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Comparison between Cementless and Cemented Bipolar Hemiarthroplasty for Treatment of Unstable Intertrochanteric Fractures: Systematic Review and Meta-analysis

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Purpose: This study was conducted to compare cemented and cementless bipolar hemiarthroplasty in elderly patients with unstable intertrochanteric fractures via meta-analysis and systematic review of relevant studies.
Materials and Methods: Systematic review and meta-analysis were performed on 31 available clinical studies; 19 of these studies used cemented stems, 12 used cementless stems, one used both types of stems, and two studies involved a comparative analysis of both stem types.
Results: There were statistically significant differences in rates of leg length discrepancy (LLD) greater than 1 cm between the cemented (event rate, 0.089) and cementless groups (event rate, 0.015 and 0.047; *P*=0.03).
Conclusion: Cemented bipolar hemiarthroplasty and cementless bipolar hemiarthroplasty performed on elderly patients with unstable intertrochanteric fracture revealed similar mortality and complication rates; however, the rate of LLD greater than 1 cm was significantly higher in the cemented group compared with the cementless group.

Key Words: Hip, Hip fractures, Hemiarthroplasty, Leg length inequality

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INTRODUCTION

Hip fractures in elderly patients are becoming a major social problem from various perspectives, including the progressive aging of global societies[1]. The elderly have a high risk of hip fracture, even with minor injuries because of osteoporosis, while early surgical treatment may be difficult due to comorbidities and medication[2]. Moreover, even after surgical treatment, secure fixation is hard to achieve due to osteoporosis. Additionally, impaired mobility following surgery may increase complications (e.g., pneumonia, sores, mortality). These conditions not only prolong the treatment period and result in higher medical expenditures, but also create a higher overall socioeconomic cost[3]. Therefore, many studies on the treatment of hip fractures in elderly patients have examined methods for increasing successful treatment outcomes and enabling early ambulation without increasing patient mortality[4,5].

Intertrochanteric fractures-one of the most common types of fracture in elderly patients-account for roughly 45% to 50% of all hip fractures, and of these, 35% to 60% are unstable and accompanied by comminution of the posteromedial buttress, exceeding a simple lesser trochanteric fragment or those with subtrochanteric extension[6-9]. Failure rates of unstable intertrochanteric fracture treatment have been decreasing, in part because of the development of various types of proximal nail and surgical techniques that can achieve accurate reduction. However, osteoporosis and cognitive dysfunction of patients still remain major causes of fixation failure as they may make it difficult to achieve strong fixation in the fracture site and interfere with early ambulation[4,5]. Consequently, although still debatable, arthroplasty may be considered a preferred approach for treating unstable intertrochanteric fractures[10].

Positive outcomes have been reported from those studies using arthroplasty to treat hip fractures in elderly patients. However, in cases of unstable intertrochanteric fractures, it is difficult to achieve stable fixation and identify the anatomic structure because of comminution and displacement of the bones near the stem; this injury is also associated with risks of complications (e.g., greater trochanteric nonunion, heterotopic ossification [HO]). Additionally, cement-related fatal cardiovascular complications are also present[11-13]. Therefore, the decisions on which surgical approach and prosthesis to use become very important, particularly which type of stem, just as is the case with femoral neck[14].

Accordingly, this study aimed to compare cemented and cementless bipolar hemiarthroplasty in elderly patients with unstable intertrochanteric fractures by using a meta-analysis and systematic review of studies on these two methods.

MATERIALS AND METHODS

A systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[15].

1. Study Eligibility Criteria

Studies were selected based on the following inclusion criteria: 1) studies of unstable intertrochanteric fracture was reported; 2) cemented or cementless hemiarthroplasty was used for fracture treatment; and 3) studies reporting treatment outcomes. Studies were excluded if they failed to meet the above criteria, were case reports, or involved pathologic fractures.

2. Search Methods for Identification of Studies

PubMed Central, OVID Medline, Cochrane Collaboration Library, Web of Science, EMBASE, and AHRQ databases were searched to identify relevant studies published up until September 2017 with English language restriction. The following search terms were used: “unstable intertrochanteric fracture arthroplasty”, “unstable trochanteric fracture arthroplasty”, “unstable trochanteric fracture bipolar”. A manual search was also conducted to identify other potential references of relevance. Two investigators independently reviewed titles, abstracts, and full text of all potentially relevant studies as recommended by the Cochrane Collaboration.

3. Data Extraction

The following information was extracted from the included articles: authors, publication date, study design, patient number, gender, fracture classification, prosthesis type, operation time, blood loss, hospital stay period, outcome, complication, and mortality.

4. Methodological Quality Assessment

The Newcastle-Ottawa scale was used to assess methodological quality of non-randomized studies. It contains 8 items, which are categorized into 3 dimensions: the selection of the study population, the comparability of the groups, and the ascertainment of the exposure (case-control study) or outcome (cohort study). Each dimension consists of subcategorized questions: selection (a maximum of 4 stars), comparability (a maximum of 2 stars), and exposure or outcome (a maximum of 3 stars). Thus, a study can be awarded a maximum of 9 stars, indicating the highest quality. Two of the authors independently evaluated the quality of all the studies.

5. Data Analysis

The primary outcome was leg length discrepancy (LLD). Secondary outcomes were treatment outcomes (i.e., aseptic loosening, dislocation, nonunion of greater trochanter) and complications (i.e., infection, HO, periprosthetic fracture, mortality).

