Research Article

Journal of Pain (ISSN 2996-1793)

Osteosynthesis and Reconstruction in Neglected Neck of Femur Fracture: A single-center Study and literature review.

Muhammad Waqas Khan

1st Author's Name : Nauman Hussain
Designation : Assistant Professor
Affiliation : Dow university of health sciences
Email : dr_nhrajput@hotmail.com
Contact : +923453050009

2nd Author's Name : Muhammad Waqas Khan
Designation : Postgraduate Resident
Affiliation : Dow university of health sciences
Email : muhammadwaqad343@gmail.com
Contact : 03055814216

3rd Author's Name : Syed Bilal Ali
Designation : Postgraduate Resident
Affiliation : Dow university of health sciences
Email : Syed.bilal.ali.shah331@gmail.com

4th Author's Name : Taimoor Ali
Designation : Postgraduate Resident
Affiliation : Dow University of health sciences
Email : taimur_ali18@yahoo.com

5th Author's Name : Sajjad Ahmed
Designation : Postgraduate Resident
Affiliation : Dow University of health sciences
Email : drsajjadmemon325@gmail.com

6th Author's Name : Dr. Maratib Ali
Designation : Professor of orthopaedics,Orthopedics Unit-II,
Affiliation : Dow University of health sciences
Email : azizamaratib@hotmail.com

Corresponding author

Muhammad Waqas Khan ,
Orthopedic resident, Dow University of Health Sciences (DUHS).
Phone : 03055814216
Email : muhammadwaqad343@gmail.com

Received Date: June 18, 2024
Accepted Date: June 19, 2024
Published Date: July 22, 2024

ABSTRACT

Purpose : Our study evaluates the effectiveness of our innovative treatment for neglected femoral neck fractures.
Methods : This retrospective study included 23 patients from January 2016 to March 2023, treated with our new innovative technique. Data has been extracted from the respective department, and informed consent has been obtained prior to any intervention. Radiographs, including AP and lateral radiographs and range of motion at the hip joint, were evaluated in follow-ups at different intervals. Post-operative complications and total hip arthroplasty conversions were also noted. The SPSS software version 26 was used to analyze data for this study.
Results : With a mean follow-up of 4.5 ± 1 years, the participants' ages ranged from 14 to 60 years old, with a mean age of 29.74 ± 11.47 years. The database record indicates that 20 subjects had the radiological and clinical union observed. The non-union was reported in 3 (14.2%) patients; however, only one was symptomatic. Almost 41.7% of the patients reported feeling pain occasionally after exertion. At the operated hip, all patients had excellent range of motion (ROM), primarily in the areas of hip flexion, abduction, adduction, and external rotation. Following reconstruction, the average hip Haris score was 83.46 ± 10.40 at one year. As a post-operative complication, 4 individuals (16.7%) had an infection.
Conclusion : Our unique technique has dramatically improved neglected femur neck fractures, even in young patients. It involves ORIF using three cancellous screws, non-vascularized fibular and iliac crest cancellous grafts for reconstruction, and vascularized Tensor fascia lata pedicle graft osteosynthesis.

Keywords : *Femoral fracture, Traumatic fracture, Open reduction, internal fixation, Osteotomy, Bone graft.*

INTRODUCTION

Intra-capsular femoral neck fractures are often seen in elderly adults after a low-energy trauma. Two to three percent of all femur neck fractures occur in adults under the age of fifty, and they are usually caused by high-energy trauma. Lack of knowledge, financial hardship, or a dearth of medical facilities would be the reasons for the delay in reporting the femoral neck fracture. These are also known as unresolved fractures

Journal of Pain (ISSN 2996-1793)

because the injured site begins to resorb as a result of neglect, and the growing gap brought on by severe shearing pressure complicates the fracture for the surgeon. Avascular necrosis (AVN) of the femoral head is caused by resorption of the neck, which complicates the prognosis (1, 2, 3).

Closed reduction becomes problematic over time due to the accumulation of fibrous tissues, while open reduction is no longer feasible if the delay exceeds three months. Older patients who receive open reduction and internal fixation of these fractures have a poorer prognosis than younger patients because of the increased risk of nonunion and avascular necrosis. Out of six patients who had primary surgery in adults and had an untreated dislocation for more than three months, only four had good results (4, 5, 6). The intracapsular placement of these fractures, the intense muscle strains across the hip joint, the flow of synovial fluid, and osteoporosis with widespread trabecular atrophy of the femoral neck all contribute to the difficulty of fracture healing. The abductors atrophy as a consequence of surgical postponement (7, 8).

