

Brazilian Academy of Neurology practice guidelines for stroke rehabilitation: part I

Diretrizes da Academia Brasileira de Neurologia para reabilitação do acidente vascular cerebral: parte I

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ABSTRACT

The Guidelines for Stroke Rehabilitation are the result of a joint effort by the Scientific Department of Neurological Rehabilitation of the Brazilian Academy of Neurology aiming to guide professionals involved in the rehabilitation process to reduce functional disability and increase individual autonomy. Members of the group participated in web discussion forums with predefined themes, followed by videoconference meetings in which issues were discussed, leading to a consensus. These guidelines, divided into two parts, focus on the implications of recent clinical trials, systematic reviews, and meta-analyses in stroke rehabilitation literature. The main objective was to guide physicians, physiotherapists, speech therapists, occupational therapists, nurses, nutritionists, and other professionals involved in post-stroke care. Recommendations and levels of evidence were adapted according to the currently available literature. Part I discusses topics on rehabilitation in the acute phase, as well as prevention and management of frequent conditions and comorbidities after stroke.

Keywords: Stroke; Guideline; Neurological Rehabilitation; Practice Guidelines as Topic.

RESUMO

As Diretrizes Brasileiras para Reabilitação do AVC são fruto de um esforço conjunto do Departamento Científico de Reabilitação Neurológica da Academia Brasileira de Neurologia com o objetivo de orientar os profissionais envolvidos no processo de reabilitação para a redução da incapacidade funcional e aumento da autonomia dos indivíduos. Membros do grupo acima participaram de fóruns de discussão na web com pré-temas, seguidos de reuniões por videoconferência em que as controvérsias foram discutidas, levando a um consenso. Essas diretrizes, divididas em duas partes, focam as implicações de recentes ensaios clínicos, revisões sistemáticas e metanálises sobre reabilitação do AVC. O objetivo principal é servir de orientação a médicos, fisioterapeutas, fonoaudiólogos, terapeutas ocupacionais, enfermeiros, nutricionistas e demais profissionais envolvidos no cuidado pós-AVC. As recomendações e níveis de evidência foram adaptados de acordo com a literatura disponível atualmente. Aqui é apresentada a Parte I sobre tópicos de reabilitação na fase aguda, prevenção e tratamento de doenças e comorbidades frequentes após o AVC.

Palavras-chave: Acidente Vascular Cerebral; Guia; Reabilitação Neurológica; Guias de Prática Clínica como Assunto.

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





























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INTRODUCTION

Stroke is the second leading cause of death and disability worldwide^{1,2}. It is estimated that in 2016, there were almost 260,000 stroke cases, approximately 107,000 deaths, and more than 2.2 million adjusted life years lost due to disability following a stroke in Brazil^{3,4}. Worldwide, stroke is the most prevalent neurological disease that needs rehabilitation, with 86 million disabled individuals⁵. More than two-thirds of individuals after stroke receive rehabilitation services after hospitalization⁶. Despite the development and support of stroke centers and national societies in Brazil to raise awareness of stroke symptoms, only a minority of stroke patients in the acute phase receive thrombolytic therapy or thrombectomy. Consequently, many stroke survivors have residual functional deficits. Stroke rehabilitation differs in many regions in Brazil according to socio-economic conditions. In large urban centers

stroke patients are referred to a rehabilitation center by the time of discharge; however, in most parts of the country stroke survivors have few opportunities to initiate or continue rehabilitation after the acute phase. This data is lacking in Brazil and has been evaluated by the Access to Rehabilitation Study across 17 public health centers in Brazilian cities in the North, Northeast, West, Southeast and South of Brazil⁷. Therefore, the need for effective rehabilitation of stroke patients remains an essential part of the continuum of stroke treatment.

Considering this premise, the Scientific Department of Neurological Rehabilitation of the Brazilian Academy of Neurology made efforts to draft the first Brazilian Guidelines for Stroke Rehabilitation to guide professionals involved in the rehabilitation process to reduce functional disability and increase the autonomy of individuals. The members of the group participated in discussion forums on the web with pre-defined themes, followed by videoconference meetings in which

controversies were discussed, leading to a consensus. For the preparation of the Brazilian Guidelines for Stroke Rehabilitation, several national co-authors, with prior knowledge in their areas of expertise, were asked to write the suggested topics following criteria defined by the coordinators of these guidelines. The original texts were adapted to follow a format in which, after the general information, the Recommendations for each intervention were added.

The present work focuses on recent clinical trials, meta-analyses, and systematic reviews in stroke rehabilitation literature. The main objective of this paper is to guide physicians, physiotherapists, speech therapists, occupational therapists, nurses, nutritionists, and other professionals involved in post-stroke care. Recommendations and levels of evidence have been adapted according to currently available literature.

We have sought to provide visibility to broader rehabilitation aspects based on the intervention concepts proposed in the International Classification of Functioning, Disability, and Health⁸. The rehabilitation strategies included in this guideline cover the different stroke phases: hyper-acute (0-24 hours), acute (1-7 days), early subacute (7 days-3 months), late subacute (3-6 months), and chronic phases (> 6 months)⁹. Most studies in stroke rehabilitation include participants over the age of 18 years¹⁰. In clinical practice, the same interventions are used

for all ages. Therefore, the Recommendations of this guideline can be applied to all individuals after a stroke. In addition, these guidelines also aim to highlight the issues of accessibility and palliative care. The guidelines have been divided into two groups. Part I includes topics on rehabilitation in the acute phase as well as prevention and management of the most frequent conditions and comorbidities after stroke. A section on Secondary Stroke Prevention was included in Part I because the incidence of stroke recurrence is higher in the first months after stroke⁹ and it is a potential and preventable complication that impairs the process of rehabilitation as do falls, deep vein thrombosis and others. More detailed information about Secondary Stroke Prevention is available at <https://www.aha-journals.org/doi/pdf/10.1161/STR.0000000000000375>. Table 1 shows daily doses, adverse effects, and duration of follow-up during the study periods of drugs used in the management of central pain, mood disorder, sleep disorder, and epilepsy after stroke. Part II covers the topics on rehabilitation of neurological deficits and disabilities after stroke, and transitions to community rehabilitation and palliative care. A table with validated scales to assess neurological impairment, disability, and quality of life is included in Part II. At the end of Part II, supporting material includes suggestions for patients, caregivers, and other health professionals, including legal rights after stroke,

Table 1. Daily doses, adverse effects, and duration of follow-up during the study periods of drugs used in the management of central pain, mood disorder, sleep disorder, and epilepsy after stroke.

Comorbidities	Drug	Daily dose	Duration of study follow-up	Adverse effects
Central Pain	Amitriptyline ³⁹	Start with 25 mg, up to 75 mg	4 weeks	Dry mouth, urinary retention, drowsiness, and confusion
	Lamotrigine ³⁹	Start with 25 mg, up to 200 mg	8 weeks	Rash and severe headache
	Duloxetine ⁴²	Start with 30 mg, up to 60 mg	3 weeks	Nausea, agitation, and drowsiness
	Pregabalin ⁴³	Start with 150 mg, up to 600 mg	12 weeks	Somnolence, and peripheral edema
	Gabapentin ³⁹	Start with 900 mg, up to 2400 mg	8 weeks	Dizziness and drowsiness
	Fluvoxamine ⁴⁴	Start with 50 mg, up to 125 mg	2 to 4 weeks	Drowsiness, insomnia, and restlessness
Mood disorder	Nortriptyline ⁷⁹	Start with 25 mg, up to 100 mg	6 weeks	Dry mouth, urinary retention, drowsiness, and confusion
	Trazodone ⁷⁹	Start with 25 mg, up to 200 mg	32 days	Dry mouth, urinary retention, drowsiness, and confusion
	Citalopram ⁷⁹	Start with 5 mg, up to 10 mg	6 weeks	Nausea, drowsiness, weakness, dizziness, anxiety, trouble sleeping, and sexual dysfunction
	Fluoxetine ⁷⁹	Start with 10 mg, up to 10 mg	6 weeks to 3 months	Nausea headaches, insomnia, diarrhea, weakness, and anxiety
	Reboxetine ⁷⁹	4 mg	16 weeks	Dry mouth, constipation, and sexual dysfunction
Sleep disorders	Trazodone ¹¹⁰	100 mg	1 week	Dry mouth, urinary retention, somnolence, and confusion
Epilepsy	Levetiracetam ¹⁵⁷	Start with 500 mg up to 300 mg	52 weeks	Fatigue, drowsiness, skin eruptions or allergies
	Lamotrigine ¹⁵⁷	Start with 25 mg up to 200 mg	52 weeks	Dizziness and rash
	Controlled release carbamazepine ¹⁵⁷	Start with 200 mg up to 1600 mg	52 weeks	Confusion, skin eruptions or allergies, nausea, and vomiting

as well as functional accessibility laws and the care network. We have also included a chapter on the possibilities of paths to be followed in the future, based on promising approaches to rehabilitation after stroke.

We hope that this pioneering Brazilian work will soon be followed by new versions that can improve and update the content presented here.

RECOMMENDATION RATING AND LEVEL OF EVIDENCE

The recommendation rating and level of evidence used in these guidelines is an adaptation of the framework established by the American Heart Association¹⁰.

Recommendations

Class I: There is evidence and/or consensus that intervention is effective.

Class II: There is conflicting evidence and/or divergence of opinions about the effectiveness and usefulness of intervention.

a) Although there is divergent evidence on the usefulness and effectiveness of intervention, the Recommendations are in favor of intervention;

b) Utility and effectiveness are less established by the evidence or opinions.

Class III: There is evidence and/or consensus that intervention is not useful or effective and may cause harm.

Levels of evidence

A: Data are obtained from multiple randomized clinical trials or meta-analyses.

B: Data are obtained from a single randomized or non-randomized study.

C: Consensus and expert opinion, case studies, or usual (standardized) treatments.

ORGANIZATION OF POST-STROKE REHABILITATION CARE (LEVELS OF CARE)

The ideal organization of post-stroke rehabilitation care includes rehabilitation during the acute phase in stroke units, nursing home facilities, inpatient, home-based and outpatient rehabilitation services¹¹. The level of care to which patients will be referred depends on the status of clinical conditions and the degree of neurological impairment and disability. These services should be delivered by a multidisciplinary team with physicians, physical, occupational, speech and language therapists, physical educators, social workers, psychologists, and psychiatrists¹⁰. Integration within the whole system of health and social community care is necessary. At all levels of care, specific needs should be assessed, such as swallowing, hydration and nutrition, continence, mobility, activities of everyday life,

communication, cognition, alertness and engagement, vision, hearing, perception, behavior, emotional, need for assistance, and social engagement¹¹.

The level of care after stabilization of the acute phase will depend on the degree of dependence in activities of daily living, status of comorbidities and neurological impairments and disabilities. It is suggested that the Assessment for Rehabilitation Tool (ART)¹², a pathway and decision tool that considers individual particularities, such as age, prognosis, neurological impairment and disability domains, level of function, and management level available, i.e., inpatient, home or outpatient rehabilitation. ART also considers exceptions where there is no need to initiate rehabilitation, such as the patient returning to pre-morbid function, coma and/or unresponsiveness or palliative care.

Recommendation

- Organized, coordinated, and multidisciplinary care should be available to patients after stroke. (Recommendation I-A).

REHABILITATION IN THE ACUTE PHASE

This topic will address themes of relevance to rehabilitation in the acute phase of stroke that do not involve reperfusion or clinical stabilization interventions, as there are specific guidelines for that purpose^{13,14}.

All patients must be evaluated by a multidisciplinary team using an objective framework, through the application of scales to assess the risk of pulmonary aspiration, malnutrition, pressure ulcers, deep vein thrombosis, neurological deficits, focal and global disabilities, and psychiatric disorders⁹. A multidisciplinary team should include physicians, physical, occupational, speech and language therapists, physical educators, social workers, psychologists, and psychiatrists¹¹.

All rehabilitative interventions should be initiated as soon as the impairments and disabilities after stroke are diagnosed and should be continued as outpatient rehabilitation in the community^{11,15}. Some conditions are contraindications to the commencement of rehabilitation: early deterioration, immediate surgery, another serious medical illness or unstable coronary condition, systolic blood pressure lower than 110 mm Hg or higher than 220 mm Hg, oxygen saturation lower than 92% with oxygen supplementation, resting heart rate of less than 40 beats per min or more than 110 beats per min, and temperature higher than 38.5°C¹⁶. Mobilization out of bed or any other intervention should be initiated only if the patient's blood pressure does not drop by more than 30 mm Hg on achievement of an upright position¹⁶.

