

NEUROSENSORY AND COGNITIVE STIMULATION IN FUNCTIONAL RECOVERY AFTER A STROKE: A CASE REPORT

Estimulação neurosensorial e cognitiva na recuperação funcional após AVC: relato de caso

Estimulación neurosensorial y cognitiva en la recuperación funcional tras un ictus: caso clínico

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ABSTRACT

Background: stroke is one of the leading causes of death and disability, with thalamic hemorrhage associated with severe motor, sensory, and cognitive deficits, compromising the person's autonomy and resulting in a poor prognosis. Comprehensive functional rehabilitation, including neurosensory and cognitive stimulation, is essential for functional recovery and participation in activities of daily living. **Objective:** to describe the implementation and outcomes of a 16-session rehabilitation nursing program, focusing on neurosensory and cognitive stimulation, in a person with hemorrhagic thalamic stroke. **Methodology:** case report of an 82-year-old woman, previously independent, admitted to the surgical ward after a hemorrhagic thalamic stroke. Sixteen rehabilitation nursing sessions (15–30 minutes per intervention) were performed, involving multisensory stimulation and functional cognitive training. Progress was monitored using validated instruments. **Results:** progressive improvement was observed on the Glasgow Coma Scale (9 to 13), NIHSS (28 to 12), Rancho Los Amigos Scale (level II to VI), and MIF (18 to 32), reflecting improvements in cognition and overall functionality. **Conclusion:** the study suggests potential benefit of structured interventions of neurosensory stimulation, cognitive training, and family involvement for functional recovery in severe hemorrhagic stroke.

Keywords: hemorrhagic stroke; neurological rehabilitation; rehabilitation nursing; case reports

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RESUMO

Enquadramento: o acidente vascular cerebral (AVC) constitui uma das principais causas de morte e incapacidade, sendo a hemorragia talâmica associada a défices motores, sensoriais e cognitivos, com impacto na autonomia e no prognóstico funcional. A reabilitação funcional, incluindo estimulação neurosensorial e cognitiva, é essencial para a recuperação funcional e para a participação nas atividades de vida diária (AVD). **Objetivo:** descrever a implementação e os resultados de um programa de 16 sessões de enfermagem de reabilitação (ER), com enfoque na estimulação neurosensorial e cognitiva, numa pessoa com AVC talâmico hemorrágico. **Metodologia:** relato de caso de mulher, 82 anos, previamente autónoma, internada após AVC talâmico hemorrágico. Realizaram-se 16 sessões de ER (15–30 min por intervenção), envolvendo estimulação multissensorial e treino cognitivo funcional. A evolução foi monitorizada através de instrumentos validados. **Resultados:** observou-se melhoria nas escalas Escala de Coma de *Glasgow* (ECG), (9 para 13), NIHSS (28 para 12), Escala *Rancho de Los Amigos* (ERA), (nível II para VI) e Medida de Independência Funcional (MIF), (18 para 32), refletindo evolução da cognição e funcionalidade global. **Conclusão:** o estudo sugere potencial benefício das intervenções estruturadas de estimulação neurosensorial, treino cognitivo e envolvimento familiar, para a recuperação funcional no AVC hemorrágico grave.

Palavras-chave: acidente vascular cerebral hemorrágico; reabilitação neurológica; enfermagem em reabilitação; relatos de casos

RESUMEN

Marco contextual: el accidente cerebrovascular es una de las principales causas de muerte y discapacidad, y la hemorragia talámica se asocia con déficits motores, sensoriales y cognitivos graves, lo que compromete la autonomía de la persona y se traduce en un mal pronóstico. La rehabilitación funcional global, incluida la estimulación neurosensorial y cognitiva, es esencial para la recuperación funcional y la participación en las actividades de la vida diaria. **Objetivo:** describir la implementación y los resultados de un programa de 16 sesiones de enfermería de rehabilitación, con enfoque en la estimulación neurosensorial y cognitiva, en una persona con accidente cerebrovascular hemorrágico grave. **Metodología:** informe del caso de una mujer de 82 años, previamente autónoma, ingresada en el servicio de cirugía tras un accidente cerebrovascular talâmico hemorrágico. Se realizaron 16 sesiones de enfermería de rehabilitación (15-30 minutos por intervención), que incluyeron estimulación multisensorial y entrenamiento cognitivo funcional. La evolución se supervisó mediante instrumentos validados. **Resultados:** se observó una mejora progresiva en las escalas Escala de Coma de *Glasgow* (9 a 13), NIHSS (28 a 12), Escala *Rancho Los Amigos* (nivel II a VI) y MIF (18 a 32), lo que refleja la evolución del cognición y la funcionalidad global. **Conclusión:** el estudio sugiere un beneficio potencial de las intervenciones estructuradas de estimulación neurosensorial, entrenamiento cognitivo y participación familiar para la recuperación funcional en casos de accidente cerebrovascular hemorrágico grave.

