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The Proximal Femoral Nail Versus the Proximal Femoral Locked Plate for Fixation of Unstable Proximal Femoral Fracture

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Abstract

Background: Unstable proximal femur fractures are common in elderly patients and are related to high death and morbidity. Surgical fixation aims to achieve stability, permit early mobilization, and minimize complications.

Objective: To compare the functional and radiological outcomes of proximal femoral nail (PFN) fixation and proximal femoral locking compression plate (PFLCP) fixation in unstable proximal femur fractures.

Methods: This prospective comparative research has been on 46 cases with unstable proximal femur fractures treated at Badr University Hospital between November 2022 and November 2023. Patients were separated into two groups: Group A treated with PFN (n=23) and Group B with PFLCP (n=23). Outcomes assessed included operative parameters, fracture union time, functional recovery (Harris Hip Score), hospital stay, and complications.

Results: PFN fixation was associated with shorter operative time, less intraoperative blood loss and smaller incision length compared with PFLCP. Time to fracture union was significantly shorter in the PFN group. Functional outcomes were comparable, with good-to-excellent Harris Hip Scores in 82.5% of PFN cases and 73.9% of PFLCP cases. Complication rates, including infection, nonunion, and limb shortening, were similar between groups.

Conclusion: PFN offers a less invasive technique with reduced blood loss, shorter surgery, and faster union compared with PFLCP, while both methods provide comparable functional outcomes and complication rates. PFN is therefore preferable for unstable proximal femur fractures, particularly in elderly patients.

Keywords: Proximal femur fracture, PFN, PFLCP

Introduction

Approximately 300,000 people are affected by unstable proximal femoral fractures each year, making them a common injury among older cases. Proximal femur fractures have been shown to have a fatality incidence ranging from 4.5% to 22% [1]. Most medical professionals concur that treating unstable proximal femur fractures conservatively leads to serious consequences. As a result, intensive surgery combined with the use of different implants is recommended for patients with these fractures [2].

In order to avoid complications such as pulmonary embolism, thrombophlebitis, lung and urinary infections, and ulcers, the procedure aims to achieve initial stability and early mobilization of cases [3]. Intramedullary implants have been recommended by numerous studies in the long-running dispute over the best implant for fractures in this area. They are

superior to extramedullary implants in terms of biomechanics and biology, but they have a unique set of technological challenges [4].

For the treatment of challenging comminuted and osteoporotic fractures, the 21st-century proximal femoral locking compression plate (PFLCP) provides angular stable plate fixation [5]. By combining locking screw technology with conventional plating, the PFLCP offers superior fixation for comminuted and extremely unstable fractures that encounter high shearing and pull-out forces [6].

The purpose of the proximal femoral nail (PFN), an intra-medullary fixation device with a helical blade, is to improve the rotational and angular fracture stability of unstable proximal femur fractures. Along the compression neck screw's axis, it permits regulated secondary impaction. It is a weight-sharing device that enables early mobilization and rapid full weight bearing following surgery, particularly in older patients [7].

Most trauma surgeons find it extremely difficult to treat unstable proximal femoral fractures in older patients, mostly because of severe osteoporosis and other common comorbidities that increase the risks associated with anesthesia and surgery. For improved therapeutic outcomes, it is therefore essential to identify appropriate fixation methods and tools for specific fracture types [8].

This study compared the functional results of proximal femoral compression locked plate fixation vs proximal femoral nail fixation for unstable proximal femur fractures.

Patients and methods

Our work included 46 cases with unstable proximal femur fractures treated by PFN and PFLCP between November 2022 and November 2023 at Badr university hospital. The patients were divided into two treatment groups. With 23 cases in each group, Patients of group I were managed with the proximal femoral nails (PFN) and those of group II were managed with the proximal femoral locked plates (PFLCP).

Inclusion criteria: Age between 30 to 80 years, Patients have unstable proximal femur fractures (AO type 2:1 – type 2:2 – type 2:3 – type 3:1 – type 3:2 – type 3:3) and Both genders will be included.

Exclusion criteria: Associated femur fractures, open fractures, patients who lost follow up and pathological fractures.

