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Rehabilitation of a 75 year old female with Boyd and Griffin type 3 intertrochanteric fracture left side due to slip and fall along with right knee flexion deformity: A case report

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ABSTRACT

Intertrochanteric (IT) fractures are one of the most frequently encountered fractures in geriatric osteoporotic patients, and they are usually caused by trivial trauma such as a slip and fall. These fractures result in significant decrease in functional independence. Therefore, early physiotherapy rehabilitation post-operatively is crucial in regaining functional independence in ADLs. We present the case of a 75 year old female, who sustained injury to the left hip after experiencing slip and fall at home. Her relatives took her to the orthopaedics department of a tertiary care rural hospital, citing pain and swelling in her left hip as the main concerns. After investigations, patient was diagnosed with Boyd and Griffin type 3 IT femur fracture which was surgically managed by Open Reduction and Internal Fixation (ORIF) with Dynamic Hip Screw (DHS). Patient also had Fixed Flexion Deformity (FFD) over right knee. Post-operatively physiotherapy rehabilitation was initiated with the aim of restoring mobility, improving range of motion and muscle strength as well as reducing Flexion Deformity (FD) of right knee as much as possible. Patients endure secondary impairments such as diminished mobility, strength, and endurance, as well as increasing functional reliance, despite the fact that these fractures are effectively managed surgically. This case demonstrated that Physiotherapy rehabilitation as an adjunct to surgical management plays an important role in preventing secondary impairments and thus enhancing recovery.

Keywords: Intertrochanteric fracture, dynamic hip screw, knee flexion deformity, physiotherapy rehabilitation.

1. INTRODUCTION

The increase in the average longevity of the elderly, combined with comorbidities such as decline in muscle strength, balance, and Bone Mineral

Density (BMD), culminating to osteopenia and osteoporosis, has caused an increase in trauma cases and consequently, fractures (Woo et al., 2007; Carneiro et al., 2013). IT fractures are most commonly seen fractures in geriatric population. By 2040, the frequency of the same is expected to double owing to a rise in the number of elderly osteoporotic patients (Sonawane, 2015). IT fractures are proximal femoral extracapsular fractures that occur between the Greater Trochanter (GT) and the Lesser Trochanter (LT). Between the GT and LT, this section of the femur is composed of thick trabecular bone. A thick bone wall that runs vertically from the posteromedial aspect of the femur shaft to the posterior region of the femoral neck is known as the calcar femorale. This structure is significant because it influences the stability of a fracture. The broad metaphyseal region has a relatively abundant blood supply, which contributes to a higher union rate and less osteonecrosis (Attum and Pilson, 2022).

As internal and external rotators are attached distally and proximally to the head and neck fragments, respectively, they may produce displacement following an IT fracture. The most prevalent cause of this fracture is a fall involving directly and indirectly acting stresses. Directly acting stresses act on the GT or along the femur axis. Indirect forces such as the iliopsoas pulling on the LT or the abductors pulling on the GT (Eiff and Hatch, 2012). These fractures are relatively frequent in elderly individuals, especially those over the age of 65, when there is a considerable loss of bone mass. Females are two to three times more likely than males to suffer from these fractures (Zayda et al., 2018). Bone fragility owing to osteoporosis and senile muscular insufficiency are the main pathologic causes of fractures in elderly people who suffer from low-energy trauma such as simple falls (Uttamchandani et al., 2021).

This fractures can be managed conservatively with traction or surgically with ORIF with nails or plates (such as DHS or proximal femoral nail), calcar replacement, or external fixation (Zayda et al., 2018). Steady fixation and incipient mobility with full weight bearing are the most important aspects of surgical treatment. As per current literature, the DHS is a secure, satisfactory, and dependable fixation method for IT fractures (Uttamchandani et al., 2021). It has the advantage of allowing for dynamic interfragmentary compression while also being less expensive than intramedullary implants (Attum and Pilson, 2022). After fracture fixation, physiotherapy is critical because it emphasizes on early mobilisation, gait training, and other treatment strategies to maintain or repair any potential impairments.

