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Efficacy of Early Rehabilitation in Closed Traumatic Fracture of Knee ACL & PCL Tibial Bony Avulsion with Tibial Condyle with Common Peroneal Nerve Injury in Young Individual - A Case Study

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Abstract: ***Objective: To see the effectiveness of complete rehabilitation program in traumatic case of comminuted tibial condylar fracture with common peroneal nerve injury on left side. Materials & methods: The study includes a patient age 23 years female with comminuted closed traumatic fracture of knee ACL & PCL tibial bony avulsion with tibial condyle with footdrop on the left side. An entire rehabilitation protocol which incorporates various exercises and electric therapy was followed for this condition on regular basis daily. Result: during this study, outcome was pain assessment (NPRS), improvement in Range of motion. Strength-duration curve for peroneal nerve and lower extremity functional scale (LEFS) after giving physiotherapy management was checked. Conclusion: This study concluded that a correct rehabilitation protocol for lower limb injury encompasses a significant effect in reducing pain, increasing range of motion at knee and to enhance the performance of daily living.***

Keywords: tibial fracture, foot drop, rehabilitation, physiotherapy, lower extremity function

1. Introduction

This study guides a stepwise walkthrough by Experts for writing a successful journal or a research paper ranging from inception of ideas till their publications. Research papers are highly recognized in scholar fraternity and form a core a part of PhD curriculum. Research scholars publish their research add leading journals to complete their grades. Additionally, the published research work also provides an enormous weight-age to urge admissions in reputed university. Now, here we enlist the proven steps to publish the research paper in a very journal.[1]Tibia is that the second large and long bone of the lower extremity. Proximally tibia consists of tibial plateau which constitute the medial and lateral condyles and also the intercondylar eminence. The medial condyle is larger than the lateral condyle and is that the sturdy of the two tibial condyles. Smaller lateral condyle is more commonly fractured. Tibial plateau fracture encompasses a large range of severity, starting from stable non-displaced fractures with minimal soft tissue injury to highly comminuted unstable fractures with massive soft tissue injury that threaten the viability of the limbs. Tibia plateau fractures are well classified by Schatzker classification which consists of 6 sub classification namely type 1 lateral plateau fracture without depression, type 2 lateral plateau facture with depression, type 3 compression fracture of the lateral or central plateau, type 4 medial plateau fracture, type 5 bi-condylar plateau fracture and type 6 plateau fracture with diaphyseal discontinuity.[2]Fracture of the tibial plateau accounts for 1 percent of all fractures annually. Bi condylar tibial plateau fracture could be a particular kind of low incidence tibial plateau fracture so far, few reports are reported on this kind of fracture. Surgical procedure of tibial plateau fractures can provide excellent anatomical reduction, restore articular congruity, promote early movement, minimize post-traumatic osteoarthritis and achieve optimal knee function.[3] post-surgery progressive physiotherapy rehabilitation has shown to achieve success, including passive to active movements, manual joint mobilization, progressive resistance exercise, muscle energy technique, electrotherapy and proper patient education.[4]Foot drop is defined as a lack of ability in the person to lift the foot at the ankle (dorsiflex), wherein dorsiflexion enables him to attain ground clearance during walking.[5]On the premise of the causes, foot drop is unilateral or bilateral. The foremost prevailing peripheral reason behind foot drop is that the injury to the common peroneal nerve, which provides nerve supply to the ankle and footextensors. Foot drop causes weakness within the dorsiflexor muscles and may also affect the muscles of eversion, which include peroneus tertius and peroneus longus muscles.[6] It results in an alteration within the gait pattern, which frequently ends up in an increased risk of falls reason being the lack of the foot to achieve ground clearance effectively as a result of weak or absent voluntary ankle dorsiflexion.[7]The lower extremity functional scale (LEFS) could be a valid patient-rated outcome measure (PROM) for the measurement of lower extremity function. The target of the Lower Extremity Functional Scale (LEFS) is to measure “patients' initial function, on-going progress, and outcome" for a large range of lower extremity conditions. The utmost possible

score is 80 points, indicating very high function. The minimum possible score is 0 points, indicating very low function.[8]

