Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Orthopaedics

Comparison of PFNA vs Hip Arthroplasty in Patients with Intertrochanteric Fractures

Arslan Arshad, MS[1], Muhammad Asif Saeed, FCPS[2], Muhammad Hammad Abbas, FCPS[2], Sawaira Parvaiz, MBBS[2], Asihaerjiang Maimaitiyiming, MD[1], Li Cao, MD, FRCS[1*]

[1]Department of Orthopaedics, First Affiliated Hospital of Xinjiang Medical University, 137 South LiYuShan Road, Urumqi, Xinjiang 830054, China
[2]Department of Orthopaedics Surgery, Imran Idrees Teaching Hospital of Sialkot Medical College, Sialkot, Punjab, Pakistan

DOI: 10.36347/sjams.2024.v12i04.027 | **Received:** 18.03.2024 | **Accepted:** 25.04.2024 | **Published:** 29.04.2024

***Corresponding author:** Li Cao, MD, FRCS
Department of Orthopaedics, First Affiliated Hospital of Xinjiang Medical University, 137 South LiYuShan Road, Urumqi, Xinjiang 830054, China

Abstract **Original Research Article**

Aims: Intertrochanteric fractures are common types of hip fractures in the elderly population. Different types of surgical treatment options are available for intertrochanteric fractures such as Closed Reduction and Inter Fixation with Proximal Femoral Nail Anti-rotation (PFNA), Open Reduction and internal fixation with Dynamic Hip Screw (DHS), and Hip Arthroplasty. The main purpose of this study is to compare the clinical outcomes of PFNA with Hip arthroplasty in patients with Intertrochanteric Fractures. ***Materials and Methods:*** A retrospective cohort study method was used in the current study. The medical record of 101 patients with intertrochanteric fractures was collected. These 101 patients were divided into two groups according to the type of surgical treatment they received, PFNA (n=52) or THA (n=49). The outcome of Hip function was assessed according to the Harris Hip Score (HHS). A simple t-test was performed for statistical analysis. $\chi 2$ test used for the analysis of categorical data. P-values <0.05 was considered as significant. ***Results:*** Hip Arthroplasty patients had longer surgery duration, length of incision was longer and intraoperative blood loss was more than in those patients who were treated with PFNA (P <0.05). Hip arthroplasty patients could start early weight bearing than those in the PFNA group (P <0.05). There was no any statistical difference between hospital stays in both groups (P >0.05). HHS assessed at those 3 points showed that Hip function in Hip Arthroplasty patients was higher than with those who were treated with PFNA (P <0.05). There was no statistically significant difference between the post-operative complication of both groups, as the P value is >0.05. ***Conclusion:*** we concluded that treatment of intertrochanteric fracture with PFNA and Hip Arthroplasty is safe and effective. Each treatment has its advantages and disadvantages but with no significant difference in postoperative complications. Orthopaedic surgeons can choose the type of treatment according to the quality of the bone condition of the Hip Joint.

Keywords: Intertrochanteric Fracture, Closed Reduction and Internal Fixation (CRIF), Proximal Femoral Nail Anti-rotation (PFNA), Hip Arthroplasty (HA), Harris Hip Score (HHS).

INTRODUCTION

Intertrochanteric fractures are one of the most common hip fractures in elderly patients [1]. The incidence of Intertrochanteric fracture is increasing with the increased expected age of the elderly population [2]. Different types of treatments have been suggested for intertrochanteric fracture. Conservative treatment by applying a de-rotational boot has also been used in the past. However, due to poor clinical outcomes and a higher rate of complications such as the development of deep venous thrombosis (DVT), pneumonia, bed sores, etc., it is not recommended anymore [3, 4]. To prevent patients from long-term bedridden complications, early surgical intervention has been recommended for intertrochanteric fractures [5]. Different surgical treatment options have been suggested previously. The most commonly used surgical treatments are Proximal Femoral Nail anti-rotation (PFNA), Dynamic Hip Screw (DHS) and Hip Arthroplasty (Total Hip Arthroplasty and Hemi-arthroplasty). The selection of the type of surgical treatment is still mainly dependent on the Surgeon's choice. These surgical treatments have their advantages and disadvantages, so which type of surgical treatment should be used is still controversial [6-8]. Recently, some studies suggested that PFNA is the most favorable surgical treatment option for the treatment of intertrochanteric fractures [9-12]. PFNA has several advantages as it has a shorter surgery duration, less blood

