

A physiotherapy rehabilitation programme for patient with thermal burn injury: A case report

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ABSTRACT

Burns is one of the most usual and deadly injuries to the human body. About 450000 people suffered from burn injuries in a year, out of which 86% of cases are thermal burn injuries, 4% are electric types of burns, 4% are chemical burns and the remaining 6% are other types of burn injuries. Almost 8 lakh people per year need to be hospitalized for the treatment of burn injury, out of them, 2.8 lakh people become disabled due to burning injury. In this scenario, we report a 48-year-old male who received a thermal burn while doing household chores. He was taken to the local hospital immediately after the trauma. On the next day, he was then referred to a tertiary care hospital for further specific burn management. Where he was assessed and diagnosed with a 45% thermal burn injury case and management was started accordingly. The patient was referred to the physiotherapy unit for further management. Carefully planned physiotherapy rehabilitation protocol including thorough assessment and management via acute phase, sub-acute phase and maturation phase was found to be very effective on the general mobility, strength and functional performance of the patient.

Keywords: Thermal Burn, Partial thickness burn, Physiotherapy, Exercise, Rehabilitation, Case report.

1. INTRODUCTION

Burns is said to be the leading cause of disabilities in the world. The majority of key breakthroughs in burn care have occurred in the previous 50 years, fuelled by conflicts and large fires. One of the main factors of death and disability worldwide is still burns (Lee et al., 2014). In India, the annual burn incidence is estimated to be 6-7 million. The high prevalence is related to the population's illiteracy, poverty and poor degree of safety knowledge. A step in this approach is the National Program for the Prevention of Burn Injuries (NPPBI). The National Program for Burn Injury Prevention (NPPBI) aims to lower incidence by promoting prevention and improving physical and human capacity throughout all levels within the health care delivery system,

providing burn patients with prompt and adequate care will lower mortality and complications and survivors will receive good rehabilitation (Gupta et al., 2010). In India, over 6 million burn cases occur each year, of which approximately 0.7 million require hospitalization and approximately 0.12 million die. The kind of burn—thermal, chemical, electrical or radiation-related—should be taken into consideration first. The amount of a burn is typically expressed as a percentage of the total body surface area (%TBSA). The burn's depth is then divided as superficial (first degree), partial (second degree) or complete thickness (third degree). Burns are skin injuries that affect both the thin, superficial epidermis and the larger, deeper dermis. Chemical burns, electrical burns and thermal burns are all examples of burns (Salunke et al., 2022).

The indications and symptoms of thermal burns are as follows: Superficial or first-degree burn: The skin is painful and red, there are no blisters, but the skin turns white when touched; just the epidermis is affected. Partial-thickness burns, also known as second-degree burns, are characterized by painful red regions of skin that turn white when touched, blister formation, the presence of hair on the skin and involvement of the layers of skin called the epidermis and dermis. Full-thickness or third-degree burns are painless. There is no sensation to touch. The skin may be white or burnt and leathery in appearance. The three layers of the skin (epidermis, dermis and subcutaneous tissue) are all involved. Muscle tissue and/or bone may be visible in severe full-thickness burns (Simões et al., 2020). The skin is the biggest organ in the body, accounting for approximately 16% of a person's weight. If thermal burns are severe (> 20% of body surface area), they can impair the local and systemic health. A circular target pattern corresponds to three zones of injury that can be used to roughly categorize local injuries. The most serious injury occurs in the zone of coagulation or necrosis, which indicates an area of permanent apoptosis. The outermost portion is the zone of hyperaemia, which represents a reversible vasodilation zone that normally returns to normal (Schaefer and Szymanski, 2022).

2. CASE PRESENTATION

A case of 48-year-old male working as a shopkeeper came to the emergency department with acute burn injury over both upper and lower extremities and face. The patient's relative narrates the history that while fitting the regulator of the cylinder at his home, he found that the cylinder was leaking and suddenly it got flamed and burned to upper extremities, lower extremity and face. His family members noticed this and put on the towels in the burnt area, the flames got reduced. Then they took him to the government hospital via bike, where he was admitted for the day. Blood investigations were done. The doctor referred them to the private hospital for further treatment. Here patient was kept in the male burn intensive care unit (ICU) for treatment, dressing and blood investigations were done and referred to Physiotherapy to prevent further complications.

3. CLINICAL FINDINGS

Pain history

Pain was present over the upper extremity, lower extremity and face as mentioned (Figure 1, 2, 3, 4). It was sudden in onset and gradual in progression with continuous duration. The intensity of pain at rest was 5/10 and at movement, it was 8/10 on numerical pain rating scale (NPRS). The pain got aggravated by the movements of the extremities and facial expressions and got relieved on rest and by medications.

Drug History

The drugs prescribed to the patient are given (Table 1).

Personal History

His sleep was altered due to pain, appetite was reduced. Bowel and bladder were intact but due to injury patient was catheterized.

Environmental history

Patient lives in a pucca house with 3 rooms on the ground floor with a non-slippery surface. He uses an Indian toilet that is inside the house.