Palabras clave: accidente cerebrovascular hemorrágico; rehabilitación neurológica; enfermería en rehabilitación; informes de casos



INTRODUCTION

Stroke is one of the leading causes of death and acquired disability both globally and nationally, representing a public health problem with significant functional, social and economic implications. In Portugal, stroke remains among the leading causes of death and disability, with haemorrhagic stroke accounting for approximately 20% of cases; this is associated with greater clinical severity and poorer functional outcomes compared to ischaemic stroke (Direção-Geral da Saúde, 2017; Figueiredo et al., 2020; Organisation for Economic Co-operation and Development & European Observatory on Health Systems and Policies, 2025). According to the National Programme for Cerebrovascular and Cardiovascular Diseases, stroke continues to represent a health priority, requiring integrated strategies for prevention, treatment and rehabilitation (Direção-Geral da Saúde, 2017).

Among haemorrhagic strokes, thalamic haemorrhage accounts for approximately 8–15% of spontaneous intracerebral haemorrhages and is frequently associated with poor prognoses, particularly when complicated by intraventricular extension and hydrocephalus, which are independent factors associated with higher mortality and poorer functional recovery (Lee et al., 2015; Menon et al., 2019).

The thalamus plays a central role in sensory integration, motor modulation and thalamocortical cognitive circuits; consequently, damage to it is associated with complex neurological deficits, notably including paresis, paraesthesia and impaired cognition—specifically attention, memory,

executive functions and processing speed— with a significant impact on overall functionality, compromising not only the person's independence but also their autonomy (Costa et al., 2011).

Accordingly, the present study aims to describe the implementation and results of a 16-session rehabilitation nursing (RN) programme, focusing on neurosensory and cognitive stimulation, in a person with a thalamic haemorrhagic stroke.

BACKGROUND

Evidence suggests that post-stroke cognitive deficits are highly prevalent and constitute a critical determinant of functional prognosis and participation in activities of daily living (ADL), yet they are often underestimated compared to motor deficits (Mulhern, 2023; O'Donoghue et al., 2022).

In this context, comprehensive functional rehabilitation, with a specific focus on cognitive rehabilitation, plays a central role in post-stroke recovery, not only in addressing cognitive deficits but also in improving sensorimotor deficits. Cognitive and neurosensory rehabilitation is based on the principles of neuroplasticity, understood as the central nervous system's capacity to structurally and functionally reorganise its neural networks in response to injury, experience and targeted stimulation (Johansson, 2000; Lima, 2024). Studies indicate that early interventions, oriented towards functional and meaningful tasks, promote cortical reorganisation and enhance functional recovery following a stroke; to this end, a balance must be struck between the routine of interventions and the introduction of new stimuli (Barbosa et al., 2024). Multimodal neurosensory stimulation, by

integrating the activation of sensory systems, helps to increase alertness, improve sensorimotor integration and facilitate higher-order cognitive processes, thereby acting as a facilitator of learning and cognitive rehabilitation (Abbate et al., 2014; Johansson, 2012; Laste et al., 2024; Parisi et al., 2022).

The Guidelines for International Cognitive Rehabilitation following Traumatic Brain Injury (INCOG 2.0) recommend that cognitive rehabilitation following injury should be structured, individualised and integrated into comprehensive functional rehabilitation programmes, combining restorative and compensatory approaches, so as to maximise the transfer of cognitive gains to functional performance and the person's daily life (Bayley et al., 2023; Cicerone et al., 2019). The evidence further reinforces that the integration of neurosensory stimulation with cognitive training focused on meaningful tasks enhances task-dependent neuroplasticity mechanisms and promotes more consistent and sustained functional gains (Mulhern, 2023; Parisi et al., 2022).

In this context, Rehabilitation Nursing, as a specialised field of practice, possesses key competencies in neurological and systemic functional assessment, in the planning and implementation of individualised functional rehabilitation programmes, including neurosensory and cognitive stimulation, as well as in monitoring functional progress and preventing complications (Ordem dos Enfermeiros, 2019).

METHODOLOGY

The case report is a research methodology that describes, in detail, a specific participant in light of an unusual situation, serving as a rapid and concise strategy for generating scientific knowledge (Heart Views, 2017).

Case reports are particularly relevant as they enable an understanding of the potential contribution of RE interventions in complex and individualised neurological contexts. Thus, the main advantage of this methodological approach lies in its practical applicability, enabling an in-depth study of concrete real-life situations and establishing a closer link between theory and clinical practice. This methodology also contributes to the advancement of scientific knowledge by encouraging evidence-based decision-making and problem-solving in clinical contexts (Galdeano et al., 2003).