Regarding mobilization in the acute phase, the AVERT¹⁶ multicenter trial showed that the group that received very early mobilization, within 24 hours of stroke onset, had a lower chance of favorable results at three months. Mobilization to maintain range of motion, sensory stimulation and body posture

change is not considered intensive rehabilitation¹⁶. A multi-center study (HeadPoST)¹⁷ did not find differences between outcomes when comparing a group that rested with the head in the horizontal position, without elevation (i.e., 0°) in the first 24 hours post-randomization and another group in which the head was elevated to at least 30°.

COMPREHENSIVE STROKE CENTER

The Comprehensive Stroke Center (CSC), a combined and integrated service for acute-phase care and rehabilitation, offers the best outcomes¹⁸. Care in a CSC reduces deaths by two and dependence by six in every 100 patients and promotes the return home of six individuals¹⁸. It is a cost-effective intervention^{15,18,19}. The benefits of CSCs apply to all stroke cases, regardless of severity, age, sex, and whether the stroke is ischemic, hemorrhagic, or a transient ischemic attack¹⁸.

Despite the limited number of CSCs in Brazil, patients must be admitted to these units in the acute phase, preferably within the first hours of the stroke²⁰. A suspicious case evaluated in a service not dedicated to stroke must be immediately transferred to the nearest qualified unit. All services must offer protocols for managing fever, blood pressure, blood glucose, and dysphagia²⁰. Additionally, patients must have their rehabilitation needs assessed within 24-48 hours of admission by members of a multidisciplinary team^{11,15}.

There is evidence that individuals with mild stroke may have impairments neglected by professionals in multidisciplinary teams²¹. On the other hand, severely affected patients are not referred to rehabilitation services²². To avoid these situations the ART¹² can be used to provide an appropriate course of post-stroke rehabilitation.

Recommendations

- All patients in the acute stroke phase must be admitted to specialized stroke care units where they can receive care from a multidisciplinary team. (Recommendation I-A);
- All patients in the acute stroke phase must be seen by specialized professionals and objectively assessed, with the use of scales, for risk of pulmonary aspiration, malnutrition, pressure ulcers, deep vein thrombosis, neurological deficits, focal and global disabilities, and psychiatric disorders. (Recommendation I-A);
- Very early and high-intensity mobilization within 24 hours of stroke onset is not recommended. (Recommendation III-A);
- Keeping the head in the horizontal position, without elevation, did not show benefit in the acute post-stroke phase. (Recommendation III-A).

CONTRACTURES

Contractures are defined as the shortening or stiffening of muscles, skin, or connective tissue resulting in decreased movement and range of motion²³. Observational studies have shown the incidence of contractures to be between 15% and 60%, mainly in patients with greater motor impairment²⁴. The predictors of contractures include spasticity, muscle weakness, upper limb dysfunction, impaired dexterity, and pain²³.

Few studies have addressed the treatment of contractures after stroke. Systematic reviews and randomized studies evaluating passive movement and positioning with limb resting orthoses have shown little evidence of benefits in prevention and treatment of contracture²⁵⁻²⁹. A dynamic, progressive orthosis fixed in the forearm to lengthen the wrist in extension in post-stroke hemiplegic patients improved the range of motion and resistance to passive movement, but this benefit was not sustained³⁰. A recent meta-analysis of several neurological conditions, including those found in post-stroke patients, for interventions to reduce muscle contractures, did not find convincing evidence in favor of non-surgical interventions, such as stretching, botulinum toxin, electrical stimulation, physical activity, and robot-assisted therapies³¹. Surgical release of the brachial, brachioradialis, and biceps muscles improved pain, passive range of motion, and decreased spasticity of the elbow with a contracture³².

Recommendations

- Progressive casting and adjustable orthotics may be considered to reduce mild to moderate contractures of the elbow joints. (Recommendation IIb-B);
- Resting ankle and wrist orthotics may be used to prevent contractures. (Recommendation IIb-B);
- The effects of stretching, botulinum toxin, electrical stimulation, physical activity, and robot-assisted therapies have not been well established. (Recommendation IIb-B);
- Surgical interventions in the brachial, brachioradialis, and biceps muscles in elbow contractures might be considered. (Recommendation IIb-B).

PHYSICAL DECONDITIONING

People who have had a stroke spend 81% of the day in sedentary time, increasing the risk of glucose intolerance, diabetes, heart disease, mood disorders, cognitive decline, decreased muscle mass, increased dependency for daily activities, stroke recurrence, and death. Physical activity (PA) plays a central role in reducing these risks and improving cardiovascular performance³³. PA also has benefits for bone structure, fatigue, cognition, mood, wellness, sensation, gait speed, social isolation, and has the potential to reduce treatment costs³⁴.

The Recommendations below are based on the American and Canadian guidelines^{33,35}.

Recommendations

- It is recommended that all post-stroke individuals participate in PA interventions once they are clinically stable. (Recommendation I-A);
- Assessment of PA must be performed by qualified professionals. (Recommendation I-B);
- Monitoring of heart rate, blood pressure, and rating of perceived exertion before, during, and after completion of the test is recommended. Cardiac monitoring is recommended if stress testing is performed. (Recommendation I-A);
- Aerobic training is recommended in a rehabilitation program with the addition of muscle strengthening, task-oriented activities of motor control, balance, gait, and functional use of the upper limb. (Recommendation I-C);
- It is recommended that a PA program be developed and supervised by physical therapists or cardiovascular rehabilitation specialists. (Recommendation I-C);
- Exercises to activate a large group of muscles for a sufficient period to produce aerobic effort are recommended. (Recommendation I-B);
- A minimum period of eight weeks is recommended to obtain significant effects, followed by PA being maintained indefinitely. (Recommendation I-B);
- A frequency of three times a week of PA and lighter physical activities on other days is recommended. (Recommendation I-B);
- Sessions lasting more than 20 minutes are recommended, with a period of five minutes of warm-up and relaxation before and after each session. (Recommendation I-B);
- It is recommended that exercise intensity has individualized parameter values based on the percentage of heart rate reserve, percentage of maximum heart rate, and individual perceived exertion. (Recommendation I-B);
- It is recommended that the effects of PA be monitored by measures of cardiovascular capacity, blood pressure, lipid profile, fasting blood glucose, waist circumference, medication adherence, tobacco use, cognition, mood, and sleep quality. (Recommendation I-B);
- A PA program is recommended to be continued by the patient so that he/she can practice on their own. (Recommendation I-B);
- Clinical dates and stress tests with sub-maximal limits of tolerance should be used for prior evaluation of PA as a reference. (Recommendation IIa-C).

CENTRAL PAIN

Central pain after stroke is defined as neuropathic pain resulting from spinothalamic or thalamocortical tract lesions in the central nervous system (CNS), affecting patients in the acute or chronic phase after a stroke³⁶. As a diagnostic criterion, it is necessary that the pain that occurs after a stroke should be located in a body area corresponding to the CNS lesion and not caused by peripheral neuropathic pain or nociceptive stimuli³⁷. Numbness, tingling, or needling sensations may also be present. The onset of symptoms is always gradual, coinciding with improvement in sensory perception and the onset of dysesthesia³⁸. The pain can be intermittent or constant and can manifest as hyperalgesia or allodynia³⁶.

Amitriptyline and lamotrigine can be first-line pharmacological treatments^{39,41}. Duloxetine, as an adjuvant treatment, has shown positive effects in pain reduction⁴². Pregabalin and gabapentin can be considered second-line medications, and pregabalin has a favorable secondary effect of reducing anxiety and improving sleep⁴³. Fluvoxamine reduced pain in an open observational study⁴⁴. Levetiracetam and carbamazepine do not improve post-stroke neuropathic pain symptoms³⁹. There is no evidence for the use of opioids in the treatment of central post-stroke pain⁴⁵. Table 1 shows the drugs with favorable outcomes.

Steroids, intravenous infusions of lidocaine, ketamine propofol, repetitive transcranial magnetic stimulation (rTMS), deep brain stimulation, and spinal electrical stimulation showed favorable results^{46,47}. However, they should be reserved for refractory cases⁴⁸.

Recommendations

- Amitriptyline and lamotrigine should be used as first-line treatments for neuropathic pain. (Recommendation I-A);
- Duloxetine can be considered as an adjuvant treatment. (Recommendation IIa-B);
- Pregabalin and gabapentin can be used as second-line medication. (Recommendation IIa-B);
- Fluvoxamine can be considered. (Recommendation IIb-B);
- rTMS, deep brain, or spinal electrical stimulation may be considered in refractory cases. (Recommendation IIb-B);
- Levetiracetam, carbamazepine, and opioids are not recommended. (Recommendation III-B).

PAINFUL SHOULDER

Painful shoulder (PS) after stroke has an incidence range of 9% to 73%, depending on the diagnostic criteria used in the studies⁴⁹. It can appear in the first two weeks but is more frequent between the second and fourth months after stroke⁵⁰.

The most frequent causes are spasticity, adhesive capsulitis, and glenohumeral subluxation⁴⁹.

Evidence for the use of shoulder orthoses to prevent dislocation, decrease pain, and improve function is conflicting^{50,51}. These orthoses can improve gait efficiency⁵¹. Placing an orthosis on an already dislocated shoulder can reduce vertical subluxation on imaging examinations, but the improvement is not maintained after removing the orthosis⁵².

Gentle joint alignment movements and mobilization with external rotation and abduction may be beneficial⁴⁹. Analgesics, such as acetaminophen and ibuprofen, and neuromodulators can be used⁴⁹. Botulinum toxin has positive effects on pain reduction and functional improvement and increases the range of motion⁵³. Subacromial corticosteroid injections can be used if the pain is caused by trauma or inflammation of the subacromial region⁵⁴. Suprascapular nerve blocks, with and without corticosteroids, increased passive range of motion⁵⁵. A functional bandage reduced shoulder subluxation, improved upper limb motor function and activities of everyday life, and reduced pain when compared to placebo^{56,57}.

Conventional acupuncture and electroacupuncture have shown uncertain benefits⁵⁸. Electrical functional stimulation can be beneficial in reducing pain and regaining independence in activities of everyday life⁵⁹. The pulley system should not be used⁶⁰.

Recommendations

- Functional bandages are recommended for PS after stroke. (Recommendation I-A);
- Botulinum toxin injection in the subscapular and pectoral muscles is recommended, mainly if PS is associated with spasticity. (Recommendation I-A);
- Arm position and support during rest, arm protection, and support during functional movements can be considered to prevent PS. (Recommendation IIa-C);
- Functional electrical stimulation can be considered in the prevention of PS. (Recommendation IIa-A);
- PS can be treated with gentle alignment movements and mobilization with external rotation and abduction. (Recommendation IIa-B);
- Analgesics, such as acetaminophen and ibuprofen, and neuromodulators, can be used. (Recommendation IIa-A);
- Subacromial corticosteroid injections and suprascapular nerve block are reasonable options for hemiplegic PS. (Recommendation IIb-B);
- Acupuncture, as an adjunctive treatment, has an uncertain value. (Recommendation IIb-B);
- The use of orthotics to prevent dislocations is uncertain. (Recommendation IIb-B);
- The pulley system should not be used for the prevention of PS. (Recommendation III-A).

PRESSURE INJURY

Pressure injury (PI) is defined as localized injury to the skin and/or underlying tissues, usually over a bony prominence, resulting from pressure or pressure in combination with shear⁶¹. Its etiology is multifactorial and can include advanced age, cognitive, physical, and sensory impairment, comorbid conditions, malnutrition, and limited mobility.

The PI classification of the Associação Brasileira de Estomatoterapia (SOBEST) and Associação Brasileira de Enfermagem em Dermatologia (SOBENDE) is recommended in these guidelines⁶².

Although not specific to patients after stroke, the Braden Scale is a widely used tool for assessing pressure injury risk and had moderate predictive validity⁶³. The Sunderland Scale and the Cubbin & Jackson Revised Scale can also be used and have been translated and validated in Portuguese⁶⁴.

The Recommendations for the prevention and care of PI after stroke are based on an adaptation of the latest version of the Prevention and Treatment of Pressure Ulcers/Injuries Quick Reference Guide published by the European Pressure Ulcer Advisory Panel, National Pressure Injury, Advisory Panel, and Pan Pacific Pressure Alliance⁶⁵.