loss, lower rate of fixation failure, and early mobilization after surgery [12, 13]. Some studies have suggested that Hip Arthroplasty has also proven to be an effective method of surgical treatment of intertrochanteric fractures, as it has a lower rate of complications [14, 15]. Hip Arthroplasty in these patients can help the patients to start early weight bearing and can prevent them from complications related with an implant [17]. The main purpose of this study is to compare the clinica7l outcomes of PFNA with Hip Arthroplasty in patients with intertrochanteric fracture.

MATERIALS AND METHODS

The Medical record of patients was collected retrospectively from January 2020 to December 2022. A retrospective cohort method was used in this study. Initially, 140 patients with intertrochanteric fractures were included in this study. Then patients were sorted according to inclusion and exclusion criteria.

The Inclusion Criteria Used Were:

1. Patients with Intertrochanteric Fracture due to high energy trauma or history of falls.
2. Patients who fall in Evans-Jensen classification 3 or above
3. Patients who were treated Surgically.
4. Patients with intact skin surface

The Exclusion Criteria Used Were:

1. Patients with pathological fractures.
2. Patients with incomplete medical records.
3. Patients who had open wound fractures.

Finally, 101 patients were included in this study. Out of these 101 patients, 52 were treated by Closed Reduction and Internal Fixation (CRIF) with PFNA and 49 were treated by Hip Arthroplasty. Demographic Characteristics of patients are given in Table 1.

Table 1: Demographic Characteristics of Patients

Characteristics	**Hip Arthroplasty**	**PFNA**
Demographics:		
Number of patients, n	49	52
Age, mean± SD	65.84 ± 3.88	65.51 ± 4.30
Male: Female	22:27	28:24
Smoker, n (%)	5 (10.20%)	7 (13.46%)
Alcohol intake, n (%)	3 (6.12%)	2 (3.85%)
BMI, Kg/m^2 (range)	22.67(18-34)	23.84 (19-36)
Comorbidities:		
Diabetes, n (%)	7 (14.29%)	8 (15.38%)
Hypertension, n (%)	6 (12.25%)	9 (17.31%)
Rheumatoid Arthritis, n (%)	0 (0%)	2 (3.85%)
Cardiovascular Disease, n (%)	4 (8.16%)	6 (11.54%)
Other diseases	10 (20.41%)	4 (7.69%)
Type of fracture according to Evans-Jensen classification:		
3, n (%)	10 (20.41%)	17 (32.69%)
4, n (%)	17 (34.69%)	23 (44.23%)
5, n (%)	22 (44.9%)	12 (23.1%)
	Type of Hip Arthroplasty:	
	BHA: 35 (71.43%)	
	THA: 14 (28.57%)	

n = number, SD = Standard Deviation, BMI = Body Mass Index, BHA = Bipolar Hemiarthroplasty, THA = Total Hip Arthroplasty

Surgical Methods and Post-operative Care: All the surgeries were performed by experienced professors in our departments. The type of surgery was decided according to the Professor's choice. All the surgeries were performed under spinal anesthesia. Prophylactic antibiotics were administered 30 minutes before surgery.

Hip Arthroplasty: Two types of Hip Arthroplasties, Bipolar Hemiarthroplasty (BHA) and Total Hip Arthroplasty (THA) were used in this study.

Bipolar Hemiarthroplasty (BHA): 35 out of 49 patients, who were treated by hip arthroplasty, had uncemented Bipolar Hemiarthroplasty (BHA). Under spinal anesthesia, the patient was lying in a lateral decubitus position. The Hardinge approach (lateral approach of the hip joint) was used to approach the fracture area. The joint capsule was incised in a T shape. The femoral head was removed and the size of the femoral head was measured. Osteotomy of the Femoral neck was performed and the femoral canal was prepared for placement of Prosthesis. The femoral stem was inserted and the anteversion angle was maintained

around 20°. Fragments of the Greater trochanter were reduced and fixed by the application of a claw plate and cables (Fig. 1). The Hip joint was reduced and stability of the hip joint was assessed by checking the range of motion of the hip joint. The wound was washed, the capsule closed, muscles approximated by applying sutures, the skin closed layer by layer, and an aseptic dressing was applied.