A case report was conducted through a descriptive, observational and retrospective analysis of the intervention carried out by the Specialist Nurse in Rehabilitation Nursing (SNRN), during the hospitalisation of a specific clinical case in an inpatient surgical ward, covering a 30-day period from 29 December 2025 to 28 January 2026.

This article describes the clinical case of a patient with a thalamic haemorrhagic stroke, considered unique as the patient had no medical prognosis for neurological recovery. The aim of this article is therefore to describe the implementation of a programme comprising 16 sessions of RN, focusing on neurosensory and cognitive stimulation, and to present the results obtained in this clinical case.

The patient was enrolled in a RN programme, with a total of 16 sessions carried out, each lasting

between 15 and 30 minutes with breaks, depending on the patient's tolerance.

Criteria were established for the suspension or postponement of sessions, namely the presence of fatigue, drowsiness, fever (temperature above 38°C), complications such as respiratory and urinary tract infections, and the scheduling of additional diagnostic tests coinciding with the intervention times.

The individual's clinical progress throughout the RN programme was monitored using validated instruments, enabling an objective analysis of neurological, cognitive and functional recovery.

Specific, validated assessment tools were used to monitor clinical progress and the recovery process, namely: the Glasgow Coma Scale (GCS) for assessing the level of consciousness in people with brain injuries (Teasdale, 2015); the National Institutes of Health Stroke Scale (NIHSS), to determine the severity and extent of neurological deficit following a stroke (National Institute of Neurological Disorders and Stroke, 2025); the Medical Research Council (MRC) scale, to assess the degree of muscle strength in various body segments (Portuguese Nursing Council, 2016); the Ashworth Scale, to assess spasticity/muscle tone through passive mobilisation of the limbs and the resistance encountered (Ordem dos Enfermeiros, 2016); the Rancho Los Amigos Scale (RAS), for characterising cognitive and behavioural patterns (Pereira et al., 2021); and the Measure of Functional Independence (MFI), which assesses the degree of functional

ability through performance in motor and cognitive tasks of daily living (Portuguese Nursing Council, 2016).

This case report was structured in accordance with the Case Report (CARE) guidelines, with the necessary adaptations made to reflect the specific nature of the clinical case under consideration (Riley et al., 2017). Informed consent was obtained from the family for the use of clinical data for scientific purposes. It should be noted that this study received approval from the Ethics Committee of the Local Health Unit, with approval code 2026-27.

Clinical case: social background and reason for admission

This clinical case concerns Mrs M, an 82-year-old caucasian woman who was previously cognitively intact, self-sufficient and functionally independent in ADLs, having retired from her career as a teacher. She was socially active, particularly within her family circle, with close family members forming her support network. Her relevant medical history included hypertension, with poor adherence to the prescribed treatment.

She was admitted to the emergency department presenting with paresis and paraesthesia of the right side of her body, and fluctuations in her level of consciousness, which had been developing for one hour. Imaging confirmed the presence of a deep intraparenchymal haematoma on the left side, consistent with a hypertensive thalamic haemorrhagic stroke, as shown in Figure 1.

