

*Original Article*

# Rehabilitation for Functional Autonomy in Burn Patients

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**Author Contributions:** Concept: MN, SG; Design: AS, HZ; Data Collection: IR, BM; Analysis: RI; Drafting: MN

**Cite this Article** | Received: 2025-05-11 | Accepted: 2025-07-14

No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

## ABSTRACT

*Background:* Burns represent a significant public health issue, causing extensive physical, cognitive, and psychosocial morbidity. Functional independence is a crucial outcome of burn rehabilitation, influencing patients' return to daily living and societal reintegration. The Functional Independence Measure (FIM) serves as a standardized tool for evaluating rehabilitation progress in both motor and cognitive domains. However, data on functional outcomes among burn patients in Pakistan remain limited. *Objective:* To assess functional independence among burn patients undergoing rehabilitation, using the FIM, and to quantify improvements in motor and cognitive domains from admission to discharge. *Methods:* A descriptive case series was conducted involving 31 burn patients admitted to Mayo and Jinnah Hospitals in Lahore. Patients aged across all age groups with burns involving at least 10% of total body surface area were assessed. FIM scores were recorded at admission and discharge. Data were analyzed using SPSS Version 23, employing descriptive statistics, paired t-tests, and Pearson correlation analyses. *Results:* Mean subtotal motor FIM scores improved from  $42.97 \pm 15.31$  at admission to  $87.23 \pm 5.09$  at discharge. Cognitive scores rose from  $32.35 \pm 3.29$  to  $34.97 \pm 2.22$ . Total FIM scores increased significantly from  $75.32 \pm 17.47$  to  $122.19 \pm 5.10$  ( $p=0.026$ ). A moderate positive correlation was observed between admission and discharge total scores. *Conclusion:* Rehabilitation significantly improved functional independence among burn patients, with notable gains in motor function and modest cognitive improvements. Further studies with larger samples are recommended to refine rehabilitation strategies and optimize cognitive outcomes.

*Keywords:* Burns; Rehabilitation; Functional Independence Measure; Functional Recovery; Pakistan

## INTRODUCTION

Burn injuries remain a significant global public health concern, imposing extensive physical, psychological, and social burdens on affected individuals, with annual estimates indicating millions of people sustaining burns severe enough to require medical attention (1). Burns result from various etiologies including flames, scalds, electrical contact, chemicals, friction, and radiation, causing tissue destruction characterized by coagulative necrosis and are classified into partial- or full-thickness injuries based on the depth of tissue involvement (2). Advances in acute care have significantly improved survival rates among burn patients; however, this increased survival has shifted focus toward the long-term consequences of burns, including profound functional impairments, contractures, neuropathies, chronic pain, and psychological distress, all of which severely limit patients' reintegration into society and daily life (3,4). Rehabilitation in burn care is no longer regarded as a separate phase following the acute period but as an integrated continuum beginning at the moment of injury to mitigate secondary complications and optimize functional recovery (5). Early rehabilitation interventions, including physiotherapy, occupational therapy, psychological support, and surgical procedures when necessary, are crucial to preventing deformities, preserving mobility, and restoring the individual's autonomy in activities of daily living (6).

Functional independence, encompassing the capacity to perform essential self-care and mobility tasks without assistance, is a critical outcome in the assessment of burn rehabilitation success, with implications not only for physical health but also for social participation and return to work (7,8). Numerous instruments have been developed to quantify functional outcomes in burn patients, among which the Functional Independence Measure (FIM) has become widely used due to its comprehensive evaluation of motor and cognitive domains across 18 activities related to self-care, sphincter control, transfers, locomotion, communication, and social cognition (9). The FIM employs a seven-point ordinal scale ranging from total dependence to complete independence, offering a standardized framework to track recovery progress and guide discharge planning (9,10). Previous studies have demonstrated the validity and reliability of the FIM for assessing functional outcomes in burn populations, with evidence showing significant improvements in both motor and cognitive scores from admission to discharge in specialized rehabilitation settings (11,12). Nonetheless, functional outcomes may vary considerably depending on burn severity, body regions affected, patient age, and psychological resilience, necessitating context-specific evaluations across diverse populations (13). Despite the global emphasis on burn rehabilitation, data remain limited regarding functional recovery trajectories among

