Parker MJ, Gurusamy KS, Azegami S. Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. Cochrane Database of Systematic Reviews 2010, Issue 6. Art. No.: CD001706.

Design: meta-analysis of randomized and quasi-randomized clinical trials

Study purpose: to compare outcomes of various arthroplasties in the setting of proximal femoral fractures

PICOS:

- Patient population: skeletally mature adults with proximal femoral fractures
- Interventions: total hip replacement , hemiarthroplasty (unipolar or bipolar), and cemented or uncemented stem fixation
- Comparisons:
    - Cemented versus uncemented prostheses
    - Different types of unipolar hemiarthroplasties
    - Different types of bipolar hemiarthroplasties
    - Unipolar hemiarthroplasty versus bipolar hemiarthroplasty
    - Cemented hemiarthroplasty versus total hip replacement (THR)
    - Uncemented hemiarthroplasty versus THR
    - Different types of THR
- Outcomes:
    - Operative details (length of surgery, operative blood loss, etc)
    - Implant related complications (dislocation, loosening, acetabular wear, breakage, etc)
    - Postoperative complications (pneumonia, deep vein thrombosis, etc)
    - Hospital stay and use of resources
    - Anatomical restoration (leg shortening, range of motion at the hip)
    - Final outcome measures
        - Mortality
        - Pain at final followup
        - Residence at final followup (return to home or otherwise)]
        - Mobility (use of walking aids, return of mobility)
        - Other functional outcomes
        - Health-related quality of life measures
- Study types: Primarily randomized trials, but quasi-randomized trials were considered for inclusion as well

Study selection:

- Databases included the Cochrane Central Register, MEDLINE, EMBASE, and CINAHL through September 2009; reference lists of articles were also searched
- Two authors independently assessed articles for inclusion with masking of the journal and author names
- The main assessment of quality was allocation concealment, but a further nine aspects of methodology were evaluated
- Meta-analysis was done with pooling of data where appropriate; if there were considerable heterogeneity (measured by I squared>50%), a random effects model was used; otherwise, a fixed effect model was used

Results:

- 23 trials with 2861 older and primarily female patients were included in the review
    - 12 studies had adequate methods of randomization and allocation concealment
    - 5 studies were quasi-randomized (hospital number, day of admission, week of admission)
    - Only five studies had blinded assessment of outcome
    - No study followed patients for five years or longer
- For the comparison of cemented versus uncemented prostheses, data was taken from 6 studies with 899 patients
    - Operative risk of fracture of the femur was greatly reduced with the cemented prosthesis (0/291) versus uncemented (17/306)
    - Residual pain in the hip was less frequent at three months with a cemented (96/192 =35%) versus uncemented prosthesis (84/183=46%)
    - Trends (less than statistically significant) were observed in favor of cemented over uncemented prostheses for operative blood loss, occurrence of medical complications, return to home of residence, and success at regaining preoperative mobility
    - Three-month mortality did not differ between groups (14% mortality in each group)
- For the comparison of different types of unipolar hemiarthroplasty, only one study was identified, in which a ceramic head was compared with a conventional head; the mean hip scores were compared at an unspecified time, with no difference between groups
- For the comparison of unipolar versus bipolar hemiarthroplasty, seven studies were included
    - No statistically significant differences were reported for mortality, dislocation, acetabular erosion, deep wound sepsis, reoperations, or mobility
- For the comparison of hemiarthroplasty versus THR, many of the analyses for cemented and uncemented stems were presented in subgroups but then combined into an overall summary effect measure, and in some studies, both cemented and

uncemented stems were used, but some statistically significant differences were reported

