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The bad contretemps causes mid-shaft tibia and fibula fracture with traumatic amputation of 2nd toe: A case report

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ABSTRACT

Background: The most complicated type of open bone fracture is a tibia-fibula diaphyseal fracture and an average of twenty percent mid-age with eight % affection of elderly. Depending on the size of the wound, bony injury and the level up to contamination, Gustilo and Anderson assigned Compound fractures grading it into 3. The standard treatment approaches used daily are Open reduction with internally or externally fixate, as well as intramedullary nailing gathering momentum to speed up early recovery and resuming normal functioning here are some techniques covered in this article. After a road accident, a 65-year-old male patient was diagnosed on x-ray with a compound Grade IIIB right mid-shaft tibia and fibula fracture with soft tissue destruction, compound grade 3B proximal phalanx fracture of great toe right side, traumatic amputation of 2nd toe right side, and nail avulsion of index finger right side, which required open reduction and external fixation. Pain, restricted ranges for the right lower extremity with the inability of weight-bearing on the same were some of the specific chief complaints informed by the patient. Following surgery, the patient received physiotherapy for 10 weeks, which included exercises, electrotherapy, proprioception training, and gait training, and resulted in pain relief, increased mobility and improved functional activities. *Conclusion:* The case study demonstrates that a traditional surgical approach combined with early structured physical rehabilitation resulted in a significant and progressive improvement in functional goals, which is an important factor in a successful recovery.

Keywords: Tibia-fibula fracture, Open reduction with external fixator, Physical Rehabilitation.

1. INTRODUCTION

Open fractures of the tibia-fibula take place where the broken bone is visible to the outside of the environment via injured soft tissue and the most common

being the tibial diaphyseal fracture. Post-menopausal females suffer from low-intensity fragile bone fractures whereas the younger population gets high-energy traumatic injuries (Lee et al., 2022). Tibia fractures are most frequently caused by direct blows, assaults, sports injuries, car accidents, and bullet wounds (Wali et al., 2021). Several antecedents are held responsible for the difficulty in treating such fractures due to various complicated infections, impaired healing of the bone, reduced vascular supply and contaminated wound last but not least lesser coverage of soft tissue structure (Sun et al., 2021).

Gustilo and Anderson Classification observed more than 350 patients prospectively and made the division of open injuries into three categories: Grade I= Open fractures with a wound less than 1 cm long and clean; Grade II= fractures with bigger soft-tissue damage, measuring more than one centimeter; Grade III= Open fractures represent the most serious injuries and are divided into three categories. Grade IIIA= fractures classified as High-energy fractures, as shown by extensive bone injury (segmental or severely comminuted fractures) and/or massive, often contaminated soft-tissue lesions; In Grade IIIB fractures = there is severe soft-tissue injury or loss, exposing bone, and reconstruction may necessitate a soft-tissue transfer (flap) to cover the wound; Grade IIIC fractures = necessitate vascular intervention, because the fracture is linked with vascular damage to the extremity (Kim and Leopold, 2012). Many procedures of stabilization and immobilization, including minimally invasive percutaneous plate osteosynthesis (MIPPO), reamed or unreamed tibial intramedullary nailing, and external skeletal fixation, have been used to treat open tibial fractures over the years (Wang et al., 2019).

A consequential acceptance has been gained by the External fixation technique since its speed and ease of usage, and the fact that it does not involve any further blood supply irritation or soft tissue stripping (Fu et al., 2018). When treating an open fracture, the goal is to achieve union while avoiding or eradicating wound infection (Wali et al., 2021). External fixators are always recommended in open fractures, periarticular fragile fractures, mobile knee injuries, and most typically compound diaphyseal fractures (Sun et al., 2021). The teething troubles are maintenance of the hygiene by the patient of pin-track, infection the site of pin, loosening of it and chances of malunion (Fu et al., 2018). Common complications include compartment syndrome, infection, nonunion and freedom of movement for the leg is limited at the knee and ankle joints (Wali et al., 2021). It was found that geriatric patients with similar injuries did not experience significantly more problems than younger patients, and that early definitive fixation and primary wound closure enhanced outcomes (Lee et al., 2022).

The therapeutic technique, which is separated into four categories, begins with proper protection and progresses to strength training. Joint manipulation, progressive exercise performance, a gait training program, and adequate health education have all been demonstrated to aid in physiotherapy rehab. The goal of this case study is to use a physiotherapy program to help with early functional recovery.