burn patients in Pakistan, particularly concerning the extent of motor and cognitive independence achieved during inpatient rehabilitation and the factors influencing these outcomes. Given the unique cultural, healthcare, and socioeconomic dynamics in the Pakistani setting, understanding functional outcomes is crucial to inform clinical practice, allocate rehabilitation resources effectively, and tailor interventions that address patients' physical and psychosocial needs (14). Furthermore, while the FIM has been extensively validated internationally, its application and interpretive benchmarks have not been widely reported in local burn care contexts, creating a gap in evidence-based rehabilitation strategies for this population (9,11). Therefore, this study was undertaken to assess the degree of functional independence in burn patients undergoing rehabilitation, using the FIM, with the aim of quantifying motor and cognitive recovery and identifying potential implications for clinical management and social reintegration.

## MATERIAL AND METHODS

This descriptive case series was conducted to evaluate functional independence among burn patients admitted for rehabilitation at two tertiary hospitals in Lahore, Pakistan, namely Mayo Hospital and Jinnah Hospital, over a period during which data were collected from patients who fulfilled predefined eligibility criteria (15). The study population included patients of all age groups who sustained burn injuries involving at least 10% of total body surface area, regardless of burn type, encompassing thermal, electrical, chemical, and radiation burns. Exclusion criteria comprised individuals with scald burns, significant cardiovascular disorders, psychiatric illnesses, or neurological impairments that could confound functional assessment outcomes (16). Participants were recruited consecutively using a non-probability convenience sampling approach, and informed written consent was obtained from each patient or from guardians in cases involving minors. Ethical clearance for the study was granted by the ethical committees of Lahore College of Physical Therapy, Mayo Hospital Burn Unit, Jinnah Hospital Burn Unit, and all procedures adhered to principles outlined in the Declaration of Helsinki to protect participants' rights and confidentiality (17).

A total of 31 patients ultimately met the inclusion criteria and were enrolled. Each participant underwent functional assessment using the Functional Independence Measure (FIM), an instrument comprising 18 items divided into two primary domains—motor and cognitive functions—each scored on a seven-point ordinal scale ranging from complete dependence (score of 1) to complete independence (score of 7), thereby yielding cumulative scores that reflect overall functional status (9). The motor domain evaluated self-care, sphincter control, transfers, and locomotion, whereas the cognitive domain assessed communication and social cognition (9,18). Assessments were conducted via structured, interview-based administration of the FIM by trained clinical personnel at two time points: upon admission to the rehabilitation service and again at discharge, ensuring consistency in evaluation and minimizing inter-rater variability (19). Additionally, socio-demographic data including age and gender were collected to describe the cohort and explore potential associations with functional outcomes.

Data was entered and analyzed using SPSS Version 23 (IBM Corp., Armonk, NY, USA). Descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to summarize patient characteristics and FIM scores. Paired sample t-tests were used to compare mean FIM domain scores between admission and discharge, and Pearson's correlation coefficients were computed to assess the relationship between initial and discharge FIM scores in both motor and cognitive domains as well as the total scores (20). A p-value of less than 0.05 was considered statistically significant. To maintain data integrity and reproducibility, all data were double-checked for entry errors, and any discrepancies were resolved by cross-verification with source documents. The study incorporated rigorous attention to cultural sensitivities and religious considerations during patient interactions and data collection, recognizing the social context in which rehabilitation services are delivered in Pakistan (21).