Before attempting the surgery, the surgeon must consider the fracture's location and extent, its displacement, and the hip's stability and capacity to reduce. Its complexity has made its treatment so controversial because there is no agreement on the surgical approach (2, 9, 10). Considering disagreements around surgical treatments, the fundamental concept of optimal care is well understood. The foundation for treating these fractures is an emergency closed reduction of the hip, which is followed by final treatment using either an open reduction method or a closed approach, with the aim of anatomical fracture reduction and joint restoration (9, 10).

Such fractures may be treated with internal fixation alone, in conjunction with osteotomy or vascularized or a-vascularized bone grafting. In these cases, cannulated or cancellous screws are the most typical internal fixation. Various surgeons have employed internal fixation using screws and bone grafts with variable degrees of success. Fibular bone graft is more successful in these cases as it inhibits subchondral collapse and serves as a re-vascularization pathway (11).

In this research, 23 patients who had internal fixation osteotomy with bone grafting for ignored neck femur fractures had their postoperative assessment of fracture union retrospectively analyzed.

METHODS

From January 2016 to March 2023, this retrospective research was carried out at the Civil Hospital Karachi's orthopedic department. In order to treat neglected femur neck fracture, osteosynthesis and reconstruction were performed on 23 individuals in this research. MRI patients with early AVN alterations and those who reported to the clinic after three weeks with a displaced, neglected femoral neck fracture were included in the research. Patients who were unable to comprehend the post-operative programmed, had pathological fractures, or were bedridden as a result of other medical issues were not included in the research. Before any data was collected, all patients gave their permission, and the research was carried out in accordance with the Declaration of Helsinki. Data extraction was permitted by the relevant department, and the department and institution gave their ethical approval.

Surgical technique (figure 2 and 3)

A unique and innovative technique called **Nauman's combo** construct is used to treat neglected non-union neck of femur fractures. This technique involves a combination of different procedures, including fixation of the non-union neck of the femur using cannulated screws, placement of a strut fibular graft for femoral neck reconstruction, and the use of cancellous iliac graft to fill the gap at the non-union site. Additionally, a vascularized tensor fascia lata pedicle graft from the iliac crest is harvested to augment osteosynthesis.

The patient was positioned supine and accessed the fracture site using the extended Smith Peterson approach, with a T-shaped incision used to open the capsule (Figure 2A & B). The bone edges at the fracture site were refreshed, and the fracture was stabilized with three wires passed through a lateral incision. A fibular strut graft was taken from the ipsilateral leg, about 8cm away (as indicated in Figure 2C). Using a DHS reamer, along the inferior wire, a gap was made that extended from the proximal femur to the head of the femur. The fibular graft was then pushed into the created space to achieve the desired length and provide additional bony stability. The non-union fracture was fixed using three cannulated screws that were passed over the K-wires.

The cortico-cancellous iliac graft was taken along the tensor fascia lata attachment over the crest and then mobilized the fascia to get some length to bring it down at the constructing site along with the muscle pedicle. The cancellous chip graft was harvested for the ilium's inner cortex to fill the construct gap. A small part of the anterior femoral head, ranging from 5mm to 10mm, was chiseled off in all 23 cases to adapt the pedicle graft across the neck appropriately. It was then fixed with 4mm screws. The capsule was ensured to cover the neck adequately, and the wound was closed over a drain.

A de-rotation boot was applied for 3 weeks. Partial weight-bearing started in the 6th week, followed by full weight-bearing in the 12th week. All patients received routine follow-up, including radiographs at 6 weeks (Figure 3), 3 months, 6 months, 1 year, and 3 years.

