Efficacy and safety of Intertan versus proximal femoral nail antirotation in treating intertrochanteric femoral fractures

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SUBJECT AREAS
Orthopedics

KEYWORDS
Intertrochanteric femoral fractures, IFFS, InterTan, proximal femoral nail antirotation, PFNA
Abstract

Background: Two different devices, InterTAN and proximal femoral nail antirotation (PFNA), have been used in treating intertrochanteric femoral fractures (IFFs). This study was to compare the advantages and disadvantages of InterTAN and PFNA in treating IFFs.

Methods: The relevant studies were searched from the database of MEDLINE, Web of Science, EMBASE, Cochrance Library and CNKI. Nineteen randomized controlled trials (RCTs) with 2285 patients were involved in this analysis.

Results: Comparing the InterTAN with PFNA, harris hip score and fracture healing time of patients with IFFs did not show significant differences (P = 0.133; P = 0.152). However, compared with PFNA, InterTAN seemed to cause more intraoperative blood loss (standardized mean difference, SMD = -1.45; P<0.001) and take more operative time (SMD = -1.95; P<0.001). But postoperative complications of InterTAN were significantly lower than PFNA (odds ratio, OR = 2.22; P<0.001).

Conclusions: InterTAN had the same long-term efficacy as PFNA. Although the surgical operation of PFNA surgery had a relative advantage, InterTAN had a low incidence of postoperative complications.

Introduction

The number of patients who suffer from fractures around the hip has been increasing in aging society [1]. The intertrochanteric femoral fractures (IFFs) is one of the most common fractures, which account for more than half of hip fractures in older patients [2]. Clinically, IFFs is generally divided into three categories according to the anatomic location of fracture: femoral neck fracture, intertrochanteric fracture and subtrochanteric fracture [3]. These fractures often result in other complications (pneumonia and bedsores), which reduces the quality of life for patients. Proper surgical fixation can
promote rapid repair of the fracture and reduce complications during and after surgery [4]. Currently, intramedullary fixation is the main method of IFFs treatment. This technique includes two major strategies: extramedullary fixation and placement of a proximal femoral nail. The fixation devices used in the surgery are as follows: proximal femoral nail-InterTAN, Gamma nail, and proximal femoral nail antirotation-PFNA) [5]. Due to factors such as osteoporosis and calcium deficiency in the elderly, fixation and healing of fractures are still a major medical problem. Although a variety of implants are available for fixation of the fracture site, the optimal implant for treating IFFs is not known [6]. The PFNA system was first designed in 2003 and is considered a suitable implant for unstable IFFs. Although it is known PFNA system provides high union rates with low major complication rates, some reports have shown penetration and cutout of the helical blade [7]. The InterTan Intertrochanteric Antegrade nail was introduced in 2005 and increases intertrochanteric rotational stability and decreases lag screw cutout [8]. However, the advantages and disadvantages of PFNA and InterTan in treating IFFs are still controversial. The aim of this study was to do a systematic evaluation and meta-analysis in order to assess the clinical advantages and disadvantages of PFNA and InterTan in treating IFFs.

Methods And Materials

Searching and screening of studies

From the following electronic science databases (from June 2000 to June 2018): Springer-Link, Medline/PubMed, Ovid Technologies, Excerpt Medica Database, Web of Science (SCI), and China Academic Journals (CNKI)-Databases. We searched the academic reports on PFNA versus InterTan in the treatment of IFFs. The text and the Medical Subjects Headings (MeSH) terms we used in this process included “intertrochanteric femoral fractures”, “intertrochanteric fracture”, “femoral neck fracture”, “femoral intertrochanteric fracture”, “femoral neck fracture”, “InterTan”, “INTERTAN”, “proximal femoral nail antirotation”, and
Criteria of inclusion made for selecting studies

Criteria of inclusion: (1) must compare PFNA to InterTan in the treatment of IFFs; (2) must be randomized control trials (RCTs); (3) the general baseline data of patients in both groups must be balanced and equivalence; (4) other medical care that patients received in two groups must be equal; (5) lost follow-up rate must be less than 5%; (6) must have showed the key measurement indicators: harris hip score, fracture healing time, intraoperative blood loss, cut length, operation time, and postoperative complications; and (7) the total number of cases must be greater than or equal to 80.

