

“Fixation of Sub-Trochanteric Fracture Femur by Dynamic Condylar Screw versus Proximal Femoral Nail, A prospective randomized study”

[Ashraf Abd El aziz Mahmoud](#)² [Mohamed El tabaey El greatly](#)² [Yasser Mohamed Sakr](#)² [Ahmed Hassan el banna](#)
[Mohamed](#)¹

¹ Orthopedic surgery, Faculty of medicine, Portsaid University

² Orthopedic surgery, faculty of medicine, Port Said University

ABSTRACT:

Background: The subtrochanteric fractures are the fractures occurring in the region of the proximal femur extending from the distal end of the lesser trochanter by 5 cm.

Aim: In this study we aimed to assess fixation of subtrochanteric fracture femur by comparing two methods of fixation, proximal femoral nail PFN (group A) versus dynamic condylar screw (group B).

Methods: This was prospective study; the ongoing study was held in Al-Salam insurance hospital Port Said in the period from October 2021 to October 2022. It was a prospective study that included 30 cases with subtrochanteric femoral fracture.

Results: Patients treated by either of these two methods were statistically analyzed for comparing advantages and disadvantages in terms of operation time, intra and post-operative blood loss, duration of hospital stay, union time and Harris hip score.

Conclusion: The results of subtrochanteric fracture fixation by intramedullary P.F.N or D.C.S were not quite different. The results of P.F.N group were better in terms of intra-operative, post-operative blood loss, intra-operative time, duration of hospital stay and Harris hip score.

Keywords: Fixation, Sub-Trochanteric Fracture, Femur, Dynamic Condylar Screw, Proximal Femoral Nail.

Submitted: 20/06/2023

Accepted:12/07/2023

DOI: 10.21608/MUJ.2023.218898.1141

ISSN : 2682-2741

This is an open access article licensed under the terms of the Creative Commons Attribution International License (CC BY 4.0).

<https://muj.journals.ekb.egdean@med.psu.edu.eg>

vice_dean_postgraduate@med.psu.edu.eg

<https://creativecommons.org/licenses/by/4.0/>.



Introduction

In young age, it needs high energy injury to induce subtrochanteric fracture. However, in older cases with osteoporosis, trivial fall in everyday activities is sufficient to produce these fractures (**Arvind et al., 2019**).

The subtrochanteric area located distal to the distal end of the lesser trochanter by 5cm (**Chaturvedi et al., 2015**). Out of all the hip fractures, these fractures represent 10%-30% (**Schulze et al., 2020**).

Subtrochanteric bone is under high stress of body weight with all of the daily activities (**Jackson et al., 2018**). So, it is important to choose the appropriate treatment method. Complications as mortality, can be avoided by early surgery (**Bedi et al., 2004**).

Prolonged immobilization may cause problems as: thrombophlebitis, UTI, chest infections, DVT & bed sores (**Ong et al., 2019**).

Subtrochanteric fractures treatment options are variable (**Tekin et al., 2019**). Still, the best treatment method is questionable. So, the aim of our study is to compare 2 methods of fixation: Proximal Femur Nail (PFN) and the AO Dynamic condylar screw (DCS).

Subjects and Methods

The current study was held in Al-Salam insurance hospital Port Said in the period from October 2021 to October 2022. It was a prospective comparative study that included 30 patients with subtrochanteric femoral fractures.

Cases: Inclusion criteria: patients older than 18 years, both genders and all types of subtrochanteric fractures. Exclusion criteria: Open fractures and ongoing chemotherapy or irradiation treatment due to malignancy.

Preoperative management protocol

On admission: Careful history taking, clinical assessment for all cases as Clinical assessment cautiously to identify any related wounds, skin condition, ecchymosis on the affected side

Radiological assessment: Plain X-ray: AP & lateral view on pelvis, the two hips. CT scan to detect the extension of the fracture to the piriformis fossa.

Laboratory testing: Routine preoperative CBC, liver, renal function tests, bleeding profile, ECG, ECHO for elder cases.

