Intramedullary Nailing versus Dynamic Screw and Plate for Treatment of Trochanteric Fractures of the Femur

Ahmed Mohamed Morsi[1], MD; Mohammed Mohammed Hafez Eltawila[2], MBBCh and Zakaria Hassan Ibrahim Abuelghait[3], MD

Orthopedic Surgery Department, Faculty of Medicine, Ain Shams University

1- Ass. Professor of Orthopedic Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt
2- Resident of Orthopedic Surgery, Police Hospital, Cairo, Egypt
3- Lecturer of Orthopedic Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Corresponding author: Mohammed Mohammed Hafez Eltawila, MBBCh
Email: mohamedhafez.Prp@gmail. com;
Phone: 01061030316

The Egyptian Orthopedic Journal; 2022 supplement, December, 57: 22-30

ABSTRACT

Background:
Extracapsular fractures of the proximal femur at the level of the greater and lesser trochanters are known as trochanteric and intertrochanteric femur fractures. Trochanteric fractures primarily impact older individuals in the adult population. The frequency of osteoporosis is rising as the population ages, despite advancements in therapy. Intramedullary nailing and screw-plate fixation are the two most commonly employed methods of internal fixation. These procedures are routinely carried out by trainee surgeons because of their high occurrence and perceived ease.

Patients and Methods:
In this investigation, we adhered to the standards outlined in the PRISMA statement and conducted all necessary procedures following the Cochrane Handbook of Systematic Reviews of Intervention. In June 2021, we conducted a comprehensive search on various databases including PubMed, Scopus, Cochrane, Web of Science, Embase, and Science Direct. We used relevant keywords to refine our search. In July 2021, we updated the search using the same methodology. The studies were included based on the following eligibility inclusion criteria: (1) Patients who are 18 years of age or older. (2) Designs that involve the use of two arms. (3) The study designs are restricted to randomized control trials (RCTs). (4) Only studies conducted in English are included. (5) Any outcome is considered acceptable. The Cochrane Handbook of Systematic Reviews of Interventions 5.1.0 was used to assess the potential for bias. Concerning the extraction of data, we acquired information from several sources including text, tables, figures (utilizing Graph Grabber version 2.0), and supplementary data. We performed this meta-analysis utilizing Review Manager software (RevMan version 5.4).

Results:
Compared to the control group (Dynamic hip screw and plate technique), Intramedullary nailing (IMN) showed a significant improvement in length of operation time(MD = -9.27; 95% CI: [-18.07, -0.47]; P = 0.04) and perioperative blood loss(MD = -120; 95% CI: [-164.05, -77.89]; P < 0.00001) than dynamic hip screw with plate fixation technique. However, in the term of intraoperative radiation exposure time (Fluoroscopy time), dynamic hip screw (DHS) with plate fixation showed a significantly lesser fluoroscopy time than IMN(MD = 0.61; 95% CI: [0.23, 0.99]; P = 0.002). Regarding the postoperative patient satisfaction (assessed by visual analog scale), postoperative Fracture non-union, perioperative wound infection, femur shaft fracture, and hip prosthetic instability, they showed no significant difference between IMN and dynamic hip screw with plate fixation. The reoperation rate also showed no significant difference between IMN and DHS with plate fixation. Based on qualitative evidence and the results of some high-quality studies intramedullary nailing is an acceptable treatment option for trochanteric fractures in old osteoporotic patients favoring the IMN technique over DHS.

Conclusion:
The use of DHS with a plate is not recommended as the primary implant for trochanteric femur fractures, especially in cases of osteoporotic trochanteric fractures. IMN had superior performance compared to DHS. In our view, the IMN is biologically preferable to DHS for the fixing of trochanteric fractures. This is because it offers stable intramedullary fixation that is resistant to varus collapse and fixation failure. Additionally, the IMN requires less operation time and results in less blood loss compared to DHS.

Keywords:
Intramedullary Nailing, Dynamic Screw, Trochanteric Fractures, Femur

INTRODUCTION

The incidence of trochanteric fracture varies according to ethnicity and gender and also differs among countries. The annual incidence of intertrochanteric fractures in the United States is 34 per 100,000 in males and 63 per 100,000 in women. [(1)] Factors identified as being linked to a patient with a trochanteric fracture include a higher prevalence of

comorbidities, older age, previous osteoporosis fractures, and increased reliance on assistance for everyday tasks. [2] Trochanteric fractures in young individuals typically occur due to high-impact incidents, such as car accidents or falls from significant heights. The majority (90%) of trochanteric fractures in elderly individuals are caused by a straightforward fall. The propensity to experience falls escalates with advancing age and other factors, including reduced muscular strength, impaired vision, fluctuating blood pressure, concurrent musculoskeletal disorders, limited reflexes, and vascular The propensity to experience falls escalates with advancing age and other factors, including reduced muscular strength, impaired vision, fluctuating blood pressure, concurrent musculoskeletal disorders, limited reflexes, and vascular disorders. [3]

While research indicates that falls have the potential to cause fractures, only a small percentage of falls in elderly individuals, ranging from 5% to 10%, actually lead to any type of fracture. Furthermore, the occurrence of hip fractures as a result of falls is even lower, with less than 2% of falls resulting in such fractures. [4]