2. Patient History

This case relates to the assessment and management of a 23-year-old female, presented with operated case of comminuted fracture involving the proximal end of tibia involving medial as well as lateral condyle and the inter-condylar region. Fracture is also seen involving the head of fibula in medial aspect on left side. Mechanism of injury was road traffic accident and bending force was applied to the left side. Patient was admitted after proper investigation including radiographs and MRI of left knee joint. She was operated with open reduction done for PCL bone avulsion & fixed with 4 mm canulated cancellous screw & for posterolateral fragment fixed with same approach. ACL bony avulsion & lateral condyle tibia fracture managed conservatively. Immobilization was given for 21 days. Apart from pain and restricted range of motion at knee joint her chief complaint was she can't able to lift her left foot from ankle joint, hence the distal neurovascular structure is normal before the surgery. The doctor diagnosed foot drop due to the common peroneal nerve injury after the immobilization removed. Aggravating factor for pain was movement of left leg along with the difficulty to lift the left leg. Patient was unable to walk, stand and functional activities were significantly affected. She was only able to sit with knee extended. No relevant or significant past medical history was described, no regular medication was taken and any history of smoking, drug allergies, alcohol intake was not present.

3. Examination

On examination, the patient's vitals were normal. Attitude of limb at left side was hip was in 90 flexed and knee was in extended position with wearing a brace and ankle is in plantar flexed position in long sitting. Pain assessment was taken at initial stage before starting the physiotherapy on NPRS, the score was 7 and type of pain was dull aching pain. Scar was present at posteromedial side of the left knee. The skin texture was normal. The active and passive range of motion was restricted severely in left knee and at ankle joint. Foot drop is present. The strength in muscles of hip, knee and ankle was reduced as compared to sound side. Sensory examination (superficial and deep) was done. There was lost sensation of touch and temperature at anterolateral side of the lower leg and dorsum of foot. No atrophy was present of any muscles. Range of Motion, manual muscle testing was taken before and during the treatment. SD curve was taken on 35th day, 55th day, 75th day and 110th day after the injury. Lower functional extremity scale was taken and the score was 20 out of 80 during examination.

4. Management

Patient specific rehabilitation protocol was structured. Patient underwent physiotherapy rehabilitation for duration of 18 weeks, 6 days per week.

Week 1: Maximum protection

- Cryotherapy to reduce inflammation and swelling for 15 minutes. Knee Braces was applied throughout.
- Active assisted right hip, knee ROM exercises 10 repetitions 2 times a day. Full range of motion active resisted left lower limb and both upper limb exercises with weight cuffs.
- VMO activation was more focused upon and static contraction exercises with 10 repetitions and 10 second holds each for quadriceps, hamstrings and glutei muscles were performed. All the exercises were performed twice daily.
- Passive movements of ankle were given. Stretching of calf was given 3 repetitions with 30 sec. hold.
- Sensory stimulation was given with materials of different textures to stimulate the sensory function.

Week 2-6: Progression to achieve full ROM and gait training

- Knee was maintained in extension to avoid flexion contracture. Phase-1 program exercises were continued.
- Cryotherapy was continued to control inflammation. Strengthening of uninvolved lower extremity and upper extremities was progressed with increase in intensity and repetitions.
- Active pain free movement is appreciated in available range. Straight leg raising in all planes were encouraged with 10 sec. hold.
- Gait training was initiated with non-weight bearing with walker and long knee brace support to the right lower limb.
- (Ankle-Foot-Orthosis) splint was prescribed to maintain proper alignment of the ankle and foot and also for walking with a proper gait. Gait training was done for approximately 10-20 min. Removal of splint was advised during the night.
- Proper care of limb was taught to the patient in order to prevent the skin from infection. Proper inspection of the region was advised to look for any bruises. As the skin type of the patient was dry, he was informed to apply moisturizing ointment over that part.
- Electrical muscle stimulation was given to the affected muscles (current type-Intermittent Galvanic; Wavelength-Triangular; duration-15min) for effective muscle education. The motor points for stimulation were Tibialis Anterior, Peroneus Longus, Peroneus Brevis, Extensor Hallucis Longus, and Extensor Hallucis Brevis.
- Visual Feedback exercises were advised to the patient in order to improve the posture and gait pattern.

Week 6-8: Strengthening and proprioceptive phase

- Same phase-2 exercises were continued. Strength training of right lower extremity was progressed to active pain free movement in available range.

- In supine left knee ROM was gradually initiated active assisted within pain free range. Modalities like CPM were used to enhance the knee range of motion.
- Electrotherapy surged faradic stimulation was given to quadriceps and hamstrings to enhance the muscle fibers recruitment for functional training. Dynamic quadriceps exercises were progressed with minimal to no assistance.
- Weight bearing was initiated in gait training with 25 percent weight bearing and progression in weight bearing every 2 weeks by 25 percent. Gait training in parallel bar systems was done to cope with the weight bearing status.

