Physiotherapy Management of Post-Operative Cellulitis for Functional Recovery: A Case Report

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ABSTRACT

Background: Most frequently affecting the lower limbs, cellulitis is an acute bacterial infection of the skin and subcutaneous tissues. Inadequate treatment may result in serious side effects like necrotising fasciitis and joint contractures. Physiotherapy is important for post-operative pain and oedema reduction, range of motion (ROM) restoration, muscular strength enhancement, and functional mobility facilitation.

Objective: To evaluate how well a comprehensive physiotherapy rehabilitation program improves a patient's discomfort, range of motion, muscular strength, and functional mobility after cellulitis surgery.

Methodology: A 43-year-old male presented with post-cellulitis complications following surgical intervention for left lower limb cellulitis, resulting in knee contracture and reduced mobility. Over the duration of six weeks, an individualised physiotherapy program was implemented with an emphasis on pain management, oedema reduction, range of motion restoration, muscle strengthening, and gait training. Cryotherapy, interferential therapy (IFT), therapeutic ultrasound, and faradism under pressure were among the therapeutic methods. In addition to balance and gait re-education, progressive exercise therapy focused on the hip, knee, and ankle joints.

Results: The patient showed significant clinical improvement after six weeks of rehabilitation. During activities, pain levels dropped from 8/10 to 2/10. Hip, knee, and ankle joint range of motion significantly improved. On the MRC rating, muscle strength improved from grade 3+ to grade 4. Functional mobility progressed from cane-assisted walking to unassisted gait, from wheelchair dependence to independent ambulation. Both overall quality of life and functional ability were significantly improved.

Conclusion: This case study emphasises how important systematic physical therapy is for managing cellulitis-related complications after surgery. Mobility, muscle strength, and functional independence were successfully

restored by an individualised rehabilitation program, highlighting the significance of physiotherapy in optimising recovery and eliminating long-term disability.
Keywords: Cellulitis, physiotherapy, rehabilitation, contracture, edema, range of motion, post-operative recovery, gait training.
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1.INTRODUCTION

Cellulitis is a common bacterial infection of the skin and subcutaneous tissue that occurs mostly in the lower limbs and is associated with inflammatory signs such as tenderness on palpation, edema, erythema and warmth of the demarcated area and the infection is non-dischaging. It is typically caused by Beta-hemolytic streptococci. The population affected by cellulitis includes immunosuppressed patients, also with underlying comorbidities like diabetes, and who have had animal bites.[1] Most cases of cellulitis 88% happen on the lower limbs.[2] As bacteria invade the skin, white blood cells called neutrophils start to gather and chemical signals i.e cytokines are released. Antimicrobial peptides are activated as a result, which stimulates the body's inflammatory reaction.[1] If there is noticeable oedema, blistering and ulceration could occur. Lower leg oedema of any causation is a risk factor. Lymphoedema is especially important as a cause of recurrent episodes and is a situation in which streptococcal cellulitis can be particularly aggressive.[3]
The risk factors of lower limb cellulitis are multiple, and can be grouped into general and local risk factors. General risk factors include obesity, diabetes, history of cellulitis, immunosuppression, chronic alcoholism and chronic use of non-steroidal anti-inflammatory drugs (NSAIDs), while disruption of the skin barrier, neglected wounds, toe-web intertrigo, leg ulcers, use of depigmentation drugs and leg oedema, were the most commonly reported local risk factors.[2]
Cellulitis may progress to necrotizing fasciitis, which can be treated by surgical intervention.[4] This includes release of fascia by fasciotomy with debridement.[4] Once the surgery is done, the later can be managed by physiotherapy interventions. The goals of physiotherapy treatment are to educate the patient, to reduce swelling and edema, to prevent further complications (including DVT and/or contractures), scar and soft tissue mobilization, improving range of motion of the affected joints and enhance gait pattern, evolve the muscle strength, and improve balance and quickness of movement.[5]
The aim of this case report is to show the effectiveness of physiotherapy intervention in a post-operated case of cellulitis in improving the range of motion, muscles strength and quality of life of the patient.

