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Review

Comparative assessment of early versus delayed surgery to treat proximal femoral fractures in elderly patients: A systematic review and meta-analysis

Peng Chen[a], Xiaotian Shen[a], Weimin Xu[a], Wanglin Yao[a], Ning Ma[b,*]

[a] Department of Orthopaedics, Yancheng 3rd people's hospital (Affiliated Yancheng Hospital of Southeast University), Yancheng, 224001, China
[b] Department of Orthopaedics, Zhejiang Taizhou Central Hospital (Affiliated Hospital of Taizhou University), Taizhou, 318000, China

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ABSTRACT

Background: Recently, many studies have suggested that timely surgery to treat proximal femoral fractures can benefit patients in many respects. However, both the short- and long-term outcomes, and the perioperative complications, of early surgery remain controversial. In addition, the optimal cut-off time for early surgery remains unclear. Thus, we performed a meta-analysis to compare and evaluate the benefits of early versus delayed surgery in terms of the clinical outcomes of patients with proximal femoral fractures.

Methods: We searched the Cochrane Library, PubMed, EMBASE, and Web of Science databases to February 1, 2018 and retrieved original studies comparing the efficacy of early versus delayed surgery for proximal femoral fractures. We calculated risk ratios (RRs) and odds ratios (ORs) with 95% confidence intervals (CIs) and compared the outcomes of early and delayed surgery. We performed subgroup analyses to explore mortality and perioperative complications associated with different cut-off times for surgery, for various periods. Two reviewers assessed the quality of the included studies and independently extracted the data. We followed the suggestions of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement. All statistical analyses were performed using the standard statistical procedures of Review Manager 5.2.

Results: A total of 27 studies (N = 33,727 participants) were included in the present analysis. Compared to delayed surgery, early surgery significantly reduced mortality and complications. The mortality rates of patients who underwent surgery within 48 and 24 h of fracture were 28 and 23% less than those of patients operated upon after 48 h (RR = 0.72; 95% CI: 0.71–0.73) and 24 h (RR = 0.77; 95% CI: 0.65–0.93). In addition, early surgery was associated with fewer perioperative complications than delayed surgery (OR = 0.52; 95% CI: 0.35–0.76), especially in terms of postoperative pressure ulcers (OR = 0.55; 95% CI: 0.45–0.68), urinary tract infections (OR = 0.57; 95% CI: 0.49–0.67), and thromboembolic events (OR = 0.61; 95% CI: 0.39–0.96).

Conclusions: Early surgery reduces mortality associated with proximal femoral fractures and the frequency of serious perioperative complications when comparing with delayed surgery.

1. Introduction

Femoral fractures are a major public health concern in many countries [1]. Maalouf et al. evaluated 1199 patients and found that femoral fractures increased exponentially with age; initially, they were more common in females but the gender difference tended to diminish over time. The crude annual incidence rate of the patients aged > 50 years was 147 per 100,000 (132 per 100,000 males and 160 per 100,000 females) and the female-to-male ratio was 1.2 [2]. In the elderly, fractures cause immobility and permanent dependence, negatively impacting the quality of life and placing a financial burden on healthcare systems [3,4]. Femoral fractures are associated with a high mortality rate in the elderly, of 14–36% within 1 year [5–7]. Delays in surgery are associated with complications, increasing healthcare costs and hospital stays [7]. Pincus et al. found that patients who underwent surgery later than 24 h post-fracture incurred average direct 1-year medical costs that were $2638 higher (95% CI: 1595–3,680, $p < 0.0001$), and hospital stays 0.610 days longer (95% CI: 0.1749–1.0331, $p = 0.0058$), than those of patients who underwent surgery within 24 h [7]. Many factors affect clinical outcomes after femoral fracture, including age, gender, comorbidities, anticoagulation therapy status, and general physical health [8]. The timing of surgery may be critical to prognosis. Many studies have suggested that early surgery can increase the risk of perioperative complications, including

* Corresponding author. Department of Orthopaedics, Zhejiang Taizhou Central Hospital (Affiliated Hospital of Taizhou University), No. 999, Donghai Avenue, Jiaojiang District, Taizhou City, Zhejiang Province, 318000, China.
E-mail address: maningn1026@163.com (N. Ma).

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pneumonia, deep-vein thrombosis, bleeding, pulmonary embolism, urinary tract infection, and decubital ulceration; clinicians lack the time to optimise preoperative medical status [8,9]. However, many recent studies have shown that early surgery affords major benefits, in terms of lower mortality and incidence of perioperative complications (pressure ulcers, pneumonia, urinary tract infections, and thrombotic events [9–35]). However, the short- and long-term outcomes, and the perioperative complications, of early surgery remain controversial. In addition, the optimal cut-off time for early surgery remains unclear. Thus, we performed a meta-analysis comparing and evaluating the efficacy and safety of early versus delayed surgery in terms of clinical outcomes. We performed extensive subgroup analyses to explore this issue in great detail.

2. Materials and methods

2.1. Inclusion and exclusion criteria

The inclusion criteria were: (1) randomised controlled trials (RCTs), non-RCTs, and prospective and retrospective observational studies; (2) the use of surgery to treat acute femoral fractures; (3) comparison of the outcomes of early and delayed surgery; and, (4) data on mortality and perioperative complications (either reported or obtained on request from corresponding authors). The exclusion criteria were: (1) animal studies; (2) abstracts, letters, editorials, expert opinions, reviews, and case reports; (3) other fractures; (4) studies lacking adequate data; and, (5) duplicate articles.