Week 8-10: Advanced strengthening and balance regimen

- All the above phase exercises were progressed and advanced strengthening weight transfers and weighing scale press were initiated to improve proprioception.
- Strength training to the left side lower limb muscles was progressed by using increasing repetitions and hold durations. Use of brace was withdrawn after the accomplishment of fair quadriceps, hamstrings and VMO muscle strength.
- Weight bearing in gait training was progressed with 50% which helped to improve patient's confidence in ambulating independently.

Week 10-16: return to functional activities and enhance independent walking

- All the above phases' exercises were progressed and for 100% weight bearing patient was instructed to initiate only after the orthopaedic surgeons instruction on radiological confirmation of fracture fragments fused and a physiotherapy follow-up to teach the necessary progressions.
- Independent forward, backward, sideward and tendom walking, stair climbing was also started. Training of walking on uneven surfaces was initiated.
- Single leg standing, partial lunges followed by full lunges and other plyometrics exercises were encouraged at the end of 16 weeks.

5. Result

LEFS outcome score was checked after physiotherapy treatment and score was increased by 56 out of 80. This indicates patient does its work independently. Post 16 weeks of rehabilitation patient showed remarkable improvements. The NPRS score was also taken after physiotherapy treatment and it was decreased. The patient had achieved independent walking and full range of knee flexion and extension range of motion.

Hip joint	Pre	Post
Flexion	0°-90°	0°-120°
Extension	0°-20°	0°-40°
Abduction	0°-45°	0°-45°
Adduction	45°-0°	45°-0°
Internal rotation	0°-30°	0°-45°
External rotation	0°-40°	0°-45°

Knee joint	Pre	Post
Flexion	10°-30°	0°-120°
Extension	30°-10°	120°-0°
Ankle joint		
Plantar flexion	0°-45°	0°-45°
Dorsi flexion	0°	0°-15°
Inversion	0°-5°	0°-15°
Eversion	0°-5°	0°-10°

