



(RESEARCH ARTICLE)



FUNCTIONAL OUTCOMES AND PREDICTORS OF RECOVERY IN PATIENTS UNDERGOING INPATIENT REHABILITATION AT RASHID IBN AL-HUSSEIN MILITARY HOSPITAL

Mohammed Ali Al-Mughrabi *, Mohammad Mahmoud Faris Aljarrah, Atta Aqeel Almashaqbeh, Asma Ahmad Ibrahim Alhusamia and Aman Abdallah Abed Bani Amer

Department of Physical Medicine and Rehabilitation, Rashid Ibn Al-Hussein Military Hospital, Royal Medical Services, Amman, Jordan

* Corresponding Author

World Journal of Advanced Research and Reviews, 2026, 32(01), 436–443

Publication history: Received on 30 September 2026; revised on 05 October 2026; accepted on 07 October 2026

Article DOI: <https://doi.org/10.30574/wjarr.2026.32.1.2567>

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ABSTRACT

Background: Inpatient rehabilitation plays a pivotal role in restoring function and independence in patients recovering from stroke, spinal cord injury (SCI), traumatic brain injury (TBI), amputation, and major orthopedic surgery. Understanding functional outcomes and predictors of recovery in a military hospital setting is essential for optimizing rehabilitation protocols, resource allocation, and discharge planning. However, there is still a lack of comprehensive data on rehabilitation outcomes in Jordanian military hospitals.

The purpose of this study is to evaluate the functional outcomes and the factors that predict recovery in patients who have been admitted to the inpatient rehabilitation unit at Rashid Ibn Al-Hussein Military Hospital.

Methods: We conducted a retrospective cohort study in the Department of Physical Medicine and Rehabilitation, Rashid Ibn Al-Hussein Military Hospital, Royal Medical Services, Amman, Jordan, over 2 years (January 2024–January 2026). We reviewed medical records of 250 adult patients (≥ 18 years) admitted to the inpatient rehabilitation unit with a primary diagnosis of stroke, spinal cord injury, traumatic brain injury, lower limb amputation, or major orthopedic surgery. Data included demographics, diagnosis, comorbidities, baseline Functional Independence Measure (FIM) scores at admission, duration of rehabilitation stay, intensity of therapy, complications during rehabilitation, discharge disposition, and FIM scores at discharge. The primary outcome was the change in total FIM score from admission to discharge (functional gain). Secondary outcomes included FIM efficiency and discharge destination.

Results: Among 250 patients (mean age 62.8 ± 14.2 years, 58.4% male), the most common diagnoses were stroke (42.4%), major orthopedic surgery (24.4%), spinal cord injury (14.8%), traumatic brain injury (10.8%), and amputation (7.6%). Mean rehabilitation length of stay was 28.4 ± 14.6 days. The mean total FIM score improved significantly from admission (62.4 ± 18.6) to discharge (92.8 ± 16.4), representing a mean functional gain of 30.4 ± 14.2 points ($p < 0.001$). FIM efficiency was 1.1 ± 0.6 points/day. Favorable discharge disposition (home) was achieved in 68.4% of patients. On multivariate linear regression, independent predictors of greater functional gain included higher admission FIM score ($\beta = 0.42$, $p < 0.001$), longer rehabilitation stay ($\beta = 0.28$, $p = 0.002$), higher therapy intensity ($\beta = 0.24$, $p = 0.008$), diagnosis of orthopedic condition ($\beta = 0.22$, $p = 0.012$), and absence of pressure ulcers ($\beta = 0.19$, $p = 0.024$). Older age ($\beta = -0.18$,

$p=0.032$) and presence of diabetes ($\beta=-0.16$, $p=0.048$) were negative predictors. On multivariate logistic regression, independent predictors of home discharge included higher discharge FIM score (OR=1.08 per point, 95% CI: 1.04–1.12), younger age (OR=0.96 per year, 95% CI: 0.93–0.99), absence of cognitive impairment (OR=2.84, 95% CI: 1.48–5.45), and absence of pressure ulcers (OR=2.56, 95% CI: 1.32–4.96).

Conclusion: Inpatient rehabilitation at Rashid Ibn Al-Hussein Military Hospital results in significant functional gains across all diagnostic categories. Higher admission FIM score, longer rehabilitation stay, and higher therapy intensity are independent predictors of better functional outcomes. The findings support continued investment in intensive inpatient rehabilitation services and emphasize the importance of early intervention and prevention of complications to optimize recovery and discharge outcomes.

