Research in Health Science
ISSN 2470-6205 (Print) ISSN 2470-6213 (Online)
Vol. 11, No. 4, 2026
www.scholink.org/ojs/index.php/rhs

Original Paper

Practice Research on a Sustained Multi-modal Rehabilitation Intervention Program Guided by Social Reintegration Among Young and Middle-aged Patients with Septic Shock in the ICU

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Received: October 19, 2026 Accepted: November 2, 2026 Online Published: November 17, 2026

doi:10.22158/rhs.v11n4p59 URL: http://dx.doi.org/10.22158/rhs.v11n4p59

Abstract

Objective: To evaluate the impact of a sustained, social reintegration-oriented multimodal rehabilitation intervention on psychological well-being, functional recovery, and activities of daily living (ADL) in middle-aged and young adults surviving infectious shock in the ICU. Methods: A prospective randomized controlled trial enrolled 105 middle-aged and young adults with infectious shock admitted to Ganzhou People's Hospital between January 2023 and February 2025. Participants were randomly assigned to either an intervention group (n = 55), receiving standard care plus a structured, multidisciplinary rehabilitation program focused on social reintegration, or a control group (n = 50), receiving conventional ICU nursing protocols. Muscle strength, cognitive function, negative psychological states (anxiety/depression), and ADL performance were measured at baseline, 3 months, and 6 months post-intervention using validated clinical instruments. Results: Repeated-measures ANOVA revealed statistically significant main effects for time ($P < 0.05$), group ($P < 0.05$), and the time-by-group interaction ($P < 0.05$) across all outcome domains, indicating differential trajectories of recovery between groups over time. Conclusion: A social reintegration-focused, sustained multimodal rehabilitation program significantly enhances muscle strength and cognitive recovery, mitigates anxiety and depression, and improves functional independence in ICU survivors of infectious shock, thereby promoting holistic rehabilitation and successful reintegration into community life.

Keywords

Sustained multi-modal rehabilitation intervention, Social reintegration, Activities of daily living, Septic shock, Young and middle-aged patients

1. Introduction

Septic shock is caused by the invasion of pathogens into the body and the release of toxins into the blood, resulting in tissue hypoperfusion and circulatory disturbance [1]; despite completion of goal-directed volume resuscitation, patients remain in a persistent hypotensive state and require vasopressor intervention to maintain organ perfusion pressure [2]. The clinical course of this disease is often refractory and readily progresses to multiple organ dysfunction syndrome, so patients are at high risk of death; in addition, survivors often have severe complications that affect their quality of life after rehabilitation [3]. Therefore, patients with septic shock require focused attention. At present, appropriate volume resuscitation, early antibiotic administration, vasoactive drug therapy, and advances in intensive care for septic shock have significantly reduced mortality [4,5]. With improved survival rates, the focus of intensive care has expanded from acute resuscitation to the long-term sequelae of critical illness, and research has gradually focused on patient rehabilitation interventions; health initiatives have also addressed continuity of care from the ICU to discharge and community reintegration, ensuring that survivors receive structured follow-up, rehabilitation, and psychosocial support [6,7]. As the core labor force of families and society, the functional recovery and social re-adaptation of young and middle-aged patients with septic shock are of great significance to both individuals and society. Based on this, this study conducted a randomized controlled trial to investigate the effects of a sustained multi-modal rehabilitation intervention program guided by social reintegration on the psychological state, functional recovery, and activities of daily living of young and middle-aged patients with septic shock in the ICU, aiming to provide a theoretical basis and practical reference for optimizing rehabilitation management models for critically ill patients and promoting their social re-adaptation.

2. Materials and Methods

2.1 General Information

A total of 105 young and middle-aged patients with septic shock who were hospitalized in Ganzhou People's Hospital between January 2023 and February 2025 and met the inclusion and exclusion criteria were collected. A random number table was used to implement blinded grouping, with 50 patients in the control group and 55 patients in the experimental group. Inclusion criteria: ① age between 18 and 59 years; ② meeting the diagnostic criteria for septic shock [8] and ICU stay ≥ 72 hours; ③ APACHE II score [9] 12–35 points; ④ first diagnosis of septic shock and no history of cognitive dysfunction; ⑤ Glasgow Coma Scale (GCS) [10] ≥ 12 points at ICU transfer out; ⑥ informed consent; ⑦ expected survival > 6 months. Exclusion criteria: ① end-stage malignant tumor; ② severe neurological disease (such as stroke, traumatic brain injury) or psychiatric history (such as schizophrenia, bipolar disorder); ③ multiple organ failure; ④ autoimmune system disease; ⑤ severe hearing or language impairment; ⑥ pre-existing limb disability or long-term bedridden history before ICU admission; ⑦ residence > 100 km from the hospital or no fixed contact channel. There was no statistically significant difference between the two groups ($P > 0.05$), and comparability between groups was established. The baseline data

of patients are shown in Table 1. This study was reviewed and approved by the Ethics Committee of Ganzhou People's Hospital (IIT-ZKY2025-016-01).