Journal of Pain (ISSN 2996-1793)

Figure 2

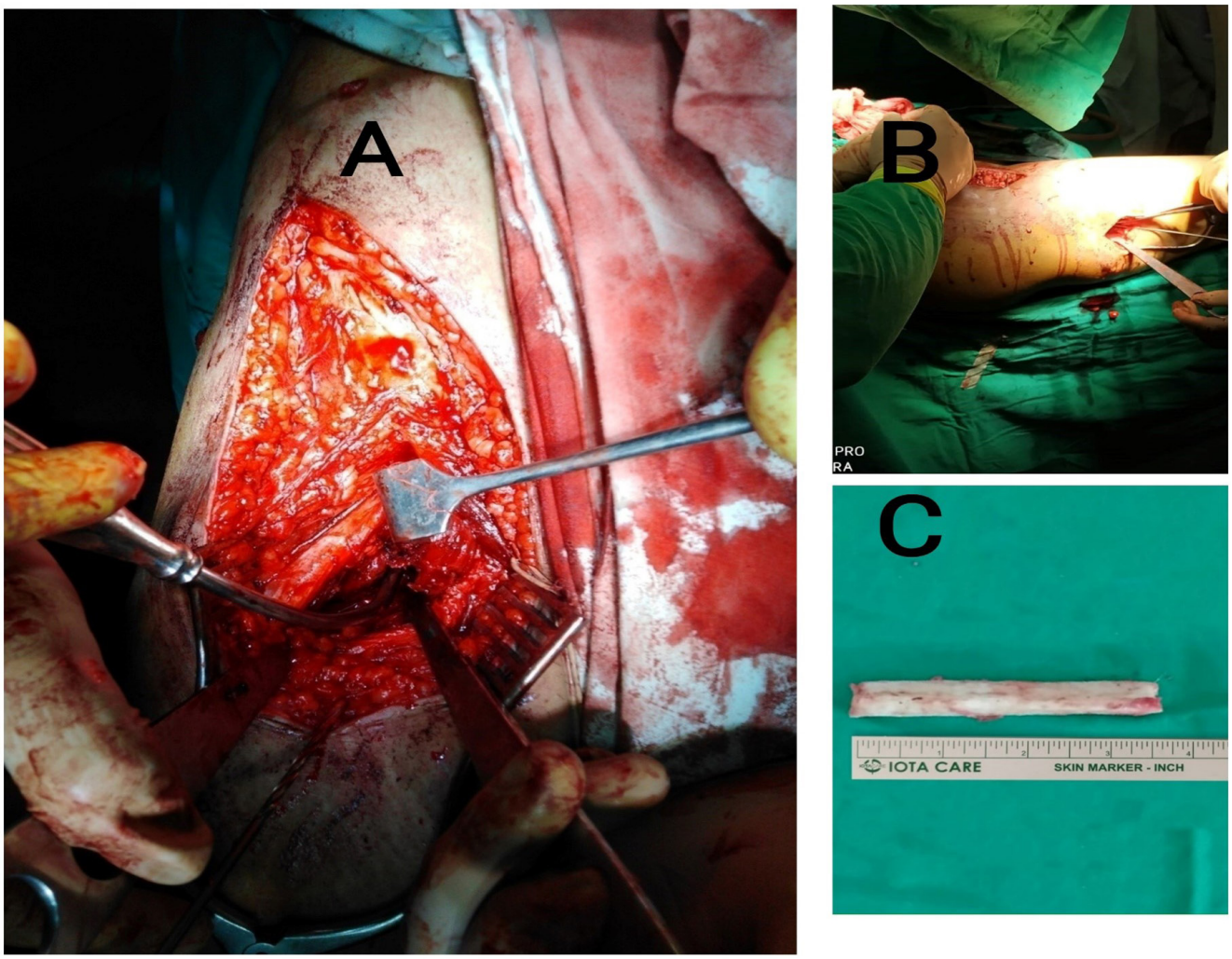


Figure.2. (A, B). Fracture site was approached after giving a T-shaped incision over the capsule (C). The fibular strut graft harvested approximately 8cm from ipsilateral leg

Journal of Pain (ISSN 2996-1793)