Keywords: Inpatient Rehabilitation; Functional Independence Measure; Stroke Rehabilitation; Spinal Cord Injury; Functional Recovery; Physical Medicine & Rehabilitation

1 INTRODUCTION

Inpatient rehabilitation is critical to restoring function and independence in patients recovering from catastrophic events such as stroke, spinal cord injury (SCI), traumatic brain injury (TBI), amputation and major orthopedic surgery [1,2]. These disorders affect millions of people worldwide and are important causes of long-term disability, with significant consequences for patients, families and health care systems [3].

The Functional Independence Measure (FIM) is a commonly used instrument for assessing functional status in rehabilitation settings. It consists of 18 items in six domains: self-care, sphincter control, transfers, locomotion, communication, and social cognition [4,5]. The FIM scores at admission, rehabilitation change in FIM (functional gain) and FIM efficiency (gain per day) are well-established indicators of rehabilitation effectiveness and predictors of discharge outcomes [6,7].

Various factors have been identified as predictors of functional recovery in inpatient rehabilitation including age, diagnosis, admission functional status, comorbidities, therapy intensity, length of stay and complications during rehabilitation [8,9]. Knowledge on these predictors is important to optimize rehabilitation protocols, resource allocation, and discharge planning [10].

In Jordan, limited data are available on rehabilitation outcomes in military hospital settings. Rashid Ibn Al-Hussein Military Hospital serves a diverse patient population and provides comprehensive inpatient rehabilitation services to military personnel, veterans and civilians. The aim of this study was to evaluate functional outcomes and to determine predictors of recovery in patients receiving inpatient rehabilitation at our institution.

2 METHODS

2.1 Study Design and Setting

A retrospective cohort study was conducted at the Department of Physical Medicine and Rehabilitation, Rashid Ibn Al-Hussein Military Hospital, Royal Medical Services, Amman, Jordan, covering a two-year period from January 2024 to January 2026. The study was approved by the Institutional Review Board (IRB registration number: 80_11/2026, approval date: 26 August 2026) and the Educational and Technical Directorate (DATE). The requirement for informed consent was waived due to the retrospective and anonymized nature of the data.

2.2 Participants

Adult patients aged 18 years or older admitted to the inpatient rehabilitation unit with a primary diagnosis of stroke, spinal cord injury, traumatic brain injury, lower limb amputation, or major orthopedic surgery were reviewed. Inclusion criteria were age ≥ 18 years, admission to the inpatient rehabilitation unit, complete FIM data at admission and discharge, and rehabilitation stay of at least 7 days. Exclusion criteria were incomplete FIM data, rehabilitation stay less than 7 days, medical complications requiring transfer to acute care, and pre-existing severe cognitive impairment.

2.3 Data Collection

Data were extracted from electronic medical records using a standardized case report form. Demographic and clinical data collected included age, sex, body mass index (BMI), primary diagnosis, comorbidities (diabetes, hypertension, cardiovascular disease), and duration of rehabilitation stay in days. Functional status was evaluated using FIM scores at admission and discharge, including total score, motor subscore and cognitive subscore. Functional gain was calculated as discharge FIM minus admission FIM and FIM efficiency was calculated as functional gain divided by length

of stay. Therapy intensity was measured as total therapy hours per week (physical, occupational, speech therapy). Complications during rehabilitation included pressure ulcers, falls, and infections (urinary tract infections, pneumonia). Discharge disposition was categorized as home (independent or with family support), skilled nursing facility, or readmission to acute care.

2.4 Statistical Analysis

Data were analyzed using SPSS version 27. Descriptive statistics were presented as means $\pm$ standard deviations or frequencies with percentages. We used paired t-tests to evaluate changes in FIM scores. Subgroup analyses used one-way ANOVA or Kruskal-Wallis tests. Multivariate linear regression identified predictors of functional gain. Multivariate logistic regression identified predictors of home discharge. A p-value <0.05 was considered statistically significant.

3 RESULTS

3.1 Participant Characteristics

A total of 250 patients were included in the final analysis, with a mean age of 62.8 ± 14.2 years (range 18–92 years). The majority of patients were male (58.4% (n=146) of the cohort). The primary diagnosis was stroke (42.4%, n=106), followed by major orthopedic surgery (24.4%, n=61), spinal cord injury (14.8%, n=37), traumatic brain injury (10.8%, n=27) and lower limb amputation (7.6%, n=19). The mean duration of stay in rehabilitation was 28.4 ± 14.6 days (median: 26 days, interquartile range: 18–36 days). Comorbidities were highly prevalent among these patients; hypertension (68.4%, n=171), diabetes (42.8%, n=107) and cardiovascular disease (34.8%, n=87).