Surgical Technique (Group 1: Proximal Femoral Nail – PFN):

In order to replicate human anatomy, the proximal femoral nail (PFN) used in this study is a titanium reconstruction nail with a 6° proximal nail angle in the coronal plane and a blade–nail angle of 125°–130°. In order to avoid rotation and provide controlled back-out for fracture site compression, the device features a helical blade at its cephalic end. Patients were placed supine on a radiolucent traction table during surgery while under general or spinal anesthesia. To enable C-arm fluoroscopic guidance, the undamaged limb was flexed and abducted, and the ipsilateral hip was abducted by tilting the torso 10–15° contralaterally. The greater trochanter was made visible in the operating field following fracture reduction using longitudinal traction. To prevent cortical perforation or iatrogenic fracture, a longitudinal incision has been created close to the trochanter, carefully identifying the proper entrance location at its tip. Prior to canal preparation utilizing sequential reaming and a proximal conical reamer up to the level of the lesser trochanter, a guide wire was inserted centrally into the proximal femur. In order to avoid hammering, the chosen PFN was inserted over the guide wire using moderate rotational movements. A lag screw and an anti-rotation hip pin were inserted under imaging guidance following fluoroscopic alignment confirmation. The hip pin was advanced slightly shorter to serve as an anti-rotational device, and the lag screw was placed in the middle of the femoral neck and head. Static or dynamic screws were used in a targeting device to accomplish distal locking. Prior to multilayer wound closure, final intraoperative imaging verified implant location and fracture reduction. Complications, intraoperative blood loss, and operating time were recorded.

Surgical Technique (Group 2: Proximal Femoral Locked Compression Plate – PFLCP):

A pre-contoured 4.5 mm titanium plate with five proximal locking holes for 6.5 mm screws and extra calcar screws served as the proximal femoral locked compression plate (PFLCP). The subject was positioned laterally on a radiolucent operating table for the procedure, which was carried out under general or spinal anesthesia. This allowed for full draping of the pelvis, hip, and afflicted limb for traction and fluoroscopic evaluation. Over the greater trochanter, a longitudinal lateral incision

has been made that extends distally along the femur. In order to limit soft tissue disturbance and bleeding, the vastus lateralis was mobilized using a sub-vastus approach after the fascia lata was cut and the distal part of the tensor fasciae latae was separated. Longitudinal traction and temporary fixation with K-wires or reduction forceps were used to reduce fractures. After that, the PFLCP was oriented under fluoroscopy and placed along the lateral aspect of the proximal femur. Locking screws were inserted into the proximal femur and femoral diaphysis after non-locking screws were used for distal preliminary fixation. Restoration of the neck-shaft angle, resistance to varus collapse, and avoidance of screw cutout were all guaranteed by proper screw placement. To maximize stress distribution and lessen implant fatigue in situations of subtrochanteric comminution, two to three screw holes were purposefully left empty at the fracture level. Following radiological confirmation of fixation, layers of muscle, fascia, subcutaneous tissue, and skin were used to seal the wound. Intraoperative problems, blood loss, and operating time have all been documented.