This meta-analysis was performed with Comprehensive Meta-Analysis statistical software (version 2.0; Biostat, Englewood, NJ, USA) and the level of significance was set at $P<0.05$. For dichotomous outcomes, odds ratio and 95% confidence interval (CI) were calculated. For continuous outcomes, standardized mean difference and 95% CI were calculated. The size of heterogeneity across studies was estimated with I^2 statistic and the chi-squared test. A *P*-value of >0.10 and an $I^2 \leq 50\%$ were considered of no statistical heterogeneity[16]. To test heterogeneity, Higgins I^2 statistics were used. Significant heterogeneity was observed in these studies; therefore, we reported the data from a random-effects perspective. A random-effect or fixed-effect model was adopted depending on the heterogeneity of the included studies. Sensitivity analysis was conducted by omitting one study in each turn and pooling the data of the remaining studies to explore possible explanations for high heterogeneity and determine the stability of the outcomes.

RESULTS

1. Search Results

The initial search identified 357 references from the selected databases. However, 315 were excluded after screening the abstracts and titles. The remaining 42 studies underwent full-text review; four studies were further excluded after a full review. Details on the identification of relevant studies are shown in the flow chart of the study selection process (Fig. 1). Study design, number of subjects, demographic factors, surgical approach, type of prosthesis and clinical results included in this study are summarized in Tables 1 and 2.

There were 19 studies that used cemented stem, 14 that used cementless stem, and two comparative studies that used both stems. Eleven studies were prospective studies, which used methods with wires, cables, and sutures for fixation of fracture fragments[1,2,4,11,17-42].

2. Over 1 cm Leg Length Discrepancy

A total of 11 comparative studies included an assessment on the frequency of LLD greater than 1 cm, of which seven used cemented stems[17-23]; the remaining four used cementless stems[24-27]. There was low evidence of heterogeneity across these studies (I^2=52%; P=0.02) leading to the use of a random model. There were statistically significant differences in the occurrence of LLD greater than 1 cm between the cemented and cementless groups (logit event rate=–2.54; $P<0.001$) (Fig. 2).

3. Analysis of Treatment Results

1) Aseptic loosening

A total of 17 comparative studies included an assessment of aseptic loosening rates, of which 11 used cemented

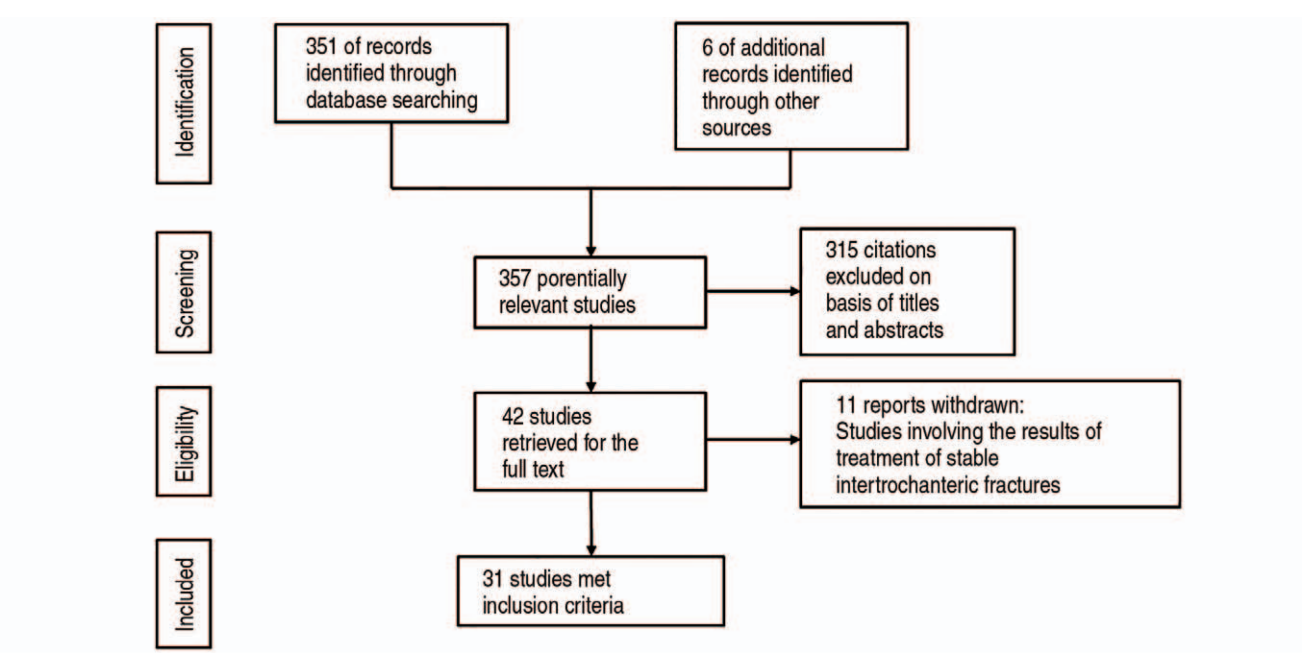


Fig. 1. Flow chart of the study-selection process.

