Impact of Early Rehabilitation in a complex case of Non-union of Tibial Plafond fracture with Osteosynthesis associated infection – A case Report

Abstract

Background

Fractures of Distal end of tibia associated with soft tissue injuries and fracture of distal fibular end are very complex and forms a total of 1-2% of all fracture of lower limb. These fractures are widely termed as Plafond fractures.

Case Presentation

A 26 year old male, a follow up case, gave a history of Road traffic accident following which he underwent cortecotomy and application of external elizaro ring fixator. At present due to nonunion of the fracture segments patient got readmitted after a year. Further management through a three step surgical approach was done. Rehabilitation programme began from post-operative day 1 and was continued for a period of three weeks.

Investigations

On the day of examination the patient's pain was severe on movement with presence of disuse trophy of lower limb musculature of the affected extremity. Ranges on the right lower limb at all joints were reduced due to pain. The X-ray showed presence of 9 hole recon plate fixed distally over talus and proximally to tibia.

Management

Physiotherapeutic intervention began with educating the patient and the caregivers about the condition, the precautions to be taken, the expected time of healing and extent of healing. The exercise programme was based on the principles of variability and individuality. The protocol was changed weekly with the observed progression in the patients range, muscles strength and ability to perform more challenging in bed activities.

Conclusion

Early rehabilitation in complex cases of tibial plafond fracture facilitates the process of healing as well as maintain the patients level of functioning by maintain muscle properties. Post-operative complications are also reduced.

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Key words: Tibial Plafond fracture, Osteosynthesis associated infection (OAI), Physiotherapeutic Rehabilitation.

Introduction

Tibia and fibula are the long bones of the lower limb, forming a tibiofibular syndesmosis. Fracture of these long bones due to high energy axial compression is also known as tibia plafond fractures and can have an associated soft tissue involvement and extension of fracture into fibula(1). These fractures are rare and account for only 1-10 % of total fractures of lower limbs. The type 3 fracture of this is the most severe with commination and metaphysical impaction (2).

These fractures are managed surgical in 4 phases, beginning from restoration of fibular length, followed by autologous bone graft for filling the defect and ending by insertion of buttress plate on distal aspect of tibia (3)(4). Even with advancement in the surgical approaches used long term complication of non- union still persists and therefore the fracture was also termed as not "amenabe to surgery" (2).

Osteosynthesis associated infection (OAI) is one of the most common complication post-surgical management of these fractures indicated by infection in the presence of an implant. OAI is difficult to treat due to presence of instable fracture site, open wound or trauma and need for preservation of cartilage (5).

Clinical presentation

A 26 year old male, a follow up operated case came to the hospital on 1/10/21 for grade III B fracture of distal tibiofibular joint of right leg. The patient presents with the history of road traffic accident 2 years back on 16/09/19 following which he sustained injuries to right leg. There was an open wound with excessive blood loss associated with pain was sudden in onset.The pain was progressive and continuous in nature. There was no history of head injury, loss of consciousness or chest trauma. Patient was then by the by standers was bought to the hospital where he was managed with external fixator application on the same day. The patient was then discharged and since then at home patient had a non- weight bearing ambulatory functional status.The patient was then re -admittedon 1/10/19 for further wound management. The x ray revealed non- union of the distal tibia fibula fracture segment for which he was operated on 4/10/21 where external elizaro ring fixator was removed and open reduction internal fixation with plate osteosynthesis. The second operation was conducted on the same day where bone graft from right iliac fossa and skin graft from left thigh was taken. Since then the patient is referred for physiotherapy for further rehabilitation.

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Clinical Findings

On Observation: Patient was lying in supine lying with hands by the side, right lower extremity was in elevation with pillows underneath and in slight external rotation and in 5 degrees of plantarflexion. Wound dressing was present from the balls of the feet upto mid knee joint line. Quadriceps muscle wasting could be seen indicating disuse atrophy.

On Palpation: Distal pulses and tenderness at the ankle could not be assessed due to dressing. Tenderness of grade 2 at the right iliac region at the suture site was present indicated by pain and flinching by the patient on palpation. Swelling over the exposed parts of left lower extremity was absent. Muscle wasting of quadriceps was quantitatively confirmed by a difference of 3.5 cm during limb girth measurement.

On Examination:

Pain: On numeral pain rating scale during movement 6/10 (passive dorsiflexion and assisted hip flexion) and at rest 2/10.

Range of motion: All the ranges for right lower limb at hip knee and ankle were with normal functional ranges. There was no active dorsiflexion present and rest of the ranges at knee and hip were restricted due to pain giving an empty end feel.

Table 1: Range of motion of Right affected extremity

Joint movement on Right side	Active (in Degrees)	Passive (in Degrees)	End feel
Ankle Plantarflexion	5-10	5-12	Empty
Ankle dorsiflexion	0	0	-
Knee flexion	0-60	0-65	Empty
Knee Extension	60-0	60-0	Firm
Hip flexion	0	0-40	Empty
Hip abduction	0-10	0-15	Empty
Hip Adduction	Cannot be assessed		-

Manual Muscle Strengthening: Manual muscle testing for left side for all the major muscle groups was 3+ (Fair) indicating ability to perform complete range of motion against gravity with mild resistance.

Table 2: Grades of Manual muscles strength

Muscle Tested	Grade of MMT
Ankle Plantar flexors	Weak painless (On Resisted isometric contraction
Ankle Dorsiflexors	0 (no visible palpable contraction)

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Knee extensors	Strong painless (on resisted isometric contraction)
Hip Flexors	Could not be assessed.
Hip Abductors	2- (partial range of motion in gravity eliminated)

Investigations

Pre and post -operative X- rays and clinical images of the wound are as follow:

Figure1: Pre -Operative x-ray of right lower extremity, Lateral view. Bones exposed are tibia fibula, talus, calcaneus, navicular and metatarsals. (Orange) Arrow is indicative of fracture segments and (red) arrow indicates presence of swelling.