Results

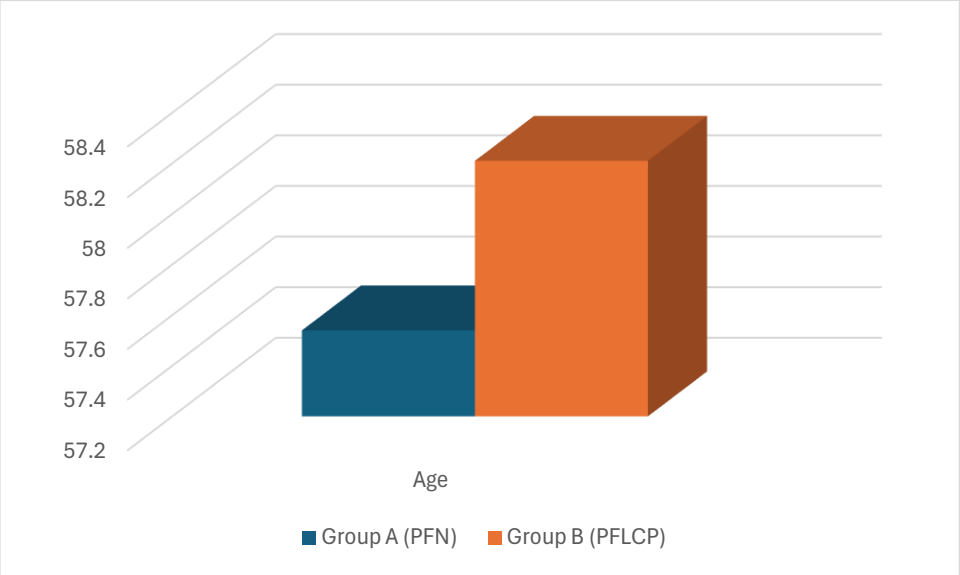

Figure 1: Age distribution among examined groups

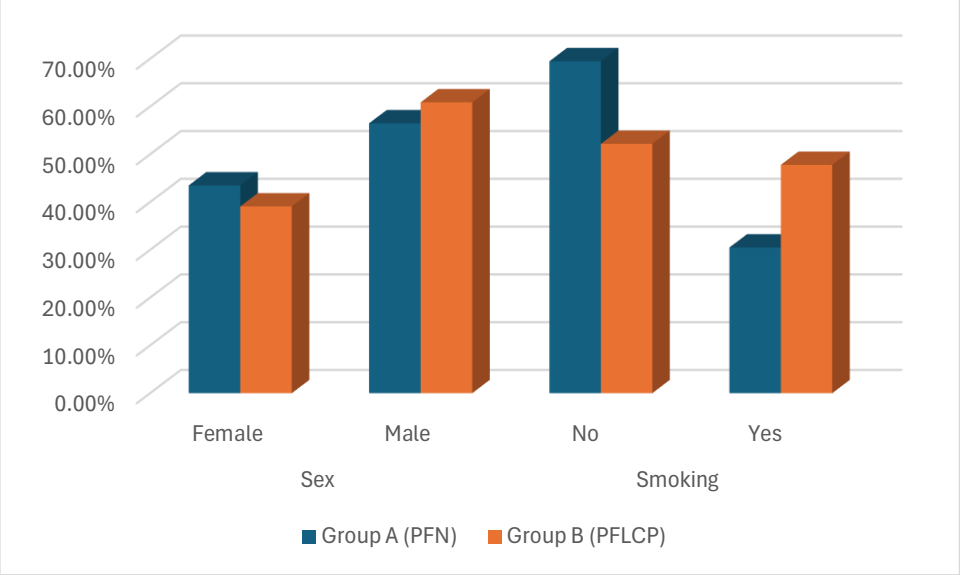

Figure 2: demographic data distribution among examined groups

Figure (1 and 2) shows that there were a statistically insignificant variances among Group A (PFN) and Group B (PFLCP) regarding age, sex distribution, or smoking status (p>0.05).

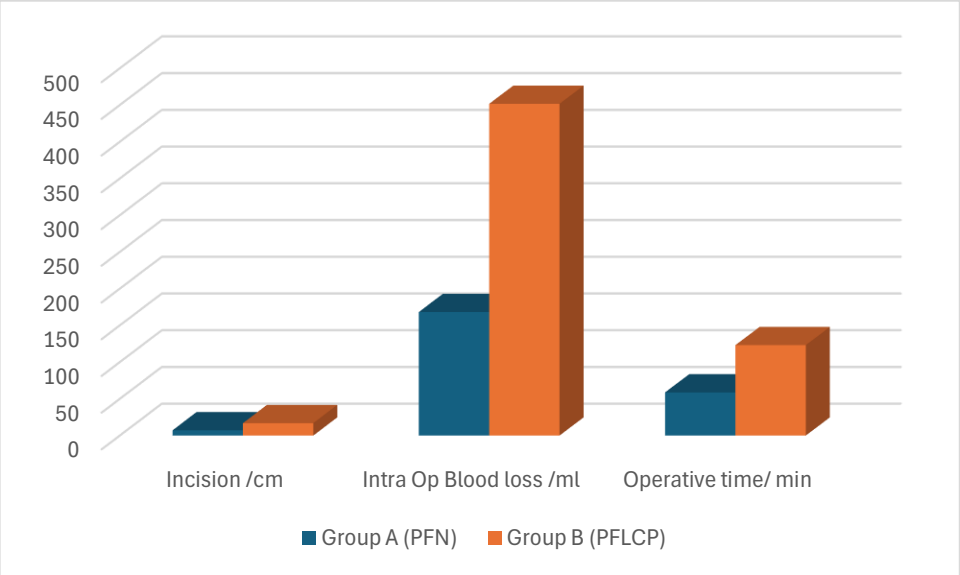

Figure 3: Intra- Operative data distribution among examined groups

Figure (3) reveals that Group A (PFN) had significantly shorter incision length, less intraoperative blood loss, and reduced operative time compared with Group B (PFLCP) (p<0.001).

