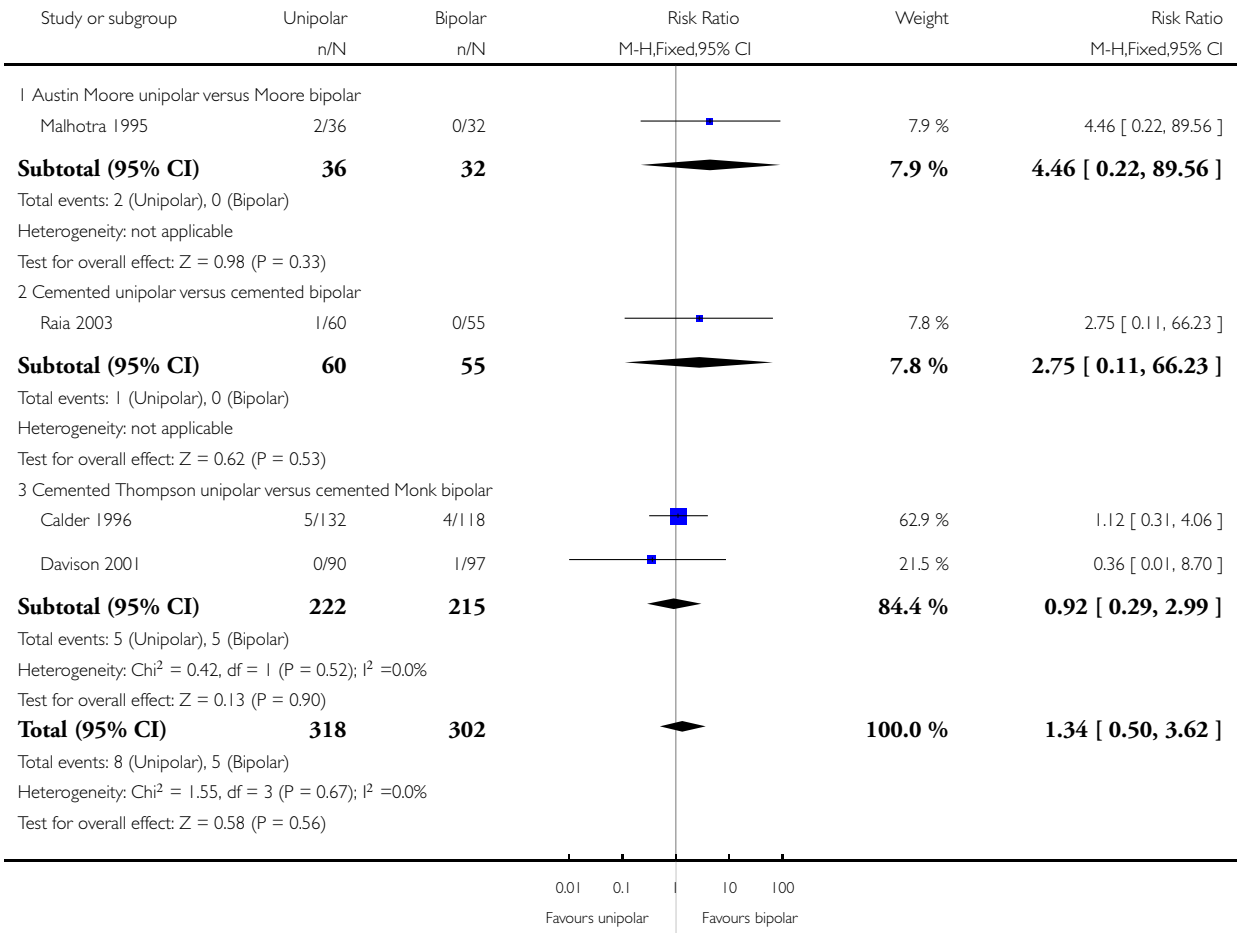
Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Austin Moore unipolar versus Moore bipolar				
Malhotra 1995	2/36	0/32		4.46 [0.22, 89.56]
Subtotal (95% CI)	**36**	**32**		**4.46 [0.22, 89.56]**
Total events: 2 (Unipolar), 0 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.98 (P = 0.33)				
3 Cemented Thompson unipolar versus cemented Monk bipolar				
Calder 1996	0/132	0/118		0.0 [0.0, 0.0]
Davison 2001	2/90	1/97		2.16 [0.20, 23.37]
Subtotal (95% CI)	**222**	**215**		**2.16 [0.20, 23.37]**
Total events: 2 (Unipolar), 1 (Bipolar)				
Heterogeneity: Chi² = 0.0, df = 0 (P = 1.00); I² =0.0%				
Test for overall effect: Z = 0.63 (P = 0.53)				
Total (95% CI)	**258**	**247**		**2.97 [0.47, 18.85]**
Total events: 4 (Unipolar), 1 (Bipolar)				
Heterogeneity: Chi² = 0.14, df = 1 (P = 0.71); I² =0.0%				
Test for overall effect: Z = 1.16 (P = 0.25)				

Analysis 3.5. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 5 Deep sepsis.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 5 Deep sepsis

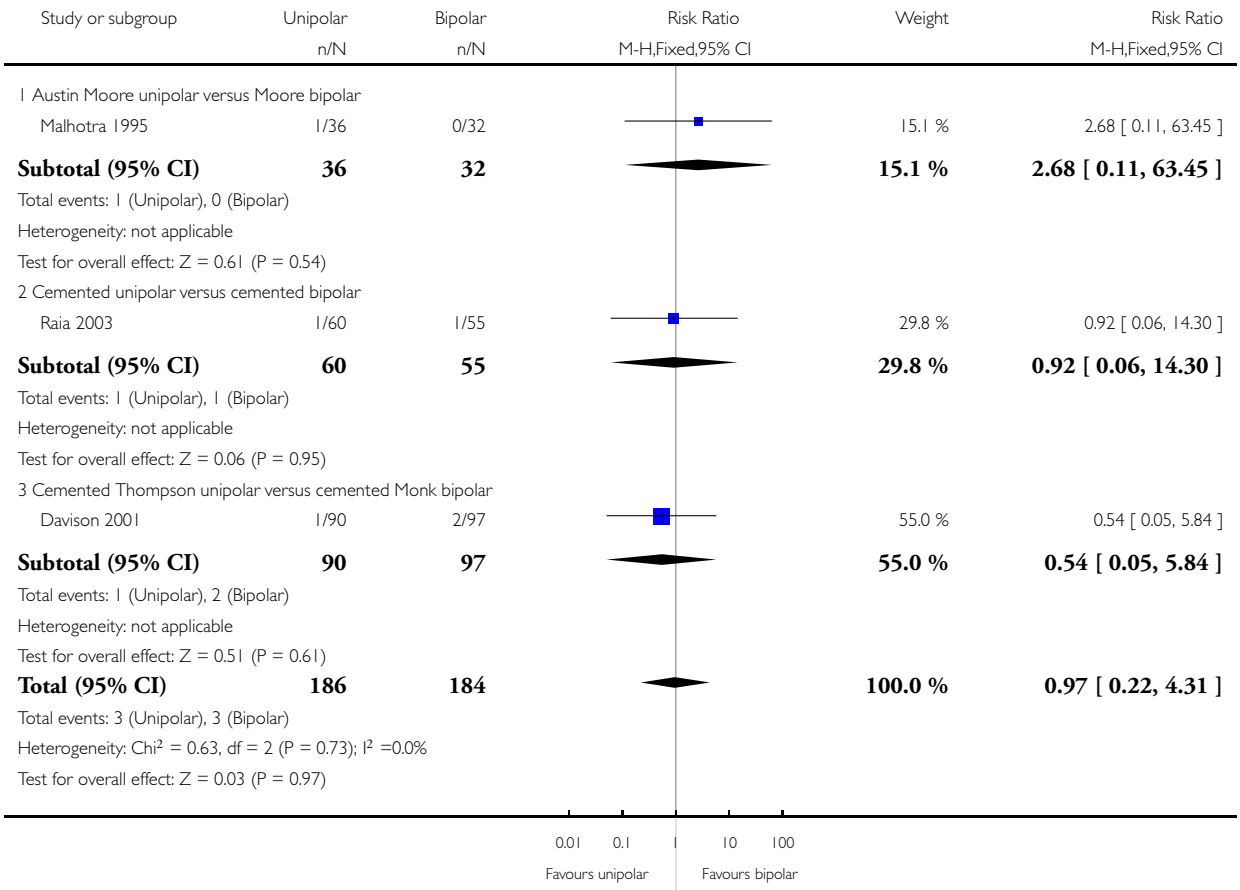


Analysis 3.6. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 6 Reoperations - minor.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 6 Reoperations - minor

