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Abstract

Background: Bilateral lower limb amputation is becoming more frequent in recent years. This case report will outline the pre-operative and post-operative physiotherapy protocol for bilateral lower limb amputations following dry gangrene. Additionally, this case was evaluated to see if postoperative physiotherapy treatment consisting of prevention of complications, patient education, independent self-care, and functional mobility improved outcome. **Case:** A 76-year-old man came to the hospital with clinical features of dry gangrene of both feet. Preoperatively he was given education on care for his limbs along with the therapy plan following surgery. Pain on VAS scales were taken prior to surgery and postoperatively as well. **Results:** Preoperative education helped the patient improve his pain status, which is an important aspect for postoperative rehabilitation. Decreasing pain on VAS facilitated early rehabilitation which further helped lessening the chances of postoperative complications. **Conclusion:** Pre- and early post-operation rehabilitation improve patient outcomes such as improved pain levels, range of motion and prevention of complication related to bilateral lower limb amputation.

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ABSTRACT

Background: Bilateral lower limb amputation is becoming more frequent in recent years. This case report will outline the pre-operative and post-operative physiotherapy protocol for bilateral lower limb amputations following dry gangrene. Additionally, this case was evaluated to see if postoperative physiotherapy treatment consisting of prevention of complications, patient education, independent self-care, and functional mobility improved outcome. **Case:** A 76-year-old man came to the hospital with clinical features of dry gangrene of both feet. Preoperatively he was given education on care for his limbs along with the therapy plan following surgery. Pain on VAS scales were taken prior to surgery and postoperatively as well. **Results:** Preoperative education helped the patient improve his pain status, which is an important aspect for postoperative rehabilitation. Decreasing pain on VAS facilitated early rehabilitation which further helped lessening the chances of postoperative complications. **Conclusion:** Pre- and early post-operation rehabilitation improve patient outcomes such as improved pain levels, range of motion and prevention of complication related to bilateral lower limb amputation.

Keywords: bilateral lower limb amputation, dry gangrene, physiotherapy rehabilitation, dry gangrene rehabilitation, amputation physiotherapy

INTRODUCTION

Dry gangrene is a necrosis caused by severe arterial ischemia or complete block of the circulation of blood inside the arterial system. The risk factors for peripheral atherosclerosis overlap with the risk factors for coronary artery disease: diabetes, smoking, hypertension and hyperlipidaemia. Feet and hands are the most common affected parts, and symptoms may include change in skin color (from red to black), swelling, ulceration, pain, and detachment of local skin. Affected part is dry, shrunken, and darker reddish-black and it is painful with loss of sensitivity at this level.^{1,2}

Bilateral lower limb amputation is being frequently performed in recent years due to increased incidence of diabetes and peripheral vascular disease among older populations.³ Estimates suggest there are 0.62 amputees per thousand population in India, a diverse country with many disabilities.⁴

Rehabilitation for bilateral lower limb amputees poses numerous challenges for both the rehabilitation team and the amputees themselves. Most of these challenges are focused on preventing post-amputation complications such as residual limb hematoma, flap necrosis or infection, and phantom limb pain, along with psychological problems and depression.⁵ In later periods, amputated individuals may also experience neuroma formation, bony erosion, ulceration and ongoing ischaemia. Finally, it is important to develop independence in order to regain functional mobility as well as improve quality of life after a lower extremity amputation.⁶

Purpose

The purpose of this case report was to develop a pre- and postoperative physiotherapy protocol specifically for bilateral lower limb amputation following dry gangrene. Additionally, this report evaluates the efficacy of a one-week postoperative physiotherapy treatment that consists of prevention of complications, patient education, independent self-care, and functional mobility.

PATIENT INFORMATION:

A 76-year-old man farmer went to the local practitioner because he was experiencing pain in his abdomen and swelling on both his lower limbs. After a day, he developed darker skin coloration (along with other changes) on one of his lower extremities. Over time, this process continued in other extremity as well. Gradually the patient could no longer walk due to the leg pain caused by these changes. The patient had no history of diabetes mellitus, hypertension, or family history of similar problems; however, he did smoke for 34 years, but has quit smoking 20 years ago.

CLINICAL FINDINGS:

Pain Assessment

There is pain on the plantar aspects of both feet, which makes it difficult to walk and stand (VAS on rest: 4/10 and during activity: 7/10).

Palpation

The line of demarcation was appreciated with a mummified appearance to toes on both feet. All pulses were present in the left lower limb until tibial pulsation, while for right limb posterior tibial pulses were palpable.

Auscultation

Air entry into both sides was reduced bilaterally on anterior, middle and lower zones.

Functional Limitations

The patient is finding it difficult to stand and walk without assistance with all their hygiene activities done on bed.

