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Early mobilization post-stroke: care flowchart

Mobilização precoce pós-AVC: fluxograma assistencial

Movilización temprana tras un ictus: flujograma asistencial

ABSTRACT

Objective: To develop a flowchart for early mobilization of stroke patients in a referral hospital. **Method:** A methodological study based on health literacy, using action research principles for prototype development and evaluation through the Think Aloud method with five physiotherapists. It was improved in terms of usability and accessibility, incorporating the Intensive Care Unit Mobility Score (IMS) for standardization. The interviews were analyzed, and the prototype adjusted according to suggestions. The study was conducted in the Stroke Unit (SU) of the *Hospital Regional do Sertão Central* (HRSC), with Ethics Committee approval. **Results:** The final flowchart included criteria for ischemic and hemorrhagic stroke, considering hemodynamic, respiratory, and neurological parameters. The IMS was used to classify mobility, facilitating communication among professionals. Safety criteria, risk stratification, and layout improvements were incorporated. **Final considerations:** The flowchart standardizes early mobilization and strengthens patient safety, based on the team's experience and the best available evidence.

Keywords: Stroke; Early Mobilization; Rehabilitation; Action Research.

RESUMO

Objetivo: Desenvolver um fluxograma para mobilização precoce de pacientes com AVC em hospital referência. **Método:** Estudo metodológico baseado no letramento em saúde, com preceitos da pesquisa-ação para construção de protótipo e avaliação pelo método *Think Aloud* com cinco fisioterapeutas. Aprimorado quanto à usabilidade e acessibilidade, incorporando a *Intensive Care Unit Mobility Score* (IMS) para padronização. As entrevistas foram analisadas e o protótipo ajustado conforme sugestões. Pesquisa realizada na Unidade de AVC (UAVC) do Hospital

Regional do Sertão Central (HRSC), com aprovação do Comitê de Ética. **Resultados:** O fluxograma final contemplou critérios para AVC isquêmico e hemorrágico, incluindo parâmetros hemodinâmicos, respiratórios e neurológicos. Utilizou-se a IMS para classificação da mobilidade, facilitando a comunicação entre profissionais. Foram incorporados critérios de segurança, estratificação de risco e melhorias de *layout*. **Considerações finais:** O fluxograma padroniza a mobilização precoce e fortalece a segurança assistencial, baseado na experiência da equipe e nas melhores evidências disponíveis.

Palavras-chave: *Acidente Vascular Cerebral; Mobilização Precoce; Reabilitação; Pesquisa-Ação.*

RESUMEN

Objetivo: Desarrollar un diagrama de flujo para la movilización precoz de pacientes con ACV en un hospital de referencia. **Método:** Estudio metodológico basado en la alfabetización en salud, con principios de investigación-acción para la construcción de un prototipo y evaluación mediante el método *Think Aloud* con cinco fisioterapeutas. El diagrama fue mejorado en cuanto a usabilidad y accesibilidad, incorporando la *Intensive Care Unit Mobility Score* (IMS) para la estandarización. Las entrevistas fueron analizadas y el prototipo ajustado según las sugerencias. El estudio se realizó en la Unidad de ACV (UACV) del Hospital Regional do Sertão Central (HRSC), con aprobación del Comité de Ética. **Resultados:** El diagrama final incluyó criterios para ACV isquémico y hemorrágico, considerando parámetros hemodinámicos, respiratorios y neurológicos. La IMS se utilizó para clasificar la movilidad, facilitando la comunicación entre profesionales. Se incorporaron criterios de seguridad, estratificación de riesgo y mejoras en el diseño. **Consideraciones finales:** El diagrama estandariza la movilización precoz y fortalece la seguridad asistencial, basado en la experiencia del equipo y en la mejor evidencia disponible.

Descriptores: *Accidente Cerebrovascular; Movilización Precoz; Rehabilitación; Investigación-Acción.*

INTRODUCTION

A stroke is defined as a group of cerebrovascular diseases of sudden onset characterized by focal or global neurological deficits, caused by interruption of cerebral blood flow due to infarction (ischemic stroke) or spontaneous hemorrhage (hemorrhagic stroke)^{1,2}. It is considered the second leading cause of death and disability worldwide^{3,4}. Functional capacity is not defined exclusively by diagnosis. People with the same health condition may present different levels of functionality, just as individuals with different diagnoses may present similar levels of functionality and participation⁵.