Preoperative preparation: Skin traction in bed, and good padding to all the bony prominences.

Informed consent: All patients were consented about surgery and possible complications.

Operative procedures: Sedation: All cases got spinal anesthesia, prophylactic antibiotic third generation cephalosporin was given to all cases 30 minutes before surgery.

Operative technique: Proximal femoral nail technique. After anesthesia, patients were positioned supine on traction table, image intensifier was used to assess reduction. Once accepted reduction was achieved, we start to scrub the patient (Fig.1). In AP view, nail entry was done on the tip or slightly medial to the tip of the greater trochanter, and a guidewire was inserted with the help of cannulated awl, and the cannulated

drill bit was used through protection sleeve over the guidewire, and the sequential reaming was done manually. The nail was carefully inserted into the femoral opening with slight twisting movements.



Fig.1: Patient on traction table with protection of heels and perineum

After nail insertion, the aiming arm device was connected and a small skin incision was made for proximal lag screw. A drill sleeve assembly was inserted through the aiming device and was pushed through the soft tissues to the bone. Through the sleeve, a guide wire was inserted into the femoral neck, checking its position under C-arm on AP and lateral views

The perfect guide wire site in the AP view is parallel to the femoral neck axis and slightly in the distal third. In lateral orientation, it should be central in position. After measuring the guide wire, a shorter blade by 10-15 mm was selected to keep a TAD of 10 mm away from the joint (Fig.2).



Fig.2: After insertion of the lag, the anti-rotational screws

The distal locking screws were then fixed using the triggered drill bit sleeve, introducing the screw measure device, then fixation of 2 screws distally (fig.3).

Finally, we irrigated the proximal entry wound with saline, closed the wound in layers with absorbable sutures, then covered the wound with antiseptic solution and dressing.

Dynamic condylar screw (D.C.S): After anesthesia, patients were positioned supine on traction table with proper padding of the bony prominences, heel and perineum. After traction image intensifier was used to assess reduction. Once accepted reduction was achieved we start to scrub the patient, if not we proceeded to open reduction. A skin incision was made by lateral approach to the femur, starting at the tip

of the greater trochanter and extending the incision distally in line with the lateral aspect of the femur for about 10 cm. The guide wire ideal position at the AP view is in the distal third of the head of femur and at lateral view, central in the neck (fig.3, 4). Then we advanced the guide 10 mm away from the joint subchondral and used the measuring device to obtain the adequate lag screw length.



Fig.3: Insertion of the guide wire



Fig.4: AP view for the guide wire position

We adjusted the triple reamer on the same length that we previously measured, and a hole for the cannulated lag screw and the plate sleeve was made. We mounted the screw over the guide wire using its handle, then the handle was removed parallel to the longitudinal neck axis (Fig.5).



Fig.5: Lag screw insertion over the guide pin under image

Then the plate was introduced, we selected the plate length according to each fracture pattern to insure biomechanical stability, leaving at least 4 holes distal to the distal fracture line.

We used an impactor to secure the plate barrel against the lag screw, then start to fix the plate against the femoral shaft by cortical 4.5 mm screw (Fig.6).



Fig.6: Final look with image intensifier after fixation had done

(D) Postoperative follow up

After the operation was finished all the patients were transferred to the ward and the following protocol was done: Intra venous broad spectrum double antibiotics (3rd generation cephalosporin + Metronidazole) were given for all patients for 5 days. Low molecular weight heparin was given postoperative to all patients in hospital as prophylaxis against DVT and pulmonary embolism. In group B cases suction drain was evacuated every 24 hours and removed when it drained less than 100 ml in last 24 hours: after 48 hours in 9 cases and after a 36 hours in 7 cases.

Discharge from the hospital: All patients discharged from the hospital on analgesics, anti-edematous, oral broad spectrum antibiotics (Amoxicillin/clavulanic acid + clindamycin). and oral anticoagulant (Rivaroxaban) for 21 days as prophylaxis against DVT and pulmonary embolism.