Table 1. Demographics in Included Studies

Study	Design	Case (n)	Gender (n), female /male	Age (yr)	Follow-up (mo)	Prosthesistype	Approach	Fracture fixation
Mansukhani 2017[4]	Prospective	13	8/5	74.38	19	Cemented	Not mentioned	20 gauge steel wire
Camurcu 2017[36]	Retrospective	160	59/47	80.7±5.7	24.6±17.8	Cemented	Posterolateral	Not mentioned
Wada 2017[35]	Retrospective	44	42/2	89.6	12	Cementless	Not mentioned	Integrated greater trochanter plate
Thakur 2016[43]	Prospective	42	40/2	80.7±6.54	16.5	Cemented	Posterolateral	Wire with ethibond
Chang 2016[34]	Prospective	80	68/12	83.4	21.4	Cementless	Posterolateral	Wire, cable or trochanteric transfixation plate
Göçer 2016[11]	Retropective	17	85/36	77.1±6.1	16	Cementless	Posterolateral	Wire
		36		79.9±8.8	22	Cemented	Posterolateral	
		68		78.3±9.7	24	Cemented	Posterolateral	
Cui 2016[1]	Retrospective	57	34/23	83	36	Cemented	Posterolateral	Greater trochanter reattachment device
Park 2015[24]	Retrospective	22	18/4	76.9	42.84	Cementless	Not mentioned	Dall-Miles cable or steel wire
Thakkar 2015[17]	Retrospective	34	29/5	79.2	54.5	Cemented	Posterolateral	18 gauge wire with Ethibond
Celiktas 2015[33]	Prospective	54	39/15	81.3	31	Cementless	Posterolateral	Cable
Desteli 2015[38]	Prospective	42	26/16	65±1.52	12, 24	Cementless	Not mentioned	Not mentioned
Suh 2015[30]	Retrospective	50	30/20	81.8±6.9	12	Cementless	Not mentioned	Wire
Singh 2014[39]	Prospective	25	11/14	64.92	12	Cemented	Posterior	Tension band wiring, screws, K-wire
Kim 2014[31]	Retrospective	143	84/23*	84.9±3.5	45.6	Cementless	Posterolateral	16 gauge steel wire
			23/12[†]	85.1±3.7				
Kumar 2013[18]	Prospective	20	9/11	72.4	9	Cemented	Posterior	Tension band wiring or suture
Park 2013[25]	Retrospective	37	21/16	73.5	34.5	Cementless	Anterolateral	Dall-miles cable or wire
Gu 2013[40]	Retrospective	15	11/4	85	>12	Cemented	Posterior	Coated vicryl plus antibacterial suture or Ethibond suture
Abdelkhalek 2013[19]	Prospective	20	12/8	69±5.59	24.2±5.71	Cemented	Posterior	Tension band wiring
Shen 2012[37]	Retrospective	60	47/13	78.2	>24	Cemented	Posterolateral	Wire
Karthik 2012[20]	Prospective	28	19/9	79	50.4	Cemented cementless	Lateral, posterior	18 gauge wire
Fan 2012[29]	Retrospective	72	45/27	76.5±8.3	39.7±13.3	Cemented	Posterior	16 gauge wire
Lee 2011[26]	Retrospective	85	72/13	81.1	38.4	Cementless	Posterolateral	16 gauge wire
Choy 2010[32]	Retrospective	40	32/8	78.8	40.5	Cementless	Anterolateral	Wires or nonabsorbable sutures
Sinno 2010[21]	Retrospective	48	34/14	78.6	22	Cemented	Transgluteal lateral	Wire
Sancheti 2010[28]	Retrospective	37	27/10	77.1	24.5	Cemented	Posterior	Ethibond sutures or wire

Continue

Table 1. Continued

Study	Design	Case (n)	Gender (n), female /male	Age (yr)	Follow-up (mo)	Prosthesistype	Approach	Fracture fixation
Gu 2008[41]	Retrospective	19	12/5	85	>12	Cemented	Lateral, posterior	Wire or cable
Kayali 2006[27]	Retrospective	42	30/12	73±9	24±8.3	Cementless	Posterior	Not mentioned
Kim 2005[2]	Prospective	29	23/6	82.34±3.4	35	Cementless	Posterolateral	Not mentioned
Rodop 2002[22]	Retrospective	54	34/20	75.6	22.3	Cemented	Posterolateral	Not mentioned
Chan 2000[23]	Retrospective	55	44/10	84.2	13.6	Cemented	Anterior	Wire
Green 1987[42]	Retrospective	20	15/5	82.2	13.2	Cemented	Posterolateral	Not mentioned

Values are presented as number only, mean±standard deviation, or mean only.
* Stable reduction group, † unstable reduction group, and ‡ calcar preserving stem.

stems[1,11,17-22,28,29,43]; the remaining six used cementless stems[2,26,27,30-32]. There was low evidence of heterogeneity across the studies (I^2=0%; *P*=0.972) leading to the use of a fixed model. There were no statistically significant differences in the rates of aseptic loosening between the cemented and cementless groups (logit event rate=–3.90; *P*=0.110) (Fig. 3A).

2) Dislocation

A total of 19 comparative studies included an assessment of dislocation rates, of which 12 used this cemented stem[1,4,11,17-22,28,29,43]; the remaining seven used cementless stems[2,25-27,31-33]. There was low evidence of heterogeneity across the studies (I^2=0%; *P*=0.674) leading to the use of a fixed model. There were no statistically significant differences in dislocation rate between the cemented and cementless groups (logit event rate=–3.70; *P*=0.3) (Fig. 3B).