2. PATIENT'S INFORMATION

The patient is a 65-year-old men farmer by occupation with a mesomorphic built and right-hand dominance. He claims to have been in a road crash in which he was injured in his right leg and foot, as well as his right index finger, when a two-wheeler collided with another two-wheeler on the shirgaon road at 4 p.m. on 31/10/ 21. Following a fall, the patient developed a sudden onset of pain that was progressive, acute, and increased by movement, but was reduced by medications and splinting. On the NPRS, the patient reported pain over the mid-shaft region of the tibia in the right leg as 7/10 at rest and 9/10 during movement. There was no unconsciousness. The patient had a contaminated wound that was actively bleeding and had exposed bone. Following primary care, Foley catheterization, and 1 unit whole blood and 1 unit PRC (Packed red cells) transfusions, the patient was transferred to rural hospital for further treatment. After consulting with an orthopedic specialist at rural hospital, an X-ray was taken, and the findings confirmed that the right leg had a mid-shaft tibia and fibula fracture with soft tissue destruction, and that the right foot had a proximal phalanx fracture of the first toe. On 02/11/2021, the patient received a surgical procedure that included debridement of the wound over the right mid-shaft tibia and dorsolateral aspect of the right leg, as well as the placement of an external fixator and VAC over the right tibia. The timeframe of the incidents is shown in (table 1). Following the procedure, physiotherapy sessions began. The main complaint after surgery was pain and a cut on the patient's right leg. The patient couldn't stand on the injured limb. The patient seemed to have no relevant family history and was having trouble sleeping as a result of the pain.

Table 1 depicts the timeline

Radio diagnosis done on	4/11/21
Color Doppler done on	1/11/21
Date of admission	1/11/21
Date of operation	2/11/21
Date of evaluation	8/11/21

3. CLINICAL FINDING

A form of informed consent was signed before going ahead with the therapeutic protocol by the patient. During the general examination, the patient was alert, aware of time, place, and identity, and cooperative. With a BP of 100/70 mm Hg, a PR of 74 beats per minute, and a RR of 16 breaths per minute, he was hemodynamically stable and afebrile. He had no symptoms of cyanosis, icterus, clubbing, or edema. He was examined in a supine position. On inspection, the patient is in a supine lying position on the bed, with the head and torso supported on a pillow, shoulders resting on the bed, elbows slightly flexed, pronated, and wrist in the neutral position resting on the bed, pelvis supported, hip slightly flexed, knee slightly flexed, and externally rotated, pelvis supported, hip slightly flexed, knee slightly flexed, and externally rotated. The patient's right leg was slightly elevated, abducted, and in the neutral position at the knee and ankle. The range of motion on the right side was assessed on the first day and reported to be reduced (table 2). On the day that PT was completed, ROM was measured (table 3). Muscle strength is evaluated and presented in (table 4). On palpation, the local area's temperature was afebrile, and there was Grade 2 pain over the mid-right leg and foot. On the NPRS scale, the pain was rated 7/10 at rest and 9/10 during light activity; Berg Balance was 10/56, and the Dynamic Gait Index was 3/24.

Table 2 The range of motion is assessed on day one

Joint	Movement	Left		Right	
Hip		AROM	PROM	AROM	PROM
	Flexion	0-100	0-110	NT	0-30
	Extension	100-0	110-0	NT	30-0
	Abduction	0-30	0-40	NT	0-20
	Adduction	30-0	40-0	NT	20-0
	Internal rot	0-30	0-40	NT	NT
	External rot	0-30	0-40	NT	NT
Knee	Flexion	0-125	0-130	NT	0-30
	Extension	125-0	130-0	NT	30-0
Ankle	Plantarflexion	0-35	0-40	NT	0-10
	Dorsiflexion	0-10	0-15	NT	0-5
	Inversion	0-25	0-30	NT	0-10
	Eversion	0-25	0-30	NT	0-10

Table 3 ROM on day of completion of physiotherapy

Joint	Movement	Left		Right	
Hip		AROM	PROM	AROM	PROM
	Flexion	0-120	0-125	0-100	0-110
	Extension	120-0	125-0	100-0	110-0
	Abduction	0-40	0-45	0-30	0-35
	Adduction	40-0	45-0	30-0	35-0
	Internal rot	0-35	0-40	0-25	0-30
	External rot	0-35	0-40	0-25	0-30
Knee	Flexion	0-140	0-145	0-110	0-115
	Extension	140-0	145-0	110-0	115-0
Ankle	Plantarflexion	0-45	0-50	0-35	0-40
	Dorsiflexion	0-15	0-20	0-10	0-15
	Inversion	0-30	0-35	0-25	0-30
	Eversion	0-25	0-30	0-10	0-15

Table 4 Muscle strength is assessed

Joint Muscles	Left side	Right side
Shoulder Flexors	4+/5	4+/5
Extensors	4+/5	4+/5
Elbow Flexors	4+/5	4+/5
Wrist Flexors	4+/5	4+/5
Extensors	4+/5	4+/5
Hip Flexors	4/5	2+/5
Extensors	4/5	NT
Knee Flexors	4/5	NT
Extensors	4/5	NT
Ankle Dorsiflexors	4+/5	NT
Plantarflexors	4+/5	NT