All patients were followed in the outpatient clinic as follows:

After two weeks: For wound condition and removal of stitches.

6 weeks: The patients were screened for any infection, follow up x-ray was done, and allowed to start controlled toe touch weight bearing.

3 months and six months: Complications (nonunion, mal-union, infection, device failure, thromboembolism, pneumonia, compartment syndrome, and deep vein thrombosis), range of motion of hip joint, onset of complications' incidence, and time of full-weight bearing.

Case presentation

A 29 years old male, electrician, fell from height, not diabetic not hypertensive, he had a subtrochanteric fracture of the right femur. He was admitted to Al Salam insurance hospital Port Said on the same day of trauma. On admission clinical examination and plain x-rays were done. The patient was given proper analgesia, skin traction was done and was admitted to the department where he was prepared for surgery which was done after 3 days. Anesthesia: spinal. Operation: Approach: percutaneous nail insertion. Reduction: closed aided by traction table. Fixation method: proximal femoral nail. Operative time: 60 min.

Intra operative blood loss: 250 cc. No intraoperative blood transfusion, no postoperative blood loss also no postoperative blood transfusion. Postoperative hospital stay was 3 days.

Follow up: At 2 weeks: Clean wound, sutures were removed. Follow up x-rays showed stable fixation and well fracture alignment. At 6 weeks: Cleanly healed wound. Follow up x-rays showed callus formation, well proximal femoral alignment. Mobilization: patient was advised to start partial weight bearing. After 3 months: Follow up x-ray showed more consolidation of the previously formed callus. Mobilization: patient was advised to start full weight bearing. the patient was more comfort to move independently and had a Harris hip score 70. After 6 months: Follow up x-ray complete fracture healing, no fracture line was detected on x-ray. Harris hip score was 90.



Fig.7: Preoperative x-ray

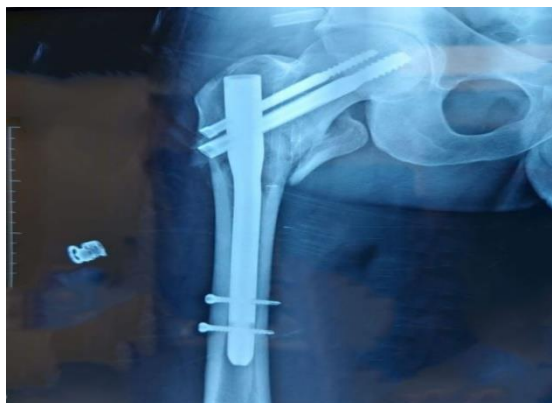


Fig.8: 3 months' postoperative x-ray

Results

The present study was a prospective randomized study that was carried out on 15 patients out of 30 surgically interfered by PFN (group A), and the other 15 by DCS (group B).

Table (1): comparison of demographic characteristics between the studied groups

	Group A N=15	Group B N=15	test of significance
Age/years mean±SD	53.93±12.70	62.87±11.41	t=21.03 p=0.052
Sex N (%)			
Male	7(46.7)	7(46.7)	$\chi^2=0.0$ p=1.0
Female	8(53.3)	8(53.3)	

t: Student t test, χ^2 : Chi-Square test

Table (1) illustrates non statistically critical difference between studied groups as regard their mean age, sex. Mean age of group A had 53.93 years versus 62.87 years for group B. Male cases represent 53.3% of group A & group B.