Table 1. Comparison of General Data between the Two Groups of Patients

Item	Cases	Sex (male/female)	Mean age	Length of ICU stay	APACHE II score
Intervention group	55	35/20	44.36 ± 8.45	11.80 ± 4.21	18.05 ± 2.78
Control group	50	28/22	45.60 ± 8.48	11.52 ± 4.05	17.48 ± 3.15
P value		0.43	0.46	0.73	0.32

2.2 Methods

Both groups received the same treatment, including antibiotics to control the source of infection, appropriate volume resuscitation, and improvement of tissue perfusion; vasoactive drugs were given when necessary to maintain stable blood pressure.

2.2.1 Control Group

The control group received conventional nursing care: (1) Condition monitoring and basic nursing: monitor basic vital signs hourly, perform laboratory re-examinations as prescribed, and provide basic health education. (2) Airway care: suction as needed for mechanically ventilated patients, assist with turning over and back percussion every 2 hours to promote sputum expectoration. (3) Nutritional support: according to the results of the Nutritional Risk Screening 2002 (NRS2002) score, formulate enteral and parenteral nutrition support plans, with a target calorie intake of 25–30 kcal/(kg·d). (4) Analgesia and sedation management: follow the "sedation-awakening-assessment" cycle and dynamically adjust drug doses as prescribed. (5) Complication prevention: daily passive lower limb exercise and pneumatic therapy to prevent deep vein thrombosis, and elevate the head of the bed by 30° to prevent ventilator-associated pneumonia. At the same time, provide life care as needed (such as oral cleaning, perineal care, skin care, etc.). (6) Follow-up: after transfer out of the ICU, regular telephone follow-up (once a week) and outpatient re-visits (once a month) were conducted to track health status, and patients were guided to perform home rehabilitation training (such as limb function exercise, breathing training), provided with nutritional guidance and medication precautions, and their questions were answered. The intervention period was from ICU admission to 6 months after transfer out.

2.2.2 Intervention Group

The intervention group received the sustained multi-modal rehabilitation intervention program guided by social reintegration in addition to the control group's care, with the intervention period from ICU admission to 6 months after transfer out. Details are shown in Table 2.

Table 2. Sustained Multi-modal Rehabilitation Intervention Program for Young and Middle-aged Patients with Septic Shock Guided by Social Reintegration

Intervention dimension	Stage	Time and frequency	Core operations
Early functional rehabilitation training	ICU stay, in-hospital rehabilitation stage	Initiated 48 h after condition stabilization; passive training 3–4 times/day; progressive active and standing training	Passive flexion, extension, and rotation training of limb joints in bed; active training in bed and standing training at the bedside after muscle strength meets the standard; pulmonary and limb rehabilitation carried out jointly with the rehabilitation department, with rehabilitation records established
Cognitive function rehabilitation training	ICU and in-hospital stay	Memory training 1–2 times/day, 15–20 min/time; attention training once/day, 20–30 min/time; logical training 3–4 times/week, 25–30 min/time	Memory training through event recall and word recitation; attention training with puzzles, Sudoku, etc.; logical thinking training through problem analysis and causal reasoning
Psychological intervention	ICU stay, transfer to general ward	Psychological counseling 1–2 times/day; mindfulness training 2 times/day, 10–15 min/time; patient group activities 1–2 times/month, 40–60 min/time	Implement humanistic care and individualized counseling for negative emotions; guide deep breathing and meditation mindfulness stress reduction training; organize patient mutual-aid activities to promote experience exchange and psychological support
Activities of daily living training	In-hospital stay, home rehabilitation period	In-hospital training 2–3 times/day, 20–30 min/time; continuous training as needed at home	In-hospital training of basic life skills such as eating, washing, and dressing; at home, carry out complex life training such as item organization and simple housework, with dynamic adjustment of training difficulty
Social adaptation ability cultivation	In-hospital recovery period, post-discharge community and home	Social simulation training 2–3 times/week; community public welfare activities 1–2 times/month, 30–60 min/time	Assist patients in communicating with relatives and friends and simulate social scenarios; organize participation in community public welfare activities,

			rebuild social connections, and enhance social adaptation and role identity
Health management education	Whole rehabilitation cycle (in-hospital + home)	Health lectures once/month, 40–50 min/time; full-process dynamic assessment and monitoring	Carry out health education on rehabilitation, diet, medication, and daily routines; formulate individualized dietary plans and regularly evaluate and adjust them; guide patients to independently monitor vital signs and wound recovery
Continuous nursing intervention	Home rehabilitation stage after discharge	Online follow-up once/week; offline re-visit assessment once/2 months	Follow up rehabilitation progress and optimize rehabilitation plans through telephone and video follow-up; carry out multi-dimensional offline re-visit assessment and dynamically adjust individualized intervention measures