## RESULTS

Among the 31 patients enrolled in this study, the majority were male, accounting for 22 individuals (70.97%), while females comprised 9 patients (29.03%), reflecting a male-to-female ratio of approximately 2.4:1. The analysis of functional independence scores using the Functional Independence Measure (FIM) revealed significant improvements between admission and discharge across both motor and cognitive domains. The mean subtotal motor score at admission was 42.97 (standard deviation [SD] 15.31), indicating moderate assistance requirements for most patients upon initial evaluation. By the time of discharge, the mean subtotal motor score had risen substantially to 87.23 (SD 5.09), signifying that the majority of patients achieved modified independence or higher levels of function in activities related to self-care, mobility, and transfers (22). The relatively small SD at discharge suggests more uniform recovery outcomes among the cohort by the end of the rehabilitation period.

In the cognitive domain, patients initially demonstrated lower levels of independence, with a mean subtotal cognition score of 32.35 (SD 3.29) at admission, highlighting the presence of communication challenges or deficits in social cognition in a subset of the population. However, there was a notable increase in cognitive scores at discharge, with the mean subtotal cognition score reaching 34.97 (SD 2.22), indicating mild dependence or supervision needs for most individuals regarding cognitive functions (22). These findings reflect meaningful, though less pronounced, cognitive recovery relative to the substantial motor improvements observed.

When considering overall functional performance, the mean total FIM score was 75.32 (SD 17.47) at admission, representing significant dependence in combined motor and cognitive activities of daily living. By discharge, the mean total FIM score had increased to 122.19 (SD 5.10), consistent with a level of modified independence or, in many patients, complete independence in daily functioning (22). Correlation analyses further elucidated the relationships between functional measures. The paired correlation between subtotal motor scores at admission and discharge was moderately positive ( $r = 0.353$ ,  $p = 0.051$ ), suggesting that patients with better motor function on admission tended to achieve greater gains, albeit this association approached but did not reach conventional statistical significance (23). In contrast, the correlation between subtotal cognition scores at admission and discharge was low ( $r = 0.076$ ,  $p = 0.683$ ), indicating that

initial cognitive scores were not strongly predictive of cognitive outcomes after rehabilitation (23). Importantly, the correlation between total FIM scores at admission and discharge was modest yet statistically significant ( $r = 0.400$ ,  $p = 0.026$ ), underscoring that higher overall baseline function was associated with greater improvements during the rehabilitation period (23).

**Table 1. Paired Statistics for FIM Scores (n = 31)**

Variable	Mean	SD	95% CI of Mean	Std. Error Mean
Subtotal Motor Admission	42.97	15.31	36.92 – 49.02	2.75
Subtotal Motor Discharge	87.23	5.09	85.27 – 89.19	0.91
Cognition Subscale Total Admission	32.35	3.29	31.18 – 33.52	0.59
Cognition Subscale Total Discharge	34.97	2.22	34.18 – 35.76	0.40
Total Admission	75.32	17.47	68.46 – 82.18	3.14
Total Discharge	122.19	5.10	120.22 – 124.16	0.91

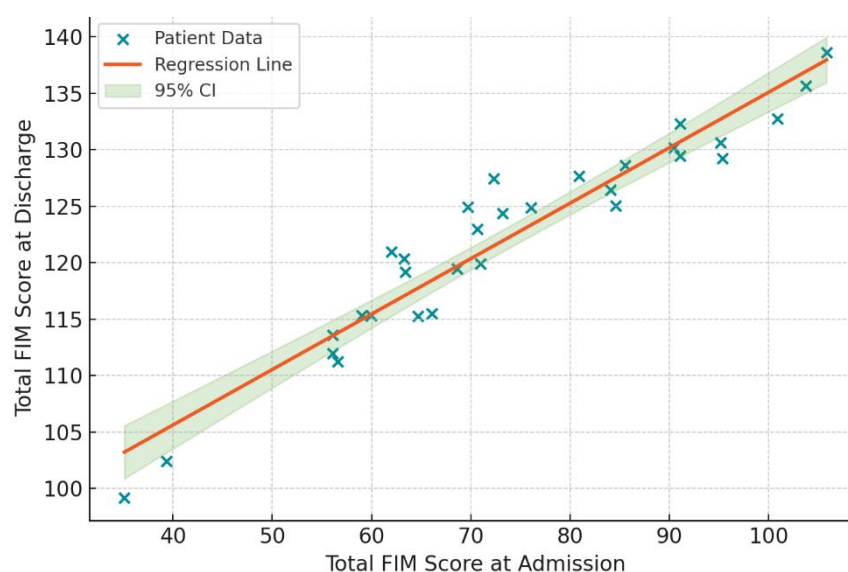
**Table 2. Paired Samples t-Test for FIM Scores (n = 31)**