Recommendations

- Skin assessment for the risk of pressure injuries over pressure points is recommended in subjects with impaired mobility, sensory perception, older age, and diabetes. (Recommendation I-A);
- Structured PI risk assessment and PI classification are recommended. (Recommendation I-C);
- The skin of individuals at risk of PI should be inspected to identify the presence of erythema. (Recommendation I-A);
- The skin of individuals at risk of PI should be kept clean and appropriately hydrated. (Recommendation I-C);
- Full-thickness excision of pressure sores, including abnormal skin as well as granulation and necrotic tissues, should be performed. (Recommendation I-B);
- The following factors should be considered for PI surgery: comorbidities, surgical risk, the individual's clinical condition, and the likelihood of healing with non-surgical versus surgical interventions. (Recommendation I-C);
- Airflow mattresses can be considered for stroke patients at risk of developing PI. (Recommendation IIa-B);
- Pulsed current electrical stimulation to facilitate wound healing in recalcitrant PI should be considered. (Recommendation IIa-A);
- High absorbency incontinence products can be used to protect the skin in stroke patients with urinary incontinence at risk of PI. (Recommendation IIa-B);

- Post-stroke individuals at risk of PI can undergo nutritional assessment. (Recommendation IIa-B);
- Stroke patients with, or at risk of, pressure injuries can be repositioned on an individualized schedule. (Recommendation IIa-B);
- Hydrogels, hydrocolloids, and polymeric wound dressings for non-infected stage II PI can be considered. (Recommendation IIa-B);
- Wound dressing with calcium alginate for stages III and IV PI with moderate exudates can be considered. (Recommendation IIa-B);
- Hydrogel for stage III and IV non-infected PI with minimal exudate is recommended. (Recommendation IIa-B);
- Subjects at risk of PI may be encouraged to sit out of bed for limited periods. (Recommendation IIb-B);
- Offering high-calorie, high-protein fortified foods or nutritional supplements in addition to the usual diet might be considered for stroke individuals at risk of PI. (Recommendation IIb-C);
- The benefits of topical antiseptics that are active against biofilms are uncertain. (Recommendation IIb-C).

NUTRITIONAL SUPPORT

After a stroke, individuals are susceptible to nutritional changes due to a variety of symptoms and sequelae. The risk factors for nutritional changes after stroke are dysphagia, immobility, impaired cognition, as well as reduced food and macro- and micronutrient intake⁶⁶. Approximately 50% of stroke patients suffer from malnutrition⁶⁷.

For individuals without dysphagia and who are not malnourished or at risk of malnutrition, the use of oral nutritional supplements is not indicated⁶⁶. Oral supplements are indicated for individuals who are able to eat and have been diagnosed with malnutrition or were at risk of malnutrition during hospital admission⁶⁶.

Individuals with dysphagia who need food texture modification or fluid thickening should be referred to a dietitian to ensure adequate nutrition and water intake⁶⁶. If oral feeding is not possible, feeding by a nasogastric/enteric tube is recommended⁶⁷. Patients with severe dysphagia, probably lasting longer than seven days, should receive early enteral nutrition, preferably in the first 72 hours⁶⁷. If enteral nutrition is needed for a period longer than three weeks, a percutaneous endoscopic gastrostomy is recommended⁶⁷.

Sarcopenia is a complication of malnutrition after stroke, and it is associated with an increased risk of falls, fractures, functional disability, rehabilitation difficulties, and mortality⁶⁸. Sarcopenia is caused by increased inactivity, muscle atrophy, neural loss, and bed rest^{69,70}. The most severe muscle loss occurs

in the limb affected by the brain injury⁷¹. The instrument recommended for identifying the risk of developing sarcopenia is the SARC-F (sluggishness, requiring assistance in walking, rising from a chair, climbing stairs, falls) questionnaire⁷². It assesses muscle strength, muscle quantity/quality, and physical performance.

Recommendations

- Screening for the risk of malnutrition is highly recommended within the first 48 hours of hospital admission. (Recommendation I-C);
- If oral feeding is not possible, feeding by a nasogastric/enteric tube is recommended. (Recommendation I-A);
- Every patient with dysphagia who needs food texture modification or fluid thickening should be referred for nutritional assessment to ensure adequate nutrition and water intake. (Recommendation I-C);
- Percutaneous endoscopic gastrostomy is recommended when there has been a need for enteral nutrition for more than three weeks. (Recommendation I-A);
- Patients should be screened for the risk of sarcopenia using the SARC-F questionnaire. (Recommendation I-C);
- The use of oral nutritional supplements is probably recommended for individuals who are able to eat and have been diagnosed with malnutrition or were at risk of malnutrition during hospital admission. (Recommendation IIa-C);
- For patients with severe dysphagia lasting longer than seven days, early enteral nutrition is probably recommended. (Recommendation IIa-C);
- The use of oral nutritional supplements is not recommended for patients without dysphagia and those who are not malnourished or at risk of malnutrition. (Recommendation III-C).

MOOD DISORDERS

Post-stroke depressive disorder (PSDD) is defined by the presence of a significantly depressed mood or a marked decrease in interest or pleasure that occurs as a consequence of a stroke⁷³. It occurs in approximately 30% of patients in the first five years after stroke⁷⁴. The risk of developing PSDD is proportional to the severity of the stroke⁷⁵, and social, genetic, and epigenetic factors⁷⁶. However, the association with the topography of the stroke is not clear⁷⁶. The presence of PSDD increases the risk of death threefold over a 10-year period, particularly in patients with less social support⁷⁷. PSDD is associated with fewer feelings of guilt and a high risk of suicide, and this should be specifically monitored in younger patients with a history of depressive episodes before the stroke⁷⁸.

Adequate social support is necessary to prevent PSDD^{79,80}. A systematic review and meta-analysis of low quality showed that prophylactic use of selective serotonin reuptake inhibitors (SSRI) in nondepressed stroke patients for one year may reduce the odds for development of post stroke depression⁸¹. Non-pharmacological treatment of PSDD involves family support, cognitive behavioral therapy, and lifestyle interventions⁷⁹. Patient education about stroke has a positive effect⁷⁹. Physical exercise training is a potential treatment option for PSDD⁷⁹. Transcranial magnetic stimulation is a promising treatment⁸². Pharmacological treatment with antidepressants, especially SSRIs, has been shown to be effective in improving post-stroke survival and in cases of emotional lability⁷⁹ (Table 1). Neuroleptics, anticonvulsants, and lithium have been used for post-stroke manic symptoms⁷⁹.

Recommendations

- Pharmacological treatment with antidepressants, such as SSRIs, can be recommended for the treatment of PSDD. (Recommendation IIa-A);
- Selective serotonin reuptake inhibitors may be used prophylactically after stroke. (Recommendation IIb-B);
- Family support, cognitive behavioral therapy, and lifestyle interventions can be considered. (Recommendation IIa-B);
- Exercise training may be used as a complementary treatment option in cases of PSDD. (Recommendation IIb-B);
- The combination of pharmacological and non-pharmacological treatments may be considered. (Recommendation IIb-B);
- Transcranial magnetic stimulation has unclear benefits. (Recommendation III-B).

DEEP VEIN THROMBOSIS

Acute stroke survivors are at high risk of deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE), with incidence ranging from 10% to 75% in this population⁸³. The main risk factors for post-stroke DVT are advanced age, atrial fibrillation, limb paresis, or plegia⁸⁴. DVT may be present on the second day, with a peak incidence from the second to the seventh day and may persist during the rehabilitation phase in 30% of patients with severe paresis⁸³. The main complications of DVT in post-stroke patients are post-thrombotic syndrome and PTE, which can occur in 15% of cases with proximal DVT and account for approximately 3% of post-stroke deaths⁸⁵.

Non-pharmacological interventions have been effective in preventing DVT and PTE. The randomized CLOTS 3 study showed that in patients with ischemic or hemorrhagic stroke, intermittent pneumatic compression was effective in reducing DVT and possibly improved survival⁸⁶.

For the prevention of DVT or PTE in patients with ischemic stroke, a meta-analysis⁸⁷ concluded that: 1) intermittent pneumatic compression should be used in immobilized patients; 2) elastic compression stockings are not indicated; 3) prophylactic anticoagulation with unfractionated heparin (UFH)* or low molecular weight heparin (LMWH)** or heparinoids should be considered in immobilized post-stroke patients for whom the benefits of reducing the risk of DVT outweigh the risk of intra- or extracranial bleeding; 4) if anticoagulation is chosen, LMWH or heparinoids should be prioritized over UFH due to the greater reduction in the risk of DVT, better ease of use, cost reduction, and patient comfort; and 5) LMWH is associated with a higher risk of extracranial bleeding, with the risk being higher in elderly patients with renal dysfunction.

A double-blind randomized study showed that in critically ill patients, including 15% of patients with ischemic stroke, after hospital discharge, rivaroxaban at a dose of 10 mg/day for 45 days reduced the combined risk of fatal and severe thromboembolism by approximately 28%, without a significant increase in bleeding tendencies⁸⁸.

Regarding hemorrhagic stroke, a prophylactic dose of heparin between the second or fourth day did not increase the risk of intracranial bleeding, despite the low quality of the evaluated studies⁸⁹⁻⁹¹.

In patients with ischemic stroke and DVT or PTE, the anticoagulation maintenance period will be three months, unless another overlapping medical condition increases the risk of recurrence⁹².

Literature lacks studies using the inferior vena cava filter (IVCF) in cases of hemorrhagic stroke. However, considering its use in other conditions with contraindications for the use of anticoagulants, the use of inferior vena cava filters in patients with hemorrhagic stroke can be considered^{93,94}.

*Recommend dose of unfractionated heparin: < 15.000 UI/day. ** Recommended dose for low molecular weight heparin: 30 to 60 mg/day.

Recommendations

- Intermittent pneumatic compression is recommended in immobilized post-stroke patients to prevent DVT. (Recommendation I-A);
- In ischemic stroke, prophylactic doses of UFH or LMWH should be used during the hospital stay or even after discharge until the patient regains mobility. (Recommendation I-A);
- In ischemic stroke, a prophylactic dose of LMWH over UFH can be used to prevent DVT. (Recommendation IIa-A);
- Rivaroxaban at a dose of 10 mg/day for 45 days can be considered as prophylaxis for thromboembolism. (Recommendation IIa-B);

- IVCF can be considered in immobilized hemorrhagic stroke patients if anticoagulation is contraindicated. (Recommendation IIa-B);
- In hemorrhagic stroke, it may be reasonable to use a prophylactic dose of UFH or LMWH to start between the second and fourth days of hospitalization rather than no prophylaxis. (Recommendation IIb-C);
- The use of elastic compression stockings is not recommended. (Recommendation III-B).

SECONDARY STROKE PREVENTION

After an ischemic stroke or a transient ischemic attack (TIA), the risk of recurrence without treatment was 10% in the first week, 15% at one month, and 18% at three months⁹⁵. In the long term, it was 10% in one year, 25% in five years, and 40% in ten years⁹⁶.

Meta-analysis of individuals with cardiovascular disease through long-term follow-up identified that a reduction of 1 g/d sodium (2.5 g/d salt) was associated with a decrease in cardiovascular events⁹⁷. Another study established the efficacy of physical activity compared with usual care to reduce risk factors after stroke⁹⁸. Some evidence suggests that smoking cessation and reduced alcohol consumption reduce recurrent events^{99,100}.

Antihypertensive therapy reduces the risk of ischemic or hemorrhagic stroke¹⁰¹. All classes of antihypertensive drugs have been shown to be equally effective, to the detriment of beta-blockers, due to their permissiveness in pressure variability¹⁰¹. The use of statins is recommended regardless of the initial LDL cholesterol level¹⁰². The target for maximum secondary prevention is an LDL < 70 mg/dl, preferably using high-potency statins, such as rosuvastatin or atorvastatin.

Prediabetes and diabetes are associated with increased risk of initial ischemic stroke¹⁰³. The American Diabetes Association and European Association for the Study of Diabetes recommend metformin and lifestyle optimization as first-line therapies¹⁰⁴. To prevent vascular events, including ischemic stroke, GLP-1 receptor agonists should be added¹⁰⁴.

Antiplatelet agents should be prescribed to patients with non-cardiac-embolic stroke or TIA. Short-term use of aspirin plus clopidogrel for up to 21 days is recommended in patients with acute minor stroke or high-risk TIA¹⁰⁵. In the long term, agent selection must be individualized based on the risk profile, cost, and tolerance¹⁰⁵.

Patients with cardiac embolism, particularly those with atrial fibrillation, should be treated with anticoagulants¹⁰⁵. Options include warfarin with an adjusted dose INR between 2 and 3 or direct oral anticoagulants (DOACs: apixaban, dabigatran, edoxaban, or rivaroxaban). The safety profile of DOACs is superior to that of warfarin, with equal or superior efficacy in preventing new events¹⁰⁵.

Patent foramen ovale (PFO) closure is recommended for patients with cryptogenic stroke aged < 60 years, large PFO,

or pronounced right-to-left shunt, without other concomitant etiologies¹⁰⁵.

Severe symptomatic intracranial stenosis or occlusion should be treated with antiplatelet agents, and the combination of clopidogrel with aspirin for 90 days may be reasonable¹⁰⁵.

The approach to stroke rehabilitation does not differ in the presence of comorbidities.