2. CASE PRESENTATION

A 43-yr old male was referred to MGM Physiotherapy, Department of Musculoskeletal at Chh. Sambhajinagar for physiotherapy treatment. He was having major symptoms, including pain and swelling in the left lower extremity extending from the thigh down to the toes, along with walking difficulty.
The patient experienced pain in his left leg from the thigh to the foot. He took medications to relieve pain. After a few days, the patient noticed some rashes and experienced pain with a burning sensation in the swollen leg. Later, he was operated on for the condition, but due to reduced movement, there was the formation of contracture in the left knee joint. The patient reported pain 8/10 on the NPRS on the initial day of pretreatment.

3.PHYSICAL EXAMINATION

The examination started with assessment of movement for both the lower extremities in which the left lower extremity active movements were painful and restricted as well as the passive movements were painful and incomplete. We measured the hip, knee and ankle range of motion and performed further analysis using universal goniometer.
The hip muscles featured weakness bilaterally. In right limb quadriceps, hamstrings, calf and foot muscles evidenced reduced strength and featured reduced flexion, extension, abduction and adduction of hip with reduced flexion / extension of knee joint. The hip, knee and foot muscles in pretreatment MRC muscle power graded 3.
The patient had grade 3 pitting oedema on left lower limb. On neurological examination sensory proprioception and deep tendon reflexes were intact.

Figure. 1. Ankle Toe Movements with Straight Leg Raises.

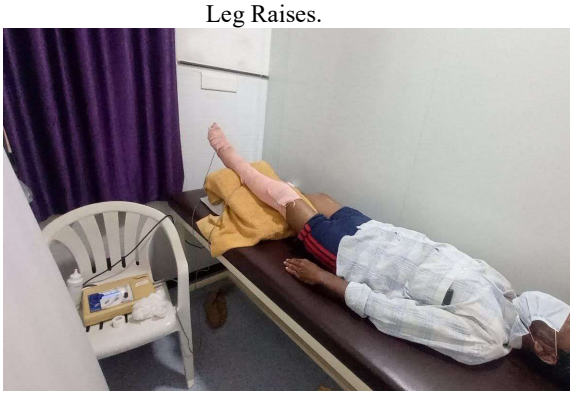

Figure. 2. Faradism Under Pressure for left leg.

Figure.3. Pre and post difference in oedema for lower limb

Figure.4. Gait Training with walker

Figure.5. Gait Training with cane

4. INVESTIGATION

Left lower limb arterial and venous doppler showed diffuse subcutaneous oedema over upper middle and lower third of leg, ankle and dorsum of foot.

There were no presence of hemodynamically significant stenosis and no such evidence of Deep venous thrombosis (DVT).

High frequency USG presented with diffuse cellulitis changes involving left foot extending left lower limb.

5.DIFFERENTIAL DIAGNOSIS

Soft-tissue infections that resemble cellulitis must be distinguished from it, since the management of necrotizing fasciitis or gas gangrene requires extensive debridement. The diagnosis of necrotizing fasciitis can be established definitively only by direct examination on surgery or by biopsy with frozen section

6. DIAGNOSIS

Based on subjective and objective evaluation and investigation report the case was diagnosed as Post Cellulitis left leg contracture release in knee with left knee and ankle dysfunction (stiffness).

7. PRE- AND POST-TREATMENT OUTCOME MEASURES

Pre-treatment assessment revealed significant pain and functional limitations. The patient reported 6/10 pain at rest and 8/10 discomfort during activity on the Numeric Pain Rating Scale (NPRS). Pain levels significantly decreased to 1/10 at rest and 2/10 during activity after the intervention.

Measurements of range of motion (ROM) showed significant improvements after treatment. Regarding the hip joint, the right hip flexion increased from 0–100° to 0–120°, while the left hip flexion improved

from 0–80° to 0–110°. The right side remained at 0–30° both before and after treatment, but the left side's hip extension increased from 0–20° to 0–30°.

Hip abduction increased from 0–25° to 0–35° on the left and from 0–30° to 0–35° on the right. Bilateral hip adduction remains constant between 0 and 15°. Internal rotation increased from 0–25° to 0–30° on the left and from 0–30° to 0–35° on the right. At 0–40° on the left and 0–45° on the right, external rotation stayed constant.