The absence of hip fractures in the majority of falls suggests that the mechanics of the fall play a crucial role in determining the occurrence of a fracture. Four factors determine whether a fall will result in a hip fracture: inadequate protective reflexes, landing on or near the hip, insufficient bone strength, and poor local shock absorbers. [4] The nature and frequency of related injuries are influenced by various factors, including the characteristics of the patient and the damage itself. Occasionally, elderly individuals who experience low-energy trauma and sustain trochanteric fractures may also have an additional fracture related to osteoporosis, such as a distal radius or proximal humeral fracture. Trochanteric fractures in young individuals typically occur as a consequence of a high-impact incident, such as a car collision or a fall from a significant height. When encountering such situations, it is necessary to evaluate the potential presence of related injuries to the head, neck, abdomen, and chest. A total of 66 trochanteric fractures in individuals under the age of 40 were documented. The cause of the incidents included a fall in 11 cases, a road traffic accident in 36 cases, and a fall from height in 19 cases. Out of the total of 32 patients, which accounts for 48.5% of the sample, a significant number suffered additional injuries. The most prevalent types of associated injuries observed were fractures in the pelvis, head, and femoral shaft. [5]

AIM OF THE WORK

A systematic review of literature and meta-analysis comparing intramedullary nailing and dynamic plate and screw in the treatment of trochanteric fractures of the femur according to operative details of the time of surgery, fluoroscopy time, operative blood loss, patient satisfaction after surgery, and length of hospital stay and also regarding the incidence of complications.

PATIENTS AND METHODS

For this systematic review and meta-analysis, we adhered to the PRISMA statement guidelines [6] and followed all the procedures outlined in the Cochrane Handbook of Systematic Reviews of Intervention. [7]

Methodology for doing the search and selecting relevant studies:

In June 2021, we conducted a comprehensive search utilizing relevant terms in many databases including PubMed, Scopus, Cochrane, Web of Science, Embase, and Science Direct. We also updated the search in July 2021. Our search approach for querying several databases was as follows: (("Hip Fracture" OR "Fractures, Hip" OR "Trochanteric Fractures" OR "Fractures, Trochanteric" OR "Intertrochanteric Fractures" OR "Fractures, Intertrochanteric" OR "Subtrochanteric Fractures" OR "Fractures, Subtrochanteric") AND ("Fixation, Intramedullary Fracture" OR "Intramedullary Fracture Fixation" OR "Intramedullary Nailing" OR "Intramedullary Nailings" OR "Nailing, Intramedullary")) AND ("Bone Screws" OR "Bone Screw" OR "Screw, Bone" OR "Screws, Bone" OR "Bone plates")). The terms "bone plate," "plate, bone," or "plates, bone" are being referred to.

Criteria for eligibility and selection of studies:

We incorporated research that adhered to the following criteria: (1) Inclusion of adult patients aged 18 years or older (2) Utilization of double arm designs (3) Restriction of study designs to randomized control trials (RCTs) (4) Inclusion of studies conducted in English (5) Acceptance of any outcome. We have omitted conference abstracts or unpublished data, research written in languages other than English, articles that describe non-surgical approaches to trochanteric fractures, in-vitro studies, and repeated articles by the same author unless they provide longer follow-up data. The screening process for data search involved reviewing all published articles without any limitations. The process involved two separate stages: the creation of

titles and abstracts, followed by the screening of full-text documents. The reference lists of the included research were carefully examined to identify any additional acceptable studies that may have been overlooked in prior stages.

Evaluation of quality:

The Cochrane Handbook of Systematic Reviews of Interventions 5.1.0 [8] assessed the risk of bias using various criteria. These criteria included selection bias, which was evaluated through random sequence generation and allocation concealment. Other risks evaluated were selective reporting, attrition bias, performance bias through blinding of participants and personnel, and detection bias through blinding of outcome assessment. Each prejudice category is categorized as either low risk, high risk, or unknown risk.

Data extraction

We collected data from several sources including text, tables, figures (using Graph Grabber version 2.0), and supplemental data. We concentrated on the subsequent outcome measures:

Length of the operation time, Fluoroscopy time, perioperative blood loss, and incidence of complications such as fracture non-union, perioperative wound infection, and Reoperation Rate. The summary of baseline characteristics of the patients is presented in Table 1. The outcomes will be discussed in detail in the results section.

Statistical Analysis

We performed this meta-analysis using the Review Manager (RevMan) computer tool, version 5.4, developed by The Nordic Cochrane Centre and The Cochrane Collaboration in 2014. In terms of the study results, the risk ratio (RR) with a 95% confidence interval (CI) was employed for dichotomous variables, whereas the mean difference (MD) and its 95% CI were reported for continuous variables. The heterogeneity among the studies was assessed by testing Cochrane's P values and I2. The presence of significant heterogeneity in this meta-analysis can be attributed to several clinical and methodological reasons. Therefore, the random effect model was used, despite the lower I2 value. Due to the restricted number of trials included, it was not possible to conduct funnel plots and the Egger regression test. In addition, a sensitivity analysis was conducted by systematically removing trials to assess the consistency of the main results.

RESULTS

Literature search results

The initial search yielded a total of 2096 articles from five different databases: 298 entries from PubMed, 24 articles from Cochrane, 679 articles from Scopus, 339 articles from Web of Science, and 756 items from Embase. Out of the total 2096 articles. We eliminated 762 articles because they were duplicates. A total of 1379 publications were subjected to screening based on their titles and abstracts, out of which 1309 were eliminated since they did not fulfill the inclusion criteria. The remaining 70 articles were subjected to full-text screening. Thirteen papers were ultimately selected for the final qualitative and quantitative analysis.

(Figure 1).