Recommendations

- Antiplatelet agents are recommended in patients with non-cardioembolic stroke or TIA for secondary stroke prevention. (Recommendation I-A);
- Anticoagulation with warfarin or DOACs is recommended for stroke or TIA with a cardioembolic source, with a preference for DOACs over warfarin. (Recommendation I-A);
- Patients with diabetes should control their blood glucose with physical activity, lifestyle modifications, and glucose-lowering agents with proven effectiveness in reducing risk for major cardiovascular events. (Recommendation I-A);
- In severe symptomatic intracranial stenosis or occlusion, a combination of clopidogrel and aspirin should be used. (Recommendation I-A);
- An exercise program by a health care professional, in addition to routine rehabilitation, is beneficial for secondary stroke prevention. (Recommendation I-A);
- Blood pressure control with a goal of systolic pressure less than 140 mmHg and diastolic pressure less than 90 mmHg is recommended. (Recommendation I-A);
- It is recommended that LDL values be kept below 70 mg/dl. (Recommendation I-A);
- Quitting smoking and reducing alcohol consumption are recommended. (Recommendation I-B);
- Reducing sodium intake is recommended to reduce the risk of stroke. (Recommendation II-A);
- PFO closure is recommended for cryptogenic stroke patients aged < 60 years. (Recommendation IIa-B);
- For severe symptomatic intracranial stenosis or occlusion, the combination of clopidogrel and aspirin for 90 days should be considered. (Recommendation IIa-B).

SLEEP DISORDERS

Post-stroke patients experience insomnia, excessive daytime sleepiness, fatigue, non-restorative sleep, nocturia, and sleep fragmentation, often present even before the stroke¹⁰⁶. It is important that conventional polysomnography be performed in this population, as stroke can cause respiratory changes that are undetectable by the screening devices available on the market¹⁰⁷.

Obstructive sleep apnea syndrome (OSAS) affects 50% of stroke patients, and there is a strong interrelationship between the two conditions¹⁰⁸⁻¹¹². OSAS exacerbates post-stroke deficits by impairing the consolidation of neuroplastic synaptic processes involving cognition and praxis¹¹³.

Muscle relaxants, including benzodiazepines, are known to worsen OSAS¹⁰⁶. Continuous positive airway pressure (CPAP) treatment of OSAS must be performed with a positive pressure sufficient to eliminate the apnea events. The device must be worn in an uninterrupted fashion during sleep, every day of the week, with an appropriate nosepiece¹¹⁴. A meta-analysis has shown that the use of CPAP can be beneficial for post-stroke neurological recovery¹¹⁵. Whether OSAS treatment also reduces the recurrence of stroke remains controversial¹¹⁶.

Fully-fledged insomnia or symptoms of insomnia affect one-third to nearly half of all post-stroke patients¹⁰⁶. Antidepressants should be taken in the morning, so avoiding the conditioning effect associated with the idea that night-time use of these drugs is intended to induce sleep¹⁰⁸. Trazodone has been shown to improve sleep and blood pressure parameters in post-ischemic stroke patients¹¹⁰. (Table 1). Cognitive-behavioral therapy is beneficial and positively impacts neurofunctional outcomes¹¹¹.

Excessive daytime sleepiness is frequent in post-stroke patients and is associated with higher mortality and less successful rehabilitation¹¹⁷. Restless leg syndrome can have a negative impact on the prognosis of post-stroke patients¹¹⁸.

Recommendations

- CPAP is recommended in individuals with post-stroke OSAS. (Recommendation I-A);
- Excessive daytime sleepiness and restless leg syndrome should be investigated and treated if present. (Recommendation I-B);
- Trazodone can be considered in individuals with ischemic stroke and OSAS. (Recommendation IIa-A);
- Conventional polysomnography is probably recommended in individuals with a history of stroke or TIA. (Recommendation IIa-B);
- Antidepressants should be taken in the morning. (Recommendation IIa-B);
- Cognitive behavioral therapy can be considered in individuals with post-stroke sleep disorders. (Recommendation IIa-B);
- Benzodiazepines and muscle relaxants should not be used in the management of post-stroke sleep disorders. (Recommendation III-C).

FALLS

Falls are one of the most common causes of post-stroke complications. They can occur in the acute or chronic phases^{119,120}. Approximately 7% of falls occur in the first week after stroke,

25% to 37% between one and six months, and 40% to 50% at six to 12 months. After one year, falls continue to occur in 73% of patients¹²¹. Falls are most frequent in the first three weeks of rehabilitation¹²².

Falls are associated with motor, sensory, or visual impairment, cognitive dysfunction, hemineglect, and stroke in the posterior circulation^{123,124}. The causes of falls include cardiac arrhythmias; orthostatic hypotension; vasovagal syncope; psychological factors, such as depression and fear of falling; seizures; and some drugs, such as antihypertensives, diuretics, anticholinergics, antidepressants, and antiepileptics¹²⁴⁻¹²⁸.

Prevention of falls can be achieved by supervision, strength training, improvement of balance and cognition, less use of sedative drugs and diuretics, and counseling to avoid risky situations^{129,130}. Physical activity showed positive outcomes in long-term stroke patients, mainly with specific tasks to improve postural stability, walking in challenging situations, and agility training programs for effective fall prevention¹³¹⁻¹³³. A systematic review with meta-analysis showed a reduction in falls in post-stroke patients with the practice of ancient tai chi¹³⁴.

Recommendations

- Exercises aimed at preventing falls, with training to improve balance, are recommended. (Recommendation I-B);
- Prevention of falls through patient supervision, reduction of the use of sedatives and diuretics, and restriction of activities with a risk of falling should be instituted. (Recommendation I-C);
- Tai chi can be considered for fall prevention. (Recommendation IIa-B);
- Agility training programs for fall prevention is reasonable. (Recommendation IIa-C).

OSTEOPOROSIS

Osteoporosis is a metabolic bone disease characterized by an imbalance between bone resorption and accumulation, leading to changes in the bone microarchitecture and a reduction in bone mineral density (BMD)^{135,136}. In addition to spasticity, changes in geometric bone properties on the paretic side, increased skeletal fragility, and accelerated bone loss that occurs after a stroke, result in osteoporosis due to disuse¹³⁵. This loss of bone mass as well as reduction in bone structure is greater on the paretic side than on the non-paretic side and affects the upper limbs more than the lower limbs¹³⁵. The risk of fractures in stroke patients is seven times higher than that in the same population according to sex and age¹³⁶. Eighty percent of fractures occur on the paretic side.

The evidence for drug treatment strategies for osteoporosis in stroke patients is limited¹³⁷. It is not known who is eligible, the best timing, which drug is better, and the best duration of treatment¹³⁸. Further studies are needed to recommend calcium

and vitamin D supplements^{139,140}. However adequate supplementation of both can be used in all post-stroke patients^{141,142}. Bisphosphonates such as zoledronic acid are a therapeutic option for both oral and intravenous administration^{143,144}. Hormonal therapy, tibolone, and selective estrogen receptor modulators have cardiovascular risks¹⁴⁵.

Some medications, such as warfarin, pioglitazone, enzyme-inducing anticonvulsant drugs¹⁴⁶ and selective serotonin reuptake inhibitors, are associated with an increased risk of fracture¹⁴⁷. There are clinical studies showing the potential benefits of statins in preventing osteoporosis and fractures¹⁴⁸.

Physical activity with gait training and resistance exercises may have some beneficial effects on BMD loss, but there is limited evidence¹⁴⁹.

Recommendations

- Vitamin D and calcium supplementation can be recommended for stroke patients. (Recommendation IIa-C);
- Bisphosphonates can be used. (Recommendation IIa-B);
- Statins can be beneficial in preventing osteoporosis after stroke. (Recommendation IIa-B);
- Physical activity with gait training and resistance exercises can be useful. (Recommendation IIa-C);
- Selective estrogen receptor modulators, warfarin, pioglitazone, enzyme-inducing anticonvulsants, and selective serotonin reuptake inhibitors can be used with caution. (Recommendation IIb-B);
- Tibolone should be avoided. (Recommendation III-B).

SEIZURE MANAGEMENT

Stroke is the leading cause of epilepsy among individuals over 60 years of age¹⁵⁰. The incidence of post-stroke epileptic seizures is 7% and may be higher in cases with cortical involvement, greater severity of the vascular event, and hemorrhagic stroke¹⁵¹. Epilepsy is associated with increased mortality, prolonged hospitalization, and higher rates of disability¹⁵². In stroke patients, the risk of subsequent seizures after an unprovoked seizure is approximately 70%¹⁵³. A single unprovoked seizure is sufficient for the diagnosis of epilepsy.

The risk of acute symptomatic seizures or unprovoked seizures is low. Even in patients with hemorrhagic stroke and cortical involvement, the risk does not exceed 35%. Therefore, the use of antiseizure medication (ASM) as primary prophylaxis is not justified¹⁵⁴. Likewise, since the risk of seizure recurrence within seven days of stroke is less than 20%, initiation of ASM after a first symptomatic seizure is generally not recommended¹⁵⁵. Nevertheless, no adequately powered randomized trial results are available, and this issue is still being debated¹⁵⁶. In addition, there is a lack of data to determine the differences between ischemic and hemorrhagic stroke-related seizures in terms of risk factors and treatment approaches¹⁵⁰. Therefore,

the guidelines end with generalized Recommendations¹⁵⁵. In practice, clinicians consider the risk of clinical worsening following seizure. It is therefore reasonable to base the decision on stroke severity, injury location, stroke subtypes (intracerebral hemorrhage/subarachnoid hemorrhage), and electroencephalogram findings^{150,156}. If ASM is used for some reason, it should be limited to the acute phase¹⁵⁵.

Conversely, the risk of recurrence after an unprovoked seizure is approximately 70%, which defines epilepsy. In this situation, the use of ASM as secondary prophylaxis should be considered. The decision of a possible future suspension of ASM must be individualized since the risk of seizures after ASM withdrawal is high in patients with structural damage¹⁵⁵.

Most patients with post-stroke epilepsy have seizure control with monotherapy alone¹⁵⁶. The drugs that have proved to be effective in controlling focal epilepsy are carbamazepine, levetiracetam, phenytoin, and zonisamide for adults, with lamotrigine and gabapentin for the elderly¹⁵⁷. However, there is no current evidence for ASM choice in stroke patients. The newer ASMs seem to be better tolerated, with fewer drug interactions and better side effect profiles¹⁵⁰. In a systematic review with network meta-analysis, levetiracetam and lamotrigine were better tolerated than controlled-release carbamazepine for post-stroke epilepsy, with no significant differences in seizure control¹⁵⁷ (Table 1).

Recommendations

- Long-term use of antiseizure medication after an unprovoked seizure is recommended. (Recommendation I-B);
- Recurrent post-stroke seizures must be treated, and the selection of antiseizure medication should consider the patient's characteristics. (Recommendation I-B);
- Use of antiseizure medication after an acute symptomatic seizure is generally not recommended, but it can be considered during the acute phase. (Recommendation IIa-B);
- Use of antiseizure medication as primary prophylaxis of post-stroke seizures is not recommended. (Recommendation III-B).

NEUROGENIC LOWER URINARY TRACT DYSFUNCTION AND FECAL INCONTINENCE

Post-stroke neurogenic lower urinary tract dysfunction (NLUTD) is defined as a dysfunctional condition of the muscles of the bladder, urethra, urethral sphincter, and pelvic floor, and is related to the topography of the damage caused by the stroke, leading to abnormal or difficult control in voluntary and/or involuntary muscle contraction and/or relaxation during the storage and voiding phases of the bladder¹⁵⁸.

Approximately one-third of adult stroke survivors have symptoms related to NLUTD¹⁵⁹ with a prevalence ranging from 11.1% to 70%. Detrusor hyperactivity is the most prevalent

symptom (64.7%)¹⁶⁰ and urinary incontinence is associated with a high risk of death after a new stroke¹⁶¹.

Fecal incontinence (FI) is the inability to control bowel movements, causing stool to unexpectedly leak from the rectum. The prevalence of FI is approximately 40% in the post-stroke acute phase and 20% during rehabilitation. The risk factors are age and functional limitations¹⁶².

Due to the low quality of the studies, no significant effects on NLUTD in post-stroke individuals have been shown by behavioral interventions, assistance from specialized professionals, complementary therapies such as acupuncture (electroacupuncture and moxibustion), transcutaneous electrical stimulation, physical therapy techniques, pharmacotherapy with oxybutynin or estrogen, and a combination of interventions¹⁶³.

There are few studies in the literature on interventions for FI in post-stroke individuals, and they show that educational actions and dietary control have inconclusive effects¹⁶⁴.

Recommendations

- For post-stroke NLUTD, behavioral interventions, specialized professional care, complementary therapies such as acupuncture (electroacupuncture and moxibustion), transcutaneous electrical stimulation, physical therapy techniques, pharmacotherapy, and a combination of interventions have uncertain benefits. (Recommendation IIb-B);
- For post-stroke FI, educational actions and dietary control have inconclusive effects. (Recommendation IIb-B).