Figure 3

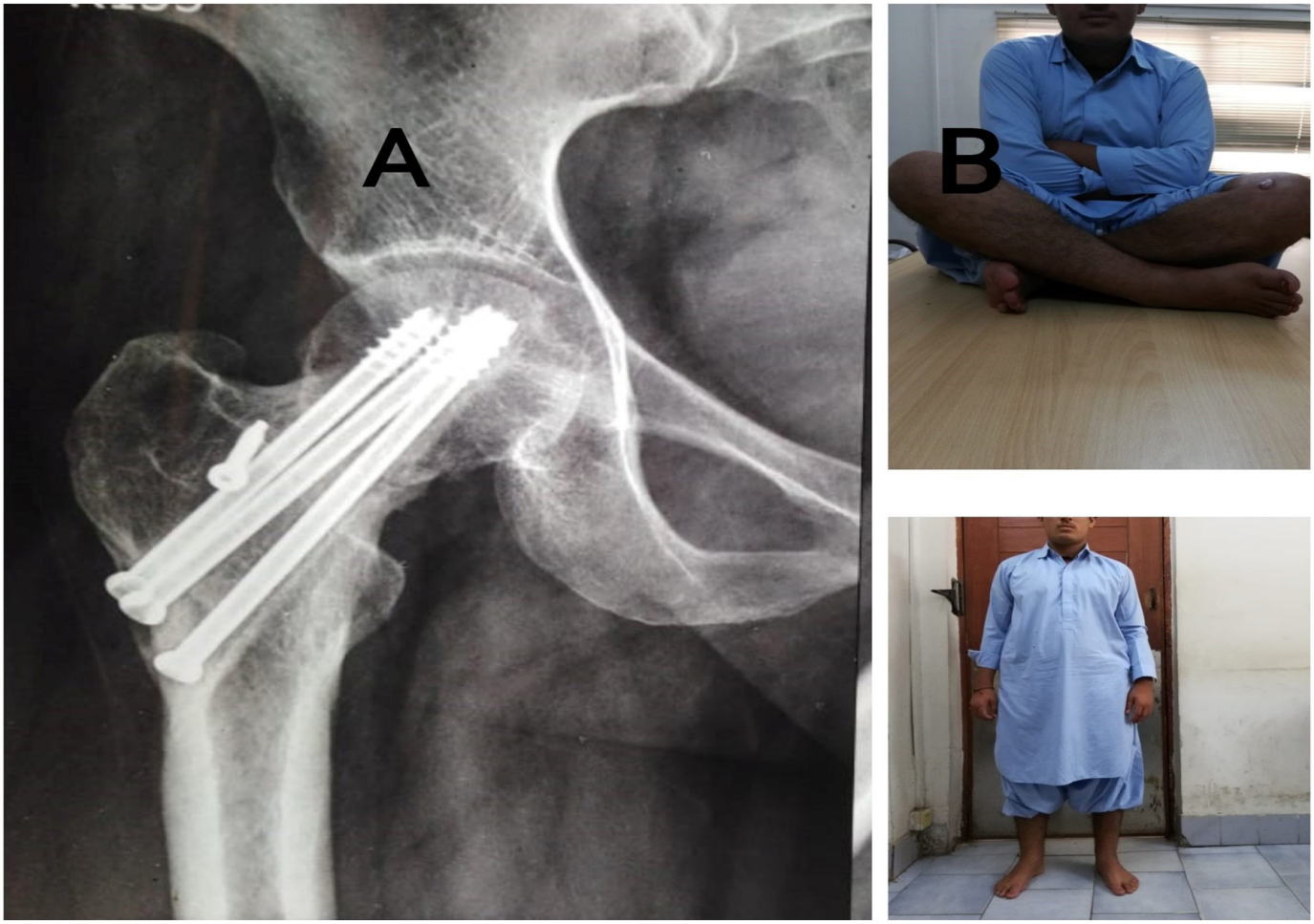


Figure 3: A showing postoperative Xray with Cannulated screw in situ , B denotes patient follow-up in standing and cross leg positions.

Outcome measures

Every patient's demographic data was gathered from the corresponding departments. To determine the degree of neck resorption, anteroposterior (AP) hip radiographs with an internal rotation of 15° were taken for each patient. At every follow-up, AP and lateral radiographs were also obtained to assess fracture union after repair. All patients had pre-operative X-rays taken in order to determine any union and deformity (see Figure 1). Radiological and clinical outcomes were evaluated after surgery. The range of motion at the hip joint was assessed, and the Haris Hip score was used to evaluate functional outcomes. Information regarding the year of surgery, fracture union, leg length discrepancy, and pain intensity were reported. Daily live activities such as distance walking, shoe and sock donning and doffing, use of public transport, walking with support, limping, stair climbing, and sitting, were also reported. Conversion to total hip arthroplasty and any other post-operative complications were noted.