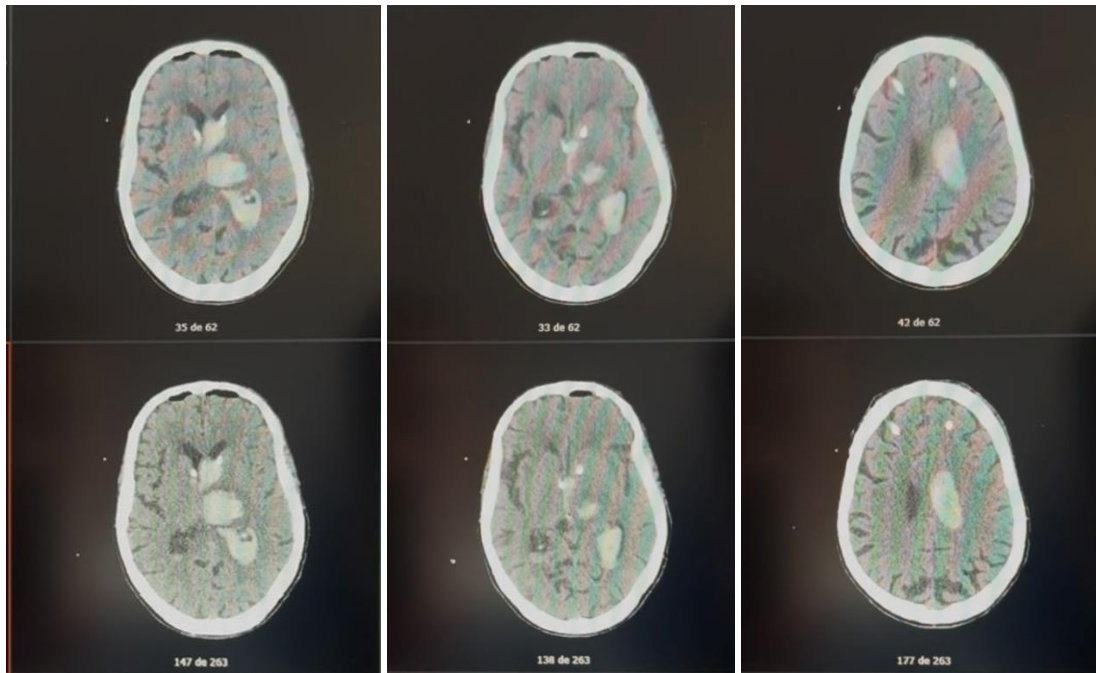


Figure 1
Cranial computed tomography scan on admission

Due to a deterioration in the patient’s clinical condition (difficult-to-control hypertension and altered level of consciousness), with the development of acute hydrocephalus, the patient was admitted to the intensive care unit (ICU), where they underwent bilateral external ventricular drainage (EVD) for ten days and invasive mechanical ventilation (IMV). Extubation failed on the second day of IMV, secondary to atelectasis, which necessitated its continuation for a total period of 28 days, culminating in surgical tracheostomy. Her stay in the ICU was also marked by haemodynamic instability, transient seizures, and recurrent infections (respiratory, urinary and ventriculitis).

Initial RN assessment

Mrs M was transferred to a surgical ward 40 days after her admission and was haemodynamically stable, breathing spontaneously with a non-fenestrated size 6 endotracheal tube and receiving

oxygen therapy at 2 L/min. Since her admission, and following a thorough assessment, she was enrolled in a rehabilitation programme, which included respiratory functional rehabilitation (with a view to decannulation) as well as sensorimotor and cognitive rehabilitation. This case study highlights the assessments carried out and the resulting outcomes of the rehabilitation interventions over a 30-day period.

With regard to the assessment of level of consciousness, Mrs M fluctuated between a score of 9 and 10 on the GCS. The NIHSS was also applied, as it is appropriate for the context of stroke, enabling a progressive and integrated assessment of the patient’s neurological deficits. Thus, on admission, Mrs M had a score of 28, which corresponds to a severe level of neurological deficits – in motor function, language and attention (right visual neglect). In terms of motor function, Mrs M

presented with right-sided hemiplegia and grade 2 hemiplegia on the left, according to assessment using the MRC scale. Regarding spasticity, she presented with flaccid hemiplegia on the right, whilst the left side of her body exhibited grade 2 spasticity, according to the Ashworth scale.

To complete the cognitive assessment, the RAS and MFI were used to evaluate language, comprehension, attention and executive function. According to the RAS, the patient was at level II, exhibiting a generalised response that was inconsistent, inappropriate and not directed towards the stimulus. Thus, based on the overall, sensorimotor and cognitive assessments, it was concluded that the patient had low functional capacity for self-care, presenting on admission with a degree of total dependence as assessed by the MFI – a score of 18.

RN diagnoses

Based on the assessment of overall functioning, the nursing diagnoses relevant to the focus of this study on cognitive and neurosensory rehabilitation were identified. These were therefore formulated in accordance with the terminology of the

International Classification for Nursing Practice 2019:

1. Impaired cognition
2. Impaired psychomotor activity
3. Sensory deficit
4. Deficit in self-care

Cognitive and neurosensory functional rehabilitation programme

Following an assessment of Mrs M, in which diagnoses relevant to the study context were identified and prioritised, an individualised, dynamic rehabilitation programme was developed, tailored to the patient’s clinical progress. Accordingly, RN interventions were established, along with an example of a daily session plan, which are set out in Tables 1 and 2. It should be noted that there was a logical and progressive sequence of interventions, in accordance with the person’s functional abilities during the period in question. The involvement of the family enabled us to understand what types of stimuli would be meaningful and familiar to Mrs M (namely music, objects/images and toiletries), which would facilitate the rehabilitation process and lead to gains in this regard, with the prospect of a better response from the individual (Mulhern, 2023).