SEXUAL DYSFUNCTION

Sexual dysfunction after stroke is underrecognized. It affects over half of stroke survivors and it is not solely attributed to the physical effects of stroke¹⁶⁵. Fewer than 10% of patients receive any advice, despite 90% of patients hoping for advice relating to sexual dysfunction in stroke. Symptoms are characterized by changes in sexual activity, sexual dissatisfaction, decreased libido, problems in achieving orgasm, and erectile dysfunction (ED)¹⁶⁶.

Sexual dysfunction is associated with depression, fear of recurrence of a new stroke, and self-perception of impaired motor function¹⁶⁷. Antihypertensive drugs, depression, and anxiety are associated with ED¹⁶⁸.

Sexual rehabilitation involves counseling and non-pharmacological and pharmacological interventions^{169,170}. Counseling may address sexual performance related to medication issues

and comorbid conditions that may affect sexual function. Orientation to reduce anxiety related to sexual problems involves discussions regarding the ideal timing for sexual activity (in the morning when the person is not tired), dealing with bladder and bowel issues, and working around the weakness (physical support with pillows), thus helping stroke survivors and their partners. Pharmacological interventions include phosphodiesterase-5 inhibitors, intracavernosal injections, and intraurethral suppositories to assist erectile function. Non-pharmacological interventions, such as mechanical devices, lubricating gels, and psycho-educational interventions, are also components of sexual rehabilitation^{169,170}.

The effectiveness of interventions to treat sexual dysfunction is limited. According to a recent meta-analysis, data indicating the benefits or risks of using sertraline to treat premature ejaculation, pelvic floor physiotherapy and sexual rehabilitation to treat sexual dysfunction after stroke are insufficient¹⁷¹.

Recommendations

- It is recommended that stroke subjects be asked about their sexual function. (Recommendation I-C);
- Mood disorders and fears should be addressed in sexual dysfunction after stroke.
- If ED is present in men after stroke, antihypertensive drug use, anxiety, and depression should be investigated. (Recommendation I-B);
- The benefits of sertraline in treating premature ejaculation are uncertain. Recommendation IIb-B);
- The effects of sexual rehabilitation for treating sexual dysfunction after stroke are not well established. (Recommendation IIb-B).

CONCLUSION

The Brazilian Guideline for Stroke Rehabilitation – Part I presents Recommendations on interventions to manage and prevent complications and comorbidities after stroke. However, this guideline is open to criticism for potential issues in the Recommendations: 1) the variety of topics covered; 2) the diverse effects of a single intervention in recovery from neurological deficits and disabilities; 3) the low methodological quality of the studies evaluated in systematic reviews and meta-analyses; 4) the personal experience of each professional; and 5) the complexity of the theme of stroke rehabilitation. We hope that Part I of this guideline helps the multidisciplinary team in offering the best care of the most frequent clinical conditions after stroke.

References

1. GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017 Sep 16;390(10100):1151–210. [https://doi.org/10.1016/S0140-6736\(17\)32152-9](https://doi.org/10.1016/S0140-6736(17)32152-9)
2. Johnson CO, Nguyen M, Roth GA, Nichols E, Alam T, Abate D, et al. Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol*. 2019 May;18(5):439–58. [https://doi.org/10.1016/S1474-4422\(19\)30034-1](https://doi.org/10.1016/S1474-4422(19)30034-1)
3. Roth GA, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018 Nov 10;392(10159):1736–88. [https://doi.org/10.1016/S0140-6736\(18\)32203-7](https://doi.org/10.1016/S0140-6736(18)32203-7)
4. Martins SC, Sacks C, Hacke W, Brainin M, Figueiredo FA, Pontes-Neto OM, et al. Priorities to reduce the burden of stroke in Latin American countries. *Lancet Neurol*. 2019 Jul 1;18(7):674–83. [https://doi.org/10.1016/S1474-4422\(19\)30068-7](https://doi.org/10.1016/S1474-4422(19)30068-7)
5. Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020 Dec;396(10267):2006–17. [https://doi.org/10.1016/S0140-6736\(20\)32340-0](https://doi.org/10.1016/S0140-6736(20)32340-0)
6. Buntin MB, Colla CH, Deb P, Sood N, Escarce JJ. Medicare spending and outcomes after postacute care for stroke and hip fracture. *Med Care*. 2010 Sep;48(9):776–84. <https://doi.org/10.1097/MLR.0b013e3181e359df>
7. Cacho RO, Conforto AB, Guarda SNF, et al. Access to rehabilitation after stroke in Brazil (AReA study): an observational multicenter protocol. XXIX Congresso Brasileiro de Neurologia. *Arq Neuropsiquiatr*. 2021;79(1): 281.
8. World Health Organization. ICF: International classification of functioning, disability and health. Geneva (CH): World Health Organization; 2011.
9. Bernhardt J, Hayward KS, Kwakkel G, Ward NS, Wolf SL, Borschmann K, et al. Agreed definitions and a shared vision for new standards in stroke recovery research: the stroke recovery and rehabilitation roundtable taskforce. *Int J Stroke*. 2017 Jul 12;12(5):444–50. <https://doi.org/10.1177/1747493017711816>
10. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2016 Jun;47(6):e98–169. <https://doi.org/10.1161/STR.0000000000000098>
11. Miller EL, Murray L, Richards L, Zorowitz RD, Bakas T, Clark P, et al. Comprehensive overview of nursing and interdisciplinary rehabilitation care of the stroke patient: a scientific statement from the American Heart Association. *Stroke*. 2010 Oct;41(10):2402–48. <https://doi.org/10.1161/STR.0b013e3181e7512b>
12. Australian Stroke Coalition Rehabilitation Working Group. Assessment for rehabilitation: pathway and decision-making tool 2012. Melbourne (AU): Australian Stroke Coalition; 2012. 25 p.
13. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 Guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2019 Dec;50(12):e344–418. <https://doi.org/10.1161/STR.0000000000000211>
14. Ntaios G, Bornstein NM, Caso V, Christensen H, De Keyser J, Diener HC, et al. European Stroke Organization. The European Stroke Organization Guidelines: a standard operating procedure. *Int J Stroke*. 2015 Oct;10 Suppl A100:128–35. <https://doi.org/10.1111/ijs.12583>
15. Hunter RM, Davie C, Rudd A, Thompson A, Walker H, Thomson N, et al. Impact on clinical and cost outcomes of a centralized approach to acute stroke care in London: a comparative effectiveness before and after model. *PLoS One*. 2013 Aug 13;8(8):e70420. <https://doi.org/10.1371/pone0070420>
16. AVERT Trial Collaboration group. Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial. AVERT Trial Collaboration group. *Lancet*. 2015 Jul 4;386(9988):46–55. [https://doi.org/10.1016/S0140-6736\(15\)60690-0](https://doi.org/10.1016/S0140-6736(15)60690-0)
17. Anderson CS, Arima H, Lavados P, Billot L, Hackett ML, Olavarria VV, et al. Cluster-randomized, crossover trial of head positioning in acute stroke. *N Engl J Med*. 2017 Jun 22;376(25):2437–47. <https://doi.org/10.1056/NEJMoa1615715>
18. Langhorne P, Ramachandra S; Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis. *Cochrane Database Syst Rev*. 2020 Apr 23;4(4):CD000197. <https://doi.org/10.1002/14651858.CD000197.pub4>
19. Safanelli J, Rosa Vieira L, Araujo T, Manchope LFS, Kuhlhoff MH, Nagel V, et al. The cost of stroke in a public hospital in Brazil. *Arq Neuropsiquiatr*. 2019 Jun;77(6):404–11. <https://doi.org/10.1590/0004-282X201900059>
20. Middleton S, McElduff P, Ward J, Grimshaw JM, Dale S, D'Este C, et al. Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. *Lancet*. 2011 Nov 12;378(9804):1699–706. [https://doi.org/10.1016/S0140-6736\(11\)61485-2](https://doi.org/10.1016/S0140-6736(11)61485-2)
21. Lynch EA, Luker JA, Calihac DA, Fryer CE, Hiliter SL. A qualitative study using the theoretical domains framework to investigate why patients were or were not assessed for rehabilitation after stroke. *Clin Rehabil*. 2017 Jul;31(7):966–77. <https://doi.org/10.1177/0269215516658938>
22. Lynch EA, Luker JA, Cadilhac DA, Hillier SL. Inequities in access to rehabilitation: exploring how acute stroke unit clinicians decide who to refer to rehabilitation. *Disabil Rehabil*. 2016 Jul;38(14):1415–24. <https://doi.org/10.3109/09638288.2015.1103791>
23. Matozinho CO, Teixeira-Salmela LF, Samora GR, Sant'Anna R, Faria C, Scianni A. Incidence and potential predictors of early onset of upper-limb contractures after stroke. *Disabil Rehabil*. 2021 Mar;43(5):678–84. <https://doi.org/10.1080/09638288.2019.1637949>
24. Kwah LK, Harvey LA, Diong JH, Herbert RD. Half of the adults who present to hospital with stroke develop at least one contracture within six months: an observational study. *J Physiother*. 2012;58(1):41–7. [https://doi.org/10.1016/S1836-9553\(12\)70071-1](https://doi.org/10.1016/S1836-9553(12)70071-1)
25. Sackley C, Brittle N, Patel S, Ellins J, Scott M, Wright C, et al. The prevalence of joint contractures, pressure sores, painful shoulder, other pain, falls, and depression in the year after a severely disabling stroke. *Stroke*. 2008 Dec;39(12):3329–34. <https://doi.org/10.1161/STROKEAHA.108.518563>
26. Harvey LA, Katalinic OM, Herbert RD, Moseley AM, Lannin NA, Schurr K. Stretch for the treatment and prevention of contractures. *Cochrane Database Syst Rev*. 2017 Jan 9;1(1):CD007455. <https://doi.org/10.1002/14651858.CD007455.pub3>
27. Prabhu RKR, Swaminathan N, Harvey LA. Passive movements for the treatment and prevention of contractures. *Cochrane Database*

