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Early physiotherapy intervention in a 26-year-old male with 41% total body surface area burns: A case report on functional rehabilitation and outcomes

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Abstract

Background: Severe burns require multidisciplinary care, including early physiotherapy to prevent complications such as contractures and functional limitations. This case highlights the role of structured physiotherapy in improving outcomes for a patient with 41% partial-thickness burns.

Case Presentation: A 26-year-old male sustained burns to the face, neck, upper limbs, lower limbs, and external genitalia due to a gas explosion. Initial management included wound care and antibiotics, followed by referral for specialist rehabilitation. Key challenges included reduced cardiopulmonary function, edema, pain (NPRS: 6/10), and impaired mobility (Barthel Index: 12/20).

Intervention: A 10-week physiotherapy program focused on chest physiotherapy, joint mobilization, muscle strengthening, and functional re-education.

Outcomes: Post-intervention, pain reduced to NPRS: 3/10, muscle strength improved from grade 3 to 4, and functional independence increased (Barthel Index: 17/20). The patient achieved independent ambulation.

Conclusion: Early, tailored physiotherapy reduces functional decline in burn patients. This case underscores the need for integrated rehabilitation protocols in burn care.

Keywords: Burns rehabilitation; Physiotherapy; Functional outcomes; Contracture prevention.

Introduction

Burn injuries are a major global health burden and are a leading cause of morbidity in low- and middle-income countries (LMICs), with Nigeria reporting an annual incidence of 8.1 per 100,000 population (Isiguzo et al., 2020). Burn is an injury to the skin or other body tissue that could be as a result of heat,

prolonged exposure to heat, chemical agents, electrical current or radioactive materials [5]. Its complications include infection, scarring, and functional impairment. Partial-thickness burns exceeding 20% Total Body Surface Area (TBSA) necessitate multidisciplinary management to address systemic inflammation, infection risk, and functional decline. Over 40% of burns involve the extremities, often leading to reduced mobility and independence [1]. Physiotherapy is critical for preserving Range of Motion (ROM), strength, and cardiopulmonary function. However, evidence on optimal rehabilitation strategies for extensive burns remains limited, particularly in low-resource settings. This case report details the rehabilitation journey of a patient with 41% total body surface area (TBSA) burns, emphasizing the role of early physiotherapy in improving functional outcomes.

Case Presentation

Patient information

The patient was a 26-year-old Nigerian male who was admitted to ESUTH Parklane after suffering significant burn injuries a day prior. The patient recently graduated from the University of Nigeria, Nsukka, was living alone and was apparently healthy until he sustained a 41% TBSA partial-thickness burns from a gas explosion in his kitchen.

The explosion involved ignition of leaked gas, resulting in flame burns to the face, neck, bilateral upper/lower limbs, and external genitalia but there was no loss of consciousness. He was rushed to a private hospital in Enugu State where he was initially managed with wound dressings, IV antibiotics (cefloxacine, meropenem), and analgesics before referral to ESUTH Parklane for expert management the following day.

Clinical findings

On observation and examination, the patient was met in semi-fowler's position, afebrile to touch, acyanosed, anicteric and in no obvious respiratory distress. Burns on the face and right side of the neck and Clean wound dressing on the bilateral forearm to hand and lower limbs were also observed. His vital signs were 128/96 mmHg blood pressure, 118 beats per minute (bpm) pulse rate, 24 cycles per minute respiratory rate, and 98% of oxygen saturation.

On physical examination, inhalational injuries were observed as evidenced by the singed hairs, nasal flaring and difficulty with breathing. Physical assessment of the thorax and abdomen showed fine crackles in bilateral lower lobes of the lungs and reduced air entry globally. Musculoskeletal assessment showed edema in hands, limited/painful ROM in elbows, wrists, and ankles (Numerical Pain Rating Scale, NPRS: 6/10) and Muscle strength graded 3/5 using the Oxford Muscle Grading Scale. Functional Status was assessed using Barthel Index score. (Barthel Index score: 12/20, indicating severe dependence).