Journal of Pain (ISSN 2996-1793)

Figure 1

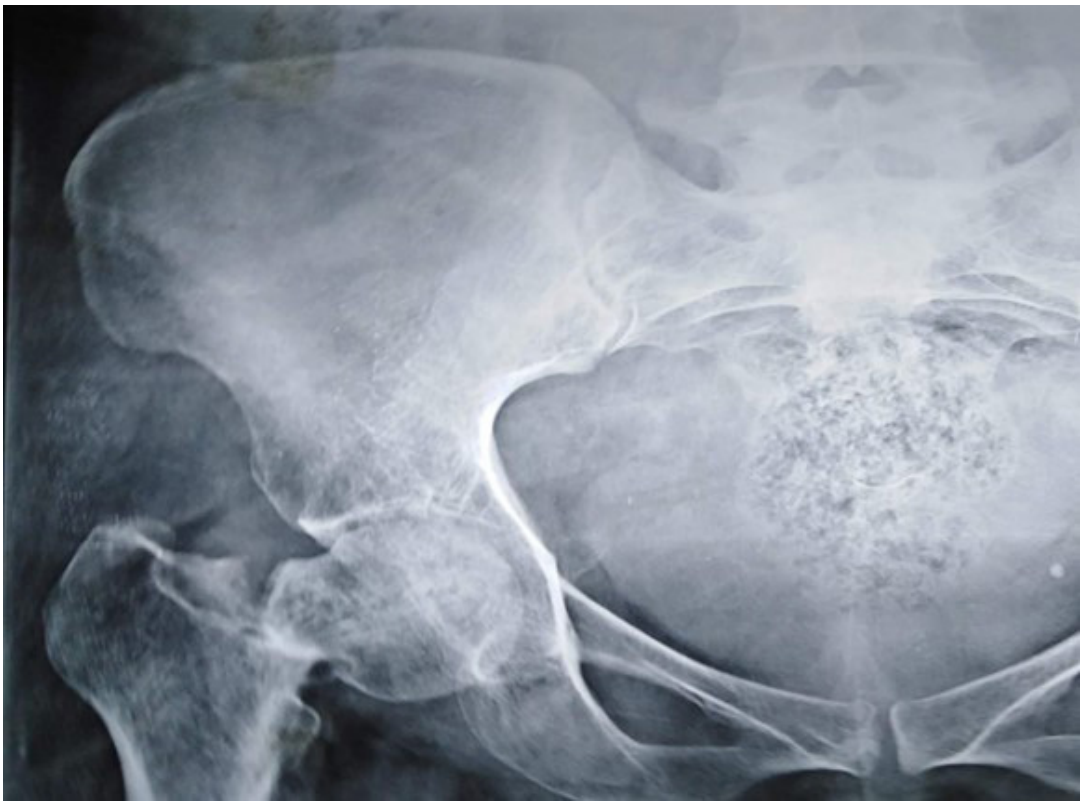


Figure.1. Pre-operative right radiograph of 32 years old male patient, presented after 6 weeks of neglected neck of the femur fracture.

Data analysis

The SPSS, version 26, was used to analyses the data for this investigation. To summarize the findings, descriptive statistics were used, which included determining the frequencies and percentages of all categorical variables, including everyday life activities. For numeric data, estimates of the mean and standard deviation were made.

RESULTS

A total of 23 patients were included in this retrospective study; however, two patients' data were missing, therefore their inclusion in the final analysis was not possible. With a mean follow-up time of 4.5 ± 1 years, the average age of all participants was 29.74 ± 11.47 years (range: 14 to 60 years). Almost 58% of the patients underwent three years of monitoring after surgery. The leg length disparity (LLD) after surgery was 2.08 ± 0.36 cm, and the average duration of stay in the hospital was 5 ± 2 days (Table 1).

Table 1

		Age	Year of Surgery	hospital stay	nonunion both radiological and clinical	Shortening(cms)
N	Valid	23	23	23	23	23
	missing	1	1	1	1	1
Mean		29.74	4.57	5.48	13	2.0870
std.Deviation		11.474	843	1.974	344	36718
Range		46	4	8	1	1.40
minimum		14	2	3	0	1.40
maximum		60	6	11	1	2.80

Table 1: showing range average of age, surgery years, hospital stay, radiological and clinical union and shortening.

Journal of Pain (ISSN 2996-1793)

According to the data, the radiological and clinical union was observed in 20 participants, as presented in Figure 3. The remaining 3 (14.2%) patients had non-union, but only one of them was symptomatic. Almost 41.7% of the patients reported occasional pain after exertional activities. Most (70.8%) of the patients could quickly put on and remove their shoes and socks. After surgery, all patients could walk without any supportive device, but 25% needed a cane or stick for long walks. Three (12.5%) patients were able to walk unlimited distances without any difficulty, while most of them (62.5%) could walk up to six blocks (30 minutes). Almost 54.2% of them could sit on a high chair for 30 minutes, and 41.7% of the patients could climb stairs without the support of a railing. Most patients (54.2%) had a slight limp while walking due to LLD (Table 2).