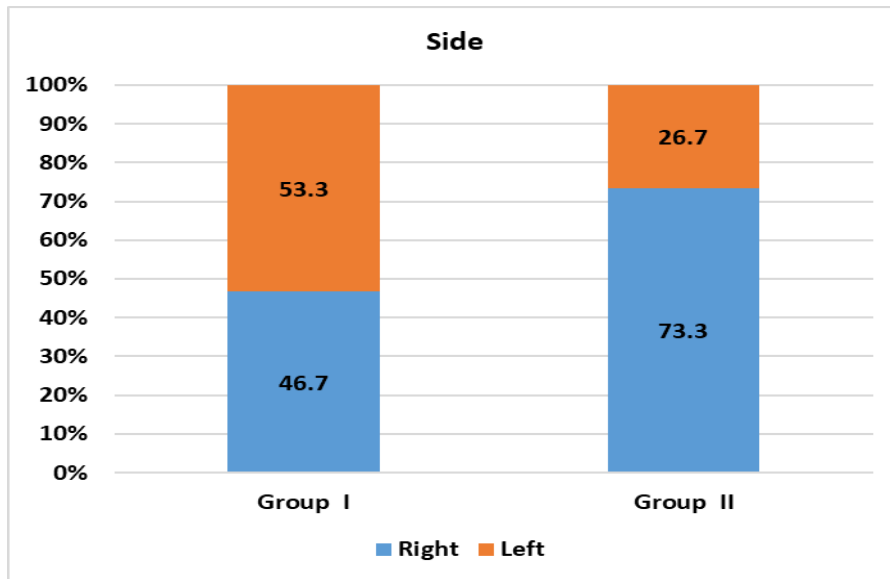


Fig. (9): distribution of the studied cases according to side of lesion

Fig.9 demonstrates non statistically critical difference between studied groups as regard side of lesion with 53.3% of group A versus 26.7% of group B had at left side.

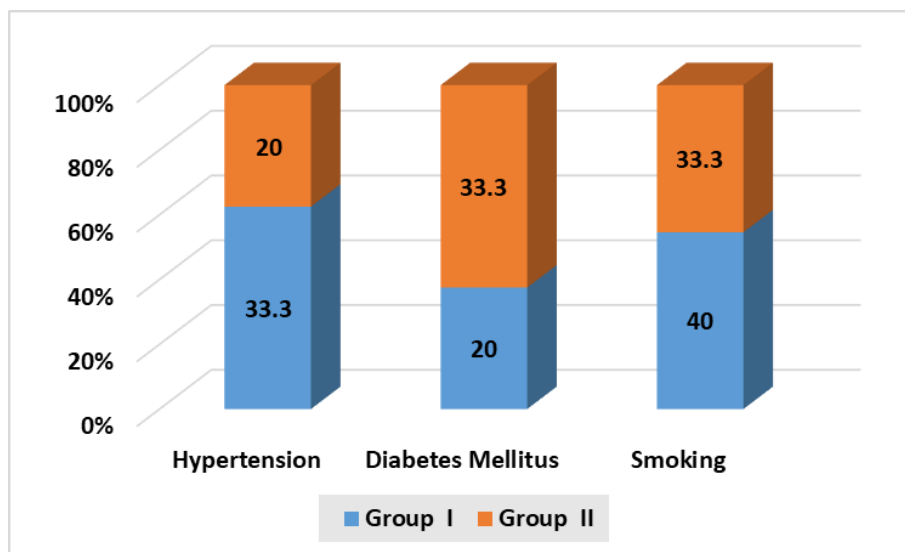


Fig.10: distribution of the studied cases according to their medical history

Fig.10 demonstrates that there was no statistically critical difference between studied groups as regard medical history. Hypertension had been detected among 33.3% & 20%, diabetes among 20% & 33.3%, smoking among 40% & 33.3% for group A & B, respectively.

Table (2): comparison of operative, post-operative characters between studied groups

	Group A N=15	Group B N=15	test of significance
Operation time (minutes)	69.67±8.96	101.67±11.90	t=8.32 p<0.001*
Intra-operative blood loss /ml	92.67±48.77	379.33±141.14	z=7.44 p<0.001*
Post-operative blood loss	0.0±0.0	326.67±96.12	t=13.16 p<0.001*
Hospital stay / days	5.27±1.58	9.47±1.46	t=7.57 p<0.001*

t: Student t test, Z: Mann Whitney U test, *statistically critical

Table (2) illustrates that there was a statistically critical higher mean operative time among group B than group A (101.67±11.90 & 69.67±8.96 minutes). Mean intra-operative blood loss was 379.33 ml for group B versus 92.67ml for group A with statistically critical difference between them. Mean post-operative blood loss was 326.67 ml for group B that shows statistically critical difference with group A that shows no blood loss. Mean ±SD hospital stay was 5.27±1.58 days for group A which was statistically critical lower than group B 9.47±1.46 days.