- Operating time was 18.5 minutes shorter for hemiarthroplasty than for THR
- There was less risk of dislocation with hemiarthroplasty than with THR (15/343=4.4% for hemiarthroplasty versus 24/305=7.9% for THR
- There were more "minor" reoperations for THR (13/274=4.7%) than for hemiarthroplasty (22/236=9.3%)
- There were more "major" reoperations for hemiarthroplasty (25/317=7.9%) than for THR (9/279=3.2%)
    - Most of this difference was due to the increased reoperation rate for the uncemented hemiarthroplasty groups
- There was less residual pain at one year for THR than for uncemented hemiarthroplasty
- Several functional outcome scores were better for THR than for hemiarthroplasty
    - These included the Oxford hip score, the Harris hip score, the Barthel score, and the EuroQol score
    - Most of these were reported in only one study; the Harris hip score at one year was reported in two studies
- Other outcomes, including mortality, were not different between THR and hemiarthroplasty

Authors' conclusions:

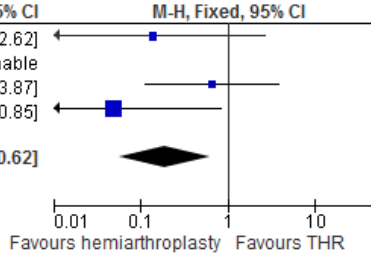
- Many trial reports had a poor level of methodological rigor, lacking such features as allocation concealment, assessor blinding, and intention-to-treat analysis
- This problem may be more a matter of poor reporting rather than poor trial methodology, since some of the reports were taken from conference abstracts which were never published as full text journal articles
- Some comparisons, such as between cemented and uncemented stems, may have been clouded by the fact that some of the prostheses differed in other ways than only cementing or non-cementing
    - The highest quality cemented/uncemented study found in favor of cement for intraoperative and postoperative fractures
- There is limited evidence from three studies that a cemented THR results in less residual pain and better hip function than uncemented hemiarthroplasty
- Unipolar and bipolar hemiarthroplasty showed no differences in the seven studies testing the comparison

Comments:

- Because of a wide variety of treatment comparisons and a large number of outcome measures, many treatment effects were estimated using only one study; for the comparison of THA versus hemiarthroplasty, only one of the functional scores (Harris Hip Score at one year) had two studies
- In Analysis 4.13, THA and hemiarthroplasty are compared for frequency of medical complications, with paradoxical results
    - For deep vein thrombosis, the risk was lower for hemiarthroplasty (1/170) than for THA (8/169)
    - For pulmonary emboli, the risk was greater for hemiarthroplasty (7/133) than for THA (2/126)
    - Each comparison was based on three studies, and for each comparison, the same two studies reported thromboembolic complications; and the paradoxical results arise from these two studies
        - That is, there were no DVTs among 110 hemiarthroplasty cases, but there were 6/110 pulmonary emboli; for the THR cases, there were 8/109 with a DVT but 1/109 with a PE
- A later study (van den Bekerom 2011) provides further data in addition to Analysis 4.4 comparing THR with hemiarthroplasty for frequency of fractures
    - Pooled data from the three studies in the Cochrane analysis estimated a lower risk of fracture with hemiarthroplasty than with THR with a pooled relative risk of 0.38; with van den Bekerom 2011, the pooled RR is 0.19

	Hemiarthroplasty		Total Hip Replacement			Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI	M-H, Fixed, 95% CI
Baker 2006	0	41	3	40	22.4%	0.14 [0.01, 2.62]	
Blomfeldt 2007	0	60	0	60		Not estimable	
STARS 2006	2	69	3	69	19.0%	0.67 [0.11, 3.87]	
van den Bekerom 2011	0	137	8	115	58.5%	0.05 [0.00, 0.85]	
Total (95% CI)		**307**		**284**	**100.0%**	**0.19 [0.06, 0.62]**	
Total events	2		14				

Heterogeneity: Chi² = 2.89, df = 2 (P = 0.24); I² = 31%
Test for overall effect: Z = 2.73 (P = 0.006)