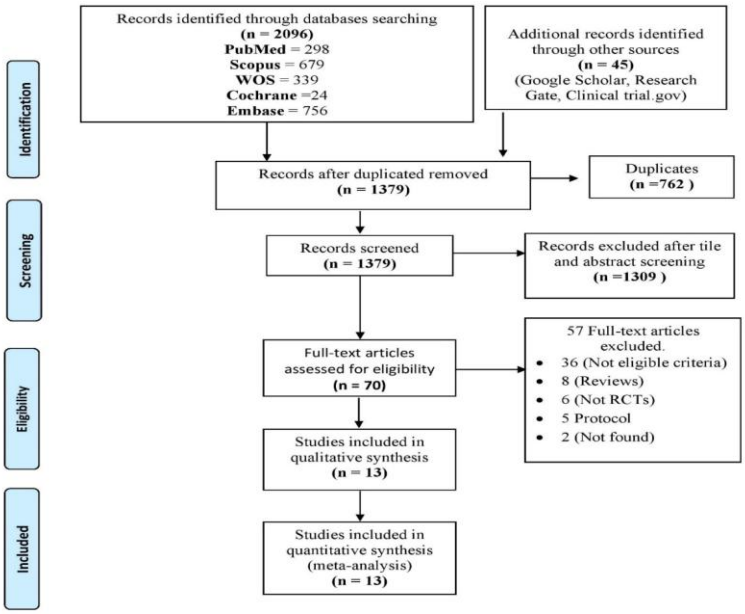

Figure 1: PRISMA flow diagram.

Evaluation of possibilities for bias in the included studies:

According to the Cochrane risk of bias tool, as described in chapter 8.5 of the Cochrane Handbook of Systematic Reviews of Interventions 5.1.0, the random sequence generation was deemed to have a low risk of bias in all trials, except for Sudan et al. [9], Shen et al. [10], and Pajarinen et al. [11]. The studies considered in the analysis exhibited an intermediate level of evidence overall. All trials exhibited no significant risk in terms of performance bias, attrition bias, detection bias, selective reporting, and other biases. ***(Figure 2, 3)***