Boyd and Griffin type 3 IT fractures are characterized by extension to or are distal to the LT. Their clinical importance is that they are typically more difficult to treat and cause more difficulties during surgery and recovery (Sonawane, 2015). Knee flexion contracture, or FD, is defined as knee's inability to completely lengthen to zero degrees, either actively or passively. Various factors contribute to the inability to fully extend knee joint, viz – "bone impingement, posterior capsular contracture, hamstring shortening, and ligament contracture." The quadriceps are required to constantly contract to avoid buckling consequently due to a FFD of the knee, resulting in increased energy expenditure and fatigue (PSE, 2012). As a result, increased forces at the patellofemoral and tibiofemoral joints influence knee biomechanics (Khatri et al., 2020). As a result, there is an increase in energy consumption in daily activities such as standing, walking, and stair-climbing, as well as a decrease in endurance. The aberrant forces on the other knee are increased by FD at one knee, leg length discrepancy, and short stride length, resulting in abnormal gait and an increase in extension and adduction in the contralateral limb (PSE, 2012; Khatri et al., 2020). As a result, it is critical to fix this deformity. The goal of this report is to portray physiotherapy management following surgical fixation of an IT fracture on the right side in conjunction with a decrease in knee FD.

2. PATIENT INFORMATION

A 75 year old female suffered a slip and fall at home on January 6, 2022, injuring her left hip, which was followed by pain and swelling. On 13th, patient presented to orthopaedic department of tertiary care rural hospital with the chief complaints of pain and swelling at left hip. As narrated by herself, pain was sudden in onset and gradually increasing in nature. Pain was localised to hip and upper thigh left side and was sharp in nature. She experienced difficulty in weight bearing over the left limb immediately after the incident. Pain aggravated with movement and relieved by medication and traction. A pelvic X-ray including bilateral hips was taken, which revealed a Boyd and Griffin type 3 intertrochanteric femur fractures on the left side. Patient was primarily managed by below knee skin traction with 3 kg weight. ORIF of femur was done with DHS under spinal plus epidural anesthesia on 19th. Pre operative reduction was achieved under c arm guidance. Guide wire was inserted in head of femur centrally and inferiorly. Following surgery, physiotherapy rehabilitation was started. Pain and stiffness over operated region were the patient's main complaints post-operatively. Pain was dull in character with an intensity of 7/10 on NPRS at rest and 8/10 while moving slightly.

3. CLINICAL FINDINGS

Physical examination was carried out after taking consent from the patient. On general examination, patient was awake, co-operative and oriented. Vitals were stable. Patient was examined in supine position. On inspection left leg, left hip was externally rotated and ankle was plantarflexed. On palpation, hip Range of motion (ROM) was painful and grossly restricted. Knee ROM was painful and restricted. Patella was not freely mobile and was adherent. Ankle ROM was painless and restricted. Leg length discrepancy was noted. Right lower limb shortening of 1 cm is present. Pre rehabilitation ROM is given in Table 1. Pre rehabilitation Resisted Isometric Contraction (RIC) is given in Table 2. Pre rehabilitation Manual Muscle Testing (MMT) is given in Table 3.

Table 1 ROM assessment pre intervention

Joint	Left Active	Left Passive	Right Active	Right Passive
Hip				
Flexion	0-5°	0-10°	0-110°	0-110°
Extension	0-10°	0-15°	0-20°	0-25°
Knee				
Flexion	0-40°	0-50°	0-120°	0-120°
Extension	40-0°	50-0°	120-95°	120-95°
Ankle				
Plantarflexion	0-20°	0-20°	0-35°	0-35°
Dorsiflexion	0-10°	0-10°	0-10°	0-15°

Table 2 RIC pre intervention

RIC		
Muscles	Left	Right
Hip		
Flexors	Weak and painful	Strong and pain-free
Extensors	Weak and painful	Strong and pain-free
Knee		
Flexors	Weak and painful	[Not Assessed (NA)]
Extensors	Weak and painful	NA
Ankle		
Plantarflexors	Strong and pain-free	Strong and pain-free
Dorsiflexors	Strong and pain-free	Strong and pain-free

Table 3 MMT pre intervention

Muscle Strength Testing		
Muscles	Left	Right
Hip		
Flexors	1/5	3/5
Extensors	1/5	3/5
Knee		
Flexors	1/5	NA
Extensors	1/5	NA
Ankle		
Plantarflexors	2/5	3/5
Dorsiflexors	2/5	3/5

Diagnostic Assessment

Pelvic X-ray (Fig 1.) including bilateral hips was done which was suggestive of Boyd and Griffin type 3 intertrochanteric femur fracture left side and (Fig 2.) is the post operative Xray showing DHS in situ.