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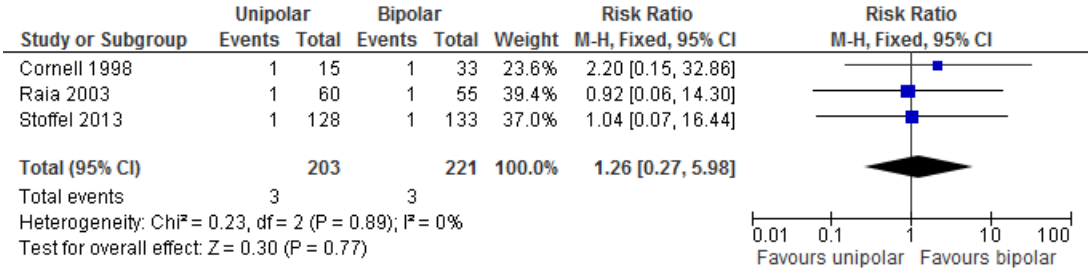
- The same van den Bekerom 2011 study also had comparative data on function with the Harris Hip Score, and reported approximately equal results between hemiarthroplasty and THR, but did not report standard deviations, preventing the pooling of functional results with the Harris Hip Score in Analysis 4.20, where a single study showed a small advantage of THR over hemiarthroplasty
- For the comparison of unipolar versus bipolar hemiarthroplasty, two studies were combined in Analysis 3.1, which estimated no difference in risk of dislocation between the two procedures (Relative risk of 1.4 favoring bipolar with 95% confidence interval from 0.21 to 9.20), which is a very wide confidence interval
    - An additional study, Stoffel 2013, also showed no difference in risk of dislocation, and the pooled RR is 1.26 (95% CI from 0.27 to 5.98) with no

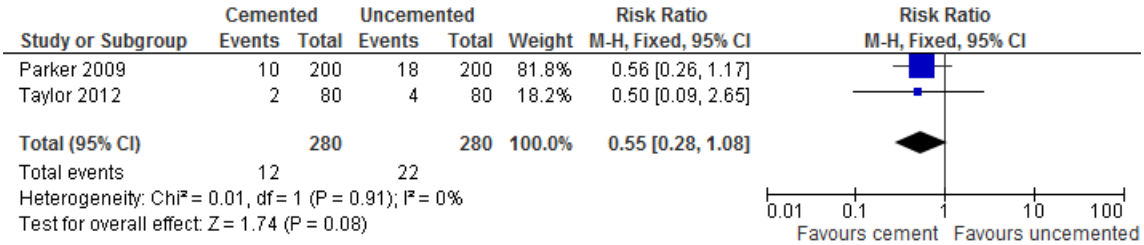
difference between procedures



- The comparison of cemented versus uncemented hemiarthroplasty relied heavily on data from Parker 2009, but some studies published later can be combined with Parker 2009 to add precision to the estimates of treatment effect
    - For cemented versus uncemented hemiarthroplasty, Taylor 2102 adds data to Parker 2009 for intraoperative fracture in Analysis 1.2; the risk of intraoperative fracture is much greater with uncemented procedures

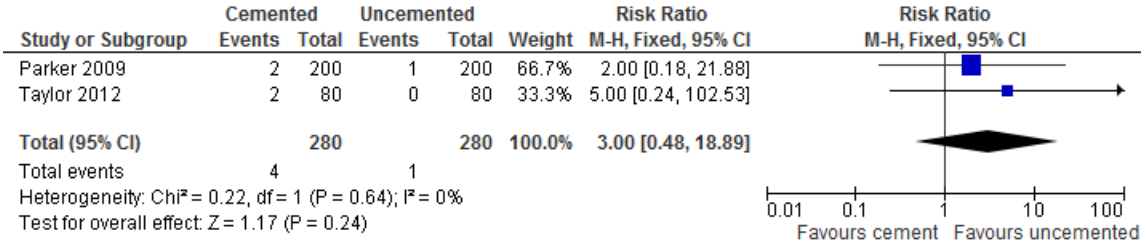
For postoperative fracture, Taylor 2012 also adds data to Parker 2009 in Analysis 1.7; the risk of later fracture is also much greater with uncemented procedures