Table 1

RN interventions

Stimulus Regulation	Multisensory Stimulation	Cognitive Stimulation	Resources
<p>Environment: calm and initially featuring familiar stimuli, with distractions introduced gradually</p> <p>Frequency: 1–2 times a day, increasing as the person’s tolerance</p>	<p>Auditory</p> <ul style="list-style-type: none"> • Calm tone of voice • Recognisable sounds • Music during care (selected according to the user’s preferred style and with sequencing, as advised by the family) <p>Olfactory</p>	<p>Orientation</p> <ul style="list-style-type: none"> • Person, time and space • Music <ul style="list-style-type: none"> ➢ Instrumental – Piano/orchestra ➢ The first two pieces are always the same; variations in themes and musicians are introduced in the following pieces, interspersed with pieces already used <p>Attention</p>	<ul style="list-style-type: none"> • Family visits (contributed to the user’s cognitive stimulation, particularly orientation and memory) • Materials and technologies for activities

<p>allows; establish a care routine Duration: 15 to 45 minutes (with breaks)</p>	<ul style="list-style-type: none"> • The person’s personal hygiene products • Familiar smells <p>Gustatory</p> <ul style="list-style-type: none"> • Oral Hygiene • Familiar flavours <p>Visual</p> <ul style="list-style-type: none"> • Approach via the right side of the body • Familiar objects and people • Painting and building with Lego <p>Tactile and Proprioceptive</p> <ul style="list-style-type: none"> • Cross-facilitation • Muscle and joint mobilisation • Massage • Functional respiratory rehabilitation • Objects with different textures and thermal sensations (slime, hot water bottle, etc.) • Orthostatic training <p>Vestibular</p> <ul style="list-style-type: none"> • Balance training • Orthostatic training • Gait training 	<ul style="list-style-type: none"> • Simple tasks/activities, progressing to greater complexity (self-care training) • Gradual introduction of distractions <p>Memory</p> <ul style="list-style-type: none"> • Reminiscence • Photographs and meaningful familiar objects • Multisensory stimulation with recognisable stimuli <p>Language</p> <ul style="list-style-type: none"> • Sound repetition • Naming • Sentence production (simple, everyday sentences) • Reading • Dialogue • Writing • Alternative communication (charts and images) <p>Executive Functions</p> <ul style="list-style-type: none"> • Self-care training (in sequence) • Matching games (Lego, cards) <p>Perception</p> <ul style="list-style-type: none"> • Multisensory stimulation • Functional motor and respiratory rehabilitation 	
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Table 2

Example of a daily session plan

Session Plan	
Activities	Duration
Musculo-articular mobilisation in bed (includes some cognitive training and multisensory stimulation with music and massage)	30 minutes
Break	
Self-care training (includes some cognitive training and multisensory stimulation – music, personal hygiene products)	15 minutes with progression
Balance and Orthostatic Training	15 minutes
Break	
Continued Multisensory and Cognitive Stimulation	30 minutes
Break	
Strength Training and Functional Respiratory Rehabilitation	30 minutes

RESULTS

The rehabilitation programme was drawn up at the start of Mrs M’s admission to the surgical ward and was adjusted in line with her progress. It was implemented by the rehabilitation team until the 30th day of her hospital stay. It should be noted, however, that sessions were not held every day due to the absence of the rehabilitation team during certain shifts. Throughout the rehabilitation

programme, there were clinical complications, namely nosocomial infections of the respiratory and urinary tracts, which led to a temporary functional setback, possibly affecting the gains previously achieved. The patient’s clinical progress during the RN programme was monitored using the instruments mentioned above, allowing for an objective analysis of neurological, cognitive and functional recovery, the results of which are summarised in Table 3.

Table 3

Comparative table of results obtained

Scale Used	Day 1 of admission	Day 7 of admission	Day 30 of admission
GCS	9-10 (O4V1M5)	11 (O4V1M6)	13 (O4V3M6)
NIHSS	28 – Severe • Motor, language and attention deficits	18 – Moderate to Severe • Improvement in motor and attention deficits	9 – Moderate • Improvement in motor, language and attention deficits
RAS	II – Generalised Response • Inconsistent and inappropriate reaction	III – Localised Response • Specific but inconsistent response (responsive to sounds and visual stimuli)	VI – Confused-Appropriate • Directed behaviour, dependent on external instruction
MFI	18 – Maximum Dependence • MFI Cognitive score 5	19 – Total Dependence • MFI Cognitive score 7	35 – Modified Dependence • MFI Cognitive score 13
Modifications to the Rehabilitation Plan	<ul style="list-style-type: none"> • Reduction of distractions and a calm environment • Shorter session times (30-minute sessions with breaks) • Focus on multisensory stimulation, guidance, focused attention, simple language and memory stimulation using family photographs 	<ul style="list-style-type: none"> • Introduction of occasional, simple distractions • Increase in session duration (45-minute sessions with breaks) • Focus on slightly increasing the complexity of activities, introducing sequencing and participation in isolated aspects of self-care, and training in sustained attention 	<ul style="list-style-type: none"> • Increase in the number and complexity of distractions • Increase in session duration and introduction of different activities • Training in self-care, sustained and focused attention, and reminiscence