Thus, functionality encompasses the positive aspects of the interaction between the individual, their health, and contextual factors, while disability highlights limitations and impairments. Specific early rehabilitation programs for stroke should prioritize increasing functional capacity, valuing the potential of individuals and promoting their social integration from a broader perspective of care.⁷

In this context, it becomes essential to initiate Early Mobilization (EM) as soon as possible, respecting the clinical condition of each person being treated. Although the literature presents divergences regarding the ideal time for its initiation, most studies indicate that, after 24 hours of the event, EM can be considered safe and contribute to functional recovery, reducing the deleterious effects of immobility^{8,9}.

Decree nº 665 of April 12, 2012 establishes the criteria for the qualification of hospital establishments as Emergency Care Centers for stroke patients, providing – among other requirements – the availability of written clinical and care protocols, as well as the daily availability of a physical therapist¹⁰. Given the demands identified by the service professionals and the experience gained from the multidisciplinary residency program in high-complexity Neurology and Neurosurgery at the Stroke Unit (SU), the need to systematize an EM protocol that considered care pathways and the specific characteristics of this patient population became evident. Therefore, the objective of this study was to develop a clinical care flowchart for the early mobilization of post-stroke patients in a referral hospital in the State of Ceará.

METHODS

This is a methodological study of a mixed nature, conducted under the precepts of the action-research method and structured in three stages. In the first stage, the exploratory phase, a bibliographic survey was carried out and a flowchart was qualified using the principles and tools of health literacy. In the second stage, the prototype was evaluated using the Think Aloud verbal protocol method. Finally, in the third stage, the flowchart was refined based on the analysis of the interviews obtained during Think Aloud, culminating in the presentation of the flowchart for EM in acute stroke. The participants of the study were physiotherapists, whose expertise contributed to the adaptation and validation of the material.

The collected information supported the improvement of the flowchart design, aiming to make it more intuitive and suitable for clinical use. In the Think Aloud method, characterized as a usage simulation, participants interacted with the flowchart based on clinical scenarios and verbalized their perceptions, identifying facilitating aspects and possible difficulties related to graphic interpretation.

The research was conducted at the Stroke Unit (SU) of HRSC, a tertiary hospital located in Quixeramobim, Ceará, Brazil. Five physiotherapists participated, including the unit coordinator, a number that allowed for theoretical saturation in the qualitative component of the study. The participants' average length of service was four years in the general hospital and two in the SU. Three physiotherapists had at least two years of experience in the unit, and two had been working there since the hospital's opening in 2011. Regarding educational and professional experience, two physiotherapists reported experience in protocol development, four had postgraduate degrees in neurology, intensive care, or health management, and one was specializing in neurology.

The flowchart for the management of acute stroke is being improved in this research⁸ based on Health Literacy, known as the ability to understand and use health-related information to support care and decision-making in clinical practice, while ensuring an accessible design for healthcare professionals and patients¹¹. Legible fonts, optimized spacing, effective contrast, and short sentences were adopted, with a simple background and color highlighting for relevant information. Formatting the document in Google Docs, an accessible tool within the online office suite, contributed to the organization and accessibility of the flowchart.

Intensive Care Unit Mobility Score (*IMS*) scale was chosen, which classifies the mobility level of critically ill patients from 0 to 10 — where 0 represents no mobility and 10 represents independent ambulation. This scale was chosen because of its widespread adoption by the institution's professionals, facilitating communication and integration among the team¹².

The flowchart draft was presented to the study participants, and their suggestions and considerations regarding the use and applicability of the instrument were collected using the Think Aloud method¹³, which allowed for a detailed analysis of the participants' inferences (validation stage). These considerations were recorded in audio format, and each participant was presented with three test tasks to assess the applicability of the tool in different clinical situations.

Using the Think Aloud method, spontaneous verbalizations from participants during the performance of a task were utilized, allowing access to aspects related to their cognitive processes. The analysis of these verbalizations involves detailed transcription, categorization, and qualitative interpretation of the collected information to identify patterns and strategies in the participants' thinking.¹³

The interviews were transcribed using Microsoft software and analyzed by content, dividing it into four topics based on the structured Think Aloud script: procedure for patients with hemorrhagic stroke (*ICTUS* < 48h); procedure for patients with ischemic stroke and safety criteria for early mobilization; use of thrombolytics and mobilization decision; suggestions for improvement in the flowchart and usability. This study complies with Resolution 466/12 and was submitted to the Research Ethics Committee of institution¹⁴, obtaining a favorable opinion under protocol number 6.898.669.