Criteria of exclusion made for selecting studies

Criteria of exclusion: (1) non-original researches; (2) single arm study; (3) observable reports; (4) the manufacturers of internal fixation devices provided the research funding; (5) patients were combined with tumors, pathological fractures, mental illness, other parts of the fracture and open intertrochanteric fractures; and (6) the ethics and informed consent is not explicitly stated.

Extraction of data

The basic information: (1) the author and date of publication; (2) demographic characteristics, causes of fractures, and combination of medical illnesses; (3) the implementation of statistical design; and (4) the indicators on quality of the study design. The key outcomes: (1) harris hip score; (2) fracture healing time; (3) intraoperative blood loss; (4) cut length; (5) operation time; and (6) postoperative complications.

Quality assessment of included studies

According to the criteria of Cochrane Handbook for Systematic Reviews of Interventions (Version 5.0.1) [9], the evaluation items contained: (1) generation method of random sequence generation method; (2) blind method for patients and data surveyors; (3)
allocation concealment for patients and data surveyors; (4) data report form for outcomes; (5) the selection of a subset of analyses to be reported; (6) other possible offset factors; and (7) intention-to-treat analysis (ITT). The quality was categorized into low risk of bias, unclear risk of bias, or high risk of bias.

Statistics process

The entire statistical idea included: (1) the Chi-square test and the $I^2$ analysis were employed finish the heterogeneity test. When the P value of Chi-square test $>0.10$ and $I^2$ value $\leq 50\%$, the fixed effects method of meta-analysis was selected; otherwise, the random effects method was used; (2) the continuity variable were calculated using the standardized mean difference (SMD) and 95% confidence interval (CI); dichotomous variables were through the estimation of odds ratios (OR) and 95% CI; (3) the overall statistical effect was determined by the Z-scores, and the statistical significance was defined as $p < 0.05$; (4) a sensitivity analysis was performed to assess the influence of any study on overall efficacy; (5) the Egger’s test, the funnel plots and the Begg’s test, were performed for evaluating the potential publication bias; (6) the statistical software, Revman 5.2 (Cochrane Collaboration), SPSS (IBM Corporation), and Stata version 14.0 (Stata Corporation), were used in this study.

Results

Selection and screening of studies

Originally, a total of 109 relevant reports were noticed in a series of electronic literature database. However, fifty-six studies were considered completely unavailable. Of the remaining 53 studies, 31 were deleted due to the following flaws: non-RCTs (18), poor outcome data (7), repeated reports (2), and unreasonable statistical design (4). Next, we had to abolish three trials of remaining 22 studies because of the following causes:
combination of other therapy (1) and low quality of study implementation (2). Finally, 19 studies [10–28] published between 2013 and 2017 were put into this systemic analysis (Fig. 1A).

**Description of included studies**

A total of 19 studies [10–28] with a total of 2285 patients were included in this study (male of 1102 and female of 1183). The size of research oscillated between 85 [19] and 252 [27] patients. Ten studies [10, 14–16, 18–21, 23, 28] reported the causes of the fracture. Eight [15, 19–21, 23, 26–28] showed the data on other medical diseases. Nineteen studies [10–28] demonstrated the key endpoints. Detailed clinical characteristics are shown in table 1.

**Quality of included studies**

As presented in Table 2, all studies were single-center studies [10–28] and patients were grouped using a random approach. After assessing the studies, we found 18 [10–20, 22–28] of the 19 RCTs (95%) showed unclear risk of bias, and one study [21] displayed low risk of bias (5%) (Fig. 1B, C). As presented in Table 3, 19 studies [10–28] compared the efficacy between PFNA and InterTan in treating IFFs (PFNA group: 1098 patients; InterTan group: 964 patients). Clinical features, including age, gender, fracture causes, medical basic diseases, etc., were no differences between the two groups (p>0.05), revealing that they had a rational comparability and clinical homogeneity.

