



Bridging the Gap between Locking Compressive Plate, Skin Grafting and Rehabilitation for Tibia Fracture: A Case Report

**Simran Narang¹, Pratik Phansopkar^{1*}, Laukik Vaidya¹, Neha Chitale¹
and Dushyant Bawiskar¹**

¹Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, DattaMeghe Institute of Medical Sciences, SawangiMeghe, Wardha, Maharashtra, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors contributed equally for the study. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Introduction: Road traffic accidents (RTA) have remained an ongoing endemic problem over the years and a serious economic and medical-social burden for many countries around the world. Among the most complex and frequent fractures inside the joint is tibial plateau fractures. Such fractures are linked to adverse results, because of reasons such as the damage of cartilage but also soft tissue envelopes, complications like compartment syndrome, postoperative infection, knee dysfunction or rigidity, or even post-traumatic osteoarthritis.

Case Description: An 18-year-old young girl complaining of pain and inability to perform activities of daily living was referred to physiotherapy after being operated with external fixator (LCP) and skin grafting. Locking compressive plate was placed at lateral side of leg with 2 nails near head of fibula and 2 nails near lateral malleolus. Grafted skin was seen at anterior aspect of knee and anterior to medial aspect to leg. Patient was mostly suffering from pain in right leg and knee with intensity 7/10 at rest and 9/10 slight movement and swelling over right lower limb and patient complained of limited mobility and unable to walk.

Discussion: The significance of early mobilisation and range of knee joint motion exercises has

*Corresponding author: E-mail: drpratik77@gmail.com;

been apparent in literature in the past 40 years. From low-intensity activities to progressive strengthening and partial to complete weight with walkers, recovery objectives were devised. Good grafting rates can be achieved with fast ambulation leading low extremity skin grafting operations, which runs counter to conventional lessons in post-operative skin grafting after lower extremity

Keywords: Skin grafting; rehabilitation; external fixator; physiotherapy; Physical therapy.

ABBREVIATIONS

RTA : Road traffic accident
TPF : Tibial plateau fractures
LCP : Lock Compression Plate
ROM : Range of Motion
ADL : Activities of daily living
SLR : Straight leg raise

1. INTRODUCTION

The rise in population and automobiles, results in increased amount of road injury. Road traffic accidents (RTA) have remained an ongoing endemic problem over the years and a serious economic and medical-social burden for many countries around the world [1]. RTA is the sole leading cause of death between the ages of 15-29. Tibia is damaged in the long bones and seems to be a bit more prone being an open fracture with bone loss because of its shallow location.

Open tibia fractures remain a frequent source of admission and are proven to cause roadway death as well as incidence [2]. Among the most complex and frequent fractures inside the joint is tibial plateau fractures (TPFs), affecting nearly 1% among all fractures in adults [3]. Intra-articular tibia fractures are widely referred as tibial plateau fractures. The two main age ranges exist, first cohort includes younger men suffering from heavy impact trauma, whereas second is older women suffering from limited injury [4]. Such fractures are linked to adverse results, because of reasons such as the damage of cartilage but also soft tissue envelopes, complications like compartment syndrome, postoperative infection, knee dysfunction or rigidity, or even post-traumatic osteoarthritis.

As a result, they do not only pose surgical issues but will have significant adverse impacts on quality of life and well-being functionality [3,5] In certain heavy breaks with severe comminution as well as osteoporous fractures, lock compression plate were suggested. The laterally based locking plate offers an alternate to a

supplementary medial plate or external fixator to protect the media column from bicondylar fractures [6-7]. There are many benefits to external application of LCP, such as angular stability from locking-head mechanism, decreased pain owing to its poor profile compared to conventional external fixators, Probability to circumvent a skin plate and to attain ankle mobility.

Open tibia fractures are associated with skin during direct violent trauma, and muscle injury is prevalent due to the distal tibia's comparatively small, soft tissue coverage [8]. Lower limb skin loss is managed either conservatively by dressings to allow secondary intension healing or by providing skin cover in the form of skin graft or flap surgically. Larger wounds need either a split skin graft or flap patch for skin cover [9].