Table (3): comparison of Harris hip score between studied groups

	Group A N=15	Group B N=15	test of significance
Harris hip score	88.93±5.57	74.40±11.26	t=4.48 p<0.001*

t: Student t test, *statistically critical

Table (3) mean Harris hip score was statistically critical higher among group A than group B (88.93±5.57 & 74.40±11.26, respectively).

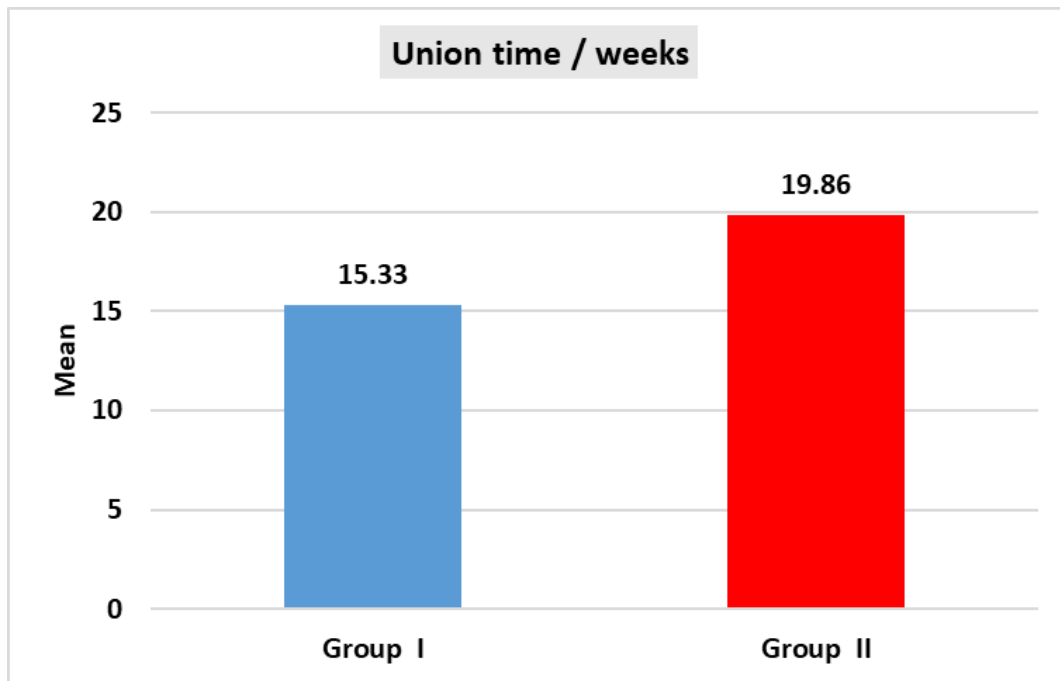


Fig.11: mean time to union among studied groups

Fig.11 mean Union time was statistically critical higher among group B than group A (19.86±2.88 weeks & 15.33±3.83 weeks, respectively)

Table (3): comparison of complications between studied groups

	Group A N=15(%)	Group B N=15(%)	test of significance
Infection	1(6.7)	4(26.7)	FET=2.16 P=0.330
Implant failure	0	1(6.7)	FET=1.03 P=1.0
Non-union	0	1(6.7)	FET=1.03 P=1.0

FET: Fischer exact test

Table (3) illustrates none statistically critical difference between studied groups as regard infection, implant failure, non-union incidence. For group A; one case had infection, for group B; 4 cases had infection, one case had implant failure, and one case had nonunion.