- Syst Rev. 2013 Dec 28;(12):CD009331. <https://doi.org/10.1002/14651858.CD009331>
28. Saal S, Beutner K, Bogunski J, Obermüller K, Müller M, Grill E, et al. Interventions for the prevention and treatment of disability due to acquired joint contractures in older people: a systematic review. *Age Ageing*. 2017 May 1;46(3):373-82. <https://doi.org/10.1093/ageing/afx026>
 29. Basaran A, Emre U, Karadavut KI, Balbaloglu O, Bulmus N. Hand splinting for poststroke spasticity: a randomized controlled trial. *Top Stroke Rehabil*. 2012 Jul-Aug;19(4):329-37. <https://doi.org/10.1310/tsr1904-329>
 30. Doucet BM, Mettler JA. Effects of a dynamic progressive orthotic intervention for chronic hemiplegia: a case series. *Hand Ther*. 2013 Apr-Jun;26(2):139-46. <https://doi.org/10.1016/j.jht.2012.10.001>
 31. Svane C, Nielsen JB, Lorentzen J. Nonsurgical treatment options for muscle contractures in individuals with neurologic disorders: a systematic review with meta-analysis. *Arch Rehabil Res Clin Transl*. 2021 Jan 13;3(1):100104. <https://doi.org/10.1016/j.arrrct.2021.100104>
 32. Namdari S, Horneff JG, Baldwin K, Keenan MA. Muscle releases to improve passive motion and relieve pain in patients with spastic hemiplegia and elbow flexion contractures. *J Shoulder Elbow Surg*. 2012 Oct;21(10):1357-62. <https://doi.org/10.1016/j.jse.2011.09.029>
 33. Fletcher GF, Ades PA, Kligfield P, Arena R, Balady GJ, Bittner VA, et al. Exercise standards for testing and training: a scientific statement from the American Heart Association. *Circulation*. 2013 Aug 20;128(8):873-934. <https://doi.org/10.1161/CIR.0b013.e31829b5b44>
 34. Faulkner J, Stoner L, Lanford J, Jolliffe E, Mitchelmore A, Lambrick D. Long-term effect of participation in an early exercise and education program on clinical outcomes and cost implications, in patients with TIA and minor, non-disabling stroke. *Transl Stroke Res*. 2017 Jun;8(3):220-7. <https://doi.org/10.1007/s12975-016-0510-6>
 35. MacKay-Lyons M, Billinger SA, Eng JJ, Dromerick A, Giacomantonio N, Hafer-Macko C, et al. Aerobic exercise Recommendations to optimize best practices in care after stroke: AEROBICS 2019 update. *Phys Ther*. 2020 Jan 23;100(1):149-56. <https://doi.org/10.1093/ptj/pzz153>
 36. Liampas A, Velidakis N, Georgiou T, Vadalouca A, Varrassi G, Hadji-georgiou GM, et al. Prevalence and management challenges in central post-stroke neuropathic pain: a systematic review and meta-analysis. *Adv Ther*. 2020 Jul;37(7):3278-91. <https://doi.org/10.1007/s12325-020-01388-w>
 37. Klit H, Finnerup NB, Jensen TS. Central post-stroke pain: clinical characteristics, pathophysiology, and management. *Lancet Neurol*. 2009 Sep 1;8:857-68. [https://doi.org/10.1016/S1474-4422\(09\)70176-0](https://doi.org/10.1016/S1474-4422(09)70176-0)
 38. Harrison RA, Field TS. Post stroke pain: identification, assessment, and therapy. *Cerebrovasc Dis*. 2015;39(3-4):190-201. <https://doi.org/10.1159/000375397>
 39. Kim JS. Pharmacological management of central post-stroke pain: a practical guide. *CNS Drugs*. 2014 Sep;28(9):787-97. <https://doi.org/10.1007/s40263-014-0194-y>
 40. Leijon G, Boivie J. Central post-stroke pain—a controlled trial of amitriptyline and carbamazepine. *Pain*. 1989 Jan;36(1):27-36. [https://doi.org/10.1016/0304-3959\(89\)90108-5](https://doi.org/10.1016/0304-3959(89)90108-5)
 41. Vestergaard K, Andersen G, Gottrup H, Kristensen BT, Jensen TS. Lamotrigine for central post-stroke pain: a randomized controlled trial. *Neurology*. 2001 Jan 23;56(2):184-90. <https://doi.org/10.1212/wnl.56.2.184>
 42. Kim NY, Lee SC, Kim YW. Effect of duloxetine for the treatment of chronic central poststroke pain. *Clin Neuropharmacol*. 2019 May-Jun;42(3):73-6. <https://doi.org/10.1097/WNF.0000000000000330>
 43. Kim JS, Bashford G, Murphy TK, Martin A, Dror V, Cheung R. Safety and Efficacy of pregabalin in patients with central post-stroke pain. *Pain*. 2011 May;152(5):1018-23. <https://doi.org/10.1016/j.pain.2010.12.023>
 44. Shimodozono M, Kawahira K, Kamishita T, Ogata A, Tohgo S, Tanaka N. Reduction of central poststroke pain with the selective serotonin reuptake inhibitor fluvoxamine. *Int J Neurosci*. 2002 Oct;112(10):1173-81. <https://doi.org/10.1080/00207450290026139>
 45. Scuteri D, Mantovani E, Tamburini S, Sandrini G, Corasaniti MT, Bagetta G, et al. Opioids in post-stroke pain: a systematic review and meta-analysis. *Front Pharmacol*. 2020 Nov 27;11:587050. <https://doi.org/10.3389/fphar.2020.587050>
 46. Oliveira RA, Andrade DC, Mendonça M, Barros R, Luvisoto T, Myczkowski M, et al. Repetitive transcranial magnetic stimulation of the left premotor/ dorsolateral prefrontal cortex does not have analgesic effect on central poststroke pain. *J Pain*. 2014 Dec;15(12):1271-81. <https://doi.org/10.1016/j.jpain.2014.09.009>
 47. Shimizu T, Hosomi K, Maruo T, Goto Y, Yokoe M, Kageyama Y, et al. Efficacy of deep rTMS for neuropathic pain in the lower limb: a randomized, double-blind crossover trial of an-coil and figure-8 coil. *J Neurosurg*. 2017 Nov;127(5):1172-80. <https://doi.org/10.3171/2016.9.JNS16815>
 48. Choi HR, Aktas A, Bottros MM. Pharmacotherapy to manage central post-stroke pain. *CNS Drugs*. 2021 Feb 7;35(2):151-60. <https://doi.org/10.1007/s40263-021-00791-3>
 49. Vasudevan JM, Browne BJ. Hemiplegic shoulder pain: an approach to diagnosis and management. *Phys Med Rehabil Clin N Am*. 2014 May;25(2):411-37. <https://doi.org/10.1016/j.pmr.2014.01.010>
 50. Ada L, Foongchomcheay A, Canning C. Supportive devices for preventing and treating subluxation of the shoulder after stroke. *Cochrane Database Syst Rev*. 2005 Jan 25;2005(1):CD003863. <https://doi.org/10.1002/14651858.CD003863.pub2>
 51. Han SH, Kim T, Jang SH, Kim MJ, Park S-B, Yoon SI, et al. The effect of an arm sling on energy consumption while walking in hemiplegic patients: a randomized comparison. *Clin Rehabil*. 2011 Jan 1;25(1):36-42. <https://doi.org/10.1177/02692155110381167>
 52. Nadler M, Pauls M. Shoulder orthoses for the prevention and reduction of hemiplegic shoulder pain and subluxation: systematic review. *Clin Rehabil*. 2017 Apr 1;31(4):444-53. <https://doi.org/10.1177/0269215516648753>
 53. Hsu PC, Wu WT, Han DS, Chang KV. Comparative effectiveness of botulinum toxin injection for chronic shoulder pain: a meta-analysis of randomized controlled trials. *Toxins (Basel)*. 2020 Apr 12;12(4):251. <https://doi.org/10.3390/toxins12040251>
 54. Lakse E, Gunduz B, Erhan B, Celik EC. The effect of local injections in hemiplegic shoulder pain: a prospective, randomized, controlled study. *Am J Phys Med Rehabil*. 2009 Oct;88(10):805-11. <https://doi.org/10.1097/PHM.0b013e3181b71c65>
 55. Terlemez R, Çiftçi S, Topaloglu M, Dogu B, Yilmaz F, Kuran B. Suprascapular nerve block in hemiplegic shoulder pain: comparison of the effectiveness of placebo, local anesthetic, and corticosteroid injections—a randomized controlled study. *Neurol Sci*. 2020 Nov;41(11):3243-7. <https://doi.org/10.1007/s10072-020-04362-0>
 56. Ravichandran H, Janakiraman B, Sundaram S, Fisseha B, Gebreyesus T, Gelaw AY. Systematic review on effectiveness of shoulder taping in hemiplegia. *J Stroke Cerebrovasc Dis*. 2019 Jun 1;28(6):P1463-73. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2019.03.021>
 57. Deng P, Zhao Z, Zhang S, Xiao T, Li Y. Effect of kinesio taping on hemiplegic shoulder pain: a systematic review and meta-analysis of randomized controlled trials. *Clin Rehabil*. 2021 Mar 1;35(3):317-31. <https://doi.org/10.1177/0269215520964950>
 58. Chau JPC, Lo SHS, Yu X, Choi KC, Lau AYL, Wu JCY, et al. Effects of acupuncture on the recovery outcomes of stroke survivors with shoulder pain: a systematic review. *Front Neurol*. 2018 Jan 31;9:30. <https://doi.org/10.3389/fneur.2018.00030>
 59. Qiu H, Li J, Zhou T, Wang H, Li J. Electrical stimulation in the treatment of hemiplegic shoulder pain: a meta-analysis of randomized controlled trials. *Am J Phys Med Rehabil*. 2019 Apr;98(4):280-6. <https://doi.org/10.1097/PHM.0000000000001067>

60. Turner-Stokes L, Jackson D. Shoulder pain after stroke: a review of the evidence base to inform the development of an integrated care pathway. *Clin Rehabil*. 2002 May 1;16(3):276-98. <https://doi.org/10.1191/0269215502cr491oa>
61. Ministério da Saúde. Manual de rotinas para atenção ao AVC. Brasília (DF): Editora do Ministério da Saúde; 2013. 50 p.
62. Caliri MHL, Santos VL, Mandelbaum MHS, Costa IG. Consenso NPUAP 2016 – Classificação das lesões por pressão adaptado culturalmente para o Brasil. 2016 [cited 2021 May 20]. 3 p. Available from: https://sobest.com.br/wp-content/uploads/2020/10/CONSENSO-NPUAP-2016_traducao-SOBEST-SOBENDE.pdf
63. Huang C, Ma Y, Wang C, Jiang M, Yuet Foon L, Lv L, et al. Predictive validity of the braden scale for pressure injury risk assessment in adults: a systematic review and meta-analysis. *Nurs Open*. 2021 Sep;8(5):2194-207. <https://doi.org/10.1002/nop2.792>
64. Sousa B. Translation, adaptation, and validation of the Sunderland Scale and the Cubbin & Jackson Revised Scale in Portuguese. *Rev Bras Ter Intensiva*. 2013 Apr-Jun;25(2):106-14. <https://doi.org/10.5935/0103-507X.20130021>
65. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and treatment of pressure ulcers/injuries: quick reference guide. Osborne Park (AU): Cambridge; 2019. 75 p.
66. Burgos R, Breton I, Cereda E, Desport JC, Dziewas R, Genton L, et al. ESPEN guideline clinical nutrition in neurology. *Clin Nutr*. 2018 Feb 1;37(1):P354-96. <https://doi.org/10.1016/j.clnu.2017.09.003>
67. Foley NC, Martin RE, Salter KL, Teasell RW. A review of the relationship between dysphagia and malnutrition following stroke. *J Rehabil Med*. 2009 Sep;41(9):707-13. <https://doi.org/10.2340/16501977-0415>
68. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019 Jul 1;48(4):601. <https://doi.org/10.1093/ageing/afz046>
69. Jeejeebhoy NK. Malnutrition, fatigue, frailty, vulnerability, sarcopenia and cachexia: overlap of clinical features. *Curr Opin Clin Nutr Metab Care*. 2012. May;15(3):213-9. <https://doi.org/10.1097/MCO.0b013e328352694f>
70. Hunnicutt JL, Gregory CM. Skeletal muscle changes following stroke: a systematic review and comparison to healthy individuals. *Top Stroke Rehabil*. 2017 Sep;24(6):463-71. <https://doi.org/10.1080/10749357.2017.1292720>
71. Scherbakov N, Sandek A, Doehner W. Stroke-related sarcopenia: specific characteristics. *J Am Med Dir Assoc*. 2015 Apr 1;16(4):P272-6. <https://doi.org/10.1016/j.jamda.2014.12.007>
72. Malmstrom TK, Miller DK, Simonsick EM, Ferrucci L, Morley JE. SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes. *J Cachexia Sarcopenia Muscle*. 2016 Mar;7(1):28-36. <https://doi.org/10.1002/jcsm.12048>
73. APA. Manual diagnóstico e estatístico de transtornos mentais: DSM-5. 5th ed. Porto Alegre (RS): Artmed; 2014.
74. Ayerbe L, Ayis S, Wolfe CD, Rudd AG. Natural history, predictors and outcomes of depression after stroke: systematic review and meta-analysis. *Br J Psychiatry*. 2013 Jan;202(1):14-21. <https://doi.org/10.1192/bjp.bp.111.107664>
75. Bogousslavsky J. William Feinberg lecture 2002: emotions, mood, and behavior after stroke. *Stroke*. 2003 Apr;34(4):1046-50. <https://doi.org/10.1161/01.STR.0000061887.33505.B9>
76. Bogousslavsky J. Mood disorders after stroke. *Front Neurol Neurosci*. 2012;30:70-4. <https://doi.org/10.1159/000333413>
77. Morris PL, Robinson RG, Andrzejewski P, Samuels J, Price TR. Association of depression with 10-year poststroke mortality. *Am J Psychiatry*. 1993 Jan;150(1):124-9. <https://doi.org/10.1176/ajp.150.1.124>
78. Stenager EN, Madsen C, Stenager E, Boldsen J. Suicide in patients with stroke: epidemiological study. *BMJ*. 1998 Apr 18;316(7139):1206. <https://doi.org/10.1136/bmj.316.7139.1206>
79. Robinson RG, Jorge RE. Post-stroke depression: a review. *Am J Psychiatry*. 2016 Mar 1;173(3):221-31. <https://doi.org/10.1176/appi.ajp.2015.15030363>
80. Hilari K, Needle JJ, Harrison KL. What are the important factors in health-related quality of life for people with aphasia? A systematic review. *Arch Phys Med Rehabil*. 2012 Jan 1;93(1 Suppl 1):S86-95. <https://doi.org/10.1016/j.apmr.2011.05.028>
81. Salter KL, Foley NC, Zhu L, Jutai JW, Teasell RW. Prevention of poststroke depression: does prophylactic pharmacotherapy work? *J Stroke Cerebrovasc Dis*. 2013 Nov 1;22(8):P1243-51. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2012.03.013>
82. Kim BR, Kim D-Y, Chun MH, Yi JH, Kwon JS. Effect of repetitive transcranial magnetic stimulation on cognition and mood in stroke patients: a double-blind, sham-controlled trial. *Am J Phys Med Rehabil*. 2010 May;89(5):362-8. <https://doi.org/10.1097/PHM.0b013e3181d8a5b1>
83. Bembenek J, Karlinski M, Kobayashi A, Czlonkowska A. Early stroke-related deep venous thrombosis: risk factors and influence on outcome. *J Thromb Thrombolysis*. 2011 Jul;32(1):96-102. <https://doi.org/10.1007/s11239-010-0548-3>
84. Kelly J, Rudd A, Lewis R, Hunt BJ. Venous thromboembolism after acute stroke. *Stroke*. 2001 Jan;32(1):262-7. <https://doi.org/10.1161/01.str.32.1.262>
85. Bromfield EB, Reding MJ. Relative risk of deep venous thrombosis or pulmonary embolism post-stroke based on ambulatory status. *J Neurol Rehabil*. 1988 Jun 1;2(2):51-7. <https://doi.org/10.1177/136140968800200202>
86. CLOTS (Clots in Legs or Socks after Stroke) Trials Collaboration; Dennis M, Sandercock P, Reid J, Graham C, Forbes J, Murray G. Effectiveness of intermittent pneumatic compression in reduction of risk of deep vein thrombosis in patients who have had a stroke (CLOTS 3): a multicentre randomised controlled trial. *Lancet*. 2013 Aug 10;382(9891):516-24. [https://doi.org/10.1016/S0140-6736\(13\)61050-8](https://doi.org/10.1016/S0140-6736(13)61050-8)
87. Dennis M, Caso V, Kappelle LJ, Pavlovic A, Sandercock P; European Stroke Organisation. European Stroke Organisation (ESO) guidelines for prophylaxis for venous thromboembolism in immobile patients with acute ischaemic stroke. *Eur Stroke J*. 2016 Mar 1;1(1):6-19. <https://doi.org/10.1177/2396987316628384>
88. Spyropoulos A, Ageno W, Albers G, Elliott G, Halperin J, Hiatt W, et al. Post-discharge prophylaxis with rivaroxaban reduces fatal and major thromboembolic events in medically ill patients. *J Am Coll Cardiol*. 2020 Jun 30;75(25):3140-7. <https://doi.org/10.1016/j.jacc.2020.04.071>
89. Lansberg MG, O'Donnell MJ, Khatri P, Lang ES, Nguyen-Huynh MN, Schwartz NE, et al. Antithrombotic and thrombolytic therapy for ischemic stroke: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest*. 2012 Feb 1;141(2 Suppl 2):e601S-36S. <https://doi.org/10.1378/chest.11-2302>
90. Boeer A, Voth E, Henze T, Prange HW. Early heparin therapy in patients with spontaneous intracerebral haemorrhage. *J Neurol Neurosurg Psychiatry*. 1991 May;54(5):466-7. <https://doi.org/10.1136/jnnp.54.5.466>
91. Paciaroni M, Agnelli G, Alberti A, Becattini C, Guercini F, Martini G, et al. PREvention of VENous thromboembolism in hemorrhagic stroke patients – PREVENTIHS study: a randomized controlled trial and a systematic review and meta-analysis. *Eur Neurol*. 2020;83(6):566-75. <https://doi.org/10.1159/000511574>
92. Trischler T, Kraaijpoel N, Gal G, Weels P. Venous thromboembolism: advances in diagnosis and treatment. *JAMA*. 2018 Oct 16;320(15):1583-94. <https://doi.org/10.1001/jama.2018.14346>