**Heterogeneity analysis of data**

For comparison of harris hip scores between PFNA and InterTan (P < 0.05; $I^2 = 86.8\%$); fracture healing time (P < 0.05, $I^2 = 46.6\%$); intraoperative blood loss, (P < 0.05, $I^2 = 79.1\%$); operation time (P < 0.05, $I^2 = 65.3\%$), we selected random-effect model and standard mean difference (SMD) to perform the meta-analysis on these data. For
comparison of postoperative complications between PFNA and InterTan (p = 0.88, I^2 = 0.0%), we employed the fixed-effect model of meta-analysis to compare these data.

**Comparison of harris hip scores between PFNA and InterTan**

As presented in Table 3, twelve trials [13-15, 18-21, 24-28] listed the data of harris hip scores at the last follow-on. The random effects model showed that SMD was -0.23 (95% CI -0.52 to 0.57; Z value = 1.50, P = 0.133), indicating that there was no difference in the harris hip scores whether PFNA or InterTan in treating IFFs (Fig. 2A).

**Comparison of fracture healing time between PFNA and InterTan**

As presented in Table 3, the data on fracture healing time was showed in the 17 studies [11-15, 17-28]. A meta-analysis with random effects model showed that the SMD was 0.09 (95% CI -0.03 to 0.21; Z value = 1.43, P = 0.152), suggesting that there was no difference in the fracture healing time whether PFNA or InterTan in treating IFFs (Fig. 2B).

**Comparison of intraoperative blood loss between PFNA and InterTan**

As presented in Table 4, 19 trials [10-28] compared the intraoperative blood loss between PFNA and InterTan for treating IFFs. A meta-analysis with random effects model exhibited that the SMD for PFNA versus InterTan was -1.45 (95% CI -2.02 to -0.87; Z = 4.94, P < 0.001), indicating that the intraoperative blood loss of PFNA operation was more than InterTan operation (Fig. 3).

**Comparison of cut length between PFNA and InterTan**

As presented in Table 4, five trials [15, 16, 20, 21, 23] provided the data on comparison of cut length between PFNA and InterTan. A meta-analysis with random effects model suggested that the cut length did not show a difference between PFNA and InterTan (SMD
Comparison of operation time between PFNA and InterTan

As presented in Table 4, eighteen trials [10–15, 17–28] compared the operation time between PFNA and InterTan for treating IFFs. The SMD of the random effects model ranged from -3.5 to -0.24. The pooled SMD was -1.95 (Z = 7.95, p < 0.001; 95% CI -2.44 to -1.47), showing that the operating time of PFNA was less than the InterTan (Fig. 4B).

Comparison of postoperative complications between PFNA and InterTan

A total of 17 RCTs [10–16, 19–28] provided the postoperative complications between PFNA and InterTan in treating IFFs (Table 4), including deep vein thrombosis, nonunion, femoral head necrosis, hip varus, varus collapse of the head, secondary fracture and fixed loose or broken. The incidence of postoperative complications in PFNA group was 11.4% (126/1105) and 5.1% (49/956) in InterTan group. A meta-analysis with fixed effects model suggested that the incidence of postoperative complications in PFNA group was higher than that in InterTan group (OR = 2.22, Z = 4.52, P < 0.001; 95% CI 1.57 to 3.14) (Fig. 5A).

Sensitivity and publication bias analysis to included trials

The sensitivity analysis suggested that the deletion and return of any study could not alter the overall results of meta-analysis (value of estimate = -1.44, and 95% CI: -2.01 to -0.87) (Fig. 5B) and the weight distribution was 4.69 to 5.37. The Egger’s test (t = 0.96, P = 0.349) (Fig. 6A), Begg’s test (Std. Dev. of Score = 28.58, P = 0.421), and funnel plot (nearly symmetrical) (Fig. 6B) all did not indicate the possibility of publication bias [10–28].

Discussion
The intertrochanteric femoral fractures (IFFs) are commonly seen in orthopedic clinics, primarily in the older population. It is agreed that early operative intervention is the preferred treatment because it allows for early rehabilitation and avoids the complications [29]. There are some implants for the treatment of IFFs, such as fixed gussets, dynamic hip screws and proximal femoral nails [30]. PFNA is used to treat unstable proximal femoral fractures. Insertion of the blade can compact the cancellous bone, providing optimal anchoring and stability [31]. InterTAN uses two cephalocervical screws in an integrated mechanism, which allow linear intra-operative compression and rotational stability of the head or neck fragment [5]. So far, a number of studies [10–28] have reported the efficacy of PFNA versus InterTAN for treating IFFs. We summarized and meta-analyzed these studies. In our study, a total of 19 studies with 2285 patients were included. We selected the random-effect model to perform the meta-analysis on measurement data.