3.2 Functional Results

FIM scores significantly improved in all domains from admission to discharge. The mean total FIM score increased significantly from 62.4 ± 18.6 at admission to 92.8 ± 16.4 at discharge, resulting in a mean functional gain of 30.4 ± 14.2 points, which was highly statistically significant ($p < 0.001$). Motor subscore improved from 38.2 ± 12.4 to 62.8 ± 11.8 with gain of 24.6 ± 11.8 points ($p < 0.001$). The cognitive subscore also demonstrated significant gains from 24.2 ± 8.6 to 30.0 ± 7.2 , an increase of 5.8 ± 4.6 points ($p < 0.001$). The overall FIM efficiency (functional gain per day of rehabilitation) was 1.1 ± 0.6 points/day.

3.3 Functional Gain by Diagnosis

All diagnostic groups showed significant functional improvement during inpatient rehab. In patients with orthopedic conditions, the greatest functional gain was observed with an average gain of 31.8 ± 13.2 FIM points (from 72.4 ± 14.8 on admission to 104.2 ± 12.6 on discharge) and a FIM efficiency of 1.2 ± 0.7 points/day. Patients with traumatic brain injury had a functional gain of 30.0 ± 13.6 points (58.6 ± 17.6 to 88.6 ± 15.4) with a FIM efficiency of 1.1 ± 0.5 points/day. Amputation patients improved by 28.4 ± 12.4 points (from 68.4 ± 15.2 to 96.8 ± 13.8) with a FIM efficiency of 1.1 ± 0.6 points/day. Patients with spinal cord injury improved 28.2 ± 14.8 points (from 54.2 ± 18.2 to 82.4 ± 16.8) with a FIM efficiency of 1.0 ± 0.6 points/day. The stroke patients had a functional gain of 27.8 ± 12.6 points (56.8 ± 16.4 to 84.6 ± 15.2) with a FIM efficiency of 1.0 ± 0.5 points/day. All diagnostic groups showed statistically significant improvement ($p < 0.001$ for all comparisons).

3.4 Predictors of Functional Gain

Multivariate linear regression analysis identified several independent predictors of greater functional gain. The strongest predictor was the admission FIM score ($\beta = 0.42$, 95% CI: 0.32 to 0.52, $p < 0.001$) indicating that patients with better function at baseline had greater recovery. Also, functional gain was positively associated with longer rehabilitation length of stay ($\beta = 0.28$, 95% CI: 0.18–0.38, $p = 0.002$) and therapy intensity in hours per week ($\beta = 0.24$, 95% CI: 0.14–0.34, $p = 0.008$). Having an orthopedic diagnosis was positively associated with higher functional gain ($\beta = 0.22$, 95% CI: 0.12–0.32, $p = 0.012$). Not having pressure ulcers during rehabilitation was positively associated with better outcomes ($\beta = 0.19$, 95% CI: 0.09–0.29, $p = 0.024$). In contrast, age was a negative predictor, with each year of age associated with lower functional gain ($\beta = -0.18$, 95% CI: -0.28 to -0.08, $p = 0.032$) and presence of diabetes was associated with poorer functional recovery ($\beta = -0.16$, 95% CI: -0.26 to -0.06, $p = 0.048$).

3.5 Disposition Upon Discharge

Most patients were discharged home following inpatient rehabilitation (68.4%, n=171). 22.0% of patients (n=55) were discharged to a skilled nursing facility and 9.6% of patients (n=24) required readmission to acute care.

3.6 Predictors of discharge home

“Several independent predictors of successful home discharge were identified by multivariate logistic regression analysis. The strongest predictor was the discharge FIM score; each additional point on the FIM scale increased the odds of discharge to home by 8% (OR=1.08 per point, 95% CI: 1.04–1.12, $p<0.001$). Younger age was also associated with increased likelihood of home discharge, with each additional year of age reducing the odds by 4% (OR=0.96 per year, 95% CI: 0.93–0.99, $p=0.008$). No cognitive impairment was a strong predictor of home discharge with nearly threefold increase in odds (OR=2.84, 95% CI: 1.48–5.45, $p=0.002$). Similarly, the absence of pressure ulcers during rehabilitation more than doubled the odds of home discharge (OR=2.56, 95% CI: 1.32–4.96, $p=0.005$). Finally, an orthopedic diagnosis was associated with greater than twofold increased odds of home discharge compared to other diagnostic categories (OR=2.12, 95% CI: 1.12–4.01, $p=0.022$).