93. Streiff MB, Agnelli G, Connors JM, Crowther M, Eichinger S, Lopes R, et al. Guidance for the treatment of deep vein thrombosis and pulmonary embolism. *J Thromb Thrombolysis*. 2016 Jan 16;41(1):32-67. <https://doi.org/10.1007/s11239-015-1317-0>
94. Duffett L, Carrier M. Inferior vena cava filters. *J Thromb Haemost*. 2017 Jan;15(1):3-12. <https://doi.org/10.1111/jth.13564>
95. Coull AJ, Lovett JK, Rothwell PM; Oxford Vascular Study. Population based study of early risk of stroke after transient ischemic attack or minor stroke: implications for public education and organization of services. *BMJ*. 2004 Feb 7;328(7435):326. <https://doi.org/10.1136/bmj.37991.635266.44>
96. Mohan KM, Wolfe CDA, Rudd AG, Heuschmann PU, Kolominsky-Rabas PL, Grieve AP. Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. *Stroke*. 2011 May;42(2):1489-94. <https://doi.org/10.1161/STROKEAHA.110.602615>
97. He FJ, Tan M, Ma Y, MacGregor GA. Salt reduction to prevent hypertension and cardiovascular disease: JACC state-of-the-art review. *J Am Coll Cardiol*. 2020 Feb 18;75(6):632-47. <https://doi.org/10.1016/j.jacc.2019.11.055>
98. Deijle IA, Van Schaik SM, Van Wegen EE, Weinstein HC, Kwakkel G, Van den Berg-Vos RM. Lifestyle interventions to prevent cardiovascular events after stroke and transient ischemic attack: systematic review and meta-analysis. *Stroke*. 2017 Jan;48(1):174-9. <https://doi.org/10.1161/STROKEAHA.116.013794>
99. Lee PN, Thornton AJ, Forey BA, Hamling JS. Environmental tobacco smoke exposure and risk of stroke in never smokers: an updated review with meta-analysis. *J Stroke Cerebrovasc Dis*. 2017 Jan 1;26(1):P204-16. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2016.09.011>
100. Patra J, Taylor B, Irving H, Roerecke M, Baliunas D, Mohapatra S, et al. Alcohol consumption and the risk of morbidity and mortality for different stroke types—a systematic review and meta-analysis. *BMC Public Health*. 2010 May 18;10:258. <https://doi.org/10.1186/1471-2458-10-258>
101. Hans-Christoph D, Hankey GJ. Primary and secondary prevention of ischemic stroke and cerebral hemorrhage. *J Am Coll Cardiol*. 2020 Apr 21;75(15):1804-18. <https://doi.org/10.1016/j.jacc.2019.12.072>
102. Grundy SM, Stone NJ, Bailey AL, Beam C, Birtcher KK, Blumenthal RS, et al. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APHA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2019 Jun 25;73(24):3168-209. <https://doi.org/10.1161/CIR.0000000000000625>
103. Selvin E, Steffes MW, Zhu H, Matsushita K, Wagenknecht L, Pankow J, et al. Glycated hemoglobin, diabetes, and cardiovascular risk in nondiabetic adults. *N Engl J Med*. 2010 Mar 4;362(9):800-11. <https://doi.org/10.1056/NEJMoa0908359>
104. Buse JB, Wexler DJ, Tsapas A, Rossing P, Mingrone G, Mathieu C, et al. 2019 Update to: management of hyperglycemia in type 2 diabetes, 2018: a consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*. 2020 Feb;43(2):487-93. <https://doi.org/10.2337/dci19-0066>
105. Kleindorfer DO, Towfighi A, Chaturvedi S, Cockroft KM, Gutierrez J, Lombardi-Hill D, et al. 2021 Guideline for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline from the American Heart Association/American Stroke Association. *Stroke*. 2021 Jul;52(7):e364-467. <https://doi.org/10.1161/STR.0000000000000375>
106. Baylan S, Griffiths S, Grant N, Broomfield NM, Evans JJ, Gardani M. Incidence and prevalence of post-stroke insomnia: a systematic review and meta-analysis. *Sleep Med Rev*. 2020 Feb;49:101222. <https://doi.org/10.1016/j.smrv.2019.101222>
107. O'Mahony AM, Garvey JF, McNicholas WT. Technologic advances in the assessment and management of obstructive sleep apnoea beyond the apnoea-hypopnoea index: a narrative review. *J Thorac Dis*. 2020 Sep;12(9):5020-38. <https://doi.org/10.21037/jtd-sleep-2020-003>
108. Barker-Collo SL. Depression and anxiety 3 months post stroke: Prevalence and correlates. *Arch Clin Neuropsychol*. 2007 May 1;22(4):519-31. <https://doi.org/10.1016/j.acn.2007.03.002>
109. Draganich C, Erdal K. Placebo sleep affects cognitive functioning. *J Exp Psychol Learn Mem Cogn*. 2014 May;40(3):857-64. <https://doi.org/10.1037/a0035546>
110. Chen C-Y, Chen C-L, Yu C-C. Trazodone improves obstructive sleep apnea after ischemic stroke: a randomized, double-blind, placebo-controlled, crossover pilot study. *Neuro*. 2021 Feb 24;268(8):2951-60. <https://doi.org/10.1007/s00415-021-10480-2>
111. Bassetti CLA, Randerath W, Vignatelli L, Ferini-Strambi L, Brill AK, Bonsignore MR, et al. EAN/ERS/ESO/ESRS statement on the impact of sleep disorders on risk and outcome of stroke. *Eur Respir J*. 2020 Apr 21;55(4):1901104. <https://doi.org/10.1183/13993003.01104-2019>
112. Balfors EM, Franklin KA. Impairment of cerebral perfusion during obstructive sleep apneas. *Am J Respir Crit Care Med*. 1994 Dec;150(6):1587-91. <https://doi.org/10.1164/ajrccm.150.6.7952619>
113. Fogel SM, Smith CT. The function of the sleep spindle: a physiological index of intelligence and a mechanism for sleep-dependent memory consolidation. *Neurosci Biobehav Rev*. 2011 Apr;35(5):1154-65. <https://doi.org/10.1016/j.neubiorev.2010.12.003>
114. Andrade RGS, Madeiro F, Genta PR, Lorenzi-Filho G. Oronasal mask may compromise the efficacy of continuous positive airway pressure on OSA treatment: is there evidence for avoiding the oronasal route? *Curr Opin Pulm Med*. 2016 Nov;22(6):555-62. <https://doi.org/10.1097/MCP.0000000000000318>
115. Brill AK, Horvath T, Seiler A, Camilo M, Haynes AG, Ott SR, et al. CPAP as treatment of sleep apnea after stroke: a meta-analysis of randomized trials. *Neurology*. 2018 Apr 3;90(14):e1222-30. <https://doi.org/10.1212/WNL.0000000000005262>
116. McEvoy RD, Antic NA, Heeley E, Luo Y, Ou Q, Zhang X, et al. CPAP for Prevention of cardiovascular events in obstructive sleep apnea. *N Engl J Med*. 2016 Sep 8;375(10):919-31. <https://doi.org/10.1056/NEJMoa1606599>
117. Ding Q, Whittemore R, Redeker N. Excessive daytime sleepiness in stroke survivors: an integrative review. *Biol Res Nurs*. 2016 Jul 1;18(4):420-31. <https://doi.org/10.1177/1099800415625285>
118. Medeiros CAM, Bruin PFC, Paiva TR, Coutinho WM, Ponte RP, Bruin VMS. Clinical outcome after acute ischaemic stroke: the influence of restless legs syndrome. *Eur J Neurol*. 2011 Jan;18(1):144-9. <https://doi.org/10.1111/j.1468-1331.2010.03099.x>
119. Holloway RG, Tuttle D, Baird T, Skelton WK. The safety of hospital stroke care. *Neurology*. 2007 Feb 20;68(8):550-5. <https://doi.org/10.1212/01.wnl.0000254992.39919.2e>
120. Davenport RJ, Dennis MS, Wellwood I, Warlow CP. Complications after acute stroke. *Stroke*. 1996 Mar;27(3):415-20. <https://doi.org/10.1161/01.str.27.3.415>
121. Indredavik B, Rohweder G, Naalsund E, Lydersen S. Medical complications in a comprehensive stroke unit and an early supported discharge service. *Stroke*. 2008 Feb;39(2):414-20. <https://doi.org/10.1161/STROKEAHA.107.489294>
122. Suzuki T, Sonoda S, Misawa K, Saitoh E, Shimizu Y, Kotake T. Incidence and consequence of falls in inpatient rehabilitation of stroke patients. *Exp Aging Res*. 2005 Oct-Dec;31(4):457-69. <https://doi.org/10.1080/03610730500206881>
123. Aizen E, Shugaev I, Lenger R. Risk factors and characteristics of falls during inpatient rehabilitation of elderly patients. *Arch Gerontol Geriatr*. 2007 Jan-Feb;44(1):1-12. <https://doi.org/10.1016/j.archger.2006.01.005>
124. Pinto EB, Nascimento C, Marinho C, Oliveira I, Monteiro M, Castro M, et al. Risk factors associated with falls in adult patients after stroke living in the community: baseline data from a stroke cohort