Right knee flexion increased from 0–90° to 0–120° at the knee joint, whereas left knee flexion improved from 0–80° to 0–110°. On the left, knee extension increased from 80–0° to 110–0° and on the right, from 90–0° to 120–0°. Before and after treatment, there was no extension lag on the right, but on the left, it decreased from 80–10° to 110–5°.

Left ankle dorsiflexion increased from 0–10° to 0–20°, while right ankle dorsiflexion stayed at 0–20° before and after therapy. While the right side remained at 0–40°, the left side's plantarflexion improved from 0–25° to 0–40°.

Manual Muscle Testing (MMT), which measures muscle strength, showed a general improvement. At the hip, all muscle groups on the right side improved from grades 3+ to grade 4, while the flexors, extensors, abductors, and adductors on the left side improved from grades 3+ to grade 4.

The right-side maintained grade 4 strength at the knee, while the left flexors and extensors increased from grade 3+ to grade 4. The right side of the ankle remained at grade 4, whereas the left dorsiflexors and Plantarflexors improved from grade 3+ to grade 4.

Muscle girth measurements indicated a reduction in limb circumference. Measurements dropped from 17.5 to 15.0 inches on the left and from 16.5 to 14.9 inches on the right above the knee at 3 inches. Values decreased from 19.8 inches to 17.3 inches on the left and from 17.7 inches to 15.8 inches on the right at 6 inches above the knee. Girth reduced from 21.4 inches to 18.9 inches on the left and from 20.5 inches to 18.8 inches on the right at 9 inches above the knee.

Overall, the post-treatment results show significant pain reductions, increased muscle strength, improved joint range of motion, and a reduction in lower limb circumference, all of which are indicative of satisfactory functional outcomes post the intervention.

8. INTERVENTION

Patient education, pain management, edema reduction, preventing complications, accelerating the healing process, scar tissue mobilization, improving range of motion, strengthening muscles, improving balance and gait, and ultimately enabling the patient to perform activities of daily living independently are the primary aims of the rehabilitation protocol. Patient education includes informative explanation about the condition and the treatment that will be given to the patient. Pain reduction was achieved by using IFT and cryotherapy. Edema was reduced by lower limb elevation and icing. Complications like deep vein thrombosis and contractures were prevented by proper positioning and ankle pumps. To fasten healing ultrasound was used. Scar tissue mobilization was given to prevent the scar from adhering to the skin. Active movements were encouraged to increase the range of motion. Core muscles and lower limb muscles were strengthened. Balance training and gait training was incorporated to make the patient self-reliant. Lastly the patient was taught exercises that were to be done at home to maintain the progress achieved.

The details of the treatment protocol are described in table 1 below.

PHASES	GOALS	INTERVENTIONS	PRESCRIPTION AND DOSAGE
1st week	Patient education	Educating the patient about the condition and assuring the patient about improving overall health of the patient	

	Pain Relief	Cryotherapy- on calf muscles and ankle joint Interferential Therapy for left knee joint. (Crossed 4 pole method, electrode placed on either side covering the knee joint)	10-15 minutes, twice a day for Type – Isoplaner vector field (4 pole) Frequency- 90 Hz Sweep – 5 sec Time- 20 minutes
	Reduce edema	-Left lower limb Elevated by using two pillows	
		-Assisted Ankle toe movements with straight leg raise	10 repetition 2 sets
		-Cryotherapy	10-15 minutes twice a day.
	Preventing complications	-Patient positioning	Supine position with pillows under the left leg.
		-Ankle toe movements with straight leg raise	20 repetition 2 sets.
	Enhance wound healing	-Ultrasound (Around the fasciotomy area on left lower leg)	**Frequency**- 3 MHz **Intensity**- 0.8 W/cm^2 **Duty cycle** - 50% **Time-** 7 minutes
2^{nd} – 3^{rd} weeks	Reduce oedema	-Faradism under pressure (Active electrode placed over the calf muscles. Passive electrode was placed over the sole of the foot)	**Type of current**: - Surged faradic current. **Duration:** - Surge duration 3 seconds Surge interval 9 seconds **Intensity** – enough to produce visible contraction in muscles. **Time**- 20 minutes.
		-Ankle toe movements with straight leg raises without assistance	20 repetition 2 sets
	Scar tissue mobilization	Myofascial release using thumb around the scar to prevent it from adhering to the skin	2-3 times per day For 5-7 minutes
	Improving Range of Motion	Active ROMs in available ranges and slight passive pressure beyond the available range for Hip Joint - flexion, hip abduction, hip extension Knee joint – Flexion and Extension Ankle Joint – dorsiflexion, plantar flexion, inversion, eversion.	5 seconds hold, 10 repetition 2 sets