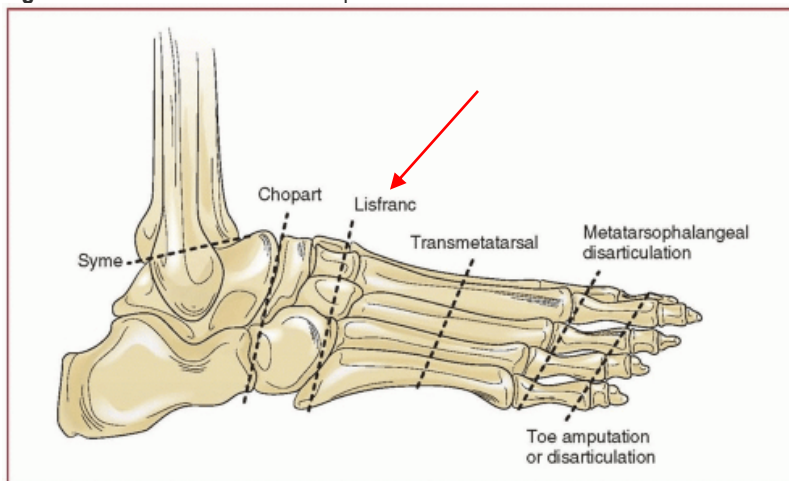
Investigations:

Residual Limb Color

Doppler showed multiple large inguinal lymph nodes on the right side, as well as atherosclerotic changes in the right arterial system in the form of multiple wall calcification. Biphasic flow was seen in posterior tibial artery, anterior tibial artery and dorsalis pedis artery to peripheral vasodilation and CT lower limb angiography suggesting diffuse osteopenia in tarsals, metatarsals and phalanges with bone erosion in both limbs.

Figure 1: Dorsal view (A) and plantar view (B) of the right foot before surgery

The patient underwent transtibial amputation on his right limb and Lisfranc amputation on his left limb. The main advantage of the Lisfranc amputation is that the heel is spared, which allows patients to perform mobility activities and ambulate. For the patient in this study, ROM and strength (Grade 4) was full preoperatively for both upper and lower limbs, but it decreased postoperatively due to pain.

Figure 2. Levels of Partial Foot Amputation**Figure3:** Front (A) and Back view (B) of the Right Foot After Surgery

The following outcome measures were assessed before and after surgery:

- Incision pain on visual analogue scale
- Range of motion using manual goniometer for bilateral limbs
- Strength with manual muscle testing grades
- Wound examination postoperatively for incidence of infection

Preoperative Physiotherapy Management:

Patient education for wound care and pain management was taught to the patient. These treatments were important in healing and maintaining the outcome measure parameters, such as keeping the wound clean and dry, checking for infection development, personal hygiene measures and preoperative range of motion exercises (Table-1). Strength training (Table 2) and breathing exercises were also included as part of our routine treatment plan to help ensure a positive outcome for our patients.

Table 1. Range of Motion Findings- Preoperatively, POD-1 & POD-7

Joint	Movement	Pre-operatively				Post-operatively Day-1				Post-operatively Day-7			
		Right		Left		Right		Left		Right		Left	
		ARO M	PRO M	ARO M	PRO M	ARO M	PRO M	ARO M	PRO M	ARO M	PRO M	ARO M	PRO M
Hip	Flexion	0-80°	0-85°	0-90°	0-95°	0-30°	0-35°	0-30°	0-40°	0-90°	0-95°	0-90°	0-95°
	Extension	0-5°	0-5°	0-5°	0-10°	0-5°	0-5°	0-5°	0-5°	0-10°	0-10°	0-10°	0-10°
	Abduction	0-25°	0-30°	0-25°	0-30°	0-25°	0-30°	0-25°	0-30°	0-30°	0-30°	0-30°	0-35°
	Med Rotation	0-25°	0-30°	0-30°	0-30°	0-25°	0-30°	0-25°	0-30°	0-30°	0-30°	0-35°	0-35°
	Lat Rotation	0-30°	0-30°	0-30°	0-30°	0-25°	0-30°	0-25°	0-30°	0-30°	0-30°	0-35°	0-35°
Knee	Flexion	0-120°	0-130°	0-125°	0-130°	0-125°	0-130°	0-125°	0-130°	0-130°	0-125°	0-130°	0-135°
	Extension	120-0°	130-0°	125-0°	130-0°	125-0°	130-0°	125-0°	130-0°	130-0°	125-0°	130-0°	135-0°
Ankle	Dorsi-flexion	0-5°	0-10°	0-5°	0-10°	0-5°	0-10°	0-5°	0-10°	0-10°	0-15°	0-10°	0-15°
	Plantar-flexion	0-25°	0-30°	0-30°	0-35°	0-25°	0-30°	0-25°	0-30°	0-35°	0-40°	0-35°	0-40°
Note: ROM of Upper Extremity (Shoulder, Elbow, Wrist)- Full Range Bilaterally													

Table 2. Manual Muscle Testing Findings – Preoperatively, POD-1 & POD-7. According to Medical Research Council (MRC) Muscle Strength Grading (MRC)

Joint	Muscle Group	Pre-operatively		Post-Operative Day-1		Post-Operative Day-7	
		Right	Left	Right	Left	Right	Left
Hip	Flexors	4	4	3	3	4	4
	Extensors	4	4	3	3	4	4
	Abductors	4	4	3	3	4	4
	Adductors	4	4	3	3	4	4
	Med Rotators	4	4	3	3	4	4
	Lat Rotators	4	4	3	3	4	4
Knee	Flexors	4	4	3	3	4	4
	Extensors	4	4	3	3	4	4