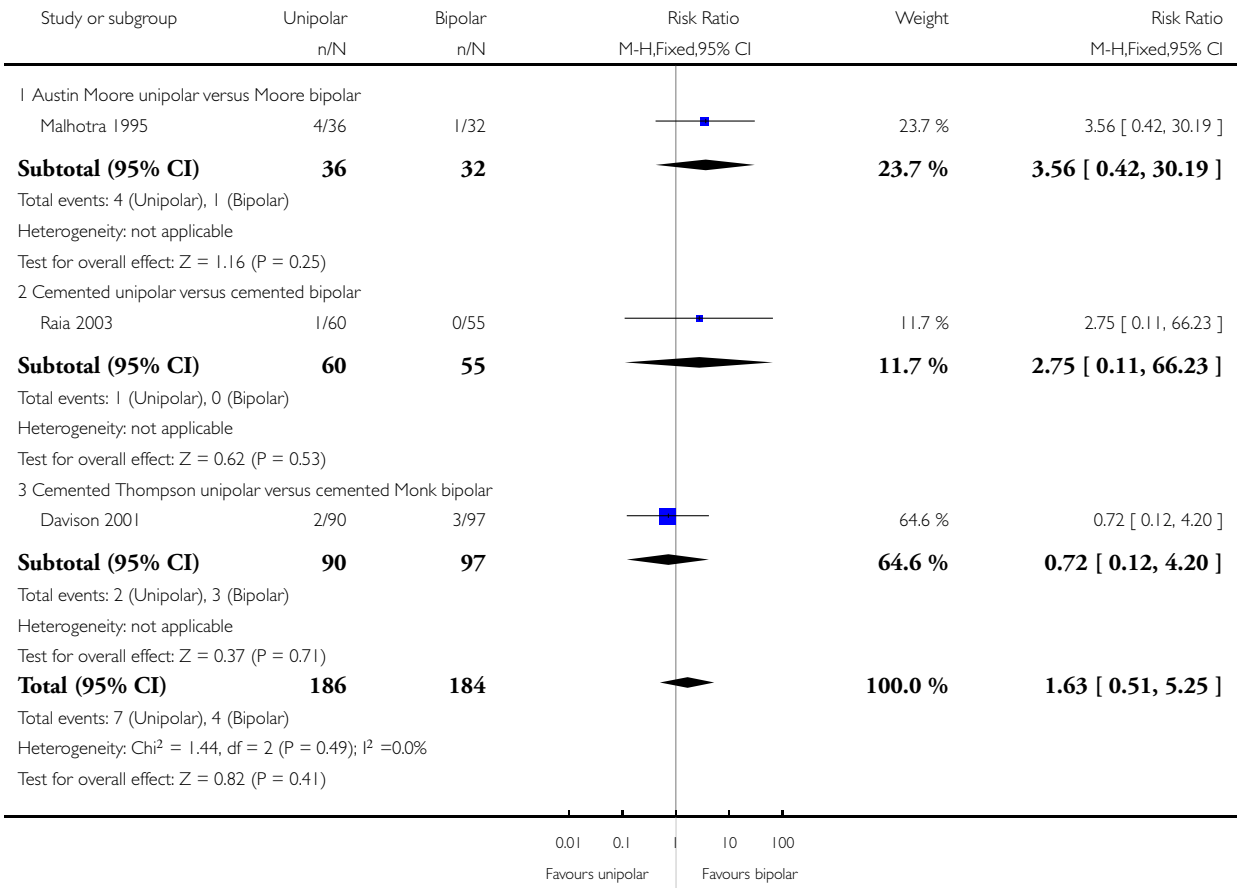


Analysis 3.7. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 7 Reoperations - major.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 7 Reoperations - major

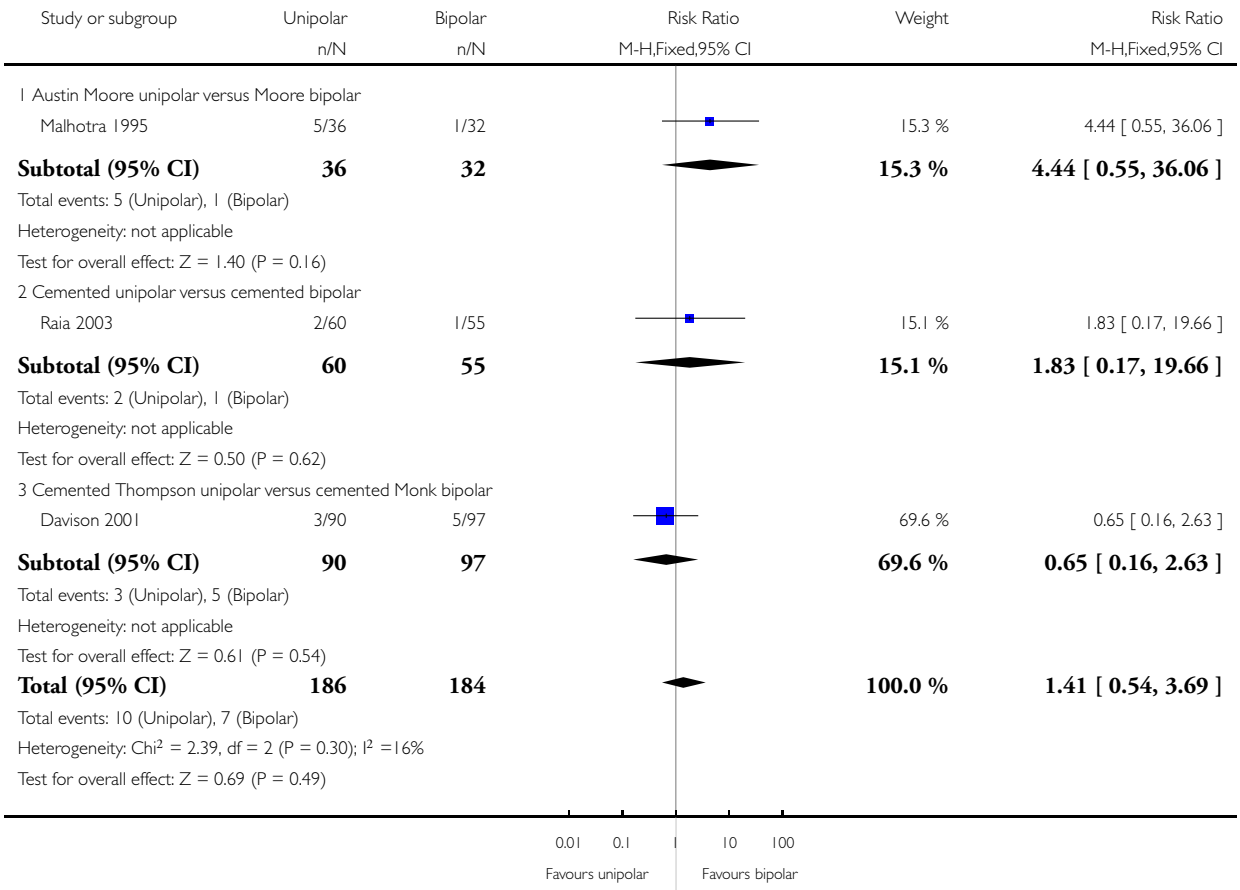


Analysis 3.8. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 8 Reoperations - any reason.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 8 Reoperations - any reason