    - For any reoperation, Taylor 2012 does not significantly affect the estimate of fewer reoperations with cement, but the pooled data remain statistically non-significant from Analysis 1.14, in which the Parker 2009 study had shown a RR of 0.55 with confidence intervals from 0.28 to 1.08



- Failure to return home after discharge was estimated in Analysis 1.27 from Parker 2009 only; DeAngelis 2012 also reported on return home at 30 days, and the combined results do not differ between cemented and uncemented procedures

- For dislocation, Taylor 2012 does not significantly affect the statistically nonsignificant relative risk in favor of uncemented procedures in Analysis 1.8



- One-year mortality also was estimated in Analysis 1.20 using data from Parker 2009 only with a relative risk of 0.85; the addition of DeAngelis 2012 does not change the relative risk estimate; there is no evidence of statistically significant mortality differences between the procedures

- Mortality rates are fairly high in this elderly and often frail population; however, differences in mortality do not appear to be significant for the different operations
  - Avery 2011 is a 7-10 year followup from one of the included studies of THR versus hemiarthroplasty (Baker 2006), which reported three-to-four year mortality which was higher (7/41) for hemiarthroplasty than for THR (3/40); this is a relative risk of 2.28 with confidence interval from 0.63 to 8.19
  - The 7-10 year mortality as reported by Avery 2011 was 21/41 for hemiarthroplasty and 13/40 for THR, this is a relative risk of 1.58 with confidence intervals from 0.92 to 2.70
  - Although the longer followup time seems to show higher mortality with hemiarthroplasty than with THR, the differences in mortality remain within the domain of chance; since the pooled mortality from the three included

studies (Analysis 4.15) was very similar for THR and hemiarthroplasty, there is no evidence that the two procedures differ on mortality

- Overall, reporting of outcome data is suboptimal; some outcomes are reported as means without standard deviations, other outcomes are reported as p values without numerical data, and it is rare to find multiple studies which report the same outcome for the same comparison
- The Parker 2009 study of cemented versus uncemented hemiarthroplasty cited in the Cochrane paper was not published as a journal article in 2009, but was published in journal form in 2010 in the British JBJS and is cited below
- Comparing THR with hemiarthroplasty is made difficult by the fact that the supposed functional and symptom advantages of THR are equivocal, with "trends" in favor of THR; however, the evidence that the risk of fractures is fairly clear, and the pooled risk of fractures for hemiarthroplasty is one fifth the risk for THR, with pooled data from four studies clearly on the side of hemiarthroplasty
- For cemented versus uncemented hemiarthroplasty, the risk of both operative and postoperative fracture is clearly less with the cemented stems, although the evidence regarding other outcomes is not as clear
- Unipolar and bipolar hemiarthroplasty appear to have similar outcomes, which would tend to favor the use of the less expensive unipolar device

Assessment: A high quality meta-analysis of numerous outcomes based on some suboptimal original studies; the results support good evidence that the risk of fracture is lower with a hemiarthroplasty than with a total hip replacement, good evidence that cemented hemiarthroplasty has a lower risk of intraoperative and postoperative fractures than an uncemented hemiarthroplasty. There is no evidence that different operations have different risks of mortality in a population with a high baseline risk of death within several years of a hip fracture. There is good evidence that unipolar and bipolar hemiarthroplasty yield similar results for mortality, acetabular erosion, reoperations, or mobility. The evidence regarding functional and pain outcomes of hemiarthroplasty versus total hip replacement remains unclear at this time.

References:

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Stoffel KK, Nivbrant B, et al. Does a bipolar hemiprosthesis offer advantages for elderly patients with neck of femur fracture? A clinical trial with 261 patients ANZ J Surg 2013;83:249–254.

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