Total Hip Arthroplasty (THA): 14 out of 49 patients in the Hip Arthroplasty group were surgically treated by Total Hip Arthroplasty. Under spinal anesthesia, the patient was lying in a lateral decubitus position. Moore/southern approach (Posterior approach of the hip joint) was used to expose the fracture area and acetabulum. The joint capsule was incised in the T-manner, the femoral head was removed, and an osteotomy of the femoral neck was done. Acetabulum was prepared, the acetabulum cup was placed and fixed with or without screws and a liner was applied. Femoral canal prepared, uncemented stem inserted and fractures parts of greater trochanter reduced and fixed by the application of cables alone or with claw plate. Hip reduction and stability of the hip joint were assessed by checking the range of motion. Wound washed, capsule sutured. Muscles approximated by application of sutures. Deep fascia-lata was sutured, the skin closed layer by layer, and an aseptic dressing was applied.

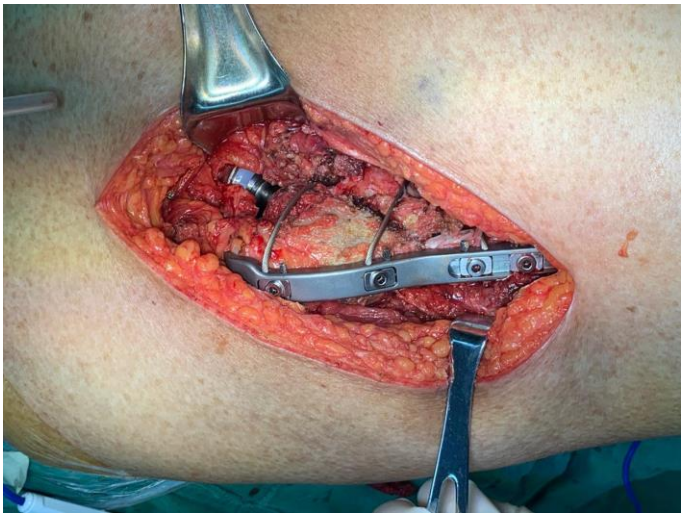

Fig. 1: Bipolar Hemiarthroplasty with claw plate and cables for Intertrochanteric fracture

Proximal Femoral Nail Anti-rotation (PFNA): Under spinal anesthesia, the patient lying in the supine position on the traction table, traction was applied and the fracture was reduced under image intensifier (C-arm) guidance. A small incision of 4 to 5 cm was given above the level of the greater trochanter. An entry was made using an awl medial to greater trochanter, at the level of piriformis sinus. A guide wire passed through the entry hole under the image intensifier. Guidewire position was confirmed by using an image intensifier, whether it was inside the femoral canal or not. Expansion of the femoral canal was done by rimming. A standard PFNA, with a width matching to femoral canal, was inserted and the guide wire was removed. The proximal end of PFNA was kept at the level of the tip of the greater trochanter. A guide wire for the femoral neck was inserted to 5 cm below the femoral head. The Collum-blade inserted, 5 to 10 mm below the level of the subchondral part of the femoral head. PFNA was distally locked by a Locking bolt. Wounds washed skin closed and aseptic dressing applied.

Post-operative Care: Second-generation cephalosporin Antibiotics were given. Wounds were regularly checked and dressing was changed daily. Bedside physiotherapy was done by the physiotherapy department of our hospital.

Data related to the length of incision, blood loss during surgery, mobilization time, and weight-bearing starting time were collected from the medical record of the patient. The hip function was assessed using the Harris Hip score at three checkpoints (3 months, 6 months, and 1 year after surgery) 17]. Harris Hip score between 90 to 100 was considered as excellent hip function, between 80 to 89 was considered as good hip function, between 70 to 79 was considered as medium hip function, and below 70 was considered as poor hip function.

Statistical Analysis: The SPSS 22.0 version was used for statistical analysis. A simple t-test was used for performing statistical analysis. $\chi 2$ test used for the analysis of categorical data. P-value <0.05 was considered as significant.