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Figure 2: Post- operative X-ray indicating the presence of nine hole recon plate (arrows) and 4.9 mm locking screw and 4.5 mm cortical screws.

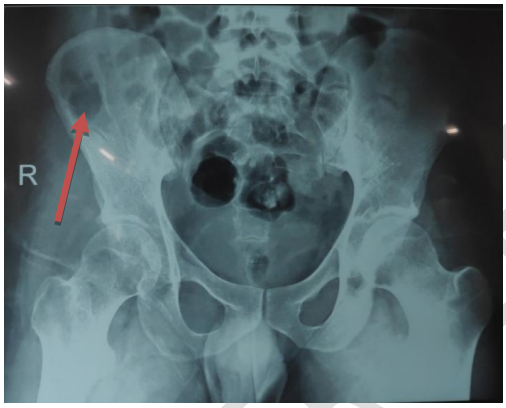

Figure 3: X-ray is an Antero-Posterior view of Pelvis. Bones exposed are Pelvis, Sacrum and head of femur bilaterally. Arrow indicates the site of bone graft from the iliac fossa.

Figure 4: Clinical Image of the wound. Arrow (orange) indicates the Flap taken for covering the wound taken from the proximal anterior-lateral aspect of the left below knee. Arrow (red) indicates the area where skin grafting is done.

Management

Rehabilitation started with patient education where patient was educated about his current condition, expected time period of recovery and the precautions of wound care to avoid re infection and bed sores. The care givers were also educated to increase the compliance towards exercise and facilitate the process of rehabilitation.

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Prevention of secondary complications like, embolism and edema was done by advising the patient to continuously perform ankle toe movements (100-150 repetition / day) and keep the limb elevated.

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For the unaffected left lower extremity and bilateral upper limbs mobility and strengthening exercises were initiated from day 1 of rehabilitation. Deep breathing and pursed lip breathing exercises were taught and advised to perform every 2 hourly.

Table 3: Further exercise programme tailor made according to the patient's progress was as follows:

Exercise type	Intensity Day 1-3	Intensity Day 4-7	Intensity Week 2-3	Rationale
Ankle toe movements Bilaterally	10 repetitions X 1 set 50-70 / per day	10 repetitions x 2 set 70-100/day	10 repetitions X 2 sets 150 reps /day	To prevent edema and maintain peripheral circulation
Passive dorsiflexion Left ankle	3 repetitions X 1 set Thrice a day	3 repetitions X 1 set Every two hour	3 repetitions X 1 set Every one hour	To prevent deformity
Static Hamstring Contraction	10 repetitions 50 / per day Without hold	10 repetitions 70-80/per day With 5 seconds hold	10 repetitions 100-150 /per day with 10 second hold	To maintain muscle properties
Static Quadriceps contraction				
Static gluteal contraction				
Active Knee Flexion	Actively in pain free range	Active assisted in pain free range	Active assisted pushing slightly beyond available range	

Active assisted Hip Abduction	10 reps thrice a day	10 reps thrice a day with minimal assistance	10 reps 2 sets thrice a day	
Active assisted Straight Leg Raise	10 reps thrice a day	10 reps with 5 second hold	10 reps thrice a day with 10 second hold	
Unilateral Bridging	-	10 repetitions Without hold	10 repetitions with 5 second hold 50 reps throughout the day	

Discussion

Fracture of tibia pilon are uncommon and difficult to manage and the severity depends upon position and rotation of the foot during the time of impact (6). Open reduction internal fixation is the most common method of management with the aim of providing stability to the ankle joint for early mobility but due to more long term complication like nonunion and infection, external ring fixator is the next choice of treatment (3). A study by Maxim et al concluded that the reduction quality analyzed through 3D imaging intraoperatively is major factor for determination of long term outcome of the surgery and rehabilitation and functional outcome (7).Another study suggests that most of the patient are treated through two stage, where fist stage involves external fixator application for a period of few weeks to months depending on severity followed by open reduction internal fixation. It is seen that the extent of involvement of soft tissues and communition of fracture segments is the basis for selecting the operative approach and procedure (8).

A study conducted by Faizal et al concluded that early rehabilitation post pilon fracture including isometrics, strengthening and initiating mobility within available ranges results in significant improvement statistically and a raised level of Mazur score , an outcome measure post pilon fractures (9). American college of sports Medicine also supports are findings of the study that the absence of any forces like weight bearing as a result of long term immobilization leading to patients been bed ridden leads to insufficiency in musculoskeletal as well as circulatory system that further delays the process of healing and worsens the prognosis (10).

The findings of this study is in line with the outcomes of research conducted by Puthoff et al that week isometric strength of lower extremity musculature if not initiated early during rehabilitation makes it difficult for the patient to perform in mobility or pat activities further in the phase of rehabilitation when initiation of standing from sitting and activation of muscles for balancing will be required (11).

Conclusion

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The three week rehabilitation programme we conclude that early initiation of range of motion, isometrics and strengthening exercises lead to a reduction in symptoms of post- operative stiffness and facilitates healing. In cases which presents with a prolonged history of reduced mobility due to long term application of ilizaro ring fixator where atrophy is present, such tailor made protocols help in early recovery of the affected area and increases patients awareness towards re-infection and motivates. Variability with respect to intensity duration and type of exercise performed also plays a major role in keeping the patient motivated and compliant.

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Informed consent

Patient was informed about the study and informed consent was taken from the patient

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