2. PATIENT INFORMATION

An 18-year-old young girl complaining of pain and inability to perform activities of daily living was referred to physiotherapy after being operated with external fixator (LCP) and skin grafting. Patient had met a road traffic accident while coming back home from hostel. She was sitting back on bike and got hit by truck from back. She was taken immediately to local hospital and X-ray investigations revealed fracture of right tibia fibula. For tibia – fibula fracture, a spanning external fixer was used. As relatives were not convinced with the treatment in private therefore, she was referred to Acharya Vinobha Bhave Rural Hospital, Sawangi, Wardha, Maharashtra for wound management. In A.V.B.R.H., close reduction and external fixator application (locking compressive plate) was done with debridement and VAC application for wound over anterior aspect of right leg was done for compound closure application of compound fracture grade 3B fracture tibia. Around mid-June, split skin grafting was done and flap was taken from left thigh region. The flap was transposed from medial side to raw area on lateral aspect of right shin region of tibia.

After surgery, patient was mostly suffering from pain in right leg and knee with intensity 7/10 at rest and 9/10 slight movement and swelling over right lower limb and patient complained of limited mobility and unable to walk.

3. CLINICAL FINDINGS

Assessment was done with two shoulders on one level in supine position and external fixator at lateral aspect of right leg. On observation, right

leg abducted, knee extended with pillow support at lateral aspect of ankle to avoid external rotation, ankle slightly plantar flexed. Locking compressive plate was placed at lateral side of leg with 2 nails near head of fibula and 2 nails near lateral malleolus. Grafted skin was seen at anterior aspect of knee and anterior to medial aspect to leg. Swelling was visible at anterior knee. The local temperature was increased on palpation and tenderness was present over lower anterior thigh region.



Fig. 1. Pre – operative X-ray
(Spanning external fixator)

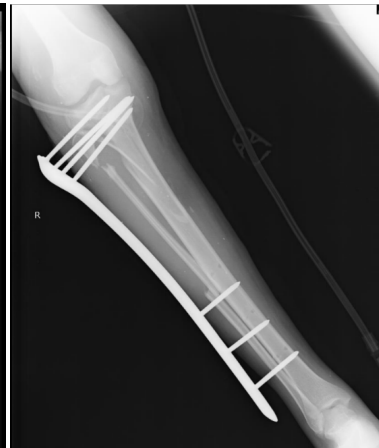


Fig. 2. Post – operative X-ray
(Locking Compression plate externally fixed)



Fig. 3. A – Post skin grafting (Anterior view) B – Locking compression plate (Lateral view)

3.1 Clinical Assessment

(All assessments are done at post-operative day 1 with patient in supine position)

4. THERAPEUTIC MANAGEMENT

4.1 Post-Operative Goals

Very first short-term aim was to teach patient how important treatment is followed by prevention of respiratory complications, prevention of contractures, reduction of pain, oedema, maintain and enhance joint motion or strength, initial movement, prevent bed sores, non-weight walking and autonomous ADL.

Long-term aims were to encourage voluntary moving either with or without walkers, static and dynamic balancing and to foster indoor and outdoor mobility, autonomy and ergonomics with ADL's.

After removal of fixation, a proper treatment programme will be made taking into consideration family, work, leisure and the psychological reactions of the individual.

4.2 Post-Operative Management

Week -1

Day- 1- 2: Active movement of unaffected limbs and appropriate position but also movement in bed were done mitigate risks of bed sores: cryotherapy, methods of relaxation, deep breathing, incentive spirometry, ankle toe movement; static quadriceps, hamstrings and glutei.

Day- 3- 4: Active assisted hip abduction (0° - 10°) to maintain quadriceps and hamstring strength, to decrease joints stiffness as well as improve range, static quadricep, hamstring and glutei; to increase joint strength and to improve range of active assisted hip abduction (0° - 10°), enhance activity of deep breathing, incentive spirometry and ankle toe movement; Heel slides (0° - 5°) to restore strength of quadriceps and hamstring, to lower joint rigidity and improve range.

Day- 5- 7: Cryotherapy, relaxation, deep breathing, incentive spirometry, movement of ankle toes; static quadriceps, hamstrings and glutei, half bridging and active movement of the unaffected legs. Active SLR (0° - 15°), active abduction (0° - 15°), adduction (15° – 0°), maintaining abduction of the hip and the

adductors' strength, reduced joint rigidity and increased range, heel slides (0° - 10°) have been improved in operated leg.