2.2. Searches

We searched the PubMed, Embase, Cochrane Library, and Web of Science databases to February 1, 2018. The search terms were: (1) “femoral fracture*” OR “femur fracture*” OR “hip fracture*” OR “pertrochanteric fracture*” OR “subtrochanteric fracture*” OR “intertrochanteric fracture*” OR “intracapsular fracture*” OR “extracapsular fracture*”; (2) “operation” OR “surgery” OR “surgical” OR “operative”; and (3) “early” OR “time” OR “timely” OR “timing” OR “earlier” OR “delay” OR “delayed”. The search strategy was: (1) AND (2) AND (3). Two assessors independently screened all titles and abstracts and then evaluated the full texts.

2.3. Quality assessment

Two reviewers independently assessed the quality of all studies using the nine-star Newcastle-Ottawa Scale (NOS) (Table 1); differences of opinion were resolved by a third reviewer. The scores reflected the quality of patient selection, comparability, and methods for outcome evaluation; a score ≥ 6 reflected high quality [36].

2.4. Data extraction

Data were independently extracted by two reviewers and differences were usually resolved via discussion, or by a third reviewer. We used a standardised form to extract sample size, year of publication, country, trial design, mean patient age, proportion of females, follow-up time, and outcome data. The work has been reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [37] and assessing the methodological quality of systematic reviews (AMSTAR) Guidelines. Data were analysed using RevMan ver. 5.2 software [38].

2.5. Statistical analysis

The outcomes of early and delayed surgery were statistically analysed [38]. We present the risk ratios (RRs) and odds ratios (ORs) of mortality and complications with 95% confidence intervals (CIs). Between-study heterogeneity was evaluated using the chi-squared Q test [39], and p-values and I^2 statistics (range: 0–100%) were generated. A $p_{heterogeneity}$ (p_h) ≤ 0.10 was deemed to indicate significant heterogeneity [40]. Combined effects were estimated using a random-effects model (DerSimonian and Laird [41]). If statistical heterogeneity was not evident ($p_h > 0.10$), we employed the fixed-effects Mantel–Haenszel model [42]. Outcomes were considered statistically significant if the pooled effects (with 95% CIs) did not contain the unit (1). To further explore the benefits of early surgery, subgroup analyses of outcomes at different times were performed, using different cut-offs.

3. Results

3.1. Characteristics and quality of the included studies

Fig. 1 shows that after removal of duplicates from the initial 1430 records, 1320 remained. Title/abstract screening excluded a further 1279 studies; 41 were subjected to full-text evaluation, among which 14 more studies were then excluded. Finally, 27 studies [9–35] (N = 33,727 participants) were included. The sample size ranged from 74 to 6638. All included studies were observational studies; 4 had a NOS score of 8, 9 had a score of 7, 10 had a score of 6, and 4 had a score of 5; about 85.2% of these studies were of good quality. The search and summarisation steps are shown in Fig. 1; study characteristics are listed in Table 1.

3.2. Early surgery reduces perioperative complications

We also compared the incidence rates of pressure ulcers, pneumonia, urinary tract infections, and thromboses between those undergoing early and delayed surgery (Fig. 2–5). With the exception of pneumonia, the complication rates were significantly reduced in those undergoing early surgery for pressure ulcers [pooled OR = 0.55; 95% CI: 0.45–0.68; $p < 0.00001$; OR = 0.57; 95% CI: 0.49–0.67; $p < 0.00001$ for urinary tract infections; and OR = 0.61; 95% CI: 0.39–0.96; $p = 0.03$ for thromboses]. The between-group pneumonia incidence did not differ (OR = 0.65; 95% CI: 0.38–1.11; $p = 0.11$). We compared the complication rate between patients who underwent early and delayed surgery. Analysis of nine studies showed that early (compared to delayed) surgery reduced the incidence of perioperative complications [pooled OR = 0.52, 95% CI: 0.35–0.76; $p = 0.0008$] (Fig. 6). We used a random-effects model because significant heterogeneity was evident ($p_h < 0.00001$, $I^2 = 84\%$). Thus, compared to delayed surgery, patients undergoing early surgery experienced 50% fewer complications.

3.3. Subgroup analyses of perioperative complications

We compared the incidence of complications between those undergoing early and delayed surgery. The pooled results showed that patients who underwent surgery within 72, 48, and 24 h experienced fewer complications than those who underwent later surgery; the pooled ORs were 0.57 (95% CI: 0.35–0.95; $p = 0.03$), 0.39 (95% CI: 0.19–0.79; $p = 0.009$), and 0.59 (95% CI: 0.44–0.78; $p = 0.0005$), respectively. However, surgery within (vs. not within) 6 h did not significantly reduce the incidence of complications (OR = 1.50; 95% CI: 0.58–3.88; $p = 0.41$). We used fixed-effect models because no significant heterogeneity was evident ($p_h > 0.10$), except in subgroup analysis of the 48-h data ($p_h < 0.00001$, $I^2 = 93\%$), for which we employed a random-effects model (Table 2).

3.4. Early surgery reduces mortality

Figs. 7 and 8 show that, compared to delayed surgery, early surgery (within 24 or 48 h) significantly reduced mortality (by 28% if surgery was performed within 48 h) (pooled RR = 0.72; 95% CI: 0.71–0.73;

Table 1
The characteristics of included studies for meta-analysis.