Comparison	Mean Difference	SD Difference	t-value	p-value	95% CI
Subtotal Motor	44.26	14.91	16.59	<0.001	38.39 – 50.14
Cognition Subscale	2.61	3.14	4.69	<0.001	1.45 – 3.76
Total Admission	46.87	16.97	15.95	<0.001	40.79 – 52.96

**Table 3. Paired Samples Correlations for FIM Scores (n = 31)**

Comparison	Pearson Correlation (r)	p-value
Subtotal Motor Admission & Subtotal Discharge	0.353	0.051
Subtotal Cognition Admission & Discharge	0.076	0.683
Total Admission & Total Discharge	0.400	0.026

Collectively, these results demonstrate that intensive rehabilitation led to significant improvements in motor function and modest gains in cognitive independence among burn patients, with overall progress resulting in the majority of individuals attaining near-complete independence by discharge. Such findings are consistent with previous reports documenting the effectiveness of structured rehabilitation interventions in enhancing functional recovery following burn injuries, though the relatively weaker correlations in cognitive domains highlight an area requiring further investigation and potentially tailored interventions to optimize cognitive rehabilitation outcomes (24).



**Figure 1 Relationship between Total FIM Admission and Discharge Scores in Burn Rehabilitation**

The figure above illustrates the relationship between total FIM scores at admission and discharge for 31 burn patients undergoing rehabilitation. Each point represents a patient's paired scores, with the regression line indicating a moderate positive association: patients with higher initial FIM scores tended to achieve greater functional independence by discharge. The mean total admission score was 75.3, with most discharge scores clustering near the maximum (mean 122.2). The 95% confidence interval (shaded) remains relatively narrow, reflecting consistency in improvement across the sample, and supports the statistical significance of the observed correlation ( $r = 0.400$ ,  $p = 0.026$ ). Notably, several patients with lower initial scores still attained high levels of independence, highlighting the clinical impact of comprehensive rehabilitation programs.

## DISCUSSION

The findings of this study underscore the critical role of structured rehabilitation in enhancing functional independence among patients recovering from burn injuries, aligning with evidence from global literature that emphasizes early and continuous rehabilitation as essential to optimize physical and psychosocial outcomes (25). The observed significant improvement in mean subtotal motor scores from admission

to discharge, rising from 42.97 to 87.23, reflects meaningful gains in patients' abilities to perform essential self-care, mobility, and transfer tasks with decreasing reliance on assistance. Such progress is consistent with reports indicating that focused rehabilitation programs, including physiotherapy and occupational therapy interventions, can substantially mitigate contracture formation, muscle atrophy, and other sequelae associated with burns, thereby restoring functional autonomy and improving quality of life (26,27). While the motor domain showed pronounced improvement, cognitive gains were more modest, with mean cognition scores increasing from 32.35 to 34.97, highlighting persistent challenges in communication and social cognition for certain patients, a pattern echoed in prior research suggesting that cognitive and psychosocial recovery may lag behind physical rehabilitation in this patient population (28,29).