RESULTS

The following results were analyzed in four topics using the Think Aloud method: a) procedures for hemorrhagic stroke (*ICTUS* < 48h), b) ischemic stroke and safety criteria, c) use of thrombolytics, d) suggestions to improve usability in the early mobilization decision-making process.

Procedure for patients with hemorrhagic stroke with *ICTUS* < 48h

The first test task presented the case of a patient with hemorrhagic stroke whose symptom onset time was less than 48 hours, hemodynamically stable, conscious, oriented, cooperative, breathing normally in room air, and exhibiting active mobility in bed, without strength deficits.

In the analysis of the test task, Participants 01 and 04 demonstrated difficulty in interpreting the flow due to the configuration of the *ICTUS* time criteria. The inversion of the comparative sign (</>) is highlighted as a barrier to intuitive reading, hindering navigation between steps. Even so, both agree with the protocol, emphasizing that, in cases of hemorrhagic stroke with *ICTUS* less than 48 hours, mobilization should be avoided, even in patients with good clinical condition.

Just invert it here. I always prefer to approach it from a “less than” perspective, for example: 'Is it less than 48 hours? Yes. Restricted. Patient older than 48 hours? No. Standard assessment (Participant 01, 2024).

The flowchart should include a specific step to identify whether the stroke is more or less than 48 hours old, with a clear question such as "Stroke > 48h: yes or no?". In this case, the patient has less than 48 hours of stroke time, so a referral for this condition would be necessary. If it were greater than 48 hours, there would be a different course of action. As the stroke time is less than 48 hours, it falls within the standard assessment, and this first step of the flowchart seems adequate for the situation (Participant 04, 2024).

Participant 02, while supporting the flowchart strategy, emphasizes the importance of a humanized and flexible approach, allowing for greater independence in basic hygiene activities, provided that the patient's clinical stability and emotional well-being are respected.

[...] he's asking here 'more than 48 hours since the ICTUS?' No. 'Standard assessment and rest', yes, absolutely.[...] We also need to consider the human side, which is very important in this matter, it's not just about following a protocol, but considering that we are treating people, sometimes the patient can't even urinate in bed, so we'll talk to the doctor to see if it's possible for them to at least sit up, of course it's not an intense activity, it's an activity that requires minimal effort, this is to improve the patient's comfort, because sometimes they really struggle with that (Participant 02, 2024).

Participants 03 and 05 expressed caution regarding early mobilization of patients with ICTUS stroke less than 48 hours, highlighting the need for rest due to the risk of worsening, regardless of clinical stability.

[...]this one is under 48 hours, so I'm not going to mobilize him, even though he seems fine to do so. His blood pressure is okay, he's responding to commands and showing active mobility in bed, but due to the ICTUS, we're not going to mobilize him[...] (Participant 03, 2024).

The patient with stroke is stable and meets safety criteria, so he is evaluated. However, since the stroke occurred less than 48 hours ago, he should remain at rest. This approach is definitely covered (Participant 05, 2024).

Procedure for patients with ischemic stroke and safety criteria for mobilization

The command was directed to identify the flow for patients with ischemic stroke, *ICTUS* greater than 24h, Systolic Blood Pressure (SBP) of 180 mmHg, preserved strength, and IMS-8. The responses to these situations can be seen in the following summary.

Participant 01 suggests replacing the terms, as the first one could be confused with other types of assessment, such as functional gait assessment:

I think it would be a good idea to remove this term 'standard assessment,' because we understand assessment

as something broader, like a gait assessment, you know? Maybe it would be better to use 'bed-restricted assessment.' We could even remove the 'bed rest' part and just leave 'bed-restricted assessment. ' (Participant 01, 2024).

All participants agreed that the patient should remain at rest until it is possible to start pacemaker therapy, with emphasis on restriction during the first 24 hours. However, some considerations emerged regarding the safe blood pressure limit, as can be seen in the following excerpt:

In the case of systolic pressure, which is at 180 mmHg, the protocol establishes a range of 110 to 220 mmHg, which places the patient within safety parameters. [...] Although the pressure is higher than expected, we use a systolic pressure of 160 as a safety standard. [...] It is important to consider that the pressure may need to be slightly higher in the first 72 hours after ICTUS. Therefore, even with a slightly higher pressure, it still falls within the safe parameters for a patient with ICTUS more than 24 hours ago and preserved strength (Participant 02, 2024).