Study/Year	Country	Study design	Sample size	Mean age (year)	Proportion of female	Follow-up time	Outcomes	NOS score
Al-Ani AN et al., 2008	Sweden	Prospective study	850	81	73%	4 months	Mortality within 4 months (adjusted for age, sex, prefracture walking ability, dementia, ASA score); pressure ulcer (adjusted for age, prefracture walking ability, dementia, ASA score, duration of surgery).	8
Bretherton CP et al., 2015	UK	Prospective observational	6638	82	78%	12 months	Mortality within 1 month (adjusted for age, gender, pre-fracture mobility, Mini-Mental Test Score, fracture type, ASA grade, prefracture residence).	7
Crego-Vita D et al., 2017	Spain	Prospective	499	83 (65–105)	61%	24 months	Mortality within 6, 12 and 24 months; functional capacity (FAC level, MBI); all outcomes: unadjusted.	5
Dailiana Z et al., 2013	Greece	Retrospective	218	79	64%	12 months	Mortality within 1 month (adjusted for age, sex, Charlson index); mortality within 12 months; (adjusted for age, sex, Charlson index).	6
Dorotka RH et al., 2003	Austria	Observational	182	77	76%	6 months	Mortality within 6 months perioperative complications (pneumonia); functional capacity (mobility); all outcomes: unadjusted.	8
Elliott J et al., 2003	UK	Prospective observational	1780		77%	12 months	Mortality within 12 months (unadjusted).	7
Hapuarachchi et al., 2014	UK	Prospective observational	146	93	84%	12 months	Mortality within 1 months; Perioperative complications; all outcomes: unadjusted	7
Kelly-Pettersson P et al., 2017	Sweden	Observational single cohort	576	82	72.4%	12 months	Mortality within 12 months; Perioperative complications (pressure ulcer, pneumonia, pulmonary embolus, urinary tract infection); all outcomes: unadjusted.	6
Lizaur-Utrilla A et al., 2016	Spain	Prospective cohort	628	84	74%	12 months	mortality within 12 months (adjusted for age, gender, ASA, Charlson index, anticoagulation therapy, fracture type, prosthetic implant, complication, readmission, dementia, ADL, mobility, pre-nursing residence, nursing discharge).	6
Lizaur-Utrilla A et al., 2018	Spain	Prospective observational	1234	83.1 (65–92)	69.7%	12 months	Reasons of delayed surgery; one year mortality; main post-operative complications.	7
Maggi S et al., 2010	Italy	Prospective Multicenter	3707	82	79%	6 months	Mortality within 6 months (unadjusted, based only on complete followup)	6
Mariconda M et al., 2015	Italy	Prospective Multicenter	568	78 (50–105)	77%	12 months	Mortality within 1 month (unadjusted) mortality within 12 months; perioperative complications within 4 months.	6
Moran CG et al., 2005	UK	Prospective observational	2660	80 (17–103)	76%	12 months	Mortality within 1 months; perioperative complications (embolism).	6
Muhm M et al., 2013	Germany	Prospective	138	84	86%	12 months	Mortality within 12 months (unadjusted)	8
Orosz GM et al., 2004	US	Prospective Multicenter	1206	82	80.6%	6 months	Mortality within 6 months; perioperative complications; functional capacity (FIM) (propensity score matched).	5
Ozturk A et al., 2010	Turkey	Prospective	74	78	70%	12 months	Mortality within 12 months (unadjusted).	7
Pajulammi HM et al., 2016	Finland	Prospective	1425	84	75%	12 months	Mortality within 12 months; functional capacity (mobility); all outcomes: unadjusted.	6
Pioli G et al., 2012	Italy	Prospective multicenter cohort study	806	86	76%	12 months	Mortality within 12 months (adjusted for age, sex, ADL, Charlson index); functional capacity (mobility, ADL; unadjusted).	5
Poh KS et al., 2013	Singapore	Prospective	294	78.1	70%	NR	Perioperative complications (unadjusted)	6
Rae HC et al., 2007	Australia	Observational study	222	79 (51–95)	72%	18 months	Mortality within 1 months (adjusted for preoperative length of stay, ASA score, procedure, age, theatre cancellations, sex).	6
Siegmeth AW et al., 2005	UK	Prospective	3628	81	81%	12 months	Mortality within 12 months (unadjusted)	5
Smektala R et al., 2000	Germany	Prospective	161	84	93%	12 months	Mortality during hospital stay (unadjusted)	7
Smektala R et al., 2008	Germany	Prospective observational study	2916	82	80%	12 months	Mortality within 12 months (adjusted for age, sex, time from fracture to surgery,ASA, MBI, comorbidities, postoperative complications) - perioperative complications (pneumonia, embolism, UTI, pressure ulcer; unadjusted).	6
Trpeski S et al., 2013	Macedonia	Prospective	120	74	78%	6 months	Mortality within 1 months; mortality within 6 months all outcomes: unadjusted.	7
Vertelis A et al., 2009	Lithuania	Prospective	265	74	68%	12 months	Mortality within 12 months (adjusted for sex, age, osteosynthesis, arrival to hospital).	7
Vidan MT et al., 2011	Spain	Prospective cohort	2250	84	82%	median 10 days	Mortality during hospital stay (adjusted for age, dementia, comorbidities, ADL) - perioperative complications (unadjusted)	8
Yonezawa T et al., 2009	Japan	Prospective	536	83	83%	Average 39.1 days	Mortality during hospital stay; functional capacity (mobility); all outcomes: unadjusted.	7