Firstly, we compared two indicators, harris hip scores and fracture healing time between PFNA and InterTan groups and found that there was no significant difference, suggesting that the long-term efficacy of PFNA and InterTan in treating IFFs is close to the same. The Intertan nail with two integrated cephalocervical screws allows linear intraoperative compression and rotational stability for the head/neck fragment and this device is reported as a promising strategy in intertrochanteric fractures [32]. PFNA is introduced to avoid the limitation of extramedullary devices. The theoretical advantage lies in the high biomechanical efficiency, low soft tissue and vascular supply damage and inherent mechanical solidity of unstable fractures [33]. Secondly, we found that the PFNA remarkably reduced the intraoperative blood loss and operation time, as compared with InterTan, indicating that PFNA has less surgical risk than InterTan. The top of the PFNA nail is six radians, allowing the recipient nail to be placed more smoothly on the hip while
ensuring a supply of blood to the bone marrow. In addition, PFNA uses a spiral blade instead of screws to simplify the operation and reduce the time of fluoroscopy and surgery [5, 23, 24]. InterTan nails have trapezoidal proximal ends, making it more difficult to insert into the bone marrow cavity of osteoporosis. Repeated reduction and manipulation may result in longer operative and fluoroscopy times and more intraoperative blood loss [10, 34]. Thirdly, we found that there was no difference on cut length between PFNA and InterTan. Because both InterTAN and PFNA are minimally invasive, there is little effect on the local soft tissue of the fracture, so there is no significant difference in the length of the incision.

Some postoperative complications were reported in included studies, including deep vein thrombosis, nonunion, femoral head necrosis, hip varus, varus collapse of the head, secondary fracture and fixed loose or broken. We found that the PFNA displayed a higher incidence rate of postoperative complications than the InterTAN (OR = 2.22), responding an incidence of 11.4% versus 5.1%. The PFNA group appears to have more mechanical complications than InterTAN, such as implant failure, loosening, and breakage, indicating that in terms of postoperative complications, InterTAN is more advantageous than FNA. Some shortcomings was also been seen from those studies. Firstly, due to the difference on confounding factors, it will results in the possibility of heterogeneity. Secondly, some studies did not provide the data on types of IFFs, it leads to a lack on subgroup analysis. Thirdly, most of researches from the Asian, it will lead to a risk on regional bias.

Conclusions

InterTAN and PFNA had the same long-term efficacy (harris hip score and fracture healing time) in the treatment of IFFs. Although the operative time and intraoperative blood loss of PFNA were less than PFNA, the postoperative complication rate was higher than PFNA.
Abbreviations
CI, confidence interval; IFFs, intertrochanteric femoral fractures; OR, odds ratio; PFNA, proximal femoral nail antirotation; RCTs, randomized controlled trials; SMD, standardized mean difference.

Declarations

Ethics approval and consent to participate
Ethical approval is not required for this review.

Consent to publish
Not applicable.

Availability of data and materials
The datasets supporting the conclusions of this article are included within the article.

Competing interests
None.

Funding
Not applicable.

Authors’ contributions
R BX and L M participated in the design and coordination of the study, carried out the statistical analysis of studies and wrote the manuscript.