Week- 2

We resumed all week 1 workouts. Uninfluenced limbs resumed active movement. Active assisted movements had been advanced to active SLR (0° - 20°) to retain quadriceps and hamstring strength, to minimize joint stiffness as well as increase range, active hip abduction (0° - 15°), adduction (15° - 0°) to establish hip abductor – adductor strength, to decrease joint stiffness but also increase range, heel slides (0° - 15°) to sustain quadriceps – hamstring strength, to lessen joint stiffness and increase range, long sitting with/without bed support to alleviate joint stiffness and encourage mobility.

Week- 2- 4

Non – Weight bearing walking with walker was started together with prior tasks. Active movement in active SLR (0° - 30°), active side SLR (0° - 10°), heel slides (0° - 30°), active dynamic Quadriceps were enhanced (0° - 30°). It was taught to sit long and sitting bed side, with or without mattress support. Bed side with a walker and walking with walker to maintain balance, lessen fear of fall, increase trust as well as strength

Week- 4-8

Following procedures persisted: cryotherapy, relaxation methods, deep breaths, spirometry and ankle toe mobility, transferring with walkers (no weight-bearers), static quads, hams and glutei, bridging. Improved movement range such as SLR (0° - 45°), prone SLR (0° - 30°), side SLR (0° - 10°), heel slides (0° - 45°), and dynamic quadriceps (0° - 45°) was done with resistance. It was recommended to stand and stroll with walkers (partly weight bearing)

Weeks- 8- 12

Followings was kept going: cryotherapy, relaxation methods, deep breaths, spirometry and ankle toe movement, moving with walkers (no weight-bearers), static quads, hams and glutei and bridging. Reasonable resistance with an increasing motion range, such as SLR (0° - 90°), SLR (0° - 30°), Side SLR (0° - 30°), heel slide (0° - 90°) and dynamic quadriceps (0° - 90°) was performed in resistive training. Standing and walking with a walker was advised (partial weight bearing).

Table 1. Range of motion assessment Pre - Physiotherapy treatment

| Joint | Right Leg | | Left Leg | |
|-----------------------|-------------------|-------------------|------------|-------------|
| | Active ROM | Passive ROM | Active ROM | Passive ROM |
| Hip Flexion | Unable to perform | 0-30 | 0-110 | 0-117 |
| Extension | Unable to perform | Unable to perform | 0-15 | 0-18 |
| Abduction | Unable to perform | 0-15 | 0-40 | 0-40 |
| Adduction | Unable to perform | 15-0 | 0-20 | 0-20 |
| Knee Flexion | Unable to perform | 0-25 | 0-135 | 0-135 |
| Extension | Unable to perform | 25-0 | 135-0 | 135-0 |
| Ankle Planter flexion | 0-10 | 0-15 | 0-50 | 0-50 |
| Dorsiflexion | 0-5 | 0-10 | 0-20 | 0-20 |

Table 2. Isometric Strength Pre - Physiotherapy treatment

| Joint | Movement | Left Limb | Right Limb |
|-------|-----------------|------------------|----------------|
| Hip | Flexion | Strong, painless | Weak, painless |
| | Extension | Not applicable | Not applicable |
| | Abduction | Strong, painless | Weak, painless |
| | Adduction | Strong, painless | Weak, painless |
| Knee | Flexion | Strong, painless | Weak, painless |
| | Extension | Strong, painless | Weak, painless |
| Ankle | Dorsi-flexion | Strong, painless | Weak, painless |
| | Plantar-flexion | Strong, painless | Weak, painless |

Pain assessment on NPRS: 7/10 on rest and 9/10 on movement

Functional Independence Scale: 66

Lower Extremity Functional Scale: 2 (2.5%)

Physiotherapy Intervention: protocol was organized for particular patient rehabilitation. For 12 weeks, 6 days a week, patient has received physiotherapy rehabilitation.



Fig. 4. Weight bearing with assistance

Weeks- 12- 16

Various steps persisted: cryotherapy, relaxation methods, deep breathing, motion of ankle-toe, spirometry, moving with the walker (non-

weight wearing); static quads, hams and glutees; bridging. Moderate resistance with improved motion range such as SLR (0°-90°), SLR (0°-35°) side, Heel slides (0°-135°), Quadriceps dynamics (0°-90°) with resistance. It was advised to walk

normally with footwear. Strength training exercises were recommended such as marching, stepping, escalation, steps to retro footing, tandem walking, high steps to increase balance.