Table 2

Variables	Frequencies (n)/ Mean (SD)	Percentages (%)
Non-union	3	12.5%
Pain		
No pain	5	20.8
Occasionally	10	41.7
Mild pain some times	6	25.0
Putting shoes/ socks		
With ease	17	70.8
With difficulty	4	16.7
Distance walked		
Unlimited	3	12.5
Six- blocks (30 minutes)	15	62.5
Two-three blocks (10 to 15 minutes)	3	12.5
Stairs climbing		
Normally without using a railing	10	41.7
Normally with using a railing	11	45.8
Sitting		
Comfortably, ordinary chair for one hour	8	33.3
On a high chair for 30 minutes	13	54.2
Support during walking		
None	15	62.5
Cane/Walking stick for long walk	6	25.0
Limp		
None	8	33.3
Slight	13	54.2

Table 2. Post-operative characteristics of study participants

All patients were successful in achieving a satisfactory range of motion (ROM) in the hip joint, including adequate external rotation, flexion, abduction, and adduction. Flexion, abduction, adduction, and external rotation had respective mean ranges of 45–110°, 5–20°, 5–15°, and 5–15°. The functional outcomes of the patients are presented in Figure 5. The mean hip Haris score was 83.46 ± 10.40 one year after reconstruction (Table 3). Four (16.7%) patients had an infection as a postoperative complication. Two responded well to oral antibiotics; one patient required debridement and wash, and the metal was removed from another patient.

Journal of Pain (ISSN 2996-1793)

Table 3

		Total degree of Flexion	Total degree of Abduction	Total degree of Ext rotation	Total degree of Adduction	HHS
N	Valid	21	21	21	21	21
	missing	3	3	3	3	3
Mean		2.95	1.14	.86	.81	83.4695
std.Deviation		1.687	.478	.359	.402	10.40384
Range		6	2	1	1	36.99
minimum		0	0	0	0	61.01
maximum		6	2	1	1	98.00

Table 3: showing ROM in flexion, abduction, external rotation and adduction and HHS postoperatively.

DISCUSSION

Femur neck fracture is still an issue of concern as its management ways are controversial. The prevalence of nonunion and avascular necrosis of the head of the femur is directly related to delayed treatment. Surgery can be challenging while treating a fractured femoral neck that is not united (12). The current study has presented postoperative complications in 23 patients with unilateral neck of the femur fracture treated with internal fixation osteotomy with bone grafting. 87.5 % of participants have experienced clinical and radiological union. All of the patients were able to walk without any supporting device. All patients achieved a good range of motion (ROM), mainly hip flexion, abduction, adduction, and external rotation at the operated hip. The mean flexion, abduction, adduction, and external rotation range was 45- 110°, 5-20°, 5-15°, and 5-15° respectively. Infection was reported in 16.7 % of patients as a postoperative complication.

Neglected fractures of the neck of the femur are very uncommon, and few reports have been present in the literature. A study by Kumar and Jain neglected posterior hip dislocation due to high-energy trauma treated by skeletal traction, followed by open reduction in 18 adolescents. The results indicated successful management in 17 children despite the presence of varying degrees of AVN (13). Alva et al. and Kumar et al. had successfully treated cases of a 5-month-old and 2-year-old hip dislocation through modified girdle stone operation and Total hip arthroplasty (THA) with subtrochanteric osteotomy, respectively. A satisfactory prognosis has been observed with stability in a range of motion (5, 14). In the published literature, various therapeutic approaches have been discussed for young adults with neglected fractures of the neck of the femur to maintain the natural femoral head. The most common are internal fixation, osteotomy, and bone grafting alone. Internal fixation alone has a very significant failure probability when the femoral fracture neck is more than 3 weeks old. When a patient is younger than 50 (or 55), it is preferable to retain the joint. Therefore, internal fixation must be supplemented with some sort of bone transplant or osteotomy (7, 15).