- in Brazil. *Top Stroke Rehabil.* 2014 May-Jun;21(3):220-7. <https://doi.org/10.1310/tsr2103-220>
125. Jones SA, Shinton RA. Improving outcome in stroke patients with visual problems. *Age Ageing.* 2006 Nov;35(6):560-5. <https://doi.org/10.1093/ageing/af074>
 126. Kearney FC, Harwood RH, Gladman JRF, Lincoln N, Masud T. The relationship between executive function and falls and gait abnormalities in older adults: a systematic review. *Dement Geriatr Cogn Disord.* 2013 Aug;36(1-2):20-35 <https://doi.org/10.1159/000350031>
 127. McLaren A, Kerr S, Allan L, Steen IN, Ballard C, Allen J, et al. Autonomic function is impaired in elderly stroke survivors. *Stroke.* 2005 May;36(5):1026-30. <https://doi.org/10.1161/01.STR.0000160748.88374>
 128. Jorgensen L, Engstad T, Jacobsen BK. Higher incidence of falls in long-term stroke survivors than in population controls: depressive symptoms predict falls after stroke. *Stroke.* 2002 Feb;33(2):542-54. <https://doi.org/10.1161/hs0202.102375>
 129. Tan KM, Tan MP. Stroke and falls-clash of the two titans in geriatrics. *Geriatrics (Basel).* 2016 Nov 30;1(4):31. <https://doi.org/10.3390/geriatrics1040031>
 130. Shepherd RB. Exercise and training to optimize functional motor performance in stroke: driving neural reorganization? *Neural Plast.* 2001;8(1-2):121-9. <https://doi.org/10.1155/NP2001.121>
 131. Marigold DS, Eng JJ, Dawson AS, Inglis JT, Harris JE, Gylfadottir S. Exercise leads to faster postural reflexes, improved balance and mobility, and fewer falls in older persons with chronic stroke. *J Am Geriatr Soc.* 2005 Mar;53(3):416-23. <https://doi.org/10.1111/j.1532-5415.2005.53158.x>
 132. Bayouk J-F, Boucher JP, Leroux A. Balance training following stroke: effects of task-oriented exercises with and without altered sensory input. *Int J Rehabil Res.* 2006 Mar;29(1):51-9. <https://doi.org/10.1097/01.mrr.0000192100.67425.84>
 133. Weerdesteyn V, Rijken H, Geurts AC, Smits-Engelsman BC, Mulder T, Duysens J. A five-week exercise program can reduce falls and improve obstacle avoidance in the elderly. *Gerontology.* 2006 Apr;52(3):131-41. <https://doi.org/10.1159/000091822>
 134. Winsler SJ, Tsang WW, Krishnamurthy K, Kannan P. Does Tai Chi improve balance and reduce falls incidence in neurological disorders? A systematic review and meta-analysis. *Clin Rehabil.* 2018 Sep;32(9):1157-68. <https://doi.org/10.1177/0269215518773442>
 135. Fontalis A, Kenanidis E, Kotronias RA, Papachristou A, Anagnostis P, Potoupnis M, et al. Current and emerging osteoporosis pharmacotherapy for women: state of the art therapies for preventing bone loss. *Expert Opin Pharmacother.* 2019 Jun;20(9):1123-34. <https://doi.org/10.1080/14656566.2019.1594772>
 136. Lam FMH, Bui M, Yang FZH, Pang MYC. Chronic effects of stroke on hip bone density and tibial morphology: a longitudinal study. *Osteoporos Int.* 2016 Feb;27(2):591-603. <https://doi.org/10.1007/s00198-015-3307-7>
 137. Eng JJ, Pang MYC, Ashe MC. Balance, falls, and bone health: role of exercise in reducing fracture risk after stroke. *J Rehabil Res Dev.* 2008;45(2):297-315. <https://doi.org/10.1682/jrrd.2007.01.0014>
 138. Carda S, Cisari C, Invernizzi M, Bevilacqua M. Osteoporosis after stroke: a review of the causes and potential treatments. *Cerebrovasc Dis.* 2009 Jul;28(2):191-200. <https://doi.org/10.1159/000226578>
 139. Dennis MS, Lo KM, McDowall M, West T. Fractures after stroke: frequency, types, and associations. *Stroke.* 2002 Mar;33(3):728-34. <https://doi.org/10.1161/hs0302.103621>
 140. Hsieh C-Y, Sung S-F, Huang H-K. Drug treatment strategies for osteoporosis in stroke patients. *Expert Opin Pharmacother.* 2020 May;21(7):811-21. <https://doi.org/10.1080/14656566.2020.1736556>
 141. Body J-J, Bergmann P, Boonen S, Devogelaer J-P, Gielen E, Goemaere S, et al. Extraskelatal benefits and risks of calcium, vitamin D and anti-osteoporosis medications. *Osteoporos Int.* 2012 Feb 4;23(1 Suppl 1):S1-23. <https://doi.org/10.1007/s00198-011-1891-8>
 142. Makariou SE, Michel P, Tzoufi MP, Challa A, Milionis HJ. Vitamin D and stroke: promise for prevention and better outcome. *Curr Vasc Pharmacol.* 2014 Jan;12(1):117-24. <https://doi.org/10.2174/15701611113119990119>
 143. Poole KES, Reeve J, Warburton EA. Falls, fractures, and osteoporosis after stroke: Time to think about protection? *Stroke.* 2002 May;33(5):1432-6. <https://doi.org/10.1161/01.str.0000014510.488977d>
 144. Kim DH, Rogers JR, Fulchino LA, Kim CA, Solomon DH, Kim SC. Bisphosphonates and risk of cardiovascular events: a meta-analysis. *PLoS One.* 2015 Apr 17;10(4):e0122646. <https://doi.org/10.1371/journal.pone.0122646>
 145. Cummings SR, Ettinger B, Delmas PD, Kenemans P, Stathopoulos V, Verweij P, et al. The effects of tibolone in older postmenopausal women. *N Engl J Med.* 2008 Aug 14;359(7):697-708. <https://doi.org/10.1056/NEJMoa0800743>
 146. Nicholas JM, Ridsdale L, Richardson MP, Grieve AP, Gulliford MC. Fracture risk with use of liver enzyme inducing antiepileptic drugs in people with active epilepsy: cohort study using the general practice research database. *Seizure.* 2013 Jan 1;22(1):P37-42. <https://doi.org/10.1016/j.seizure.2012.10.002>
 147. Warden SJ, Fuchs RK. Do selective serotonin reuptake inhibitors (SSRIs) cause fractures? *Curr Osteoporos Rep.* 2016 Oct;14(5):211-8. <https://doi.org/10.1007/s11914-016-0322-3>
 148. Oryan A, Kamali A, Moshiri A. Potential mechanisms and applications of statins on osteogenesis: current modalities, conflicts and future directions. *J Control Release.* 2015 Oct 10;215:12-24. <https://doi.org/10.1016/j.jconrel.2015.07.022>
 149. Borschmann K, Pang MYC, Bernhardt J, Iuliano-Burns S. Stepping towards prevention of bone loss after stroke: a systematic review of the skeletal effects of physical activity after stroke. *Int J Stroke.* 2012 Jun 1;7(4):330-5. <https://doi.org/10.1111/j.1747-4949.2011.00645.x>
 150. Doria JW, Forgacs PB. Incidence, implications, and management of seizures following ischemic and hemorrhagic stroke. *Curr Neurol Neurosci Rep.* 2019 May 27;19(7):37. <https://doi.org/10.1007/s11910-019-0957-4>
 151. Zou S, Wu X, Zhu B, Yu J, Yang B, Shi J. The pooled incidence of post-stroke seizure in 102 008 patients. *Top Stroke Rehabil.* 2015 Dec;22(6):460-7. <https://doi.org/10.1179/1074935715Z.000000000062>
 152. Huang C-W, Saposnik G, Fang J, Steven DA, Burneo JG. Influence of seizures on stroke outcomes: a large multicenter study. *Neurology.* 2014 Mar 4;82(9):768-76. <https://doi.org/10.1212/WNL.0000000000000166>
 153. Hesdorffer DC, Benn EK, Cascino GD, Hauser WA. Is a first acute symptomatic seizure epilepsy? Mortality and risk for recurrent seizure. *Epilepsia.* 2009 May 7;50(5):1102-8. <https://doi.org/10.1111/j.1528-1167.2008.01945.x>
 154. Hemphill JC, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2015 Jul;46(7):2032-60. <https://doi.org/10.1161/STR.0000000000000069>
 155. Holtkamp M, Beghi E, Benninger F, Kälviäinen R, Rocamora R, Christensen H; European Stroke Organisation. European Stroke Organisation guidelines for the management of post-stroke seizures and epilepsy. *Eur Stroke J.* 2017 Jun 1;2(2):103-15. <https://doi.org/10.1177/2396987317705536>
 156. Glauser T, Ben-Menachem E, Bourgeois B, Cnaan A, Guerreiro C, Kälviäinen R, et al. Updated ILAE evidence review of antiepileptic drug efficacy and effectiveness as initial monotherapy for epileptic seizures and syndromes. *Epilepsia.* 2013 Mar;54(3):551-63. <https://doi.org/10.1111/epi.12074>

157. Brigo F, Lattanzi S, Zelano J, Bragazzi NL, Belcastro V, Nardone R, et al. Randomized controlled trials of antiepileptic drugs for the treatment of post-stroke seizures: a systematic review with network meta-analysis. *Seizure*. 2018 Oct 1;61:P57-62. <https://doi.org/10.1016/j.seizure.2018.08.001>
158. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology*. 2003 Jan 1;61(1):P37-49. [https://doi.org/10.1016/s0090-4295\(02\)02243-4](https://doi.org/10.1016/s0090-4295(02)02243-4)
159. Dumoulin C, Korner-Bitensky N, Tannenbaum C. Urinary incontinence after stroke: identification, assessment, and intervention by rehabilitation professionals in Canada. *Stroke*. 2007 Oct;38(10):2745-51. <https://doi.org/10.1161/STROKEAHA.107.486035>
160. Ruffion A, Castro-Diaz D, Patel H, Khalaf K, Onyenwenyi A, Globe D, et al. Systematic review of the epidemiology of urinary incontinence and detrusor overactivity among patients with neurogenic overactive bladder. *Neuroepidemiology*. 2013 Nov;41(3-4):146-55. <https://doi.org/10.1159/000353274>
161. John G, Bardini C, Mégevand P, Combescure C, Dällenbach P. Urinary incontinence as a predictor of death after new-onset stroke: a meta-analysis. *Eur J Neurol*. 2016 Oct;23(10):1548-55. <https://doi.org/10.1111/ene.13077>
162. Kovindha A, Wattanapan P, Dejpratham P, Permsirivanich W, Kuptniratsaikul V. Prevalence of incontinence in patients after stroke during rehabilitation: a multi-centre study. *J Rehabil Med*. 2009 May;41(6):489-91. <https://doi.org/10.2340/16501977-0354>
163. Thomas LH, Coupe J, Cross LD, Tan AL, Watkins CL. Interventions for treating urinary incontinence after stroke in adults. *Cochrane Database Syst Rev*. 2019 Feb 1;2(2):CD004462. <https://doi.org/10.1002/14651858.CD004462.pub4>
164. Coggrave M, Norton C. Management of faecal incontinence and constipation in adults with central neurological diseases. *Cochrane Database Syst Rev*. 2013 Dec 18;(12):CD002115. <https://doi.org/10.1002/14651858.CD002115>
165. Na Y, Htwe M, Rehman CA, Palmer T, Munshi S. Sexual dysfunction after stroke-A biopsychosocial perspective. *Int J Clin Pract*. 2020 Jul;74(7):e13496. <https://doi.org/10.1111/ijcp.13496>
166. Dusenbury W, Johansen PP, Mosack V, Steinke EE. Determinants of sexual function and dysfunction in men and women with stroke: A systematic review. *Int J Clin Pract*. 2017 Jul;71(7):e12969. <https://doi.org/10.1111/ijcp.12969>
167. Dai H, Wang J, Zhao Q, Ma J, Gong X, Wang L, et al. Erectile dysfunction and associated risk factors in male patients with ischemic stroke: a cross-sectional study. *Medicine (Baltimore)*. 2020 Jan;99(1):e18583. <https://doi.org/10.1097/MD.00000000000018583>
168. Montalvan V, Ulrich AK, Tirschwell DL, Zunt JR. Assessing sexual dysfunction among stroke survivors and barriers to address this issue by physicians at a Latin American reference hospital. *Clin Neurol Neurosurg*. 2021 Apr 20;205:106642. <https://doi.org/10.1016/j.clineuro.2021.106642>
169. Song HS, Oh HS, Kim HS, Seo WS. Effects of a sexual rehabilitation intervention program on stroke patients and their spouses. *NeuroRehabilitation*. 2011 Mar 23;28(2):143-50. <https://doi.org/10.3233/NRE-2011-0642>
170. Lue TF, Giuliano F, Montorsi F, Rosen RC, Andersson KE, Althof S, et al. Summary of Recommendations on sexual dysfunctions in men. *J Sex Med*. 2004 Jul 1;1(1):P6-23. <https://doi.org/10.1111/j.1743-6109.2004.10104.x>
171. Stratton H, Sansom J, Brown-Major A, Anderson P, Ng L. Interventions for sexual dysfunction following stroke. *Cochrane Database Syst Rev*. 2020 May 1;5(5):CD011189. <https://doi.org/10.1002/14651858.CD011189.pub2>