3) Greater trochanter nonunion

A total of 10 comparative studies included an assessment of greater trochanter nonunion rates, of which, five used cemented stems[1,17,22,23,43]; the remaining five used cementless stems[2,24-26,34]. There was low evidence of heterogeneity across the studies (I^2=6%; *P*=0.385) leading to the use of a fixed model. There were no statistically significant differences in greater trochanter nonunion rate between the cemented and cementless groups (logit event rate=–3.03; *P*=0.577) (Fig. 3C).

4. Analysis of Complications

1) Superficial surgical site infection rate

A total of 17 comparative studies included an assessment of superficial surgical site infection rates, of which 10 used cemented stems[1,11,17-21,23,28,43]; the remaining seven used cementless stems[2,27,30-34]. There was low evidence of heterogeneity across the studies (I^2=0%; *P*=0.995) leading to the use of a fixed model. There were no statistically significant differences in superficial surgical site infection rate between the cemented and cementless groups (logit event rate=–3.79; *P*=0.795) (Fig. 4A).

2) Deep surgical site infection rate

A total of 18 comparative studies included an assessment of deep surgical site infection rates, of which eight used cemented stems[1,11,17-22]; the remaining 10 used cementless stems[2,25-27,30-35]. There was low evidence of heterogeneity

Table 2. Clinical Results of Included Studies

Study	Time to operation after injury (day)	Operation time (min)	Blood loss (mL)	Transfusion (unit)	Hospital stay (day)	Harris hip score
Mansukhani 2017[4]	2.69±1.32	106.2±26.31	573±152.2	1.6±0.52	18.27±4.43	
Camurcu 2017[36]	2.4±1.9	83.4±33.7	412±170, 449±151		9.3±6.2	
Wada 2017[35]		95.8				
Thakur 2016[43]	3	96	125		17.5	86.2
Chang 2016[34]		97.3				66.9
Göçer 2016[11]						80.4‖
						85.2¶
						76.4**
Cui 2016[1]		75			12	85.76±4.59
Park 2015[24]	3.6	67	293.2		40.4	77.4
Thakkar 2015[17]		55				84.96
Celiktas 2015[33]		86.6		1.2	5.3	
Desteli 2015[38]		72±2.89			6±0.68	
Suh 2015[30]						73±17
Singh 2014[39]	6.4					79.86±8.13
Kim 2014[31]		54.3±12.8	247.9±82.4	1.6	18.7±5.6	82.3*
						81.9†
Kumar 2013[18]		116±14			13.3	75
Park 2013[25]		75.3		2.0		
Gu 2013[40]		50	310			
Abdelkhalek 2013[19]	5	140		1	16	83.5±4.2
Shen 2012[37]	3.6±1.4	121±62	328±126	3.3		70.7±14.6
Karthik 2012[20]		90	550		8	
Fan 2012[29]		53.4±12.5	252±82.6	1.5	18.2±5.1	74.6±15.3
Choy 2010[32]	7					80.6±9.3
Sinno 2010[21]		112±29	192±85	1.37	6.3±1.8	82.76±4.78
Sancheti 2010[28]	5.61±3.73	71			10.96	84.8±9.72
Gu 2008[41]		90				
Kayali-2006[27]		90±24		1.28±0.8	13±3.3	
Kim 2005[2]		96±26	511±103	1.9±0.8	13±2.6	80±9.7
Rodop 2002[22]	7.1	40	185±120			
Chan 2000[23]		69		1.8	6.7	

Values are presented as mean±standard deviation or mean only.
* Stable reduction group, † unstable reduction group, ‡ cemented group, § cementeless group, ‖ cementless group, ¶ cemented group, ** cemented calcar preserving group.

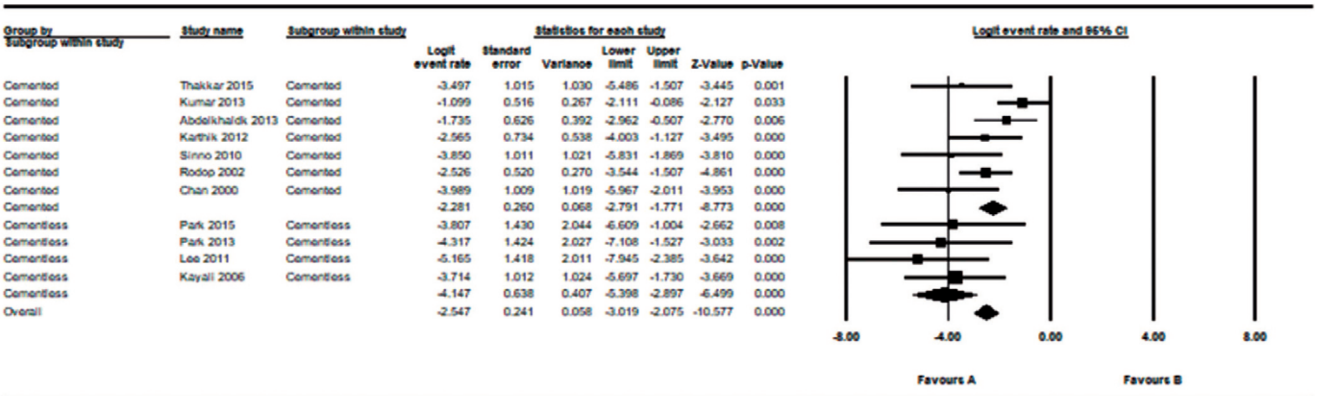


Fig. 2. Forest plot of leg length discrepancy.
95% CI: 95% confidence interval.

across the studies (I^2=0%; *P*=0.999) leading to the use of a fixed model. There were no statistically significant differences in superficial surgical site infection rate between the cemented and cementless groups (logit event rate= –4.03; *P*=0.715) (Fig. 4B).