Osteotomies have been employed to modify the biomechanics at the fracture site and encourage healing. Numerous osteotomy forms, including medial displacement osteotomies (mentioned by McMurrays) and angulation osteotomies, have been discussed in the literature (16, 17). However, the accompanying issues with osteotomy include shortening, limping, a reduced range of rotation, an increased risk of AVN, and a possible risk of nonunion. In a case series conducted by Stewart and Wells, an increased rate of nonunion (46%) has been observed after management done with osteotomy and internal fixation (18). Out of a total of 28 cases, Lifeso and Young reported 3 non-unions and 2 osteonecrosis, which indicated the difficulty in managing nonunion in young adults (19).

These fractures are treated with a variety of vascularized and non-vascularized bone grafts, such as free fibular strut grafts, Phemister-type cortical tibial grafts, and muscle and vascular pedicle grafts. A case study with thirty-two patients treated with muscle pedicle graft and internal fixation was carried out by Meyers et al. The findings showed that 40% of delayed and ignored neck of femur fractures did not heal (20). Free fibular grafting has received a lot of interest as an option to treat a neglected femoral neck fracture by providing foundational assistance and encouraging osteogenesis. According to Roshan and Ram, this procedure provided nonunion results in between 0 – 17 % and AVN rates in between 0 – 33 % (21) (Table 4).

The study has its limitations. Since this was a retrospective study, some patient data may have been lost. Also, due to the

Journal of Pain (ISSN 2996-1793)

small sample size, it is difficult to draw general conclusions from the study. Nevertheless, we recommend conducting future multi-centre prospective experimental studies with larger sample size and long-term follow-ups on similar surgical techniques to explore long-term complications and functional outcomes. Our study can serve as a framework for these upcoming experimental studies.

Journal	Year	Author	Type of Study	Number of patients	Average age	Investigation	Classification	Technique	Follow up	Time of Union	Mean neglect	Functional Result
Clinical Orthopaedics and Related Research (9)	2005	Kumar et al	Prospective	18	7.4	Radiograph	Thompson and Epstein Type I posterior dislocation of hip	Proximal tibial traction plus Open reduction was done through a standard lateral approach	25 months	-	15.6 weeks	Excellent [According to Garrett et al (22)]
BMJ Case reports (14)	2013	Alva et al	Prospective	1	25	Radiograph	Not mentioned	Modified girdlestone arthroplasty with subcapital osteotomy	36 months		5 months	Satisfactory range of motion with 20 degrees of flexion and 30 degrees of internal and external rotation
Strategies in Trauma and Limb Reconstruction (11)	2017	Kumar et al	Prospective	1	31	Radiograph	Not mentioned	THR with a constrained acetabular insert for stability was performed	Not mentioned		2 years (including two failed attempts of an open and a closed reduction)	HHS score improved from 48 (preo peratively) to 81 (posto peratively)
Journal of Orthopaedic Trauma (17)	1990	Lifeso and Younge	Retrospective	54	47	Tomograms and Fluoroscopy	Anatomic site (Femoral neck, intertrochanteric, or sub trochanteric) and Clinical problem (nonunion or malunion)	Total hip arthroplasty, Internal fixation, and Osteotomy	35 months		2 years	Good in 68 % patients

Table. 4. Comparison of our study with other surgical procedures for neglected neck of femur fractures

CONCLUSION

Early treatment is crucial for a femur neck fracture. Delayed treatment may result in avascular necrosis and joint arthritis. Neglected femoral fractures are challenging to manage for surgeons. Although various techniques have been discussed in the literature, each method has its drawbacks. Several factors, such as age, displacement, and timing, can affect the prognosis of the management. Our innovative technique does anatomical fixation without any osteotomy and produced a better prognosis for neglected femoral fractures, even in young patients.

Journal of Pain (ISSN 2996-1793)

Declaration

Patient consent for publication

Informed consent was obtained from all individual participants included in the study.

Ethics approval

Institute approval taken.

Authors contribution:

The following contributions to the work are confirmed by the authors: NH and MWK conceptualized and designed the research; TA and SA collected the data; SBA and MWK analyzed and interpreted the findings; and NH and MWK prepared the draft paper. After reviewing the findings, all authors gave their approval to the manuscript's final draft.

Acknowledgement: None.

Availability of data and materials: All data were obtained from the Orthopedic Surgery Department of Dr. Ruth K. M. Pfau Civil Hospital Karachi, Pakistan.

Funding disclosure statement: No funds taken.

Competing interests: None of the authors have any competing interests.

REFERENCES

1. Sen RK, Tripathy SK, Goyal T, Aggarwal S, Kashyap S, Purudappa PP, et al. Complications and functional outcome of femoral head fracture-dislocation in delayed and neglected cases. Indian Journal of Orthopaedics. 2021;55:595-605.