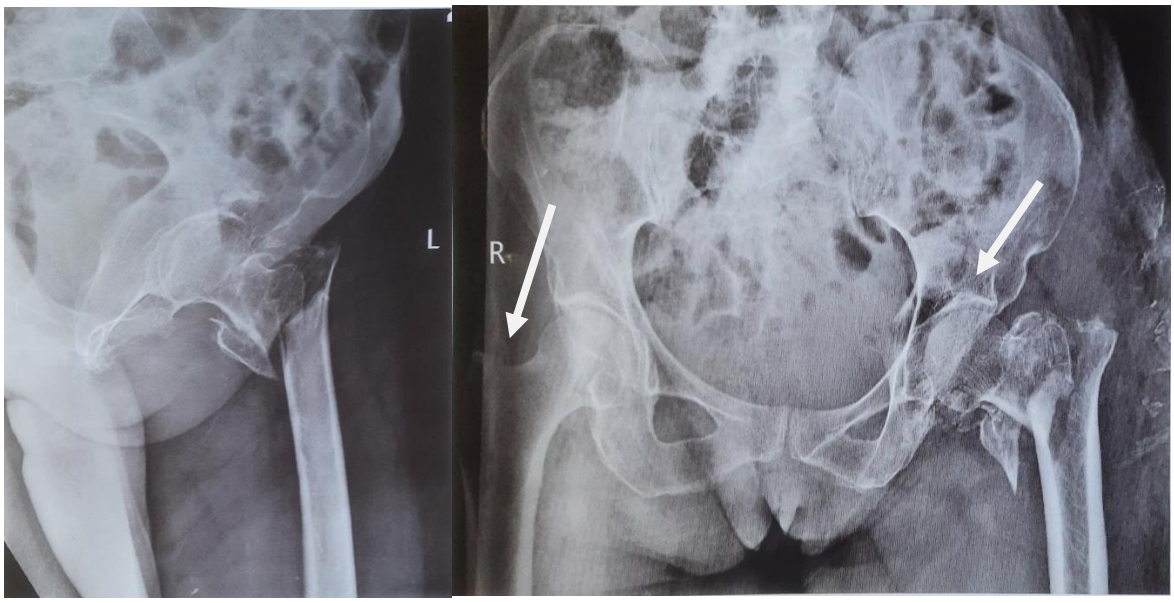

Figure 1 Pre-operative X-ray of Boyd and Griffin type 3 intertrochanteric femur fracture left side.