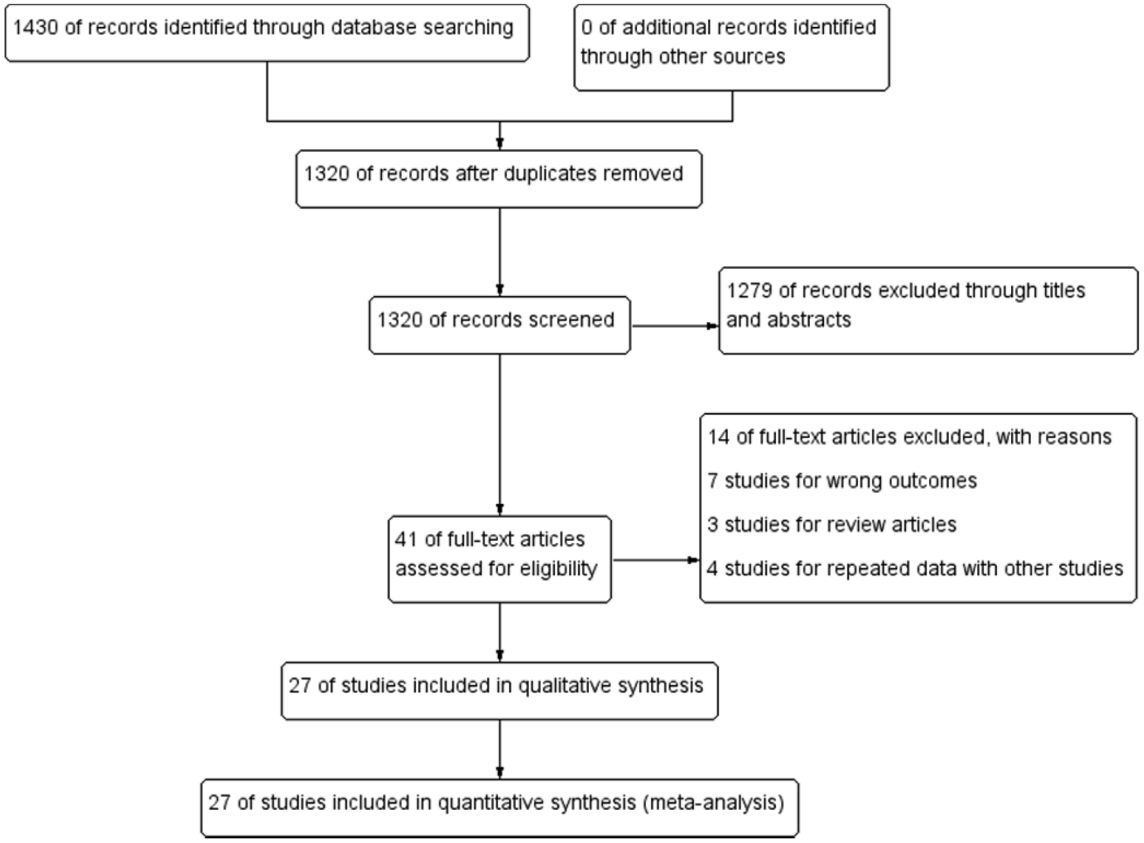

Fig. 1. Flow diagram showing the search strategy for studies included in this systematic review and Meta-analysis.

$p < 0.00001$). We used a fixed-effects model because no significant between-study heterogeneity ($p_h < 0.30$ and $I^2 = 14\%$) was evident. Patients who underwent surgery within 24 h showed a reduction in mortality rate of 23% (RR = 0.77; 95% CI: 0.65–0.93) compared to patients operated upon later. We used a random-effects model because significant between-study heterogeneity ($p_h = 0.0005$ and $I = 64\%$) was apparent.

3.5. Subgroup analyses of mortality

We performed seven analyses on 15 subgroups (Table 3). Surgery within (vs. not within) 72 h of fracture did not increase overall mortality (RR = 0.81; 95% CI: 0.59–1.11), or mortality within 1 month (RR = 0.78; 95% CI: 0.36–1.71) or 12 months (RR = 0.81; 95% CI: 0.57–1.15). Surgery within (vs. not within) 48 h significantly reduced overall mortality and mortality within 1 month (RR = 0.79; 95% CI: 0.66–0.95) and 12 months (RR = 0.72; 95% CI: 0.70–0.73). Surgery within (vs. not within) 36 h did not increase overall or 1-, 4-, or 12-month mortality. Surgery within 24 h significantly reduced overall and 12- month mortality (RR = 0.68; 95% CI: 0.56–0.84), but not 1-month mortality (RR = 1.05; 95% CI: 0.90–1.22). Surgery within 18 h significantly reduced only 6-month mortality (RR = 0.49; 95% CI: 0.25–0.96). Surgery within 12 h reduced only 1-month mortality (RR = 0.64; 95% CI: 0.45–0.91). Surgery within 6 h did not reduce 1- or 12-month mortality.

4. Discussion and conclusion

Recently, many researchers have reported that patients with proximal femoral fractures who received early surgical treatment benefitted in many aspects. Surgery for such patients is often delayed. Lizaur-Utrilla et al. found that the principal medical reasons for delayed surgery were chronic chest conditions (23.8%) and the need to reverse antiplatelet therapy (23.1%). The principal logistical reasons were the unavailability of operating theatres (23.0%) and pending medical consultations (20.0%) [18]. The effects of surgical timing remain

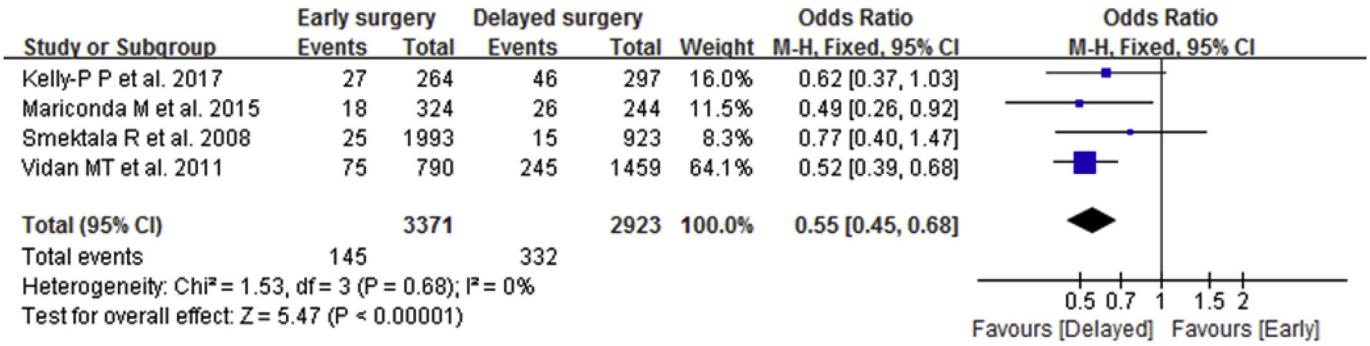

Fig. 2. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding postoperative pressure ulcers.