3) Heterotopic ossification

A total of nine comparative studies included an assessment of heterotropic ossification rates, of which five used cemented stems[1,20,28,29,43]; the remaining four used cementless stems[2,26,30,32]. There was low evidence of heterogeneity across the studies (I^2=0%; *P*=0.667) leading to the use of a fixed model. There were no statistically significant differences in HO rate between the cemented and cementless groups (logit event rate=–3.47; *P*=0.131) (Fig. 4C).

4) Periprosthetic fracture

A total of seven comparative studies included an assessment of periprosthetic fracture rates, of which four used cemented stems[1,17,20,28]; the remaining three studies used cementless stems[2,31,32]. There was low evidence of heterogeneity across the studies (I^2=74%; *P*=0.001) leading to the use of a random model. There were no statistically significant differences in periprosthetic fracture rate (logit event rate=–3.3; *P*=0.315) (Fig. 4D).

5) Mortality

A total of seven comparative studies included an assessment of 1-year mortality rates, of which, four used cemented stems[4,22,28,36]; the remaining three used cementless stems[2,11,17]. There was low evidence of heterogeneity across the studies (I^2=74%; *P*=0.012) leading to the use of a random model. There were no statistically significant differences in 1-year mortality rate between the cemented and cementless groups (logit event rate=–1.36; *P*=0.1) (Fig. 4E).

5. Risk Bias

The Newcastle-Ottawa scale was used to assess the quality of the selected studies. All included studies scored 6 to 8 points, indicating relatively high quality.

DISCUSSION

With an increase in life expectancies around the globe, and osteoporosis-a progressive condition which largely affects the elderly-hip fractures are occurring more frequently and of significant concern, particularly to elderly individuals[4,38]. Compared to other types of fractures, those affecting the hip in elderly patients involves high cost, and it is expected to become a major worldwide health problem in the future[45,46]. Among all hip fractures in elderly patients, intertrochanteric fractures are known to account for 45% to 50%; more than half of these are unstable, with comminution of the posteromedial buttress, exceeding a simple lesser trochanteric fragment or those with subtrochanteric extension[8,47]. Similar to other hip fractures in elderly patients, unstable intertrochanteric fractures are associated with high morbidity and mortality rates; while it is known that early ambulation following strong fracture fixation may help fervent morbidity and mortality, the best treatment approach for these fracture types remain a challenge.

Internal fixation is widely used as the primary treatment method for intertrochanteric fractures[48]. Although some studies have reported favorable treatment outcomes, others have reported high failure rates in cases of unstable intertrochanteric fractures. Studies in the literature reported