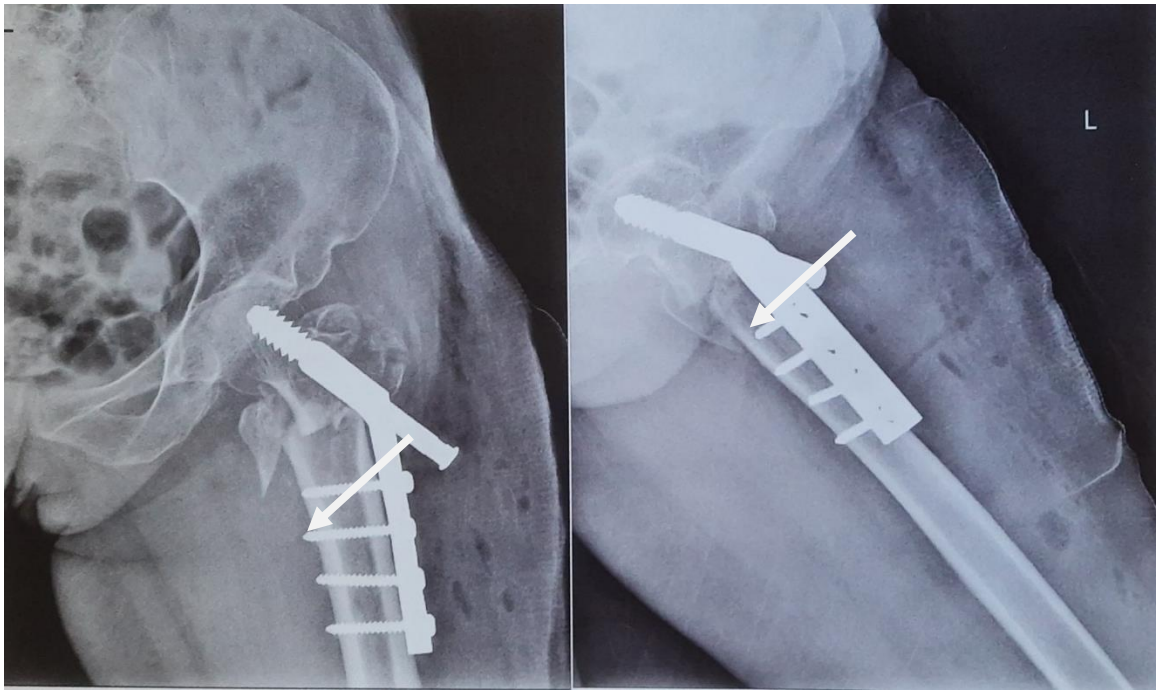

Figure 2 Post operative X-ray showing DHS in situ

Therapeutic intervention

Physiotherapy is critical in the post-operative phase for preventing or alleviating pain and swelling at the operated site, stiffness, movement restriction, and dependency in ADLs. Treatment given to the patient and the rationale for the same is given in Table 4. Phase wise treatment protocol along with repetitions, sets, hold and duration is given in Table 5 - 8.

Table 4 Treatment and rationale

TREATMENT	RATIONALE
Patient Education	To prevent anxiety and to ensure adherence to the prescribed physiotherapy protocol.
Cryotherapy and or Hot pack	To reduce pain and swelling around operated site.
[Bilateral (B/l)] [Ankle Toe	To maintain proper blood circulation in the

Movements (ATM)]	lower limb
ROM exercises for B/l [Upper Extremity (UE)] and [Lower Extremity (LE)]	To restore ROM back to normal or at least the functional range as well as to maintain available range
Isometrics Exercise	To initiate muscle contraction.
Strengthening of B/l UE with weight cuff	To ensure adequate strength of UE for gait training
Log rolling towards unaffected side	To prevent pressure sores and to facilitate in bed mobility
Unilateral pelvic bridging	To strengthen the back and hip extensors
[Straight Leg Raise (SLR)] B/l	To maintain the available range of hip flexion and knee extension and strengthen quadriceps
Dynamic Quads B/l	To maintain the available range of knee extension and strengthen quadriceps
Passive stretches for right side hamstrings and quadriceps	To reduce right knee FD
[Continuous Passive Motion (CPM)]	To improve ROM
Bed side sitting	To maintain sitting balance
Wheelchair mobilization	To aid early gait training and make patient independent
Sit to stand with walker	To improve knee mobility and strengthen quadriceps and glutei
Walking with [Full Weight Bearing (FWB)] on affected LE with walker	To reinforce the normal gait style and initiate ambulation.

Table 5 Phase 1 (Day 1 to week 2) treatment protocol

Treatment	Repetition
Patient Education The patient and relatives were educated about her current condition, the importance of following the prescribed exercise protocols, the importance of exercise adherence, and how to practice the given exercise protocol, including their repetitions, sets, and durations, with detailed description and illustrations.	
Cryotherapy	8 to 10 min, 3 times a day
B/l ATM (Fig.3)	10 [Repetitions (Reps)] 1 set 2-3 times a day
[Passive Range of Motion (PROM)] exercises for affected LE	10 Reps 1 set 2-3 times a day
Heel slides (Right side)	10 Reps 1 set 2-3 times a day
Isometrics B/l for glutei, hamstring, and quadriceps muscle	10 Reps, 5 second hold, 2 set, 2 -3 times a day
SLR (Right side) (Fig.4)	10 Reps 1 set 2-3 times a day
Passive stretches for right side hamstrings and quadriceps	10 Reps, 5 second hold 2 -3 times a day

AROM exercises with wand for B/l UE	10 Reps 1 set 2-3 times a day
Log rolling towards unaffected side	2-3 Reps, 10 sec hold, 2- 3 times a day.