2.3 Evaluation Indicators

2.3.1 Muscle strength: Muscle strength was assessed using the UK Medical Research Council (MRC) scale [11]. The scale evaluates muscle strength through 6 groups of core muscle groups throughout the body, using a Likert 6-point scoring method, with a total score of 0–60 points; higher scores indicate better muscle strength function of the subject.

2.3.2 Cognitive function: The Mini-Mental State Examination (MMSE) [12] was selected to assess multi-domain cognitive function of the subjects. The scale consists of 11 items and uses a standardized scoring system, with a total score of 0–30 points, of which the normal cognitive function score range is 27–30 points, 21–26 points indicate mild cognitive impairment, 10–20 points indicate moderate cognitive impairment, and ≤ 9 points indicates severe cognitive impairment.

2.3.3 Negative emotions: The anxiety state of patients was quantitatively assessed using the Self-Rating Anxiety Scale (SAS) [13]. This scale contains 20 items covering 4 psychological dimensions, uses a Likert 4-point scoring system, with a raw total score range of 20–80 points and a standardized score of 25–100 points after linear transformation; higher scores indicate increased severity of anxiety symptoms. Depressive mood was simultaneously assessed using the Self-Rating Depression Scale (SDS) [14]. Its structure, scoring mechanism, and scoring rules are completely consistent with the SAS, with higher scores representing more significant depression.

2.3.4 Activities of daily living (ADL): The modified Barthel Index (MBI) [15] was used as a tool to assess patients' ADL. The scale covers 10 basic activity items for critically ill patients for comprehensive assessment and obtains a final score based on standardized weighted scoring rules, with a total score range of 0–100 points; higher scores indicate better ADL functional status of patients.

2.4 Data Collection

Before the intervention and at 3 and 6 months after the intervention, the muscle strength, cognitive function, negative emotions, and ADL of the two groups of young and middle-aged patients with septic shock were assessed. Questionnaires could be completed through face-to-face, telephone, or WeChat methods.

2.5 Statistical Methods

All raw data were recorded using Excel worksheets, and all data analyses were completed based on SPSS 27.0 software to ensure reproducibility and operational consistency of the analysis process. Continuous data were described as mean ± standard deviation ($\bar{x} \pm s$), and categorical data were uniformly expressed as (n, %). Between-group comparisons of baseline characteristics were performed using the t-test; within-group and between-group changes in repeated measurement indicators were evaluated using repeated-measures analysis of variance (ANOVA), and the level of statistical significance was set at $P < 0.05$.

3. Results

3.1 Muscle Strength

After the intervention, the MRC scores of both the control group and the intervention group improved to varying degrees, and the scores of the intervention group were higher than those of the control group ($P < 0.05$). The time effect ($F = 27.093$, $P < 0.05$), between-group effect ($F = 21.730$, $P < 0.05$), and time-by-group interaction effect ($F = 32.281$, $P < 0.05$) of MRC scores in the two groups of young and middle-aged patients with septic shock all reached statistically significant levels. Specific data are shown in Table 3.

Table 3. Comparison of MRC Scores between the Two Groups of Young and Middle-aged Patients with Septic Shock before and after Intervention ($\bar{x} \pm s$, points)

Group	Before intervention	3 months after intervention	6 months after intervention	Time effect F (P)	Between-group effect F (P)	Interaction effect F (P)
Intervention group	42.27 ± 2.22	50.73 ± 2.84	56.44 ± 2.96	27.093 (<0.001)	21.730 (<0.001)	32.281 (<0.001)
Control group	42.96 ± 2.65	46.44 ± 3.05	51.82 ± 1.88			
t	-1.434	7.451	9.622			
P	0.15	<0.001	<0.001			

3.2 Cognitive Function

After the intervention, the MMSE scores of patients in both the control group and the intervention group increased significantly compared with baseline, and the intervention group was higher than the control group ($P < 0.05$). The time effect ($F = 15.779$, $P < 0.05$), between-group effect ($F = 10.140$, $P < 0.05$),

and time-by-group interaction effect (F = 6.215, P < 0.05) of the MMSE indicator in the two groups of young and middle-aged patients with septic shock all reached statistically significant levels. Specific data are shown in Table 4.