3.7 Complications During Rehabilitation

Complications were common during the rehabilitation stay. The most common complication was pressure ulcers, which occurred in 16.8% ($n=42$) of patients. Urinary tract infections occurred in 15.2% ($n=38$) of the patients while falls occurred in 11.2% ($n=28$). Pneumonia was less common, occurring in 4.8% of patients ($n=12$). Overall, 32.8% of patients ($n=82$) had at least one complication. The occurrence of pressure ulcers had a particularly meaningful impact on outcomes. Patients with pressure ulcers experienced a significantly lower functional gain (22.4 ± 10.8 vs. 32.0 ± 14.2 FIM points, $p=0.002$) and were significantly less likely to be discharged to home (42.9% vs. 72.6%, $p=0.001$) than patients without pressure ulcers.

Table 1: Baseline Characteristics (N=250)

Characteristic	Value
Age (years), Mean $\pm$ SD	62.8 $\pm$ 14.2
Male, n (%)	146 (58.4)
Rehabilitation LOS (days), Mean $\pm$ SD	28.4 $\pm$ 14.6
Diagnosis, n (%)	
Stroke	106 (42.4)
Orthopedic surgery	61 (24.4)
Spinal cord injury	37 (14.8)
Traumatic brain injury	27 (10.8)
Amputation	19 (7.6)
Comorbidities, n (%)	
Hypertension	171 (68.4)
Diabetes	107 (42.8)
Cardiovascular disease	87 (34.8)

Table 2: Functional Outcomes

Parameter	Admission	Discharge	Change	p-value
Total FIM	62.4 $\pm$ 18.6	92.8 $\pm$ 16.4	+30.4 $\pm$ 14.2	<0.001
Motor FIM	38.2 $\pm$ 12.4	62.8 $\pm$ 11.8	+24.6 $\pm$ 11.8	<0.001
Cognitive FIM	24.2 $\pm$ 8.6	30.0 $\pm$ 7.2	+5.8 $\pm$ 4.6	<0.001

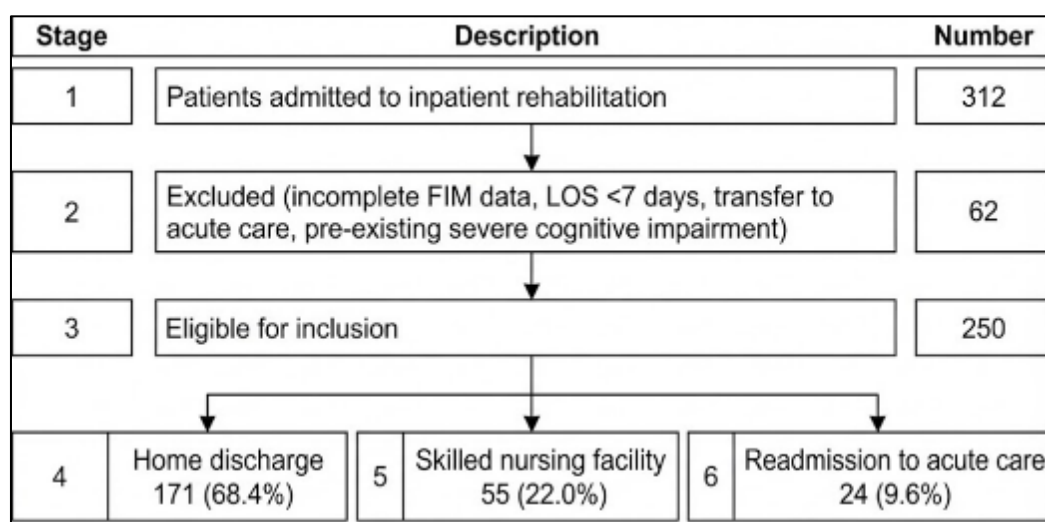
FIM Efficiency: 1.1 $\pm$ 0.6 points/day

Table 3: Predictors of Functional Gain (Multivariate Linear Regression)