Use of thrombolytics and the decision to mobilize

The flowchart identified the sequence of events for ischemic stroke patients within the therapeutic window who received thrombolytic therapy more than 24 hours prior. All interviewees agreed with the 24-hour restriction after thrombolytic administration, but some observations emerged regarding safety criteria and the presentation of the identification box labeled 'thrombolysis'. Participant 01, while quickly identifying the flowchart for thrombolized patients, suggested including a specific 'thrombolysis' box, followed by a follow-up Computed Tomography (CT) scan after 24 hours. He also emphasized the need to await medical clearance before starting the evaluation, proposing adjustments to the flowchart to include a follow-up CT scan without evidence of significant hemorrhagic transformation as a safety criterion.

Okay, but what are you going to do? You'll need to create another section for thrombolysis because, in the case of thrombolized patients, I need to wait for the follow-up CT scan. So, it would be thrombolysis, 24-hour restriction, and then the follow-up CT scan. After the CT scan, if everything is okay, medical clearance, then you can do the normal evaluation (Participant 01, 2024).

Participant 02 warned about the safety criteria, specifically regarding temperature, suggesting that the temperature limit of 38.5 °C in the flowchart be adjusted to 37.5 °C.

We consider the temperature to be slightly lower than the 38.5 °C mentioned in the protocol; we consider 37.5 °C, so it may even change, especially since when it reaches 37.5 °C, the nursing already administers antipyretics to control it (Participant 02, 2024).

Next, we check if the patient was thrombolized more than 24 hours ago, and the answer would be 'yes'. Then, it is necessary to check if they meet the safety criteria, with a 'yes' or 'no' option. I think it would be interesting to add an arrow to guide this flow (Participant 04, 2024).

Suggestions for improving the flowchart for early mobilization

Participants recommended adjustments to the mobilization safety criteria, such as target oxygen saturation considering patients with Chronic Obstructive Pulmonary Disease (COPD), level of consciousness using the Glasgow Coma Scale, temperature, use of a color scale for risk stratification, and better organization of the criteria "box" to avoid biases.

Participant 01 highlighted the usefulness of a color-coded signaling system for communicating the level of patient mobilization, which was previously used but is now discontinued.

In the past, we used signs for patient mobilization with a color-coded system. The physiotherapist would assess the patient and then identify their mobility level using a color scale, avoiding the need to constantly ask whether the patient could move or not (Participant 01, 2024).

The only thing that would be improved would be the organization of the "yes or no" questions, as we mentioned before, to make the process more intuitive and straightforward. Other than that, it's good, well done. The safety criteria are okay. I would only add Glasgow and change the color to something more eye-catching (Participant 04, 2024).

The flowchart (Figure 1) was revised based on the Think Aloud verbal protocol method, which enabled the identification and refinement of steps through the participants' verbalization of their thoughts regarding the previously defined stages and during the analysis of the flowchart (test task). This approach