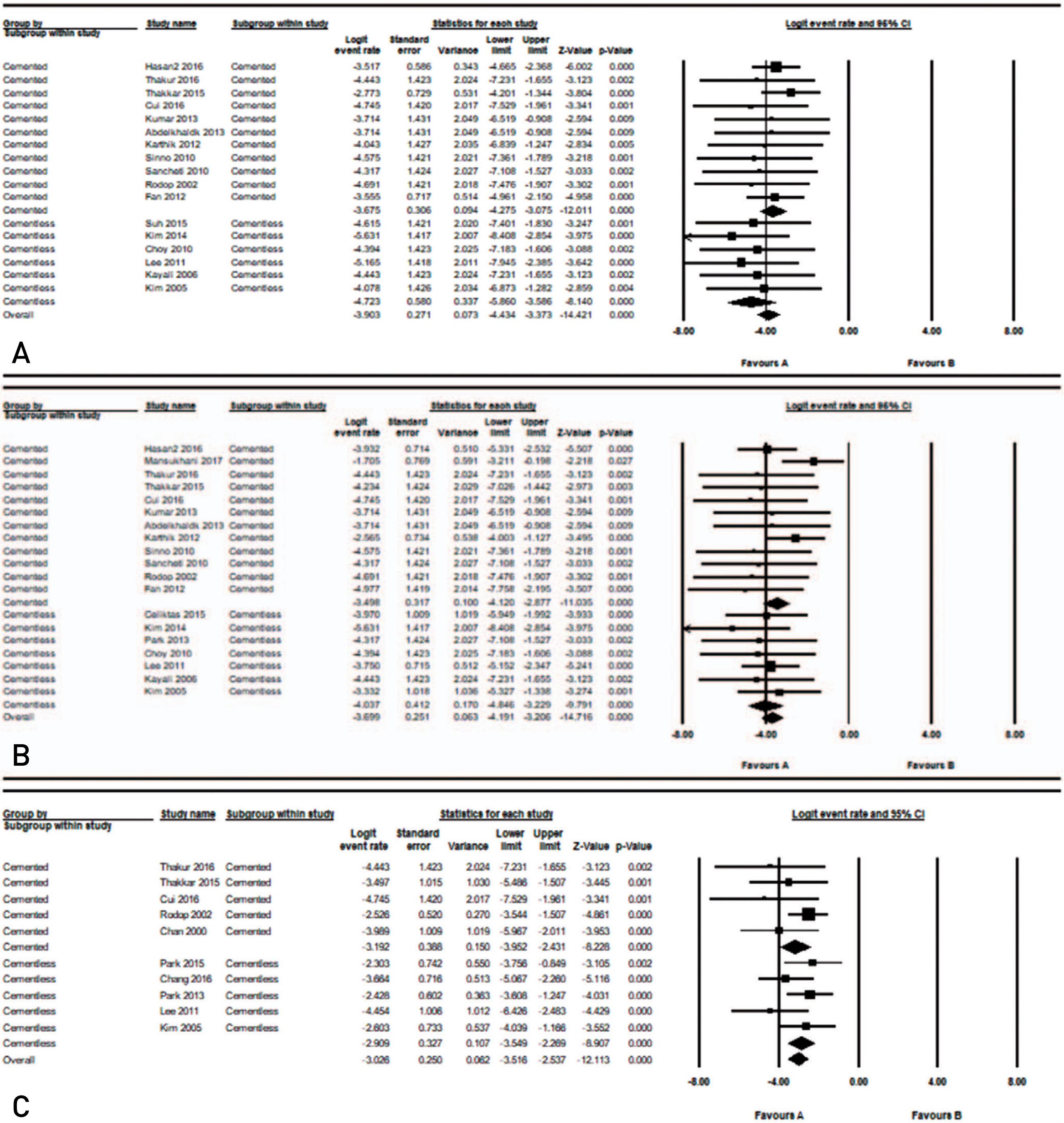


Fig. 3. Forest plot of treatment results. (A) Aseptic loosening, (B) dislocation, and (C) greater trochanter nonunion. 95% CI: 95% confidence interval.

cut-out rates of 8% for hip screws, 20% for mal-union and failure rate of osteosynthesis, and 36% to 54% for incidence of coxa vara, delayed healing, or nonunion[49-51]. Consequently, some studies reported that hip arthroplasty may shorten the weight-bearing time, reduce the incidence of implant-related complications and improve hip function when compared with internal fixation by Gamma nails, dynamic hip screws, and proximal femoral nails[52,53].

Prosthesis fixation using cement-which enables the patients to ambulate faster-can be useful since fracture injury, operation damage and catabolic effect due to misuse can influence reduction of bone mineral quantity and the functional recovery[12,54]. Using bone cement when conducting arthroplasty varies according to bone conditions of the patiens, surgeon techniques, and preferences. Many studies analysed outcomes with long-term follow-up and there appears to be no significant difference between cemented and cementless hemiarthroplasty in terms of morbidity, mortality or length of hospital stay for femoral neck fractures[14,54,55]. Furthermore, these studies report that functional outcomes of patients treated with cementless hemiarthroplasty tends to be less favorable than those with cemented hemiarthroplasty. However, research on the choice between cemented or cementless prosthesis for treatment

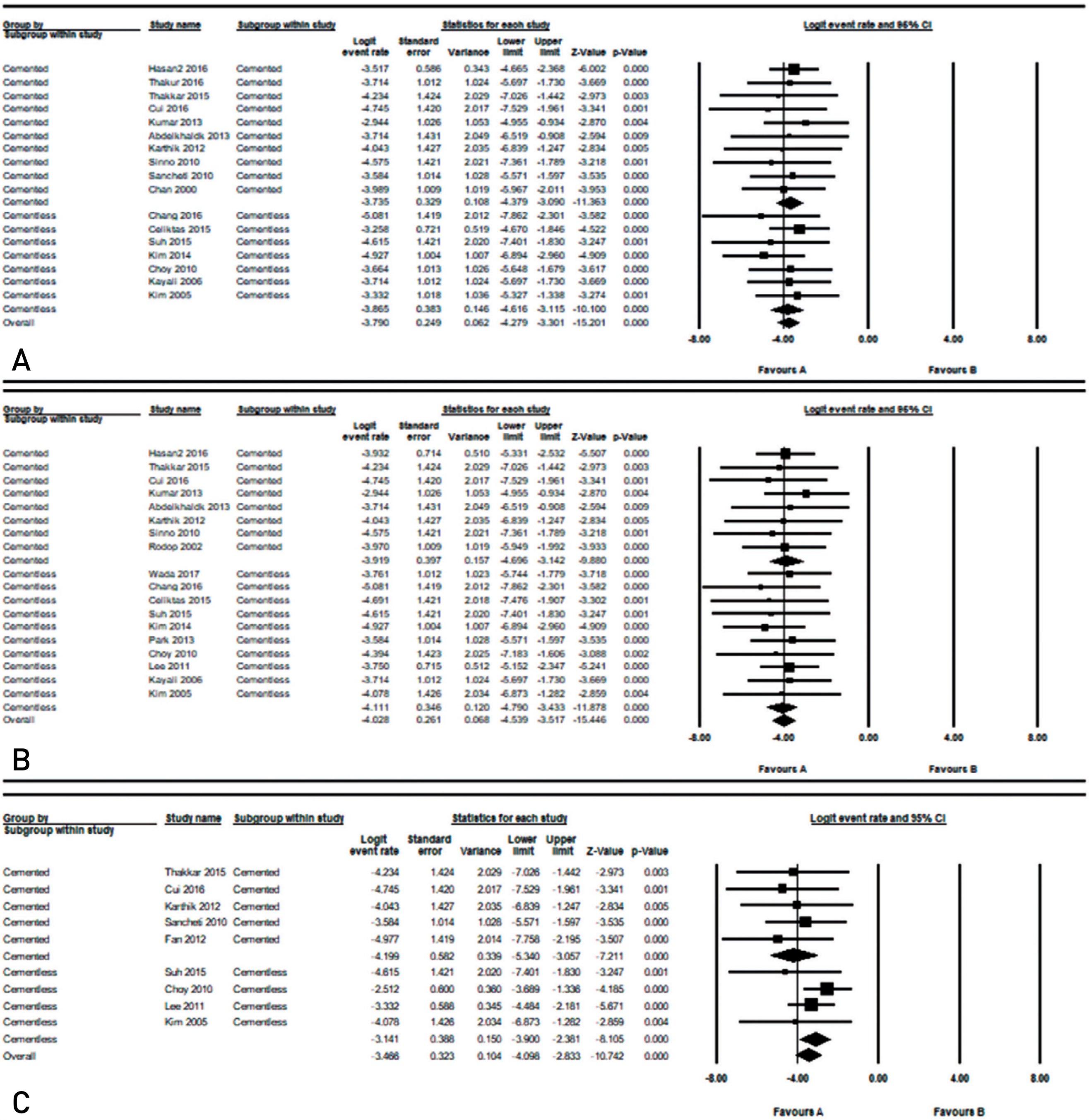
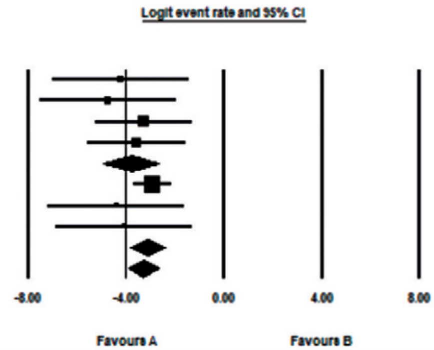