Analysis 3.9. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 9 Deep vein thrombosis.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 9 Deep vein thrombosis

Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cemented unipolar versus cemented bipolar				
Cornell 1988	0/15	1/33		0.71 [0.03, 16.45]

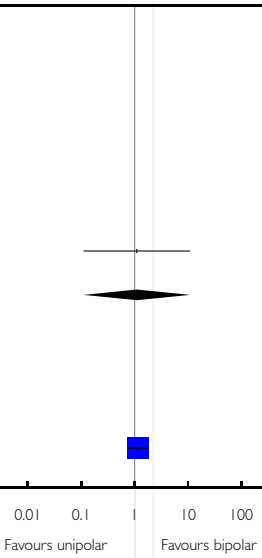
Analysis 3.10. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 10 Mortality - 6 months.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 10 Mortality - 6 months

Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Austin Moore unipolar versus Moore bipolar				
Malhotra 1995	0/36	0/32		0.0 [0.0, 0.0]
Subtotal (95% CI)	**36**	**32**		**0.0 [0.0, 0.0]**
Total events: 0 (Unipolar), 0 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Cemented unipolar versus cemented bipolar				
Cornell 1988	1/15	2/33		1.10 [0.11, 11.21]
Subtotal (95% CI)	**15**	**33**		**1.10 [0.11, 11.21]**
Total events: 1 (Unipolar), 2 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.08 (P = 0.94)				
3 Cemented Thompson unipolar versus cemented Monk bipolar				
Calder 1996	33/132	26/118		1.13 [0.72, 1.78]



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Study or subgroup	Unipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**132**	**118**		**1.13 [0.72, 1.78]**
Total events: 33 (Unipolar), 26 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.55 (P = 0.58)				
Total (95% CI)	**183**	**183**		**1.13 [0.73, 1.76]**
Total events: 34 (Unipolar), 28 (Bipolar)				
Heterogeneity: Chi² = 0.00, df = 1 (P = 0.98); I² =0.0%				
Test for overall effect: Z = 0.55 (P = 0.58)				

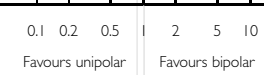
Analysis 3.11. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 11 Mortality 1-2 years.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 11 Mortality 1-2 years

Study or subgroup	Uipolar n/N	Bipolar n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Austin Moore unipolar versus Moore bipolar				
Malhotra 1995	0/36	0/32		0.0 [0.0, 0.0]
Subtotal (95% CI)	**36**	**32**		**0.0 [0.0, 0.0]**
Total events: 0 (Uipolar), 0 (Bipolar)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Cemented Thompson unipolar versus cemented Monk bipolar				
Calder 1996	37/132	37/118		0.89 [0.61, 1.31]
Raia 2003	12/60	12/55		0.92 [0.45, 1.87]
Subtotal (95% CI)	**192**	**173**		**0.90 [0.64, 1.26]**
Total events: 49 (Uipolar), 49 (Bipolar)				
Heterogeneity: Chi² = 0.00, df = 1 (P = 0.95); I² =0.0%				
Test for overall effect: Z = 0.62 (P = 0.54)				
Total (95% CI)	**228**	**205**		**0.90 [0.64, 1.26]**
Total events: 49 (Uipolar), 49 (Bipolar)				
Heterogeneity: Chi² = 0.00, df = 1 (P = 0.95); I² =0.0%				
Test for overall effect: Z = 0.62 (P = 0.54)				

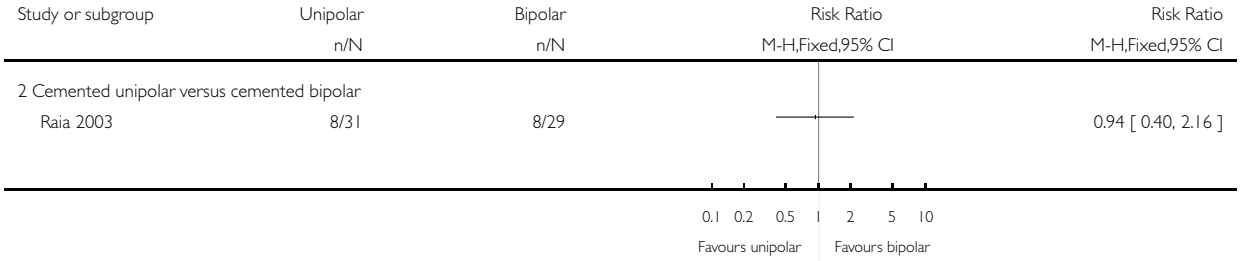


Analysis 3.12. Comparison 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty, Outcome 12 Failure to regain moblility.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 3 Unipolar hemiarthroplasty versus bipolar hemiarthroplasty

Outcome: 12 Failure to regain moblility

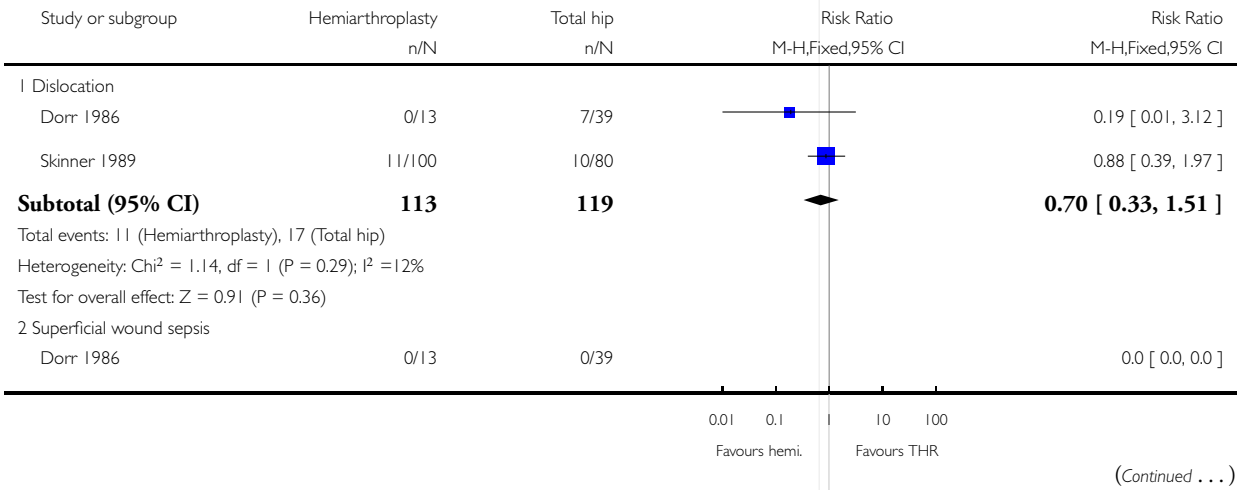


Analysis 4.1. Comparison 4 Uncemented hemiarthroplasty versus total hip replacement, Outcome 1 Surgical outcomes.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 4 Uncemented hemiarthroplasty versus total hip replacement