General Examination

The patient was ectomorph, conscious and well oriented to time place, person and co-operative. The pulse was 80 beats per minute, blood pressure 115/80 mmHg. Respiratory rate 19 breaths/min. BMI: $\text{Weight/height}^2=55/(1.54)^2=23.19 \text{ kg/m}^2$. No signs of pallor, cyanosis, lymphadenopathy, icterus, clubbing, and peripheral edema were noticed.



Figure 1 Right upper extremity



Figure 2 Left lower extremity

On observation

Attitude of the patient in a supine position as shown in (Figure 5)

On inspection

Patient position sitting. Redness over the burnt area

On palpation

All superficial and deep sensations are intact. Tenderness is present over the burnt area.

Range of motion

Range of motion of upper and lower extremity as mentioned (Table 2, 3) respectively.



Figure 3 Right lower limbs



Figure 4 Patient in sitting position

Table 1 Shows the medicine prescribed to the patient

Sr. No.	Drug Name	Dose	ROA	Frequency
1	Inj. Ceftriaxone	1.5 mg	IV	BD
2	Inj. Pantoprazole	40mg	IV	BD
3	Inj. Emset	4mg	IV	TDS
4	Inj. Amikacin	500mg	IV	BD
5	Inj. Neomol	100mL	IV	SOS



Figure 5 Shows the attitude of the patient in a supine lying position

Table 2 Range of motion of upper extremity in degrees

Joints	Movements	Right extremity	Left extremity
Shoulder	Flexion	0 ⁰ -180 ⁰	0 ⁰ -180 ⁰
	Extension	0 ⁰ -60 ⁰	0 ⁰ -60 ⁰
	Abduction	0 ⁰ -180 ⁰	0 ⁰ -180 ⁰
	Adduction	0 ⁰ -30 ⁰	0 ⁰ -40 ⁰
	Medial Rotation	0 ⁰	0 ⁰
	Lateral Rotation	0 ⁰	0 ⁰
Elbow	Flexion	0 ⁰ - 0 ⁰	0 ⁰ -40 ⁰
	Extension	150 ⁰ - 0 ⁰	150 ⁰ - 0 ⁰
	Pronation	0 ⁰	0 ⁰
	Supination	0 ⁰	0 ⁰
Wrist	Flexion	0 ⁰	0 ⁰ -10 ⁰
	Extension	0 ⁰	0 ⁰ -10 ⁰
	Radial deviation	0 ⁰	0 ⁰
	Lateral deviation	0 ⁰	0 ⁰

Table 3 Range of motion of lower extremity in degrees

Joints	Movements	Right Extremity	Left Extremity
Hip	Flexion	0 ⁰ -120 ⁰	0 ⁰ -120 ⁰
	Extension	0 ⁰ -20 ⁰	0 ⁰ -20 ⁰
	Abduction	0 ⁰ -40 ⁰	0 ⁰ -40 ⁰
	Adduction	0 ⁰ -20 ⁰	0 ⁰ -20 ⁰
	Medial Rotation	0 ⁰ -45 ⁰	0 ⁰ -45 ⁰
	Lateral Rotation	0 ⁰ -45 ⁰	0 ⁰ -45 ⁰
Knee	Flexion	0 ⁰ -30 ⁰	0 ⁰ -20 ⁰
	Extension	0 ⁰	0 ⁰
Ankle	Plantar flexion	0 ⁰ -10 ⁰	0 ⁰ -20 ⁰
	Dorsiflexion	0 ⁰ -10 ⁰	0 ⁰ -10 ⁰

	Inversion	0 ⁰	0 ⁰
	Eversion	0 ⁰	0 ⁰

Manual Muscle Testing

Manual muscle testing of upper and lower extremity is given (Table 4, 5).

Table 4 Manual muscle testing of upper extremity

Joints	Movements	Right extremity	Left extremity
Shoulder	Flexors	3	3
	Extensors	3	3
	Abductors	3	3
	Adductors	3	3
	Medial Rotation	3	3
	Lateral Rotation	3	3
Elbow	Flexors	2+	2+
	Extensors	2+	2+
Wrist	Flexors	2+	2+
	Extensors	2+	2+
	Radial deviators	2+	2+
	Lateral deviators	2+	2+

Table 5 Manual muscle testing of lower Extremity

Joints	Movements	Right Extremity	Left Extremity
Hip	Flexors	3	3
	Extensors	3	3
	Abductors	3	3
	Adductors	3	3
Knee	Flexors	2+	2+
	Extensors	2+	2+
Ankle	Plantarflexors	2+	2+
	Dorsiflexors	2+	2+

Wallace Rule of Nine

Calculated as shown in (Figure 6). Face-9%, Upper extremity-9%, Lower extremity-right-18%, left-9%

Physiotherapy Management

Burns treatment can be separated into three phases: Acute, subacute, healing and scar maturation (Wallace et al., 2022).