Table 4. Comparison of MMSE Scores between the Two Groups of Young and Middle-aged Patients with Septic Shock before and after Intervention ($\bar{x}$ ± s, points)

Group	Before intervention	3 months after intervention	6 months after intervention	Time effect F (P)	Between-group effect F (P)	Interaction effect F (P)
Intervention group	17.91 ± 5.14	25.31 ± 3.13	28.04 ± 1.77	15.779 (<0.001)	10.140 (0.002)	6.215 (0.007)
Control group	17.48 ± 5.37	22.02 ± 3.72	26.18 ± 2.53			
t	0.418	4.914	4.386			
P	0.67	<0.001	<0.001			

3.3 Negative Emotions

After the intervention, the SAS and SDS scores of both the control group and the intervention group decreased significantly compared with baseline, but the SAS and SDS scores of the intervention group were lower (P < 0.05). The time effect (F = 32.732/27.198, P < 0.05), between-group effect (F = 22.643/17.860, P < 0.05), and time-by-group interaction effect (F = 31.873/15.186, P < 0.05) of SAS and SDS scores in the two groups of young and middle-aged patients with septic shock all reached statistically significant levels. Specific data are shown in Tables 5 and 6.

Table 5. Comparison of SAS Scores between the Two Groups of Young and Middle-aged Patients with Septic Shock before and after Intervention ($\bar{x}$ ± s, points)

Group	Before intervention	3 months after intervention	6 months after intervention	Time effect F (P)	Between-group effect F (P)	Interaction effect F (P)
Intervention group	64.96±2.79	48.56±2.27	45.91±2.95	32.732 (＜0.001)	22.643 (＜0.001)	31.873 (＜0.001)
Control group	64.14±2.94	53.78±2.95	49.86±2.37			
t	1.469	-10.196	-7.51			
P	0.15	＜0.001	＜0.001			

Table 6. Comparison of SDS Scores between the Two Groups of Young and Middle-aged Patients with Septic Shock before and after Intervention ((±S), points)

Group	Before intervention	3 months after intervention	6 months after intervention	Time effect F (P)	Between-group effect F (P)	Interaction effect F (P)
Intervention group	65.53±2.82	49.87±2.58	42.75±3.52	27.198 (＜0.001)	17.860 (＜0.001)	15.186 (＜0.001)
Control group	65.78±2.98	55.92±2.55	48.82±2.83			
t	-0.446	-12.047	-9.682			
P	0.66	＜0.001	＜0.001			

3.4 Activities of Daily Living

After the intervention, the MBI scores of both the control group and the intervention group increased to varying degrees, and the intervention group was higher than the control group ($P < 0.05$). The time effect ($F = 98.102$, $P < 0.05$), between-group effect ($F = 32.281$, $P < 0.05$), and time-by-group interaction effect ($F = 84.638$, $P < 0.05$) of MBI scores in the two groups of young and middle-aged patients with septic shock all reached statistically significant levels. Specific data are shown in Table 7.

Table 7. Comparison of MBI Scores between the Two Groups of Young and Middle-aged Patients with Septic Shock before and after Intervention ($\bar{x} \pm s$, points)

Group	Before intervention	3 months after intervention	6 months after intervention	Time effect F (P)	Between-group effect F (P)	Interaction effect F (P)
Intervention group	36.09±4.85	63.47±5.07	83.89±3.60	98.102 (＜0.001)	32.281 (＜0.001)	84.638 (＜0.001)
Control group	36.68±4.28	56.46±4.42	77.62±2.84			
t	-0.657	7.526	9.833			
P	0.51	＜0.001	＜0.001			

4. Discussion

Septic shock is a common critical emergency in the ICU, with rapid disease progression and strong systemic inflammatory response; it not only severely damages patients' physiological functions but can also cause lasting psychological damage and social dysfunction [16,17]. Young and middle-aged people are the backbone of social production and family life; the ICU treatment experience, impaired physical function, and interruption of social roles make their rehabilitation process more complex and expose them to higher rehabilitation challenges. Traditional ICU nursing mostly focuses on acute-phase condition management, infection prevention and control, and basic life care. Although it can effectively reduce short-term mortality [6], the intervention system is relatively single and pays insufficient attention

to patients' long-term psychological adjustment, physical function recovery, and social adaptation ability reconstruction [18], resulting in some patients having long-term negative emotions, decreased self-care ability, and difficulties in social participation after discharge [19], making it difficult for them to smoothly return to family and society. Therefore, building a comprehensive intervention system that takes into account physiological, psychological, and social functions is the key to improving the long-term prognosis of patients with septic shock. The sustained multi-modal rehabilitation intervention guided by social reintegration can effectively make up for the limitations of traditional nursing.