Outcome: 1 Surgical outcomes



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Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**13**	**39**		**0.0 [0.0, 0.0]**
Total events: 0 (Hemiarthroplasty), 0 (Total hip)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
3 Deep wound infection				
Dorr 1986	0/13	0/39		0.0 [0.0, 0.0]
Skinner 1989	0/100	1/80		0.27 [0.01, 6.47]
Subtotal (95% CI)	**113**	**119**		**0.27 [0.01, 6.47]**
Total events: 0 (Hemiarthroplasty), 1 (Total hip)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.81 (P = 0.42)				

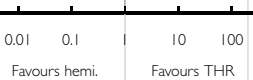
Analysis 4.2. Comparison 4 Uncemented hemiarthroplasty versus total hip replacement, Outcome 2 Reoperations.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 4 Uncemented hemiarthroplasty versus total hip replacement

Outcome: 2 Reoperations

Study or subgroup	Hemiarthroplasty n/N	THR n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Reoperations - minor					
Dorr 1986	0/13	7/39		16.9 %	0.19 [0.01, 3.12]
Skinner 1989	11/100	10/80		83.1 %	0.88 [0.39, 1.97]
Subtotal (95% CI)	**113**	**119**		**100.0 %**	**0.72 [0.26, 2.04]**
Total events: 11 (Hemiarthroplasty), 17 (THR)					
Heterogeneity: Tau^2 = 0.15; Chi^2 = 1.14, df = 1 (P = 0.29); I^2 =12%					
Test for overall effect: Z = 0.61 (P = 0.54)					
2 Reoperations - major					
Dorr 1986	1/13	2/39		29.0 %	1.50 [0.15, 15.22]
Skinner 1989	13/100	3/80		71.0 %	3.47 [1.02, 11.75]
Subtotal (95% CI)	**113**	**119**		**100.0 %**	**2.89 [0.98, 8.51]**
Total events: 14 (Hemiarthroplasty), 5 (THR)					



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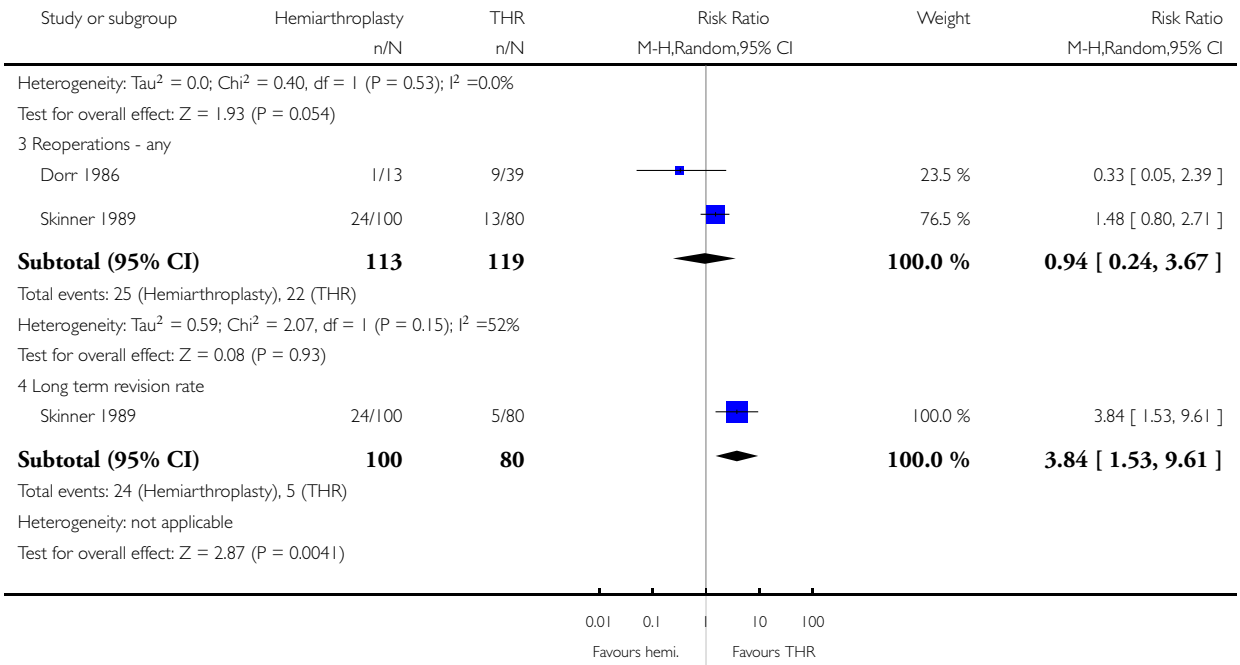
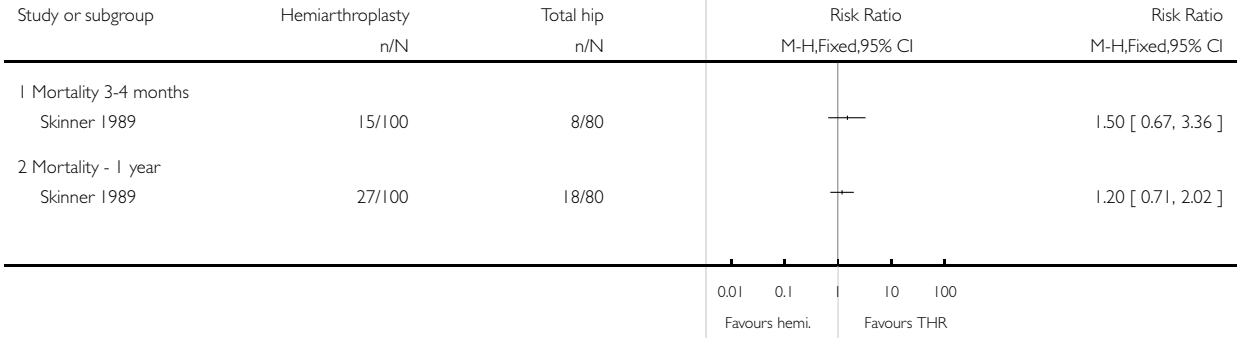


Analysis 4.3. Comparison 4 Uncemented hemiarthroplasty versus total hip replacement, Outcome 3 Mortality.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 4 Uncemented hemiarthroplasty versus total hip replacement