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Tables
| Study | N   | M/F   | Age (Years) | Causes of fracture (N) | Internal medicine diseases | End point |
|-------|-----|-------|-------------|------------------------|-----------------------------|-----------|
|       |     |       |             | Tumbling | Falling | Impact | Injury | Other | Diabetes | Hypertension | Heart Dysfunction | COPD |        |
| Zhan  | 113 | 42/71 | -           | 113      | 0       | 0      | 0      | -     | -        | -        | -         | 2③⑥     |
| g S  | 2013 |      |             |          |         |        |        |       |          |          |           |          |
| Jie R | 102 | 47/55 | 52-88       | -        | -       | -      | -      | -     | -        | -        | -         | 2③⑤     |
| 2013   |      |       |             |          |         |        |        |       |          |          |           |          |
| Hua   | 113 | 66/47 | 80-87       | -        | -       | -      | -      | -     | -        | -        | -         | 2③⑤     |
| C      | 2013 |      |             |          |         |        |        |       |          |          |           |          |
| Xiaod | 106 | 52/54 | 59-83       | -        | -       | -      | -      | -     | -        | -        | -         | 1②③     |
| ong Z | 2014 |      |             |          |         |        |        |       |          |          |           |          |
| Jinhui| 178 | 74/10 | 64-90       | 68       | 20      | 90     | 0      | -     | -        | -        | -         | 1②③     |
| Z      | 2015 |      |             |          |         |        |        |       |          |          |           |          |
| Fei Y | 102 | 59/43 | 65-91       | 61       | 9       | 32     | -      | 26    | 45       | 29       |           | ①②③     |
| 2015   |      |       |             |          |         |        |       |       |          |          |           |          |
| Chao  | 92  | 40/52 | 29-81       | 47       | 11      | 34     | 0      | -     | -        | -        | -         | 2③     |
| xuan  | L   | 2015 |            |          |         |        |        |       |          |          |           |          |
| L      |      |       |             |          |         |        |        |       |          |          |           |          |
| Guoq  | 120 | 58/62 | 56-78       | -        | -       | -      | -      | -     | -        | -        | -         | 2③⑤     |
| ing L | 2015 |      |             |          |         |        |        |       |          |          |           |          |
| Junjie| 86  | 59/27 | 57-85       | 55       | 22      | 9      | 0      | -     | -        | -        | -         | 1②③     |
| L      | 2016 |      |             |          |         |        |        |       |          |          |           |          |
| Ming  | 85  | 46/39 | 53-85       | 38       | 15      | 32     | 0      | -     | 73       |          |           | ①②③     |
| L      | 2016 |      |             |          |         |        |        |       |          |          |           |          |
| Weili | 90  | 49/41 | 60-80       | 41       | 28      | 13     | 6      | 13    | 7        | 19       | 14        | ①②③     |
| ang W | 2016 |      |             |          |         |        |        |       |          |          |           |          |
| Zhihu  | 172 | 111/6 | 70.05 ±6.5  | 149      | 5       | 18     | 0      | 65    | 77       | 19       | -         | ①②③     |
| a G   | 2016 |      |             |          |         |        |        |       |          |          |           |          |
| Year | Authors | N   | M/F  | Age  | Males | Females | OP Time | Blood Loss | Fracture Healing Time | Complications |
|------|---------|-----|------|------|-------|---------|---------|------------|----------------------|---------------|
| 2016 | Yu et al | 147 | 67/80| 65-92| 63    | 20      | 45      | 0          | 30                   | 36            | 25            | 2, 3, 5, 6 |
| 2016 | Wei et al | 128 | 58/70| 65-92| 63    | 20      | 45      | 0          | 30                   | 36            | 25            | 2, 3, 4, 5, 6 |
| 2016 | Shuai et al | 87  | 44/43| 21-96| -     | -       | -       | -          | -                    | -             | -             | 1, 2, 3, 5, 6 |
| 2017 | Chu et al | 97  | 38/59| -     | -     | -       | -       | -          | -                    | -             | -             | 1, 2, 3, 5, 6 |
| 2017 | Yong et al | 102 | 39/63| 75.3 ± 6.7 | -     | -       | -       | -          | 29                   | 37            | 42            | 1, 2, 3, 5, 6 |
| 2017 | Peng et al | 252 | 108/144| 60-86| -     | -       | -       | -          | 34                   | 124           | -             | 1, 2, 3, 5, 6 |
| 2017 | Jun et al | 113 | 45/68| 65-85| 65    | 11      | 14      | 23         | 47                   | 69            | 19            | 13, 5, 6 |

N = number of patients; M/F = male/female; COPD, chronic obstructive pulmonary diseases; ①=Harris Hip score; ②=Operation time; ③=Intraoperative blood loss; ④=Cut length; ⑤=Fracture healing time; ⑥=Postoperative complications.