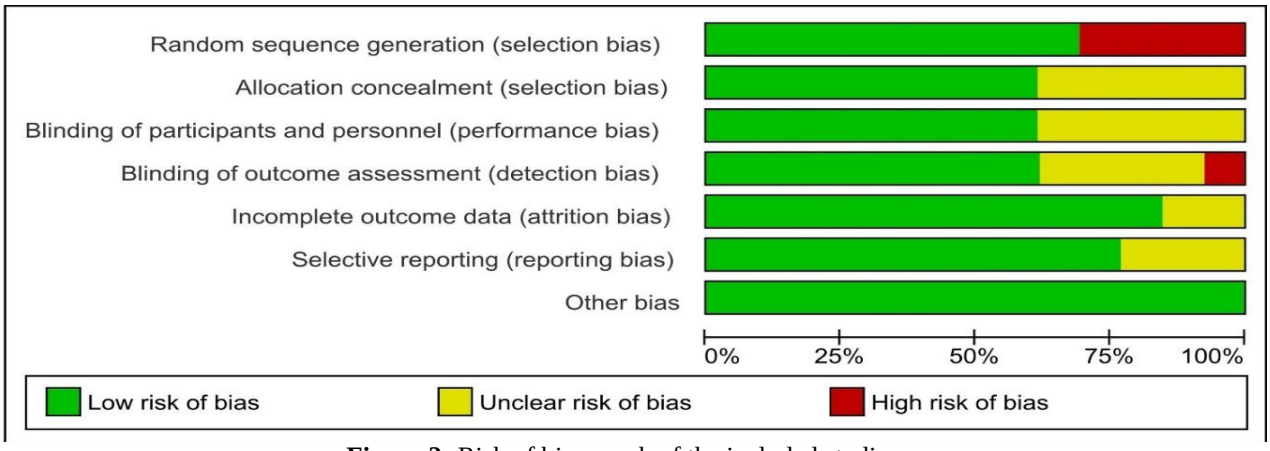

Figure 2: Risk of bias graph of the included studies

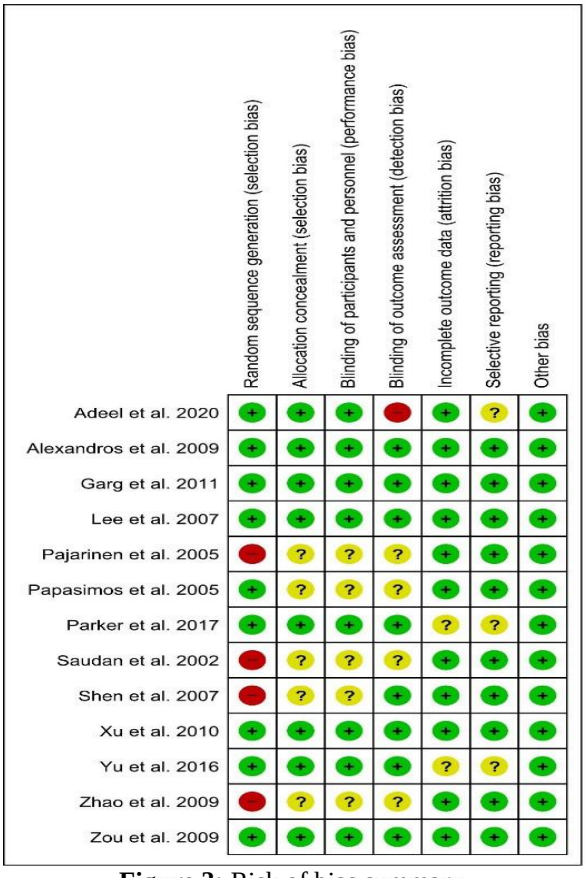

Figure 3: Risk of bias summary

Characteristics of the included studies

We identified 13 studies that compared intramedullary nailing versus dynamic hip screw and plate for treatment of trochanteric fractures of the femur with a total number of 1204 patients in the intramedullary nailing (IMN) group versus 1153 patients in the dynamic hip screw (DHS) and plate group. The average age of patients in the research varied from 60 to 90 years. All investigations were conducted using a prospective and randomized approach. The overview and fundamental characteristics of the research that were considered are outlined in **Table 1.**

Primary and secondary outcomes

Our primary outcomes were to compare the efficacy and safety of intramedullary nailing versus dynamic screw and plate. We assessed the effectiveness by the following measured outcomes: length of the operation time, Fluoroscopy time, perioperative blood loss, patient satisfaction after surgery (assessed by VAS score), and length of hospital stay.

Regarding the incidence of complication, we evaluated the following outcomes: Fracture non-union, Perioperative wound infection, Femur shaft fracture and fixation failure, Hip Prosthetic instability, and Reoperation Rate.

Qualitative evidence regarding IMN and DHS in osteoporotic patients

Regarding the risk of osteoporosis after IMN and DHS with plate fixation for intertrochanteric fractures. The intramedullary nail often fails to gain cut out in osteoporotic bone. Based on the results of some high-quality studies (Ito et al. and Elbarbary et al), Intramedullary nailing is an acceptable treatment option for intertrochanteric fracture in old

osteoporotic patients. Based on the qualitative evidence, IMN is better for old osteoporotic patients than DHS with plate fixation.

Table 1: Summary and baseline Characteristics table of the included studies

Study ID	Design	Sample size	Age, (mean, SD)	Gender, Male (%)	Target population	Number of fractures		Primary outcomes
						PFNA	DHS	
Saudan et al.	RCT	206	83 (9.7)	22.3%	Switzerland	100	100	Operative time, Postoperative infection rate, lag screw cut-out rate, Reoperation rate.
Papasimos et al.	RCT	90	79.4	38.6%	Greece	40	40	Postoperative infection rate; lag screw cut-out rate, Reoperation rate.
Pajarinen et al.	RCT	190	80.9 (9.1)	25.0%	Finland	54	54	Intraoperative blood loss; postoperative infection rate; lag screw cut-out rate; Reoperation rate.
Shen et al.	RCT	107	72.1 (6.61)	40.2%	Asia	51	56	Operative time; intraoperative blood loss; postoperative infection rate
Zhao et al.	RCT	104	76 (6)	40.4%	Asia	33	71	Operative time; intraoperative blood loss; length of incision; lag screw cut-out rate
Parker et al., 2017	RCT	1000	82.2 (19.5)	22.4%	Germany	500	500	Mean length of anaesthesia, mean length of surgery, required blood transfusion, mean days acute ward stay, Mean total institutional stay
Adeel et al., 2020	RCT	68	60.88(12.49)	64.71%	Pakistan	32	36	Mean duration of Surgery (Minutes), Mean Blood Loss (ml), Mean Harris Hip Score
Alexandros et al., 2009	RCT	118	79.22 (7.99)	33.90%	Switzerland	59	59	Mean operative time (min), Radiation exposure, Blood loss (ml), Neurologic complication, Superficial wound infection
Lee et al., 2007	RCT	66	36.1	77%	Switzerland	32	34	Hospital stay (d), Mobility score, Pain in hip (score), Pain in thigh (score), Hip movements (total in degrees, Union time (wk)
Zou et al., 2009	RCT	121	65 (13.5)	21%	China	63	58	Operative time, Fluoroscopy time, The amount of blood loss, Salavati and Wilson scores, Femoral shaft fracture
Yu et al., 2016	RCT	222	72.02 (6.50)	49%	China	112	110	Harris hip score for 1, 2, 12, 15, 18, 21, 24, 36, 48 Months postoperatively, Femur shaft fracture, Prosthetic instability, Nonunion, Intraoperative nerve injury
Garg et al., 2011	RCT	81	64.3 (4.5)	73%	India	42	39	Mean surgical time, time of radiation exposure, External blood loss
Xu et al., 2010	RCT	106	78.5 (7.97)	0.3	China	55	51	Mean operating and fluoroscopy times, External blood loss

DISCUSSION

We identified 13 clinical trials assessing the effectiveness and safety of intramedullary nailing versus dynamic plate and screw in treating trochanteric fractures of the femur according to the following outcomes: length of the mean operation time, time of radiation exposure (fluoroscopy time), Intraoperative blood loss, reoperation rate, fracture non-union, and postoperative wound infection wither superficial or deep infection. Compared to the control group (Dynamic hip screw and plate technique), Intramedullary nailing (IMN) showed a significant improvement in length of operation time and perioperative blood loss than dynamic hip screw with plate fixation technique. However, in terms of intraoperative radiation exposure time (Fluoroscopy time), dynamic hip screw (DHS) with plate fixation showed a significantly lesser fluoroscopy time than IMN. Regarding the postoperative patient satisfaction (assessed by visual analog scale), postoperative Fracture non-union, perioperative wound infection, femur shaft fracture, and hip prosthetic instability, they showed no significant difference between IMN and dynamic hip screw with plate fixation. The reoperation rate also showed no significant difference between IMN and DHS with plate fixation.