Fig. 4. Forest plot of complications. (A) Superficial surgical site infection rate, (B) deep surgical site infection rate, (C) heterotopic ossification, (D) periprosthetic fracture, and (E) 1-year mortality rate.
95% CI: 95% confidence interval.

Fig. 4. Continued.

Group by Subgroup within study	Study name	Subgroup within study	Logit event rate	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Cemented	Thakkar 2015	Cemented	-4.234	1.424	2.029	-7.026	-1.442	-2.973	0.003
Cemented	Cui 2016	Cemented	-4.745	1.420	2.017	-7.529	-1.961	-3.341	0.001
Cemented	Karthik 2012	Cemented	-3.296	1.018	1.037	-5.292	-1.300	-3.236	0.001
Cemented	Sancheti 2010	Cemented	-3.584	1.014	1.028	-5.571	-1.597	-3.535	0.000
Cemented			-3.795	0.585	0.342	-4.941	-2.649	-6.491	0.000
Cementless	Kim 2014	Cementless	-2.937	0.388	0.150	-3.697	-2.177	-7.572	0.000
Cementless	Choy 2010	Cementless	-4.394	1.423	2.025	-7.183	-1.606	-3.088	0.002
Cementless	Kim 2005	Cementless	-4.078	1.426	2.034	-6.873	-1.282	-2.859	0.004
Cementless			-3.105	0.362	0.131	-3.814	-2.395	-8.578	0.000
Overall			-3.296	0.308	0.095	-3.899	-2.693	-10.710	0.000



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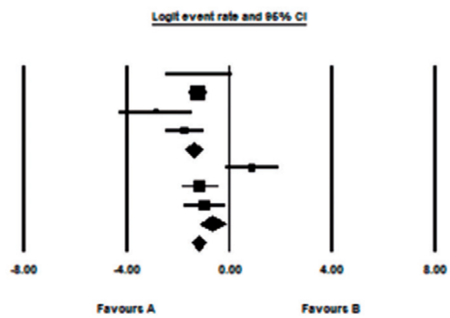
Group by Subgroup within study	Study name	Subgroup within study	Logit event rate	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Cemented	Mansukhani 2017	Cemented	-1.204	0.658	0.433	-2.494	0.086	-1.829	0.067
Cemented	Camurcu 2017	Cemented	-1.237	0.189	0.036	-1.608	-0.866	-6.533	0.000
Cemented	Sancheti 2010	Cemented	-2.862	0.727	0.529	-4.287	-1.437	-3.937	0.000
Cemented	Rodop 2002	Cemented	-1.749	0.383	0.147	-2.500	-0.998	-4.566	0.000
Cemented			-1.404	0.160	0.026	-1.718	-1.089	-8.756	0.000
Cementless	Hasan 2016	Cementless	0.875	0.532	0.283	-0.168	1.919	1.645	0.100
Cementless	Kayali 2006	Cementless	-1.163	0.362	0.131	-1.873	-0.453	-3.211	0.001
Cementless	Kim 2005	Cementless	-0.965	0.415	0.173	-1.779	-0.151	-2.323	0.020
Cementless			-0.671	0.243	0.059	-1.147	-0.195	-2.761	0.006
Overall			-1.181	0.134	0.018	-1.444	-0.919	-8.829	0.000