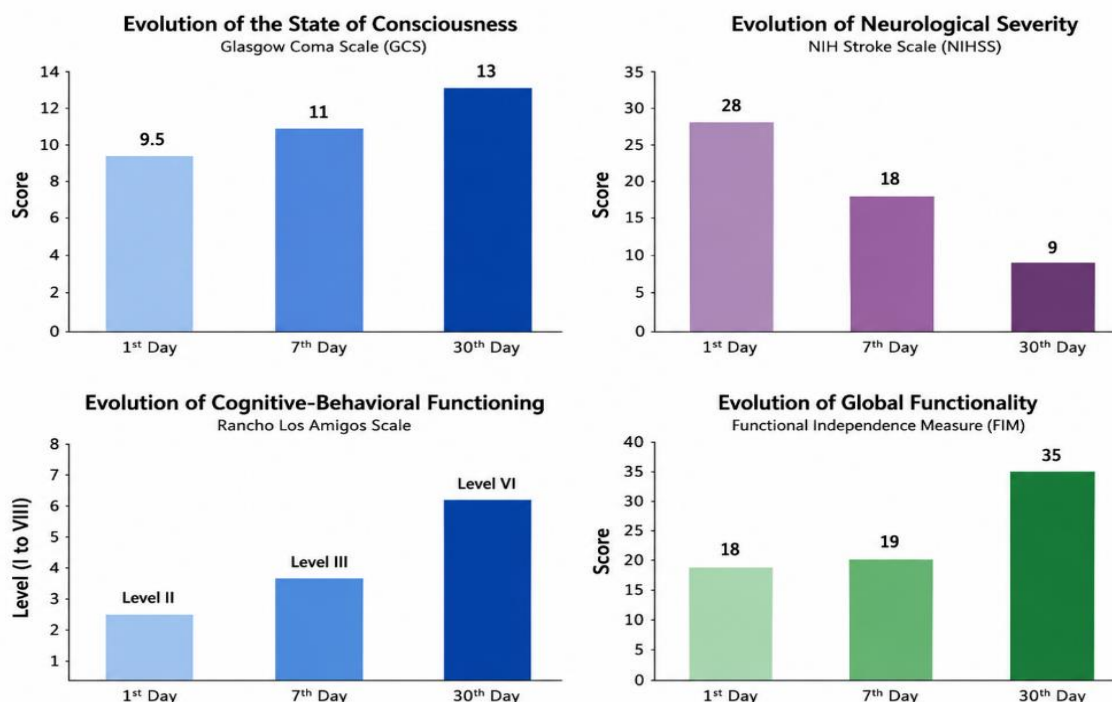


Figure 2

Results by assessment tool used

From the graphs (Figure 2) presented, a positive and gradual improvement in Mrs M's neurological condition can be observed. The contribution of comprehensive functional rehabilitation to the improvement of the patient's cognitive status is evident, with a focus on neurosensory and cognitive interventions.

With regard to the level of consciousness, the GCS was used, and a progressive improvement was observed throughout the follow-up period. On admission, the patient exhibited fluctuations in her level of consciousness, with a score between 9 and 10, progressing steadily to reach a score of 13 by the third day, reflecting a sustained improvement in alertness and responsiveness to the environment. From a state of constant drowsiness, the patient progressed to being able to verbalise their name, albeit dysarthric, and to name other people and objects, as well as attempting to communicate verbally whenever possible and when not too tired. Regarding the severity of the neurological deficit, as assessed by the NIHSS, a reduction in the total score was observed, falling from 28 on admission—consistent with a severe neurological deficit—to 18 on the 7th day and 9 on the 30th day, corresponding to a moderate neurological deficit. A gradual improvement was observed in motor, language and attention deficits, particularly in the visual neglect previously identified. With regard to motor deficits, the patient acquired sufficient psychomotor ability to mobilise the right side of the body at strength grade 3 and the left side at grade 4, though not consistently across all periods, due to fatigue and impaired cognitive function.

In the cognitive-behavioural domain, the RAS showed significant improvement over the course of

the intervention period. On admission, the patient was at level II, characterised by inconsistent, unfocused and inappropriate responses to stimulation. By day 7, she had progressed to level III, showing more specific, albeit inconsistent, responses, primarily guided by auditory and visual stimuli. By day 30, she had reached level VI, displaying more directed and functionally appropriate behaviour, although dependent on external instruction and structure, reflecting a significant improvement in attention, comprehension and the ability to perform simple tasks. Furthermore, Mrs M demonstrated the ability to read whenever requested, particularly reading short sentences and titles in a phased manner, word by word and gradually. These results inevitably had a positive influence on her ability to care for herself. Thus, regarding functionality, assessed using the MFI, a favourable progression was observed, albeit at a slow pace. She initially had a total score of 18, corresponding to maximum dependence, progressing to 19 by the 7th day and reaching 35 by the 30th day, indicating a transition to modified dependence. In particular, the cognitive component of the MIF showed progressive improvement, reflecting gains in attention, comprehension and participation in self-care activities, as would be expected.

