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ORIGINAL ARTICLE

Outcome of Internal Fixation by Cephalomedullary nail Versus Bipolar Hemiarthroplasty in Treatment of Unstable Pertrochanteric Femoral Fractures in Elderly: A Systematic Review and Meta-analysis.

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ABSTRACT

Background: Intertrochanteric fractures frequently occur in older patients, and effective care is essential for enhancing outcomes in this at-risk demographic. Proximal femoral nailing (PFN) and bipolar hemiarthroplasty (BHA) are two common surgical interventions for managing unstable intertrochanteric fractures, each presenting unique advantages and disadvantages. The aim of this systematic review and meta-analysis was to evaluate the clinical outcomes and consequences linked to PFN and BHA in the management of unstable intertrochanteric fractures in older individuals.

Methods: The research was executed in compliance with PRISMA criteria. A thorough search of electronic databases, such as PubMed, Scopus, Web of Science, and Cochrane Library, was conducted to locate pertinent studies. Eligible studies encompassed senior patients aged 60 to 80 with closed, isolated intertrochanteric fractures, comparing the functional results, comorbidities, and perioperative metrics of PFN and BHA. Essential data on patient demographics, surgical duration, intraoperative hemorrhage, postoperative hospitalization duration, reoperation frequencies, and fatality rates were retrieved and examined.

Results: Twelve papers fulfilled the inclusion criteria, yielding data for qualitative synthesis and meta-analysis. The investigation indicated that PFN typically related to less intraoperative blood loss, abbreviated hospital stays, and enhanced functional results relative to BHA. Nonetheless, BHA provided instant weight-bearing ability, which could be beneficial for patients with restricted life expectancy necessitating swift mobilization. Mortality and reoperation rates differed among trials, highlighting the necessity for personalized treatment choices.

Conclusions: Both PFN and BHA are effective alternatives for the management of unstable intertrochanteric fractures in geriatric patients. PFN may be advantageous for patients anticipated to have extended recovery durations, as it can facilitate less intraoperative blood loss and enhanced functional results. BHA, however, may be better suitable for individuals necessitating immediate weight-bearing.

Key Words: Proximal femoral nailing; Bipolar hemiarthroplasty; Intertrochanteric fractures; Elderly patients; Unstable fractures

INTRODUCTION:

Pertrochanteric fractures are extracapsular metaphyseal fractures of the proximal femur, occurring in the area between the femoral neck and shaft. Pertrochanteric fractures are a significant public health concern. [1]

Intertrochanteric fractures constitute roughly 45-50% of all hip fractures in the elderly, with 50-60% categorized as unstable. Unstable intertrochanteric fractures encompass those featuring a comminuted posteromedial calcar, surpassing a mere minor trochanteric fragment, or those exhibiting subtrochanteric extension. Unstable IT fractures

pose significant challenges in the elderly due to elevated morbidity and mortality rates. [2]

The objective of any therapy strategy is to eradicate pain and restore the patient to their pre-injury functional level. [3]

Non-operative management of pertrochanteric fractures may be appropriate for non-ambulatory, demented, and terminally ill patients, as well as for individuals with severe medical comorbidities or those who are asymptomatic. [4]

Operative intervention is warranted for all previously ambulatory individuals with pertrochanteric fractures, provided they do not have dementia and lack substantial medical comorbidities that would contraindicate surgery. Surgery should ideally commence within 48 hours of the injury. Operative alternatives can be classified into three primary categories: arthroplasty, extramedullary fixation, and intramedullary fixation. Arthroplasty yielded favorable outcomes in individuals with osteoporosis and comminuted pertrochanteric fractures. [5]

Theoretically, intramedullary devices offer superior load transfer efficiency due to their proximity to the medial calcar, in contrast to extramedullary implants, and experience reduced implant strain owing to their alignment with the mechanical axis of the femur, which results in a shorter lever arm. [6]

Hemiarthroplasty replacements facilitate early patient recovery and yield favorable long-term outcomes. For several decades, the therapy of unstable pertrochanteric fractures in the elderly has involved the use of proximal femur nails (PFN) to facilitate early postoperative movement and prevent excessive collapse at the fracture site. [7,8]

The optimal care remains ambiguous due to substandard bone quality, patient comorbidities, and challenging rehabilitation. There was significant disparity in the literature concerning the preference for intramedullary nailing versus hemiarthroplasty in the management of pertrochanteric fractures. Kim et al. identified no disparities in functional results, duration of hospital stay, complications, or delay to weight-bearing in their comparative evaluation of hemiarthroplasty versus intramedullary fixation for AO/OTA 31-A2 fractures. [9]

Tang et al. has discovered that intramedullary nailing of pertrochanteric fractures yields superior postoperative outcomes compared to hemiarthroplasty. [10]

Chan and Gill presented their findings on cemented hemiarthroplasty in elderly osteoporotic patients with pertrochanteric fractures, revealing that among 54 patients, only 48% restored their pre-injury ambulation level, while 23% entirely lost the capacity to walk. [11]

This systematic review and meta-analysis aim to assess and contrast the clinical results and complication rates linked to internal fixation with cephalomedullary nails versus bipolar hemiarthroplasty in treating unstable pertrochanteric femoral fractures in older individuals.