E

Fig. 4. Forest plot of complications. (A) Superficial surgical site infection rate, (B) deep surgical site infection rate, (C) heterotopic ossification, (D) periprosthetic fracture, and (E) 1-year mortality rate.
95% CI: 95% confidence interval.

of unstable intertrochanteric fractures is still lacking. The routine use of cement in elderly patients has been reported to be a technically more demanding procedure and may be associated with cardiopulmonary complications[56,57]. Using cement is even more difficult in unstable intertrochanteric fracture accompanied by comminution of the posteromedial buttress, exceeding a simple lesser trochanteric fragment or those with subtrochanteric extension; since this can result in larger amount of blood loss and longer operation times, it may lead to higher morbidity rates due to increased cardiopulmonary loading. However, in this study, there was no difference in 1-year mortality rate, and overall mortality rate between cemented and cementless groups. Previous studies have shown that cemented hemiarthroplasty with or without calcar replacement remains a good option in elderly patients with intertrochanteric femur fractures; the literature reviewed in this study revealed that more studies used cemented stems than cementless stems[19,58]. Despite this, many orthopedic surgeons remain concerned about increased mortality from fat embolization due to increased intramedullary pressure during cementation[14,54,55,59-61]. Moreover, according to a comparative study by Cankaya et al.[13] on cemented and cementless stems in unstable intertrochanteric fractures, cement was reported to be the factor that increased mortality. There are, however, a number of other studies which report that the use of cement does not increase mortality[14,59,60]. Intertrochanteric fractures have larger fracture surfaces and more bleeding, and compared to femoral neck fractures, intertrochanteric fractures generally occur in patients with poorer health status. Although the use of cement may be a potential factor leading to an increased frequency of complications, including mortality, additional studies are needed on this topic[62].

There are several factors involved in HO, including hypertrophic osteoarthritis, ankylosing spondylitis, and male gender[63,64]. Among them, surgical approach is one of the important factors that cause HO[63]. Compared to anterior or anterolateral approaches, the posterior approach to the hip joint involves less abductor manipulation, which may influence the occurrence of HO. Similarly, when compared to neck fractures, unstable intertrochanteric fractures require a significant amount of manipulation of fragments that are attached to the abductor and wire or plate for fixation, especially when cement is used because of longer operation time. It is believed that such differences between the two groups occurred because of these factors, but there were no statistically significant differences in the HO occurrence rates in this study. Moreover, considering that the studies included in the present study reported HO rate of up to 10%, while other studies had reported HO occurrence rate of 25% for femoral neck fractures, it is believed that performing bipolar hemiarthroplasty for unstable intertrochanteric fracture does not increase HO rate. However, additional studies are needed on this topic.

Compared to femoral neck fractures, unstable intertrochanteric fractures may require fixation of fracture; in our study, union status was not statistically different among the cement vs. cementless groups. Moreover, additional studies are deemed necessary since there were only few reports including the healing status of the fracture site.

Complication rates associated with infection, dislocation, aseptic loosening, and periprosthetic fracture were not significantly different between the cement and cementless groups. The studies reviewed did not have long-term follow-ups since the studies involved elderly patients, and as a result, there were no differences in aseptic loosening rates-a pattern similar to studies that compared cemented and cementless stems in femoral neck fracture cases[14,65]. However, the rate of LLD greater than 1 cm was significantly higher in the cemented group compared with the cementless group. Stable femoral stem fixation in the proximal femoral medullary canal and protrusion of the femoral implant from the femoral bone by a vertical distance are essential for proper leg length. Various anatomical markers and radiological methods have been used for restoration of leg length[66]. It is considered difficult to obtain a proper leg length when performing cemented total hip arthroplasty in a state where anatomical markers are damaged considerably. Therefore, additional comparative studies are needed on this topic as well.

Our review has several limitations. First, although this study reviewd studies that performed bipolar hemiarthroplasty for unstable intertrochanteric fractures, most were retrospective case series studies or studies that made comparisons against an internal fixation group. Except for two studies, there were no randomized controlled trial or comparative studies on cementless and cemented groups. In such a case, studies with positive or statistically significant results would be expected to be over-represented in our review, as such studies were more likely to be published, particularly in the English language. Second, the validity of our results is limited by the low quality of the included studies; double-blinding was unattainable for most of the trials, which may decrease the strength of our conclusions. Third, there is the potential for bias because of high heterogeneity in some comparisons, which may have affected the pooled results. Studies brought together in a meta-analysis will inevitability differ, and any kind of variability among studies may be termed heterogeneity. The included studies had clinical heterogeneity caused by variability in the participants (e.g., age, gender, comorbidities, preoperative ambulatory status), interventions (e.g., instrumentation from different manufacturers, different surgeons) and outcomes (e.g., selective reporting, data deficiency), and methodological heterogeneity caused by variability in study design and risk of bias. Fourth, it is not sufficient to analyze related factors of surgical complications, such as prosthesis position and comorbidity.

CONCLUSION

Cemented bipolar hemiarthroplasty and cementless bipolar hemiarthroplasty performed on elderly patients with unstable intertrochanteric fracture showed similar rates of mortality and complications. However, the rate of LLD greater than 1 cm was significantly higher in the cemented group than in the cementless group.

CONFLICT OF INTEREST

The authors declare that there is no potential conflict of interest relevant to this article.

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