Resisted Isometric Contraction

Right Knee: Flexion – Weak and painful (Grade 1)
Ankle: Plantarflexion : Weak and Painful
Dorsiflexion: Weak and Painful

Measurement of Limb Length

Right limb: True – 69 cm
Apparent – 74 cm
Left limb: True – 71 cm
Apparent – 76 cm
Difference of 2cms in lower limbs

On neurological examination, all the sensations were present, distal circulation was intact. Reflexes were normal. Figure illustrates, a post-operative X-ray showing the application of an External Fixator over the right tibia with Vacuum Assisted Closure (VAC) application.

Diagnosis

Compound grade 3B right midshaft tibial and fibula fracture with soft tissue destruction shown in (fig 1). Compound grade 3B proximal phalanx fracture of great toe right side with Traumatic amputation of 2nd toe right side, Nail avulsion of index finger right side shown in (fig 2).

Figure 1 X-ray showing right mid-shaft tibia and fibula fracture with external fixator

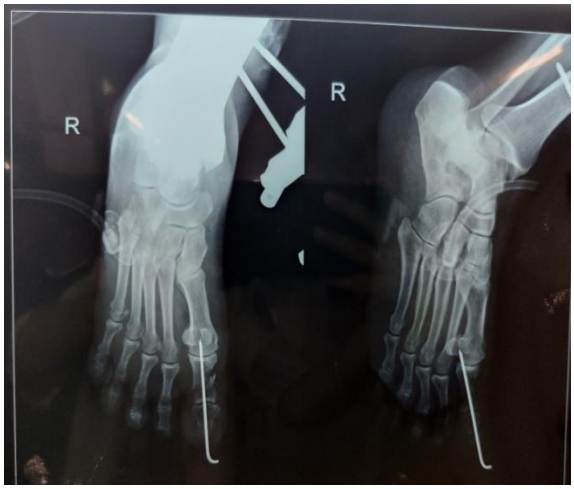

Figure 2 X-ray showing proximal phalanx fracture of great toe right side

Outcome measures

VAS, NPRS, MMT, Barthel Index

Therapeutic Intervention

Patient education, pain and tenderness reduction, respiratory complications prevention, improved range of motion, muscle strength of lower limb and promote early mobility were the short-term goals, while the long-term goals were to promote independent walking with or without a frame, improve static and dynamic balance, improve endurance, and restore functional activities of daily living restoration. Every week, the physiotherapy rehabilitation regimen was modified to include new therapeutic exercises.

Post-operative day 1 -7

Active ROM exercises for bilateral upper limb and left lower limb with 10 repetitions in one set. Gripping exercises for the smooth function of hands. Active ankle toe movements, heel slides, static quads and straight leg raise for left extremity. The patient was requested to do vigorous toe motions in the available range with the right lower limb elevated and supported on a Wedge pillow shown in (fig 3). Passive SLR started in the available range. Pursed lip breathing with every 2 hourly side positioning taught to avoid any occurrence of pressure sores on the dependent parts. Due to age and unbearable pain, the patient was unable to do knee movements in the initial days. Counseling to the patient was delivered as the patient seemed to be quite demotivated with the condition and staying hospitalized was his first-time experience for this much duration.

Figure 3 Showing patient is in supine lying position.

Day 8-15

Same active movements continued for the mentioned extremities with the inclusion of weight cuffs weighing 250gms to help strengthen the musculature which is intact. Active assisted SLR in available range with knee flexion and extension exercises were started. He was continuously reminded of having a good diet and changing the side in breaks. Static quads (left) and glutes withhold for 3secs began. The patient was placed in a long sitting position and continued to practice spirometry with a 600 cc/sec ball rise shown in (fig 4). Weight-bearing: it will not be implemented, due to comminution, low cortical contact, and considerable bone loss.

Figure 4 Patient performing Spirometry exercises.

Day 16-21

Continued active movements for bilateral upper limb and left lower limb. Muscle strengthening with 500gms weight cuffs tied with 10 reps in one set. Static quads and glutes with 5 secs hold and isometrics for right knee initiated. Active heel slides with hip flexion exercises were initiated which showed a tremendous change in the patient's attitude towards his protocol. Unilateral bridging with the support of both the hands with 3secs hold, he did ankle-toe movements also for the right foot. Sitting in lengthened position with the right extremity supported on pillow, he started having meals and medications without any stubbornness. He sat bed side with both the lower limbs unsupported. Long sitting position with back support, stand/pivot transitions, and non-weight bearing ambulation with assistive device are all achievable.