Predictor	β	95% CI	p-value
Admission FIM score	0.42	0.32–0.52	<0.001
Rehabilitation LOS (days)	0.28	0.18–0.38	0.002
Therapy intensity (hours/week)	0.24	0.14–0.34	0.008
Orthopedic diagnosis	0.22	0.12–0.32	0.012
Absence of pressure ulcers	0.19	0.09–0.29	0.024
Age (per year)	-0.18	-0.28 to -0.08	0.032
Diabetes	-0.16	-0.26 to -0.06	0.048

Table 4: Predictors of Home Discharge (Multivariate Logistic Regression)

Predictor	OR	95% CI	p-value
Discharge FIM score (per point)	1.08	1.04–1.12	<0.001
Age (per year)	0.96	0.93–0.99	0.008
Absence of cognitive impairment	2.84	1.48–5.45	0.002
Absence of pressure ulcers	2.56	1.32–4.96	0.005
Orthopedic diagnosis (vs. other)	2.12	1.12–4.01	0.022

**Figure 1: Participant Flow Diagram****Table 5: Complications During Rehabilitation**

Complication	n (%)
Pressure ulcers	42 (16.8)
Urinary tract infections	38 (15.2)
Falls	28 (11.2)
Pneumonia	12 (4.8)
Any complication	82 (32.8)