Outcome: 3 Mortality

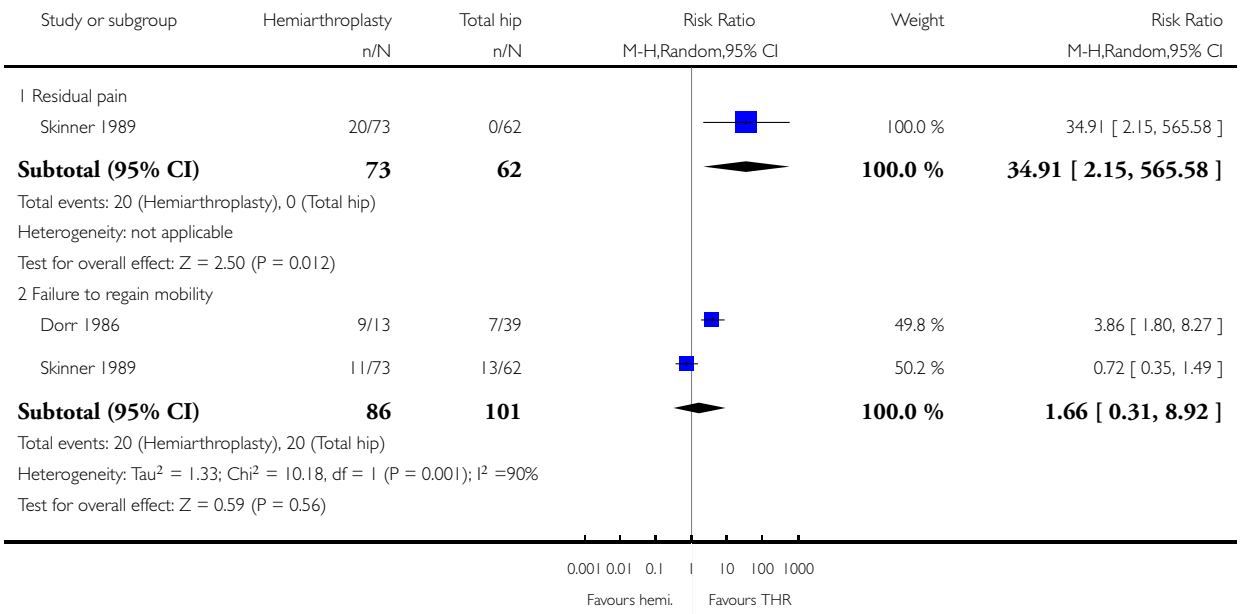


Analysis 4.4. Comparison 4 Uncemented hemiarthroplasty versus total hip replacement, Outcome 4 Final outcomes for survivors.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 4 Uncemented hemiarthroplasty versus total hip replacement

Outcome: 4 Final outcomes for survivors

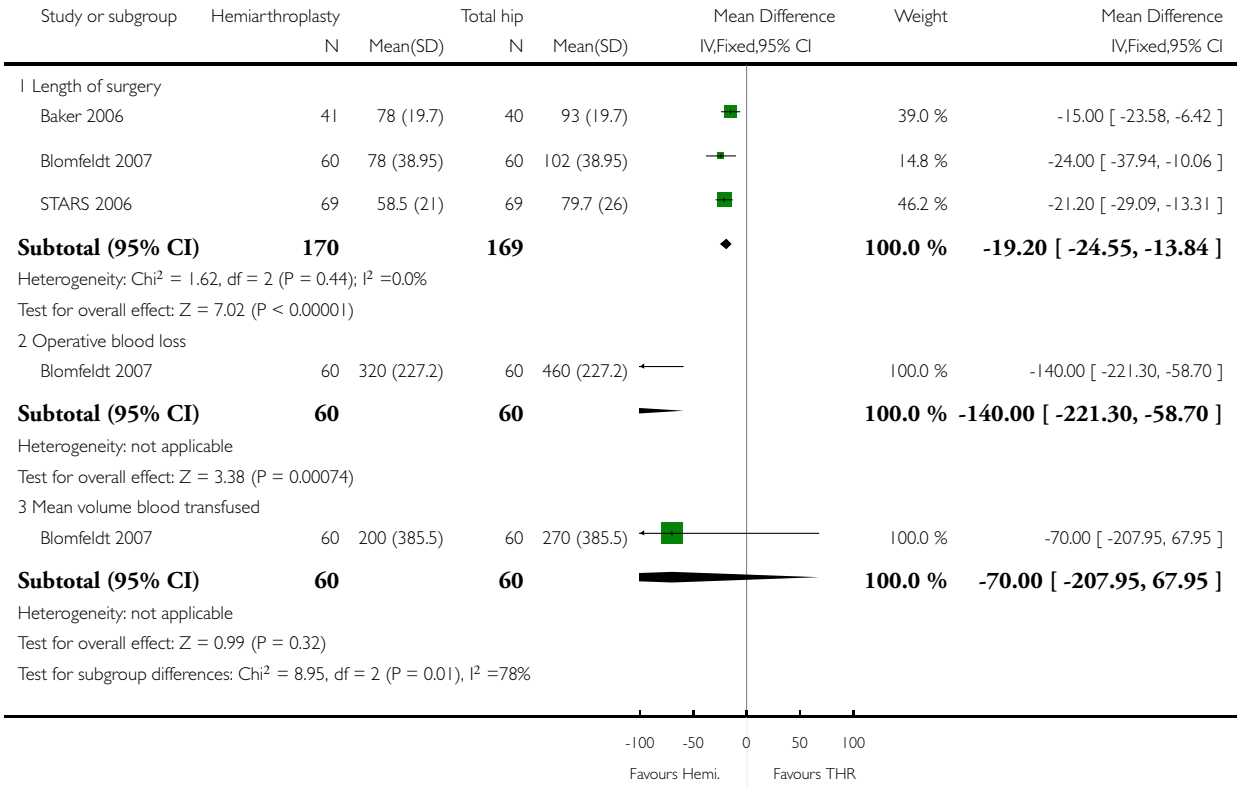


Analysis 5.1. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 1 Operative outcomes.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 1 Operative outcomes