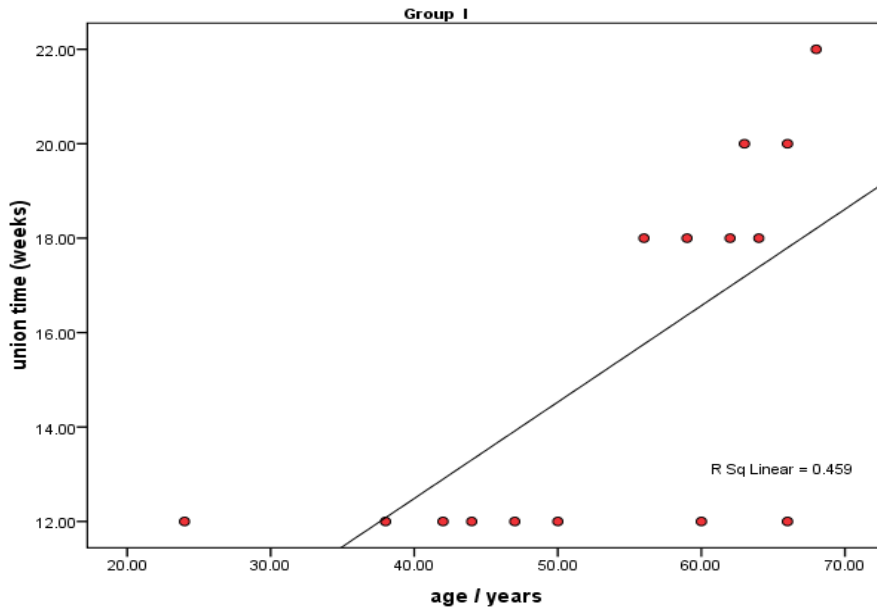


Fig.12: Scatter diagram showing correlation between age, union time among group A

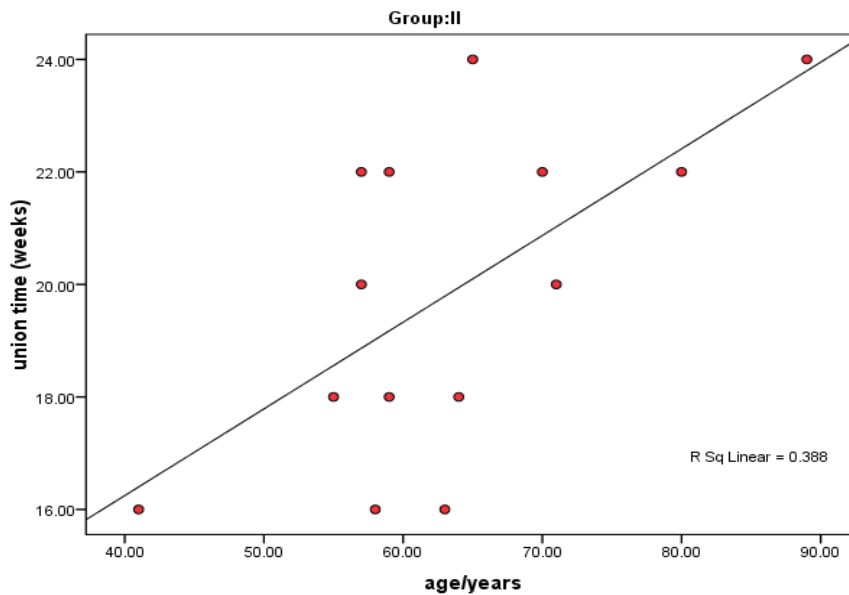


Fig.13: Scatter diagram showing correlation between age, union time among group B

Discussion

We compared our results with the results of the studies in literature which discussed the two techniques in management of subtrochanteric fracture.

In our present study there was no statistically significant difference between studied groups as regard their mean age and sex. Mean age of group A (PFN) is 53.93 years versus 62.87 years for group B (DCS). Male cases represent 53.3% of group A & group B.