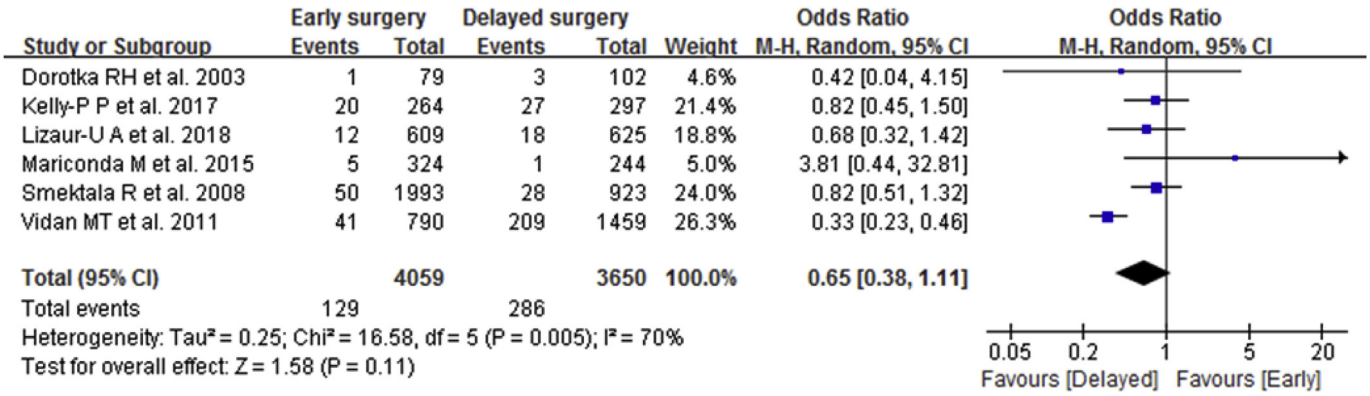

Fig. 3. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding postoperative pneumonia.

controversial. Some authors have reported that early surgery (within 48 h) reduced complications and mortality [43,44], but others found otherwise [45,46]. In some studies, no negative effects were apparent if surgery proceeded within 4 days of admission [47,48]. Rodriguez-Fernandez retrospectively analysed patients experiencing average surgical delays of more than 1 week and prospectively evaluated patients operated upon within 48 h of fracture, or as soon as their medical conditions permitted [48]. More complications (pressure ulcers, urinary infections, deep vein thromboses, and extended postoperative hospital stays) were evident in those for whom treatment was delayed, but no differences in mortality were evident at 3 months or 1 year [48]. Delayed surgery will be reverse anti-platelet therapy or anticoagulation because our result indicated that the incidence of deep vein thrombosis was higher that early surgery. A 1-week treatment delay did not increase the mortality rate or prolong recovery, but did increase the incidence of postoperative complications; it was suggested that elderly patients should undergo surgery as soon as their medical conditions permitted [48]. Thus, the effects of early/delayed surgery on short-/long-term outcomes and perioperative complications remain unclear. In addition, the optimal surgical timing is also unclear. Thus, we compared efficacy and safety between early and delayed surgery in this context. and found that early surgery reduced mortality and complications. The mortality of those who underwent surgery within 48 h was 28% less than that of patients operated upon after 48 h (Table 2), consistent with the data of Klestil et al., who found that the absolute rate of mortality within 12 months was 17% and 21% in patients who underwent surgery before and after 48 h; the long-term mortality rate was thus 20% less in the former patients [49]. Further, our subgroup analysis newly revealed a significant reduction in 1-month mortality in patients who underwent early surgery. In addition, the mortality rate of patients who underwent surgery within 24 h fell by 23% compared to that of patients undergoing later surgery, attributable principally to a reduction in 12-month (not 1-month) mortality, unlike the study of Klestil [49]. In addition, patients operated upon within 18 and 12 h experienced reduced 6- and 1-month mortality rates, respectively (Table 2). It was unexpected that surgeries with the longest and shortest cut-offs (72 and 6 h) were not associated with significant differences in mortality. Surgery within either 24 or 48 h significantly reduced mortality; surgery within shorter or longer times did not. Also, patients operated upon within 24, 48, or 72 h experienced significantly fewer complications than those operated upon later; surgery within 6 h did not affect either mortality or the rate of complications. However, Dorotka et al. found that patients operated upon within 6 h of fracture had significantly lower mortality [14], and those operated upon within 24 h exhibited better outcomes than those for whom surgery was delayed. It was concluded that surgery should proceed even after pre-clinical delays of more than 6 h [14]. One early systematic review and meta-analysis assessed the impact of timing of surgery in elderly patients with acute hip fracture on morbidity and mortality [49]. Their results showed that patients operated on within 48 h had a 20% lower risk of dying within 12 months. They found that no statistical significant different mortality risk was observed when comparing patients operated on within or after 24 h. Our pooled analysis results concur with the result that patients operated on within 48 h had a 20% lower risk of dying within 12 months. However, the difference was that we found significant reduction of mortality in patients operated on within 24 h. This inconsistence should be cleared if early surgery has different effect on hip and proximal femoral fractures.