Weight bearing: non-weight bearing with crutches or a walker and a three-point gait should be continued until bone congruity is restored, at which point partial weight bearing can be attempted. With strengthening and training, postural sway and the chance of falling are reduced. Depending on the patient's weight-bearing status, ambulatory assistive equipment may still be required.

Day 21-discharge

Active neck ROM exercises with the inclusion of B/L, UL and LL with a great mindset towards recovery. Weight cuffs with ½ kg for 15 reps for unaffected limbs and isometrics for the affected knee continued. Progression of repetitions for Static quads and glutes with core strengthening - Unilateral bridging with the support of both the hands for 5secs hold for 10 times. Dynamic quads with the arms supported on the bed. Sit to stand with no weight-bearing with the assistance of a walker and therapist.

Weight- bearing: All wounds should be healed and covered by this time, either through primary healing and skin or flap coverage. It is planned to remove the fixator. A patella-tendon-bearing cast or orthosis will then be applied to the leg. Gait: ambulatory assistive aids may still be required depending on the patient's weight-bearing status. The barthel index was used during the examination to test the patient's current independence levels and abilities to perform ADL. There is a scoring system for motoric function: 0-40 high dependence; 45-60 middle level dependence; 65-90 light dependency; 100 independency. He scored 60 for motoric function which means he was middle dependent and 90 for cognitive function which means no cognitive impairment.

4. DISCUSSION

The rehabilitation of an open tibia–fibula fracture is challenging because it is often coupled with soft tissue injuries, comminution, and intricacy, all of which are frequently case of high-energy trauma, further complicating the management of such a complex fracture (Pawar, 2021). The patient in this case had pain, limited range of motion, and weak muscle strength in his right lower leg. A treatment plan that included range of movement exercises, strength exercises, therapeutic techniques, and locomotor retraining was devised after a clinical evaluation. Physical therapy is an important element of a patient's rehabilitation as they work to get back to their pre-injury activity level, or as close to it as possible. It can assist patients focus on the areas where they need to improve or prevent specific concerns from occurring. In the current study, a professional orthopedic physiotherapist gave the patient a well-structured physiotherapy rehabilitation that included several exercises and strength training.

Cryotherapy and analgesics resulted in a gradual decrease in pain, allowing the patient to put more effort into rehabilitation, resulting in progressive increases in range of motion, muscular strength, and functional results. The goal of the physiotherapy sessions was to maintain muscle integrity in the right lower leg while also enhancing the left lower extremity and both upper limbs to enable independent non-weight-bearing walking with a walker and little assistance for routine activities. It is encouraged to begin active knee joint mobility as soon as possible, but to limit weight-bearing for the first six to eight weeks. Pain control, improved range of motion, and early weight-bearing are aspects of novel protocols that help with rehabilitation and enhance patient outcomes (Abbafati et al., 2020). After surgical stabilization of a fractured tibia, precise physiotherapy aids in the correction of substitution movements and the patient's recovery (Murray, 2020). Once the fracture site has healed sufficiently, physiotherapy is critical to ensuring the ORIF surgery's success and the recovery of full or near-full lower leg function.

According to Gabriel's research, post-operative physiotherapy improves confidence and gait (Bonifacio, 2019). Muscular energy technique given, which helps in improving range of motion in the lower extremity, decreased pain, and improved flexibility and strength (Ambalkar et al., 2021). In traumatic post-operative instances, physiotherapy can help to maintain and improve mobility and strength (Zunzunwala, 2021). In the following phase, some proprioception and stabilization exercises were implemented to increase proprioception and weight transfer. The patient was given a written protocol and told to come back for follow-up visits and complete all of the exercises as part of the home program. The purpose of this case study was to illustrate the need of receiving timely surgical treatment and physiotherapy rehabilitation in order to accomplish functional goals for the patient and improve their prognosis.

5. CONCLUSION

Open Tibia-fibula fractures are a type of complex fracture with a high incidence. An open reduction external fixator is the best way to treat them because it gives great anatomical reduction, restores articular congruity, promotes early movement, decreases post-traumatic osteoarthritis, and improves knee function. A standard surgical approach combined with prompt structured physiotherapy rehabilitation resulted in progressive improvement in functional goals, which is a significant aspect in attaining a good recovery in post-operative patients, according to the following case study. The patient was significantly more efficient in his daily activities.

Abbreviation

ROM-Range of Motion
NT- Not Testable
VAS- Visual Analog Scale
NPRS- Numerical Pain Rating Scale
REP- Repetitions
NWB- Non Weight Bearing
CPM- Continuous Passive Motion

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Author Contributions

All authors made best contribution for the concept, assessment, data acquisition, analysis and the interpretation of data.

Informed consent

Proper written and oral consent was taken from the patient included in this case report.

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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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