METHODS

The Institutional Review Board (IRB#10996- 30/8-2023) of Zagazig University accepted the protocol for this systematic review and meta-analysis. The review adheres to known protocols for systematic reviews in surgical operations, assuring ethical compliance.

This systematic review complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, guaranteeing stringent methodological standards and thorough reporting. The search strategy utilized the PICOS model, which includes participants, intervention, comparison, outcomes, and study design, to enable systematic data gathering and analysis.

This review encompasses older patients with pertrochanteric fractures. The principal therapies being evaluated are proximal femur nailing (PFN) and bipolar hemiarthroplasty (BH), both of which are prevalent therapeutic modalities for this kind of fracture. The functional outcomes and complication rates of these two therapies are rigorously compared. The review precisely analyzes surgical outcomes, encompassing operative duration, intraoperative hemorrhage, requirement for blood transfusions, and postoperative hospitalization duration. Moreover, outcomes pertaining to functional recovery, including the duration for partial weight-bearing, postoperative mobility scores, and complication rates, are deemed essential for a comprehensive assessment of each treatment modality.

Studies qualifying for inclusion adhered to strict criteria. Only human research published in English were considered to maintain relevance. The investigations included patients with closed, isolated pertrochanteric fractures, limited to an age range of 60 to 80 years. Research excluding ipsilateral hip arthritis, proximal femur pathologies, or fractures extending into the femoral diaphysis was conducted to concentrate on primary fractures devoid of complicating comorbidities or fracture

patterns. Furthermore, studies utilizing case reports, cross-sectional analyses, case series, or animal research were omitted to guarantee that the data obtained was clinically relevant to human patients in analogous demographic circumstances.

Search Strategy

Identification of studies

The literature search was carried out in the Web of Science, PubMed, Scopus, and Cochrane databases from 2005 to 2022 using the following key words: (((cephalomedullary OR gamma) AND nail*) OR (proximal AND femur AND nail*) OR PFN OR ((internal OR intramedullary) AND fixation)) AND ((Bipolar AND Hemiarthroplasty) OR BH OR Hemiarthroplasty) AND ((pertrochanteric OR intertrochanteric OR pertrochanteric) AND fractures). The reference lists of all relevant articles were also hand screened for additional articles.

Studies selection

The search results will be evaluated based on the titles of papers and their abstracts. Upon identifying the pertinent research, the complete publications will be obtained and independently evaluated by both authors to ascertain their eligibility for final inclusion. In the absence of unanimity, a third reviewer will assess eligibility and authorize the final compilation of retained research.

Data Extraction and Quality Assessment:

Data were systematically extracted using a predetermined data extraction form in Excel.

The data extraction and quality assessment for this systematic review were conducted systematically to ensure accurate and trustworthy results. Essential data obtained from each qualifying study encompassed participant demographic information, specific intervention details—identifying the proximal femoral nail or type of bipolar hemiarthroplasty—outcome measures, including operative duration, intraoperative blood loss, postoperative hospital stay, and functional recovery metrics, as well as any reported complications that occurred during the process. Outcomes were collected as continuous or categorical data when feasible to facilitate statistical analysis in the meta-analysis.

The Cochrane Risk of Bias tool was employed to assess the quality and bias risk of the included randomized controlled trials, whereas the Newcastle-Ottawa Scale was used for the observational research.

Each study underwent a rigorous methodological assessment focusing on participant selection, group comparability, and the completeness of outcome data. The risk of bias for the evaluated items was classified as low, moderate, or high. Extracted data and quality ratings were deliberated upon by reviewers, and any differences were handled; in the absence of consensus, a third reviewer was consulted, therefore mitigating subjective bias. Additionally, the funnel plot and Egger's regression test were employed to identify publication bias in the studies incorporated in this meta-analysis. The rigorous data extraction and quality assessment methodology employed in this analysis will provide a complete and reliable comparison of outcomes associated with proximal femur nailing versus bipolar hemiarthroplasty in older patients with pertrochanteric fractures.

The results of the meta-analysis aim to aid clinicians in making informed decisions on surgical treatments and highlight the implications for future research and clinical practice.