Table 6 Phase 2 (Week 2 to 4) treatment protocol

Treatment	Repetition
Cryotherapy	8 to 10 min, 3 times a day
B/l ATM	10 Reps 2 set 2-3 times a day
[Active Assisted Range of Motion (AAROM)] exercises for affected LE	10 Reps 1 set 2-3 times a day
Heel slides B/l	10 Reps 1 set 2-3 times a day
Isometrics B/l for glutei, hamstring, and quadriceps muscle	10 Reps, 10 second hold, 2 set 2 -3 times a day
SLR B/l	10 Reps 1 set 2-3 times a day
Passive stretches for right side hamstrings and quadriceps	10 Reps, 10 second hold 2 -3 times a day
B/l UE strengthening 0.5 kg weight cuff	10 Reps 2 set 2-3 times a day
Log rolling towards unaffected side	2-3 Reps, 10 sec hold, 2- 3 times a day.
Unilateral pelvic bridging	10 Reps,1 set, 5 sec hold 2-3 times a day
Bed side sitting (Fig 5.)	5 minutes
Dynamic Quads B/l	10 Reps, 10 second hold, 1 set 2 -3 times a day
Wheelchair mobilization	10 minutes 2-3 times a day

Figure 3 Patient performing active ankle toe movements

Figure 4 Therapist assisting patient in performing SLR and internal rotation of hip

Figure 5 Patient taken in bed side sitting

Table 7 Phase 3 (Week 4 to 6) treatment protocol

Treatment	Repetition
Hot pack	8 to 10 min, 3 times a day
B/l ATM	10 Reps 2 set 2-3 times a day
AAROM) exercises for affected LE	10 Reps 2 set 2-3 times a day

Heel slides B/l	10 Reps 2 set 2-3 times a day
B/l LE strengthening with 0.5 kg weight cuff	10 Reps 2 set 2-3 times a day
SLR B/l	10 Reps, 1 set, 10 sec hold 2-3 times a day
Passive stretches for right side hamstrings and quadriceps	10 Reps, 15 second hold 2 -3 times a day
B/l UE strengthening with 1 kg weight cuff	10 Reps 2 set 2-3 times a day
Log rolling towards unaffected side	2-3 Reps, 10 sec hold, 2- 3 times a day.
Unilateral pelvic bridging	10 Reps,1 set, 10 sec hold 2-3 times a day
Bed side sitting	10 minutes
Dynamic Quads B/l with 0.5 kg weight cuff	10 Reps, 10 second hold, 1 set 2 -3 times a day
Sit to stand with walker	5 Reps 10 sec hold
Wheelchair mobilization	10 minutes 2-3 times a day
[Partial Weight Bearing (PWB)] (Left LE) ambulation with walker as right knee in FD	1-2 rounds 2-3 times a day

Table 8 Phase 4 (Week 6 to 8) treatment protocol

Treatment	Repetition
B/l ATM	10 Reps 2 set 2-3 times a day
AROM exercises for affected LE	10 Reps 2 set 2-3 times a day
Heel slides B/l with 0.5 kg weight cuff	10 Reps 2 set 2-3 times a day
B/l LE strengthening with 1 kg weight cuff	10 Reps 2 set 2-3 times a day
SLR B/l with 0.5 kg weight cuff	10 Reps 2 set 2-3 times a day
Passive stretches for right side hamstrings and quadriceps	10 Reps, 20 second hold 2 -3 times a day
B/l UE strengthening with 1.5 kg weight cuff	10 Reps 2 set 2-3 times a day
Log rolling towards unaffected side	2-3 Reps, 10 sec hold, 2- 3 times a day.
Unilateral pelvic bridging	10 Reps,1 set, 10 sec hold 2-3 times a day
Dynamic Quads B/l with 1 kg weight cuff	10 Reps, 10 second hold, 1 set 2 -3 times a day
CPM for left LE	15 minutes
Sit to stand with walker	10 Reps 10 sec hold
FWB (left LE) ambulation with walker as right knee in FD	1-2 rounds 2-3 times a day