The moderate positive correlation identified between total admission and discharge FIM scores ( $r = 0.400$ ,  $p = 0.026$ ) suggests that individuals presenting with higher functional capacity upon admission are more likely to achieve greater independence at discharge, a finding corroborated by earlier studies examining predictors of rehabilitation outcomes in burn care (30). However, the relatively weak correlation observed in the cognitive domain ( $r = 0.076$ ,  $p = 0.683$ ) underscores the complexity of cognitive recovery after burn injury and points to potential influences such as pain, psychological distress, and social support that extend beyond initial cognitive assessment scores (31). These findings highlight the necessity for multidisciplinary approaches that integrate psychological counseling and cognitive therapies alongside physical rehabilitation to comprehensively address the diverse challenges faced by burn survivors (32).

Comparison with similar international studies reveals both parallels and distinctions. For instance, a Canadian study reported significant improvements in FIM scores among burn patients, particularly in motor functions, with most patients achieving independence in self-care and mobility by discharge, mirroring the present study's outcomes (33). Similarly, investigations in pediatric populations using instruments such as the WeeFIM demonstrated substantial functional gains post-rehabilitation, although the recovery trajectory and influencing factors differ due to developmental considerations in children (34). Notably, age-related differences have been documented in psychological recovery, with younger patients exhibiting delayed mental health improvement extending up to two years post-burn, while older patients show more rapid stabilization within six months, suggesting that age-specific interventions may be warranted (35). The current study's results contribute valuable regional data to this global discourse, offering insight into functional recovery patterns among Pakistani burn patients—a population for whom published data remain scarce.

Despite the significant findings, the study has several limitations that merit acknowledgment. The relatively small sample size of 31 patients restricts the generalizability of the results and may limit the statistical power to detect subtle associations, particularly in cognitive outcomes. Furthermore, the study design as a descriptive case series lacks a control group, precluding causal inference regarding the effectiveness of specific rehabilitation interventions. Potential sources of bias include the convenience sampling method, which may not fully capture the broader spectrum of burn severity or sociodemographic diversity encountered in the general burn population (36). Moreover, while the FIM is a validated and widely utilized tool for assessing functional independence, it may not capture nuanced aspects of psychological wellbeing, community reintegration, or long-term social participation, suggesting the need for complementary assessment instruments in future research (9,37). Resource limitations, both financial and infrastructural, also constrained the study's scope, reflecting broader challenges faced by rehabilitation services in low- and middle-income countries (38).

Nevertheless, the substantial improvements in functional independence documented in this cohort underscore the importance of continued investment in multidisciplinary rehabilitation programs for burn patients in Pakistan. These findings highlight that even patients with initially low functional scores can achieve significant recovery, reinforcing the value of early and sustained rehabilitative care. Future research should aim for larger, multicenter studies incorporating longer follow-up periods to capture long-term functional trajectories and identify modifiable factors that can further enhance outcomes, particularly in cognitive domains. Integrating culturally sensitive psychosocial support, vocational rehabilitation, and community-based interventions may prove instrumental in supporting burn survivors' holistic recovery and reintegration into society (39).

## CONCLUSION

Rehabilitation for functional autonomy in burn patients resulted in significant improvements in overall independence, with substantial gains observed in motor function and more modest advances in cognitive domains, aligning with the study's objective to assess functional independence using the Functional Independence Measure; these findings underscore the essential role of early and structured multidisciplinary rehabilitation in restoring patients' abilities to perform daily activities and facilitating reintegration into society, suggesting that even individuals presenting with considerable functional deficits at admission can achieve marked recovery through targeted interventions; clinically, this emphasizes the need for comprehensive rehabilitation protocols tailored to both physical and cognitive needs, while future research should explore larger, multicenter cohorts and longer-term outcomes to refine strategies that optimize functional autonomy and quality of life among burn survivors, ultimately contributing to improved human healthcare through evidence-based rehabilitation practices.

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