STATISTICAL ANALYSIS

All statistical analyses were conducted using version 5.3 of the Cochrane Collaboration Review Manager (RevMan) and manually assessed for eligibility for inclusion. The PRISMA Flow Chart was generated based on search outcomes and inclusion/exclusion criteria, with P values below 0.05 deemed statistically significant.

RESULTS:

The flow diagram delineates the methodical procedure employed in locating and selecting studies for this review in accordance with PRISMA recommendations. The process commences with the identification phase, during which 642 records were obtained from electronic databases (PubMed, Scopus, WOS, and Cochrane), supplemented by 8 records from alternative sources. Following the elimination of 320 duplicates, 330 distinct studies were retained for screening.

During the screening step, these 330 studies were subjected to title and abstract evaluation. Of these, 278 studies were rejected according to various criteria: There were 19 non-English research, 68 non-human studies, 167 investigations of alternate treatment approaches, and 24 abstracts lacking full-text availability. This filtration resulted in 52 studies for comprehensive evaluation.

Fifty-two full-text papers were meticulously scrutinized during the eligibility assessment. At this stage, forty studies were removed for failing to meet inclusion criteria: 18 were case reports or case series, and 22 lacked data on functional outcomes.

After adhering to these stringent procedures, 12 research satisfied the inclusion criteria and were considered appropriate for the final qualitative synthesis and quantitative analysis (meta-analysis). This methodical process emphasizes a comprehensive selection of research to guarantee that only pertinent, high-quality data were incorporated into the analysis.

Table (1) gives a succinct overview of patient demographics, fracture classifications, interventions, and essential outcome metrics from the 12 studies included in this systematic review and meta-analysis. The research primarily focuses on elderly people with pertrochanteric fractures, with mean ages across studies ranging from around 65 to 87 years, underscoring the value of this study for an aging population often afflicted by these injuries. Fracture classifications were frequently defined using methodologies such as AO and Evans-Jensen, which aided in the assessment of fracture severity and guided management decisions.

Bipolar hemiarthroplasty (BHA) and proximal femur nailing (PFN) were assessed as treatment options. Numerous studies suggest that calcar-replacement treatments may be beneficial in the treatment of unstable fractures. Regarding intraoperative blood loss, BHA generally shown a higher mean blood loss compared to PFN, suggesting that PFN may serve as a less invasive option with a potentially more favorable perioperative profile.

After the procedure, patients receiving BHA frequently had slightly prolonged hospitalizations compared to individuals treated with PFN.

Nevertheless, certain investigations revealed negligible distinctions between the two therapies. Reoperation and death rates differed among therapies. Studies conducted by Kim et al. [9]. and Özkan et al. indicated significant death rates associated with BHA, although reoperation rates were consistently low for both intervention modalities.

Table (1) indicates that PFN may provide benefits compared to BHA, including reduced blood loss and shorter hospital stays; however, variability in mortality and reoperation rates underscores the necessity of personalized treatment decisions based on individual patient characteristics. This comparison data elucidates the clinical results and potential risks linked to each strategy, guiding best treatment methods for older individuals with unstable pertrochanteric fractures.

Meta-analysis Results

1. **Intraoperative blood loss**

Nine studies mentioned blood loss during BHA and PFN. The included studies were heterogeneous (I2= 99%, p<0.00001) so the random effect model was used. The overall mean difference of blood loss reported a significant increase in blood loss in BHA versus PFN (MD 184.65, 95%CI [113.23,256.07], P<0.00001) with low publication bias (Figure 2).

2.Hospital Stay

Nine studies mentioned postoperative hospital stay in BHA and PFN. The included studies were heterogeneous (I2=100%, P<0.00001), so random effect model was used. There was no significant difference in postoperative hospital stay between BHA and PFN (MD 2.36, 95% CI [-0.65, 5.37], P=0.12) (Figure 3).

3.Mobility Score

The overall effect estimates for post-operative mobility score demonstrated that there was no significant difference between BHA group and PFN group (MD 0.2, 95% CI [-0, 0.41], p=0.06) without heterogeneity (I2=0%, p=0.53) (Figure 4).

4.Mortality Rate

The overall effect estimates for mortality rate demonstrated a significant increase in mortality rate in BHA group versus PFN group (RR 1.9, 95% CI [1.31, 2.75], p=0.0008) without heterogeneity (I2=0%, p=0.53) and without evidence for publication bias (Egger's test P value=0.06) (Figure 5).

5.Reoperation Rate

The overall effect estimates for reoperation rate demonstrated that there was no significant difference between BHA group and PFN group (RR 0.62, 95% CI [0.34, 1.15], p=0.13) without heterogeneity (I2=10%, p=0.35 with moderate publication bias in funnel plot (Egger's test P value=0.04) (Figure 6).