RESULTS

Initially, 140 patients with intertrochanteric fractures were included in this study. 39 out of 140

patients were excluded due to incomplete data, pathological fracture, and patients who had polytrauma or open wound fracture. Finally, 101 patients with intertrochanteric fractures were included in this study, which were then divided into two groups, based on the method of surgical treatment they underwent. 52 patients were included in the PFNA treatment group and 49 patients were included in the Hip Arthroplasty group. Demographic characteristics of these patients are given in Table 1.

Comparison of Hospitalization and Perioperative Conditions:

Hip Arthroplasty patients had longer surgery duration, length of incision was longer and intraoperative blood loss was more than in those patients who were treated with PFNA (P <0.05). Hip arthroplasty patients could start early weight bearing than those with the PFNA group (P <0.05). There was no any statistical difference between hospital stays in both groups (P >0.05). A comparison of these characteristics is given in Table 2.

Table 2: Comparison of Hospitalization and perioperative conditions

Characteristics	Hip Arthroplasty (mean±SD)	PFNA (mean±SD)	P-value
Surgery time (min)	125.67 ± 33.49	94.38 ± 20.94	< 0.001
Incision Length (cm)	10.49±1.60	4.47±1.69	<0.001
Blood Loss (ml)	224.95±32.85	140.61±19.26	<0.001
Weight bearing time (days)	12.14±1.76	22.06±3.12	<0.001
Hospital stay (days)	16.63 ± 3.64	17.13 ± 2.92	0.548

cm= centimeter, ml= milliliter, PFNA= Proximal Femoral Nail anti-rotation, SD= Standard Deviation

Comparison of functional outcome of Hip Arthroplasty vs PFNA:

Functional outcomes of both groups were assessed by checking the Harris Hip score (HHS) at the points, 3 months, 6 months, and one year (Table 3). HHS assessed at those 3 points showed that Hip function in Hip Arthroplasty patients was higher than with those who were treated with PFNA (P <0.05).

Table 3: Comparison of functional outcome (Harris-Hip Score) of Hip Arthroplasty vs PFNA

Follow-up	Hip Arthroplasty (mean±SD)	PFNA (mean±SD)	P-value
3 months	73.20 ± 6.56	68.91 ± 8.15	0.027
6 months	79.27±6.01	60.67±5.25	<0.001
1 year	84.95±5.99	65.31±5.64	<0.001

PFNA= Proximal Femoral Nail anti-rotation, SD= Standard Deviation

Post-operative Complications:

Infection, Deep Venous Thrombosis (DVT), Bed sores, and cutouts were the main post-operative complications that were observed in both groups (Table 4). There was no any statistically significant difference between the postoperative complications of both groups, as the P value is >0.05.

Table 4: Post-operative complications of Hip Arthroplasty and PFNA [n (%)]

Complication	Hip Arthroplasty (n = 49)	PFNA (n = 52)	$\chi 2$	P-value
Infection	2(4.08)	3(5.76)		
DVT	0(0.00)	1(1.92)		
Bed sores	1(2.04)	2(3.85)		
Cutout	0(0.00)	3(5.76)		
Total Incidence	3(6.12)	9(17.31)	2.04	0.563

n= number of patients, DVT= Deep venous thrombosis, PFNA= Proximal Femoral Nail anti-rotation

DISCUSSION

The findings of the current study, which compared the outcomes and postoperative complications of PFNA with Hip Arthroplasty for intertrochanteric fractures, suggested that both treatment types have their advantages and disadvantages. Intertrochanteric fracture fixation by PFNA brought less trauma to patients, as the length of the incision was short, there was less loss of blood, and the duration of surgery was short. However, Hip Arthroplasty enabled the patients to start early mobilization and early weight bearing. Patients with Hip Arthroplasty had better hip functions as compared to PFNA. There was no significant difference between post-operative complications of both treatment types.

As the expected age of the elderly population is increasing, the number of patients with intertrochanteric fractures is also increasing. Patients with these fractures show poor treatment outcomes and are not able to return to pre-trauma status, because bone quality in these patients is poor, which leads to other morbidities and poor mobilization outcomes [18]. Multiple surgical treatment options have been proposed for this kind of fracture. The best surgical treatment option should bring less trauma to the patient and fewer complications associated with that treatment [20]. Until now, it's not clear which treatment option is best for intertrochanteric fractures, and most of the time it is according to the Surgeon's choice.