After the intervention, the improvement in MRC scores in the intervention group significantly exceeded that in the control group ($P < 0.05$), and the time effect, between-group effect, and time-by-group interaction effect were statistically significant ($P < 0.05$). This indicates that the sustained multi-modal rehabilitation intervention program guided by social reintegration can effectively improve the muscle strength of young and middle-aged patients with septic shock and has a continuous long-term effect, which is basically consistent with the research results of Wang Xiaosha et al. [20]. This study implemented a staged rehabilitation training program for patients; early passive movement can maintain joint range of motion and ensure muscle blood perfusion, effectively avoiding disuse muscle atrophy. After condition stabilization, patients gradually transitioned to assisted active and active training, activating muscle fibers, improving muscle strength, and assisting the recovery of physical motor function. On this basis, activities of daily living training was carried out simultaneously to promote patients' gradual transition from limb function recovery to the reconstruction of basic life skills such as independent eating, washing, and dressing, effectively improving self-care ability and laying a solid foundation for patients to live independently and smoothly return to family and society.

After the intervention, the improvement in MMSE scores was more significant in the intervention group ($P < 0.05$), supporting the effectiveness of this study's intervention program in improving patients' cognitive function. The improvement in patients' cognitive function benefited from targeted cognitive training and environmental stimulation within the program. Septic shock induces brain injury, and combined with ICU sedative drug intervention, it easily causes cognitive impairment such as decreased attention and memory [21]. This study, through continuous cognitive stimulation such as logical thinking and memory reinforcement, promoted brain synaptic remodeling and repair; early social contact and information interaction can reduce the risk of cognitive decline and help patients gradually recover cognitive ability, building cognitive conditions for smoothly returning to society [22].

After the intervention, the psychological symptom levels of the two groups showed between-group differences, and the SAS and SDS scores of the intervention group were significantly lower than those of the control group ($P < 0.05$), indicating that the sustained multi-modal rehabilitation intervention program guided by social reintegration can effectively reduce the anxiety and depression levels of young and middle-aged patients with septic shock and alleviate negative emotions. This intervention program, through regular psychological intervention, alleviates patients' negative emotions such as anxiety and depression, directly reducing SAS and SDS scores; at the same time, it guides family members to provide

emotional support and instructs them to participate in rehabilitation, which not only strengthens the social support system but also assists patients in rebuilding cognitive frameworks and effectively delays cognitive decline [23]. On this basis, continuous cognitive stimulation activities such as logical thinking and memory reinforcement are carried out to promote synaptic remodeling and repair and gradually improve attention, memory, and other impairments [7]. The above multi-dimensional interventions act synergistically from emotional stabilization and social connection to cognitive retraining, laying the necessary cognitive foundation for patients to return to society.

After the intervention, the MBI scores of patients in the intervention group were significantly better than those in the control group ($P < 0.05$), suggesting that the sustained multi-modal rehabilitation intervention program guided by social reintegration can effectively improve the activities of daily living of young and middle-aged patients with septic shock, similar to the results of Ahn et al. [24]. This study started functional rehabilitation training early and ran it throughout the whole process, dynamically adjusting training intensity and content according to the patient's condition, from passive activity to active exercise, gradually restoring limb muscle strength and coordination [25]. This continuous and targeted training can promote neuromuscular function remodeling and improve joint range of motion [26], enabling patients to gradually master basic life skills such as eating, dressing, and washing, reduce dependence on others, and thus significantly improve activities of daily living.

In summary, the sustained multi-modal rehabilitation intervention program guided by social reintegration can coordinate rehabilitation processes in various fields, improve patients' physiological function, psychological state, and social participation, significantly improve the muscle strength and cognitive function of young and middle-aged patients with septic shock, alleviate negative emotions, and thereby improve patients' activities of daily living, which has important clinical value for promoting comprehensive rehabilitation and social re-adaptation of patients. However, this study only conducted intervention research on young and middle-aged patients with septic shock in one hospital; in the future, research will be carried out among young and middle-aged patients with septic shock in different provinces and cities to continuously accumulate clinical experience.

Fund Project

Ganzhou Municipal Key R&D Program Project (2023LNS17481).

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