Our paper has several limitations, the most significant being the wide variation in sample size of included studies. Although we analysed 33,727 patients, sample size ranged from 74 to 6.638 among studies, which may have created bias [11,24]. Also, although all included studies were prospective, none was an RCT. Thus, many factors that might affect the results were poorly controlled. Given the limitations of non-RCTs, future well designed, high quality RCTs are desirable but would be difficult to justify given the outcomes already known. In addition,

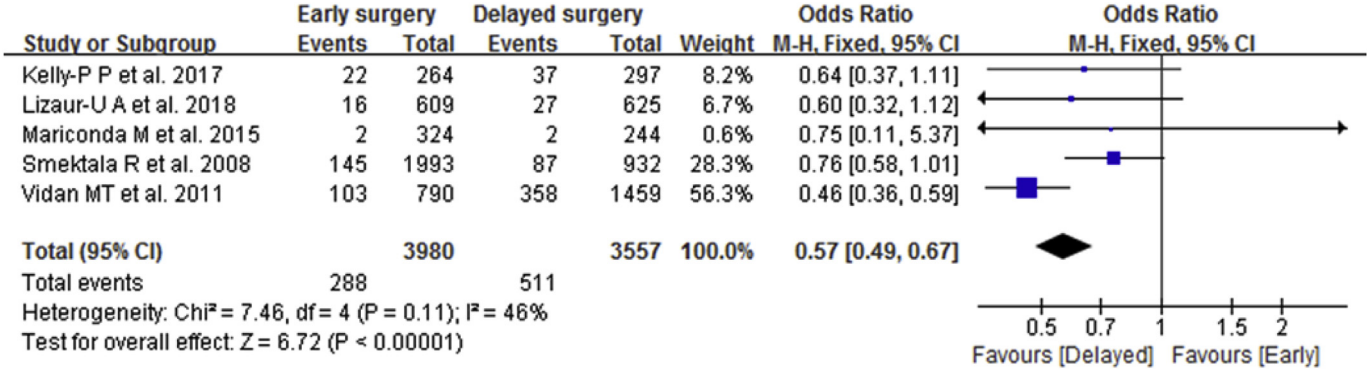

Fig. 4. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding postoperative urinary tract infection.

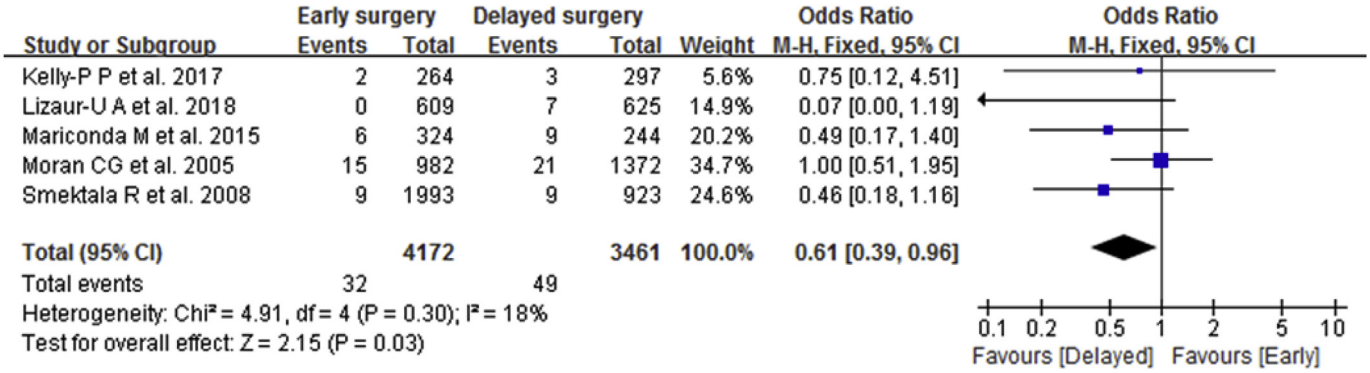

Fig. 5. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding postoperative thromboembolic events.

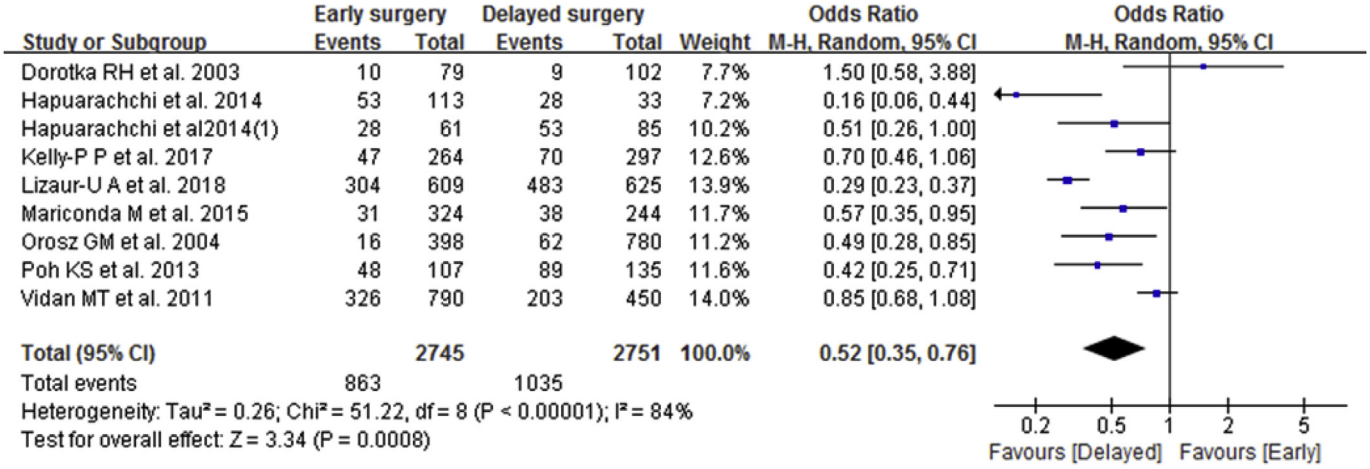

Fig. 6. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding perioperative complications.