Overall, Mrs M has managed to maintain a sense of connection with her surroundings and the people around her, particularly her family (who are very much present), however, she displayed high emotionality whenever she saw her family or when she appeared to be critical of her level of dependency and functional status, reacting with sadness, compulsive crying and demotivation

regarding this and possible progression, which at times compromised, albeit partially, her participation in the rehabilitation programme.

Taken together, these results suggest positive clinical, cognitive and functional progress over the 30-day intervention period, supporting the importance and potential contribution of RN interventions.

DISCUSSION

The data obtained in this case report suggest that early NR intervention, focusing on neurosensory and cognitive stimulation, may contribute to the functional and cognitive recovery of patients with severe thalamic haemorrhagic stroke. Although the literature describes poor prognoses for thalamic haemorrhages, particularly when associated with complications such as hydrocephalus or the need for EVD (Menon et al., 2019), the clinical course observed in this case contrasts with expectations, potentially suggesting a positive effect of structured and individualised interventions.

In the initial assessment, the GCS indicated a score of 10, indicating moderate impairment of consciousness, consistent with previous studies that associate low initial scores (11.56 ± 3.26) with a higher risk of mortality and a lower probability of functional recovery (Menon et al., 2019). On the other hand, some authors report that the group considered to have a good prognosis presents a level of consciousness, according to the GCS, of 13.79 ± 1.67 , a value that approximates the patient's score after 14 days of rehabilitation, which was 12 points (Lee et al., 2015).

With regard to associated complications, such as hydrocephalus and the placement of an EVD, the literature identifies hydrocephalus as a negative prognostic factor (Menon et al., 2019). Although intraventricular haemorrhage is not traditionally considered a factor associated with mortality, some authors have identified associations between intraventricular haemorrhage, hydrocephalus and the need for EVD, suggesting a poorer prognosis and an unfavourable clinical course (Lee et al., 2015).

On the first day of assessment, the high NIHSS score (28 points) reflected severe neurological deficit, predominantly in the motor, language and attention domains. The RAS classification at level II, characterised by generalised responses and inconsistent and inappropriate reactions to stimuli, corroborated the impairment of consciousness. The MFI, with a total score of 18 and a cognitive component of 5 points, indicated maximum dependency, both motor and cognitive. These initial results are consistent with the literature describing severe haemorrhagic stroke as a clinically severe event, frequently associated with low levels of consciousness and marked functional loss in the early stages (Lee et al., 2015).

Mrs M's clinical progress showed gradual improvement over the first two weeks. A gradual increase in the GCS score (from 10 to 12 points), a significant reduction in the NIHSS score (from 28 to 12 points) and progression in the RAS (from level II to level V) were observed, indicating a transition from reflex responses to goal-directed behaviours under external instruction. In functional terms, there was an increase in the total MFI score (from 18 to 32 points), with a parallel improvement in the cognitive component (from 5 to 13 points). In just

14 days, the RN programme may be associated with improvements in motor, language and attention deficits, as well as directed cognitive and behavioural progress. This progress contrasts in part with the outcomes reported by Menon et al. (2019), where only 50% of participants showed improvement after three months, suggesting that the early therapeutic approach, centred on structured multimodal sensory stimulation, may have contributed to the observed recovery (Lee et al., 2015; Reddin et al., 2021).

A key factor in this case was the implementation of a structured neurosensory stimulation programme, integrating auditory, visual, tactile, proprioceptive, vestibular, olfactory and gustatory stimuli, combined with environmental regulation and active family involvement. Jeffay et al. (2023) confirm that the use of music during hygiene care promotes improvements in executive function and behavioural engagement, suggesting that organised, predictable environments with familiar stimuli help regulate alertness and attention, facilitating the transition between levels of functional consciousness.