Laboratory and radiological investigations, Hb level=12.5 mg/dl. Clinical Impression;

1. Reduced Functionality + Pain 20 partial thickness burn following gas explosion flame.
2. Reduced cardiopulmonary function 20 mild inhalation injury

Treatment plan and therapeutic intervention

Our short-term goals (4 weeks) were to improve air entry globally, reduce edema, relieve pain and improve grip and muscle strength. In the long term, we planned to prevent contractures, achieve standing and walking and to improve functional independence.

To achieve both the short- and long-term goals, we used chest physiotherapy techniques (Incentive spirometry, deep breathing exercises), joint mobilization protocols (passive ROM exercises for neck, elbows, wrists, and ankles), soft tissue mobilization, strengthening exercises (resisted exercises, static quadriceps, and grip strengthening with softballs), positioning and progressive ambulation (sitting, standing, and ambulation training using a Zimmer frame).

Outcomes

Edema resolved in the hands with no pitting. Patient's pain on joint mobilization reduced from NPRS 6 to 3/10 while his strength improved to grade 4/5 Oxford scale in upper/lower limbs. Patient's function (Barthel Index) improved to 17/20; this indicates that independent ambulation was achieved. Also, no contractures or infections were observed.

Table 1: Outcome (pre-intervention).

Upper limbs	Right	Left
Edema	Present at the dorsum of the hand	Present at the dorsum of the hand
Sensation (light and deep)	Intact (painful)	Intact (painful)
Muscle tone	Normatonia	Normotonia
Muscle bulk	Could not be objectively assessed because of the bandage	Could not be objectively assessed because of the bandage
Grip strength	Fair	Fair
AROM	Full and painful at the elbow, wrist, knee and ankle joints (NPRS = 6)	Full and painful at the elbow, wrist, knee and ankle joints (NPRS = 6)
PROM	Full and painful at the elbow and wrist joints	Full and painful at the elbow and wrist joints
Muscle power chart		
Shoulder flexor Shoulder extensor Shoulder abductors Shoulder adductors Elbow flexors Elbow extensors Wrist flexors	3	3
Wrist extensors	3	3
	3	3
	3	3
	3	3
	3	3
	3	3
	3	3
On observation and palpation	Tenderness and redness over burnt areas	Tenderness and redness over burnt areas

Pelvis and perineum
Burns at the external genitalia

Lower limbs	Right	Left
Edema	Absent	Absent
Sensation (light and deep)	Intact	Intact
Muscle tone	Normatonia (0)	Normotonia (0)
Muscle bulk	Could not be objectively assessed because of the bandage	Could not be objectively assessed because of the bandage
Patella	Mobile	Mobile
TA tightness	Could not be objectively assessed because of the bandage	Could not be objectively assessed because of the bandage
AROM	Full and painful except at the ankle joint which was limited because of the bandage	Full and painful except at the ankle joint which was limited because of the bandage
PROM	Full and painful except at the ankle joint which was limited because of the bandage	Full and painful except at the ankle joint which was limited because of the bandage
Muscle power chart		
Hip flexor Hip extensor Hip abductors Hip adductors Knee flexors	3	3
Knee extensors Ankle Dorsiflexor Ankle Plantaflexor	3	3
	3	3
	3	3
	3	3
	3	3
	2	2
	2	2
Observation and palpation	Tenderness and redness over burnt areas	Tenderness and redness over burnt areas

Table 2: Physiotherapy intervention protocol (Weeks 1–10).

Weeks	Goals	Interventions
1–4	Edema control, pain relief, ROM preservation	- Elevation: Bilateral hands-on pillows.
		- Manual Edema Mobilization: Deep effleurage to dorsal hands.
		- Chest Physiotherapy: Incentive spirometry (4 times hourly), diaphragmatic breathing.
		- Passive Mobilization: Neck (lateral rotation), elbows, wrists, ankles (10 reps, 2 sets).
		- Positioning: Upper limbs in extension/abduction/supination; lower limbs in extension.
5–8	Strengthening, functional re-education	- Isometric Exercises: Shoulder, elbow, knee (10 sec hold, 10 reps).
		- Resisted Active Movements: Manual resistance to upper/lower limbs (5 reps).
		- Grip Strengthening: Softball squeezes (10 reps).
		- Sitting/Standing Re-education: Gradual weight-bearing using Zimmer frame.
8–10	Aerobic conditioning, ambulation	- Ambulation Training: Zimmer frame-assisted gait (5–10 min sessions).
		- Aerobic Exercise: Treadmill walking.
		- Stretching: Prolonged holds (30–40 sec) for quadriceps, hamstrings.