Acute phase

Respiratory care is critical, especially in situations of inhalation damage and chest burns (Palackic et al., 2021). Deep breathing, pursing the lips and chest expansion exercises were given as in Figure 7 positioning of the affected joint. The joint is correctly positioned to achieve goals such as reducing swelling and preventing deep vein thrombosis. Protect the joints and exposed tendons from additional harm. Avoid pressure sores in specific locations, such as the styloid process, medial malleolus, lateral malleolus and Achilles tendon, to avoid harming the new skin graft. Therapeutic exercise is provided to maintain joint integrity, muscular flexibility and skin elasticity, help increase muscle strength and endurance, prevent contractures and return the musculoskeletal system to its ideal state.

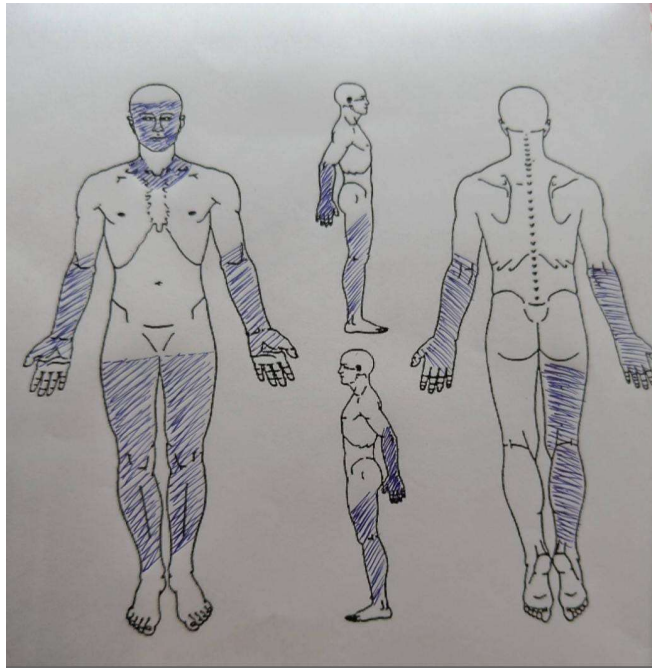


Figure 6 Body surface affected due to burn



Figure 7 Breathing exercises

Sub-acute phase

To enhance outcomes and reduce severity associated with burn injuries, it is necessary to utilise a well-organized, policy-based approach to respiratory management in burn injury (Mlcak et al., 2007). A joint contracture can be stretched to its full range, but maintaining that range is dependent on static and dynamic posture achieved through splinting and casting as in (Figure 8, 9). As a result, it is common to splint joints in full extension for extended periods since the patient seems anatomically right; however, the function is compromised. This is especially true for elbows, which are frequently put in extension (Esselman, 2007).



Figure 8 Showing mobility exercise of the lower extremity



Figure 9 Showing mobility exercise of the upper extremity

Healing and scar maturation phase (Post Epithelial Healing)

Scar Massage Method

Apply the lotion to the burnt area. Then, using required pressure, massage the skin in a rounded up and down and side to side motion and was combined with mild stretching for better results as in Figure 10 for three times a day.



Figure 10 Scar massage

Outcome Measures

1. Numerical Pain Rating Scale (NPRS):

At movement- 8/10

At rest- 5/10

2. Barthel Index: 6/20

4. DISCUSSION

The current case report depicts a patient who is admitted to the intensive care unit (ICU) after suffering a significant burn injury and aims to emphasize the importance of early physiotherapy. Because of the intricacy of the diverse clinical course, burn injuries necessitate a long-term treatment plan. Patients require precise therapy that begins in addition to the initial injury and immediate life-saving treatments, clinical stabilization procedures using the best healthcare conservative and surgical wound management and reconstruction and long-term rehabilitation (Patsaki et al., 2020). Study concluded that early physiotherapy in severely ill individuals is important to functional recovery. Burn patients have serious problems that limit their functioning abilities (Patsaki et al., 2020).

Gittings et al., (2018) sought resistance training to have some positive effects on muscle strength and psychological quality of life in adults with burns, according to low-quality evidence. This is based on research that looked at the effects of resistance training on children's and adults' muscle strength, lean muscle mass, features, life quality and pain after burn injury (Gittings et al., 2018).

According to research the reaction to burn injuries happens on both a local and systemic basis. Large burns (>20%) cause the production of inflammatory mediators from damaged tissue, which might affect the entire body. The result is predictable changes in major organ systems, resulting in hypovolemic shock in the short term and numerous organ system failures in the subacute period (Gillenwater and Garner, 2017).

In today's burn literature, Sullivan et al., (1990) found that there is no reliable, objective or universal technique for assessing burn scars. Such a strategy is required to give descriptive terms for comparing burn scars and treatment outcomes. Pigmentation, vascularity, pliability and scar height are all individually assessed, with a higher score suggesting a poorer pathologic condition (Sullivan et al., 1990).

5. CONCLUSION

In this case report we have given phase management after burn injury. Physiotherapy is the responsible health branch for begin, assisting and improving one's life. Thermal burn injury has shown major loss to an individual. The exercise therapy aims for prevention of long-term problems like scarring, joint damage and other physical function concerns. The interventions performed by

the patient have significantly manifested the outcome measures. Thus, including physiotherapy rehabilitation programme have been displayed a quality recovery in the patient with burn injury.

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Author Contributions

Our every author contributed equally in this case report.

Informed consent

Written and Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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