Previous studies suggested that treatment of intertrochanteric fractures with PFNA has significant advantages, as PFNA is a minimally invasive procedure, with less blood loss and shorter surgery time [21]. Fixation of fracture with PFNA increases the fracture stability through anti-rotation and anti-compression mechanisms [22]. In one study, Shin Yoon Kim et al., [23] compared long-stem uncemented hemiarthroplasty with PFNA for intertrochanteric fractures. They concluded that those patients who were treated with PFNA required a smaller number of units of blood transfusion as there was less blood loss and the duration of surgery was short. Some studies suggested that PFNA surgery is simple and the clinical outcomes of this surgery are remarkable [24]. Although, PFNA has been a preferred choice for intertrochanteric fractures by many surgeons due to its multiple advantages [25, 26], but still some shortcoming exists. If fracture is not well reduced before starting surgery then there are higher chances of separation of fractured parts. In patients with severely comminuted intertrochanteric fracture, fixation with PFNA is less effective as chances of loosening of screw and cutting are higher [27-29]. Results of our studies also showed that 3(5.76%) patients who were treated with PFNA had cutouts of the helical blade, which later on required removal of PFNA and Total Hip Arthroplasty needed to be done.

Hip Arthroplasty has been used as an alternative method for intertrochanteric fractures in elderly patients [30]. Patients with severely osteoporotic bones and in which fixation with PFNA will lead to poor prognosis are highly recommended for Hip Arthroplasty [30]. Hip Arthroplasty can help the patient to get early mobilization and make the patient start early weight bearing when compared to PFNA. Results of our studies showed that patients with Hip Arthroplasty were able to start early weight bearing with meantime (Days) of 12.14±1.76 (mean±SD), compared to those patients who were treated with PFNA, meantime (Days) of 22.06±3.12 (mean±SD). Though, Hip Arthroplasty has multiple advantages in Intertrochanteric fracture still some Disadvantages exist, such as long incision length, long surgery duration, and more blood, as compared to PFNA.

Restoration of hip function is an important factor that is considered in the treatment of intertrochanteric fractures. In our study, hip function was assessed at three different points, 3 months, 6 months, and 12 months. Harris-Hip score (HHS) was higher in the Hip Arthroplasty group as compared to the PFNA group. The mean values (mean±SD) of HHS at 3 months, 6 months, and 1 year for Hip Arthroplasty patients were 73.20 ± 6.56, 79.27±6.01 and 84.95±5.99 respectively. The mean values (mean±SD) of HHS at 3 months, 6 months, and 1 year for PFNA patients were 68.91 ± 8.15, 60.67±5.25 and 65.31±5.64 respectively. It remained statistically significant at all three checkpoints, as the P value remained <0.05. There was no any significant difference between post-operative complications of Hip Arthroplasty and PFNA, as the P-value was >0.05.

There were few limitations in the current study. Firstly, it's a retrospective study, with a small sample size. Furthermore, selection bias was inevitable as baseline characteristics were similar. Lastly, shorter follow-up times may affect long-term follow-up outcomes of these treatments. Further multicenter prospective studies with large sample sizes are required to make some final decisions that which treatment option is more appropriate for intertrochanteric fractures.

CONCLUSION

From the results of our studies, we concluded that treatment of intertrochanteric fracture with PFNA and Hip Arthroplasty is safe and effective. Each treatment has its advantages and disadvantages but with no significant difference in postoperative complications. Orthopaedic surgeons can choose the type of treatment according to the quality of the bone condition of the Hip Joint.