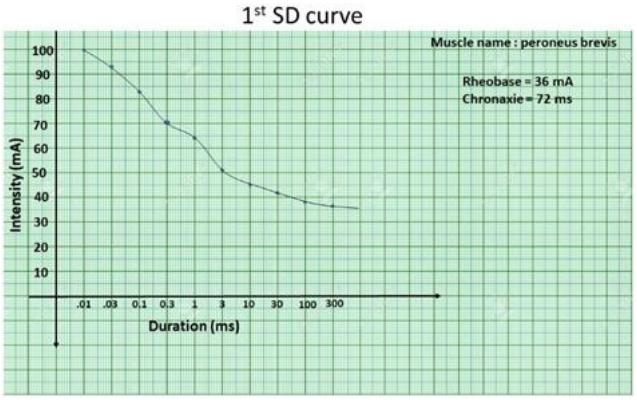

Figure 1.1: SD curve on 35th day

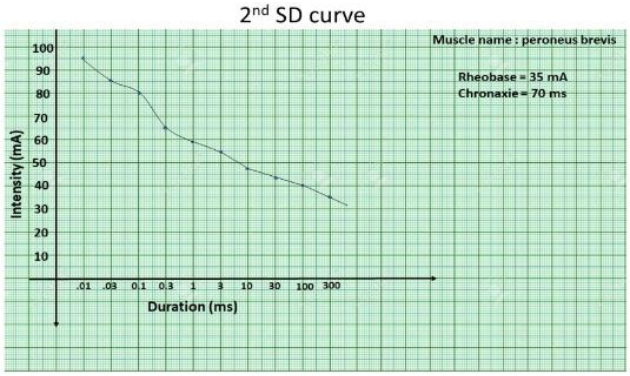

Figure 1.2: SD curve on 55th day

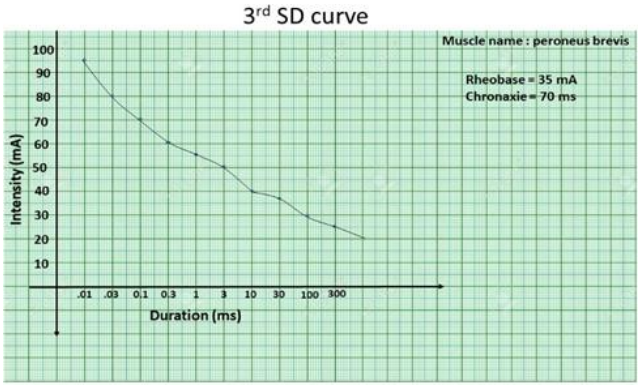

Figure 1.3: SD curve on 75th day

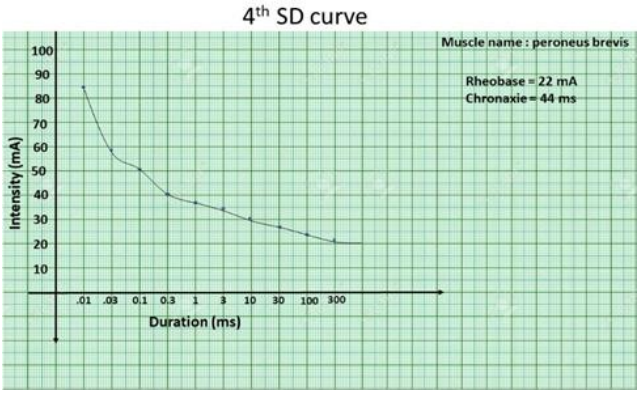

Figure 1.4: SD curve on 110th day

6. Discussion

Bi-condylar tibial plateau fracture could be a challenge because it is related to soft tissue injuries, communication and complexity which usually results from high energy trauma in turn which further complicates the management of such complex fracture.[9] Early passive mobilization has shown to be effective in greater improvement in knee flexion ROM during rehabilitation and lowered risk of deep venous thrombosis.[10]The different approaches like cryotherapy, progressive range of motion exercises, soft tissue mobilization, isometric exercises, open and close chain muscle strengthening, stretching, gait training has been found to be effective in recovery of bi-condylar tibial plateau fracture . The study conducted by Gabriel found that physiotherapy intervention includes a positive impact to achieve confidence, improve gait in post-operative physiotherapy.[11] it's always recommended for a structural rehabilitation program for the recovery of post-operative patient based on his physical status and functional must achieve positive prognosis outcomes.

In the present report, the patient was provided a well-structured physiotherapy rehabilitation with various exercises, electrotherapy and by a talented physiotherapist. Cryotherapy, analgesics cause gradual reduction in pain because of which the patient was able to put more effort within the rehabilitation which led to progressive improvements in the range of motion and muscle strength and functional outcomes. The physiotherapy sessions were designed to keep up the muscle integrity for the right lower extremity and enhance left lower extremity and both upper extremities to encourage independent non weight bearing walking with walker and minimal assistance for daily activities. Electrotherapy modalities like continuous passive motion was used to initiate and enhance the knee range of motion in the early phase to take care of and improve knee mobility. Various proprioception and stabilization exercises in the later phase were initiated to enhance proprioception and weight transfer. Involvement of proprioception exercises in the rehabilitation of patients under gone knee injuries and knee surgeries is important aspect in rehabilitation. Effective electrical stimulation includes stimulating the weakened muscle by utilizing surface or implanted electrodes alone or in conjunction with the related peroneal nerve to recruit more muscle fibers to resolve weakness.[12]A slowly increasing triangular pulse is required to stimulate a selected denervated muscle, because this muscle has less capacity to accommodate.

So, on achieve a contraction in a much denervated muscle, either triangular pulses of long duration (100–500 ms) or rectangular pulses of sufficient duration (30 ms or more) are often used.[13]The patient was instructed to follow all the exercises as part of home program and was given written protocol and advised for follow-up visits.

This case report's purpose was to concentrate on the importance of prompt surgical procedure and essential physiotherapy rehabilitation to achieve the functional goals with to reference to patient and its prognosis.

7. Conclusion

In conclusion, the study suggests that the proper rehabilitation protocol should be emphasized. Muscle re-education and sensory stimulation by the electrical nerve stimulation in early phase has significant effect on the muscle strength of tibialis anterior, halluces longus and peroneus muscles. Apart from the additive effects of the splinting and encourage the active range of motion has a positive beneficial effect on the functional tasks. At the late stage proper gait training plays a crutial role in the daily living activities of the patients.

So, the study concluded that physiotherapy plays a very effective role in the treatment of closed traumatic fracture of knee ACL & PCL tibial bony avulsion with tibial condyle with common peroneal nerve injury

8. Acknowledgement

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9. Conflict of Interest

There is no personal or institutional conflict of interest for this study.

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