Table 2. Raw data and methodological quality of included trials
| Studies          | Region  | Random sequence generation | Allocation concealment | Blind     | Outcome data |
|------------------|---------|-----------------------------|------------------------|-----------|--------------|
| Zhang S 2013[10]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Jie R 2013[11]  | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Hua C 2013[12]  | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Xiaodong Z 2014[13]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Jinhui Z 2015[14]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Fei Y 2015[15]  | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Chaoxuan L 2015[16]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Guoqing L 2015[17]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Junjie L 2016[18]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Ming L 2016[19] | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Weiliang W 2016[20]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Zhihua G 2016[21]| Single center | Yes                      | Sufficient            | Clear     | Yes          |
| Yu W 2016[22]   | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Wei L 2016[23]  | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Shuai A 2017[24]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Chunling G 2017[25]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Yongwei L 2017[26]| Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Peng L 2017[27] | Single center | Yes                      | Unclear                | Unclear   | Yes          |
| Jun Z 2017[28]  | Single center | Yes                      | Unclear                | Unclear   | Yes          |

ITT, intention-to-treat.

Table 3. Efficacy comparison between PFNA and InterTan System in treating intertrochanteric fractures
| Study          | Cases (N) | Extra medicine               | Interventions (N) | Harris score ± surgery |
|---------------|-----------|------------------------------|-------------------|------------------------|
|               | Group 1   | Group 2                      | Group 1           | Group 2                |
| Jie R 2013[11]| 50        | 52                           | PFNA              | InterTan               |
| Hua C 2013[12]| 58        | 55                           | Antibiotics; LMWH | PFNA                   |
| Xiaodong Z 2014[13]| 52    | 36                           | Antibiotics; LMWH | PFNA                   |
| Jinhui Z 2015[14]| 100  | 78                           | Antibiotics; LMWH | PFNA                   |
| Fei Y 2015[15]| 47        | 55                           | Antibiotics; LMWH | PFNA                   |
| Guoqing L 2015[17]| 60    | 60                           | Antibiotics; LMWH | PFNA                   |
| Junjie L 2016[18]| 43    | 43                           | Antibiotics; LMWH | PFNA                   |
| Ming L 2016[19]| 45        | 40                           | LMWH              | PFNA                   |
| Weiliang W 2016[20]| 45   | 45                           | Antibiotics; LMWH | PFNA                   |
| Zhihua G 2016[21]| 86    | 86                           | -                 | PFNA                   |
| Yu W 2016[22]| 72        | 75                           | -                 | PFNA                   |
| Wei L 2016[23]| 59        | 69                           | Antibiotics; LMWH | PFNA                   |
| Shuai A 2017[24]| 57    | 30                           | -                 | PFNA                   |
| Chunling G 2017[25]| 58   | 39                           | Antibiotics; LMWH | PFNA                   |
| Yongwei L 2017[26]| 48    | 54                           | Antibiotics; LMWH | PFNA                   |
| Peng L 2017[27]| 154       | 98                           | Antibiotics; LMWH | PFNA                   |
| Jun Z 2017[28]| 64        | 49                           | Antibiotics; LMWH | PFNA                   |

N=cases; LMWH, low-molecular-weight Heparins; PFNA, proximal femoral nail antirotation; Group 1, PFNA; Group 2, InterTan.
Table 4. Comparison of surgical condition and complications between PFNA and InterTan System in treating intertrochanteric fractures