	Improving strength of core muscles and lower limb muscles	-Static quadriceps -Static abdominals -Static hamstrings -Static back -Dynamic Quadriceps	10 seconds hold, 10 repetition, 1 set
		-VMO strengthening (using VMO Board)	10 seconds hold, 10 repetition ,1 set
		Progressed by using resistance – band Yellow elastic band (Clam shell exercise) For Gluteus Medius and Gluteus Minimus.	10 repetition, 3 sets
4th – 5th weeks	Improving balance	-Single leg standing with support (right leg followed by left leg)	10 seconds hold, 2 sets
		-Step marching exercise (Performing alternate hip knee flexion 45 degrees)	8 steps, 1 set
	Improving gait pattern	-Walking using walker -Walking using parallel bars with mirror feedback -Walking using cane -Independent walking -Tandem walking -Lateral walking	• **Duration:** 5-10 minutes • **Frequency:** 2-3 times per day • **Intensity:** Moderate pace, emphasizing safety and stability • **Progression:** Increase duration by 1-2 minutes each day as tolerated
6th weeks	Making the patient independent and planning tailored home program	-Ergonomic advice -Lifestyle modification -Educating the patient about importance of exercise at home	

9. DISCUSSION

The importance of physiotherapy in managing post-operative complications after cellulitis surgery is emphasized in this case study. A frequent bacterial infection of the skin and subcutaneous tissues, often presents with symptoms such as pain, edema, and erythema, primarily affecting the lower limbs [7]. In the present case, the patient had considerable

discomfort and functional restrictions that could have resulted in significant long-term disabilities if left untreated.

The importance of physiotherapy in helping the patient heal cannot be overlooked from pain and swelling control. Cryotherapy and Interferential Therapy (IFT) were used to reduce pain and manage oedema. Researches have shown that cryotherapy works efficiently for the management of pain and inflammation after surgery [8]. Furthermore, the use of IFT, which involves the use of medium frequency currents, helps in pain relief and increases blood flow. [9].

Faradism under pressure was used as another modality in aiding the treatment of edema because it uses the combination of electric current with compressions to elevate fluid movement to reduce edema. It can be said that faradism under pressure has its basis in evidence as there is literature available indicating that electrical stimulation can be effective for treating postoperative edema [6,10]. Additionally, ultrasound therapy was used as it helps heal tissues, which is evidenced by literature sources [11]. The systematic nature of the exercises for rehabilitation played a very important role in helping to restore the range of motion, strength of muscles, and functional ability. Early mobilization and range of motion exercises play a vital role in the prevention of contractures. To enhance general stability and gait, strengthening exercises were included, especially those that focused on the lower limbs and core. Evidence demonstrating the significance of muscle training in improving functional recovery following lower limb surgeries supports these therapies [13].

In addition to helping the patient overcome the initial challenges after surgery, this comprehensive physiotherapy regimen was essential in promoting the patient's general recovery and better quality of life. By the time the treatment was finished, the patient had made significant progress in terms of joint mobility, muscle strength, and pain levels, which allowed him regain the capacity to walk on his own—a crucial accomplishment for him [14].

10. PATIENT PERSPECTIVE

In comparison to the first day, the patient claimed that his pain and swelling had significantly decreased, that his gait pattern had improved, that he was no longer wheelchair bound, that he could walk on his own with a cane, and that by the sixth week, his quality of life had improved.

11. CONSENT

As per international standard or university standard, patients written and informed consent has been collected and preserved by the author(s).

12. ETHICAL APPROVAL

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

13. COMPETING INTERESTS

Authors have declared that no competing interests exist.

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