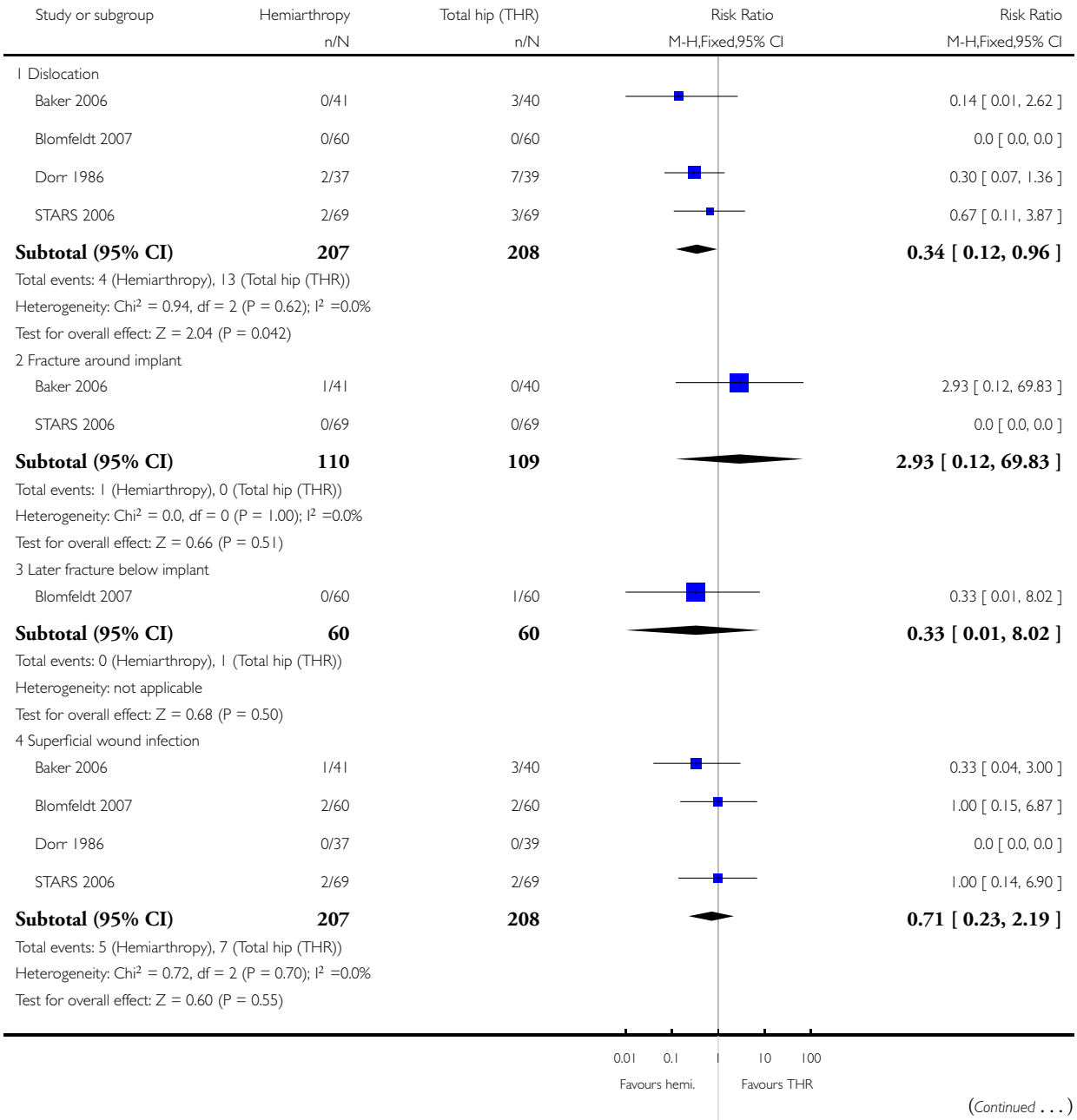


Analysis 5.2. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 2 Surgical outcomes.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 2 Surgical outcomes



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Study or subgroup	Hemiarthropy n/N	Total hip (THR) n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
5 Deep wound infection				
Baker 2006	0/41	0/40		0.0 [0.0, 0.0]
Blomfeldt 2007	0/60	1/60		0.33 [0.01, 8.02]
Dorr 1986	0/37	0/39		0.0 [0.0, 0.0]
STARS 2006	1/69	1/69		1.00 [0.06, 15.67]
Subtotal (95% CI)	**207**	**208**		**0.60 [0.08, 4.48]**
Total events: 1 (Hemiarthropy), 2 (Total hip (THR))				
Heterogeneity: Chi^2 = 0.26, df = 1 (P = 0.61); I^2 =0.0%				
Test for overall effect: Z = 0.50 (P = 0.62)				

Analysis 5.3. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 3 Reoperations.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 3 Reoperations

Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Reoperations - minor					
Baker 2006	0/41	4/40		35.4 %	0.11 [0.01, 1.95]
Blomfeldt 2007	0/60	1/60		11.7 %	0.33 [0.01, 8.02]
Dorr 1986	2/37	7/39		53.0 %	0.30 [0.07, 1.36]
Subtotal (95% CI)	**138**	**139**		**100.0 %**	**0.24 [0.07, 0.80]**
Total events: 2 (Hemiarthroplasty), 12 (Total hip)					
Heterogeneity: Chi^2 = 0.42, df = 2 (P = 0.81); I^2 =0.0%					
Test for overall effect: Z = 2.32 (P = 0.020)					
2 Reoperations - major					
Baker 2006	3/41	1/40		22.7 %	2.93 [0.32, 26.97]
Blomfeldt 2007	0/60	1/60		33.6 %	0.33 [0.01, 8.02]
Dorr 1986	3/37	2/39		43.7 %	1.58 [0.28, 8.93]

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Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**138**	**139**		**100.0 %**	**1.47 [0.45, 4.76]**
Total events: 6 (Hemiarthroplasty), 4 (Total hip)					
Heterogeneity: Chi² = 1.21, df = 2 (P = 0.55); I² =0.0%					
Test for overall effect: Z = 0.64 (P = 0.52)					
3 Reoperations - any					
Baker 2006	3/41	5/40		22.7 %	0.59 [0.15, 2.29]
Blomfeldt 2007	0/60	2/60		11.2 %	0.20 [0.01, 4.08]
Dorr 1986	5/37	9/39		39.3 %	0.59 [0.22, 1.59]
STARS 2006	5/69	6/69		26.9 %	0.83 [0.27, 2.60]
Subtotal (95% CI)	**207**	**208**		**100.0 %**	**0.61 [0.32, 1.15]**
Total events: 13 (Hemiarthroplasty), 22 (Total hip)					
Heterogeneity: Chi² = 0.82, df = 3 (P = 0.84); I² =0.0%					
Test for overall effect: Z = 1.53 (P = 0.13)					

Analysis 5.4. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 4 Medical complications.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 4 Medical complications

Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Deep vein thrombosis					
Baker 2006	0/41	4/40		47.7 %	0.11 [0.01, 1.95]
Blomfeldt 2007	1/60	0/60		5.2 %	3.00 [0.12, 72.20]
STARS 2006	0/69	4/69		47.1 %	0.11 [0.01, 2.03]
Subtotal (95% CI)	**170**	**169**		**100.0 %**	**0.26 [0.07, 1.04]**
Total events: 1 (Hemiarthroplasty), 8 (Total hip)					
Heterogeneity: Chi² = 2.95, df = 2 (P = 0.23); I² =32%					
Test for overall effect: Z = 1.91 (P = 0.056)					
2 Pulmonary embolism					

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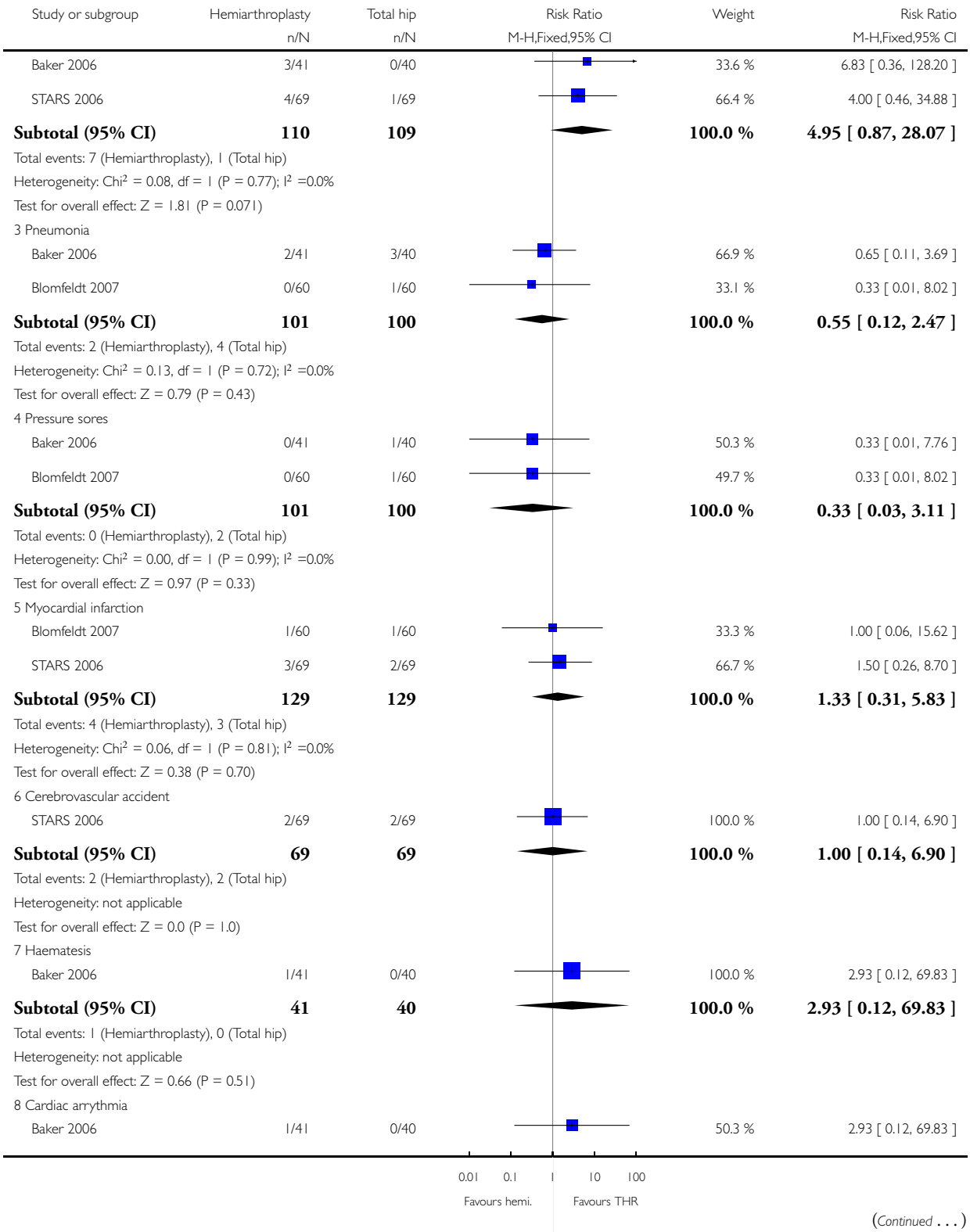