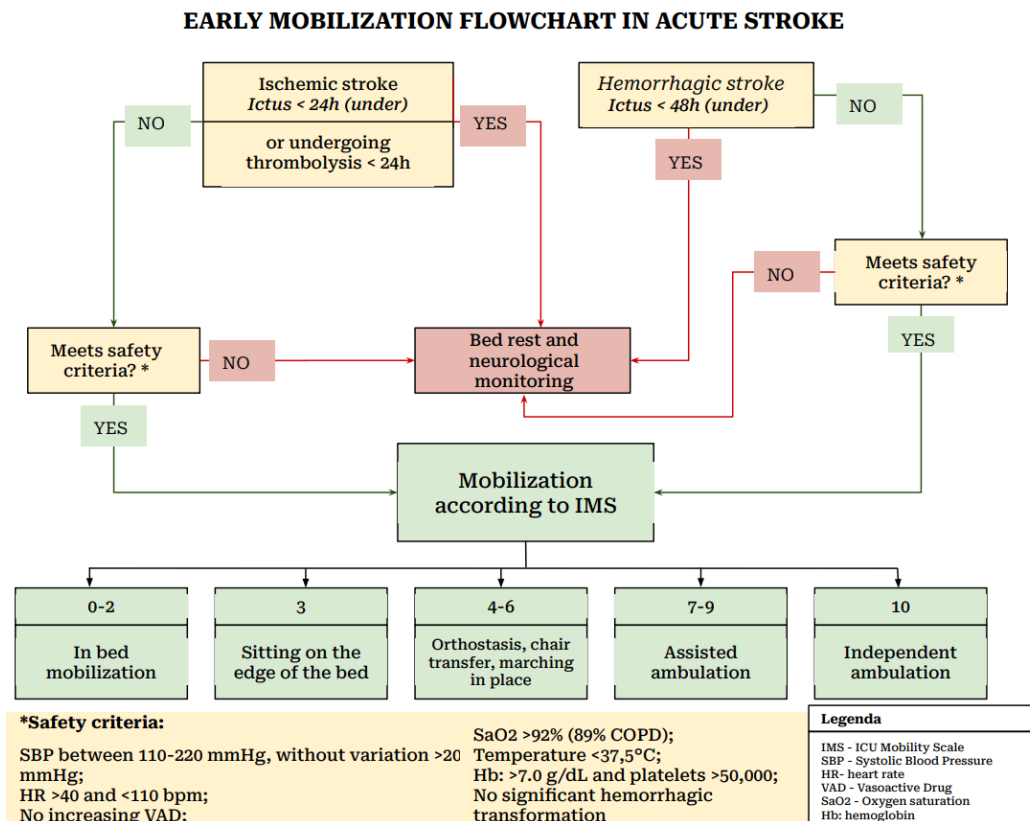
provided a more detailed evaluation of the process, contributing to improved clarity and practical applicability.

The contribution of physiotherapists in action research for the construction of a flowchart in acute stroke using the Think Aloud method

In summary, there was a consensus that patients with hemorrhagic stroke (HS) with a traumatic brain injury (TBI) of less than 48 hours should remain in bed rest, and motor assistance should be avoided, even in cases of clinical and hemodynamic stability, in order to prevent worsening of the condition. The initial 24-hour period after the *TBI* stands out as crucial for rest in ischemic events with or without thrombolysis, reinforcing the need for neurological monitoring during this interval.

However, discrepancies were identified regarding the safety parameters defined in the flowchart and standard clinical practice, especially concerning the established pressure limit, temperature, and control CT for thrombolized patients. Suggestions included replacing the term "standard assessment" with a more specific nomenclature to avoid ambiguities, and inverting the signs 'greater than (>) and less than (<)' to facilitate the distinction of *ICTUS time*. Additionally, the contributions of the IMS scale were discussed, and the flowchart was adjusted based on the suggestions, incorporating references to strengthen its clinical applicability.

During testing, it was observed that participants had difficulty reading the figure due to the size and font of the lettering. Following recommendations on educational materials in health and health literacy, a serif font was chosen, with a size of seven (7) for the text boxes and eleven (11) for the title boxes ¹⁰. The color scheme was defined according to the participants' suggestions: green for patients with permitted mobilization, red for those with restrictions, and neutral colors for clinical decisions. The final product is shown in Figure 1.

Figure 1 – Flowchart of Early Mobilization in acute stroke qualified by physiotherapists, in 2024.

Source: Authors.

DISCUSSION

One of the main challenges of functional rehabilitation is defining the ideal time to initiate recovery and repair strategies. For this, it is essential to establish a timeline of stroke recovery, considering the following steps: hyperacute, within the first 24 hours; acute, from 1 to 7 days; early subacute, from 7 days to 3 months; late subacute, from 3 to 6 months; and, from 6 months onwards, the chronic phase¹⁵.

Endogenous plasticity processes begin in the acute phase and progress through the first six months, the period of greatest motor recovery. This time is crucial for defining treatment and optimizing interventions. The duration of recovery varies between neural systems: arm movement can take weeks to months, while language can take years. Many stroke survivors experience spontaneous recovery at typical stages; however, a significant group deviates from this pattern¹⁵.

Early mobilization in acute and hyperacute stroke.