Trochanteric and intertrochanteric femur fractures are extracapsular fractures of the proximal femur at the level of the greater and lesser trochanter. Trochanteric fractures involve the proximal femur between the cervical region and the shaft**.** There

are numerous classifications of trochanteric fractures based on fracture line location and displacement and the consequences for external reduction maneuvers. Two classifications are particularly widely used: the Evans classification is based on fracture site stability and comprises five types, from non-displaced 2fragment (Type I) to medially and posterolateral comminuted fracture (Type V). The second classification is the AO classification comprises three groups: 31A1, which means simple 2fragment peri-trochanteric fracture, 31A2, which is multi-fragment peri-trochanteric fractures, and the last grade is 31A3, representing intertrochanteric fracture. Regarding epidemiology, Trochanteric fracture primarily impacts the geriatric population. Alongside a femoral neck fracture, it falls under the category of proximal femoral fractures, which accounted for almost 80,000 cases reported in France in 2005. Trochanteric fracture in senior individuals occurs due to decreased bone strength and increased susceptibility to falls, which can be produced by particular medications such as hypnotics and recent anti-hypertensive therapy [(23)]. A trochanteric fracture primarily affects those over the age of 75, with a noticeably higher occurrence in females. It frequently occurs after a basic high fall, leading to complete loss of function in the lower limbs. The typical deformity pattern characterized by shortening, adduction, and external rotation may not be seen in cases when there is no displacement. CT is solely recommended to detect hidden fractures. A comprehensive examination is conducted to identify any additional medical conditions that may be present during a period of worsening health. It is crucial to do screening for malnutrition to predict potential challenges in achieving functional recovery.

Surgical intervention is the preferred treatment for intertrochanteric fractures, which can be addressed using either a sliding compression hip screw and side plate or an intramedullary nail. The compression hip screw is affixed to the lateral aspect of the bone using bone screws. A substantial secondary lag screw is inserted through the plate into the femoral head and neck. Orthopedic surgeons currently employ intramedullary (IM) nailing or dynamic hip screws and plates. Recently, the intramedullary (IM) nail with two integrated lag screws has been utilized to address the Z-affect phenomena in intertrochanteric fractures.

Intramedullary nailing is a surgical procedure performed to mend a fractured bone and maintain its stability. The predominant bones addressed by this surgery include the femur, tibia, pelvis, and humerus. An enduring nail or rod is inserted into the central part of the bone. It will facilitate the ability to bear weight on the bone. The surgical procedure involves the insertion of a metal rod, known as an intramedullary rod or nail, into the medullary cavity of a bone. This rod does not require any fixation at the proximal or distal ends and is sometimes referred to as an interlocking nail or Küntscher nail. Intramedullary nails have traditionally been employed for the treatment of fractures in the long bones of the body. The Titanium Trochanteric Fixation Nail (TFN) is designed to address both stable and unstable fractures of the proximal femur, including peri-trochanteric fractures, intertrochanteric fractures, basal neck fractures, and various combinations of these fractures. Intramedullary nailing is the preferred therapy for fractures occurring in the middle part of the tibia. However, in certain cases, the nail may need to be removed in the future due to problems. While intramedullary nail removal is generally considered to be a technique with low risk, it is nonetheless associated with specific problems. The surgical procedure has a maximum duration of two hours. Currently, fractured femurs are repaired using intramedullary nails that are produced from either stainless steel or titanium alloy. The nail exhibits a minor curvature, commonly characterized by a 1 cm arc over a length of 30 cm, and has a hollow structure. Certain designs feature a longitudinal slit and holes at both ends to accommodate fixing screws.

The Dynamic Hip Screw (DHS) was a commonly used method for treating intertrochanteric fractures. The Dynamic Hip Screw (DHS) is a screw designed to enable controlled dynamic sliding of the femoral head. It is utilized for the fixation of both the femoral head and the device to the femur's shaft. Dynamic compression facilitates the stabilization of weight-bearing forces on the femur, promoting remodeling and effective healing of fractures. Following a period of 30 weeks, 75% of the patients saw a complete restoration of their normal bodily function. While initially considered the benchmark for treating fractures of the proximal femur, there are now alternative devices available for fracture fixation, such as intramedullary nailing or Locking Compression Plate (LCP). Most people can return to work between 4 weeks to 4 months after surgery. However, the whole recovery process may require a duration of 6 months to 1 year. Certain individuals, particularly the elderly, may experience a decline in their mobility compared to their previous abilities. Optimal healing occurs when one diligently attends to self-care. The

extraction of dynamic hip screw implants involves the removal of the side plate and compression screws. At times, the embedded bone may hinder the smooth removal of the plate. The optimal selection for each surgical procedure is the most suitable one for each individual instance. While the selection of the most suitable fixing method for a fracture may be evident in certain instances, it appears that the expertise and proficiency of surgeons in employing the described technique can influence the decision. The intramedullary nailing method has many advantages over the DHS approach, such as smaller incisions and reduced bleeding. However, certain components, particularly in the long term, pose challenges for surgeons. It is important to acknowledge that, similar to other studies, the principles of nailing are considered more intricate compared to other strategies for controlling and enhancing outcomes. However, it is crucial to emphasize the necessity for ongoing training.