Home programme: In order to avoid fall reoccurrence owing to weakness and failure of balance patient was ordered to perform all resisted exercises, gait training exercises and walk with a complete weight bearing.

5. RESULTS

A goal-based treatment program for postoperative pain, edema, range, intensity and patient responsiveness was incorporated into the recovery programme. Recovery goals were developed from low-intensity exercises to incremental enhancements and partial to full weight with walkers. She was able to restart her ADLs during her rehabilitation program with hardly any assistance.

6. DISCUSSION

In this situation, we found a young girl who has met an accident on the road with tibia and fibula fractures. From low-intensity activities to progressive strengthening and partial to

complete weight with walkers, recovery objectives were devised. Three times a day of 10 sets per workout was carried out. She was enabled to restart her ADLs with limited intervention by way of her recovery programme [10-11].

The significance of early mobilisation and range of knee joint motion exercises has been apparent in literature in the past 40 years [4,12]. A research performed by Gabriel showed that involvement in physiotherapy has a beneficial effect on gaining confidence, enhancing gait in post-operative physiotherapy [13]. But early mobilization was not done so as to prevent movement of the skin graft.

Cryotherapy and analgesics contribute to a significant decrease in pain owing to which patient is likely to invest greater time into recovery, leading to incremental changes in range of motion, muscle strength and functional results. Physiotherapy interventions were planned to preserve the muscle function for the right lower extremity and strengthen left lower extremity and both upper extremities to facilitate independent non weight bearing walking with walker and limited help for everyday activities [14].

Table 3. Range of motion assessment Post - Physiotherapy treatment

| Joint | Right | | Left | |
|-----------------------|-------------------|-------------------|--------|---------|
| | Active | Passive | Active | Passive |
| Hip Flexion | 0-90 | 0-100 | 0-110 | 0-117 |
| Extension | Unable to perform | Unable to perform | 0-15 | 0-18 |
| Abduction | 0-35 | 0-40 | 0-40 | 0-40 |
| Adduction | 0-20 | 0-20 | 0-20 | 0-20 |
| Knee Flexion | 0-90 | 0-100 | 0-135 | 0-135 |
| Extension | 90-0 | 100-0 | 135-0 | 135-0 |
| Ankle Planter flexion | 0-25 | 0-30 | 0-50 | 0-50 |
| Dorsiflexion | 0-10 | 0-17 | 0-20 | 0-20 |

Table 4. Isometric Strength Post - Physiotherapy treatment

| Joint | Movement | Left | Right |
|-------|----------------|---------------------|---------------------|
| Hip | Flexion | Strong and painless | Strong and painless |
| | Extension | Not applicable | Not applicable |
| | Abduction | Strong and painless | Strong and painless |
| | Adduction | Strong and painless | Strong and painless |
| Knee | Flexion | Strong and painless | Strong and painful |
| | Extension | Strong and painless | Strong and painful |
| Ankle | Dorsiflexion | Strong and painless | Strong and painful |
| | Plantarflexion | Strong and painless | Strong and painless |

*Pain assessment on NPRS: 2/10 on rest and 5/10 on movement
 Functional Independence Scale: 102
 Lower Extremity Functional Scale: 32 (40%)*

Usually six weeks after surgery, partial weight bearing is promoted [15]. Ismail Jan however in current report weight bearing was started good lately as skin grafting was performed.

Toby O. Smith's study [16]. indicates that early ambulation could be suggested after split skin graft procedure in patients.

J.P.Gawaziuk stated that patients had been outpaced within 1 day of the operation [9]. A same study shows that good grafting rates can be achieved with fast ambulation leading low extremity skin grafting operations, which runs counter to conventional lessons in post-operative skin grafting after lower extremity.

7. CONCLUSION

In this case a young girl with a right tibia fracture - a fibula fracture because of RTA is studied. The rehabilitation program consisted of a goal-based care programme to improve post-operative pain, oedema, range, intensity and patient response. With the assistance of regular therapy, she was willing a willingly regain normal life (ADLs).

LIMITATIONS

Early weight bearing was hindered because she was applied externally with split skin graft.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

CONSENT

Informed consent was obtained from patient included in the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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