Table 1: Patient Demographics, Operative properties and complications data according to 12 studies were deemed suitable for inclusion in the systematic review and meta-analysis

Author	Total sample	Age	Fracture types	Intervention
				BHA/PFN
Kim et al. [9]	29	82 ± 3.4	AO 31 A2	Calcar-replacement BHA
	29	81 ± 3.2	AO 31A2	PFN
Desteli et al. [12]	42	65 ± 1.5	A1:6, A2:28, A3:10	BHA
	44	67 ± 1.2	A1:30, A2:3, A3:9	PFN
Görmeli et al. [13]	75	76.2	A1:30, A2:37, A3:8	BHA
	68	77.4	A1:25, A2:33, A3:7	PFN
Özkayın et al. [14]	33	83.94 ± 4.9	A1:4, A2:16, A3:13	BHA
	21	79.57 ± 4.83	A1:4, A2:27, A3:10	PFN
Park et al. [15]	22	76.9	NA	BHA
	31	78.1		PFN
Esen et al. [16]	58	80.24	A1:6, A2:49, A3:3	Calcar-replacement BHA
	34		A1:4, A2:28, A3:2	PFNA
Suh et al. [17]	50	73.8 ± 9.5	NA	PFNA
	50	81.8 ± 6.9	NA	BHA
Bansal et al. [18]	52	68.9	31A2.2 12, 31A2.3 17, 31A3.3 11	PFN
	40			BHA
Song et al. [19]	32	79.9 ± 6.1	Evans-Jensen classification 3 (5), 4 (7), 5 (20)	PFNA
	30	81.0 ± 9.1	Evans-Jensen classification 3 (5), 4 (8), 5 (17)	BHA
Zhou et al. [20]	61	83.5 ± 4.8	ASA grade III 42 and grade IV 19	PFNA
	47	83.8 ± 6.4	ASA grade III 30 and grade IV 17	BHA
Mansukhani et al. [21]	13	74.4	Evans Classification III 3, IV 7, V 3	BHA
	18	74	Evans Classification III 8, IV 8, V 2	PFN
Ucpunar et al. [22]	64	85.9 ± 4.6	31A2 (44) /31A3 (20)	PFN
	76	87 ±4.1	31A2 (51) /31A3 (25)	Calcar replacement BHA

Follow up period/weeks	Intra-operative blood loss				Post-operative hospital stay				reoperation	Mortality
	BHA		PFN		BHA		PFN			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
36	511	103	168	44	13	2.6	11	3.1		**16**
36									**1**	**5**
24					16	0.68	7	0.83		
24										
29.6	136.5	34.2	30.6	12.5					**2**	**11**
32.3									**8**	**6**
31.33					5.6	0.9	6.8	0.6		
32.33									**1**	
42.84	293	80	142.3	55	40.4	3.6	35.8	2.8		**7**
									4	**5**
27.2(12–47)	420	90	50	10	9.4	0.7	5.9	0.6	**4**	**24**
										11

Follow up period/weeks	Intra-operative blood loss				Post-operative hospital stay				reoperation	Mortality
12										
12										
23 (18-29)	185	126	311	126	14	9.5	10	9.5	**2**	**4**
25 (19-32)									**1**	**1**
NA	335.3	90.87	153.3	59.9	16.63	3.64	17.13	2.92		
NA										
12.5–36.2	286.3	43.2	132.5	33.2	6.9	2.2	7.6	1.8		
12.5–36.2										
19										**3**
19									**2**	**2**
6									**7**	
6									**6**	