The safe management of neurocritical patients requires an understanding of the physiological and pathological hemodynamic processes associated with each clinical condition. The nourishment of brain tissue depends on blood supply, which is related to Cerebral Perfusion Pressure (CPP), defined as the difference

between Mean Arterial Pressure (MAP) and Intracranial Pressure (ICP). Reduced CPP decreases Cerebral Blood Flow (CBF) and compromises cerebral autoregulation, potentially resulting in cerebral edema and infarctions¹⁶.

In stroke, EM (bedside sitting, standing, and ambulation) is essential in hospital rehabilitation¹⁷. However, in neurocritical patients, brain injury may impair autoregulation and increase intracranial pressure (ICP). Since perfusion of the penumbra depends on collateral circulation, Very Early Mobilization (VEM), that is, during the hyperacute phase, may alter Cerebral Blood Flow (CBF), increase the risk of ischemia, and worsen the infarction and its complications¹⁸.

A recent study investigated the outcomes of VEM compared to usual care. The technique resulted in higher mortality rates (8.5%) compared to the usual care group (7%). Despite a reduction in length of hospital stay in the VEM group, these conclusions were based on less evidence. Therefore, considering the risks reported in the largest clinical trial analyzed (n=2,104), initiating mobilization before 24 hours of the event may increase the risk of the infarction and its complications¹⁹.

The guidelines of the Brazilian Academy of Neurology recommend initiating rehabilitation as soon as the sequelae of a stroke are identified, since there are no contraindications, such as early deterioration, immediate postoperative period, serious medical illness, coronary instability, blood pressure above 220/110 mmHg or a variation greater than 30 mmHg upon changing position, oxygen saturation <93% on support, heart rate <40 or >110 bpm, and temperature >38.5 °C. The guideline also reinforces that mobilization should begin at least 24 hours after the ischemic²⁰.

The Clinical Protocol and Therapeutic Guidelines for ischemic stroke recommend treating axillary temperature equal to or greater than 37.5 °C, a criterion adjusted in the institution's Stroke Unit to promote early and effective interventions in thermoregulation, aligning with the needs of real-time management without compromising the safety and effectiveness of early rehabilitation¹.

The Stroke Care Routine Manual recommends the immediate discontinuation of recombinant tissue-type plasminogen activator (rtPA) in cases of suspected intracranial hemorrhage in patients undergoing thrombolysis. Urgent cranial CT scan and laboratory tests, such as complete blood count, Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), platelets count, and fibrinogen levels, are recommended for appropriate management²¹. The First Brazilian Consensus on the treatment of the acute phase of stroke recommends a follow-up CT scan between 24 and 48 hours if the initial examination is normal or if there is unsatisfactory clinical progression, aiming to determine the nature of the event, assess the lesion, rule out differential diagnoses, and identify complications²².

The literature is divided on the ideal timing for mobilization after thrombolysis. While some services recommend absolute rest for 24 to 48 hours

to reduce the risk of intracerebral hemorrhage, a Japanese study compared very early mobilization (on the day of admission or the following day) with late mobilization (from the third day onwards). There was no difference in mortality or cerebral hemorrhage; however, the group mobilized early showed better functional outcomes. However, the study does not precisely specify the time between admission, rtPA administration, and the start of rehabilitation, allowing for a variation of up to 48 hours in the start of mobilization²³.

American Heart Association guidelines recommend initiating rehabilitation as early as possible, without defining time, intensity, or type of activity²⁴. A Chinese study compared patients mobilized within 48 hours with those mobilized from the seventh day onwards, observing greater survival up to six months in the early motor rehabilitation group. However, the study did not evaluate predictors of mortality in intracerebral hemorrhage, which may have favored this group²⁵.

FINAL CONSIDERATIONS

The flowchart developed through action research constituted a tool for organizing and standardizing physiotherapy practice, with the purpose of contributing to the improvement of performance in the SU. The study showed that team engagement strategies are essential for the safe implementation of early mobilization techniques, considering the complexity and multidisciplinary nature of care for patients with acute stroke. The participation of the physiotherapy team in the development of the prototype was crucial for its applicability and adoption in the hospital setting.

As a follow-up, the flowchart is expected to be made available in the SU, along with standard operating procedures, subject to approval by the hospital's quality control team, aiming to ensure quick access to guidelines and reinforce the uniformity and quality of interventions, aligned with the best scientific evidence.

Further studies are recommended to monitor the implementation of the flowchart and evaluate its effects over time, through a historical series of its practice in the service.

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