Table 3: Outcome (post-intervention).

Upper limbs	Right	Left
Edema	Absent	Absent
Sensation	Intact	Intact

Muscle bulk	Could not be objectively assessed because of the bandage	Could not be objectively assessed because of the bandage
Grip strength	Good	Good
Arom	Limited due to the bandage and painful at the elbow and wrist (NPRS=3)	Limited due to the bandage and painful at the elbow and wrist (NPRS=3)
Prom	Limited due to the bandage and painful at the elbow and wrist (NPRS=3)	Limited due to the bandage and painful at the elbow and wrist (NPRS=4)
Muscle power chart		
Shoulder flexor Shoulder extensor Shoulder abductors Shoulder adductors Elbow flexors Elbow extensors Wrist flexors	4	4
Wrist extensors	4	4
	4	4
	4	4
	4	4
	4	4
	4	4
	4	4
Observation and palpation	No redness and tenderness	No redness and tenderness
Lower limbs	Right	Left
Edema	Absent	Absent
Sensation	Intact	Intact
Muscle bulk	Could not be objectively assessed because of the bandage	Could not be objectively assessed because of the bandage
Patella	Mobile	Mobile
Ta tightness	Absent	Absent
Arom	Full and painful except at the ankle joint which was limited because of the bandage (NPRS=3)	Full and painful except at the ankle joint which was limited because of the bandage (NPRS=3)
Prom	Full and painful except at the ankle joint which was limited because of the bandage	Full and painful except at the ankle joint which was limited because of the bandage
Muscle power chart		
Hip flexor Hip extensor Hip abductors Hip adductors Knee flexors	4	4
Knee extensors Ankle dorsiflexors Ankle plantarflexors	4	4
	4	4
	4	4
	4	4
	4	4
	3	4
	3	4
Observation and palpation	No redness and tenderness	No redness and tenderness

Table 4: Outcome (post-intervention).

Parameter	Pre-Intervention	Post-Intervention
Pain (NPRS)	6/10	3/10
Barthel Index	12/20	17/20
Muscle Strength	3/5	4/5
Ambulation Status	Dependent	Independent

Discussion

This case aligns with evidence supporting early physiotherapy in burn care (Cartotto et al., 2023; Cinar et al., 2019; [6,9]. Dewey et al. [3] emphasize positioning and splinting to prevent contractures, which were prioritized in this patient's regimen. The observed improvement in ROM and strength mirrors findings by Shah et al. [10], who noted the efficacy of active/passive exercises in hand rehabilitation. It also aligns with Patsaki et al. [8]'s findings that structured physiotherapy improves functional outcomes in burns. However, the absence of contractures contrasts with Nthumba [7]'s report of 32% contracture rates in sub-Saharan Africa, this could be attributed to early splinting and positioning of this patient.

Key challenges

Pain Management: Analgesics and graded exercises minimized discomfort during mobilization. Adherence: Caregiver education ensured compliance with home exercises.

Limitations

Single-case design and short follow-up period restrict generalizability.

Conclusion

This case demonstrates that structured physiotherapy initiated during acute burn care improves functional outcomes and prevents complications. Future research should focus on standardizing burn protocols in LMICs and explore cost-effective rehabilitation strategies in resource-limited settings and also, integrating tele-rehabilitation to address follow-up challenges.

Declarations

Ethics statement: Informed consent was obtained and patient was anonymized as «Mr. O.P.» Institutional ethics approval waived for retrospective case reports at ESUTH Parklane.

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