Follow up and outcome

ROM post rehabilitation is given in (Table 9)

Table 9 ROM post intervention

Joint	Left Active	Left Passive	Right Active	Right Passive
Hip				
Flexion	0-80˚	0-90˚	0-110˚	0-110˚
Extension	0-25˚	0-30˚	0-25˚	0-30˚
Knee				

Flexion	0-110°	0-110°	0-120°	0-120°
Extension	110-0°	110-0°	120-100°	120-100°
Ankle				
Plantarflexion	0-25°	0-30°	0-35°	0-35°
Dorsiflexion	0-15°	0-15°	0-15°	0-15°

RIC: Strong and painless for hip and knee flexors and extensors, ankle plantarflexors and dorsiflexors of left leg and hip flexors and extensors, ankle plantarflexors and dorsiflexors of right leg.

MMT: Gradings were 3/5 for hip and knee flexors and extensors, ankle plantarflexors and dorsiflexors of left leg and for hip flexors and extensors, ankle plantarflexors and dorsiflexors of right leg.

4. DISCUSSION

We are discussing case of a 75 year old female with IT fracture femur operatively treated by ORIF with DHS. In this case, the main objective of physiotherapy rehabilitation was to educate the patient, to restore normal or functional ROM, restore and maintain muscle strength, to encourage early weight bearing, gait training and improving independence in day to day activities. The main goal of rehabilitation following an IT fracture is to re-establish the patient's ability to ambulate, particularly if they had been previously ambulatory (Metzger and Lombardi, 2014). According to some researches, less than half of those who sustain a proximal femoral fracture recover their physical function six months following the fracture (Carneiro et al., 2013). Mobility issues are fairly frequent, and they might be linked to a lack of strength and muscle power (Carneiro et al., 2013; Metzger and Lombardi, 2014). After the surgical procedure, mobilization should be as early as possible. Immediately once the pain subsides, ROM exercises are recommended. To avoid flexor and adductor deformity, which can make ambulation difficult, ROM in both directions is recommended (Metzger and Lombardi, 2014). These people's postoperative walking ability tends to be lower because of their lowered muscle strength. Knowing this, the purpose of physiotherapy in the postoperative period is to improve muscular strength, ambulatory security and effectiveness, enabling them to be relatively self-sufficient (Carneiro et al., 2013).

An asymmetric loss in muscle strength and power can make shifting weight from one leg to the other more difficult, resulting in primarily lateral imbalance, which is associated with the greatest incidence of falls (Portegijs et al., 2008; Carneiro et al., 2013). According to literature, strengthening hip abductors and adductors enhances lateral stability and dynamic balance during walking. It's also vital to strengthen the hip flexor, extensor, and rotator muscles, in addition to abductors and adductors, to ensure that muscular strength, flexibility, and endurance are restored so that further progressions can be made in gait training (Carneiro et al., 2013). To determine weight-bearing status, the precision and integrity of the reduction attained during operation, bone quality, premorbid state, and mental awareness are all taken into account.

In the present case, PWB was initiated, which was further advanced to FWB in gait training. The training of the non - affected limb is crucial for gait training. For this purpose, ROM and strength training was given for the unaffected leg (Bagga et al., 2021).

5. CONCLUSION

Even though IT fractures are effectively managed surgically, patients experience secondary impairments like reduced mobility, strength and endurance and increased functional dependency. Physiotherapy rehabilitation complementary to surgical management is critical in preventing secondary impairments and thus enhancing recovery.

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Author Contributions

All authors contributed equally to this work and they have read and agreed to the final manuscript.

Informed Consent

Written and oral consent was obtained from the patient involved in the study.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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