Regarding the length of the operation time, we found a favorable significance for IMN over DHS with plate fixation. However, regarding the fluoroscopy time, DHS took a longer time than IMN. These results were similar to that of Zou et al., 2009 and Sudan et al., 2002**.** We agree with these results. Also, Adeel et al., 2020 found the same results of low operative time and high fluoroscopy time as we found. They concluded that the proximal femoral nail provided equivalent functional outcomes compared to dynamic hip screws with lesser blood loss and surgical time. Adeel et al. reported the mean surgery time was significantly lower in the IMN group ($P < 0.05$). However other studies did not agree with our results, [(35)] found that there is no significance between both groups regarding the operation time and fluoroscopy time. Their results were justified based on the surgeons' prior experience with the use of these implants. The radiation exposure did not show any notable variation, as it is typically directly proportionate to the duration of the operation. [(38)].

In terms of intraoperative blood loss, our analysis favored the IMN over DHS. similarly, a meta-analysis of five randomized controlled trials (RCTs) also reported that there was less blood loss ($P< 0.0001$) in the PFN group compared to the DHS group**.** The results indicated that the use of the DHS for fracture fixation resulted in a significantly increased duration of the surgical procedure and was accompanied by a significantly higher amount of blood loss during the operation compared to the use of the IMN. We concur with Yu et al.'s findings, which indicated that DHS (Dynamic Hip Screw) had a lengthier duration of operation, more blood loss, elevated early death rates, and a greater number of comorbidities. Garg et al. discovered that the amount of blood lost after surgery was approximately 110 ml in the IMN group, whereas in the DHS group, it was approximately 250 ml. The interpretation of these findings is attributed to the shorter duration of surgery and less blood loss resulting from the smaller incision and limited dissection of soft tissues in the intramedullary nail (IMN) operation compared to the dynamic hip screw (DHS) technique.

The reoperation rate is a frequently assessed result following any surgical surgery. It provides a favorable assessment of the effectiveness of the procedure. No statistically significant difference was observed between intramedullary nailing (IMN) and dynamic hip screw (DHS) in terms of the rate of reoperation. However, based on the existing literature, Zou et al. found that the rate of having to undergo surgery again was lower in the intramedullary nail (IMN) group compared to the dynamic hip screw (DHS) group. The outcome was different. However, the study demonstrated a higher reoperation rate following Dynamic Hip Screw (DHS) procedures. In the 1-year follow-up, there were 6 reoperations (5.4%) in the DHS group, primarily due to peri-implant fractures. This is in contrast to the 6% rate reported in the earlier study.

Regarding the rest of the outcomes including fracture non-union, operative infection, and hip prosthetic instability, no significant differences were found between IMN and DHS with plate fixation. Superficial wound infection is characterized as an infection in the skin or underlying tissue that necessitates the use of antibiotics. A deep wound infection is characterized as a confirmed infection that occurs behind the fascia and necessitates surgical debridement. Delayed union is characterized by the absence of any indication of fracture healing 24 weeks following the first surgical procedure. Nonunion was characterized as the lack of bone union 48 weeks following the initial procedure. The findings of our study align closely with those presented by the researchers. They found that there was no significant statistical difference in infection rate, hospitalization, systemic and local complications, consolidation time, non-union, and overall functional outcome. It was noted that neither the IMN group nor the DHS group showed any complications such as deep wound infection, non-union, or malunion. During their experiment, it was discovered that patients in the DHS group and 1 (2.9%) patient in the PFN group

experienced an infection. However, the difference in infection rates between the two groups was not statistically significant (P > 0.05). During the 12th week, there was a reported infection rate of 5.9% in 2 patients in the DHS group and 2.9% in 1 patient in the PFN group (P > 0.05). The authors in (99) observed a higher occurrence of hematoma and wound infection in the DHS group. They found that the DHS group had an 11 percent rate of reoperation due to complications, whereas the intramedullary nail group had a rate of 6.3 percent.

Osteoporosis is commonly regarded as the primary health issue in developed nations. Osteoporosis is a medical condition characterized by a reduction in the quantity and changes in the structure of bone tissue, resulting in weakened skeletal strength and a higher risk of fractures. Osteoporotic hip fracture is a leading cause of death among the elderly, according to mortality rate surveys. In our study, we examined osteoporosis and compared the findings to a study conducted by Ito et al. Their study demonstrated that the intramedullary nail (IMN) has advantages in terms of increasing the surface area of the bone-implant interface and enhancing the immediate stiffness and strength of fracture fixation in osteoporotic cancellous bone. Elbarbary et al. found similar results, concluding that intramedullary nailing (IMN) is a viable and effective treatment option for older patients with osteoporotic femoral shaft fractures. The procedure offers a reasonable healing period and carries minimal risk of significant consequences.

These results which we agree with can be interpreted as due to the significantly lower amount of the perioperative blood loss in the IMN favoring the IMN technique over DHS. Zoledronic acid injection combined with proximal femoral nail anti-rotation (PFNA) is recommended as a treatment for osteoporotic intertrochanteric fractures. This treatment effectively alleviates bone pain, enhances bone density, improves quality of life, reduces the likelihood of new fractures, and facilitates fracture healing. Elderly people with osteoporosis commonly suffer from bone discomfort, which often leads to restricted functional activity, reduced physical function, and a decline in their capacity to take care of themselves. These issues frequently induce anxiety in patients and impose a strain on their relatives.

That's why we recommend IMN over the DHS for osteoporotic intertrochanteric fracture.