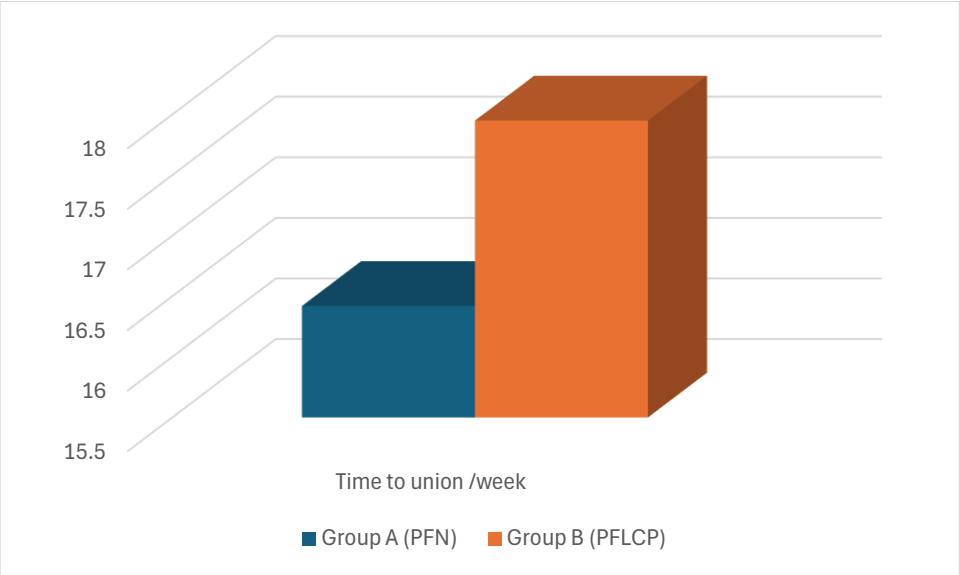

Figure 4: Time of union distribution among examined groups

Figure (4) demonstrates that the mean time to fracture union was significantly shorter in Group A (PFN) compared with Group B (PFLCP) (p=0.013).

Discussion

Age, sex distribution, and smoking status did not differ statistically significantly between Group A (PFN) and Group B (PFLCP) (p>0.05).

Surgical results revealed significant differences between the two groups in terms of incision length, blood loss, and operating time. Group B (PFLCP) had a considerably longer mean incision length of 16.95 cm (range from 15 to 20 cm), whereas Group A (PFN) had a mean incision length of 7.22 cm (ranging from 5 to 8 cm). The average operating time for

Group A procedures was 58.77 minutes (50 to 70 minutes), whereas the average for Group B procedures was 123.12 minutes (100 to 150 minutes). With less blood loss, a shorter operating time, and a shorter incision length, these intraoperative variations demonstrate a less invasive technique in Group A.

Roy and Banik, [9] showed that proximal femoral locking plating required 101.94 minutes of operating time, while proximal femoral nailing required 86.94 minutes. According to our findings, the patient who had a proximal femoral nail required a substantially less operating time than their counterpart.

In the study of **Sandhu et al., [10]** It was discovered that the PFN group needed between 50 and 70 minutes for surgery, but the PFLCP group needed between 60 and 90 minutes. This difference was highly significant. Surgery took an average of 58.25±5.20 minutes for PFN patients and 74.65±10.12 minutes for the PFLCP group, with a mean difference of 16.40±4.92 minutes in favor of the PFN technique.

Group A (PFN) Proximal Femoral Nail had a mean intraoperative blood loss of 168.18 ml (range from 120 to 350 ml) in this study, while Group B (PFLP) Proximal Femoral Locking Plate had a mean of 451.66 ml (ranging from 300 to 600 ml). This difference can be explained by the fact that PFN fixation is a minimally invasive procedure associated with a smaller surgical incision.

Kulkarni et al., [11] evaluates the efficacy of proximal femur locking compression plate (PFLCP) and proximal femur nail (PFN) in the treatment of unstable proximal femur fractures. The union rate, operational time, and functional results did not change much. Shorter incisions, less blood loss, and a quicker time to full weight-bearing were all benefits of PFN.

In a study of **Ozkan et al., [12]** In comparison to the locking plate approach, it was discovered that the proximal femoral nail typically permits earlier weight bearing and may result in a faster time to union. More stability is specifically provided by the PFN, which is essential for the healing process in cases of unstable proximal femur fractures. On the other hand, the PFLCP might necessitate greater prudence when it comes to early weight bearing, which could result in a longer period to reach full union.

Conclusion

In conclusion, for unstable proximal femur fractures, proximal femur nail (PFN) fixation showed a number of advantages over proximal femur locking compression plate (PFLCP) fixation. With a shorter operating time, less blood loss, and a smaller incision, PFN was less intrusive. Additionally, it demonstrated a quicker fracture union (16.42 weeks as opposed to 17.95 weeks for PFLCP). Although PFN marginally outperformed PFLCP in "good" to "excellent" Harris Hip Scores, functional outcomes were similar and both procedures resulted in positive recovery. Both groups had similar rates of complications, including controllable problems such infections, nonunion, and limb shortening. Although PFLCP is still a good option in certain situations, PFN is generally the favored choice because to its effectiveness and safety.

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