Table 2
The pooled results of subgroup analysis according to cut-off values of operative time for the perioperative complications of proximal femoral fractures patients.

Subgroups	Pooled results			Heterogeneity		
	OR	95% CI	*P* value	I^2	P_h value	Analytical effect model
Pressure ulcers	0.55	0.45, 0.68	< 0.00001	0%	0.68	Fixed-effect model
Pneumonia	0.65	0.38, 1.11	0.11	70%	0.005	Random-effect model
Urinary tract infection	0.57	0.49, 0.67	< 0.00001	46%	0.11	Fixed-effect model
Thrombosis	0.61	0.39, 0.96	0.03	18%	0.30	Fixed-effect model
Overall complications						
Cut-off value of 72 h	0.57	0.35, 0.95	0.03	0%	0.43	Fixed-effect model
Cut-off value of 48 h	0.39	0.19, 0.79	0.009	93%	< 0.00001	Random-effect model
Cut-off value of 24 h	0.59	0.44, 0.78	0.0005	0%	0.52	Fixed-effect model
Cut-off value of 6 h	1.50	0.58, 3.88	0.41	41%	0.15	Fixed-effect model

the ages of included patients ranged from 74 to 93 years [16,32], possibly leading to heterogeneity and inconsistent outcomes. For example, Hapuarachchi found a significant reduction in the mortality of patients of mean age 93 years when they were operated upon within 48 h [16], but the opposite was reported by Trpeski et al. for patients of mean age 74 years [32]. In addition, mortality and complications may have been influenced by fracture site or type; we did not subject these variables to subgroup analysis because there were insufficient data. Finally, other studies have reported that medical conditions and gender were more important in terms of mortality than was a delay in surgery [50]. One study reported that early surgery was associated with higher mortality in patients who were unwell at the time of injury [35]. We did not include comorbidities in our evaluation; further research is thus required. Randomised trials controlling for various possible biases are needed. Also, the optimal timing of early surgery should be further explored.

In conclusion, our meta-analysis indicates that early surgery reduces the mortality of patients with proximal femoral fractures and minimises perioperative complications. Stable patients should undergo surgery as soon as possible.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical Approval

Ethical Approval is not applicable.

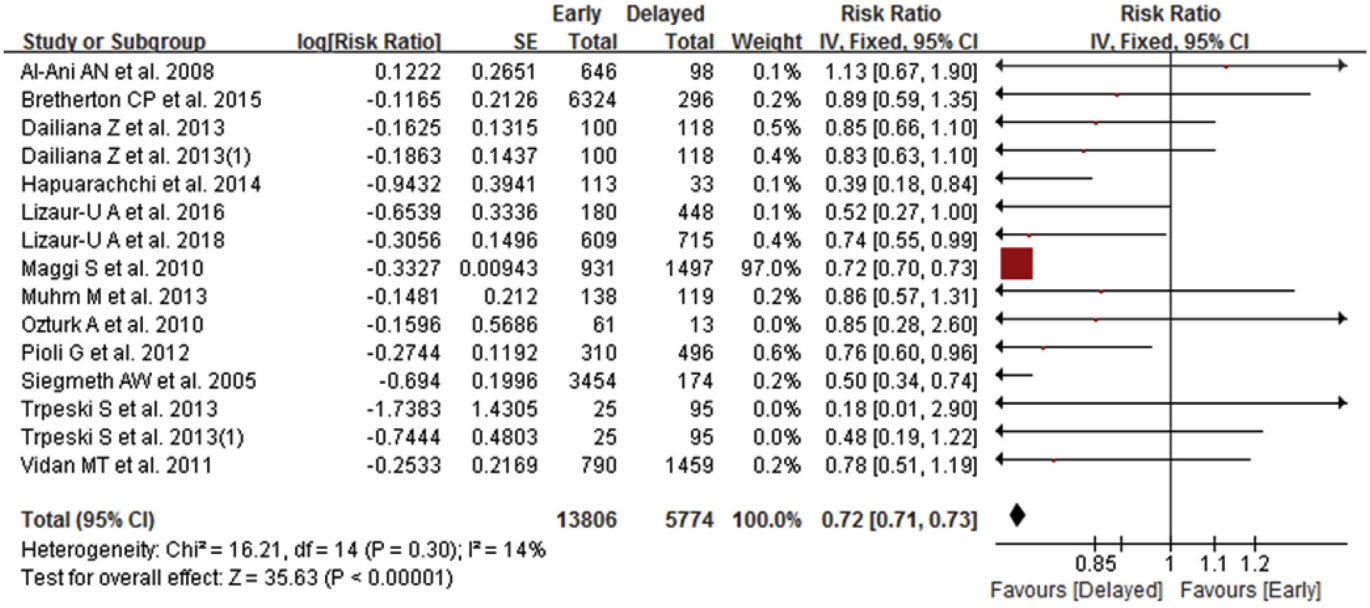

Fig. 7. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding the cut-off value of 48 h overall mortality.