CONCLUSION

Intramedullary nailing (IMN) provides better outcomes such as less blood loss, short surgical operative time, and earlier recovery compared to DHS with plate fixation and also regarding osteoporotic trochanteric fractures. DHS showed a lesser fluoroscopy time than IMN. Finally, we can conclude that DHS with a plate is not the preferred implant for trochanteric femur fractures. IMN showed a better result than DHS. In our view, the IMN is biologically preferable to DHS when it comes to fixing inter-trochanteric fractures. This is because it offers a durable intramedullary fixation that is resistant to varus collapse and fixation failure. Additionally, the IMN requires less operation time and results in less blood loss compared to DHS. Additionally, it is necessary to conduct more extensive randomized controlled trials (RCTs) with extended periods of observation to validate the benefits of intramedullary nailing (IMN) compared to dynamic hip screws (DHS).

REFERENCES

1. **Melton JL, Ilstrup DM, Riggs BL.** Fifty-year trend in hip fracture incidence. Clin Orthop 1982; 162:144-9.
2. **Koval KJ, Aharonoff GB, Rokito AS.** Patients with femoral neck and intertrochanteric fractures. Are they the same? Clin Orthop 1996; 330:166-72.
3. **Hayes WC.** Biomechanics of falls and hip fractures in the elderly. In: Apple DF, Hayes WC, eds. Prevention of falls and hip fractures in the elderly. Rosemont, Illinois: American Academy of Orthopaedic Surgeons, 1994:41-65.
4. **Cummings SR, Nevitt MC.** A hypothesis: the causes of hip fractures. J Gerontol 1989; 44:10711.
5. **Hwang LC, Lo WH, Chen WM.** Intertrochanteric fractures in adults younger than 40 years of age. Arch Orthop Trauma Surg 2001; 121(3):123-6.
6. **Moher D, Liberati A, Tetzlaff J, et al.** Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med. 2009; 6(7):e1000097.
7. **Higgins JP, Green S.** Cochrane Handbook for Systematic Reviews of Interventions: Cochrane Book Series. Vol Version 2008; 5: 2008.
8. **Green S, Higgins P, Alderson TJ, Clarke M, Mulrow DC, Oxman DA.** Cochrane Handbook: Cochrane Reviews: Ch 8: Assessing risk of bias in included studies. In: Cochrane Handbook for Systematic Reviews of Interventions. Vol 6.; 2011:3-10.
9. **Saudan M, Lübbeke A, Sadowski C, Riand N, Stern R, Hoffmeyer P.** Petrochanteric fractures: Is there an advantage to an intramedullary nail? A randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. J Orthop Trauma. 2002; 16(6):386-393.
10. **Shen HM, Liang CW, Fan YQ.** The clinical study of the treatment of intertrochanteric fractures in the elderly with DHS, Gamma nail, and PFN. Chin J Clin Med. 2007; 2:226-228.
11. **Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E.** Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomized study comparing post-operative rehabilitation. J Bone Joint Surg Br. 2005;87(1):76-81.
12. **Garg B, Marimuthu K, Kumar V, Malhotra R, Kotwal PP.** Outcome of short proximal femoral nail antirotation and dynamic hip screw for fixation of unstable trochanteric fractures. A randomised prospective comparative trial. HIP Int. 2011;21(5):531-536.