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Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Blomfeldt 2007	1/60	0/60		49.7 %	3.00 [0.12, 72.20]
Subtotal (95% CI)	**101**	**100**		**100.0 %**	**2.96 [0.31, 28.01]**
Total events: 2 (Hemiarthroplasty), 0 (Total hip)					
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.99); I^2 =0.0%					
Test for overall effect: Z = 0.95 (P = 0.34)					
9 Congestive cardiac failure					
Blomfeldt 2007	0/60	1/60		100.0 %	0.33 [0.01, 8.02]
Subtotal (95% CI)	**60**	**60**		**100.0 %**	**0.33 [0.01, 8.02]**
Total events: 0 (Hemiarthroplasty), 1 (Total hip)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.68 (P = 0.50)					
10 Hyponatraemia					
Baker 2006	0/41	1/40		100.0 %	0.33 [0.01, 7.76]
Subtotal (95% CI)	**41**	**40**		**100.0 %**	**0.33 [0.01, 7.76]**
Total events: 0 (Hemiarthroplasty), 1 (Total hip)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.69 (P = 0.49)					
11 All medical complications					
Baker 2006	7/41	8/40		31.0 %	0.85 [0.34, 2.13]
Blomfeldt 2007	3/60	4/60		15.3 %	0.75 [0.18, 3.21]
STARS 2006	12/69	14/69		53.6 %	0.86 [0.43, 1.72]
Subtotal (95% CI)	**170**	**169**		**100.0 %**	**0.84 [0.50, 1.41]**
Total events: 22 (Hemiarthroplasty), 26 (Total hip)					
Heterogeneity: Chi^2 = 0.03, df = 2 (P = 0.99); I^2 =0.0%					
Test for overall effect: Z = 0.66 (P = 0.51)					

Analysis 5.5. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 5 Hospital stay.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 5 Hospital stay

Study or subgroup	Hemiarthroplasty N	Mean(SD)	Total hip N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
STARS 2006	69	11.5 (8)	69	12.3 (10)		-0.80 [-3.82, 2.22]

Analysis 5.6. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 6 Mortality.

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 6 Mortality

Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Mortality at 3-4 months					
STARS 2006	5/69	2/69		100.0 %	2.50 [0.50, 12.45]
Subtotal (95% CI)	**69**	**69**		**100.0 %**	**2.50 [0.50, 12.45]**
Total events: 5 (Hemiarthroplasty), 2 (Total hip)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.12 (P = 0.26)					
2 Mortality at 1 year					
Blomfeldt 2007	3/60	4/60		50.0 %	0.75 [0.18, 3.21]
STARS 2006	6/69	4/69		50.0 %	1.50 [0.44, 5.08]
Subtotal (95% CI)	**129**	**129**		**100.0 %**	**1.13 [0.45, 2.83]**
Total events: 9 (Hemiarthroplasty), 8 (Total hip)					
Heterogeneity: Chi^2 = 0.51, df = 1 (P = 0.47); I^2 =0.0%					
Test for overall effect: Z = 0.25 (P = 0.80)					
3 Mortality at 2 years					
Baker 2006	7/41	3/40		33.6 %	2.28 [0.63, 8.19]

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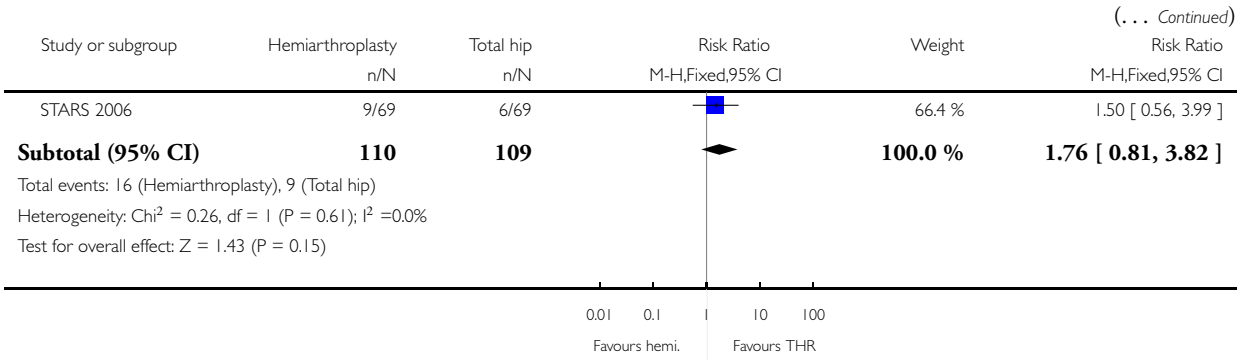
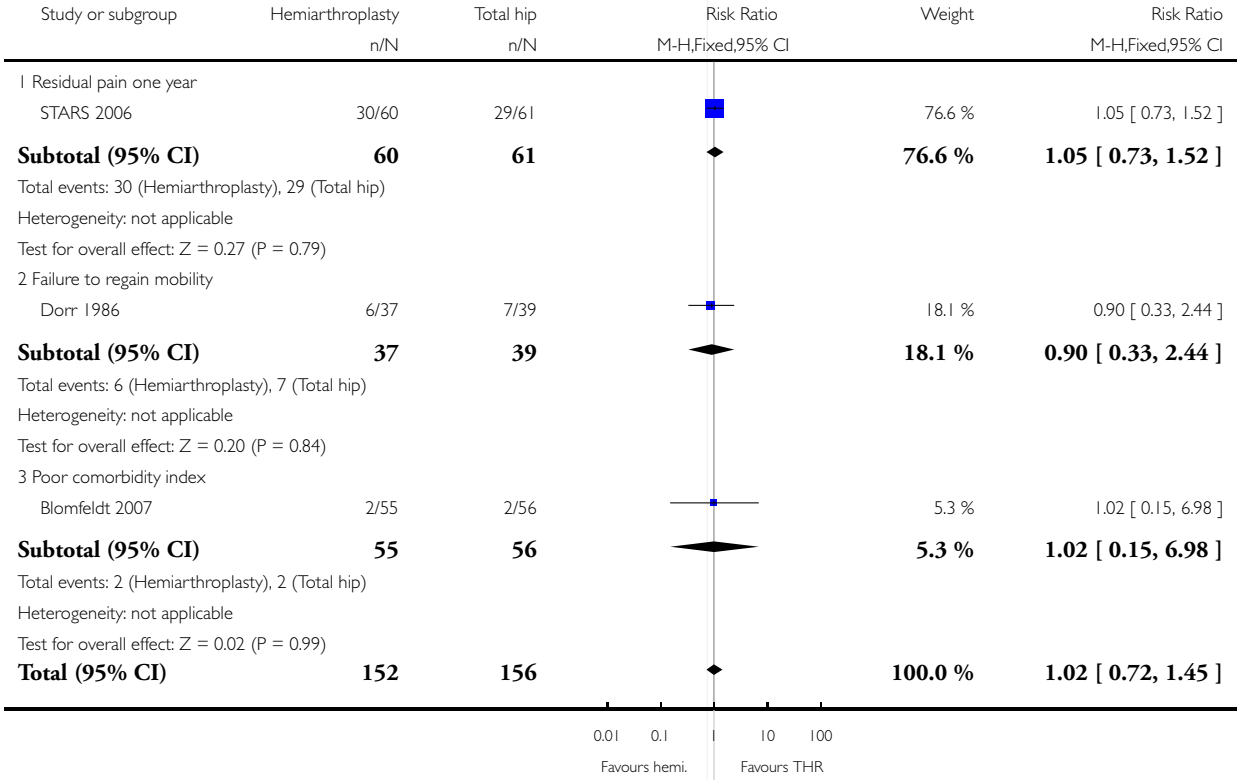