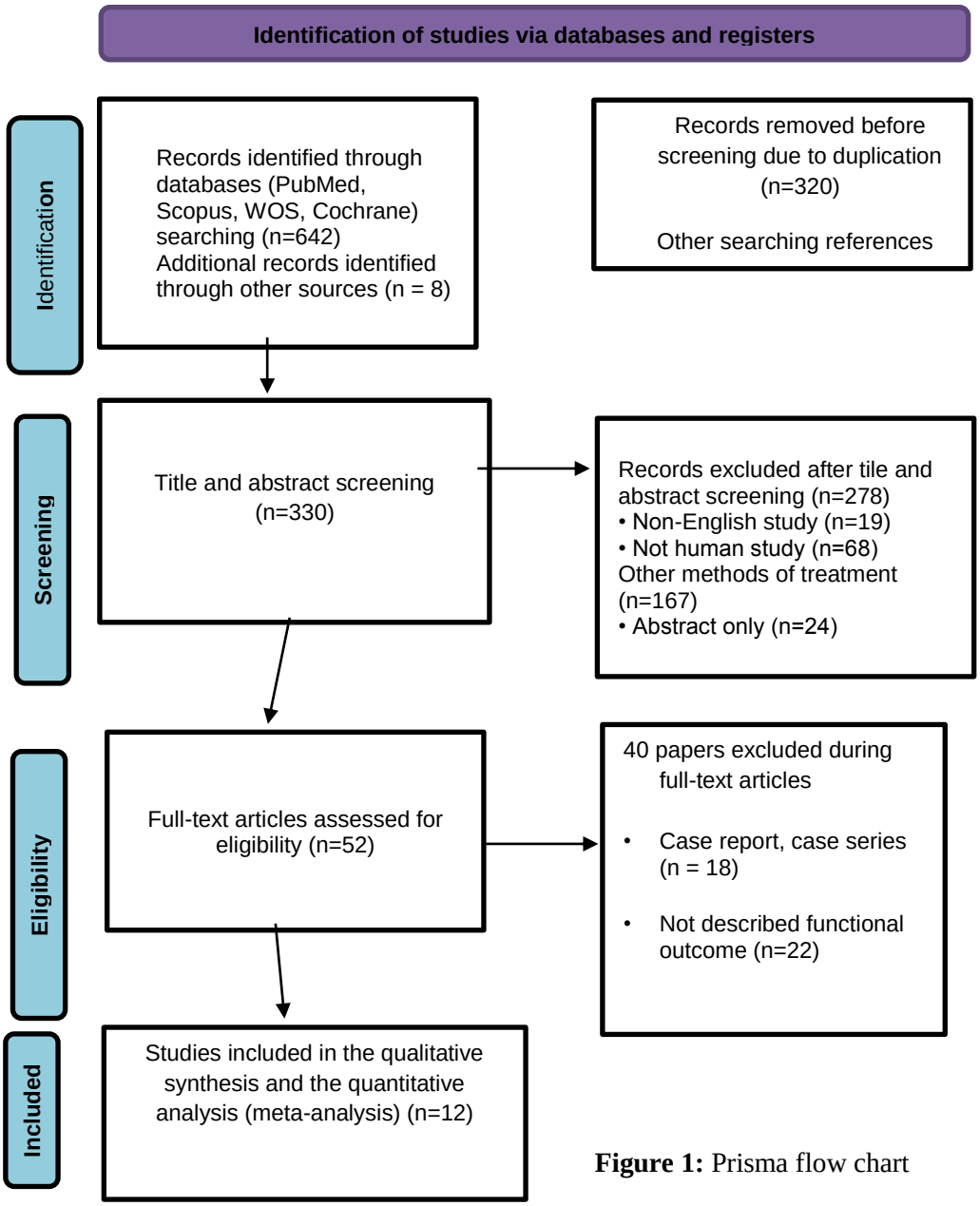
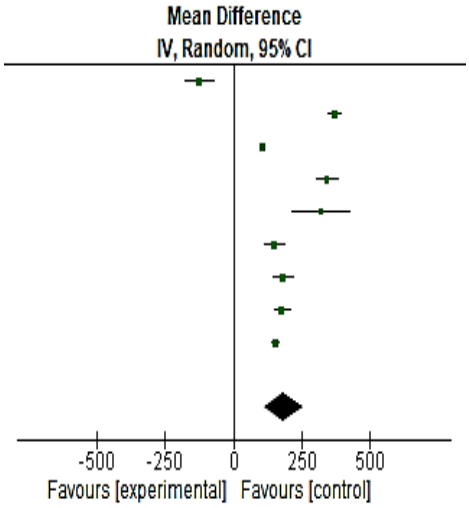
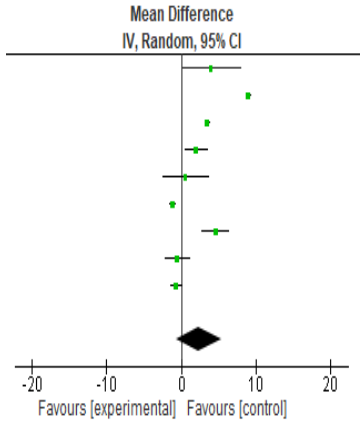