2. Sen R, Tripathy S. ECAB Difficult Hip Fracture. 2014.

3. Bhuyan BK. Augmented osteosynthesis with tensor fascia latae muscle pedicle bone grafting in neglected femoral neck fracture. Indian Journal of Orthopaedics. 2012;46:439-46.

4. Rahman M. Outcome of Hemi Arthroplasty Using Cemented Bipolar Prosthesis in Neglected Fracture Neck of Femur in Elderly: A Study of 1156 Cases. Saudi J Biomed Res. 2021;6(5):123-8.

5. Kumar S, Dahuja A, Narula M, Garg S, Kaur R. Neglected hip dislocation: an unusual presentation, its management and review of the literature. Strategies in Trauma and Limb Reconstruction. 2017;12(3):189-92.

6. Jain M, Swaroop S, Doki SK. Neglected posterior hip dislocation in adults presenting after one year managed successfully with single stage Total hip arthroplasty: a case series. Journal of Orthopaedic Case Reports. 2021;11(6):84.

7. Jaiswal A, Pruthi K, Goyal R, Pathak V, Habib M, Tanwar YS, et al. Evaluation of osteosynthesis with dual fibular bone grafting for neglected femoral neck fractures. journal of clinical orthopaedics and trauma. 2013;4(2):58-69.

8. Singh A, Kumar P, Singh S, Singh RN, Telagareddy K. Primary complex total hip arthroplasty in neglected anterior hip dislocation with comminuted pertrochanteric femur fracture. Arthroplasty Today. 2021;10:63-7.

9. Giordano V, Giordano M, Glória RC, de Souza FS, di Tullio P, Lages MM, et al. General principles for treatment of femoral head fractures. Journal of clinical orthopaedics and trauma. 2019;10(1):155-60.

10. Ross JR, Gardner MJ. Femoral head fractures. Current reviews in musculoskeletal medicine. 2012;5:199-205.

11. Jaiswal A, Pruthi KK, Goyal RK, Pathak V, Habib M, Tanwar YS, et al. Evaluation of osteosynthesis with dual fibular bone grafting for neglected femoral neck fractures. J Clin Orthop Trauma. 2013;4(2):58-69.

12. Bhuyan BK. Augmented osteosynthesis with tensor fascia latae muscle pedicle bone grafting in neglected femoral neck fracture. Indian J Orthop. 2012;46(4):439-46.

13. Kumar S, Jain AK. Neglected traumatic hip dislocation in children. Clinical Orthopaedics and Related Research (1976-2007). 2005;431:9-13.

14. Alva A, Shetty M, Kumar V. Old unreduced traumatic anterior dislocation of the hip. Case Reports. 2013;2013:bcr2012008068.

15. Singh D, Sharma C, Bansal M, Meena D, Asat R, Joshi N. Ununited fracture neck of femur treated with closed reduction and internal fixation with cancellous screw and fibular strut graft. Indian J Orthop. 2006;40:90-3.

16. Kalra M, Anand S. Valgus intertrochanteric osteotomy for neglected femoral neck fractures in young adults. International orthopaedics. 2001;25:363-6.

17. Vaishya R, Vaish A, Ansari AH. Challenges in total hip replacement after McMurray's osteotomy: a report of 3 cases and review of literature. Clinics in Orthopedic Surgery. 2020;12(4):442.

18. Stewart MJ, Wells R. Osteotomy and osteotomy

Journal of Pain (ISSN 2996-1793)

combined with bone-grafting for non-union following fracture of the femoral neck. JBJS. 1956;38(1):33-49.

19. Lifeso R, Younge D. The neglected hip fracture. Journal of orthopaedic trauma. 1990;4(3):287-92.

20. Meyers MH, Harvey Jr JP, Moore TM. Delayed treatment of subcapital and transcervical fractures of the neck of the femur with internal fixation and a muscle pedicle bone graft. Orthopedic Clinics of North America. 1974;5(4):743-56.

21. Roshan A, Ram S. The neglected femoral neck fracture in young adults: review of a challenging problem. Clinical medicine & research. 2008;6(1):33-9.

22. Garrett JC, Epstein H, Harris W, Harvey Jr J, Nickel V. Treatment of unreduced traumatic posterior dislocations of the hip. JBJS. 1979;61(1):2-6.