Analysis 5.7. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 7 Final outcomes for survivors (dichotomous outcomes).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 7 Final outcomes for survivors (dichotomous outcomes)



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Study or subgroup	Hemiarthroplasty n/N	Total hip n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 38 (Hemiarthroplasty), 38 (Total hip)					
Heterogeneity: $Chi^2 = 0.08$, df = 2 (P = 0.96); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.13 (P = 0.90)					

Analysis 5.8. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 8 Final outcomes for survivors (continuous outcomes for which a lower score is advantagous).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 8 Final outcomes for survivors (continuous outcomes for which a lower score is advantagous)

Study or subgroup	Hemiarthroplaty N	Mean(SD)	Total hip N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Oxford Hip Score						
Baker 2006	33	22.3 (6.7)	36	18.8 (6.7)		3.50 [0.34, 6.66]

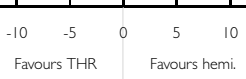
Analysis 5.9. Comparison 5 Cemented hemiarthroplasty versus total hip replacement, Outcome 9 Final outcomes for survivors (continuous outcomes for which a higher score is advantagous).

Review: Arthroplasties (with and without bone cement) for proximal femoral fractures in adults

Comparison: 5 Cemented hemiarthroplasty versus total hip replacement

Outcome: 9 Final outcomes for survivors (continuous outcomes for which a higher score is advantagous)

Study or subgroup	Hemiarthroplasty N	Mean(SD)	Total hip N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Hip rating questionnaire						
STARS 2006	50	73.8 (16)	56	79.9 (17)		-6.10 [-12.38, 0.18]
2 Self reported walking distance (kilometres)						
Baker 2006	33	1.9 (3.35)	36	3.6 (3.35)		-1.70 [-3.28, -0.12]
3 Short form 36 physical score						
Baker 2006	33	38.1 (10.85)	36	40.53 (10.85)		-2.43 [-7.56, 2.70]
4 Short form 36 mental score						
Baker 2006	33	55.3 (14.43)	36	52 (14.43)		3.30 [-3.52, 10.12]
5 EuroQol (EQ-5d) questionnaire						
STARS 2006	65	0.53 (0.36)	66	0.69 (0.32)		-0.16 [-0.28, -0.04]
6 Harris Hip Score for pain						
Blomfeldt 2007	55	39.1 (6.26)	56	43.1 (6.26)		-4.00 [-6.33, -1.67]
7 Harris Hip Score for function						
Blomfeldt 2007	55	31.6 (9.23)	56	35.3 (9.23)		-3.70 [-7.13, -0.27]
8 Harris Hip Score - total score						
Blomfeldt 2007	55	79.4 (12.14)	56	87.2 (12.14)		-7.80 [-12.32, -3.28]



APPENDICES

Appendix 1. Search strategies for EMBASE and CINAHL

EMBASE (OVID-WEB)	CINAHL (OVID-WEB)
1. exp Hip Fracture/ 2. ((hip$ or ((femur$ or femoral$) adj3 (neck or proximal))) adj4 fracture$).tw. 3. or/1-2 4. exp Randomized Controlled trial/ 5. exp Double Blind Procedure/	1. exp Hip Fractures/ 2. ((hip$ or ((femur$ or femoral$) adj3 (neck or proximal))) adj4 fracture$).tw. 3. or/1-2 4. exp Clinical Trials/ 5. exp Evaluation Research/

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6. exp Single Blind Procedure/ 7. exp Crossover Procedure/ 8. Controlled Study/ 9. or/4-8 10. ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed)adj3 (trial or study)).tw. 11. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. 12. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. 13. (cross?over$ or (cross adj1 over$)).tw. 14. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. 15. or/10-14 16. or/9,15 17. limit 16 to human 18. and/3,17	6. exp Comparative Studies/ 7. exp Crossover Design/ 8. clinical trial.pt. 9. or/4-8 10. ((clinical or controlled or comparative or placebo or prospective or randomi#ed)adj3 (trial or study)).tw. 11. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. 12. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. 13. (cross?over$ or (cross adj1 over$)).tw. 14. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. 15. or/10-14 16. or/9,15 17. and/3,16

WHAT'S NEW

Last assessed as up-to-date: 14 May 2007.

9 May 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 3, 1999

Review first published: Issue 3, 2001

19 February 2008	New search has been performed	For the third update (Issue 2, 2008), the following changes were made: 1. Search was updated to February 2007. 2. New studies of Baker 2006 and Blomfeldt 2007 were included. 3. Functional outcome data for Stars 2006 presented in the analyses There were no substantial changes made to the conclusions of the review.
19 May 2006	New search has been performed	For the second update (Issue 3, 2006) the following changes were made: 1. Search updated to December 2005; 2. New studies of STARS 2005 and Santini 2005 included;

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		3. Ongoing study of Georgescu 2004 identified; 4. Study of Field 2005 excluded; 5. Comparisons adjusted to split hemiarthroplasty versus total hip replacement into those with and without cement. There were no changes to the conclusions of the review.
18 February 2004	New search has been performed	For the first update (Issue 2, 2004) the following changes were made: 1. new studies of Branfoot 2000 and Raia 2003 included; 2. studies of Clark 2001, Faraj 1999, Gierer 2002, Graf 2000, Johnson 2001, Leidinger 2002, and Sadr 1977 added to excluded studies; 3. study of Bonke 1999 and Moroni 2002 added to ongoing studies. There were no changes to the conclusions of the review.

CONTRIBUTIONS OF AUTHORS

Martyn Parker initiated and designed the review, extracted data, contacted trialists for further information and compiled the review. For the first update, Kurinchiselvan Gurusamy independently extracted data, checked the text and assisted in writing the update. Martyn Parker is the guarantor of the review.

DECLARATIONS OF INTEREST

The lead review author, Dr Martyn Parker, is the principal investigator of an ongoing trial investigating comparisons relevant to this review (Parker).

SOURCES OF SUPPORT

Internal sources

- Peterborough and Stamford Hospitals NHS Foundation Trust, UK.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Bone Cements; Arthroplasty, Replacement, Hip [*methods]; Femoral Neck Fractures [surgery]; Hip Fractures [*surgery]; Prosthesis Design; Randomized Controlled Trials as Topic; Treatment Outcome

MeSH check words

Adult; Humans