Jamil et al., (2022). In DCS group majority 54.55% patients lies between age 61 to 80 years with mean age of 59.82 ± 11.59 years which was less than our study and in PFN group 40.00% patients lies between age 41 to 60 years with mean age of 54.2 ± 16.22 years which was similar to our study. In DCS group male

patients were more (54.55%) than female patients and in PFN group female patients were more (73.33%) than male patients.

Shukla et al., (2007). Between January 1999 and February 2005, 102 nails were inserted in 101 patients (67 females, 34 males) for traumatic, non-pathological subtrochanteric femoral fractures which was not similar to our study. The mean age of the patients was 75 years (range: 31–99).

Vaidya et al., (2003). There were 28 males and 3 female patients that was not similar to our study where the males represent 53.3%. The mean age of the patients was 32.6 years (range 14–45 years). Maximum number of patients were in the 20–40 years' age group which was not similar to the mean age in our study. In our study there was significant difference in operative time between the two groups with a higher mean operative time among group B than group A (101.67±11.90 and 69.67±8.96 minutes respectively)

Gadegone et al., (2007). the mean duration for the operation was 45 minutes (range: 32–95 min) for 100 cases treated with PFN which was less than our results.

Shukla et al., (2007). Mean operative time for PFN by closed reduction was 79 minutes that was longer than our mean time and for PFN by open reduction 103 minutes.

Vaidya et al., (2003). The mean operating time was 2 hours for cases with subtrochanteric fractures treated by DCS which was higher than our results.

Mean intra-operative blood loss in our study was 379.33±141.14 ml for group B versus 92.67±48.77 ml for group A (PFN) with statistically significant difference between them. Mean post-operative blood loss was 326.67±96.21 ml for group B that shows statistically significant difference with group A that shows no blood loss.

Vaidya et al., (2003). Average blood loss in cases fixed with DCS was 430 ml (range 780–1640 ml), which was similar to our results.

Gadegone et al., (2007). Average blood loss in cases with subtrochanteric fractures treated with PFN was less than 100 ml with no post-operative blood loss which was similar to our results. Blood transfusion was needed for three patients who had a very low preoperative hemoglobin level, which was not needed in our cases.

In our study we found mean ±SD hospital stay is 5.27±1.58 days for group A (PFN) which is statistically significant lower than group B (DCS) 9.47±1.46 days.

Vaidya et al., (2003). Found mean time was 9 days for DCS, which was the same as our results.

Jackson et al., (2018). Found the hospital stay in cases treated with PFN is less than that for DCS cases, which was similar to what we found.

In our study we found that there was no statistically significant difference between studied groups as regard infection, implant failure and non-union incidence. For group A (PFN); one case had superficial infection (6.66%) and for group B (DCS); 4 cases had infection (26.6%), one case had implant failure (6.66%) and another one case had nonunion (6.66%).

Jamil et al., (2022). In DCS group, implant failure was observed as breakage of barrel plate in 2 cases (28.57%) and lag screw cut out through femoral head in 1 case (14.29%) this was more than our results. While in PFN group varus collapse with backing out of hip screws was noted in one patient (7.69%). Lag screw breakage was seen in 1 (7.69%) patient in PFN group which was more than our results.

In our study the average time for full union was statistically significant higher among group B (DCS) than group A (PFN) (19.86 ± 2.88 weeks and 15.33 ± 3.83 weeks, respectively).

Shukla et al., (2007). 95% of fractures showed a successful fracture union by PFN. The mean time to union in this series was 27.6 ± 1.9 weeks, which was a longer duration in comparison to our results.

Vaidya et al., (2003). All the fractures (fixed by DCS) united (100%) at an average of 18.4 ± 1.7 weeks, which was similar to our results.

Kachewar et al., (2020). The mean union time for patients treated with PFN was 16 ± 2.9 weeks, while the mean union time in patients treated with DCS was 19 ± 3.1 weeks, which was similar to our results. The mean Harris Hip Score for cases treated with P.F.N was 90, for the cases treated with D.C.S was 85, which was similar to our outcomes.