Another key factor relates to family involvement throughout the therapeutic process. Although prognostic studies of thalamic haemorrhage focus predominantly on acute clinical variables, the rehabilitation literature recognises family support as a facilitator of continuous stimulation and adherence to interventions, contributing to better functional outcomes (Lima, 2024; Jeffay et al., 2023). In this regard, efforts were made to encourage family visits, initially with a key and significant figure (daughter and/or husband); subsequently, a visit from the grandchildren was

suggested, as they held great significance for Mrs M. This event took place once during these 30 days, following a substantial improvement in the patient's general condition. Although it was a deeply emotional and psychologically challenging day for her, both the family and Mrs M expressed satisfaction (through cooperative behaviour and a cheerful mood) in the days following the event. As for the family's involvement, it was through dialogue with them that the team was able to identify Mrs M's preferences regarding music, literature, objects and images, hygiene products, and pleasant smells and tastes (particularly in the early stages, when neurological deficits are at a high level of severity), in order to tailor the stimuli selected for the rehabilitation sessions. It was therefore through her family that we were able to gain a deeper understanding of Mrs M – of who she was before the neurological event, helping her to reclaim her identity – and of how this might influence the recovery process.

Recent studies highlight the effectiveness of multimodal interventions in improving overall cognitive functioning following a stroke. O'Donoghue et al. (2022), through a meta-analysis, demonstrated that interventions with multiple components improve overall cognition, including memory, as well as functional benefits and balance, when compared with standard care. Thus, the progressive improvement in the cognitive component of MFI and the changes in RAS levels observed in this case precisely reflect the domains highlighted by some authors, namely attention, behavioural organisation, working memory and active participation (Jeffay et al., 2023; O'Donoghue et al., 2022).

The present study demonstrated early neurological and functional recovery, exceeding expectations. Although the deep location of the lesion imposes significant limitations, the implementation of structured multimodal rehabilitation strategies appears to act as a prognostic modifier, promoting the reorganisation and formation of new neural connections, that is, neuroplasticity (Lima, 2024).

Stimulating neuroplasticity requires an integrated approach, involving physical activity, cognitive challenges and emotional support, thereby promoting functional recovery and quality of life following a stroke (Laste et al., 2024). Sensory and cognitive stimulation enhances the activation and reorganisation of neural circuits, contributing to positive outcomes during the RN programme (Lima, 2024; Mulhern, 2023). Mrs M's cognitive improvement can be explained by the reinforcement of adaptive plastic processes through repeated sensory stimuli and cognitively challenging activities, such as manipulating Lego bricks or colouring pictures, promoting progression in RAS and an increase in cognitive MIF.

In summary, the positive progress observed in this case appears to be associated with early multimodal sensory stimulation, environmental regulation and family involvement, highlighting the importance of integrating these strategies into care protocols for people with severe haemorrhagic stroke.

Despite the observed results, it is important to acknowledge some limitations inherent to this study. As this is a case report, it is not possible to establish causal relationships between the intervention and the observed gains. Furthermore, the clinical progress may have been influenced by other factors, notably the natural recovery from the

condition and the intervention of other healthcare professionals. The use of assessment tools, even if validated, may not fully capture all aspects of functional and cognitive recovery.

CONCLUSION

This case report demonstrates positive clinical, cognitive and functional progress in a patient with severe haemorrhagic thalamic stroke, initially associated with a poor prognosis. Over 30 days of intervention, comprising 16 sessions, a progressive improvement in the level of consciousness, a reduction in the severity of neurological deficits, favourable progress in cognitive functioning and an increase in overall functionality were observed, as assessed using validated instruments widely used in clinical practice.

The integration of neurosensory and cognitive stimulation into meaningful functional activities is clinically feasible and suggests potential benefits for the recovery of level of consciousness, attention and participation in self-care. The regulation of the therapeutic environment, the phased progression of stimuli and systematic monitoring using validated instruments are essential elements for the effectiveness of the intervention.

Family involvement also plays a facilitating role in the rehabilitation process, contributing to the creation of meaningful stimuli and the continuity of care. One of the limitations of this case report relates to the inherent constraints of the assessment scales used, which do not fully capture the functional gains and acquired abilities observed, nor their effective transfer to Mrs M's daily life. On the other hand, although it is not possible to

establish a direct causal link between the intervention and the observed improvements, given the nature of the study, the clinical course reported contrasts with the prognosis generally described for deep thalamic haemorrhage, suggesting that structured neurosensory and cognitive rehabilitation approaches may act as a modifier of functional recovery in complex neurological contexts.

Implications for practice

This case report reinforces the importance of early ER intervention in patients with acute and subacute thalamic haemorrhagic stroke, even in contexts associated with a poor prognosis. The role of the EEER proves central to the overall assessment of functionality, the identification of cognitive and sensory deficits, and the implementation of individualised rehabilitation programmes.

This study highlights the need for future research, particularly longitudinal studies, case series or experimental studies, to further explore the potential contribution of these interventions and to contribute to the development of protocols based on more robust scientific evidence.

CONFLICTS OF INTEREST

No conflicts of interest were identified.

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