REFERENCES

1. Tucker, A., Donnelly, K. J., Rowan, C., McDonald, S., & Foster, A. P. (2018). Is the best plate a nail? A review of 3230 unstable intertrochanteric fractures of the proximal femur. *Journal of Orthopaedic Trauma*, *32*(2), 53-60.
2. Hiragami, K., & Ishii, J. (2018). Embedding the lateral end of the lag screw within the lateral wall in the repair of reverse obliquity intertrochanteric femur fracture. *Journal of International Medical Research*, *46*(3), 1103-1108.
3. Yoo, J. I., Ha, Y. C., Lim, J. Y., Kang, H., Yoon, B. H., & Kim, H. (2017). Early rehabilitation in elderly after arthroplasty versus internal fixation for unstable intertrochanteric fractures of femur: systematic review and meta-analysis. *Journal of Korean medical science*, *32*(5), 858.
4. Shin, K. H., Hong, S. H., & Han, S. B. (2020). Posterior fully threaded positioning screw prevents

femoral neck collapse in Garden I or II femoral neck fractures. *Injury*, *51*(4), 1031-1037.

5. Yu, J., Zhang, C., Li, L., Kwong, J. S., Xue, L., Zeng, X., ... & Sun, X. (2015). Internal fixation treatments for intertrochanteric fracture: a systematic review and meta-analysis of randomized evidence. *Scientific reports*, *5*(1), 18195.
6. Park-Wyllie, L. Y., Mamdani, M. M., Juurlink, D. N., Hawker, G. A., Gunraj, N., Austin, P. C., ... & Laupacis, A. (2011). Bisphosphonate use and the risk of subtrochanteric or femoral shaft fractures in older women. *Jama*, *305*(8), 783-789.
7. Min, B. W., Lee, K. J., Oh, J. K., Cho, C. H., Cho, J. W., & Kim, B. S. (2019). The treatment strategies for failed fixation of intertrochanteric fractures. *Injury*, *50*(7), 1339-1346.
8. Parker, M. J., & Cawley, S. (2017). Sliding hip screw versus the Targon PFT nail for trochanteric hip fractures: a randomised trial of 400 patients. *The Bone & Joint Journal*, *99*(9), 1210-1215.
9. Liu, Y., Tao, R., Liu, F., Wang, Y., Zhou, Z., Cao, Y., & Wang, H. (2010). Mid-term outcomes after intramedullary fixation of peritrochanteric femoral fractures using the new proximal femoral nail antirotation (PFNA). *Injury*, *41*(8), 810-817.
10. Sadic, S., Custovic, S., Jasarevic, M., Fazlic, M., Smajic, N., Hrustic, A., ... & Krupic, F. (2014). Proximal femoral nail antirotation in treatment of fractures of proximal femur. *Medical archives*, *68*(3), 173.
11. Li, M., Wu, L., Liu, Y., & Wang, C. (2014). Clinical evaluation of the Asian proximal femur intramedullary nail antirotation system (PFNA-II) for treatment of intertrochanteric fractures. *Journal of orthopaedic surgery and research*, *9*, 1-8.
12. Gardenbroek, T. J., Segers, M. J., Simmermacher, R. K., & Hammacher, E. R. (2011). The proximal femur nail antirotation: an identifiable improvement in the treatment of unstable pertrochanteric fractures?. *Journal of Trauma and Acute Care Surgery*, *71*(1), 169-174.
13. Shen, L., Zhang, Y., Shen, Y., & Cui, Z. (2013). Antirotation proximal femoral nail versus dynamic hip screw for intertrochanteric fractures: a meta-analysis of randomized controlled studies. *Orthopaedics & Traumatology: Surgery & Research*, *99*(4), 377-383.
14. Ma, K. L., Wang, X., Luan, F. J., Xu, H. T., Fang, Y., Min, J., ... & He, S. J. (2014). Proximal femoral nails antirotation, Gamma nails, and dynamic hip screws for fixation of intertrochanteric fractures of femur: a meta-analysis. *Orthopaedics & Traumatology: Surgery & Research*, *100*(8), 859-866.
15. Enocson, A., Mattisson, L., Ottosson, C., & Lapidus, L. J. (2012). Hip arthroplasty after failed fixation of trochanteric and subtrochanteric fractures: a cohort study with 5–11 year follow-up of 88 consecutive patients. *Acta Orthopaedica*, *83*(5), 493-498.
16. D'Arrigo, C., Perugia, D., Carcangiu, A., Monaco, E., Speranza, A., & Ferretti, A. (2010). Hip arthroplasty for failed treatment of proximal femoral fractures. *International orthopaedics*, *34*, 939-942.
17. Fichman, S. G., Mäkinen, T. J., Safir, O., Vincent, A., Lozano, B., Kashigar, A., & Kuzyk, P. R. (2016). Arthroplasty for unstable pertrochanteric hip fractures may offer a lower re-operation rate as compared to cephalomedullary nailing. *International orthopaedics*, *40*, 15-20.
18. Harris, W. H. (1969). Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty: an end-result study using a new method of result evaluation. *JBJS*, *51*(4), 737-755.
19. Müller, F., Doblinger, M., Kottmann, T., & Füchtmeier, B. (2020). PFNA and DHS for AO/OTA 31-A2 fractures: radiographic measurements, morbidity and mortality. *European Journal of Trauma and Emergency Surgery*, *46*, 947-953.
20. Ong, J. C., Gill, J. R., & Parker, M. J. (2019). Mobility after intertrochanteric hip fracture fixation with either a sliding hip screw or a cephalomedullary nail: sub group analysis of a randomised trial of 1000 patients. *Injury*, *50*(10), 1709-1714.
21. Wang, H. H., Shu, W. B., Lan, G. H., Zhang, X. B., Jiang, Z. Q., Xu, D. H., ... & Li, A. B. (2018). Network meta-analysis of surgical treatment for unstable femoral intertrochanteric fractures. *Oncotarget*, *9*(35), 24168.
22. Li, J., Cheng, L., & Jing, J. (2015). The Asia proximal femoral nail antirotation versus the standard proximal femoral antirotation nail for unstable intertrochanteric fractures in elderly Chinese patients. *Orthopaedics & Traumatology: Surgery & Research*, *101*(2), 143-146.
23. Kim, S. Y., Kim, Y. G., & Hwang, J. K. (2005). Cementless calcar-replacement hemiarthroplasty compared with intramedullary fixation of unstable intertrochanteric fractures: a prospective, randomized study. *JBJS*, *87*(10), 2186-2192.
24. Wild, M., Jungbluth, P., Thelen, S., Laffrée, Q., Gehrmann, S., Betsch, M., ... & Hakimi, M. (2010). The dynamics of proximal femoral nails: a clinical comparison between PFNA and Targon PF. *Orthopedics*, *33*(8).
25. Dehghan, N., & McKee, M. D. (2018). What's new in orthopaedic trauma. *JBJS*, *100*(13), 1158-1164.
26. Maroun, G., Chaftari, R., Chokr, J., Maroun, C., El-Jerdi, M., & Saade, C. (2019). High comorbidity index is not associated with high morbidity and mortality when employing constrained arthroplasty as a primary treatment for intertrochanteric fractures in elderly patients. *European Journal of Orthopaedic Surgery & Traumatology*, *29*, 1009-1015.
27. Socci, A. R., Casemyr, N. E., Leslie, M. P., & Baumgaertner, M. R. (2017). Implant options for the treatment of intertrochanteric fractures of the hip:

rationale, evidence, and recommendations. *The bone & joint journal*, *99*(1), 128-133.

28. Huang, S. G., Chen, B., Zhang, Y., Nie, F. F., Ju, L., Li, M., & Zhang, Y. H. (2017). Comparison of the clinical effectiveness of PFNA, PFLCP, and DHS in treatment of unstable intertrochanteric femoral fracture. *American Journal of Therapeutics*, *24*(6), e659-e666.
29. Jia, L., Zhang, K., Wang, Z. G., Wang, L., Yang, S. Y., & Zheng, Y. P. (2017). Proximal femoral nail antirotation internal fixation in treating intertrochanteric femoral fractures of elderly subjects. *Journal of biological regulators and homeostatic agents*, *31*(2), 329-334.
30. Fahad, S., Khan, M. Z. N., Khattak, M. J., Umer, M., & Hashmi, P. (2019). Primary Proximal femur replacement for unstable osteoporotic intertrochanteric and subtrochanteric fractures in the elderly: A retrospective case series. *Annals of medicine and surgery*, *44*, 94-97.
31. Haentjens, P., & Lamraski, G. (2005). Endoprosthetic replacement of unstable, comminuted intertrochanteric fracture of the femur in the elderly, osteoporotic patient: a review. *Disability and Rehabilitation*, *27*(18-19), 1167-1180.