Figure 1: Prisma flow chart



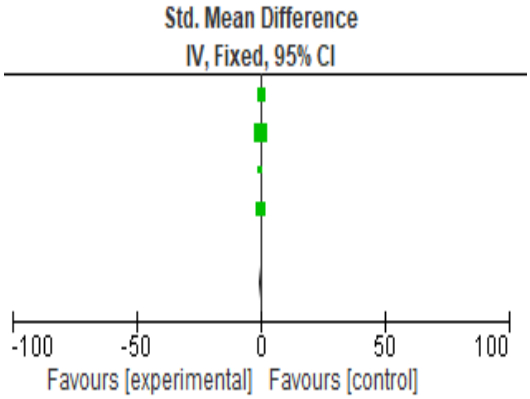
	BHA Group			PFN Group				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95%CI
Bansal et al. [18]	185	126	40	311	126	52	11.0%	-126.2 [-177.94, -74.06]
Esen et al. [16]	420	90	58	50	10	34	11.5%	370.0 [346.60, 393.40]
Görmeli et al. [13]	136.5	34.2	75	30.6	12.5	68	11.6%	105.90 [97.61, 114.19]
Kim et al. [9]	511	103	29	168	44	29	11.2%	343.00[302.24, 383.76]
Mansukhani et al. [21]	573	152	13	252	146	18	9.2%	321.00 [214.34, 427.66]
Park et al. [15]	293	80	22	142.3	55	31	11.2%	150.7 [112.07, 189.33]
Song et al. [19]	335.3	90.87	30	153.3	59.9	32	11.3%	182.00 [143.42, 220.58]
Ucpunar et al. [22]	429	126	76	251	17	64	11.4%	178.00 [149.37, 206.63]
Zhou et al. [20]	286.3	43.2	47	132.5	33.2	61	11.6%	153.80 [138.9, 168.7]
Total (95% Cl)			390			389	100%	184.65 [113.23, 256.07]
	Heterogeneity: Tau^2= 11415.39; Chi² = 656.16, df = 8 (P = <0.0001); I² = 99%							
	Test for Overall effect: Z = 5.07 (P = <0.0001)							

Figure 2: Forest plot of Intraoperative blood loss distribution between Groups among all studies



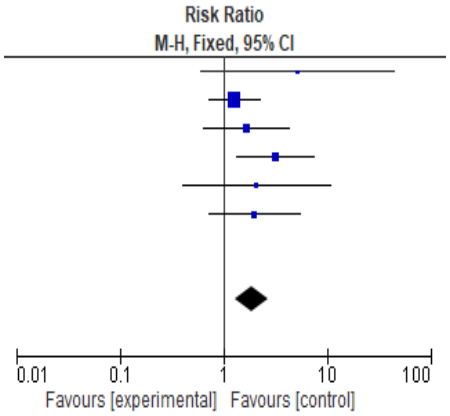
	BHA Group			PFN Group				Mean Difference
Desteli et al. [12]	16	0.68	42	7	0.83	44	11.6%	9.00 [8.68, 9.32]
Esen et al. [16]	9.4	0.7	58	5.9	0.6	34	11.6%	3.5[3.233, 3.77]
Kim et al. [9]	13	2.6	29	11	3.1	29	11.3%	2.00[0.53, 3.47]
Mansukhani et al. [21]	18.27	4.43	13	17.72	4.14	18	10.4%	0.55[-2.53, 3.63]
Özkayın et al. [14]	5.6	0.9	33	6.8	0.6	21	11.6%	-1.2 [-1.60, -0.80]
Park et al. [15]	40.4	3.6	22	35.8	2.8	31	11.1%	4.6[2.80, 6.40]
Song et al. [19]	16.63	33.64	30	17.13	2.92	32	11.2%	-0.50[-2.15, 1.15]
Zhou et al. [20]	6.9	2.2	47	7.6	1.8	61	11.5%	-0.70[-1.47, 0.07]
Total (95% Cl)			**314**			**322**	**100%**	**2.36[-0.65, 5.37]**
Heterogeneity: Tau²= 20.32; Chi² = 1781.59, df = 8 (P = <0.0001); I² = 100%								
Test for Overall effect: Z = 1.53 (P = 0.12)								

Figure 3: Forest plot of hospital stay after BHA versus PFN



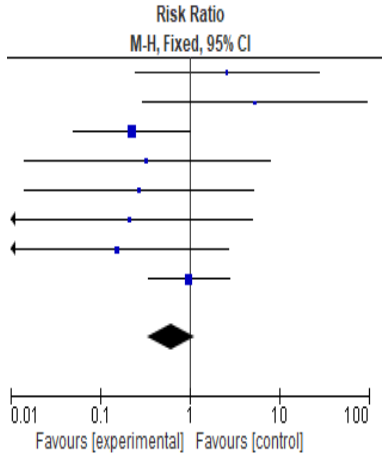
	BHA Group			PFN Group				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95%Cl
Desteli et al. [12]	5.31	0.81	42	5.05	0.02	44	23.5%	0.46[0.03, 0.88]
Görmeli et al. [13]	2.2	2.14	75	1.93	1.05	68	40.0%	0.16[-0.17, 0.49]
Mansukhani et al. [21]	6.5	2.2	13	6.75	2.3	18	8.5%	0.11[-0.82, 0.61]
Suh et al. [17]	2.8	1.7	50	2.5	2.2	50	28.0%	0.15[-0.24, 0.54]
Total (95% Cl)			180			180	100%	0.2[-0.00, 0.41]
Heterogeneity: Chi² = 2.20, df = 3 (P = 0.53); I² = 0%								
Test for Overall effect: Z = 1.92 (P = 0.06)								