In our study there was significant difference regarding Harries Hip Score favoring the nail group. Mean Harris Hip Score is statistically significant higher among group A (PFN) than group B (DCS) (88.93 ± 5.57 and 74.40 ± 11.26 , respectively).

Jackson et al., (2018). Mean Harris Hip Score for PFN was 90.1, which was similar to our results.

Lundy & Douglas W (2007). No significant differences were found between the Harris Hip Score of the two groups as PFN group mean Harris hip score was 89.7 ± 4.5 as our study and for DCS group was 88.6 ± 2.6 , which better than our results.

Kachewar et al., (2020). The mean Harris Hip Score for patients treated with PFN was 90 and for the patients treated with DCS was 85, which was similar to our results.

Conclusion

The results of subtrochanteric fracture fixation by intramedullary PFN or DCS were not quite different. The results of PFN group were better in terms of intra and post-operative blood loss, intra-operative time & duration of hospital stay. Both groups were not different in relation to complications, however time to full union was better in PFN cases than DCS group. PFN group also showed better Harris hip score than DCS group.

References

- Arvind S. M., Yeluri R.** Mechanical comparison of reconstruction nail, dynamic condylar screw in the treatment of unstable Subtrochanteric fracture in vitro study. *International Journal of Orthopaedics* 5.4 (2019): 646-51.
- Bedi, Asheesh, T. Toan Le.** Subtrochanteric femur fractures." *Orthopedic Clinics* 35.4 (2004): 473-83.
- Chaturvedi, Bhuvnesh S. Banerjee.** Study of internal fixation of subtrochanteric fracture of femur with dynamic hip screw, dynamic condylar screw, and proximal femoral nail." *International Journal of Scientific, Research Publications* (2015).
- Gadegone, W. M., Y. S. Salphale.** Proximal femoral nail—an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year. *International orthopaedics* 31.3 (2007); 403-08.
- Jackson, Christopher, Nabil Ebrahim, et al.** Management of subtrochanteric proximal femur fractures: a review of recent literature. *Advances in orthopedics* (2018).
- Jamil, Md Faraz, Mohd, et al.** A comparative study of Proximal Femoral Nail (P.F.N) versus Dynamic Condylar Screw (D.C.S) in management of unstable trochanteric fractures. *International Journal of Burns, Trauma* 12.3 (2022); 83.
- Kachewar, Virupaksha B., Bhaskar D Bute, et al.** Comparative study of the clinical, radiological outcome of subtrochanteric fracture femur fixed by dynamic condylar screw (D.C.S), long proximal femur nail (P.F.N). *Indian Journal of Orthopaedics*. (2020); 6.4: 311-15.
- Lundy & Douglas W.** "Subtrochanteric femoral fractures." *JAAOS-Journal of the American Academy of Orthopaedic Surgeons* 15.11 (2007); 663-71.
- Ong, Joshua, CY James R. Gill, et al.** Mobility after intertrochanteric hip fracture fixation with either a sliding hip screw or a cephalomedullary nail: Sub gathering analysis of a randomised trial of 1000 cases. *Injury* 50.10 (2019): 1709-14.
- Schulze, Christoph, Kollig E., et al.** Analysis of the Influence of Osteosynthesis Technique, Case-specific Factors on the Outcome of Subtrochanteric Fracture Treatment. *The Open Orthopaedics Journal* 14.1 (2020).
- Shukla, Sourav, Johnston, et al.** Outcome of traumatic subtrochanteric femoral fractures fixed using cephalomedullary nails. *Injury* 38.11 (2007); 1286-93.
- Vaidya, Shrinand V., Devesh B., et al.** The use of a dynamic condylar screw, biological reduction techniques for subtrochanteric femur fracture. *Injury* 34.2 (2003); 123-28.
- Wang, Jie, Xing, D., Yang, Y., et al.** Biomechanical analysis of four types of internal fixation in subtrochanteric fracture models. *Orthopedic surgery* 6.2 (2014): 128-36.