Table 2. Manual Muscle Testing Findings – Preoperatively, POD-1 & POD-7. According to Medical Research Council (MRC) Muscle Strength Grading (MRC)

Joint	Muscle Group	Pre-operatively		Post-Operative Day-1		Post-Operative Day-7	
		Right	Left	Right	Left	Right	Left
Ankle	Dorsiflexors	3	3	2	2	3+	3+
	Planter flexors	3	3	2	2	3+	3+

Note: MMT of Upper Extremity (Shoulder, Elbow, Wrist)- Grade 4 Bilaterally

Postoperative Physiotherapy Management:

After surgery, patient education is important to help minimize postoperative complications. Amputee care includes cleaning and dressing the wound and providing appropriate support. Prevention of postoperative complications includes good nutrition, restful sleep, proper positioning, and use of anti-inflammatory drugs as necessary. Once the patient is stable, we focus on ROM (range of motion) with exercises prescribed by a physical therapist to improve strength in the affected muscles. Finally, patients are taught how to ambulate using a walker under close supervision. A detailed protocol for postoperative rehabilitation is included in Table 3.

Table 3. Postoperative Rehabilitation Protocol

Days	VAS	Goals	Physiotherapy Management	Doses
POD-1	8	Patient Education Amputee Care Pain Management Prevent Circulatory Complications Prevent Pulmonary Complications Prevention of Suture Site Infection	Education about gangrene and postoperative complication Position of lower extremities and bandaging Positioning & low frequency, high intensity TENS Limb elevation, ankle pumps, heel slides Lateral costal expansion and thoracic mobility exercise Splinted coughing and huffing	Every 2 hr & Every day 10 Min twice a day 10 rep thrice a day 10 rep twice a day
POD-2	7	Continue same treatment as POD-1 Bed mobility training	Bed mobility exercise- Supine to side lying then sitting	
POD-3	6	Continue same treatment as POD-1 & 2 Improve bed mobility activity Improve range of motion Improve muscle strength	Bed mobility exercise- Progress from sitting to standing with walker (minimum weight on amputee area) All upper & lower extremity All Upper extremity muscle training and quadriceps	10 rep twice a day 1kg weight, 10 rep twice a day
POD-4	4	Continue same treatment as POD-1, 2, 3 Improve functional capacity	Ambulation with walker and minimum weight on toes	Twice a day
POD-5	4	Continue same treatment as POD-1, 2, 3, 4 Improve functional capacity Maintain Muscle strength	Ambulation with walker and minimum weight on toes and minimum 60 m All Upper extremity muscle training and quadriceps	Twice a day Upto 2 kg weight, 10 rep twice a day
POD-6	3	Continue same treatment as POD-1, 2, 3, 4, 5	Increase waking distance upto 100 m and started balance training	
POD-7	3	Continue same treatment as POD-1, 2, 3, 4, 5, 6	Increase waking distance upto 120 m and discharge planned	

DISCUSSION:

Dry gangrene induced bilateral amputation presents a number of challenges for the patient. Pain, decreased range of motion, decreased strength, and functional mobility all contribute to these difficulties. The main goal is proper patient education and rehabilitation regarding the condition and its associated challenges. As there is limited literature available on this subject matter, this case study provides tailored rehabilitation exercises that help reduce pain and improve range of motion and strength in the patient.

The patient progressed significantly from Postoperative Day 1 to Postoperative Day 7 during the course of treatment. Pain on the VAS decreased from 7/10 to 3/10, and simultaneously, ROM and strength increased. Strength training for hip, knee, lower limb muscles, and upper limb muscle strength has shown benefits for patients with lower limb amputation.

The patient progressed significantly from Postoperative Day 1 to Postoperative Day 6 during the course of treatment. Pain on the VAS decreased. After a week of training, the patient's range of motion and strength was improved which facilitated better performance of exercises. Strength training for hip, knee muscles, lower limb muscles and upper limb muscle strength training has shown benefits for patients with lower limb amputation.

Chest physiotherapy, like breathing exercises and segmental expansion exercises, were recommended to the patient in order to reduce the pulmonary complications caused by amputation. This exercise has been shown to improve chest expansion and performance levels, making it easier for patients to complete exercises. In addition, chest physiotherapy reduces the risk of developing subsequent chest/lung infections.

Our main goal was to improve and maintain the ROM and strength, and reduce complications after surgery. This would help the patient be more independent during recovery. A study published in 2004 found that early rehabilitation, motivation of patients to regain physical function in their everyday lives, as well as improving moods after amputation can all play a role in success.⁷

CONCLUSION:

Physiotherapy rehabilitation after surgery restored strength, range of motion (ROM), and functionality, helping the patient reduce pain and regain a sense of independence. Furthermore, pre-operation exercise has been shown to improve physical performance and make the patient more able to perform self-care activities on their own. This intensive rehabilitation program helps patients who have had bilateral amputations overcome difficulty adapting physically and mentally.

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