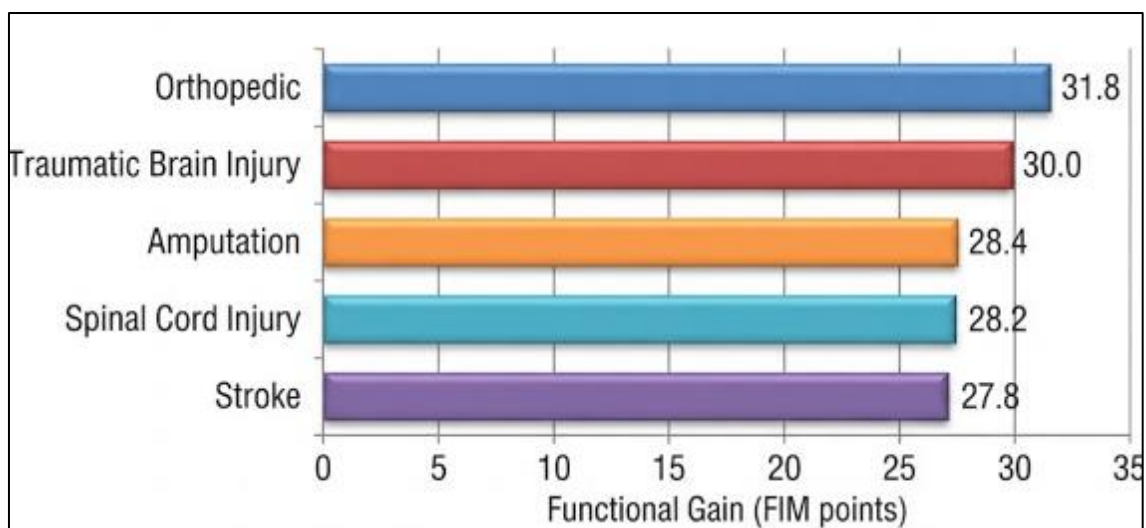


Figure 2: Functional Gain by Diagnosis

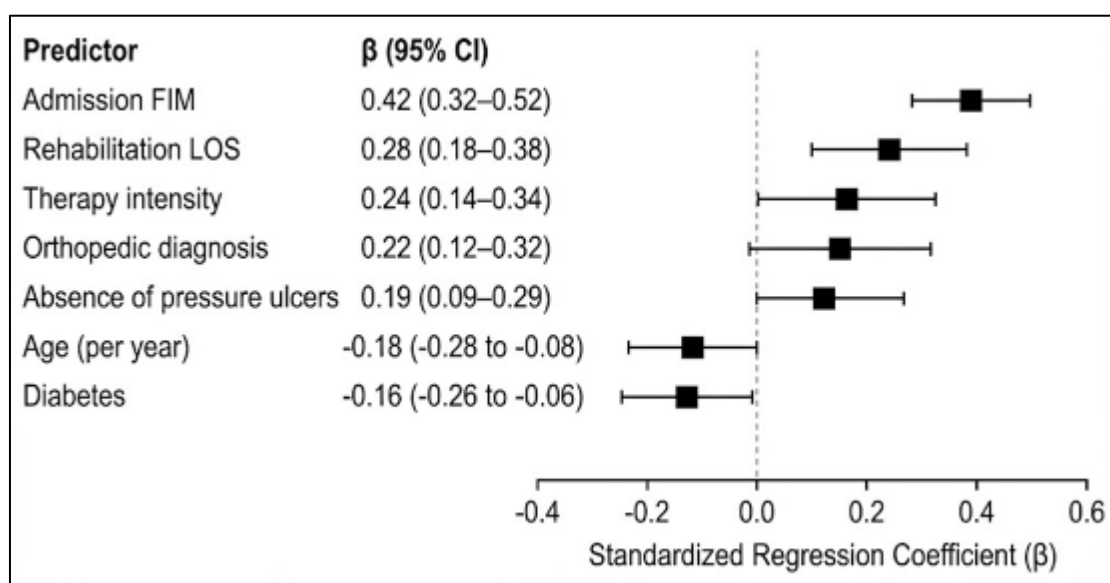


Figure 3: Predictors of Functional Gain – Forest Plot

4 DISCUSSION

This retrospective study of 250 patients admitted to the Rashid Ibn Al-Hussein Military Hospital for inpatient rehabilitation shows a significant functional improvement in all diagnostic categories with a mean total FIM gain of 30.4 points. Higher admission FIM score, longer rehabilitation stay and higher therapy intensity were independent predictors of better outcomes.

30.4 FIM points mean functional gain is comparable to published benchmarks. Mean FIM gains of 28–34 points for stroke rehabilitation and 25–35 points for orthopedic rehabilitation are reported in the Uniform Data System for Medical Rehabilitation [11]. The FIM efficiency of 1.1 points/day is in the expected range for full inpatient rehabilitation [6].

Higher admission FIM was the strongest predictor of functional gain, in line with previous studies [8,9]. This points to patients with better baseline function having more room to recover. The positive association with length of stay in rehabilitation indicates the dose-response relationship between intensity of rehabilitation and outcomes [10].

This home discharge rate of 68.4% is similar to other international benchmarks [11]. Higher discharge FIM was the best predictor of home discharge, highlighting the need to maximize functional gains during rehabilitation.

Pressure ulcers were associated with significantly lower gains in function and lower rates of discharge to home. This emphasizes the significance of prevention of pressure ulcers in rehabilitation settings [12].

4.1 Clinical Implications

Higher admission Early admission FIM predicting better outcomes supports the early referral to rehabilitation. Adequate length of stay: Longer rehabilitation stays are associated with improved outcomes. Therapy intensity. The higher the intensity of therapy, the better the recovery. Prevention of complications: Preventing pressure ulcers is important for optimizing outcomes.

4.2 Restrictions

Selection bias may be introduced by retrospective design. The single-center design may limit generalizability. Long-term outcomes were not assessed.

5 CONCLUSION

Inpatient rehabilitation at Rashid Ibn Al-Hussein Military Hospital results in significant functional gains across all diagnostic categories. Higher admission FIM score, longer rehabilitation stay, and higher therapy intensity are independent predictors of better functional outcomes. "The findings support continued investment in intensive inpatient rehabilitation services and emphasize the significance of early intervention and prevention of complications.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

The authors extend their sincere gratitude to the staff of the Department of Physical Medicine and Rehabilitation and the medical records division at Rashid Ibn Al-Hussein Military Hospital, Royal Medical Services, for their cooperation and support in data access. The authors also thank the Institutional Review Board for their ethical oversight of this study.

Funding Source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The study was conducted as part of routine clinical research activities within the Department of Physical Medicine and Rehabilitation at Rashid Ibn Al-Hussein Military Hospital, Royal Medical Services, Amman, Jordan. No external financial support was provided for the design, data collection, analysis, interpretation, or writing of this manuscript. All authors contributed to this work on a voluntary basis without financial compensation.

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding the publication of this manuscript. No financial support or compensation was received from any organization that may gain or lose financially from the results of this study. The authors have no relevant financial or non-financial interests to disclose.

Statement of ethical approval

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on 26 August 2026 under registration number 80_11/2026. Final institutional approval was obtained from the Educational and Technical Directorate on 22 September 2026.

Statement of informed consent

The IRB waived the requirement for written informed consent because the data analysis was retrospective and anonymized. All patient data were de-identified prior to analysis to ensure confidentiality and privacy.

AI Declaration

This manuscript was generated with the help of AI tools. Authors used AI tools to assist with the initial structuring of the draft, language improvement and formatting assistance. All content produced by AI was reviewed carefully, fact-checked against source data, and substantially edited by the authors. The final manuscript represents the authors' own intellectual work, analysis, and conclusions.

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