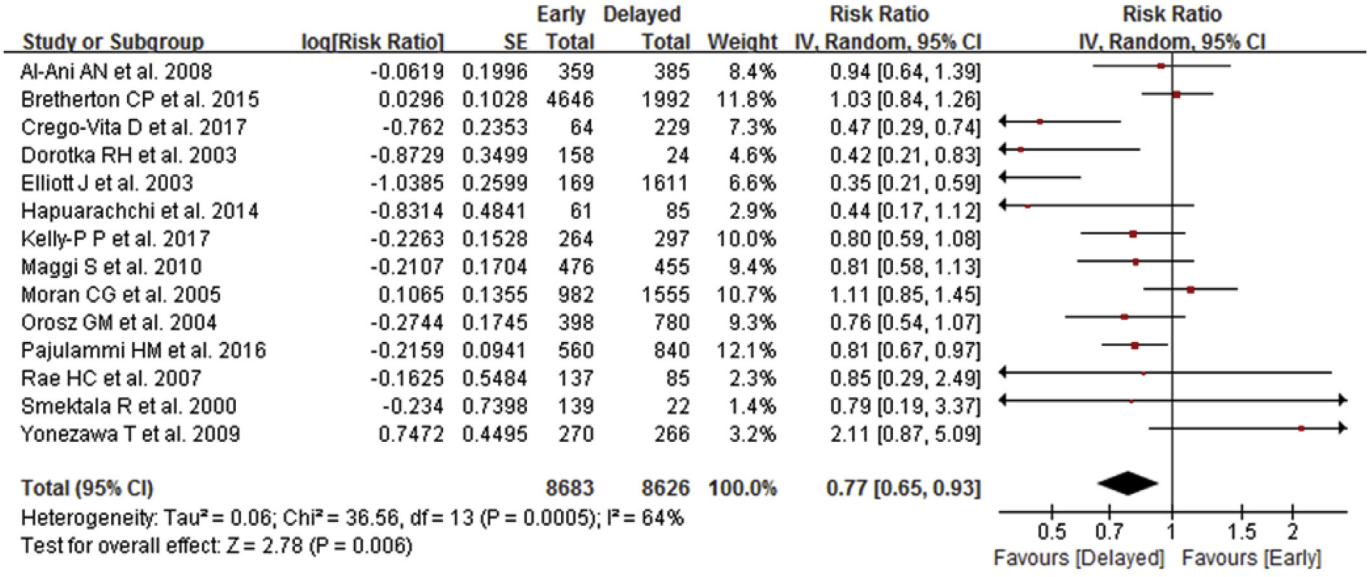

Fig. 8. Forest plot showing the comparison between early and delayed surgery for proximal femoral fractures regarding the cut-off value of 24 h overall mortality.

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Author contribution

The authors on this paper all participated in study design. All authors have read and approved this version of the article, and due care has been taken to ensure the integrity of the work. The material of this article is original research and no part of this paper has been previously published. The material has also not been submitted for publication elsewhere while under consideration. No conflict of interest exits in the submission of this manuscript. All authors have the appropriate permissions and rights to the reported data.

Conflicts of interest

The authors declare no relevant conflict of interest.

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Datastatement

The material of this article is original research. All data in this manuscript is available and transparent for readers.

Table 3
The pooled results of subgroup analysis according to cut-off values of operative time for the mortality of proximal femoral fractures patients.

Subgroups	Pooled results			Heterogeneity		
	RR	95% CI	*P* value	I^2	P_h value	Analytical effect model
Cut-off value of 72 h	0.81	0.59, 1.11	0.18	0%	0.93	Fixed-effect model
Mortality within 1 month	0.78	0.36, 1.71	0.53	0%	0.43	Fixed-effect model
Mortality within 12 month	0.81	0.57, 1.15	0.24	0%	0.91	Fixed-effect model
Cut-off value of 48 h	0.72	0.71, 0.73	< 0.00001*	14%	0.30	Fixed-effect model
Mortality within 1 month	0.79	0.66, 0.95	0.01*	6%	0.38	Fixed-effect model
Mortality within 12 month	0.72	0.70, 0.73	< 0.00001*	11%	0.35	Fixed-effect model
Cut-off value of 36 h	0.97	0.85,1.10	0.59	0%	0.62	Fixed-effect model
Mortality within 1 month	0.98	0.74, 1.30	0.89	68%	< 0.0001	Random-effect model
Mortality within 4 month	0.96	0.64, 1.44	0.84	77%	< 0.00001	Random-effect model
Mortality within 12 month	0.96	0.83, 1.11	0.59	0%	0.41	Fixed-effect model
Cut-off value of 24 h	0.77	0.65, 0.93	0.006*	64%	0.0005	Random-effect model
Mortality within 1 month	1.05	0.90, 1.22	0.54	20%	0.28	Fixed-effect model
Mortality within 12 month	0.68	0.56, 0.84	0.0002*	60%	0.02	Random-effect model
Cut-off value of 18 h	0.83	0.68, 1.02	0.08	62%	0.10	Fixed-effect model
Mortality within 1 month	0.88	0.71, 1.09	0.24	17%	0.24	Fixed-effect model
Mortality within 6 month	0.49	0.25, 0.96	0.04*	16%	0.18	Fixed-effect model
Cut-off value of 12 h	0.72	0.48, 1.09	0.12	78%	0.01	Random-effect model
Mortality within 1 month	0.64	0.45, 0.91	0.01*	60%	0.02	Random-effect model
Mortality within 12 month	0.74	0.38, 1.44	0.37	77%	0.04	Random-effect model
Cut-off value of 6 h	0.83	0.60, 1.15	0.25	25%	0.27	Fixed-effect model
Mortality within 1 month	0.90	0.57, 1.43	0.66	26%	0.11	Fixed-effect model
Mortality within 12 month	0.76	0.48, 1.20	0.24	58%	0.12	Fixed-effect model

RR, relative ratio; CI, confidence intervals.

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