| Study  | Study design (N) | Intraoperative blood loss (ml) | Cut length (cm) | Operation time (min) | Postoperative complications* |
|--------|------------------|--------------------------------|-----------------|----------------------|-----------------------------|
|        |                  |                                |                 |                      | Group 1 (N) | Group 2 (N) |
| Zh     |                  |                                |                 |                      |              |             |
| an     |                  |                                |                 |                      |              |             |
| S      | 2013[10]         | 56 57                          | 197.56±101.8    | 235.36±124.6         | -            | -            | 9 16       | 10 17 |
| jie    |                  |                                |                 |                      |              |             |
| R      | 2013[11]         | 50 52                          | 90.12±14.75     | 104.98±28.76         | -            | -            | 72 78      | 5 10 0 |
| Hu     |                  |                                |                 |                      |              |             |
| a      | 2013[12]         | 58 55                          | 120.9±20.8      | 364±70.3             | -            | -            | 60 65      | 1 1.7 1.8 |
| Xiao   |                  |                                |                 |                      |              |             |
| do     | 2014[13]         | 52 36                          | 111.92±29.67    | 129.3±38.08          | -            | -            | 47 65      | 1 1.9 0 |
| Fei    |                  |                                |                 |                      |              |             |
| Y      | 2015[14]         | 47 55                          | 132±60.88       | 172±60.06            | -            | -            | 47 ±4      | 4.2 1.8 |
| Name          | Age | Gender | Weight | Height | Waist | Hip | Skin Color | BMI | Waist:Hip | Notes |
|---------------|-----|--------|--------|--------|-------|-----|------------|-----|----------|-------|
| Chao Xu       | 54  | M      | 198.3±49.5 | 142.9±31.5 | 66    | 85  | -          | 2   | 3.7      | 1 2.6 |
| Guoqing Lu    | 60  | F      | 227.8±94.6  | 172.8±63.2  | 90    | 96  | -          | -   | -        | -    |
| Junjie Li     | 43  | M      | 128.5±21.4  | 169.8±25.6  | 53    | 85  | -          | .7  | .1       | -    |
| Ming Li       | 45  | M      | 98.73±24.24 | 103.44±30.05 | 44    | 71  | 4          | 8.9 | 2        | 5    |
| Weiling W     | 45  | F      | 164.4±39.2  | 244.8±45.5  | 11    | 12  | 62         | 85  | 2        | 4.4  |
| Zhuhua G      | 86  | M      | 105.2±37    | 233.8±42.9  | 5     | 7   | 10         | 15  | 6        | 6.9  |
| Yu W          | 72  | M      | 180.9±10.8  | 190.6±6.0   | -     | -   | 52         | 71  | 20       | 27   |
PFNA, proximal femoral nail antirotation; Group 1, PFNA; Group 2, InterTan; Postoperative complications*; Here, we calculated the sum of the various complications, including deep vein thrombosis, nonunion, femoral head necrosis, hip varus, varus collapse of the head,
secondary fracture and fixed loose or broken.

**Figures**

**Figure 1**

Selection and assessment of literature. (A) Studies were retrieved from the electronic bibliographic databases such as PubMed, Embase, Cochrane Library and CNKI database. (B, C) According to the criteria made by the Cochrane Handbook (Version 5.0.1), these studies had moderate to higher quality.
Figure 2

Long-term efficacy comparison of PFNA and InterTan devices in treating IFFs. (A) There was no difference in the Harris hip score at the last follow-on between PFNA and InterTan postoperatively. (B) The fracture healing time did not have a significant difference between PFNA and InterTan for treating IFFs. PFNA, proximal femoral nail antirotation; IFFs, intertrochanteric femoral fractures; SMD, standardized mean difference.
Comparison of intraoperative blood loss between PFNA and InterTan devices in treating IFFs. The intraoperative blood loss of PFNA operation was remarkably more than InterTan operation. PFNA, proximal femoral nail antirotation; IFFs, intertrochanteric femoral fractures; SMD, standardized mean difference.
Figure 4

Comparison of cut length and operation time between PFNA and InterTan devices in treating IFFs. (A) The cut length did not show a difference between PFNA and InterTan devices. (B) The time spent of PFNA operation was significantly less than the InterTan operation. PFNA, proximal femoral nail antitrotation; IFFs, intertrochanteric femoral fractures; SMD, standardized mean difference.
Comparison of postoperative complications between PFNA and InterTan devices in treating IFFs and sensitivity analysis of included studies. (A) The incidence of postoperative complications in PFNA group was significantly higher than that in
InterTan group. (B) Omitting any trial did not shake the pooled effect of meta-analysis. PFNA, proximal femoral nail antirotation; IFFs, intertrochanteric femoral fractures; OR, odds ratio.
Publication bias analysis. (A) Egger’s test showed that $P$ value was 0.349, suggesting included trials did not have a potential impact on the pooled effect of present meta-analysis. (B) Begg's test showed that $P$ was 0.421, and the funnel plot seems to be nearly symmetrical.