Figure 4: Forest plot for Mobility Score after BHA versus PFN



	Ilio-sacral Group		Posterior Group			Risk Ratio
Study or Subgroup	Event	total	Event	total	Weight	M-H, Fixed, 95%Cl
Bansal et al. [18]	4	40	1	52	2.7%	5.20 [0.60, 44.74]
Esen et al. [16]	24	58	11	34	43.5%	1.28 [0.72, 2.27]
Görmeli et al. [13]	11	75	6	68	19.8%	1.66 [0.65, 4.25]
Kim et al. [9]	16	29	5	29	15.7%	3.20 [1.35, 7.58]
Mansukhani et al. [21]	3	13	2	18	5.3%	2.08 [0.40, 10.72
Park et al. [15]	7	22	5	31	13.0%	1.97 [0.72, 5.41]
Zhou et al. [20]	0	47	0	61		Not estimable
Total (95% CI)		284		293	100.0%	0.92 [0.12, 7.32]
Total events	65		30			
Heterogeneity: $Chi^2 = 4.16$, $df = 4$ ($P = 0.53$); $I^2 = 0\%$						
Test for overall effect: $Z = 3.36$ ($P = 0.0008$)						

Figure 5: Funnel plot for mortality rate after BHA versus PFN



	Ilio-sacral Group		Posterior Group			Risk Ratio
Study or Subgroup	Event	total	Event	total	Weight	M-H, Fixed, 95%Cl
Bansal et al. [18]	2	40	1	52	3.4%	2.6 [0.24, 27.67]
Esen et al. [16]	4	58	0	34	5.34%	5.34 [0.30, 96.23]
Görmeli et al. [13]	2	75	8	68	32.8%	0.23 [0.05, 1.03]
Kim et al. [9]	0	29	1	29	5.9%	0.33 [0.01, 7.86]
Mansukhani et al. [21]	0	13	2	18	8.3%	0.27 [0.01, 5.22]
Özkayın et al. [14]	0	33	1	21	7.1%	0.22 [0.01, 5.06]
Park et al. [15]	0	22	4	31	14.7%	0.15 [0.01, 2.73]
Ucpunar et al. [22]	7	76	6	64	25.4%	0.98 [0.35,2.78]
Total (95% CI)		346		317	100.0%	0.62 [0.34, 1.15]
Total events	15		23			
Heterogeneity:; $Chi^2 = 7.77$, df = 7 (P = 0.35); $I^2 = 10\%$						
Test for overall effect: Z = 1.51 (P = 0.13)						

Figure 5: Forest plot for reoperation rate after BHA versus PFN

DISCUSSION

Among the most frequent fractures an orthopedic surgeon will see in his career are those in the intertrochanteric (IT) region. The frequency of these fractures is rising along with life expectancy. It is anticipated that the frequency of these fractures will double by 2040. The increased morbidity and mortality linked to unstable IT fractures make them a serious concern for the elderly. Restoring mobility in a safe and effective manner while lowering the chance of technical malfunction and medical problems is the aim of treatment. Mobility restoration is contingent upon both implant type and bone quality [22].

Recent studies have indicated that the use of PFN or prosthetic replacement for unstable IT fractures has prevented excessive collapse at the fracture site and enabled early postoperative movement. Nevertheless, when treating older patients with unstable intertrochanteric fractures, there isn't enough conclusive information from clinical research to say whether bipolar hemiarthroplasty is superior to proximal femoral nailing or vice versa. Therefore, in order to give clinicians trustworthy information when deciding which course of treatment is best for unstable intertrochanteric fractures, a meta-analysis comparing the benefits and drawbacks of the PFN and BHA was carried out. [23, 24]

The study's included articles were released between 2005 and 2022. The mean age of the pooled sample is 75 years, and the total number of patients in the included trials was 1019 patients with unstable intertrochanteric fractures, of which 515 received bipolar hemiarthroplasty (BHA) and 504 underwent proximal femoral nail (PFN). The follow-up duration averaged between six and forty-two weeks. The surgical time and post-operative hospital stay did not significantly differ between BHA and PFN in this meta-analysis investigation. Subgrouping based on study design and intervention type helped to understand the source of heterogeneity in the pooled estimate for operative time and post-operative hospital stay. The significant difference in the included studies' sociodemographic characteristics, co-morbidities, bone density, type of intervention, and study design may account for the included studies' substantial variability.