13. **Zou J, Xu Y, Yang H.** A comparison of proximal femoral nail antirotation and dynamic hip screw devices in trochanteric fractures. J Int Med Res. 2009;37(4):1057-1064.
14. **Zhao C, Liu D, Guo J, et al.** [Comparison of proximal femoral nail and dynamic hip screw for treating intertrochanteric fractures]. Zhongguo Gu Shang. 2009; 22(7):535-537.
15. **Lee PC, Hsieh PH, Yu SW, Shiao CW, Kao HK, Wu CC.** Biologic plating versus intramedullary nailing for comminuted subtrochanteric fractures in young adults: A prospective, randomized study of 66 cases. J Trauma. 2007; 63(6):1283-1291.
16. **Papasimos S, Koutsojannis CM, Panagopoulos A, Megas P, Lambiris E.** A randomised comparison of AMBI, TGN, and PFN for treatment of unstable trochanteric fractures. Arch Orthop Trauma Surg. 2005; 125(7):462-468.
17. **Parker MJ.** Sliding hip screw versus intramedullary nail for trochanteric hip fractures; a randomised trial of 1000 patients with presentation of results related to fracture stability. Injury. 2017; 48(12):2762-2767.
18. **Xu YZ, Geng DC, Mao HQ, Zhu XS, Yang HL.** A comparison of the proximal femoral nail antirotation device and dynamic hip screw in the treatment of unstable pertrochanteric fracture. J Int Med Res. 2010; 38(4):1266-1275.
19. **Adeel K, Nadeem RD, Akhtar M, Sah RK, Mohy-Ud-Din I.** Comparison of proximal femoral nail (PFN) and dynamic hip screw (DHS) for the treatment of AO type A2 and A3 pertrochanteric fractures of femur. J Pak Med Assoc. 2020; 70(5):815-819.
20. **Verettas DAJ, Ifantidis P, Chatzipapas CN, et al.** Systematic effects of surgical treatment of hip fractures: Gliding screw-plating vs intramedullary nailing. Injury. 2010; 41(3):279-284.
21. **Yu W, Zhang X, Zhu X, et al.** Proximal femoral nails anti-rotation versus dynamic hip screws for treatment of stable intertrochanteric femur fractures: An outcome analyses with a minimum 4 years of follow-up. BMC Musculoskelet Disord. 2016;17(1):1-6.
22. **Adam P.** Treatment of recent trochanteric fracture in adults. Orthopaedics & Traumatology: Surgery & Research, 2014; 100(1): S75–S83.
23. **Huang AR, Mallet L, Rochefort CM, Eguale T, Buckeridge DL, Tamblyn R.** MedicationRelated Falls in the Elderly. Drugs & Aging, 2012; 29(5): 359–376.
24. **Mizrahi EH, Fleissig Y, Arad M, Blumstein T, Adunsky A.** Rehabilitation outcome of hip fracture patients: The importance of a positive albumin gain. Archives of Gerontology and Geriatrics, 2008; 47(3): 318–326.
25. **Kim TY, Ha YC, Lee YK, Koo KH, Kim JW.** Outcome of intertrochanteric fractures treated by intramedullary nail with two integrated lag screws A study in Asian population. Indian Journal of Orthopaedics, 2015; 49(4): 436.
26. **Seyhan M, Guler O, Mahirogullari M, Donmez F, Gereli A, Mutlu S.** Complications during removal of stainless steel versus titanium nails used for intramedullary nailing of diaphyseal fractures of the tibia. Annals of Medicine and Surgery, 2018; 26: 38–42.
27. **Sun M, Shao H, Xu H, Yang X, Dong M, Gong J, Yu M, Gou Z, He Y, Liu A, Wang H.** Biodegradable intramedullary nail (BIN) with high-strength bioceramics for bone fracture. Journal of Materials Chemistry B, 2021; 9(4): 969–982.
28. **Ahmad AA, Bhutta DRI, Qasrani GH.** Unstable inter-trochanteric fractures of proximal femur. The Professional Medical Journal, 2002; 9(3): 279–282.
29. **Bucholz RW.** Rockwood and Green's Fractures in Adults: Two Volumes Plus Integrated Content Website (Rockwood, Green, and Wilkins' Fractures). Lippincott Williams & Wilkins, 2012.
30. **Mardani-Kivi M, Mirbolook A, Khajeh S, Rouhi M.** Fixation of Intertrochanteric Fractures: Dynamic Hip Screw versus Locking Compression Plate. Trauma Monthly, 2013; 18(2): 67-70.
31. **Yeganeh A, Taghavi R, Moghtadaei M.** Comparing the Intramedullary Nailing Method Versus Dynamic Hip Screw in Treatment of Unstable Intertrochanteric Fractures. Medical Archives, 2016; 70(1): 53.
32. **Zou J, Xu Y, Yang H.** A comparison of proximal femoral nail antirotation and dynamic hip screw devices in trochanteric fractures. Journal of International Medical Research, 2009; 37(4): 1057–1064.
33. **Saudan M, Lübbeke A, Sadowski C, Riand N, Stern R, Hoffmeyer P**. Petrochanteric fractures: Is there an advantage to an intramedullary nail? A randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. Journal of Orthopaedic 2002; 16(6):386-93.
34. **Adeel K, Nadeem RD, Akhtar M, Sah RK, Mohy-Ud-Din I.** Comparison of proximal femoral nail (PFN) and dynamic hip screw (DHS) for the treatment of AO type A2 and A3 pertrochanteric fractures of femur. JPMA. The Journal of the Pakistan Medical Association, 2020; 70(5): 815–819.
35. **Verettas DAJ, Ifantidis P, Chatzipapas CN, Drosos GI, Xarchas KC, Chloropoulou P, Kazakos KI, Trypsianis G, Ververidis A.** Systematic effects of surgical treatment of hip fractures: Gliding screw-plating vs intramedullary nailing. Injury, 2010; 41(3): 279–284.
36. **Shen L, Zhang Y, Shen Y, Cui Z.** Antirotation proximal femoral nail versus dynamic hip screw for intertrochanteric fractures: a meta-analysis of randomized controlled studies. Orthopaedics & Traumatology: Surgery & Research, 2013; 99(4): 377–383.
37. **Yu W, Zhang X, Zhu X, Yu Z, Xu Y, Zha G, Hu J, Yi J, Liu Y.** Proximal femoral nails antirotation versus dynamic hip screws for treatment of stable intertrochanteric femur fractures: An outcome analyses with a minimum 4 years of follow-up. BMC Musculoskeletal Disorders, 2016; 17(1): 1–6.
38. **Garg B, Marimuthu K, Kumar V, Malhotra R, Kotwal PP.** Outcome of short proximal femoral nail antirotation and dynamic hip screw for fixation of unstable trochanteric fractures. A randomised prospective comparative trial. HIP International, 2011; 21(5): 531– 536.
39. **Lee PC, Hsieh PH, Yu SW, Shiao CW, Kao HK, Wu CC.** Biologic plating versus intramedullary nailing for comminuted subtrochanteric fractures in young adults: A prospective, randomized study of 66 cases. Journal of Trauma, 2007; 63(6): 1283–1291.
40. **Papasimos S, Koutsojannis CM, Panagopoulos A, Megas P, Lambiris E.** A randomised comparison of AMBI, TGN and PFN for treatment of unstable trochanteric fractures. Archives of Orthopaedic and Trauma Surgery, 2005; 125(7): 462–468.
41. **Lee YS, Huang HL, Lo TY, Huang CR.** Dynamic hip screw in the treatment of intertrochanteric fractures: a comparison of two fixation methods. International Orthopaedics, 2007; 31(5): 683–688.