Conversely, the results of this meta-analysis study demonstrated that PFN outperformed BHA in terms of intraoperative blood loss incidence and blood transfusion requirements. This is consistent with the earlier meta-analysis research conducted by. Chen et al. [5] came to the conclusion that the arthroplasty group had greater blood loss than the PFN group (MD: 241.01, 95% CI: 43.06–438.96, P = 0.02) based on our results. [25,26]

Patients receiving hemiarthroplasty had a considerably larger quantity of intraoperative and

postoperative early bleeding. Patients who require postoperative intensive care and have a high ASA score may present challenges in hemodynamic regulation. Consequently, by carefully analyzing such individuals, it would be more appropriate to employ PFN with a substantially reduced rate of both intra- and postoperative bleeding [27].

In terms of weight bearing and functional result, HHS was higher following PFN than following BHA. The subgroup analysis based on the kind of intervention was the most effective way to address the heterogeneity in the pooling estimate for HHS. Between cementless BHA with calcar replacement and PFN, as well as between BHA and PFNA, there was no discernible variation in post-operative HHS. Cementless BHA versus PFN had the largest overall HHS mean difference, followed by cemented BHA versus PFN.

A pooling estimate for partial weight bearing showed that patients who had PFN needed more time than those who had BHA to achieve partial weight bearing.

According to Chen et al. [5] the most popular treatment for unstable intertrochanteric femoral fractures (IFFs) is proximal femoral nails (PFNs), yet bed rest is necessary after surgery. Blood is lost in significant quantities throughout the procedure. In older individuals, nonunion of fractures and other problems might result from osteoporosis. Patients can begin bearing weight earlier and have less financial strain after an arthroplasty. [26]

Early weight bearing, a brief stay in the critical care unit, and surgery all play a significant role in keeping older patients from dying or becoming seriously ill. Following PFN administrations, postoperative early weight-bearing loss occurs [27].

The total effect estimate showed that in terms of postoperative mobility ratings, reoperation rate, respiratory problems, altered limb length, UTI, and deep vein thrombosis, there was no statistically significant difference between the two groups. According to Kumar et al. [25] post-operative infections and implant failure did not differ between PFN and BHA, which is consistent with our findings. The frequency of mortality was higher after BHA than after PFN, according to the total mortality rate risk ratio.

Compared to patients who received PFNA, patients who underwent hemiarthroplasty exhibited a trend of increased postoperative 1-year mortality. When it comes to treating senile intertrochanteric fractures, PFNA clearly outperforms hemiarthroplasty. Greater surgical trauma and a higher frequency of postoperative medical problems are linked to hemiarthroplasty [28].

When HA was used instead of internal fixation, a 1.22-fold higher death rate was seen in patients with pertrochanter fractures who were over 65. When comparing BHA to PFN, Luo et al. found a statistically significant rise in the 1-year postoperative death rate. [28,29]

BPHs are particularly helpful in the case of weak individuals with shorter life expectancies who require early mobilization to support geriatric care and rehabilitation. They offer the benefit of immediate mobilization with complete weight bearing. These patients may respond less well to explicit instructions for partial or non-weight bearing, which may be necessary in PFN cases at first, because they frequently have weak mental and physical capacities. Second, because osteosynthesis is more likely to fail in cases of co-existing hip osteoarthritis, hip arthroplasty is a preferable course of action [30].

The study's findings provide solid proof that both therapeutic strategies can be applied to older individuals, with some circumstances making either approach better than the other. However, the few studies that are now accessible, the partly missing data in certain studies, and the absence of some outcome reporting are thought to be the main limitations of this research.

CONCLUSIONS

Elderly patients with intertrochanteric fractures may benefit from proximal femoral nailing (PFN) and bipolar hemiarthroplasty (BHA); nevertheless, treatment selection should be tailored to the particular needs, health state, and preferences of each patient. PFN is frequently advised for elderly patients with unstable intertrochanteric fractures, as it correlates with reduced postoperative mortality and enhanced functional results vs to BHA. This procedure is especially beneficial for individuals anticipated to endure an extended recovery duration and who may gain from a minimally invasive method. In contrast, BHA may be more appropriate for patients with limited life expectancies who necessitate prompt weight-bearing abilities, facilitating quicker deployment. The decision between PFN and BHA should be determined by the patient's overall health, expected recovery path, and the necessity for postoperative mobility.

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